Indice de documentos justificativos aportados con el Curriculum Vitae

Solicitante: **Pablo Martínez Ruiz del Árbol**

DNI: **72058705G**

Concurso para Plaza de Profesor Titular

Índice general

Capítulo 1

Datos personales

1.A. Documento Nacional de Identidad


ESPAÑA
DOCUMENTO NACIONAL DE IDENTIDAD
APELLIDOS
MARTINEZ
RUIZ DEL ARBOL
NOMBRE
PABLO
SEXO
M
NACIONALIDAD
ESP
FECHA DE NACIMIENTO
26 10 1982
NUM SOPORT
BKF122429
VALIDEZ
19 07 2029
255744
DNI 72058705G


DOMICILIO
C. BONIFAZ 22 B P05 I
SANTANDER
CANTABRIA
LUGAR DE NACIMIENTO
SANTANDER
CANTABRIA
HIJO/A DE
JOSE ANTONIO / YOLANDA
EQUIPO
39676A6D1
IDESPBKF122429072058705G<<<<<<
8210265M2907192ESP<<<<<<<<<<<2
MARTINEZ<RUIZ<DEL<ARBOL<<PABLO

Capítulo 2

Situación profesional

2.A. Situación profesional actual

2.A.1. Contrato Ramón y Cajal Marzo 2017

Pabellón de Gobierno
Avda. Los Castros, s/n
39005 Santander

CERTIFICADO Nº 1162 / 2021

HOJA DE SERVICIOS

Primer Apellido	Segundo Apellido	Nombre	N.º D. N. Identidad
MARTINEZ	RUIZ DEL ARBOL	PABLO	72058705G
Localidad Nacimiento	**Provincia Nacimiento**	**Fecha Nacimiento**	**Nº Reg. Personal**
SANTANDER	CANTABRIA	26/10/1982	

SERVICIOS PRESTADOS	FECHA DESDE	FECHA HASTA
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, PARA PRESTAR SERVICIOS EN EL PROYECTO DE INVESTIGACIÓN 'DESARROLLO Y OPERACION DE UN TIER-2 FEDERADO PARA EL EXPERIMENTO CMS', CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/01/2010	30/09/2010
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, COMO PERSONAL INVESTIGADOR DEL PROGRAMA "RAMÓN Y CAJAL", CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/03/2017	28/02/2022

Para que conste, a petición del interesado y a los efectos que convengan, se extiende la presente certificación, en Santander, a veintidós de septiembre de dos mil veintiuno.

2.B. Cargos y actividades desempeñadas con anterioridad

2.B.1. Contrato postdoctoral ETH Enero 2017 - Febrero 2017

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314410270001

Vertragsänderung

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.01.2017
2.	**Dauer ***	28.02.2017
3.	**Probezeit**	keine
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende (1023)
	Funktionsstufe	09
	Nutzbare Erfahrung	3 Jahre
7.	**Beschäftigungsgrad**	100.00 %
8.	**Lohn**	CHF 105,000.00 Auszahlung in 13 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.
9.	**Besondere Vertrags-Bestimmungen**	Dienstort ist CERN, Genf. Hauptarbeitsort ist Sitz des CERN, Meyrin.
10.	**Berufliche Vorsorge**	Standardplan
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.
	Arbeitsbewilligung	Dieser Vertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch die kantonale Migrations- und Arbeitsmarktbehörde.

* Diese Vertragsbestandteile haben sich geändert. Alle übrigen Anstellungsbedingungen bleiben unverändert.

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden.

Datum und Unterschrift
27.10.2016

C. Arnold

Catherine Arnold
Personalsachbearbeiterin ETH Zürich

Datum und Unterschrift
31.10.2016

Pablo Martinez Ruiz del Arbol
Arbeitnehmer

2.B.2. Contrato postdoctoral ETH Octubre 2016 - Diciembre 2016

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314408150005

Arbeitsvertrag

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.10.2016
2.	**Dauer**	31.12.2016
3.	**Probezeit**	keine
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende (1023)
	Funktionsstufe	09
	Nutzbare Erfahrung	3 Jahre
7.	**Beschäftigungsgrad**	100.00 %
8.	**Lohn**	CHF 105,000.00 Auszahlung in 13 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.
9.	**Besondere Vertrags-Bestimmungen**	Dienstort ist CERN, Genf. Hauptarbeitsort ist Sitz des CERN, Meyrin.
10.	**Berufliche Vorsorge**	Standardplan
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.

Kündigungsfrist	Nach der Probezeit gilt für unbefristete Verträge Art. 20a PVO-ETH. Zeitlich befristete Arbeitsverträge enden ohne Kündigung. Eine Auflösung ist nur aus wichtigen Gründen gemäss Art. 10 Abs. 4 BPG möglich.
Vertragsänderungen	Änderungen im Arbeitsbereich oder des Arbeitsortes können durch die ETH Zürich ohne Kündigung des Arbeitsvertrages vorgenommen werden, wenn diese dienstlich erforderlich und zumutbar sind. Der Arbeitsvertrag muss ebenfalls nicht gekündigt werden, wenn im Zusammenhang mit einer Reorganisation die organisatorische Eingliederung ändert.
Arbeitsbewilligung	Dieser Arbeitsvertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch die kantonale Migrations- und Arbeitsmarktbehörde.
Rechtliche Grundlagen	Soweit der vorliegende Vertrag keine anderen Bestimmungen vorsieht, richten sich die Rechte und Pflichten nach dem BPG und nach der PVO ETH-Bereich.
Vertragsbeilagen	Broschüre ETH Personalrecht oder Hinweisblatt Verordnung für das wissenschaftliche Personal

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden und bestätigt, aufgeführte Unterlagen erhalten zu haben.

Datum und Unterschrift 15.08.2016 Roland Munz Roland Munz Personalchef ETH Zürich	Datum und Unterschrift Pablo Martinez Ruiz del Arbol Arbeitnehmer

2.B.3. Contrato postdoctoral ETH Abril 2016 - Septiembre 2016

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314410200001

Vertragsänderung

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.04.2016
2.	**Dauer** *	30.09.2016
3.	**Probezeit**	keine
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende
	Funktionsstufe	3. JAHR
7.	**Beschäftigungsgrad**	100.00 %
8.	**Lohn**	CHF 95,000.00 Auszahlung in 12 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.
9.	**Besondere Vertrags-Bestimmungen**	keine
10.	**Berufliche Vorsorge**	Standardplan
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.
	Arbeitsbewilligung	Dieser Vertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch die kantonale Migrations- und Arbeitsmarktbehörde.

* Diese Vertragsbestandteile haben sich geändert. Alle übrigen Anstellungsbedingungen bleiben unverändert.

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden.

Datum und Unterschrift
20.10.2015

C. Arnold

Catherine Arnold
Personalsachbearbeiterin ETH Zürich

Datum und Unterschrift

Pablo Martinez Ruiz del Arbol
Arbeitnehmer

2.B.4. Contrato postdoctoral ETH Octubre 2014 - Marzo 2016

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314408290001

Vertragsänderung

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.10.2014
2.	**Dauer ***	31.03.2016
3.	**Probezeit**	keine
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende
	Funktionsstufe	3. JAHR
7.	**Beschäftigungsgrad**	100.00 %
8.	**Lohn**	CHF 94,400.00 Auszahlung in 12 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.
9.	**Besondere Vertrags-Bestimmungen**	keine
10.	**Berufliche Vorsorge**	Standardplan
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.
	Arbeitsbewilligung	Dieser Vertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch die kantonale Migrations- und Arbeitsmarktbehörde.

* Diese Vertragsbestandteile haben sich geändert. Alle übrigen Anstellungsbedingungen bleiben unverändert.

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden.

Datum und Unterschrift
29.08.2014
i.V. Don Peding
Catherine Arnold
Personalsachbearbeiterin ETH Zürich

Datum und Unterschrift
03.09.2014

Pablo Martinez Ruiz del Arbol
Arbeitnehmer

2.B.5. Contrato postdoctoral ETH Octubre 2013 - Septiembre 2014

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314407110001

Vertragsänderung

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.10.2013	
2.	**Dauer** *	30.09.2014	
3.	**Probezeit**	keine	
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik	
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung	
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende	
	Funktionsstufe	3. JAHR	
7.	**Beschäftigungsgrad**	100.00 %	
8.	**Lohn**	CHF 93,900.00	Auszahlung in 12 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.	
9.	**Besondere Vertrags-Bestimmungen**	keine	
10.	**Berufliche Vorsorge**	Standardplan	
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.	
	Arbeitsbewilligung	Dieser Vertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch die kantonale Migrations- und Arbeitsmarktbehörde.	

* Diese Vertragsbestandteile haben sich geändert. Alle übrigen Anstellungsbedingungen bleiben unverändert.

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden.

Datum und Unterschrift
11.07.2013

Catherine Arnold
Personalsachbearbeiterin ETH Zürich

Datum und Unterschrift
17.07.2013

Pablo Martinez Ruiz del Arbol
Arbeitnehmer

2.B.6. Contrato postdoctoral ETH Octubre 2012 - Septiembre 2013

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314408150001

Vertragsänderung

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.10.2012	
2.	**Dauer ***	30.09.2013	
3.	**Probezeit**	keine	
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik	
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung	
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende	
	Funktionsstufe *	3. JAHR	
7.	**Beschäftigungsgrad**	100.00 %	
8.	**Lohn ***	CHF 93,300.00	Auszahlung in 12 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.	
9.	**Besondere Vertrags-Bestimmungen**	Vertrag ist an Finanzierung geknüpft. Ein allfälliger Wegfall führt zur vorzeitigen Auflösung.	
10.	**Berufliche Vorsorge**	Standardplan	
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.	

* Diese Vertragsbestandteile haben sich geändert. Alle übrigen Anstellungsbedingungen bleiben unverändert.

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden.

Datum und Unterschrift
15.08.2012

C. Arnold

Catherine Arnold
Personalsachbearbeiterin ETH Zürich

Datum und Unterschrift
23.08.2012

Pablo Martinez Ruiz del Arbol
Arbeitnehmer

2.B.7. Contrato postdoctoral ETH Octubre 2010 - Septiembre 2012

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zürich
CH-8092 Zürich

0009314408300001

Arbeitsvertrag

zwischen **ETH Zürich** und Herr **Pablo Martinez Ruiz del Arbol**, geb. 26.10.1982

1.	**Beginn**	01.10.2010
2.	**Dauer**	30.09.2012
3.	**Probezeit**	31.12.2010
4.	**Arbeitsbereich**	Inst. f. Teilchenphysik
5.	**Aufgabenbereich**	gemäss Stellenbeschreibung
6.	**Funktion**	Wiss. und höhere wiss. Mitarbeitende
	Funktionsstufe	1. JAHR
7.	**Beschäftigungsgrad**	100.00 %
8.	**Lohn**	CHF 83,700.00 Auszahlung in 12 monatlichen Teilen
	Zulagen	Ansprüche sind in der Personalverordnung des ETH Bereiches (PVO ETH-Bereich) geregelt, Bestimmungen zur Familienzulage unter Artikel 41.
9.	**Besondere Vertrags-Bestimmungen**	Vertrag ist an Finanzierung geknüpft. Ein allfälliger Wegfall führt zur vorzeitigen Auflösung.
10.	**Berufliche Vorsorge**	Standardplan
11.	**Unfallversicherung**	SUVA, Berufs- und Nichtberufsunfall. Bei einer Wochenarbeitszeit unter acht Stunden entfällt die Unfalldeckung bei Nichtberufsunfall.

Kündigungsfrist	richtet sich nach dem Bundespersonalgesetz (BPG), Art. 11/12
Vertragsänderungen	Änderungen im Arbeitsbereich oder des Arbeitsortes können durch die ETH Zürich ohne Kündigung des Arbeitsvertrages vorgenommen werden, wenn diese dienstlich erforderlich und zumutbar sind. Der Arbeitsvertrag muss ebenfalls nicht gekündigt werden, wenn im Zusammenhang mit einer Reorganisation die organisatorische Eingliederung ändert.
Arbeitsbewilligung	Dieser Arbeitsvertrag gilt, falls erforderlich, vorbehältlich der Bewilligung durch das Migrationsamt.
Rechtliche Grundlagen	Soweit der vorliegende Vertrag keine anderen Bestimmungen vorsieht, richten sich die Rechte und Pflichten nach dem BPG und nach der PVO ETH-Bereich.
Vertragsbeilagen	Broschüre ETH Personalrecht oder Hinweisblatt Verordnung für das wissenschaftliche Personal

Mit der Unterzeichnung erklärt sich der Arbeitnehmer mit dem Inhalt des Arbeitsvertrages einverstanden und bestätigt, aufgeführte Unterlagen erhalten zu haben.

Datum und Unterschrift 30.08.2010	Datum und Unterschrift 27.09.2010
H. Meier	
Hans Meier Personalchef ETH Zürich	Pablo Martinez Ruiz del Arbol Arbeitnehmer

2.B.8. Descripción de funciones en la ETH de Zurich

Translation List of duties	**Dr. Pablo Martinez Ruiz del Arbol**
Job description/function:	Scientific functions
Function:	Postdoc
FS-Code:	1022-08
Position:	Physicist
Working percentage:	100 %
Department:	PHYS
Institute	IPP
Place of Work:	CERN Geneva and ETH Zurich
Name of employee:	Dr. Pablo Martinez Ruiz del Arbol
Superior:	Prof. Rainer Wallny
Date of Entry:	01.10.2010
Date of Issue:	31.08.2012

Objective of the position: Scientific assistance in the field of research and education.

Main and secondary duties:
(the sum of all duties must add up to 100% within the working percentage)

Preparation and performanc of data analysis at the LHC. Contributions to object construction and calibration. Search for New Physics and/or measurements of the Standard Model. Contributions to the development of data analysis software.
60%

Participation in the operation of the detector and in testbeam activities and/or operation of the software infrastructure, also shift work, within the framework of CMS "ESP" Servicework Systems. 15%

Assistance in teaching (participation in exercises, practical training and lectures, correction of exams, senior assistance).
Participation in summer schools, talks and poster presentations at workshops, collaboration meetings and in conferences.
Supervision of PhD students, diploma students, practical trainees and semester students. 25%

Special regulations:
Participation in shift work, including night shifts, work on weekends, Sundays and public holidays within the framework of the activity program of the research group.

Holidays should be taken only during the time of employment. When planning your holidays, please comply with the exam plan of the teaching program.

Place of employment is Zurich. Places of work are CERN Geneva, ETH Zurich and PSI Villigen.

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Human Resources

ETH Zentrum
CH-8092 Zürich

Stellenbeschreibung

Stellenbezeichnung/Funktion:	Wissenschaftliche Funktionen
Funktion:	Wiss. Assistenz II
FS-Code	1022-08
Position:	Physiker
Stellenumfang:	100 %
Departement/Bereich	PHYS
Institut/Abteilung/Einheit:	Institute of Particle Physics
Arbeitsort:	CERN Genf
Stelleninhaber:	Dr. Pablo Martinez Ruiz del Arbol
Vorgesetzter:	Prof. Rainer Wallny
Unterstellte Stellen/Personen:	
Eintritt:	01.10.2010
Erstellungsdatum:	31.08.2012
Ziel der Stelle	Wissenschaftliche Mitarbeit im Bereich Forschung und Lehre.

Haupt- und Nebenaufgaben

Die Summe aller Aufgaben muss bezogen auf die Anstellung 100 % ergeben. Bitte verwenden Sie pro Aufgabe ein Feld

Vorbereitung und Durchführung der Datenanalyse am LHC. Beiträge zur Objekt-rekonstruktion und Kalibration. Suche nach Neuer Physik und/oder Messungen des Standardmodells. Beiträge zur Entwicklung von Datenanalyse-Software.	**060 %**
Mitarbeit beim Betrieb des Detektors und bei Testbeam Aktivitäten, und/oder Betrieb der Softwareinfrastruktur, auch im Schichtbetrieb im Rahmen des CMS "ESP" Servicework-Systems.	**015 %**
Mithilfe am Unterricht (Mitarbeit bei Übungen, Praktika und Vorlesungen, Klausurkorrektur, Oberassistenz). Teilnahme an Sommerschulen, Halten von Vorträgen sowie Posterpräsentationen an Workshops, Konferenzen und Tagungen. Betreuung von Doktoranden, Diplomanden und Praktikanden.	**025 %**

Besondere Bestimmungen: a) Einsatz bei Schichtarbeit, inkl. Nachtschicht, Arbeit an Wochenenden, Sonn- und Feiertagen im Rahmen des Tätigkeitsprogrammes der Forschungsgruppe. b) Urlaub ist während der Anstellungszeit zu nehmen. Bei der Urlaubsplanung ist grundsätzlich der Prüfungsplan der Lehrveranstaltung zu beachten, der die Mitarbeiterin oder der Mitarbeiter zugeteilt ist. c) Dienstort ist ZÜRICH. Arbeitsorte sind CERN Genf, ETH Zürich und PSI Villigen.	%
	%
	%

Total

(die Summe muss 100 % ergeben) **100 %**

Kompetenzen und Verantwortung

Datum: 31.08.2012

Unterschrift Stelleninhaber/in: ....

Unterschrift Vorgesetzte/r: ....

2.B.9. Contratado con cargo a proyecto: DESARROLLO Y OPERACION DE UN TIER-2 FEDERADO PARA EL EXPERIMENTO CMS

Pabellón de Gobierno
Avda. Los Castros, s/n
39005 Santander

CERTIFICADO Nº 1162 / 2021

HOJA DE SERVICIOS

Primer Apellido	Segundo Apellido	Nombre	N.º D. N. Identidad
MARTINEZ	RUIZ DEL ARBOL	PABLO	72058705G
Localidad Nacimiento	**Provincia Nacimiento**	**Fecha Nacimiento**	**Nº Reg. Personal**
SANTANDER	CANTABRIA	26/10/1982	

SERVICIOS PRESTADOS	FECHA DESDE	FECHA HASTA
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, PARA PRESTAR SERVICIOS EN EL PROYECTO DE INVESTIGACIÓN 'DESARROLLO Y OPERACION DE UN TIER-2 FEDERADO PARA EL EXPERIMENTO CMS', CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/01/2010	30/09/2010
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, COMO PERSONAL INVESTIGADOR DEL PROGRAMA "RAMÓN Y CAJAL", CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/03/2017	28/02/2022

Para que conste, a petición del interesado y a los efectos que convengan, se extiende la presente certificación, en Santander, a veintidós de septiembre de dos mil veintiuno.

2.B.10. Becas predoctorales para el desarrollo de tesis doctorales en líneas de investigación con interés para el sector industrial.

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
14	MARISCAL COPANO, CRISTINA MARIA.	GARCIA MARTOS, JOSE MARIA.	INST. DE LA GRASA.
15	ALONSO GONZALEZ, ANGEL LUIS.	LOPEZ CABO, MARTA.	INST. DE INVESTIGACIONES MARINAS (VIGO).

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ LOPEZ, INES.	COFRADES BARBERO, SUSANA.	INST. DEL FRIO.
2	LAMA MUÑOZ, ANTONIO.	FERNANDEZ-BOLAÑOS GUZMAN, JUAN.	INST. DE LA GRASA.

Área 8: Ciencias y Tecnologías Químicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GONZALEZ VERA, JUAN ANTONIO.	HERRANZ HERRANZ, MARIA DEL ROSARIO.	INST. DE QUIMICA MEDICA.
2	SANCHEZ BARRENA, MARIA JOSE.	ALBERT DE LA CRUZ, ARMANDO JOAQUIN.	INST. DE QUIMICA FISICA «ROCASOLANO».
3	ABAD VALLE, PATRICIA.	MARTINEZ TARAZONA, MARIA ROSA.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
4	CANO MERCADO, ALMUDENA.	CAMPOS MARTIN, JOSE MIGUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
5	MARTINEZ AVILA, OLGA MARIA.	PENADES ULLATE, SOLEDAD.	INST. DE INVESTIGACIONES QUIMICAS.
6	PINILLA IBARZ, JOSE LUIS.	MOLINER ALVAREZ, RAFAEL.	INST. DE CARBOQUIMICA.
7	RUBIO MORENO, MIGUEL.	PIZZANO MANCERA, ANTONIO JOSE.	INST. DE INVESTIGACIONES QUIMICAS.
8	LOPEZ SANTOS, LAURA.	CARMONA GUZMAN, ERNESTO.	INST. DE INVESTIGACIONES QUIMICAS.
9	VALLES CALLIZO, CRISTINA MARIA.	MASER, WOLFGANG.	INST. DE CARBOQUIMICA.
10	RENDON MARQUEZ, NURIA.	PANEQUE SOSA, MARGARITA ISABEL.	INST. DE INVESTIGACIONES QUIMICAS.
11	BARBA ALBANELL, CLARA.	CODERCH NEGRA, MARIA LUISA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
12	MARTRAT SOTIL, BELEN.	GRIMALT OBRADOR, JUAN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
13	SAMPEDRO TEJEDOR, PATRICIA.	SASTRE DE ANDRES, ENRIQUE.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	BATALLA BOSQUET, PILAR.	GUISAN SEIJAS, JOSE MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
15	ORTEGA ORTEGA, REBECA.	SANZ APARICIO, JULIANA.	INST. DE QUIMICA FISICA «ROCASOLANO».
16	CASTRILLO CARREIRA, INES.	BRUIX BAYES, MARTA.	INST. DE QUIMICA FISICA «ROCASOLANO».
17	ALONSO DE LA CRUZ, CARMEN ROSA.	SUAREZ LOPEZ, ERNESTO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
18	MATAS RUIZ, INMACULADA.	CAMPORA PEREZ, JUAN.	INST. DE INVESTIGACIONES QUIMICAS.
19	AGUILAR MONCAYO, MATILDE.	GARCIA FERNANDEZ, JOSE MANUEL.	INST. DE INVESTIGACIONES QUIMICAS.
20	TRASTOY BELLO, BEATRIZ.	CHIARA ROMERO, JOSE LUIS.	INST. DE QUIMICA ORGANICA GENERAL.
21	SAAVEDRA FERNANDEZ, CARLOS JAVIER.	HERNANDEZ GONZALEZ, ROSENDO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
22	HERRERA CARRILLO, ELENA.	HARO VILLAR, ISABEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
23	ARREGUI VELAZQUEZ, ANDRES.	NALDA MINGUEZ, REBECA DE.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	HORNES MARTINEZ, AITOR.	MARTINEZ ARIAS, ARTURO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
2	MAGRIZ TASCON, ANTONIO.	LASSALETTA SIMON, JOSE MARIA.	INST. DE INVESTIGACIONES QUIMICAS.
3	SALVADOR VICO, JUAN PABLO.	MARCO COLAS, MARIA PILAR.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
4	JIMENEZ RODRIGUEZ, AURORA.	CLAPES SABORIT, PERE.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
5	FERNANDEZ AROJO, LUCIA.	BALLESTEROS OLMO, ANTONIO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
6	NAVAS GARCIA, RAQUEL.	KHIAR EL WAHABI, NOUREDDINE.	INST. DE INVESTIGACIONES QUIMICAS.
7	LOPEZ CHOCARRO, AZUCENA.	ANDRES GIMENO, JOSE MANUEL.	INST. DE CARBOQUIMICA.
8	QUINTANA HERNANDEZ, NAYRA.	FRAGA GONZALEZ, BRAULIO MANUEL.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
9	MARTIN BENITO, DARIO.	GONZALEZ COLOMA, ANA AZUCENA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
10	TORRES GUZMAN, RICARDO.	BAÑARES GONZALEZ, MIGUEL ANGEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
11	GONZALEZ JIMENEZ, INES DACIL.	ALVAREZ GALVAN, MARIA CONSUELO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
12	ORTIZ DE LA TABLA GONZALEZ, LAURA.	CAMPORA PEREZ, JUAN.	INST. DE INVESTIGACIONES QUIMICAS.

Segundo.-Ordenar la publicación de la presente Resolución a los efectos previstos por el artículo 59.6.b) de la Ley 30/1992, de 26 de noviembre.

La presente resolución, que pone fin a la vía administrativa, podrá ser recurrida potestativamente en reposición, en el plazo de un mes contado a partir del día siguiente a la fecha de su notificación, ante esta Presidencia, de conformidad con lo establecido por los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra esta resolución cabe interponer recurso contencioso administrativo ante el Juzgado Central de lo Contencioso Administrativo en el plazo de dos meses contado a partir del día siguiente a la fecha de su notificación, conforme a lo dispuesto por la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso Administrativa.

No podrá interponerse recurso contencioso administrativo hasta que sea resuelto expresamente o se haya producido la desestimación presunta del recurso de reposición interpuesto.

Madrid, 29 de noviembre de 2005.–El Presidente, Carlos Martínez Alonso

21015 *RESOLUCIÓN de 29 de noviembre, de 2005, del Consejo Superior de Investigaciones Científicas, por la que se conceden becas predoctorales para el desarrollo de tesis doctorales en líneas de investigación con interés para el sector industrial.*

Por Resolución del Consejo Superior de Investigaciones Científicas de 27 de julio de 2005 (Boletín Oficial del Estado de 19 de agosto de 2005) se convocaron becas predoctorales para el desarrollo de Tesis Doctorales en Líneas de investigación con interés para el sector industrial.

Vista la propuesta formulada por la Comisión de selección prevista en la expresada convocatoria, esta Presidencia, en ejercicio de las competencias que tiene atribuidas en virtud de lo establecido por el artículo 15.1 del Estatuto del Organismo Autónomo Consejo Superior de Investigaciones Científicas, aprobado por Real Decreto 1945/2000, de 1 de diciembre, y de conformidad con lo previsto por el artículo 81.3 del texto refundido de la Ley General Presupuestaria, aprobado por Real Decreto Legislativo 1091/1988, de 23 de septiembre, ha resuelto:

Primero.–Adjudicar las becas y designar como suplentes a los candidatos siguientes:

Becas CSIC Predoctorales

Área 1: Humanidades y Ciencias Sociales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GRUBER, DIEGO.	BURGUET VERDE, ROBERTO.	INST. DE ANALISIS ECONOMICO.
2	OSUNA LOPEZ, MARIA DEL CARMEN.	SANZ MENENDEZ, LUIS VICENTE.	UNIDAD DE POLITICAS COMPARADAS.
3	SALGADO CARMONA, JOSE ANGEL.	CELESTINO PEREZ, SEBASTIAN.	INST. DE ARQUEOLOGIA.
4	BECERRA SOLA, MALENA.	GONZALEZ LEANDRI, RICARDO OMAR.	ESCUELA DE ESTUDIOS HISPANOAMERICANOS.
5	JUAREZ, SOL PIA.	RAMIRO FARIÑAS, SOL PIA.	INST. DE ECONOMIA Y GEOGRAFIA.
6	PARGA DANS, EVA.	CRIADO BOADO, FELIPE.	INST. DE ESTUDIOS GALLEGOS P. SARMIENTO.
7	FUENTES ARCOS, REBECA.	SERRANO RUANO, DELFINA.	INST. DE FILOLOGIA.
8	TELLEZ DELGADO, VIRTUDES.	SANCHEZ CARRETERO, CRISTINA.	INST. DE LA LENGUA ESPAÑOLA.
9	MERCHAN HERNANDEZ, CARMEN.	FERNANDEZ ESQUINAS, MANUEL.	INST. EST. SOCIALES AVANZADOS ANDALUCIA.
10	MONTEIRA ARIAS, INES.	CABALLERO ZOREDA, LUIS.	INSTO. HISTORIA.
11	SANZ FUENTES, ANA.	ECHEVERRIA EZPONDA, JAVIER.	INST. DE FILOSOFIA.
12	YEGROS YEGROS, ALFREDO.	FERNANDEZ DE LUCIO, IGNACIO.	INST. GESTION INNOVACION Y CONOCIMIENTO.
13	ACERO PEREZ, JESUS.	MATEOS CRUZ, PEDRO.	INST. DE ARQUEOLOGIA.
14	GONZALEZ ALCAIDE, GREGORIO.	VALDERRAMA ZURIAN, JUAN CARLOS.	INST. DE HIST. DE LA CC. Y DOC. L.PIÑERO.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LIESE, CARSTEN.	PONSATI OBIOLS, CLARA.	INST. DE ANALISIS ECONOMICO.
2	CABRERIZO HURTADO, JORGE JESUS.	NAVARRO PALAZON, JULIO.	ESCUELA DE ESTUDIOS ARABES.
3	CRUZ VALLES, ANTONIO DE LA.	MATE RUPEREZ, MANUEL REYES.	INST. DE FILOSOFIA.
4	OSUNA NEVADO, MARIA DEL CARMEN.	IRUROZQUI VICTORIANO, MARTA.	INSTO. HISTORIA.
5	GONZALEZ CAMARA, NOELIA.	VELASCO ARROYO, JUAN CARLOS.	INST. DE FILOSOFIA.

Área 2: Biología y Biomedicina

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	ROSELLO DIEZ, ALBERTO.	TORRES SANCHEZ, MIGUEL.	CTRO. NAL. DE BIOTECNOLOGIA.
2	CASTRILLO JIMENEZ, BEATRIZ.	ROMERO RODRIGUEZ, JOSE MARIA.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
3	FUSTER ORTUÑO, JOSE JAVIER.	ANDRES GARCIA, VICENTE.	INST. DE BIOMEDICINA DE VALENCIA.
4	AQUIZU LOPEZ, NAIARA.	MARTINEZ BALBAS, MARIA ANGELES.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
5	GARCIA GARCIA, CELINA.	LOPEZ RIVAS, ABELARDO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
6	CECI, MARIA LAURA.	DE CARLOS SEGOVIA, JUAN ANDRES.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
7	ESCUDERO GONZALEZ, BEATRIZ.	SAMPER RODRIGUEZ, ENRIQUEZ.	CTRO. NAL. DE BIOTECNOLOGIA.
8	MOLINA FUENTES, AGUEDA.	NAVARRO CARRETERO, MIGUEL ANGEL.	INST. PARASITOL.Y BIOMED. «LOPEZ NEYRA».
9	UHIA CASTRO, IRIA.	GARCIA LOPEZ, JOSE LUIS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
10	RAMOS FERNANDEZ, ANTONIO.	VAZQUEZ COBOS, JESUS MARIA.	CTRO. DE BIOLOGIA MOLECULAR.
11	ESCOLANO ARTIGAS, AMELIA.	DIAZ-MECO CONDE, MARIA TERESA.	CTRO. DE BIOLOGIA MOLECULAR.
12	DIEZ NUÑO, HECTOR.	CARRION VAZQUEZ, MARIANO SIXTO.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
13	MORENO ANDRES, DANIEL.	SANZ BIGORRA, PASCUAL FELIPE.	INST. DE BIOMEDICINA DE VALENCIA.
14	ELIAS VILLALOBOS, ALBERTO.	IBEAS CORCELLES, JOSE IGNACIO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
15	VIDAL SERNANDEZ, ISORA.	MARTINEZ ALONSO, CARLOS.	CTRO. NAL. DE BIOTECNOLOGIA.
16	FERNANDEZ-TRESGUERRES TORRECILLAS, BEATR.	MARTINEZ FERRER, ANGEL TOMAS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
17	AMICH ELIAS, JORGE.	CALERA ABAD, JOSE ANTONIO.	INST. DE MICROBIOLOGIA BIOQUIMICA.
18	FERNANDEZ FERNANDEZ, ISABEL.	LAZO-ZBIKOWSKI TARACENA, PEDRO ALFONSO.	INSTO.BIOL.MOL.CEL. CANCER DE SALAMANCA.
19	MUÑOZ GALVAN, SANDRA.	AGUILERA LOPEZ, ANDRES.	CTRO.ANDALUZ DE BIOL.MOL.(CABIMER).
20	FANO BILBAO, OIHANE.	RODRIGUEZ DE CORDOBA, SANTIAGO.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
21	DOMINGUEZ CANTERO, MARIA DEL PILAR.	DOMINGUEZ OLAVARRI, ANGEL.	INST. DE MICROBIOLOGIA BIOQUIMICA.
22	LOPEZ GARAULET, DANIEL.	SANCHEZ-HERRERO ARBIDE, ERNESTO.	CTRO. DE BIOLOGIA MOLECULAR.
23	ROJAS RIOS, PATRICIA.	GONZALEZ REYES, ALFONSO ACAIMO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
24	FERNANDEZ MUÑOZ, BEATRIZ.	QUINTANILLA AVILA, MIGUEL.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
25	ESCRIBANO DIAZ, MARIA CRISTINA.	BERNAD MIANA, ANTONIO.	CTRO. NAL. DE BIOTECNOLOGIA.
26	JARAMILLO MERCHAN, JESUS A.	RAMON CUETO, MARIA ALMUDENA.	INST. DE BIOMEDICINA DE VALENCIA.
27	MARTIN SANCHEZ, IKER.	SANCHEZ RODRIGUEZ, LUCAS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
28	QUINTERO RUIZ, MARIA CRISTINA.	SANCHEZ SANZ, MARIA JOSE.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
29	MONTE NIETO, GONZALO DEL.	POMPA MINGUEZ, JOSE LUIS DE LA.	CTRO. NAL. DE BIOTECNOLOGIA.
30	FERNANDEZ NOHALES, PEDRO.	MADUEÑO ALBI, FRANCISCO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
31	LOPEZ SANCHEZ, ANA.	VARA VERA, PABLO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
32	FUENTE ARTEAGA, SARA ANDREA.	JIMENEZ CUENCA, BENILDE.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	RESA INFANTE, PATRICIA.	ORTIN MONTON, JUAN.	CTRO. NAL. DE BIOTECNOLOGIA.
2	SAN MARTIN URIZ, PATXI.	AMILS PIBERNAT, RICARDO.	CTRO. DE BIOLOGIA MOLECULAR.
3	ESTEBAN SAÑUDO, ANA.	SANTAMARIA SANCHEZ, RAMON IGNACIO.	INST. DE MICROBIOLOGIA BIOQUIMICA.
4	BUSTOS SANMAMED, MARIA DEL PILAR.	VALDIVIESO MONTERO, MARIA HENAR.	INST. DE MICROBIOLOGIA BIOQUIMICA.
5	CASAÑAS ADAM, ARNAU.	VERDAGUER MASSANA, NURIA.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
6	ABREU DE FELIPE, MIGUEL.	FERNANDEZ LOBATO, MARIA.	CTRO. DE BIOLOGIA MOLECULAR.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
7	LOZANO ROSAS, VIRGINIA.	RAMIREZ ORTIZ, ANGEL.	CTRO. DE BIOLOGIA MOLECULAR.
8	GIL RODRIGUEZ, MARIA CONCEPCION.	JUAN JOSE GARRIDO JURADO.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
9	SILIO CASTREJON, VIRGINIA.	FRADE LOPEZ, JOSE MARIA.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
10	CAMPOS MUELAS, PEDRO MANUEL.	MAYOR MENENDEZ, FEDERICO.	CTRO. DE BIOLOGIA MOLECULAR.
11	MESEGUER LLOPIS, SALVADOR.	BARETTINO FRAILE, DOMINGO.	INST. DE BIOMEDICINA DE VALENCIA.
12	NAVARRETE GOMEZ, MARIA LUISA.	FERRANDIZ MAESTRE, CRISTINA.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
13	ORDOÑO BALLESTEROS, DESIDERIO.	CASASNOVAS SUELVES, JOSE MARIA.	CTRO. NAL. DE BIOTECNOLOGIA.
14	AMADOR HIERRO, CRISTINA.	SANTERO SANTURINO, EDUARDO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
15	REDONDO MUÑOZ, JAVIER.	GARCIA PARDO, MARIA DE LOS ANGELES.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
16	GUTIERREZ BELTRAN, EMILIO.	VALVERDE ALBACETE, FEDERICO.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
17	YEPES GARCIA, ANA.	FERNANDEZ ABALOS, JOSE MANUEL.	INST. DE MICROBIOLOGIA BIOQUIMICA.
18	TARDAGUILA SANCHO, MANUEL.	SANCHEZ PACHECO, AURORA.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
19	SHLEVKOV, EVGENY.	MORATA PEREZ, GINES.	CTRO. DE BIOLOGIA MOLECULAR.
20	LAGARES SALTO, DAVID.	LACAL SANJUAN, JUAN CARLOS.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
21	ROLDAN RIVERO, ISAAC.	MERIDA BERLANGA, ANGEL.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
22	FERNANDEZ CORDERO, BALDOMERO.	RODRIGUEZ MARTINEZ, HERMINIA.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
23	BARZI DIEGUEZ, MARIA MERCEDES.	PONS FUXA, SEBASTIAN.	INST. DE INVEST. BIOMEDICAS BARCELONA.
24	RINCON GILA, ESTHER.	MERIDA DE SAN ROMAN, ISABEL.	CTRO. NAL. DE BIOTECNOLOGIA.
25	SANCHEZ RUIZ, JESUS.	GONZALEZ GARCIA, ANA.	CTRO. NAL. DE BIOTECNOLOGIA.
26	CASTELLANOS MOLINA, MILAGROS.	GARCIA MATEU, MAURICIO.	CTRO. DE BIOLOGIA MOLECULAR.
27	MARTIN MARTIN, ANA ISABEL.	TAMAME GONZALEZ, MARIA MERCEDES.	INST. DE MICROBIOLOGIA BIOQUIMICA.
28	GONZALEZ PRIETO, ROMAN.	MIRANDA VIZUETE, ANTONIO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
29	FERNANDEZ MARTIN, AMELIA.	DELGADO MORA, MARIO.	INST. PARASITOL.Y BIOMED. «LOPEZ NEYRA».

Área 3: Recursos Naturales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PEDRAZA LARA, CARLOS SALVADOR.	DOADRIO VILLAREJO, JOSE IGNACIO.	MUSEO NACIONAL DE CIENCIAS NATURALES.
2	SERRANO MUELA, MARIA PILAR.	REGUES MUÑOZ, DAVID.	INST. PIRENAICO DE ECOLOGIA.
3	KALMAN, JUDIT.	BLASCO MORENO, JULIAN.	INST. DE CIENCIAS MARINAS DE ANDALUCIA.
4	MARTINEZ GARCIA, PEDRO.	SOTO HERMOSO, JUAN IGNACIO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
5	FERNANDEZ PIÑAR, REGINA.	SAINZ DIAZ, CLARO IGNACIO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
6	CABEZAS PADILLA, PATRICIA.	MACHORDOM BARBE, ANNIE.	MUSEO NACIONAL DE CIENCIAS NATURALES.
7	GORI, ANDREA.	GILI SARDA, JOSE MARIA.	INST. DE CIENCIAS DEL MAR.
8	PEREZ RAMIREZ, ELISA.	GORTAZAR SCHMIDT, CHRISTIAN.	INST. DE INV. EN RECURSOS CINEGETICOS.
9	SETTANNI, CHIARA.	GARCIA PARIS, MARIO.	MUSEO NACIONAL DE CIENCIAS NATURALES.
10	RUIZ CONSTAN, ANA.	SANZ DE GALDEANO EQUIZA, CARLOS MANUEL.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
11	SAÑE SCHEPISI, ELISABET.	ALONSO MARTINEZ, MARIA BELEN.	INST. DE CIENCIAS DEL MAR.
12	FLORENCIO DIAZ, MARGARITA PATRICIA.	DIAZ PANIAGUA, MARIA DEL CARMEN.	ESTACION BIOLOGICA DE DOÑANA.
13	FONOLLA ARAUJO, PAULA.	MARTI ROCA, EUGENIA.	CTRO. DE ESTUDIOS AVANZADOS DE BLANES.
14	IRLES IVANAC, PAULA.	PIULACHS BAGA, MARIA DOLORES.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
15	SICILIA GARCIA, MARISA.	CASSINELLO ROLDAN, JORGE.	INST. DE INV. EN RECURSOS CINEGETICOS.
16	PASTOR MOLLA, MARIA VIRTUDES.	PELEGRI LLOPART, JOSE LUIS.	INST. DE CIENCIAS DEL MAR.
17	FERNANDEZ GOMEZ, BEATRIZ.	PEDROS ALIO, CARLOS.	INST. DE CIENCIAS DEL MAR.
18	VILLAMOR MARTIN-PRAT, ADRIANA.	BECERRO GARCIA, MIKEL AINGERU.	CTRO. DE ESTUDIOS AVANZADOS DE BLANES.
19	RODRIGUEZ JORDA, MARIA PAZ.	GARCIA GONZALEZ, MARIA TERESA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
20	TORRECILLA RIBALTA, ELENA.	PIERA FERNANDEZ, JAUME.	CTRO.MEDIT.INV.MARINAS Y AMBIENTALES.
21	TORAL JIMENEZ, GREGORIO MAGNO.	FIGUEROLA BORRAS, JORDI.	ESTACION BIOLOGICA DE DOÑANA.
22	LLEBOT LORENTE, CLARA.	ESTRADA MIYARES, MARTA.	INST. DE CIENCIAS DEL MAR.
23	VAZQUEZ RODRIGUEZ, MARCOS.	FERNANDEZ PEREZ, FIZ.	INST. DE INVESTIGACIONES MARINAS (VIGO).
24	CANAL PIÑA, DAVID.	POTTI SANCHEZ, JAIME.	ESTACION BIOLOGICA DE DOÑANA.
25	MARTIN PEREZ, ANDREA.	ALONSO ZARZA, ANA MARIA.	INST. DE GEOLOGIA ECONOMICA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ LLANDRES, ANA.	ABAIGAR ANCIN, TERESA.	ESTACION EXPERIMENTAL DE ZONAS ARIDAS.
2	NIETO MORENO, ANA.	DELGADO HUERTAS, ANTONIO LUIS.	ESTACION EXPERIMENTAL DEL ZAIDIN.
3	ECHEVESTE DE MIGUEL, PEDRO.	AGUSTI REQUENA, SUSANA.	INST. MEDITERRANEO DE ESTUDIOS AVANZADOS.
4	PEREZ RODRIGUEZ, ALFONSO.	VAZQUEZ RODRIGUEZ, ANTONIO.	INST. DE INVESTIGACIONES MARINAS (VIGO).
5	GALINDO RUEDA, MARIA DEL MAR.	LOPEZ GALINDO, ALBERTO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
6	OLLERO VILA, MARIA INMACULADA.	MOLINA DONATE, MARIA JOSEFA.	CTRO. DE INVESTIG. SOBRE DESERTIFICACION.
7	FERNANDEZ DOCASAL, SANDRA.	MURADO GARCIA, MIGUEL.	INST. DE INVESTIGACIONS MARINAS (VIGO).
8	MARTINEZ HARO, MONICA.	MATEO SORIA, RAFAEL.	INST. DE INV. EN RECURSOS CINEGETICOS.
9	MILLAN SCHEIDING, CRISTINA.	ANTOLIN TOMAS, CARMEN.	CTRO. DE INVESTIG. SOBRE DESERTIFICACION.
10	GARAGORRI ATRISTAIN, PILAR.	MUÑOZ FUENTE, JESUS.	REAL JARDIN BOTANICO.
11	SCHIAFFINO, CHIARA.	GUILLEN ARANDA, JORGE BENITO.	INST. DE CIENCIAS DEL MAR.
12	CRUZ FOLCH, ANTONIO.	DEMESTRE ALTED, MONTSERRAT.	INST. DE CIENCIAS DEL MAR.
13	MUZYLO, ALEKSANDRA.	LLORENS GARCIA, MARIA DEL PILAR.	INST. DE CIENCIAS DE LA TIERRA»J.ALMERA».
14	FERNANDEZ DE LA REGUERA TAYA, DIANA.	SARASQUETE REIRIZ, MARIA DEL CARMEN.	INST. DE CIENCIAS MARINAS DE ANDALUCIA.

Área 4: Áreas Agrarias

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GARCIA VILA, MARGARITA.	FERERES CASTIEL, ELIAS.	INST. DE AGRICULTURA SOSTENIBLE.
2	ZAFRA GOMEZ, AMELIA.	GIRALDEZ CERVERA, JUAN V.	INST. DE AGRICULTURA SOSTENIBLE.
3	PEREZ TIENDA, JACOB RAFAEL.	FERROL GONZALEZ, NURIA.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
4	RUIZ NAVARRO, ANTONIO.	ALBALADEJO MONTORO, JUAN.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
5	TORRES CORTES, GLORIA.	MARTINEZ-ABARCA PASTOR, FRANCISCO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
6	RUBIO NOVELLA, SILVIA.	RODRIGUEZ EGEA, PEDRO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
7	GAGO MONTAÑA, PILAR.	MARTINEZ RODRIGUEZ, MARIA DEL CARMEN.	MISION BIOLOGICA DE GALICIA.
8	RUIZ MIRAZO, JABIER.	GONZALEZ REBOLLAR, JOSE LUIS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
9	ARANDA SILICIA, MARIA DE LAS NIEVES.	RODRIGUEZ ROSALES, MARIA DEL PILAR.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
10	LOPEZ MONDEJAR, RUBEN.	PASCUAL VALERO, JOSE ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
11	ORTEGA MADUEÑO, ISABEL.	LUCAS SANCHEZ, MARIA MERCEDES.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
12	PEREZ MARTIN, ALFONSO.	DIAZ ESPEJO, ANTONIO.	INST. DE REC.NAT. Y AGROBIOL. SEVILLA.
13	SAGARDOY CALDERON, RUTH.	MORALES IRIBAS, FERMIN.	ESTACION EXPERIMENTAL «AULA DEI».
14	DIAZ RODRIGUEZ, ROSARIO.	GARCIA ROMERA, INMACULADA.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
15	ALEMAN GUILLEN, FERNANDO.	RUBIO MUÑOZ, FRANCISCO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
16	MARTINEZ MEDINA, AINHOA.	ROLDAN GARRIGOS, ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	SARRIA VILLADA, EMILIO.	LOPEZ SESE, ANA ISABEL.	ESTACION EXPERIMENTAL «LA MAYORA».
2	TOMAS GARCIA, DIEGO MIGUEL.	MORIONES ALONSO, ENRIQUE.	ESTACION EXPERIMENTAL «LA MAYORA».
3	FUENTES PANIAGUA, SARA.	MUÑIZ DAZA, MARIANO.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
4	ROCA HERNANDEZ, AMALIA.	RAMOS MARTIN, JUAN LUIS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
5	CONDE AGUILERA, JOSE ALBERTO.	FERNANDEZ-FIGARES IBAÑEZ, IGNACIO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
6	MACIAS HUETE, FRANCISCO.	CASTRO LOPEZ, ANTONIO JESUS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
7	ANDREU GARGALLO, VANESA.	ALFONSO LOZANO, MIGUEL.	ESTACION EXPERIMENTAL «AULA DEI».
8	GARCIA SANCHEZ, MERCEDES.	OCAMPO BOTE, JUAN ANTONIO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
9	IGLESIA FERNANDEZ, MANUEL.	BALLESTER ALVAREZ-PARDIÑAS, ANTONIO.	INST. DE INVEST. AGROBIOL. DE GALICIA.
10	SANZ CEBALLOS, LAURA.	SANZ SAMPELAYO, MARIA REMEDIOS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
11	DIAZ VIVANCOS, PEDRO.	HERNANDEZ CORTES, JOSE ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
12	LOPEZ GARRIDO, ROSA.	CABRERA CAPITAN, FRANCISCO DE PAULA.	INST. DE REC.NAT. Y AGROBIOL. SEVILLA.
13	DORADO PANIAGUA, MARIA DEL CARMEN.	SANCHEZ MARTIN, MARIA JESUS.	INST. DE REC.NAT. Y AGROBIOL. SALAMANCA.
14	EXPOSITO HARRIS, RUTH.	GALLEGOS FERNANDEZ, MARIA TRINIDAD.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
15	MARIN PIQUERAS, MARIA DEL CARMEN.	SAHRAWY BARRAGAN, MARIAM.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
16	AREVALO MARIN, LAURA.	MARTINEZ LOPEZ, VICENTE.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
17	VALDERRAMA TRASLAVIÑA, JONATHAN ANDRES.	BEDMAR GOMEZ, EULOGIO JOSE.	ESTACION EXPERIMENTAL DEL «ZAIDIN».

Área 5: Ciencia y Tecnologías Físicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	RUBIO NUÑEZ, ROBERTO.	GARCIA PRADA, OSCAR SEGUNDO.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
2	GOMEZ VERGEL, DANIEL.	BARBERO GONZALEZ, JESUS FERNANDO.	INST. DE ESTRUCTURA DE LA MATERIA.
3	SANZ RUIZ, MIKEL.	CABRILLO GARCIA, CARLOS.	INST. DE ESTRUCTURA DE LA MATERIA.
4	MARTINEZ RUIZ DEL ARBOL, PABLO.	MATORRAS WEINIG, FRANCISCO.	INST. DE FISICA DE CANTABRIA.
5	MUÑOZ MARTIN, DAVID.	GONZALO DE LOS REYES, JOSE.	INST. DE OPTICA «DAZA DE VALDES».
6	SEVILLA RUIZ, JUAN FRANCISCO.	GONZALEZ DE SANTOS, PABLO.	INST. DE AUTOMATICA INDUSTRIAL.
7	PAN COLLANTES, ANTONIO JESUS.	MUÑOZ VELAZQUEZ, VICENTE.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
8	CASAL LARAÑA, BRUNO.	RUIZ JIMENO, ALBERTO.	INST. DE FISICA DE CANTABRIA.
9	PRIETO HONORATO, JOSE CARLOS.	JIMENEZ RUIZ, ANTONIO RAMON.	INST. DE AUTOMATICA INDUSTRIAL.
10	LEÑERO BARDALLO, JUAN ANTONIO.	LINARES BARRANCO, BERNABE.	INST. DE MICROELECTRONICA DE SEVILLA.
11	DIEGO MARTINEZ, RAUL DE.	GARRIDO BELLIDO, EDUARDO.	INST. DE ESTRUCTURA DE LA MATERIA.
12	VIEJO CORTES, JULIAN.	BELLIDO DIAZ, MANUEL JESUS.	INST. DE MICROELECTRONICA DE SEVILLA.
13	PERREAU DE PINNINCHK BAS, ADRIAN.	SIERRA GARCIA, CARLOS ALBERTO.	INST. DE INV. INTELIGENCIA ARTIFICIAL.
14	GIL ORTIZ, ALEJANDRO.	DIAZ MEDINA, JOSE.	INST. DE FISICA CORPUSCULAR.
15	MALDONADO LOPEZ, ROCIO.	LIÑAN CEMBRANO, GUSTAVO.	INST. DE MICROELECTRONICA DE SEVILLA.
16	LOPEZ RUIZ, FRANCISCO FELIPE.	ALDAYA VALVERDE, VICTOR.	INST. DE ASTROFISICA DE ANDALUCIA.
17	GODINO AMADO, NIEVES.	MUÑOZ PASCUAL, FRANCISCO JAVIER.	INST. DE MICROELECTRONICA DE BARCELONA.
18	HUSAR, ATTILA PETER.	RIERA COLOMER, JORGE.	INST. DE ROBOTICA E INFORMATICA INDUST.
19	MARTINEZ GARRIDO, RAMSES VALENTIN.	GARCIA GARCIA, RICARDO.	INST. DE MICROELECTRONICA DE MADRID.
20	JANNES, GIL.	BARCELO SERON, CARLOS.	INST. DE ASTROFISICA DE ANDALUCIA.
21	SANCHEZ CONDE, MIGUEL ANGEL.	PRADA MARTINEZ, FRANCISCO.	INST. DE ASTROFISICA DE ANDALUCIA.
22	GARCIA FERNANDEZ, MARIO.	ALVAREZ CONSUL, LUIS.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
23	FERRARIO, PAOLA.	RODRIGO GARCIA, GERMAN VICENTE.	INST. DE FISICA CORPUSCULAR.
24	CASTRO ARRIBAS, ALBERTO DE.	MARCOS CELESTINO, SUSANA.	INST. DE OPTICA «DAZA DE VALDES».

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	ALONSO GONZALEZ, PABLO.	GONZALEZ SOTOS, LUISA.	INST. DE MICROELECTRONICA DE MADRID.
2	SOLANS SANCHEZ, CARLOS.	EMILIO HIGON RODRIGUEZ.	INST. DE FISICA CORPUSCULAR.
3	RUIZ OLAYA, ANDRES FELIPE.	CALDERON ESTEVEZ, LEOPOLDO.	INST. DE AUTOMATICA INDUSTRIAL.
4	HUSSEIN HASSAN, NASHAAT MOHAMED.	BARRIGA BARROS, ANGEL.	INST. DE MICROELECTRONICA DE SEVILLA.
5	GOMEZ DIAZ, JAIME.	NOGALES RUIZ, AURORA.	INST. DE ESTRUCTURA DE LA MATERIA.
6	GILLI, GABRIELLA.	LOPEZ VALVERDE, MIGUEL ANGEL.	INST. DE ASTROFISICA DE ANDALUCIA.
7	BURSET ATIENZA, PABLO.	GONZALEZ CARMONA, JOSE.	INST. DE ESTRUCTURA DE LA MATERIA.
8	CARRASCO GONZALEZ, CARLOS.	ANGLADA PONS, GUILLEM JOSEP.	INST. DE ASTROFISICA DE ANDALUCIA.
9	ATENCIA ARCAS, MANUEL.	AGUSTI CULLEL, JAIME.	INST. DE INV. INTELIGENCIA ARTIFICIAL.
10	PELAEZ MACHADO, SAMUEL.	SERENA DOMINGO, PEDRO AMALIO.	INST. DE CIENCIA DE MATERIALES MADRID.
11	VIVES TORRESCASANA, ROGER.	FUSTER VERDU, JUAN ANTONIO.	INST. DE FISICA CORPUSCULAR.
12	GERBER, DANIEL.	FERNANDEZ BARBON, JOSE LUIS.	INST. DE FISICA TEORICA.
13	MARTIN FERNANDEZ, IÑIGO.	GODIGNON, PHILIPPE.	INST. DE MICROELECTRONICA DE BARCELONA.
14	MARTIN MARTIN, RUBEN.	CEBOLLADA NAVARRO, ALFONSO.	INST. DE MICROELECTRONICA DE MADRID.
15	PERALTA CHANA, CELIA.	PONS AGLIO, ALICIA.	INST. DE FISICA APLICADA.
16	DOMINGUEZ REYES, RICARDO.	GARCIA BORGE, MARIA JOSE.	INST. DE ESTRUCTURA DE LA MATERIA.
17	CARRANZA HERREZUELO, NOEMI.	CRISTOBAL PEREZ, GABRIEL.	INST. DE OPTICA «DAZA DE VALDES».

Área 6: Ciencia y Tecnología de Materiales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	BARRIO LAS HERAS, JESUS DEL.	ORIOL LANGA, LUIS TEODORO.	INST. DE CIENC. DE MATERIALES DE ARAGON.
2	GARCIA GONZALEZ, CARLOS A.	DOMINGO PASCUAL, CONCEPCION.	INST. DE CIENCIA DE MATERIALES BARNA.
3	FERREIRO GARZON, SERGIO.	FRIAS ROJAS, MOISES.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.
4	ODRIOZOLA LLORET, CARLOS PATRICIO.	JUSTO ERBEZ, ANGEL.	INST. DE CIENCIA DE MATERIALES SEVILLA.
5	CESPEDES MONTOYA, EVA.	PRIETO DE CASTRO, CARLOS ANDRES.	INST. DE CIENCIA DE MATERIALES MADRID.
6	RIGATO, FRANCO.	FONTCUBERTA GRIÑO, JOSE.	INST. DE CIENCIA DE MATERIALES BARNA.
7	MARTI ROVIROSA, XAVIER.	SANCHEZ BARRERA, FLORENCIO.	INST. DE CIENCIA DE MATERIALES BARNA.
8	GOMEZ AVILES, ALMUDENA.	ARANDA GALLEGO, MARIA PILAR.	INST. DE CIENCIA DE MATERIALES MADRID.
9	CARRETERO DEL POZO, PAULA.	ABAJO GONZALEZ, FRANCISCO JAVIER DE.	INST. DE CIENCIA Y TECNOLOGIA POLIMEROS.
10	LUCCAS, ROBERTO FABIAN.	PUIG MOLINA, MARIA TERESA.	INST. DE CIENCIA DE MATERIALES BARNA.
11	HIDALGO MANRIQUE, PALOMA.	RUANO MARIÑO, OSCAR ANTONIO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
12	CANO TORRES, JOSE MARIA.	SERRANO HERNANDEZ, MARIA DOLORES.	INST. DE CIENCIA DE MATERIALES MADRID.
13	FARRAS COSTA, PAU.	TEIXIDOR BOMBARDO, FRANCESC.	INST. DE CIENCIA DE MATERIALES BARNA.
14	PEREÑIGUEZ RODRIGUEZ, ROSA MARIA.	HOLGADO VAZQUEZ, JUAN PEDRO.	INST. DE CIENCIA DE MATERIALES SEVILLA.
15	LLORDES GIL, ANNA.	OBRADORS BERENGUER, FRANCISCO JAVIER.	INST. DE CIENCIA DE MATERIALES BARNA.
16	RANCEL GIL, LUCIA.	MEDINA MARTIN, SEBASTIAN FLORENCIO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
17	GARCIA VILCHEZ, ANTONIO JESUS.	FERNANDEZ LOZANO, JOSE FRANCISCO.	INST. DE CERAMICA Y VIDRIO.
18	TOCADO MARTINEZ, LETICIA.	BURRIEL LAHOZ, RAMON.	INST. DE CIENC. DE MATERIALES DE ARAGON.
19	BLANCO DOMINGUEZ, MANUEL.	FUENTE LEIS, GERMAN FRANCISCO DE LA.	INST. DE CIENC. DE MATERIALES DE ARAGON.
20	SABIO GONZALEZ, JAVIER.	GUINEA LOPEZ, FRANCISCO.	INST. DE CIENCIA DE MATERIALES MADRID.
21	GARCIA GIL, SANDRA.	ORDEJON RONTOME, PABLO JESUS.	INST. DE CIENCIA DE MATERIALES BARNA.
22	TORO VALDERRANA, LINA MARIA.	FULLEA GARCIA, JOSE.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ PEREZ, JORGE.	CANADELL CASANOVA, ENRIC.	INST. DE CIENCIA DE MATERIALES BARNA.
2	GIL LUNA, MARIA DOLORES.	MONTE MUÑOZ DE LA PEÑA, FRANCISCO DEL.	INST. DE CIENCIA DE MATERIALES MADRID.
3	FRUTOS ROZAS, MANUEL DE.	GUARROTXENA ARLUNDUAGA, MIREN NEKANE.	INST. DE CIENCIA Y TECNOLOGIA POLIMEROS.
4	GARCERA JULIA, JUDIT.	MOLINS GRAU, ELIES.	INST. DE CIENCIA DE MATERIALES BARNA.
5	GALAN GARCIA, ISABEL.	RIO SUAREZ, OLGA ISABEL.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.
6	DONOSO LISBOA, WILLIAMS.	GARCIA CARCEDO, FERNANDO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
7	PAVON GONZALEZ, ESPERANZA.	CASTRO ARROYO, MIGUEL ANGEL.	INST. DE CIENCIA DE MATERIALES SEVILLA.
8	BELLO MERAYO, LAURA.	BASTIDAS RULL, JOSE MARIA.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
9	BEDOYA MARTINEZ, OLGA NATALIA.	HERNANDEZ, EDUARDO.	INST. DE CIENCIA DE MATERIALES BARNA.
10	RODRIGUEZ GARCIA, YOLANDA.	MARTINEZ FERNANDEZ, JULIAN.	INST. DE CIENCIA DE MATERIALES SEVILLA.
11	GARCIA FERNANDEZ, PEDRO DAVID.	LOPEZ FERNANDEZ, CEFERINO.	INST. DE CIENCIA DE MATERIALES MADRID.
12	SANCHEZ SANCHEZ, CARLOS.	LOPEZ FAGUNDEZ, MARIA FRANCISCA.	INST. DE CIENCIA DE MATERIALES MADRID.
13	GARCIA MARIN, HECTOR.	GARCIA LAUREIRO, JOSE IGNACIO.	INST. DE CIENC. DE MATERIALES DE ARAGON.

Área 7: Ciencia y Tecnología de Alimentos

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PEREZ TRAVES, LAURA.	QUEROL SIMON, AMPARO MERCEDES.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
2	BAUERL, CHRISTINE.	PEREZ MARTINEZ, GASPAR.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
3	PROL GARCIA, MARIA JESUS.	PINTADO VALVERDE, JOSE.	INST. DE INVESTIGACIONES MARINAS (VIGO).
4	GAÑAN MARTINEZ-BALLESTA, MONICA.	CARRASCOSA SANTIAGO, ALFONSO VICENTE.	INST. DE FERMENTACIONES INDUSTRIALES.
5	RUIZ GARCIA, LORENA.	MARGOLLES BARROS, ABELARDO.	INST. DE PRODUCTOS LACTEOS DE ASTURIAS.
6	LOPEZ GALVEZ, FRANCISCO.	GIL MUÑOZ, MARIA ISABEL.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
7	GONZALEZ MELLADO, DAMIAN.	MARTINEZ FORCE, ENRIQUE.	INST. DE LA GRASA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
8	ROMERO SEGURA, ANA JESUS.	CERT VENTULA, ARTURO.	INST. DE LA GRASA.
9	CONTRERAS APARICIO, PATRICIA.	LOPEZ-ALONSO FANDIÑO, ROSINA.	INST. DE FERMENTACIONES INDUSTRIALES.
10	GOMEZ PASTOR, ROCIO.	FERNANDEZ-ESPINAR GARCIA, TERESA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
11	SUAREZ PANTALEON, CELIA.	ABAD FUENTES, ANTONIO.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	TEJEDOR CANO, JAVIER.	GOYA SUAREZ, LUIS.	INST. DEL FRIO.
2	ELAZAQUIVEL BARCENAS, PATRICIA.	AZNAR NOVELLA, ROSA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
3	CARLAVILLA MARTINEZ, DAVINIA.	MORENO ARRIBAS, MARIA VICTORIA.	INST. DE FERMENTACIONES INDUSTRIALES.
4	CARBONELL ADROVER, LEIRE.	IZQUIERDO FAUBEL, LUIS JOAQUIN.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
4	FERRER BERNAT, CARMEN.	MARTINEZ LOPEZ, ANTONIO.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
6	SERRANO MARTINEZ, ANA.	GARCIA VIGUERA, MARIA CRISTINA.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
7	SANCHEZ GARCIA, MARIA DOLORES.	LAGARON CABELLO, JOSE MARIA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
8	GOMEZ ESTACA, JOAQUIN.	MONTERO GARCIA, MARIA DEL PILAR.	INST. DEL FRIO.
9	BRUNI, GIOVANNI.	RANDEZ GIL, MARIA FRANCISCA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
10	ROMERO DE LA FUENTE, IRENE.	MERODIO MORENO, CARMEN.	INST. DEL FRIO.
11	HERNANDEZ HARO, CAROLINA TERESA.	BRAVO CLEMENTE, LAURA.	INST. DEL FRIO.
12	LOPEZ DE DICASTILLO BERGAMO, ANA CAROLINA.	GAVARA CLEMENTE, RAFAEL JOSE.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
13	TRUCHADO GAMBAO, PILAR.	TOMAS BARBERAN, FRANCISCO ABRAHAM DE.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.

Área 8: Ciencia y Tecnología Químicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PINAR PRIETO, ANA BELEN.	PEREZ PARIENTE, JOAQUIN.	INST. DE CATALISIS Y PETROLEOQUIMICA.
2	RADJENOVIC, JELENA.	BARCELO CULLERES, DAMIA.	CTRO. DE INVESTIGACION Y DESARROLLO.
3	GONZALEZ SANTANA, ANDRES.	GARCIA FRANCISCO, COSME.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
4	ROHACOVA, JANA.	MIRANDA ALONSO, MIGUEL ANGEL.	INST. DE TECNOLOGIA QUIMICA.
5	DIAZ MOSCOSO, ALEJANDRO.	GARCIA FERNANDEZ, JOSE MANUEL.	INST. DE INVESTIGACIONES QUIMICAS.
6	PEREZ FAGINAS, PAULA.	GONZALEZ MUÑIZ, MARIA DEL ROSARIO.	INST. DE QUIMICA MEDICA.
7	VALDIVIA GIMENEZ, VICTORIA.	KHIAR EL WAHABI, NOUREDDINE.	INST. DE INVESTIGACIONES QUIMICAS.
8	ZUBIZARRETA SAENZ DE ZAITEGUI, LEIRE.	PIS MARTINEZ, JOSE JUAN.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
9	MOURE FERNANDEZ, MARIA ALEJANDRA.	MESSEGUER PEYPOCH, ANGEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
10	ONGAY CAMACHO, SARA.	FRUTOS GOMEZ, MARIA MERCEDES DE.	INST. DE QUIMICA ORGANICA GENERAL.
11	CASANOVA NAVARRO, ONOFRE.	CORMA CANOS, AVELINO.	INST. DE TECNOLOGIA QUIMICA.
12	GARCIA DOYAGUEZ, ELISA.	FERNANDEZ-MAYORALAS ALVAREZ, ALFONSO.	INST. DE QUIMICA ORGANICA GENERAL.
13	GURBANI GURBANI, ANA.	LOPEZ GRANADOS, MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	SANCHEZ NAVARRO, MACARENA.	ROJO MARCOS, FRANCISCO JAVIER.	INST. DE INVESTIGACIONES QUIMICAS.
15	TSIOUVARAS GATOS, NIKOLAOS.	GARCIA FIERRO, JOSE LUIS.	INST. DE CATALISIS Y PETROLEOQUIMICA.
16	DIEZ TORRUBIA, ALBERTO.	VELAZQUEZ DIAZ, MARIA SONSOLES.	INST. DE QUIMICA MEDICA.
17	VICO RUIZ, EMILIO JOSE.	BAÑARES GONZALEZ, MIGUEL ANGEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
18	REY BARROSO, ANA.	BAHAMONDE SANTOS, ANA MARIA.	INST. DE CATALISIS Y PETROLEOQUIMICA.
19	GONZALEZ PLAZA, MARTA.	RUBIERA GONZALEZ, FERNANDO.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
20	RODENAS TORRALBA, TANIA.	SABATER PICOT, MARIA JOSE.	INST. DE TECNOLOGIA QUIMICA.
21	BATALLA BOSQUET, PILAR.	GUISAN SEIJAS, JOSE MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LLANILLO DEL RIO, PEDRO.	BAYONA TERMENS, JOSE MARIA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
2	HERRERA CARRILLO, ELENA.	HARO VILLAR, ISABEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
3	NAJAR MALAGARRIGA, JORDI.	GRIMALT OBRADOR, JUAN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
4	SOLIS FERNANDEZ, PABLO.	DIEZ TASCON, JUAN MANUEL.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
5	GARCIA RODRIGUEZ, SERGIO.	PEÑA JIMENEZ, MIGUEL ANTONIO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
6	LOZANO VALDES, NEUS.	PINAZO GASSOL, AURORA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
7	GARCIA DE LA CALLE, RUTH.	RODRIGUEZ RAMOS, INMACULADA.	INST. DE CATALISIS Y PETROLEOQUIMICA.
8	SANTOS EXPOSITO, ALICIA.	GARCIA TELLADO, FERNANDO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
9	TRASTOY BELLO, BEATRIZ.	CHIARA ROMERO, JOSE LUIS.	INST. DE QUIMICA ORGANICA GENERAL.
10	CALVILLO LAMANA, LAURA.	LAZARO ELORRI, MARIA JESUS.	INST. DE CARBOQUIMICA.
11	MONTESA SERRANO, ISABEL.	MARTINEZ FERNANDEZ DE LANDA, TERESA.	INST. DE CARBOQUIMICA.
12	CUADROS DOMENECH, SARA.	MARSAL MONGE, AGUSTIN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
13	SAMPEDRO TEJEDOR, PATRICIA.	FERNANDEZ GARCIA, MARCOS.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	CASTRILLO CARREIRA, INES.	BRUIX BAYES, MARTA.	INST. DE QUIMICA FISICA «ROCASOLANO».
15	GUERRA ALVAREZ, ANGELA.	PAEZ PROSPER, JUAN ANTONIO.	INST. DE QUIMICA MEDICA.
16	TORRES SALAS, PAMELA.	PLOU GASCA, FCO. JOSE.	INST. DE CATALISIS Y PETROLEOQUIMICA.
17	HORNES MARTINEZ, AITOR.	MARTINEZ ARIAS, ARTURO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
18	FERMOSO DOMINGUEZ, JAVIER.	ARENILLAS DE LA PUENTE, ANA.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
19	MARTIN BENITO, DARIO.	GONZALEZ COLOMA, ANA AZUCENA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.

Segundo.–Ordenar la publicación de la presente Resolución a los efectos previstos por el artículo 59.6.b) de la Ley 30/1992, de 26 de noviembre.

La presente resolución, que pone fin a la vía administrativa, podrá ser recurrida potestativamente en reposición, en el plazo de un mes contado a partir del día siguiente a la fecha de su notificación, ante esta Presidencia, de conformidad con lo establecido por los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra esta resolución cabe interponer recurso contencioso administrativo ante el Juzgado Central de lo Contencioso Administrativo en el plazo de dos meses contado a partir del día siguiente a la fecha de su notificación, conforme a lo dispuesto por la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso Administrativa.

No podrá interponerse recurso contencioso administrativo hasta que sea resuelto expresamente o se haya producido la desestimación presunta del recurso de reposición interpuesto.

Madrid, 29 de noviembre de 2005.–El Presidente, Carlos Martínez Alonso

21016 *RESOLUCIÓN de 14 de noviembre de 2005, de la Presidencia del Consejo Superior de Deportes, por la que se convocan los Campeonatos de España Universitarios correspondientes al año 2006 y se hace pública la convocatoria de las correspondientes subvenciones.*

La Ley 10/1990, de 15 de octubre, del Deporte establece que la actuación de la Administración del Estado en el ámbito del deporte corresponde y será ejercida directamente por el Consejo Superior de Deportes, a cuyo efecto corresponde en virtud del art. 8, aptdo. J), coordinar con las Comunidades Autónomas la programación del deporte escolar y universitario cuando tenga proyección nacional e internacional.

El Real Decreto 286/1999, de 22 de febrero, sobre estructura orgánica y funciones del Consejo Superior de Deportes, dice en su art. 6.1.i) que corresponde a la Dirección General de Deportes impulsar las acciones organizativas y de promoción desarrolladas por las asociaciones deportivas y organizar, en colaboración con las Comunidades Autónomas, competiciones deportivas escolares y universitarias de ámbito nacional e internacional.

El Real Decreto 2069/1985, de 9 de octubre, sobre articulación de competencias en materia de actividades deportivas universitarias, atribuye al Consejo Superior de Deportes en su artículo 4.2.a) la organización de competiciones y demás actividades deportivas de carácter nacional e internacional.

Asimismo, la Orden de 3 de febrero de 2004, por la que se regula el Comité Español del Deporte Universitario (CEDU), establece en su apartado segundo, punto a), que el Comité Español del Deporte Universitario presentará al Consejo Superior de Deportes un plan anual de competiciones y actividades deportivas de carácter nacional.

A la vista de la normativa anterior, las Comunidades Autónomas adquieren cada vez más, un mayor protagonismo en la colaboración y coordinación de las competiciones deportivas dentro de su ámbito. La distribución territorial de nuestro país, hace necesario contemplar a las CC.AA. como punto de partida para la estructura deportiva. Este hecho aconseja la participación del conjunto de las CC.AA. del territorio nacional en las diferentes competiciones universitarias. Esto nos lleva a una necesaria revisión y modificación de la estructura anterior de la competición universitaria, que quedará regulada conforme a esta Resolución, al Reglamento General y a los Reglamentos Técnicos de los Campeonatos de España Universitarios elaborados por el Consejo Superior de Deportes oída la Comisión Permanente del CEDU.

Por otra parte, con motivo de la celebración de los Campeonatos de España Universitarios, se vienen realizando en los últimos años actividades organizadas por las universidades, como jornadas, seminarios, foros de discusión, estudios, actividades de promoción y difusión, etc. que tienen como objetivo reunir a los sectores involucrados en este ámbito con el fin de tratar temas relacionados con el deporte universitario que redunden en beneficio de la actividad deportiva universitaria a nivel nacional.

Por ello y, teniendo en cuenta el ya citado Real Decreto 286/1999 en el que se establece que corresponde a la Dirección General de Deportes impulsar acciones organizativas y de promoción, este Organismo considera que este tipo de actividades deben ser susceptibles de subvención a través de esta convocatoria.

En consecuencia este Consejo Superior de Deportes resuelve convocar los Campeonatos de España Universitarios correspondientes al año 2006 con la normativa siguiente:

Primera. *Deportes.*–Los deportes de estos Campeonatos de España Universitarios serán los siguientes:

Deportes Individuales: ajedrez, atletismo, badminton, campo a través, golf, judo, karate, orientación, padel, natación, taekwondo, tenis, tenis de mesa, triatlón y voleiplaya.

Deportes de equipo: baloncesto (masculino y femenino), balonmano (masculino y femenino), fútbol (masculino), fútbol sala (masculino y femenino), rugby (masculino y femenino), voleibol (masculino y femenino).

Los Campeonatos de España Universitarios de Deportes de Equipo se desarrollarán en fases interzonales y finales. Las fases finales de estos deportes serán, en principio, a ocho (8) equipos.

El Consejo Superior de Deportes podrá convocar, además de los anteriormente citados, hasta dos deportes considerados de interés para este Organismo.

Segunda. *Participantes.*

2.1 En estos campeonatos podrán tomar parte todos aquellos que acrediten ser estudiantes de 1.º, 2.º ó 3.º ciclo de los títulos que tengan carácter oficial y validez en todo el territorio nacional a los que se refiere el art. 34.1). 2) y los arts. 36 y 37 de la Ley Orgánica 6/2001 de 21 de diciembre de Universidades, pertenecientes a cualquier universidad reconocida y representada en el C.E.D.U., nacidos con posterioridad al 31 de diciembre de 1977.

2.2 Participación por deportes: Cada universidad podrá inscribir como máximo, en cada deporte, los siguientes participantes:

2.2.1 En Deportes Individuales:

Ajedrez: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Atletismo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Badminton: Tres deportistas masculinos y tres femeninas.
Un Entrenador/Delegado.
Total: Siete participantes máximo.
Campo a Través: Cuatro deportistas masculinos y cuatro femeninas.
Un Entrenador/Delegado.
Total: Nueve participantes máximo.
Golf: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Judo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Kárate: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/Delegados si excede este número.
Orientación: tres deportistas masculinos y 3 deportistas femeninas.
Un Entrenador/delegado
Total: siete participantes máximo.
Padel: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Natación: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Taekwondo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Tenis: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Total: Siete participantes máximo.
Tenis de Mesa: Dos deportistas masculinos y dos femeninas.
Un Entrenador/Delegado.
Total: cinco participantes máximo.
Triatlón: Cuatro deportistas masculinos y cuatro femeninos.
Un Entrenador/Delegado.
Total: nueve participantes máximo.
Voleiplaya: Las universidades podrán inscribir un equipo masculino y/ o femenino, y se acreditarán un máximo de dos (2) deportistas y un (1) oficial (entrenador/delegado). En el caso de presentar equipos masculino y femenino, podrán inscribir dos y dos deportistas y un oficial (entrenador/ delegado).

2.B.11. Beca de introducción a la investigación para alumnos de último curso de carrera

MINISTERIO
DE EDUCACION
Y CIENCIA

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS
REGISTRO GENERAL
7 MAY 2004
ENTRADA ....
SALIDA ....4406....

CSIC

CONSEJO SUPERIOR
DE INVESTIGACIONES
CIENTIFICAS

El Consejo Superior de Investigaciones Científicas, por Resolución de la Presidencia de 5 de mayo de 2004, a propuesta de la Comisión de Selección establecida en la convocatoria (B.O.E. 8 de agosto de 2003) acordó conceder a Vd., la Beca de Introducción a la Investigación para alumnos de Penúltimo curso de carrera que había solicitado.

Esta beca, dotada con la suma de 1104 Euros, debe disfrutarse obligatoriamente en los meses de julio y septiembre próximos, tal como establece el punto 6.1 de la convocatoria.

Lo que comunico a Vd. a los efectos oportunos, con el ruego de que cumplimente los impresos de acta de toma de posesión (dos ejemplares) y el de los datos bancarios que se acompañan y los remita al Departamento de Postgrado y Especialización del CSIC, C/ Serrano, 113, 28006-Madrid. La fecha límite es el 22 de mayo de 2004. Recibida esta documentación el Departamento de Postgrado y Especialización le convocará a una reunión previa a la asignación del Centro de disfrute de la beca.

En el caso de que decida no aceptar la Beca, le ruego lo comunique **por escrito dentro del mismo plazo** al Departamento de Postgrado y Especialización.

Madrid, 6 de mayo de 2004
EL SECRETARIO GENERAL

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS

Eusebio Jiménez Arroyo

MARTINEZ RUIZ DEL ARBOL, PABLO

Serrano 113
28006 Madrid (España)
Telf. 91 585 50 00
Fax: 91 585 52 87

2.B.12. Beca de Colaboración con grupos de Investigación.

MINISTERIO
DE EDUCACIÓN
Y CIENCIA

SECRETARÍA GENERAL
DE EDUCACIÓN

DIRECCIÓN GENERAL
DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

CREDENCIAL BECA-COLABORACION CURSO 2004/2005

N.I.F.:72058705G

Pongo en su conocimiento que de conformidad con lo dispuesto en la Convocatoria de Beca-Colaboración, Orden Ministerial de 14 de junio de 2004 (B.O.E. de 12 de julio de 2004),y disposiciones complementarias, le ha sido concedida una Beca para el presente curso académico 2004/2005 con las características que se especifican:

CLASE DE AYUDA : BECA - COLABORACION
CUANTIA : 2.341,00 €
CURSO Y ESTUDIOS : 5 - Licenciado en Física
UNIVERSIDAD: UNIVERSIDAD DE CANTABRIA
DEPARTAMENTO DE COLABORACION: FISICA MODERNA

El importe de la beca le será ingresado en la cuenta y entidad bancaria indicada por Vd. en la solicitud de la ayuda, cuyos datos son los siguientes:

ENTIDAD: 2066 OFICINA: 0015 DC: 14 CUENTA: 0900102771

Como alumno beneficiario tiene las obligaciones que se especifican en el artículo undécimo de la citada Orden Ministerial que convoca las ayudas al estudio de carácter especial denominadas beca-colaboración.

La presente ayuda es incompatible con cualquier otra beca o ayuda al estudio de carácter público o privado, excepto con las becas y ayudas al estudio de carácter general y con las becas de movilidad convocadas por el Ministerio de Educación y Ciencia para el curso 2004/2005.

Contra la Resolución de la Dirección General de Cooperación Territorial y Alta Inspección, por la que se concede esta ayuda, podrá interponer recurso contencioso-administrativo en el plazo de dos meses, a contar desde la fecha de la mencionada Resolución, ante la Sala de lo contencioso-administrativo de la Audiencia Nacional, sin perjuicio del recurso potestativo de reposición que podrá interponerse según lo dispuesto en los artículos 116 y 117 de la Ley 30/92 en la redacción dada por la Ley 4/99.

Madrid,22 de noviembre de 2004

DIRECCIÓN GENERAL DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

MINISTERIO DE EDUCACIÓN Y CIENCIA
Dirección General de Cooperación Territorial y Alta Inspección

PABLO MARTINEZ RUIZ DEL ARBOL
Ps. CANALEJAS, 21 -7 D
39004 - SANTANDER
CANTABRIA

Conserve la presente credencial

2.B.13. Beca de introducción a la investigación para alumnos de penúltimo curso de carrera.

CREDENCIAL BECA-COLABORACION CURSO 2004/2005

N.I.F.:72058705G

Pongo en su conocimiento que de conformidad con lo dispuesto en la Convocatoria de Beca-Colaboración, Orden Ministerial de 14 de junio de 2004 (B.O.E. de 12 de julio de 2004), y disposiciones complementarias, le ha sido concedida una Beca para el presente curso académico 2004/2005 con las características que se especifican:

CLASE DE AYUDA : **BECA - COLABORACION**
CUANTIA : **2.341,00 €**
CURSO Y ESTUDIOS : **5 - Licenciado en Física**
UNIVERSIDAD: **UNIVERSIDAD DE CANTABRIA**
DEPARTAMENTO DE COLABORACION: **FISICA MODERNA**

El importe de la beca le será ingresado en la cuenta y entidad bancaria indicada por Vd. en la solicitud de la ayuda, cuyos datos son los siguientes:

ENTIDAD: 2066 OFICINA: 0015 DC: 14 CUENTA: 0900102771

Como alumno beneficiario tiene las obligaciones que se especifican en el artículo undécimo de la citada Orden Ministerial que convoca las ayudas al estudio de carácter especial denominadas beca-colaboración.

La presente ayuda es incompatible con cualquier otra beca o ayuda al estudio de carácter público o privado, excepto con las becas y ayudas al estudio de carácter general y con las becas de movilidad convocadas por el Ministerio de Educación y Ciencia para el curso 2004/2005.

Contra la Resolución de la Dirección General de Cooperación Territorial y Alta Inspección, por la que se concede esta ayuda, podrá interponer recurso contencioso-administrativo en el plazo de dos meses, a contar desde la fecha de la mencionada Resolución, ante la Sala de lo contencioso-administrativo de la Audiencia Nacional, sin perjuicio del recurso potestativo de reposición que podrá interponerse según lo dispuesto en los artículos 116 y 117 de la Ley 30/92 en la redacción dada por la Ley 4/99.

Madrid,22 de noviembre de 2004

DIRECCIÓN GENERAL DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

MINISTERIO DE EDUCACIÓN Y CIENCIA
Dirección General de Cooperación Territorial y Alta Inspección

PABLO MARTINEZ RUIZ DEL ARBOL
Ps. CANALEJAS, 21 -7 D
39004 - SANTANDER
CANTABRIA

<u>Conserve la presente credencial</u>

Capítulo 3

Formación académica

3.A. Estudios de primer ciclo y antiguos ciclos

3.A.1. Título Licenciado en ciencias Físicas

Juan Carlos I, Rey de España

y en su nombre

el Rector de la Universidad de Cantabria

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Don Pablo Martínez Ruiz del Árbol

nacido el día 26 de octubre de 1982 en Santander (Cantabria), de nacionalidad española,

ha superado los estudios universitarios correspondientes, organizados por la Facultad de Ciencias, conforme a un plan de estudios homologado por el Consejo de Universidades, expide el presente título universitario oficial de

Licenciado en Física

con validez en todo el territorio nacional, que faculta al interesado para disfrutar los derechos que a este título otorgan las disposiciones vigentes.

Dado en Santander, a 13 de julio de 2005

El interesado, — *El Rector,* — *El Jefe del Servicio de Gestión Académica,*

1-BC-440275

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2005/230662	39011359	000027117

RCM-FNMT Mod. 4100

3.A.2. Expediente Académico

Facultad de Ciencias
Avda. de los Castros, s/n
39005 Santander

UNIVERSIDAD DE CANTABRIA

CERTIFICADO: 8.033

CERTIFICACIÓN ACADÉMICA PERSONAL

Evaristo Bra Sainz, Administrador de la FACULTAD DE CIENCIAS de esta Universidad.

CERTIFICA: Que según consta en el expediente de Don **PABLO MARTINEZ RUIZ DEL ARBOL**, con D.N.I. nº 72058705G, natural de SANTANDER (Cantabria), nacido el 26 de octubre de 1.982, ha cursado las siguientes asignaturas del Plan de Estudios de LICENCIADO EN FISICA (B.O.E. 25.05.00), en los cursos y con las calificaciones que se indican:

ESTUDIOS PREVIOS	
MODALIDAD DE ACCESO	PRUEBAS DE ACCESO (C.O.U)
UNIVERSIDAD	UNIVERSIDAD DE CANTABRIA
VÍA	CIENTÍFICO-TECNOLÓGICA
CONVOCATORIA	JUNIO 2000
CALIFICACIÓN	8,641

ASIGNATURA	TIPO	CRÉD.	TEMP.	CURSO	CONVOCATORIA Conv	Nº	CALIFICACIÓN
PRIMER CICLO							
PRIMER CURSO							
Algebra Lineal y Geometría	T	7,5	1º Cuatrimestre	2000/01	F	1	M.H. 9,50
Cálculo	T	7,5	1º Cuatrimestre	2000/01	F	1	M.H.10,00
Fundamentos de Física I	U	7,5	1º Cuatrimestre	2000/01	F	1	M.H. 9,50
Fundamentos de Física II	U	7,5	2º Cuatrimestre	2000/01	J	1	M.H. 9,50
Cálculo Avanzado	U	7,5	2º Cuatrimestre	2000/01	J	1	M.H.10,00
Laboratorio de Matemáticas	U	6,0	1º Cuatrimestre	2000/01	F	1	M.H. 9,70
Introducción a la Física Experimental	U	7,5	2º Cuatrimestre	2000/01	J	1	Notable 8,00
Fundamentos de Computadores y Lenguajes	U	9,0	Anual	2000/01	J	1	M.H. 9,70
SEGUNDO CURSO							
Ecuaciones Diferenciales	T	7,5	1º Cuatrimestre	2001/02	F	1	Sobresaliente 9,00
Métodos Matemáticos Avanzados	T	9,0	Anual	2001/02	J	1	Sobresaliente 9,00
Técnicas Experimentales I	T	4,5	2º Cuatrimestre	2001/02	J	1	M.H. 9,50
Técnicas Experimentales II	T	4,5	2º Cuatrimestre	2001/02	J	1	Notable 8,30
Mecánica y Ondas	T	12,0	Anual	2001/02	J	1	M.H. 9,50
Termodinámica	T	12,0	Anual	2001/02	J	1	Sobresaliente 9,00
Cálculo Numérico	U	7,5	1º Cuatrimestre	2001/02	F	1	Sobresaliente 9,00
TERCER CURSO							
Técnicas Experimentales III	T	4,5	1º Cuatrimestre	2002/03	F	1	Sobresaliente 9,00
Técnicas Experimentales IV	T	4,5	2º Cuatrimestre	2002/03	J	1	M.H.10,00
Técnicas Experimentales V	T	4,5	2º Cuatrimestre	2002/03	J	1	Sobresaliente 9,30
Optica	T	12,0	Anual	2002/03	J	1	M.H.10,00
Física Cuántica	T	9,0	1º Cuatrimestre	2002/03	F	1	Notable 7,20
Electromagnetismo	T	12,0	Anual	2002/03	J	1	M.H.10,00
Estructura de la Materia	U	7,5	2º Cuatrimestre	2002/03	J	1	Sobresaliente 9,70

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Facultad de Ciencias
Avda. de los Castros, s/n
39005 Santander

ASIGNATURA	TIPO	CRÉD.	TEMP.	CURSO	CONVOCATORIA Conv	Nº	CALIFICACIÓN
SEGUNDO CICLO							
CUARTO CURSO							
Electrodinámica Clásica	T	6,0	1º Cuatrimestre	2003/04	F	1	Sobresaliente 9,20
Electrónica Física	T	6,0	1º Cuatrimestre	2003/04	F	1	Sobresaliente 9,60
Circuitos Electrónicos Analógicos y Digitales	T	6,0	2º Cuatrimestre	2003/04	J	1	Notable 8,10
Mecánica Cuántica	T	7,5	1º Cuatrimestre	2003/04	F	1	Notable 7,80
Mecánica Teórica	T	6,0	1º Cuatrimestre	2003/04	F	1	Sobresaliente 9,00
Física Estadística	T	6,0	1º Cuatrimestre	2003/04	F	1	Notable 8,70
Física Nuclear y de Partículas	T	6,0	2º Cuatrimestre	2003/04	J	1	Sobresaliente 9,00
Física Atómica y Molecular	U	6,0	2º Cuatrimestre	2003/04	J	1	M.H.10,00
QUINTO CURSO							
Física del Estado Sólido	T	7,5	1º Cuatrimestre	2004/05	F	1	Notable 7,80
Ampliación de Técnicas Experimentales	U	4,5	1º Cuatrimestre	2004/05	F	1	M.H.10,00
Trabajo Fin de Carrera	U	7,5	2º Cuatrimestre	2004/05	L	1	Sobresaliente 9,50
OPTATIVAS							
PRIMER CICLO							
Astronomía General	O	6,0	1º Cuatrimestre	2002/03	F	1	M.H.10,00
Programación en Entorno Científico	O	6,0	2º Cuatrimestre	2002/03	J	1	Sobresaliente 9,00
Programación de Alto Nivel	O	6,0	2º Cuatrimestre	2001/02	J	1	M.H. 9,70
Sistemas Operativos	O	6,0	2º Cuatrimestre	2002/03	J	1	M.H.10,00
SEGUNDO CICLO							
Astrofísica Estelar	O	6,0	2º Cuatrimestre	2003/04	J	1	Sobresaliente 9,00
Galaxias	O	7,5	1º Cuatrimestre	2004/05	F	1	M.H.10,00
Relatividad General y Cosmología	O	7,5	2º Cuatrimestre	2004/05	J	1	M.H. 9,80
Métodos de Detección en Física de Altas Energías	O	7,5	2º Cuatrimestre	2004/05	J	1	M.H.10,00
Ampliación de Mecánica Cuántica	O	7,5	2º Cuatrimestre	2003/04	J	1	Sobresaliente 9,50
Física No Lineal	O	7,5	1º Cuatrimestre	2004/05	F	1	Sobresaliente 9,00
Técnicas Espectroscópicas	O	7,5	2º Cuatrimestre	2004/05	J	1	Sobresaliente 9,60
Cálculo Numérico Avanzado	O	7,5	2º Cuatrimestre	2003/04	J	1	Sobresaliente 9,00
LIBRE CONFIGURACIÓN							
Administración de un Sistema Operativo Unix/Linux		6,0	1º Cuatrimestre	2004/05	F	1	Notable 8,20
Codificación de la Información		6,0	1º Cuatrimestre	2001/02	F	1	M.H. 9,60
Protocolos Criptográficos y Seguridad en Redes		6,0	2º Cuatrimestre	2004/05	J	1	Sobresaliente 9,00

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Facultad de Ciencias
Avda. de los Castros, s/n
39005 Santander

PROYECTO/TRABAJO FIN DE CARRERA	
TÍTULO	DETECCION DE MUONES DE ALTO MOMENTO EN EL DETECTOR CMS
FECHA DE PRESENTACIÓN	12-07-2005
CURSO Y CONVOCATORIA	julio 2004/05
CALIFICACIÓN	9,500 (Sobresaliente)

TITULACIÓN	
TÍTULO	LICENCIADO EN FISICA
ITINERARIO:	FISICA EXPERIMENTAL
CURSO Y CONVOCATORIA	julio 2004/05
FECHA DE EXPEDICIÓN (ABONO)	13/07/2005
CALIFICACIÓN	
CUANTITATIVA (ESCALA 1-10)	9,268 (Sobresaliente)
CUALITATIVA (ESCALA 1-4)	3,295 (Sobresaliente)

La calificación cuantitativa está calculada de acuerdo con lo dispuesto en el artículo 5 del Real Decreto 1125/2003.
La calificación cualitativa está calculada de acuerdo con lo dispuesto en el Anexo I.Uno del Real Decreto 1487/1987 en la redacción dada por el Real Decreto 1267/1994, modificado por la disposición adicional única del Real Decreto 1004/2003

Número total de asignaturas que constan aprobadas en esta certificación : 48

RESUMEN DE LA CERTIFICACIÓN ACADÉMICA PERSONAL

	Primer Ciclo				Segundo Ciclo			Creditos Totales			
	Min.	Sup.	Pend.	Acc2C.	Min.	Sup.	Pend.	Min.	Sup.	Pend.	Mpfc
TRONC. Y OBLIGAT.	171,0	171,0	0,0		69,0	69,0	0,0	240,0	240,0	0,0	0,0
OPTATIVOS	18,0	18,0	0,0		48,0	48,0	0,0	66,0	66,0	0,0	0,0
LIBRES	12,0	12,0	0,0		22,0	22,0	0,0	34,0	34,5	0,0	0,0
TOTALES	201,0	201,0	0,0	0,0	139,0	139,0	0,0	340,0	340,5	0,0	0,0

Acc2C : Créditos por superar para acceder a asignaturas de segundo ciclo
Mpfc : Créditos por superar para presentar el proyecto fin de carrera
T : Asignatura de caracter troncal
U : Asignatura de caracter obligatoria
O : Asignatura de caracter optativo
L : Asignatura de libre elección

Y para que conste, expido la presente Certificación, extendida en 3 folios, con el sello del Centro y el Vº.Bº del Sr. Decano. En Santander, a veinticinco de noviembre de dos mil cinco.

Vº Bº
El Decano

Ernesto Anabitarte Cano

El Administrador

Evaristo Ara Sainz

3.B. Doctorados

3.B.1. Doctor en Física

Juan Carlos I, Rey de España

y en su nombre

el Rector de la Universidad de Cantabria

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Don Pablo Martínez Ruiz del Árbol

nacido el día 26 de octubre de 1982 en Santander (Cantabria), de nacionalidad española,

y Licenciado en Física el día 13 de julio de 2005 por la Universidad de Cantabria, ha superado los estudios de Doctorado en los Departamentos de Ciencias de la Tierra y Física de la Materia Condensada, de Física Aplicada y de Física Moderna, dentro del Programa de Física y Ciencias de la Tierra, y ha hecho constar su suficiencia en esta Universidad, con la calificación de SOBRESALIENTE "CUM LAUDE" y PREMIO EXTRAORDINARIO, el día 25 de junio de 2010, expide el presente título de

Doctor por la Universidad de Cantabria

con carácter oficial y validez en todo el territorio nacional, que faculta al interesado para disfrutar los derechos que a este título otorgan las disposiciones vigentes.

Dado en Santander, a 17 de diciembre de 2012

El interesado,	*El Rector,*	*El Jefe del Servicio de Gestión Académica,*

Este título es un duplicado del expedido con fecha 29 de junio de 2010 y clave alfanumérica 1-BD-406991 y se expide para hacer constar la obtención del Premio Extraordinario.

016A-000210

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2011/017362		000037673

SIGNE, S.A.

CLAVE ALFANUMERICA:	Nº REGISTRO NAL. DE TITULOS:	CODIGO DE CENTRO:	REGISTRO UNIV. DE TITULOS:	NRO. EXP. UNIV.
016A-000210	2011/017362		000037673	10DOC00001005

TITULO OFICIAL

SIGNE, S.A.

3.C. Conocimiento de idiomas

3.C.1. Certiticado C1 inglés

Linguaskill

Institution	ES165
Username	pablo.martinez.ruizdelarbol@gmail.com
Ref. No.	ES165pablo.martinez.ruizdelarbol@gmail.com

Test Report

Linguaskill General

Candidate name	Candidate number
Pablo Martínez Ruiz Del Árbol	**72058705G**

Date of birth	Organisation
26 October 1982	**EIDE desde Casa**

Average Score	180+	CEFR Level	C1 or above

Skill	Test Date	Score	CEFR Level
Listening	**08 September 2021**	**180+**	**C1 or above**

Can follow complex spoken language related to daily life and work and unfamiliar topics. Can extract details and key information, and infer intentions that are not explicitly stated. Can follow the sense of spoken information even when it is not clearly structured.

Skill	Test Date	Score	CEFR Level
Reading	**08 September 2021**	**180+**	**C1 or above**

Can understand long and complex texts on a wide range of topics in daily life and work, including unfamiliar and abstract. Can extract key information and details, and comprehend information that is implied. Can detect the writer's tone and point of view.

Skill	Test Date	Score	CEFR Level
Speaking	**08 September 2021**	**169**	**B2**

Can exchange views on familiar topics, accounting for and sustaining opinions. Can present clear, detailed descriptions on a wide range of topics with a degree of fluency and spontaneity.

Skill	Test Date	Score	CEFR Level
Writing	**08 September 2021**	**180+**	**C1 or above**

Can write well-structured, detailed text on complex subjects. Can write in an engaging style appropriate to the reader, highlight significant points and expand on supporting points of view.

CEFR Level Descriptors

Listening

Proficient User	C1 or above	Can understand complex spoken language even on unfamiliar topics.
Independent User	B2	Can understand complex spoken language on reasonably familiar topics and in a standard dialect.
	B1	Can understand the main ideas of clear, standard speech on familiar subjects encountered in daily life.
Basic User	A2	Can understand the main points of short, clear, slow speech.
	A1	Can recognise familiar words and very basic phrases from slow, clear speech.

Reading

Proficient User	C1 or above	Can understand long and complex texts from a wide range of settings, on both familiar and unfamiliar topics.
Independent User	B2	Can understand texts that contain frequently used vocabulary about familiar subjects.
	B1	Can understand short, uncomplicated texts using mainly everyday or work-related language.
Basic User	A2	Can understand very short, simple texts.
	A1	Can understand familiar names, words and very simple sentences in very short, simple texts.

Speaking

Proficient User	C1 or above	Can produce clear, detailed descriptions on a variety of complex topics.
Independent User	B2	Can produce clear, detailed descriptions on a variety of familiar topics.
	B1	Can produce straightforward descriptions on a variety of familiar topics.
Basic User	A2	Can produce a short series of simple phrases and sentences on familiar topics.
	A1	Can produce simple, mainly isolated phrases, on very familiar topics.

Writing

Proficient User	C1 or above	Can write clear, well-structured texts on complex subjects with few errors.
Independent User	B2	Can write clear, detailed texts on a variety of familiar subjects.
	B1	Can write straightforward connected texts on a range of familiar subjects.
Basic User	A2	Can link basic written phrases and sentences with simple connectors like ‘and’, ‘but’, and ‘because’.
	A1	Can write short, simple, isolated phrases and sentences.

Linguaskill assesses English language ability from below A1 to C1 or above of the Common European Framework of Reference (CEFR). For each skill assessed, candidates are awarded a CEFR level and a score on the Cambridge English Scale. If more than one skill is assessed, an average scale score is awarded. A short description of what a typical candidate can do at the achieved CEFR level is also reported. More detailed ‘Can do’ statements can be found at: **www.coe.int/lang-CEFR**.
More information about the Cambridge English Scale can be found at: **www.cambridgeenglish.org/cambridgeenglishscale**
These results can be validated at: **https://results.linguaskill.com**

CEFR Level	Score
C1 or above	180+
B2	160 – 179
B1	140 – 159
A2	120 – 139
A1	100 – 119
Below A1	82 – 99

Linguaskill assesses English language ability from below A1 to C1 or above of the CEFR and reports scores from 82 to 180 on the Cambridge English Scale.

Cambridge Assessment English

3.D. Formacion especializada

3.D.1. Taller de Altas Energías

UNIVERSIDAD DE CANTABRIA — CURSOS DE VERANO

DIPLOMA DE ASISTENCIA

Que otorga el Magnífico y Excelentísimo Rector de la Universidad de Cantabria, a propuesta del Director del Curso a,

PABLO MARTINEZ RUIZ DEL ARBOL *D.N.I.* **72058705G**

por su asistencia al Curso **TALLER DE ALTAS ENERGIAS**

celebrado del día **3 de Julio** *al* **7 de Julio** *de* **2006**

cuyas sesiones sumaron un total de **30** *horas de clase (* **3** *créditos)*

Santander, 7 de Julio de 2006

El Director — El Rector — El Director de los Cursos de Verano

UNIVERSIDAD DE CANTABRIA · CURSOS DE VERANO

Este DIPLOMA no tiene el carácter oficial establecido en el artículo 34, puntos 1 y 2, de la Ley Orgánica 6/2001, de 21 de diciembre de Universidades y artículos 1 y siguientes del RD. 1496/1987 de 6 de noviembre.

3.D.2. Curso de Inteligencia Artificial y Redes Neuronales

UNIVERSIDAD DE CANTABRIA | CURSOS DE VERANO

DIPLOMA DE ASISTENCIA

Que otorga el Magnífico y Excelentísimo Rector de la Universidad de Cantabria, a propuesta del Director del Curso a,

PABLO MARTINEZ RUIZ DEL ARBOL *D.N.I.* **72058705G**

por su asistencia al Curso **INTELIGENCIA ARTIFICIAL**

celebrado del día **21 de Julio** *al* **24 de Julio** *de* **2003**

cuyas sesiones sumaron un total de **20** *horas de clase (* **2** *créditos)*

Santander, 24 de Julio de 2003

El Director | El Rector | El Director de los Cursos de Verano

UNIVERSIDAD DE CANTABRIA · CURSOS DE VERANO

Este DIPLOMA no tiene el carácter oficial establecido en los artículos 28.1 de LRU y artículos 1 y siguientes del R.D. 1496/1987 de 6 de noviembre.

Capítulo 4

Experiencia científica y tecnológica

4.A. Proyectos de I+D financiados en convocatorias competitivas de Administraciones públicas y privadas

4.A.1. CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA

Pabellón de Gobierno
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39005 Santander

Universidad de Cantabria
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D. LUIGI DELL'OLIO, VICERRECTOR DE INVESTIGACIÓN Y POLÍTICA CIENTÍFICA DE LA UNIVERSIDAD DE CANTABRIA,

HACE CONSTAR:

Que según los datos obrantes en las bases de datos de la Universidad, D. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. 72058705G, personal del INSTITUTO DE FÍSICA DE CANTABRIA de la Universidad de Cantabria, ha participado en el desarrollo de los siguientes proyectos de investigación:

Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

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Luigi dell'Olio
Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.A.2. PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN2

Pabellón de Gobierno
Avda. Los Castros, s/n.
39005 Santander

D. LUIGI DELL'OLIO, VICERRECTOR DE INVESTIGACIÓN Y POLÍTICA CIENTÍFICA DE LA UNIVERSIDAD DE CANTABRIA,

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Que según los datos obrantes en las bases de datos de la Universidad, D. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. 72058705G, personal del INSTITUTO DE FÍSICA DE CANTABRIA de la Universidad de Cantabria, ha participado en el desarrollo de los siguientes proyectos de investigación:

Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

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Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.A.3. XDC: EXTREME DATACLOUD

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39005 Santander

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Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

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Luigi dell'Olio
Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.A.4. CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA

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39005 Santander

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HACE CONSTAR:

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Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

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Luigi dell'Olio
Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.A.5. HIGH PT PHYSICS WITH CMS AND UPGRADES OF THE CMS BARREL PIXEL DETECTOR

This document certifies the involvement and participation of **Dr. Pablo Martinez Ruiz del Arbol** as a postdoctoral researcher in the **research projects** detailed below for which I acted as the responsible and principal investigator (PI).

R Wallny

27.8. 2015

Project Name: Measurements of Higgs boson properties and Searches for Supersymmetry with CMS
Start/End: 01.04.2014 – 31.03.2016
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Co-convener of the SUSY Trigger, Monte Carlo and Interpretations group. In charge of developing a sussessful and coherent trigger and Monte Carlo strategy for the SUSY group of CMS.

Project Name: Search for New Physics and Measurements of Higgs boson properties with CMS
Start/End: 01.04.2013 – 31.03.2014
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Collaborating in the supervision of PhD. Student Marco-Andrea Buchmann.
- Supervision of Master student Pascal Jordi
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

Project Name: High pT physics with CMS and upgrades of the tracker pixel detector
Start/End: 01.04.2011 – 31.03.2013
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 7 TeV, collected by the CMS experiment.
- Collaborating in the supervision of PhD Student Marco-Andrea Buchmann.
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

4.A.6. MEASUREMENTS OF HIGGS BOSON PROPERTIES AND SEARCHES FOR SUPERSYMMETRY WITH CMS

This document certifies the involvement and participation of **Dr. Pablo Martinez Ruiz del Arbol** as a postdoctoral researcher in the **research projects** detailed below for which I acted as the responsible and principal investigator (PI).

R Wallny

27.8. 2015

Project Name: Measurements of Higgs boson properties and Searches for Supersymmetry with CMS
Start/End: 01.04.2014 – 31.03.2016
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Co-convener of the SUSY Trigger, Monte Carlo and Interpretations group. In charge of developing a sussessful and coherent trigger and Monte Carlo strategy for the SUSY group of CMS.

Project Name: Search for New Physics and Measurements of Higgs boson properties with CMS
Start/End: 01.04.2013 – 31.03.2014
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Collaborating in the supervision of PhD. Student Marco-Andrea Buchmann.
- Supervision of Master student Pascal Jordi
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

Project Name: High pT physics with CMS and upgrades of the tracker pixel detector
Start/End: 01.04.2011 – 31.03.2013
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 7 TeV, collected by the CMS experiment.
- Collaborating in the supervision of PhD Student Marco-Andrea Buchmann.
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

4.A.7. Characterization of the Higgs Boson and Searches for Supersymmetry with CMS

Project

< Back to overview

Characterization of the Higgs Boson and Searches for Supersymmetry with CMS

English title	Characterization of the Higgs Boson and Searches for Supersymmetry with CMS
Applicant	Wallny Rainer
Number	166294
Funding scheme	Project funding (Div. I-III)
Research institution	Institut für Teilchen- und Astrophysik ETH Zürich
Institution of higher education	ETH Zurich - ETHZ
Main discipline	Particle Physics
Start/End	01.04.2016 - 31.03.2018
Approved amount	880'000.00

▼ Show all

Keywords (5)

Higgs Boson; Hadron Collider Physics ; Large Hadron Collider; Supersymmetry; Pixel Detector Technology

Lay Summary (German)

Responsible applicant and co-applicants

Name	Institute
Wallny Rainer	Institut für Teilchen- und Astrophysik ETH Zürich
Dissertori Günther	Institut für Teilchen- und Astrophysik ETH Zürich
Donegà Mauro	Institut für Teilchen- und Astrophysik ETH Zürich
Grab Christophorus	Institut für Teilchen- und Astrophysik ETH Zürich

Employees

Name	Institute
Perrin Gaël Ludovic	
Kasieczka Gregor	Institut für Teilchen- und Astrophysik ETH Zürich
Berger Pirmin	
Heidegger Constantin	
Meinhard Maren Tabea	
Marionneau Matthieu	
Martinez Ruiz del Arbol Pablo	

Ruini Daniele

Publications

Collaboration

Scientific events

Awards

Associated projects

Abstract

-

Contact

Swiss National Science Foundation (SNSF)

Wildhainweg 3
P.O. Box
CH-3001 Bern
Phone +41 31 308 22 22

Contact

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> Documents for researchers
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4.A.8. SEARCH FOR NEW PHYSICS MEASUREMENTS OF THE HIGGS BOSON PROPERTIES WITH CMS

This document certifies the involvement and participation of **Dr. Pablo Martinez Ruiz del Arbol** as a postdoctoral researcher in the **research projects** detailed below for which I acted as the responsible and principal investigator (PI).

R Wallny

27.8. 2015

Project Name: Measurements of Higgs boson properties and Searches for Supersymmetry with CMS
Start/End: 01.04.2014 – 31.03.2016
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Co-convener of the SUSY Trigger, Monte Carlo and Interpretations group. In charge of developing a sussessful and coherent trigger and Monte Carlo strategy for the SUSY group of CMS.

Project Name: Search for New Physics and Measurements of Higgs boson properties with CMS
Start/End: 01.04.2013 – 31.03.2014
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 8 TeV, collected by the CMS experiment.
- Leading and conducting a novel technique for estimating the energy corrections associated to b-jets in the CMS experiment.
- Collaborating in the supervision of PhD. Student Marco-Andrea Buchmann.
- Supervision of Master student Pascal Jordi
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

Project Name: High pT physics with CMS and upgrades of the tracker pixel detector
Start/End: 01.04.2011 – 31.03.2013
Funding agency: Swiss National Science Foundation
Principal Investigator: Prof. Dr. Rainer Wallny
Institution: Swiss Federal Institute of Technology Zurich (ETH Zurich)
Main activities by Dr. Martinez:

- Leading and conducting a search for Supersymmetry in events with two opposite sign leptons, jets and transverse momentum imbalance at a center of mass energy of 7 TeV, collected by the CMS experiment.
- Collaborating in the supervision of PhD Student Marco-Andrea Buchmann.
- Trigger contact of the SUSY group within the Trigger Studies Group of CMS.

4.A.9. Desarrollo y operaciones de un TIER-2 federado para el experimento CMS

Pabellón de Gobierno
Avda. Los Castros, s/n
39005 Santander

CERTIFICADO Nº 1162 / 2021

HOJA DE SERVICIOS

Primer Apellido	Segundo Apellido	Nombre	N.º D. N. Identidad
MARTINEZ	RUIZ DEL ARBOL	PABLO	72058705G
Localidad Nacimiento	**Provincia Nacimiento**	**Fecha Nacimiento**	**Nº Reg. Personal**
SANTANDER	CANTABRIA	26/10/1982	

SERVICIOS PRESTADOS	FECHA DESDE	FECHA HASTA
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, PARA PRESTAR SERVICIOS EN EL PROYECTO DE INVESTIGACIÓN 'DESARROLLO Y OPERACION DE UN TIER-2 FEDERADO PARA EL EXPERIMENTO CMS', CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/01/2010	30/09/2010
CONTRATO DE TRABAJO PARA OBRA O SERVICIO DETERMINADOS, COMO PERSONAL INVESTIGADOR DEL PROGRAMA "RAMÓN Y CAJAL", CON DEDICACIÓN A TIEMPO COMPLETO, EN EL INSTITUTO DE FÍSICA DE LA UNIVERSIDAD DE CANTABRIA.	01/03/2017	28/02/2022

Para que conste, a petición del interesado y a los efectos que convengan, se extiende la presente certificación, en Santander, a veintidós de septiembre de dos mil veintiuno.

4.A.10. Participación en los experimentos CMS y CDF

Santander, Julio 2015

Teresa Rodrigo, con DNI 17141020V, en calidad de investigadora principal del proyecto de investigacion abajo citado, certifico que el Dr. Pablo Martinez Ruiz del Arbol participo en dicho proyecto en calidad de estudiante de doctorado durante la duracion total del proyecto.

Nombre del proyecto: Participacion en los experimentos CMS y CDF
Referencia: FPA2005-08140-C02-01

Atentamente,

Fdo: Teresa Rodrigo
Catedratica de Fisica de la Univ. de Cantabria
Investigadora del Instituto de Fisica de Cantabria (CSIC-UC)

4.A.11. Física en colisionadores hadrónicos (experimentos CMS y CDF)

Instituto de Física de Cantabria

Santander, Julio 2015

Teresa Rodrigo, con DNI 17141020V, en calidad de investigadora principal del proyecto de investigacion abajo citado, certifico que el Dr. Pablo Martinez Ruiz del Arbol participo en dicho proyecto en calidad de estudiante de doctorado, desde su inicio hasta el 31/12/2009.

Nombre del proyecto: Fisica en colisonadores hadronicos (experimentos CMS y CDF)
Referencia: FPA2008-06112-C02-01

Atentamente,

Teresa Rodrigo

Fdo: Teresa Rodrigo
Catedratica de Fisica de la Univ. de Cantabria
Investigadora del Instituto de Fisica de Cantabria (CSIC-UC)

4.B. Contratos, convenios o proyectos de I+D+i no competitivos con Administraciones o entidades públicas o privadas

4.B.1. DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES de la Universidad de Cantabria

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Universidad de Cantabria

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39005 Santander

D. LUIGI DELL'OLIO, VICERRECTOR DE INVESTIGACIÓN Y POLÍTICA CIENTÍFICA DE LA UNIVERSIDAD DE CANTABRIA,

HACE CONSTAR:

Que según los datos obrantes en las bases de datos de la Universidad, D. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. 72058705G, personal del INSTITUTO DE FÍSICA DE CANTABRIA de la Universidad de Cantabria, ha participado en el desarrollo de los siguientes proyectos de investigación:

Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

DELL OLIO LUIGI - DNI X4697958R

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Luigi dell'Olio
Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.B.2. Evolución poblacional de municipios en riesgo de despoblamiento mediante gemelos digitales

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Pabellón de Gobierno
Avda. Los Castros, s/n.
39005 Santander

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D. LUIGI DELL'OLIO, VICERRECTOR DE INVESTIGACIÓN Y POLÍTICA CIENTÍFICA DE LA UNIVERSIDAD DE CANTABRIA,

HACE CONSTAR:

Que según los datos obrantes en las bases de datos de la Universidad, D. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. 72058705G, personal del INSTITUTO DE FÍSICA DE CANTABRIA de la Universidad de Cantabria, ha participado en el desarrollo de los siguientes proyectos de investigación:

Fecha Inicio Proyecto	Fecha Fin Proyecto	Título del Proyecto	Código Externo	Entidad Financiadora	Presupuesto Total (€)	Tipo Participación
30/12/2016	29/12/2020	CENTRO DE PROCESADO DE DATOS PARA EL LHC: TIER-2 PARA EL EXPERIMENTO CMS EN EL IFCA (FPA2016-78727-R) (AEI/FEDER, UE)	FPA2016-78727-R	AGENCIA ESTATAL DE INVESTIGACION	617.100,00	Equipo investigador
01/11/2017	30/04/2020	XDC: EXTREME DATACLOUD	H2020-EINFRA-2017-777367	COMISION EUROPEA; ISTITUTO NAZIONALE DI FISICA NUCLEARE	287.875,00	Equipo investigador
01/01/2018	31/12/2021	PARTICIPACIÓN EN EL EXPERIMENTO CMS DEL LHC: RUN 2 (FPA2017-85155-C4-4-R) (AEI/FEDER,UE)	FPA2017-85155-C4-4-R	AGENCIA ESTATAL DE INVESTIGACION	502.150,00	Equipo investigador
31/03/2019	31/03/2020	DESARROLLO DE UN SISTEMA DE ADQUISICIÓN DE DATOS INTELIGENTE (DAQ) PARA LA CARACTERIZACIÓN, CORRECCIÓN Y OBTENCIÓN DE TRAZAS EN DETECTORES DE MUONES		MUON TOMOGRAPHY SYSTEMS S.L.	6.534,00	Investigador responsable
01/06/2020	31/05/2023	CENTRO DE PROCESADO DE DATOS DE CMS TIER-2 EN EL IFCA (PID2019-104974RB-I00/ AEI / 10.13039/501100011033)	PID2019-104974RB-I00	AGENCIA ESTATAL DE INVESTIGACION	526.350,00	Equipo investigador
13/09/2021	12/09/2022	EVOLUCIÓN POBLACIONAL DE MUNICIPIOS EN RIESGO DE DESPOBLAMIENTO MEDIANTE GEMELOS DIGITALES		GOBIERNO DE CANTABRIA; CONSEJERIA DE PRESIDENCIA, INTERIOR, JUSTICIA Y ACCIÓN EXTERIOR	16.940,00	Equipo investigador

Y para que conste a los efectos oportunos, lo firmo a la fecha de la firma electrónica.

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Luigi dell'Olio
Vicerrector de Investigación y Política Científica
Universidad de Cantabria

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4.B.3. Co-fundación y consultorías para la empresa Muon Tomography Systems S.L. (2015-2017)

Muon Systems
Av. Altos Hornos de Vizcaya, 33
48901. Barakaldo (Bizkaia)
Tel. 946572115
info@muon.systems
https://muon.systems

D Carlos Díez González mayor de edad, con DNI núm. 72068386-W, como Director Gerente y Administrador Único y en nombre y representación de la empresa MUON TOMOGRAPHY SYSTEMS, S.L. (**Muon Systems**), con CIF nº B-95797890, domiciliada en C/ Fernández del Campo, 24, 5º de Bilbao, que fue constituida con fecha 2 de Marzo de 2015 ante el Notario de Santander D. Juan Carlos García Cortés y de la cual tiene concedido poder en escritura otorgada con el nº 268 de su Protocolo,

CERTIFICA

1. que Muon Tomography Systems S.L. fue fundada en el año 2015 por Pablo Martínez Ruiz del Árbol y por Carlos Díez González, como fruto de una iniciativa personal para aplicar sus conocimientos sobre detección y reconstrucción de muones a la industria;

2. que hasta el momento en el que se incorporó como Ramón y Cajal en la Universidad de Cantabria, Pablo Martínez Ruiz del Árbol ha contribuido activamente a los desarrollos de la empresa como asesor científico;

3. que este asesoramiento ha sido crucial para que la empresa desarrolle sus sistemas de hardware y sus algoritmos de reconstrucción, contribuyendo a la obtención de proyectos y reconocimientos;
   - Proyecto seleccionado para el “Área 1: Desarrollo de Proyectos Empresariales Innovadores” de la Diputación Foral de Bizkaia y el Gobierno Vasco – Año 2015
   - Proyecto mejor valorado en la categoría Fabricación y Materiales del Programa “Nuevas empresas de Base Tecnológica” (NEOTEC-CDTI) - Año 2016
   - Programa de aceleración del Fondo de Emprendedores de la Fundación Repsol, fase idea – Año 2016

4. que una vez Pablo Martínez Ruiz del Árbol se incorporó a la Universidad de Cantabria, ha seguido contribuyendo en el marco de un proyecto amparado por el Artículo 83, y que es deseo expreso de la empresa continuar estas colaboraciones en el futuro.

En Barakaldo a 04 de Septiembre de 2020.

Carlos Díez González

Director Gerente

Capítulo 5

Actividad Científica y Tecnologíca

5.A. Publicaciones científicas indexadas en JCR

5.A.1. CMS TECHNICAL DESIGN REPORT VOLUME II PHYSICS PERFORMANCE

J. Phys. G: Nucl. Part. Phys. **34** (2007) 995–1579 doi:10.1088/0954-3899/34/6/S01

CMS Physics Technical Design Report, Volume II: Physics Performance

The CMS Collaboration

Received 3 January 2007
Published 20 April 2007
Online at stacks.iop.org/JPhysG/34/995

Abstract
CMS is a general purpose experiment, designed to study the physics of pp collisions at 14 TeV at the Large Hadron Collider (LHC). It currently involves more than 2000 physicists from more than 150 institutes and 37 countries. The LHC will provide extraordinary opportunities for particle physics based on its unprecedented collision energy and luminosity when it begins operation in 2007.

The principal aim of this report is to present the strategy of CMS to explore the rich physics programme offered by the LHC. This volume demonstrates the physics capability of the CMS experiment. The prime goals of CMS are to explore physics at the TeV scale and to study the mechanism of electroweak symmetry breaking—through the discovery of the Higgs particle or otherwise. To carry out this task, CMS must be prepared to search for new particles, such as the Higgs boson or supersymmetric partners of the Standard Model particles, from the start-up of the LHC since new physics at the TeV scale may manifest itself with modest data samples of the order of a few fb^{-1} or less.

The analysis tools that have been developed are applied to study in great detail and with all the methodology of performing an analysis on CMS data specific benchmark processes upon which to gauge the performance of CMS. These processes cover several Higgs boson decay channels, the production and decay of new particles such as Z' and supersymmetric particles, B_s production and processes in heavy ion collisions. The simulation of these benchmark processes includes subtle effects such as possible detector miscalibration and misalignment. Besides these benchmark processes, the physics reach of CMS is studied for a large number of signatures arising in the Standard Model and also in theories beyond the Standard Model for integrated luminosities ranging from $1\,\mathrm{fb}^{-1}$ to $30\,\mathrm{fb}^{-1}$. The Standard Model processes include QCD, B-physics, diffraction, detailed studies of the top quark properties, and electroweak physics topics such as the W and Z^0 boson properties. The production and decay of the Higgs particle is studied for many observable decays, and the precision with which the Higgs boson properties can be derived is determined. About ten different supersymmetry benchmark points are analysed using full simulation. The CMS discovery reach is evaluated in the SUSY parameter space covering a large variety of decay signatures.

Institute for Theoretical and Experimental Physics, Moscow, RUSSIA
V Gavrilov, N Ilina, V Kaftanov[1], I Kiselevich, V Kolosov, M Kossov[1], A Krokhotin, S Kuleshov, A Oulianov, G Safronov, S Semenov, V Stolin, E Vlasov[1], V Zaytsev

P N Lebedev Physical Institute, Moscow, RUSSIA
A M Fomenko, N Konovalova, V Kozlov, A I Lebedev, N Lvova, S V Rusakov, A Terkulov

Moscow State University, Moscow, RUSSIA
E Boos, M Dubinin[3], L Dudko, A Ershov, A Gribushin, V Ilyin, V Klyukhin[1], O Kodolova, I Lokhtin, S Petrushanko, L Sarycheva, V Savrin, A Sherstnev, A Snigirev, K Teplov, I Vardanyan

State Research Center of Russian Federation - Institute for High Energy Physics, Protvino, RUSSIA
V Abramov, I Azhguirei, S Bitioukov, K Datsko, A Filine, P Goncharov, V Grishin, A Inyakin, V Kachanov, A Khmelnikov, D Konstantinov, A Korablev, V Krychkine, A Levine, I Lobov, V Petrov, V Pikalov, R Ryutin, S Slabospitsky, A Sourkov[1], A Sytine, L Tourtchanovitch, S Troshin, N Tyurin, A Uzunian, A Volkov, S Zelepoukine[18]

Vinca Institute of Nuclear Sciences, Belgrade, SERBIA
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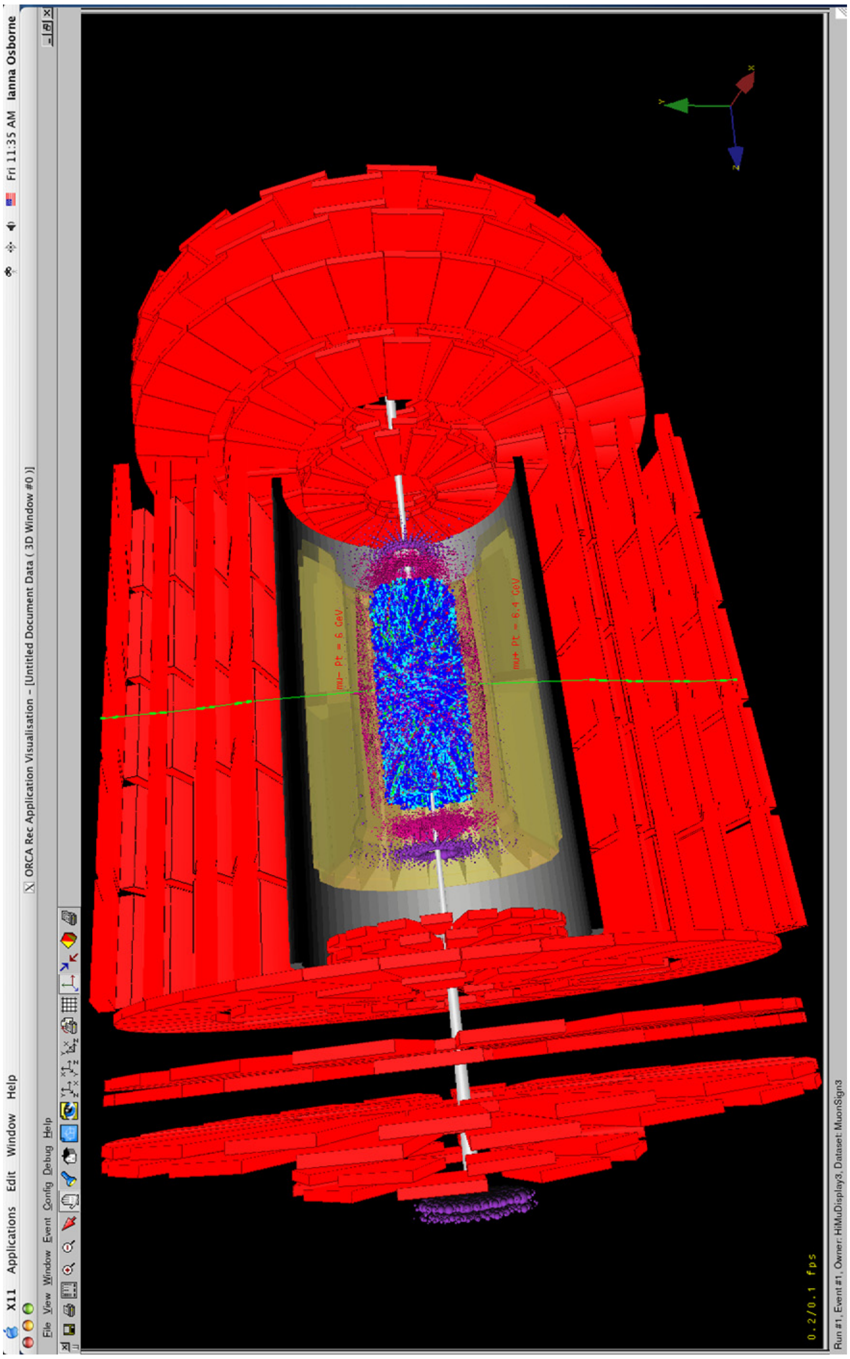

Figure CP9. $\Upsilon \rightarrow \mu^+\mu^-$ event embedded in a PbPb collision at $\sqrt{s_{NN}} = 5.5$ TeV with charged multiplicities at mid-rapidity $dN_{ch}/d\eta|_{\eta=0} = 3500$. (See section 6.1.)

5.A.2. The CMS Experiment at the CERN LHC

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THE CERN LARGE HADRON COLLIDER: ACCELERATOR AND EXPERIMENTS

The CMS experiment at the CERN LHC

CMS Collaboration

ABSTRACT: The Compact Muon Solenoid (CMS) detector is described. The detector operates at the Large Hadron Collider (LHC) at CERN. It was conceived to study proton-proton (and lead-lead) collisions at a centre-of-mass energy of 14 TeV (5.5 TeV nucleon-nucleon) and at luminosities up to $10^{34}\,\mathrm{cm^{-2}s^{-1}}$ ($10^{27}\,\mathrm{cm^{-2}s^{-1}}$). At the core of the CMS detector sits a high-magnetic-field and large-bore superconducting solenoid surrounding an all-silicon pixel and strip tracker, a lead-tungstate scintillating-crystals electromagnetic calorimeter, and a brass-scintillator sampling hadron calorimeter. The iron yoke of the flux-return is instrumented with four stations of muon detectors covering most of the 4π solid angle. Forward sampling calorimeters extend the pseudo-rapidity coverage to high values ($|\eta| \leq 5$) assuring very good hermeticity. The overall dimensions of the CMS detector are a length of 21.6 m, a diameter of 14.6 m and a total weight of 12500 t.

KEYWORDS: Instrumentation for particle accelerators and storage rings - high energy; Gaseous detectors; Scintillators, scintillation and light emission processes; Solid state detectors; Calorimeters; Gamma detectors; Large detector systems for particle and astroparticle physics; Particle identification methods; Particle tracking detectors; Spectrometers; Analogue electronic circuits; Control and monitor systems online; Data acquisition circuits; Data acquisition concepts; Detector control systems; Digital electronic circuits; Digital signal processing; Electronic detector readout concepts; Front-end electronics for detector readout; Modular electronics; Online farms and online filtering; Optical detector readout concepts; Trigger concepts and systems; VLSI circuits; Analysis and statistical methods; Computing; Data processing methods; Data reduction methods; Pattern recognition, cluster finding, calibration and fitting methods; Software architectures; Detector alignment and calibration methods; Detector cooling and thermo-stabilization; Detector design and construction technologies and materials; Detector grounding; Manufacturing; Overall mechanics design; Special cables; Voltage distributions.

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5.A.3. CMS MUON ALIGNMENT SYSTEM DESCRIPTION AND FIRST RESULTS

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CMS muon alignment: System description and first results

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ABSTRACT

The CMS detector has been instrumented with a precise and complex opto-mechanical alignment subsystem that provides a common reference frame between tracker and muon detection systems by means of a net of laser beams. The system allows a continuous and accurate monitoring of the muon chambers positions with respect to the tracker body. Preliminary results of operation during the test of the CMS 4 T solenoid magnet, performed in 2006, are presented. These measurements complement the information provided by the use of survey techniques and the results of alignment algorithms based on muon tracks crossing the detector.

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1. Introduction

For optimal performance of the CMS muon spectrometer [1] over the entire momentum range up to the TeV range, the different muon chambers must be aligned with respect to each other and to the central tracking system to within a few hundred microns in $r\phi$. The required alignment precision for the endcap chambers is 75–200 μm, while for the barrel the precision varies from 150 μm for the inner station to 350 μm for the outer station. To this end, after following strict chamber construction specifications, CMS combines precise survey and photogrammetry measurements, measurements from an opto-mechanical system, and the results of alignment algorithms based on muon tracks (both from cosmic rays and from pp collisions) crossing the spectrometer.

During the Magnet Test and Cosmic Challenge (MTCC) [2] a third of the optical alignment system was implemented allowing preliminary studies of the detector behavior under the effect of magnetic forces.

In what follows we describe the alignment strategy, a brief description of the optical alignment system, and the results from the different measurements sources.

2. Alignment strategy

There are several potential sources of misalignment in the muon spectrometer, from chamber production to final detector operating conditions, including:

Chamber construction tolerances: These are unavoidable geometrical tolerances in the production of the chamber parts. The relative positioning of the different internal components of a chamber was measured during construction to be within the required tolerances [3].

Detector assembly, closing tolerances: Gravitational distortions of the return yoke lead to static deformations of the steel support. This effect, together with the installation tolerances, results in displacements of the chambers in the different barrel wheels and endcap disks of up to several millimeters with respect to their nominal detector positions.

Solenoid effects: Magnetic forces generated by the 4 T solenoid field lead to displacements and deformations of the return yoke which is at the same time the support structure of the muon chambers. This results in further displacements of the chambers with respect to their nominal positions.

Time-dependent effects: During operation, thermal instabilities and other time-dependent factors can cause dynamic misalignments at the sub-millimeter level.

The strategy for the alignment of the CMS muon spectrometer is to combine different sources of information: from the production phase of the muon chambers to the final monitoring during operation. The set of data comes from: (a) quality control data recorded during the construction of the chambers, (b) survey and photogrammetry measurements done at the different stages of chamber construction and detector assembly, (c) optical data provided by the optical muon alignment system, and finally (d) the information provided by the tracks (cosmic rays, beam halo, or collision tracks) crossing the detector.

3. Optical alignment system description

The muon alignment system [1] was designed to provide continuous and accurate monitoring of the barrel and endcap muon detectors among themselves as well as alignment between them and the inner tracker detector.

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test. The measured relative movement did not exceed 50 μm over the entire test period, with changes in position showing a good correlation with temperature. Although a movement of this magnitude is not relevant from the physics analysis point of view, the measurement illustrates the good resolution of the optical alignment system. Two effects were observed when the magnet was powered on: the first was the change of the original closed positions of the structures (the positions before any magnet operation) after the first magnet cycles. A permanent compression towards the interaction point (IP), along the beam line axis, of several mm was measured and it was interpreted as the final closing of the structures due to the magnetic forces acting on the iron. This magnitude is understood as specific of the test conditions and cannot be extrapolated to other scenarios. The second effect is the almost perfectly elastic deformations of the iron structures between magnet-on and magnet-off states. Both effects can be seen in Fig. 4. The top figure shows for each measurement the distance between the tracker end and the first endcap muon disk, for the different field values, shown at the bottom part of the figure. The strong magnetic forces pull the central part of the endcap disks towards the IP. At 4 T it is pulled approximately 16 mm. This displacement follows, as expected, a quadratic behavior with the magnet intensity. The same compression effect, although of much smaller magnitude, was measured for the barrel wheels. Small deformations in the $r\phi$ plane were also observed.

The global reconstruction of the optical data is handled by a software package called COCOA [7]. It obtains positions and orientation angles of defined reference points or structures from a non-linear least-squares fit. In addition to the optical measurement recorded, the system description has to be provided, including the interconnection of elements and hierarchy of the components, together with an approximation of the geometry provided with previous measurements (calibrations or photogrammetry). Supplying a good estimation of the geometry speeds the convergence, ensures the goodness of the result and avoids falling in local minima.

The reconstruction method has been applied to the link system. The system was fully described with MTCC geometry and the first geometry of the detector (barrel and endcap with respect to the tracker) was reconstructed at 0 and 4 T. Comparing these two geometries, the movements and displacements of the structures, from 0 to 4 T, were obtained.

With data recorded during the whole period of the MTCC the reconstruction method was validated and the system performance was evaluated, showing a system accuracy of ~140 μm and a resolution of ~80 μm in both coordinates, as shown in Fig. 5.

5. Conclusion

The procedure to align the detectors in CMS makes use of different source of information. It includes survey and photogrammetry measurements, optical data and the results of the track-based alignment algorithms.

An analysis with tracks, taken during the commissioning, together with survey information, has allowed to build a first set of alignment corrections for the internal alignment of the muon chambers.

A complex optical muon alignment system has been successfully completed and a significant part of the system was, for the first time, tested with the full detector closed and with the 4 T solenoid field on, running in a continuous mode.

With the link system data the magnetic field effects on the detector geometry were measured. A good consistency of the results measured from different data source was obtained. A first CMS geometry of the barrel wheels and endcap disk with respect to the tracker detector, as in operation conditions, was established and the system accuracy and precision was validated with respect to the design values [1].

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5.A.4. OFFLINE CALIBRATION PROCEDURE OF THE CMS DRIFT TUBE DETECTORS

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of the drift velocity, as demonstrated by eq. (4.4), therefore higher accuracy can only be achieved using a procedure for fine tuning of the time pedestal which is independent of the drift velocity.

An alternative approach consists in using the different dependences on t_{trig} mis-calibration of the various meantimer formulas to calibrate the pedestal. The differences among the values of T_{max} computed using different formulas can be used to measure the value of the mis-calibration Δt once the dependence of the meantimer on the track impact angle is well understood. This would allow t_{trig} to be tuned without relying on the residual distribution and therefore without depending on the calibration precision of the drift velocity. This alternative approach will be investigated in the future.

5 Conclusions

The calibration task is fundamental to the DT hit reconstruction: the knowledge of the time pedestal is an unavoidable prerequisite for the computation of the drift distance, while the calibration of the average drift velocity determines the accuracy of the reconstruction.

For this reason, a robust calibration procedure has been developed to satisfy the requirements imposed by all possible running conditions: dedicated cosmic runs, test beams, and pp-collision data.

The calibration algorithms described in the present document have been tested both on simulated and real data acquired during the 2004 test beam, the 2006 Magnet Test and Cosmic Challenge [9, 10] and the commissioning with cosmics.

Using the tools developed for the calibration and synchronization procedure we also studied the effect of possible mis-calibration of the pedestals and of the drift velocity on the muon track fit and thus eventually on higher level reconstructed quantities. We analyze these systematic uncertainties in the study of the physics reach of the experiment [11].

Further optimization is still possible. In particular, the accuracy of the current procedure is limited by the interdependence of the time pedestal and the drift velocity used in the reconstruction. Other methods for fine tuning of t_{trig} are under study; a procedure based on the usage of different meantimer formulas to estimate the best value of the time pedestal is the most promising.

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5.A.5. MOTIONS OF CMS DETECTOR STRUCTURES DUE TO THE MAGNETIC FIELD FORCES AS OBSERVED BY THE LINK ALIGNMENT SYSTEM DURING THE TEST OF THE 4 TESLA MAGNET SOLENOID

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Motions of CMS detector structures due to the magnetic field forces as observed by the Link alignment system during the test of the 4 T magnet solenoid

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ABSTRACT

This document describes results obtained from the Link alignment system data recorded during the Compact Muon Solenoid (CMS) Magnet Test. A brief description of the system is followed by a discussion of the detected relative displacements (from micrometres to centimetres) between detector elements and rotations of detector structures (from microradians to milliradians). Observed displacements are studied as functions of the magnetic field intensity. In addition, the reconstructed positions of active element sensors are compared to their positions as measured by photogrammetry and the reconstructed motions due to the magnetic field strength are described.

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1. Introduction

From the point of view of muon measurement, the Compact Muon Solenoid (CMS) Detector [1–3] is a muon spectrometer and the detection of these particles is favoured. Attending to the magnet field intensity, two different technologies are employed for their measurement. In the barrel region, surrounding the coil of the solenoid, four layers of drift chambers, interleaved with the return iron yoke, make a redundant measurement of the muon momenta. A muon chamber is made of three superlayers. Each superlayer is made of four layers of drift cells. The drift cell is the basic unit measuring the drift time of a muon, providing a spatial resolution of 250 μm. Each superlayer will contribute with the measurement of one coordinate. Two superlayers measure the $r\phi$ coordinate and one layer measures the z coordinate. The mechanical design of a drift chamber is driven by the precision in the determination of a point of the muon track, 100 μm, which is obtained by a fit of the individual hits in each cell.

The muon drift chambers will be subject to variable residual magnetic fields, below 0.4 T for all the chambers except for the MB1 chambers near the endcaps. There, the magnetic field will rise up to 0.8 T. In the region of the ME1/1 chambers the field will be $B_z \approx 3$ T. For such magnetic field intensity the operation of the muon drift chambers is limited, since the drift cell escapes the linear regime. CMS uses, at the endcaps, other gaseous detectors called Cathode Strip Chambers (CSCs) that can operate in large and non-uniform magnetic fields without significant deterioration of performance. CSCs are multiwire proportional chambers in which one cathode plane is segmented into strips running across wires, both of them instrumented, giving 2D information of the particle passage. Due to the intense magnetic field, the muon trajectories bend more in the vicinity of the first endcap station where the higher precision is required (75 μm). For the rest of the chambers the precisions will be of about 150 μm.

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Table 9
Difference in position (in mm) and orientation (in mrad) between the fitted values at the quoted B field and $B = 0$ T at the end of Phase I using COCOA for the YB + 2 Disk (w.r.t. the tracker).

YB + 2 Phase I	Δ_X	Δ_Y	Δ_Z	Δ_{AngX}	Δ_{AngY}	Δ_{AngZ}
$B = 2$ T	0.81 ± 0.35	−0.24 ± 0.38	−0.58 ± 0.63	−0.51 ± 0.09	0.23 ± 0.12	0.35 ± 0.08
$B = 3$ T	1.28 ± 0.35	1.26 ± 0.38	−0.14 ± 0.63	−0.30 ± 0.09	0.91 ± 0.12	−0.07 ± 0.08
$B = 3.8$ T	1.00 ± 0.35	1.37 ± 0.38	−0.37 ± 0.63	−0.51 ± 0.09	1.27 ± 0.12	−0.37 ± 0.08
$B = 4.0$ T	1.21 ± 0.35	2.28 ± 0.38	−0.03 ± 0.63	−0.63 ± 0.09	1.71 ± 0.12	−0.33 ± 0.08

Table 10
Difference in position (in mm) and orientation (in mrad) between the fitted values at $B = 3.8$ T in Phase I using COCOA and $B = 0$ T for ME1/1, ME1/2 and MAB structures.

$B = 3.8$ T Phase I	Δ_X	Δ_Y	Δ_Z	Δ_{AngX}	Δ_{AngY}	Δ_{AngZ}
ME11-75	1.60 ± 0.34	−0.09 ± 0.27	−2.36 ± 0.39	–	–	–
ME11-255	0.08 ± 0.31	0.97 ± 0.28	−2.67 ± 0.36	–	–	–
ME11-315	−0.36 ± 0.28	−0.51 ± 0.29	−1.22 ± 0.35	–	–	–
ME12-75	2.02 ± 0.38	−1.82 ± 0.78	1.97 ± 0.39	–	−3.87 ± 0.72	−0.38 ± 0.69
ME12-255	−0.84 ± 0.34	−2.00 ± 0.64	1.45 ± 0.36	–	−3.91 ± 0.72	−0.35 ± 0.69
ME12-315	0.21 ± 0.50	−0.80 ± 0.50	3.10 ± 0.35	–	–	–
MAB-75	–	–	1.49 ± 0.76	–	−0.44 ± 0.08	−0.32 ± 0.08
MAB-255	1.25 ± 0.50	−1.18 ± 0.66	−4.16 ± 0.70	–	0.28 ± 0.16	−0.10 ± 0.16
MAB-315	−0.13 ± 0.67	−0.27 ± 0.64	2.67 ± 0.73	–	0.32 ± 0.19	−0.12 ± 0.19

– plain lines indicate degrees of freedom not measured in the fit.

Table 11
Difference in position (in mm) and orientation (in mrad) between the fitted values at the quoted B field in Phase I and $B = 0$ T using COCOA for the ME1/2 chamber placed at 255° (w.r.t. YE + 1).

ME12-255 Phase I	Δ_X	Δ_Y	Δ_Z	Δ_{AngX}	Δ_{AngY}	Δ_{AngZ}
$B = 2$ T	1.10 ± 0.34	−2.15 ± 0.64	−0.31 ± 0.36	–	−1.68 ± 0.07	0.23 ± 0.07
$B = 3$ T	0.10 ± 0.34	−1.68 ± 0.64	0.21 ± 0.36	–	−2.71 ± 0.07	−0.14 ± 0.07
$B = 3.8$ T	−0.84 ± 0.34	−2.00 ± 0.64	1.45 ± 0.36	–	−3.91 ± 0.07	−0.35 ± 0.07
$B = 4.0$ T	−0.75 ± 0.34	−1.73 ± 0.64	1.06 ± 0.36	–	−4.01 ± 0.07	−0.35 ± 0.07

Table 12
The difference in position (in mm) and orientation (in mrad) between the fitted values at the quoted B field values in Phase II and $B = 0$ T using COCOA for the YB + 2 Disk (w.r.t. YE + 1).

YB + 2 Phase II	Δ_X	Δ_Y	Δ_Z	Δ_{AngX}	Δ_{AngY}	Δ_{AngZ}
$B = 2$ T	0.05 ± 0.36	−0.34 ± 0.38	5.12 ± 0.67	−0.42 ± 0.10	−0.23 ± 0.12	−0.22 ± 0.10
$B = 3$ T	0.06 ± 0.36	−0.26 ± 0.38	8.70 ± 0.67	−0.63 ± 0.10	−0.37 ± 0.12	−0.02 ± 0.10
$B = 3.8$ T	−0.02 ± 0.36	−0.17 ± 0.38	13.30 ± 0.67	−0.72 ± 0.10	−0.31 ± 0.12	0.07 ± 0.10
$B = 4$ T	−0.09 ± 0.36	−0.17 ± 0.38	14.34 ± 0.67	−0.70 ± 0.10	−0.09 ± 0.12	−0.19 ± 0.10

Table 13
Difference in position (in mm) and orientation (in mrad) between the fitted values at the quoted B field in Phase II and $B = 0$ T using COCOA for the ME12 chamber placed at 255° (w.r.t. YE + 1).

ME12–255 Phase II	Δ_X	Δ_Y	Δ_Z	Δ_{AngX}	Δ_{AngY}	Δ_{AngZ}
$B = 2$ T	−0.96 ± 0.38	−0.71 ± 0.63	0.27 ± 0.38	–	−1.89 ± 0.08	−0.28 ± 0.07
$B = 3$ T	−0.18 ± 0.38	−1.48 ± 0.63	0.87 ± 0.38	–	−3.12 ± 0.08	0.11 ± 0.07
$B = 3.8$ T	−0.37 ± 0.38	−1.94 ± 0.63	1.74 ± 0.38	–	−4.23 ± 0.08	0.09 ± 0.07
$B = 4.0$ T	−0.71 ± 0.38	−2.01 ± 0.63	1.18 ± 0.38	–	−4.57 ± 0.08	−0.09 ± 0.07

commissioning of the four-Tesla Magnet. The test (Magnet Test and Cosmic Challenge) took place in the SX5 CMS assembly Hall at CERN. About 5% of the muon detector was also commissioned with cosmic rays.

A quarter of the Link alignment system was installed and operated during the test. The readout electronics, DAQ and detector control systems, integrated into the DCS (Detector Control System) environment, were also successfully tested. The reconstruction procedure was established and for the first time applied to a sizable set of data recorded by the system. Calibrations of individual sensors and laser holder structures, 3D measurements of sensor mounts and associated mechanics, and survey and photogrammetry

5.A.6. PRECISE MAPPING OF THE MAGNETIC FIELD IN THE CMS BARREL YOKE USING COSMIC RAYS

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Precise mapping of the magnetic field in the CMS barrel yoke using cosmic rays

CMS Collaboration

ABSTRACT: The CMS detector is designed around a large 4 T superconducting solenoid, enclosed in a 12 000-tonne steel return yoke. A detailed map of the magnetic field is required for the accurate simulation and reconstruction of physics events in the CMS detector, not only in the inner tracking region inside the solenoid but also in the large and complex structure of the steel yoke, which is instrumented with muon chambers. Using a large sample of cosmic muon events collected by CMS in 2008, the field in the steel of the barrel yoke has been determined with a precision of 3 to 8% depending on the location.

KEYWORDS: Muon spectrometers; Large detector systems for particle and astroparticle physics

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5.A.7. PERFORMANCE OF THE CMS DRIFT TUBE CHAMBERS WITH COSMIC RAYS

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Performance of the CMS drift tube chambers with cosmic rays

CMS Collaboration

ABSTRACT: Studies of the performance of the CMS drift tube barrel muon system are described, with results based on data collected during the CMS Cosmic Run at Four Tesla. For most of these data, the solenoidal magnet was operated with a central field of 3.8 T. The analysis of data from 246 out of a total of 250 chambers indicates a very good muon reconstruction capability, with a coordinate resolution for a single hit of about 260 μm, and a nearly 100% efficiency for the drift tube cells. The resolution of the track direction measured in the bending plane is about 1.8 mrad, and the efficiency to reconstruct a segment in a single chamber is higher than 99%. The CMS simulation of cosmic rays reproduces well the performance of the barrel muon detector.

KEYWORDS: Large detector systems for particle and astroparticle physics; Particle tracking detectors (Gaseous detectors)

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has been measured to be about 99% in all chambers. The comparison between measurements of the track segment positions and directions in the different chambers shows a behaviour compatible with the expectations from the multiple scattering of the muons in the steel yoke. The spread in the measurement of the track direction in the bending plane of CMS was about 6 mrad, averaged over the whole momentum spectrum of cosmic muons with $p_T > 10\,\mathrm{GeV/c}$. The bending power in the steel return yoke between the innermost and outermost station has been measured to be about 3 mrad for $p_T = 200\,\mathrm{GeV/c}$ muons. The relative misalignments of the chambers, as measured by the data collected at $B = 0$ T, are well within the mechanical tolerances (a few mm) for the insertion of the chambers into their cradles inside the magnet yoke structure.

The chamber performance is in good agreement with the simulation; it provides a good starting point that assures fully efficient operation of the muon DT trigger and eventual achievement of the original design criteria of the DT system. The criteria specify robust and efficient muon identification, and the capability of measuring the muon position in each station with a precision of about 100 μm, in order to provide good momentum resolution for highly energetic muons. The above results are very encouraging and allow the anticipation of a good performance of the DT barrel muon detector during early phases of LHC operation and data taking, which would provide efficient identification and reconstruction of muons.

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5.A.8. PERFORMANCE OF CMS MUON RECONSTRUCTION IN COSMIC-RAY EVENTS

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COMMISSIONING OF THE CMS EXPERIMENT WITH COSMIC RAYS

Performance of CMS muon reconstruction in cosmic-ray events

CMS Collaboration

ABSTRACT: The performance of muon reconstruction in CMS is evaluated using a large data sample of cosmic-ray muons recorded in 2008. Efficiencies of various high-level trigger, identification, and reconstruction algorithms have been measured for a broad range of muon momenta, and were found to be in good agreement with expectations from Monte Carlo simulation. The relative momentum resolution for muons crossing the barrel part of the detector is better than 1% at 10 GeV/c and is about 8% at 500 GeV/c, the latter being only a factor of two worse than expected with ideal alignment conditions. Muon charge misassignment ranges from less than 0.01% at 10 GeV/c to about 1% at 500 GeV/c.

KEYWORDS: Muon spectrometers; Large detector systems for particle and astroparticle physics

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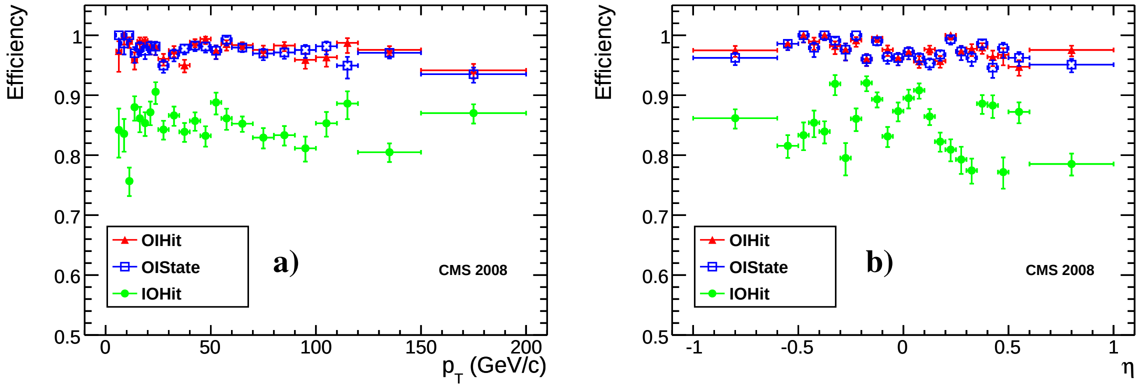

Figure 23. Reconstruction efficiency for Level-3 muons as a function of a) p_T and b) η of the Level-2 muon for three algorithms: IOHit (circles), OIHit (triangles), OIState (squares). Error bars represent statistical uncertainties only.

low p_T values and of about 8% at $p_T \sim 0.5$ TeV/c has been obtained with the initial CRAFT-based alignment of the tracker and the muon chambers. Charge misassignment has been measured to be less than 0.01% at 10 GeV/c and about 1% at 0.5 TeV/c.

The analysis of cosmic-ray muons from CRAFT has provided detailed insight into the performance of the CMS muon reconstruction algorithms. The experience gained is valuable in the preparation for data from LHC collisions, where reconstruction and identification of muons will be crucial to achieve the physics goals of the CMS collaboration.

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5.A.9. COMMISSIONING OF THE CMS EXPERIMENT AND THE COSMIC RUN AT FOUR TESLA

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Commissioning of the CMS experiment and the cosmic run at four tesla

CMS Collaboration

ABSTRACT: The CMS Collaboration conducted a month-long data-taking exercise known as the Cosmic Run At Four Tesla in late 2008 in order to complete the commissioning of the experiment for extended operation. The operational lessons resulting from this exercise were addressed in the subsequent shutdown to better prepare CMS for LHC beams in 2009. The cosmic data collected have been invaluable to study the performance of the detectors, to commission the alignment and calibration techniques, and to make several cosmic ray measurements. The experimental setup, conditions, and principal achievements from this data-taking exercise are described along with a review of the preceding integration activities.

KEYWORDS: Large detector systems for particle and astroparticle physics; Calorimeters; Particle tracking detectors (Solid-state detectors); Particle tracking detectors (Gaseous detectors)

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5.A.10. CALIBRATION OF THE CMS DRIFT TUBE CHAMBERS AND MEASUREMENT OF THE DRIFT VELOCITY WITH COSMIC RAYS

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Calibration of the CMS drift tube chambers and measurement of the drift velocity with cosmic rays

CMS Collaboration

ABSTRACT: This paper describes the calibration procedure for the drift tubes of the CMS barrel muon system and reports the main results obtained with data collected during a high statistics cosmic ray data-taking period. The main goal of the calibration is to determine, for each drift cell, the minimum time delay for signals relative to the trigger, accounting for the drift velocity within the cell. The accuracy of the calibration procedure is influenced by the random arrival time of the cosmic muons relative to the LHC clock cycle. A more refined analysis of the drift velocity was performed during the offline reconstruction phase, which takes into account this feature of cosmic ray events.

KEYWORDS: Large detector systems for particle and astroparticle physics; Particle tracking detectors (Gaseous detectors)

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The drift velocity calibration results show an approximately constant value of 54.3 μm/ns for all the chambers of the DT system, with a relative systematic uncertainty of 2.5 %. This uncertainty originates from the measured drift time, used in the mean-time method, which is limited by the uncertainty of the arrival time of cosmic ray muons. This explains why the obtained spatial resolution is worse than would be expected with collision data.

A more refined analysis of the drift velocity has been performed, exploiting the full potential of the CMS offline software for data reconstruction. It uses a track fitting procedure which leaves as free parameters the drift velocity and the time of passage of the muons through the chambers. Cosmic ray data with and without magnetic field have been studied. Without magnetic field, a constant average value of 54.5 μm/ns has been observed, with an error of 0.2 %; when the field strength is 3.8 T, the innermost chambers of the external barrel wheels measure a lower value, as expected, of about 53.6 μm/ns. These results confirm what was observed in an analysis performed on simulated collision data and provide a spatial resolution that is close to the design performance.

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5.A.11. CMS DATA PROCESSING WORKFLOWS DURING AN EXTENDED COSMIC RAY RUN

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CMS data processing workflows during an extended cosmic ray run

CMS Collaboration

ABSTRACT: The CMS Collaboration conducted a month-long data taking exercise, the Cosmic Run At Four Tesla, during October-November 2008, with the goal of commissioning the experiment for extended operation. With all installed detector systems participating, CMS recorded 270 million cosmic ray events with the solenoid at a magnetic field strength of 3.8 T. This paper describes the data flow from the detector through the various online and offline computing systems, as well as the workflows used for recording the data, for aligning and calibrating the detector, and for analysis of the data.

KEYWORDS: Detector control systems (detector and experiment monitoring and slow-control systems, architecture, hardware, algorithms, databases); Data acquisition concepts

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5.A.12. ALIGNMENT OF THE CMS MUON SYSTEM WITH COSMIC-RAY AND BEAM-HALO MUONS

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Alignment of the CMS muon system with cosmic-ray and beam-halo muons

CMS Collaboration

ABSTRACT: The CMS muon system has been aligned using cosmic-ray muons collected in 2008 and beam-halo muons from the 2008 LHC circulating beam tests. After alignment, the resolution of the most sensitive coordinate is 80 microns for the relative positions of superlayers in the same barrel chamber and 270 microns for the relative positions of endcap chambers in the same ring structure. The resolution on the position of the central barrel chambers relative to the tracker is comprised between two extreme estimates, 200 and 700 microns, provided by two complementary studies. With minor modifications, the alignment procedures can be applied using muons from LHC collisions, leading to additional significant improvements.

KEYWORDS: Muon spectrometers; Large detector systems for particle and astroparticle physics

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The overlap of CSC rings permits an analytic solution to its alignment. Non-Gaussianity in the physics of track propagation through the steel yoke implies a non-linear extension to the general alignment method.

Techniques which will be useful for re-aligning the muon system with early LHC data have been tested. The favorable distribution of muons from collisions will broaden the applicability of these methods and open new opportunities for cross-checks and diagnostics, which ultimately will lead to a better-understood momentum resolution for high-momentum muons and increased discovery reach for high-energy processes.

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5.A.13. ALIGNING THE CMS MUON CHAMBERS WITH THE MUON ALIGNMENT SYSTEM DURING AN EXTENDED COSMIC RAY RUN

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Aligning the CMS muon chambers with the muon alignment system during an extended cosmic ray run

CMS Collaboration

ABSTRACT: The alignment system for the muon spectrometer of the CMS detector comprises three independent subsystems of optical and analog position sensors. It aligns muon chambers with respect to each other and to the central silicon tracker. System commissioning at full magnetic field began in 2008 during an extended cosmic ray run. The system succeeded in tracking muon detector movements of up to 18 mm and rotations of several milliradians under magnetic forces. Depending on coordinate and subsystem, the system achieved chamber alignment precisions of 140–350 μm and 30–200 μrad, close to the precision requirements of the experiment. Systematic errors on absolute positions are estimated to be 340–590 μm based on comparisons with independent photogrammetry measurements.

KEYWORDS: Muon spectrometers; Large detector systems for particle and astroparticle physics

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Table 4. Typical precisions obtained for DT and CSC chamber alignment. Dashes in the table indicate degrees of freedom not yet measured by the system. Of the reconstructed degrees of freedom, the most relevant for momentum measurement is $r\phi_{CMS}$, the remaining affecting the momentum reconstruction as a higher-order correction.

Chamber	$r\phi_{CMS}$ [μm]	z_{CMS} [μm]	$\phi_{x_{\rm local}}$ [μrad]
DT	200	–	–
CSC ME1	–	220–340	–
CSC ME2,3,4	–	280–320	200

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5.A.14. MEASUREMENT OF THE CHARGE RATIO OF ATMOSPHERIC MUONS WITH THE CMS DETECTOR

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ABSTRACT

We present a measurement of the ratio of positive to negative muon fluxes from cosmic ray interactions in the atmosphere, using data collected by the CMS detector both at ground level and in the underground experimental cavern at the CERN LHC. Muons were detected in the momentum range from 5 GeV/c to 1 TeV/c. The surface flux ratio is measured to be $1.2766 \pm 0.0032\,(\text{stat.}) \pm 0.0032\,(\text{syst.})$, independent of the muon momentum, below 100 GeV/c. This is the most precise measurement to date. At higher momenta the data are consistent with an increase of the charge ratio, in agreement with cosmic ray shower models and compatible with previous measurements by deep-underground experiments.

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1. Introduction

The muon charge ratio R is defined as the ratio of the number of positive- to negative-charge atmospheric muons arriving at the Earth's surface. These muons arise from showers produced in interactions of high-energy cosmic ray particles with air nuclei in the upper layers of the atmosphere. The magnitude and the momentum dependence of R are determined by the production and interaction cross sections of mesons (mainly pions and kaons), and by their decay lengths. As most cosmic rays and the nuclei with which they interact are positively charged, positive meson production is favoured, hence more positive muons are expected. Previous measurements from various experiments [1–8] showed the muon charge ratio to be constant up to a momentum of about 200 GeV/c, and then to increase at higher momenta, in agreement with the predicted rise in the fraction of muons from kaon decays. Measurements of the charge ratio can be used to constrain hadronic interaction models and to predict better the atmospheric neutrino flux.

The Compact Muon Solenoid (CMS) [9] is one of the detectors installed at the Large Hadron Collider (LHC) [10] at CERN. The main goal of the CMS experiment is to search for signals of new physics in proton–proton collisions at centre-of-mass energies from 7 to 14 TeV [11].

Cosmic rays were used extensively to commission the CMS detector [12,13]. These data can also be used to perform measurements of physical quantities related to cosmic ray muons. This Letter presents a measurement of the muon charge ratio using CMS data collected in two cosmic ray runs in the years 2006 and 2008. More details of the analyses can be found in [14,15].

2. Experimental setup, data samples, and event simulation

The central feature of the CMS apparatus is a superconducting solenoid, of 6 m internal diameter, providing a field of 3.8 T. Within the field volume are the silicon pixel and strip tracker [16], the crystal electromagnetic calorimeter and the brass-scintillator hadron calorimeter. Muons are measured in gas-ionization detectors embedded in the steel return yokes [17]. In the barrel there is a Drift Tube (DT) system interspersed with Resistive Plate Chambers (RPCs), and in the endcaps there is a Cathode Strip Chamber (CSC) system, also interspersed with RPCs. In addition to the barrel and endcap detectors, CMS has extensive forward calorimetry. A detailed description of CMS can be found in [9].

The CMS detector is installed in an underground cavern, with the center of the detector 89 m below Earth's surface, and 420 m above sea level. The location is $46^\circ\,18.57'$ north latitude and $6^\circ\,4.62'$ east longitude. The upper 50 m of the material above CMS consists of moraines, followed by 20 m of molasse rock. A large access shaft with a diameter of 20.5 m rises vertically to the surface, and is offset from the center of CMS by 14 m along the beam direction. It is covered by a movable concrete plate of 2.25 m

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Table 2
The muon charge ratio R from the combination of all three CMS analyses, as a function of p and $p\cos\theta_z$, in GeV/c, together with the combined statistical and systematic relative uncertainty, in %.

p range	$\langle p \rangle$	R	Uncertainty	$p\cos\theta_z$ range	$\langle p\cos\theta_z \rangle$	R	Uncertainty
5–10	7.0	1.250	2.45	2.5–10	5.3	1.274	0.99
10–20	13.7	1.277	0.85	10–20	13.6	1.251	1.26
20–30	24.2	1.276	1.34	20–30	24.1	1.262	1.88
30–50	37.8	1.279	1.10	30–50	37.7	1.292	1.27
50–70	58.5	1.275	0.54	50–70	58.4	1.267	0.71
70–100	82.5	1.275	0.68	70–100	82.4	1.289	0.70
100–200	134.0	1.292	0.52	100–200	133.1	1.292	0.72
200–400	265.8	1.308	1.29	200–400	264.0	1.330	1.99
> 400	698.0	1.321	3.98	> 400	654.0	1.378	6.04

ment [5] below 400 GeV/c, and with the UTAH [1], MINOS [6] and OPERA [8] measurements above 400 GeV/c. Measurements by other experiments in the range 5–20 GeV/c [2–5,31] are not shown in the plot; they are consistent with the constant value fitted in the CMS data.

Models of cosmic ray showers provide an explanation for the rise in charge ratio at higher momentum. Based on the quark content of protons, and on the observation that primary cosmic ray particles are mostly positive, the ratio π^+/π^- is predicted to be around 1.27 [32]. Due to the phenomena of associated production, the charge ratio of strange particles such as kaons is expected to be even higher.

The expected muon spectrum has been parametrized [33] based on the interactions of primary cosmic ray particles and on the decays of secondary particles, and from this parametrization, the charge ratio can be extracted [7] as a function of the fractions of all pion and kaon decays that yield positive muons, f_π and f_K, respectively. These constants are not known *a priori*, and must be inferred from data.

A fit performed to the combined CMS charge ratio measurement in the entire $p\cos\theta_z$ region, with a fixed relative amount of kaon production [33], yields $f_\pi = 0.553 \pm 0.005$, and $f_K = 0.66 \pm 0.06$, with a $\chi^2/\text{ndf} = 7.8/7$. Fig. 6(b) shows the fit to CMS data only, together with a fit performed on some previous measurements by L3 + C and MINOS [7].

8. Conclusions

We have measured the flux ratio of positive- to negative-charge cosmic ray muons, as a function of the muon momentum and its vertical component, using data collected by the CMS experiment in 2006 and 2008. The result is in agreement with previous measurements by underground experiments. This is the most precise measurement of the charge ratio in the momentum region below 0.5 TeV/c. It is also the first physics measurement using muons with the complete CMS detector.

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5.A.15. SEARCH FOR PHYSICS BEYOND THE STANDARD MODEL IN OPPOSITE-SIGN DILEPTON EVENTS IN PP COLLISIONS AT SQRT S 7 TEV

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Search for physics beyond the standard model in opposite-sign dilepton events in pp collisions at $\sqrt{s} = 7$ TeV

The CMS collaboration

Abstract: A search is presented for physics beyond the standard model (SM) in final states with opposite-sign isolated lepton pairs accompanied by hadronic jets and missing transverse energy. The search is performed using LHC data recorded with the CMS detector, corresponding to an integrated luminosity of 34 pb^{-1}. No evidence for an event yield beyond SM expectations is found. An upper limit on the non-SM contribution to the signal region is deduced from the results. This limit is interpreted in the context of the constrained minimal supersymmetric model. Additional information is provided to allow testing the exclusion of specific models of physics beyond the SM.

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shapes of various relevant kinematic distributions. In the absence of evidence for BSM physics, we have set upper limits on the non-SM contributions to the signal regions. The result was interpreted in the context of the CMSSM parameter space and the excluded region was found to exceed those set by previous searches at the Tevatron and LEP experiments. Information on the acceptance and efficiency of the search was also provided to allow testing the exclusion of specific models of BSM physics.

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5.A.16. Search for new physics with same-sign isolated dilepton events with jets and missing transverse energy at the LHC

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Search for new physics with same-sign isolated dilepton events with jets and missing transverse energy at the LHC

The CMS collaboration

Abstract: The results of searches for new physics in events with two same-sign isolated leptons, hadronic jets, and missing transverse energy in the final state are presented. The searches use an integrated luminosity of 35 pb^{-1} of pp collision data at a centre-of-mass energy of 7 TeV collected by the CMS experiment at the LHC. The observed numbers of events agree with the standard model predictions, and no evidence for new physics is found. To facilitate the interpretation of our data in a broader range of new physics scenarios, information on our event selection, detector response, and efficiencies is provided.

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5.A.17. SEARCH FOR PHYSICS BEYOND THE STANDARD MODEL IN EVENTS WITH A Z BOSON JETS AND MISSING TRANSVERSE ENERGY

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Search for physics beyond the standard model in events with a Z boson, jets, and missing transverse energy in pp collisions at $\sqrt{s} = 7$ TeV ☆

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ABSTRACT

A search is presented for physics beyond the standard model (BSM) in events with a Z boson, jets, and missing transverse energy (E_T^{miss}). This signature is motivated by BSM physics scenarios, including supersymmetry. The study is performed using a sample of proton–proton collision data collected at $\sqrt{s} = 7$ TeV with the CMS experiment at the LHC, corresponding to an integrated luminosity of 4.98 fb^{-1}. The contributions from the dominant standard model backgrounds are estimated from data using two complementary strategies, the jet-Z balance technique and a method based on modeling E_T^{miss} with data control samples. In the absence of evidence for BSM physics, we set limits on the non-standard-model contributions to event yields in the signal regions and interpret the results in the context of simplified model spectra. Additional information is provided to facilitate tests of other BSM physics models.

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1. Introduction

This Letter describes a search for physics beyond the standard model (BSM) in proton–proton collisions at a center-of-mass energy of 7 TeV. Results are reported from a data sample collected with the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC) at CERN corresponding to an integrated luminosity of 4.98 fb^{-1}. This search is part of a broad program of inclusive, signature-based searches for BSM physics at CMS, characterized by the number and type of objects in the final state. Since it is not known a priori how the BSM physics will be manifest, we perform searches in events containing jets and missing transverse energy (E_T^{miss}) [1–3], single isolated leptons [4], pairs of opposite-sign [5] and same-sign [6] isolated leptons, photons [7,8], etc. Here we search for evidence of BSM physics in final states containing a Z boson that decays to a pair of oppositely-charged isolated electrons or muons. Searches for BSM physics in events containing oppositely-charged leptons have also been performed by the ATLAS Collaboration [9–11].

This strategy offers two advantages with respect to other searches. First, the requirement of a leptonically-decaying Z boson significantly suppresses large standard model (SM) backgrounds including QCD multijet production, events containing Z bosons decaying to a pair of invisible neutrinos, and events containing leptonically-decaying W bosons, and hence provides a clean environment in which to search for BSM physics. Second, final states with Z bosons are predicted in many models of BSM physics, such as supersymmetry (SUSY) [12–16]. For example, the production of a Z boson in the decay $\tilde{\chi}_2^0 \to \tilde{\chi}_1^0$ Z, where $\tilde{\chi}_1^0$ ($\tilde{\chi}_2^0$) is the lightest (second lightest) neutralino, is a direct consequence of the gauge structure of SUSY, and can become a favored channel in regions of the SUSY parameter space where the neutralinos have a large Higgsino or neutral Wino component [17–19]. Our search is also motivated by the existence of cosmological cold dark matter [20], which could consist of weakly-interacting massive particles [21] such as the lightest SUSY neutralino in R-parity conserving SUSY models [22]. If produced in pp collisions, these particles would escape detection and yield events with large E_T^{miss}. Finally, we search for BSM physics in events containing hadronic jets. This is motivated by the fact that new, heavy, strongly-interacting particles predicted by many BSM scenarios may be produced with a large cross section and hence be observable in early LHC data, and such particles tend to decay to hadronic jets. These considerations lead us to our target signature consisting of a leptonically-decaying Z boson produced in association with jets and E_T^{miss}.

After selecting events with jets and a $Z \to \ell^+\ell^-$ ($\ell = e, \mu$) candidate, the dominant background consists of SM Z production accompanied by jets from initial-state radiation (Z + jets). The E_T^{miss} in Z + jets events arises primarily when jet energies are mismeasured. The Z + jets cross section is several orders of magnitude larger than our signal, and the artificial E_T^{miss} is not necessarily well reproduced in simulation. Therefore, the critical

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Table 6
Parameters of the JZB (top) and E_T^{miss} (bottom) response function. The parameter σ is the resolution, x_{thresh} is the JZB or E_T^{miss} value at the center of the efficiency curve, and $\varepsilon_{plateau}$ is the efficiency on the plateau.

Region	σ [GeV]	x_{thresh} [GeV]	$\varepsilon_{plateau}$
JZB > 50 GeV	30	55	0.99
JZB > 100 GeV	30	108	0.99
JZB > 150 GeV	32	156	0.99
JZB > 200 GeV	39	209	0.99
JZB > 250 GeV	45	261	0.98
$E_T^{miss} > 100$ GeV	29	103	1.00
$E_T^{miss} > 200$ GeV	38	214	0.99
$E_T^{miss} > 300$ GeV	40	321	0.98

have tested this efficiency model with the LM4 and LM8 benchmark models, and find that the efficiency from our model is consistent with the expectation from the full reconstruction to within about 15%.

9. Summary

We have performed a search for BSM physics in final states with a leptonically-decaying Z boson, jets, and missing transverse energy. Two complementary strategies are used to suppress the dominant Z + jets background and to estimate the remaining background from data control samples: the jet-Z balance method and the E_T^{miss} template method. Backgrounds from $t\bar{t}$ processes are estimated using opposite-flavor lepton pairs and dilepton invariant mass sidebands. We find no evidence for anomalous yields beyond standard model (SM) expectations and place upper limits on the non-SM contributions to the yields in the signal regions. The results are interpreted in the context of simplified model spectra. We also provide information on the detector response and efficiencies to allow tests of BSM models with Z bosons that are not considered in the present study.

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Appendix A. Supplementary material

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.physletb.2012.08.026.

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5.A.18. SEARCH FOR NEW PHYSICS WITH SAME-SIGN ISOLATED DI-LEPTON EVENTS WITH JETS AND MISSING TRANSVERSE ENERGY

Search for New Physics with Same-Sign Isolated Dilepton Events with Jets and Missing Transverse Energy

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(Received 30 May 2012; published 16 August 2012)

A search for new physics is performed in events with two same-sign isolated leptons, hadronic jets, and missing transverse energy in the final state. The analysis is based on a data sample corresponding to an integrated luminosity of 4.98 fb^{-1} produced in pp collisions at a center-of-mass energy of 7 TeV collected by the CMS experiment at the LHC. This constitutes a factor of 140 increase in integrated luminosity over previously published results. The observed yields agree with the standard model predictions and thus no evidence for new physics is found. The observations are used to set upper limits on possible new physics contributions and to constrain supersymmetric models. To facilitate the interpretation of the data in a broader range of new physics scenarios, information on the event selection, detector response, and efficiencies is provided.

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The standard model (SM) is a very successful theory of elementary particles and their interactions. It is generally believed that new physics (NP) could manifest itself at the TeV scale. Supersymmetry (SUSY) is one of these attractive possibilities. It leads to gauge coupling unification at very high energy, provides a mechanism to mitigate large radiative corrections to the Higgs mass and, in its R-parity-conserving [1] realization, can provide a dark matter candidate. A comprehensive program of searches for the production of supersymmetric particles has been underway since 2010 at the Large Hadron Collider (LHC). Since SUSY models vary widely, these searches target a broad range of possible final states, including purely hadronic states [2,3], leptonic states with one lepton [4,5], two leptons of the opposite sign [6,7], two leptons of the same sign [6,8], and three or more leptons [9], as well as photonic final states [10,11].

In this Letter we report on a search for NP based on isolated same-sign (SS) dileptons, missing transverse energy ($E_{\mathrm{T}}^{\mathrm{miss}}$), and hadronic jets. In SUSY SS dileptons can arise, for example, from pair production of colored superpartners (gluinos and/or squarks), with a lepton in the decay chain of each primary SUSY particle [12–14]; more generally, this signature is sensitive to final states with same-sign W bosons and/or top quarks [15–20]. The rarity of SS dileptons in the SM makes a NP search in this final state particularly attractive.

All types of charged leptons, e, μ, and hadronically decaying τs, are included in our search. These final states are indicators of the possible presence of SUSY particles as well as other possible NP scenarios. The results are based on a data sample corresponding to $4.98 \pm 0.11\ \mathrm{fb}^{-1}$ of pp collisions at a center-of-mass energy of 7 TeV collected in 2011 by the Compact Muon Solenoid (CMS) [21] experiment at the LHC. This study results in a major improvement in sensitivity with respect to the search performed with data collected in 2010 [8] because of the 140-fold increase in the integrated luminosity of the data sample. These results are interpreted using the constrained minimal supersymmetric extension of the standard model (CMSSM) [22]. In addition, this analysis provides information on the event selection and detector response in order to facilitate the application of our results to a broader range of NP scenarios.

A detailed description of the CMS detector is found elsewhere [21]. Its central feature is a superconducting solenoid providing an axial magnetic field of 3.8 T. Muons are measured in gas detectors embedded in the steel return yoke of the magnet, while all other particle detection systems are located inside the bore of the solenoid. Charged particle trajectories are measured by a silicon pixel and strip tracker system, covering $|\eta| < 2.5$, where the pseudorapidity is defined as $\eta = -\ln[\tan\theta/2]$, and θ is the polar angle with respect to the counterclockwise beam direction. A crystal electromagnetic calorimeter (ECAL) and a brass-scintillator hadronic calorimeter surround the tracker volume. In addition, the CMS detector has an extensive forward calorimeter and nearly hermetic 4π coverage. The CMS trigger consists of a two-stage system. The first level of the CMS trigger system, composed of custom hardware processors, uses information from the calorimeters and muon detectors to select a subset of the events. The high level trigger processor farm further decreases the event rate from around 100 kHz to around 300 Hz, before data storage.

*Full author list given at the end of the article.

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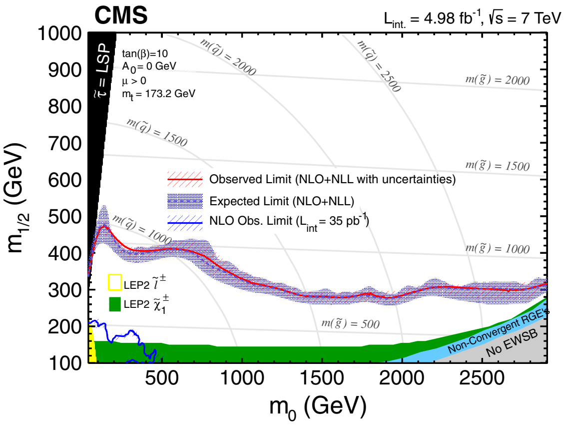

FIG. 3 (color online). Exclusion region, below the red curve, in the CMSSM corresponds to the observed upper limits on the number of events from NP. The central observed curve, which includes experimental uncertainties, is obtained using high p_T leptons with $H_T > 450$ GeV and $E_T^{miss} > 120$ GeV. The hatched region corresponds to the theoretical uncertainties on the cross section, whereas the shaded region shows the experimental errors with $\pm 1\sigma$ variation. We also show the result of the previous analysis [8] to illustrate the improvement.

123 GeV, 37 GeV), respectively. We tested the parameterized efficiency model in the CMSSM, and the results obtained agree at the 15% level with the full simulation results.

In summary, we conducted a search for physics beyond the standard model based on same-sign dileptons in the ee, $\mu\mu$, $e\mu$, $e\tau$, $\mu\tau$, and $\tau\tau$ final states, and find no evidence for an excess over the expected standard model background. We set 95% CL upper limits on contributions from new physics processes based on an integrated luminosity of 4.98 fb^{-1} in the range of 6.2 to 16.9 events, depending on the signal search region. These are the most restrictive limits in this particular final state to date. We have also shown the excluded region in the CMSSM parameter space.

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5.A.19. Search for new physics in events with same-sign dileptons and b-tagged jets in pp collisions at sqrt s 7 TeV

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Search for new physics in events with same-sign dileptons and b-tagged jets in pp collisions at $\sqrt{s} = 7$ TeV

The CMS collaboration

Abstract: A search for new physics is performed using isolated same-sign dileptons with at least two b-quark jets in the final state. Results are based on a $4.98\,\mathrm{fb}^{-1}$ sample of proton-proton collisions at a centre-of-mass energy of 7 TeV collected by the CMS detector. No excess above the standard model background is observed. Upper limits at 95% confidence level are set on the number of events from non-standard-model sources. These limits are used to set constraints on a number of new physics models. Information on acceptance and efficiencies are also provided so that the results can be used to confront additional models in an approximate way.

Keywords: Hadron-Hadron Scattering

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9 Conclusions

We have presented results of a search for same-sign dileptons with b jets using the CMS detector at the LHC based on a 4.98 fb^{-1} data sample of pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$. No significant deviations from the SM expectations are observed.

The data are used to set 95% CL upper limits on the number of new physics events for a number of plausible signal regions defined in terms of requirements in $E_{\mathrm{T}}^{\mathrm{miss}}$ and H_{T}, the number of b-tagged jets (2 or 3), and also the sign of the leptons (only positive dileptons or both positive and negative dileptons).

We use these results to set a limit $\sigma(\mathrm{pp} \to \mathrm{tt}) < 0.61\,\mathrm{pb}$ at 95% CL, and to put bounds on the parameter space of two models of same-sign top pair production. We also set limits on two models of gluino decay into on-shell or off-shell top squarks, a model of sbottom pair production, and a model of sbottom production from gluino decay. In addition, we provide information to interpret our limits in other models of new physics.

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5.A.20. Observation of a new boson with a mass of 125 GeV with the CMS experiment at the LHC

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Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC ☆

CMS Collaboration *

CERN, Switzerland

This paper is dedicated to the memory of our colleagues who worked on CMS but have since passed away. In recognition of their many contributions to the achievement of this observation.

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ABSTRACT

Results are presented from searches for the standard model Higgs boson in proton–proton collisions at $\sqrt{s} = 7$ and 8 TeV in the Compact Muon Solenoid experiment at the LHC, using data samples corresponding to integrated luminosities of up to 5.1 fb^{-1} at 7 TeV and 5.3 fb^{-1} at 8 TeV. The search is performed in five decay modes: $\gamma\gamma$, ZZ, W^+W^-, $\tau^+\tau^-$, and $b\bar{b}$. An excess of events is observed above the expected background, with a local significance of 5.0 standard deviations, at a mass near 125 GeV, signalling the production of a new particle. The expected significance for a standard model Higgs boson of that mass is 5.8 standard deviations. The excess is most significant in the two decay modes with the best mass resolution, $\gamma\gamma$ and ZZ; a fit to these signals gives a mass of $125.3 \pm 0.4(\text{stat.}) \pm 0.5(\text{syst.})$ GeV. The decay to two photons indicates that the new particle is a boson with spin different from one.

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1. Introduction

The standard model (SM) of elementary particles provides a remarkably accurate description of results from many accelerator and non-accelerator based experiments. The SM comprises quarks and leptons as the building blocks of matter, and describes their interactions through the exchange of force carriers: the photon for electromagnetic interactions, the W and Z bosons for weak interactions, and the gluons for strong interactions. The electromagnetic and weak interactions are unified in the electroweak theory. Although the predictions of the SM have been extensively confirmed, the question of how the W and Z gauge bosons acquire mass whilst the photon remains massless is still open.

Nearly fifty years ago it was proposed [1–6] that spontaneous symmetry breaking in gauge theories could be achieved through the introduction of a scalar field. Applying this mechanism to the electroweak theory [7–9] through a complex scalar doublet field leads to the generation of the W and Z masses, and to the prediction of the existence of the SM Higgs boson (H). The scalar field also gives mass to the fundamental fermions through the Yukawa interaction. The mass m_H of the SM Higgs boson is not predicted by theory. However, general considerations [10–13] suggest that m_H should be smaller than ∼1 TeV, while precision electroweak measurements imply that $m_H < 152$ GeV at 95% confidence level (CL) [14]. Over the past twenty years, direct searches for the Higgs boson have been carried out at the LEP collider, leading to a lower bound of $m_H > 114.4$ GeV at 95% CL [15], and at the Tevatron proton–antiproton collider, excluding the mass range 162–166 GeV at 95% CL [16] and detecting an excess of events, recently reported in [17–19], in the range 120–135 GeV.

The discovery or exclusion of the SM Higgs boson is one of the primary scientific goals of the Large Hadron Collider (LHC) [20]. Previous direct searches at the LHC were based on data from proton–proton collisions corresponding to an integrated luminosity of 5 fb^{-1} collected at a centre-of-mass energy $\sqrt{s} = 7$ TeV. The CMS experiment excluded at 95% CL a range of masses from 127 to 600 GeV [21]. The ATLAS experiment excluded at 95% CL the ranges 111.4–116.6, 119.4–122.1 and 129.2–541 GeV [22]. Within the remaining allowed mass region, an excess of events near 125 GeV was reported by both experiments. In 2012 the proton–proton centre-of-mass energy was increased to 8 TeV and by the end of June an additional integrated luminosity of more than 5 fb^{-1} had been recorded by each of these experiments, thereby enhancing significantly the sensitivity of the search for the Higgs boson.

This Letter reports the results of a search for the SM Higgs boson using samples collected by the CMS experiment, comprising data recorded at $\sqrt{s} = 7$ and 8 TeV. The search is performed in

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5.A.21. SEARCH FOR SUPERSYMMETRY IN HADRONIC FINAL STATES USING MT2 IN PP COLLISIONS AT 7 TEV

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Search for supersymmetry in hadronic final states using M_{T2} in pp collisions at $\sqrt{s} = 7$ TeV

The CMS collaboration

Abstract: A search for supersymmetry or other new physics resulting in similar final states is presented using a data sample of $4.73\,\mathrm{fb}^{-1}$ of pp collisions collected at $\sqrt{s} = 7$ TeV with the CMS detector at the LHC. Fully hadronic final states are selected based on the variable M_{T2}, an extension of the transverse mass in events with two invisible particles. Two complementary studies are performed. The first targets the region of parameter space with medium to high squark and gluino masses, in which the signal can be separated from the standard model backgrounds by a tight requirement on M_{T2}. The second is optimized to be sensitive to events with a light gluino and heavy squarks. In this case, the M_{T2} requirement is relaxed, but a higher jet multiplicity and at least one b-tagged jet are required. No significant excess of events over the standard model expectations is observed. Exclusion limits are derived for the parameter space of the constrained minimal supersymmetric extension of the standard model, as well as on a variety of simplified model spectra.

Keywords: Hadron-Hadron Scattering

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gluinos, in which the $E_{\mathrm{T}}^{\mathrm{miss}}$ tends to be smaller. Therefore, the restriction on M_{T2} is relaxed. The effect of the loosened M_{T2} is compensated by requiring at least one b-tagged jet and a larger jet multiplicity, to suppress the QCD multijet background. For both analyses, the standard model backgrounds, arising from QCD multijet, electroweak, and top-quark production processes, are obtained from data control samples and simulation. No excess beyond the standard model expectations is found. Exclusion limits are established in the CMSSM parameter space, as well as for some simplified model spectra. Conservatively, using the minus one standard deviation (-1σ) theory uncertainty values, absolute mass limits in the CMSSM scenario for $\tan\beta = 10$ are found to be $m(\widetilde{\mathrm{q}}) > 1110\,\mathrm{GeV}$ and $m(\widetilde{\mathrm{g}}) > 800\,\mathrm{GeV}$, and $m(\widetilde{\mathrm{q}}) = m(\widetilde{\mathrm{g}}) > 1180\,\mathrm{GeV}$ assuming equal squark and gluino masses.

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5.A.22. Performance of CMS Muon Reconstruction in pp Collision Events at sqrt s 7 TeV

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Performance of CMS muon reconstruction in pp collision events at $\sqrt{s} = 7\,\text{TeV}$

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ABSTRACT: The performance of muon reconstruction, identification, and triggering in CMS has been studied using $40\,\text{pb}^{-1}$ of data collected in pp collisions at $\sqrt{s}$ = 7 TeV at the LHC in 2010. A few benchmark sets of selection criteria covering a wide range of physics analysis needs have been examined. For all considered selections, the efficiency to reconstruct and identify a muon with a transverse momentum p_T larger than a few GeV/c is above 95% over the whole region of pseudorapidity covered by the CMS muon system, $|\eta| < 2.4$, while the probability to misidentify a hadron as a muon is well below 1%. The efficiency to trigger on single muons with p_T above a few GeV/c is higher than 90% over the full η range, and typically substantially better. The overall momentum scale is measured to a precision of 0.2% with muons from Z decays. The transverse momentum resolution varies from 1% to 6% depending on pseudorapidity for muons with p_T below 100 GeV/c and, using cosmic rays, it is shown to be better than 10% in the central region up to p_T = 1 TeV/c. Observed distributions of all quantities are well reproduced by the Monte Carlo simulation.

KEYWORDS: Performance of High Energy Physics Detectors; Large detector-systems performance; Simulation methods and programs; Particle identification methods; Muon spectrometers; Particle tracking detectors; Particle tracking detectors (Gaseous detectors)

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Algorithms to identify cosmic and beam-halo backgrounds among collision events were developed and successfully used in physics analyses of 2010 data. The performance of various muon isolation algorithms was shown to be reasonably well modelled by the simulation.

The muon trigger efficiency for isolated muons is better than 90% over the full η range, and is typically substantially better.

In this document we have shown that the performance specifications set out for the measurement of muons in CMS have largely been met. The good performance and detailed understanding of the muon reconstruction, identification, and triggering provides the necessary confidence in all elements of the chain from muon detection to muon analysis, which is essential for searches for physics beyond the Standard Model as well as accurate Standard Model measurements.

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5.A.23. SEARCH FOR NEW PHYSICS IN EVENTS WITH OPPOSITE-SIGN LEPTONS JETS AND MISSING TRANSVERSE ENERGY in pp collisions at sqrt s 7 TeV

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Search for new physics in events with opposite-sign leptons, jets, and missing transverse energy in pp collisions at $\sqrt{s} = 7$ TeV

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ABSTRACT

A search is presented for physics beyond the standard model (BSM) in final states with a pair of opposite-sign isolated leptons accompanied by jets and missing transverse energy. The search uses LHC data recorded at a center-of-mass energy $\sqrt{s} = 7$ TeV with the CMS detector, corresponding to an integrated luminosity of approximately 5 fb^{-1}. Two complementary search strategies are employed. The first probes models with a specific dilepton production mechanism that leads to a characteristic kinematic edge in the dilepton mass distribution. The second strategy probes models of dilepton production with heavy, colored objects that decay to final states including invisible particles, leading to very large hadronic activity and missing transverse energy. No evidence for an event yield in excess of the standard model expectations is found. Upper limits on the BSM contributions to the signal regions are deduced from the results, which are used to exclude a region of the parameter space of the constrained minimal supersymmetric extension of the standard model. Additional information related to detector efficiencies and response is provided to allow testing specific models of BSM physics not considered in this Letter.

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1. Introduction

In this Letter we describe a search for physics beyond the standard model (BSM) in events containing a pair of opposite-sign leptons, jets, and missing transverse energy ($E_{\mathrm{T}}^{\mathrm{miss}}$), in a sample of proton–proton collisions at a center-of-mass energy of 7 TeV. The data sample was collected with the Compact Muon Solenoid (CMS) detector [1] at the Large Hadron Collider (LHC) in 2011 and corresponds to an integrated luminosity of 4.98 fb^{-1}. This is an update and extension of a previous analysis performed with a data sample of 34 pb^{-1} collected in 2010 [2].

The BSM signature in this search is motivated by three general considerations. First, new particles predicted by BSM physics scenarios are expected to be heavy in most cases, since they have so far eluded detection. Second, BSM physics signals may be produced with large cross section via the strong interaction, resulting in significant hadronic activity. Third, astrophysical evidence for dark matter suggests [3–6] that the mass of weakly-interacting massive particles is of the order of the electroweak symmetry breaking scale. Such particles, if produced in proton–proton collisions, could escape detection and give rise to an apparent imbalance in the event transverse energy. The analysis therefore focuses on the region of high $E_{\mathrm{T}}^{\mathrm{miss}}$. An example of a specific BSM scenario is provided by R-parity conserving supersymmetric (SUSY) models, in which the colored squarks and gluinos are pair-produced and subsequently undergo cascade decays, producing jets and leptons [7,8]. These cascade decays may terminate in the production of the lightest SUSY particle (LSP), often the lightest neutralino, which escapes detection and results in large $E_{\mathrm{T}}^{\mathrm{miss}}$. This LSP is a candidate for a dark matter weakly-interacting massive particle. Another BSM scenario which may lead to similar signatures is the model of universal extra dimensions (UED) [9].

The results reported in this Letter are part of a broad program of BSM searches in events with jets and $E_{\mathrm{T}}^{\mathrm{miss}}$, classified by the number and type of leptons in the final state. Here we describe a search for events containing an opposite-sign isolated lepton pair in addition to jets and $E_{\mathrm{T}}^{\mathrm{miss}}$. We reconstruct electrons and muons, which provide a clean signature with low background. In addition, we reconstruct τ leptons in their hadronic decay modes to improve the sensitivity to models with enhanced coupling to third generation particles. Complementary CMS searches with different final states have already been reported, for example in Refs. [10,11]. Results from the ATLAS Collaboration in this final state using approximately 1–2 fb^{-1} have been reported in Refs. [12,13].

The analysis strategy is as follows. In order to select dilepton events, we use a preselection based on that of the CMS top quark pair ($\mathrm{t\bar{t}}$) cross section measurement in the dilepton channel [14]; the details of this preselection are presented in Section 3. Reasonable agreement is found between the observed yields in data and the predictions from standard model (SM) Monte Carlo

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5.A.24. A new boson with a mass of 125 GeV observed with the CMS Experiment at the Large Hadron Collider

ARTICLE

A New Boson with a Mass of 125 GeV Observed with the CMS Experiment at the Large Hadron Collider

The CMS Collaboration*†

The Higgs boson was postulated nearly five decades ago within the framework of the standard model of particle physics and has been the subject of numerous searches at accelerators around the world. Its discovery would verify the existence of a complex scalar field thought to give mass to three of the carriers of the electroweak force—the W^+, W^-, and Z^0 bosons—as well as to the fundamental quarks and leptons. The CMS Collaboration has observed, with a statistical significance of five standard deviations, a new particle produced in proton-proton collisions at the Large Hadron Collider at CERN. The evidence is strongest in the diphoton and four-lepton (electrons and/or muons) final states, which provide the best mass resolution in the CMS detector. The probability of the observed signal being due to a random fluctuation of the background is about 1 in 3×10^6. The new particle is a boson with spin not equal to 1 and has a mass of about 125 giga–electron volts. Although its measured properties are, within the uncertainties of the present data, consistent with those expected of the Higgs boson, more data are needed to elucidate the precise nature of the new particle.

The standard model (SM) of particle physics (*1*–*3*) describes the fundamental particles, quarks and leptons, and the forces that govern their interactions. Within the SM, the photon is massless, whereas the masses of the other carriers of the electroweak force, the $W^\pm$ and Z^0 gauge bosons, are generated through a symmetry-breaking mechanism proposed by three groups of physicists (Englert and Brout; Higgs; and Guralnik, Hagen, and Kibble) (*4*–*9*). This mechanism introduces a complex scalar field, leading to the prediction of a scalar particle: the SM Higgs boson. In contrast, all known elementary bosons are vector particles with spin 1. In the SM, the scalar field also gives mass to the fundamental fermions through a Yukawa interaction (*1*–*3*). The Higgs boson is predicted to decay almost instantly to lighter particles.

The theory does not predict a specific mass for the Higgs boson. Moreover, the properties of the Higgs boson depend strongly on its mass. General arguments indicate that its mass should be less than about 1 TeV (*10*–*13*), although searches for the SM Higgs boson conducted before those at the Large Hadron Collider (LHC) have excluded the mass region below 114.4 GeV (*14*). Searches at the Tevatron have excluded a narrow mass region near 160 GeV (*15*) and recently reported an excess of events in the range from 120 to 135 GeV (*16*–*18*).

The LHC is installed in a circular tunnel 27 km in circumference and 100 m underground, straddling the border between France and Switzerland, near Geneva (*19*). The LHC accelerates clockwise and counterclockwise beams of protons before colliding them head on. These collisions were at a total center-of-mass energy of 7 TeV in 2011 and 8 TeV in 2012, the highest energies reached to date in a particle accelerator. These high-energy collisions enable the production of new, and sometimes very heavy, particles by converting energy into mass in accordance with Einstein's well-known formula $E = mc^2$. The LHC can produce all known particles, including the top quark, which, with a mass of about 173 GeV, is the heaviest known elementary particle. It was predicted that the SM Higgs boson could also be produced at the LHC if it has a mass less than about 1 TeV.

The SM predicts the cross section for the production of Higgs bosons in proton-proton collisions as a function of its mass. The cross section increases with the center-of-mass energy of the collision and decreases with increasing Higgs mass. Despite the high collision energy, the predicted probability of Higgs boson production is extremely small, about 10^{-10} per collision. Thus, to detect a significant number of Higgs bosons a huge number of collisions must be analyzed, which requires very high luminosity. The maximum instantaneous luminosity achieved so far is 7.6×10^{33} cm^{-2} s^{-1}, close to the LHC peak design value that was not expected to be attained until 2015. This was achieved by having 1368 bunches of protons in each beam, spaced 50 ns apart (corresponding to a separation of about 16 m), with each bunch containing about 1.5×10^{11} protons squeezed to a transverse size of about 20 μm at the interaction point. Each bunch crossing yields more than 20 proton-proton collisions on average. The multiple collisions per bunch crossing, known as pileup, are initially registered as a single collision event by the detectors. Resolving the individual collisions within these events is an important challenge for the detectors at the LHC.

The Compact Muon Solenoid (CMS) detector surrounds one of the LHC's interaction points. Heavy particles, such as SM Higgs bosons, created in LHC collisions will typically be unstable and thus rapidly decay into lighter, more stable particles, such as electrons, muons, photons, and hadronic jets (clusters of hadrons travelling in a similar direction). These long-lived particles are what CMS detects and identifies, measuring their energies and momenta with high precision in order to infer the presence of the heavy particles produced in the collisions. Because the CMS detector is nearly hermetic, it also allows for the reconstruction of momentum imbalance in the plane transverse to the beams, which is an important signature for the presence of a neutrino (or a new, electrically neutral, weakly interacting particle) in the collision.

We report the observation of a new particle that has properties consistent with those of the SM Higgs boson. This paper provides an overview of the experiment and results that are described in greater detail in (*20*). The study examines five SM Higgs boson decay modes. Three modes result in pairs of bosons (γγ, ZZ, or W^+W^-), and two modes yield pairs of fermions ($b\bar{b}$ or $\tau^+\tau^-$), where γ denotes a photon, Z and W denote the force carriers of the weak interaction, b denotes a bottom quark (and $\bar{b}$ its antiquark), and τ denotes a tau lepton. In the following, we omit the particle charges and use b to refer to both the quark and antiquark. The unstable W, Z, b, and τ particles decay to final states containing electrons, muons, neutrinos, and hadronic jets, all of which can be detected (directly or, in the case of neutrinos, indirectly) and measured with the CMS detector. An independent observation was made by the ATLAS collaboration (*21*, *22*), which further strengthens our interpretation.

Overview of the CMS detector. The CMS detector measures particles produced in high-energy proton-proton and heavy-ion collisions (*23*). The central feature of the detector is a superconducting solenoid 13 m long, with an internal diameter of 6 m. Within its volume it generates a uniform 3.8-T magnetic field along the axis of the LHC beams. Within the field volume are a silicon pixel and strip tracker, a lead tungstate ($PbWO_4$) scintillating crystal electromagnetic calorimeter, and a brass/scintillator hadron calorimeter (HCAL). Muons are identified and measured in gas-ionization detectors embedded in the outer steel magnetic-flux-return yoke. The detector is subdivided into a cylindrical barrel part and endcap disks on each side of the

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This probability corresponds to a local significance of 5σ. The probability of observing this large a fluctuation anywhere in the mass range of 114 to 130 GeV, where the Higgs boson had not been excluded by previous data, is small and results in a global significance of 4.6σ. The global significance is smaller than the local value because of the look-elsewhere effect. Both measures convincingly show that this is not a background fluctuation, but rather the observation of a new particle. The expected sensitivity with the present data for a 125 GeV SM Higgs boson amounts to a local significance of $5.8 \pm 1.0\sigma$, consistent with the signal observed at 5σ.

In addition to being able to say with high confidence that a new particle has been observed, and that it is a boson with spin not equal to one, we were also able to derive some of its properties, such as its mass. And, as mentioned above, once the mass is known the SM allows us to calculate many other properties, such as the fractions of Higgs bosons decaying in different ways, and compare these expectations with our measurements. This is expressed as the signal strength, that is, the measured production rate of the signal, which can be determined for each decay mode individually and for the overall combination of all channels, normalized to the predicted Higgs boson production rate. The signal strength was defined to be equal to one for the SM Higgs boson. The measured signal strength was highest in the diphoton channel, namely 1.6 ± 0.4, whereas that in the ZZ channel was $0.7^{+0.4}_{-0.3}$. By using the high-resolution diphoton and ZZ channels discussed above, which show a resonance peak, we obtained the 68% confidence level (CL) contours for the signal strength versus the boson mass (Fig. 7 left). We also show the combination of the diphoton and ZZ decay modes, where the relative signal strengths of these two modes are constrained by the expectations for the SM Higgs boson. To extract the value of the mass in a model-independent way, we allowed the signal yields of the combined channels to vary independently. The combined best-fit mass is 125.3 ± 0.4 (statistical) $\pm$ 0.5 (systematic) GeV.

The signal strengths for all five channels are depicted in Fig. 7 (right). The overall combined signal strength, including all channels, is 0.87 ± 0.23. Hence, these results are consistent, within relatively large statistical and systematic uncertainties, with the expectations for the SM Higgs boson.

The CMS data also rule out the existence of the SM Higgs boson in the ranges of 114.4 to 121.5 GeV and 128 to 600 GeV at 95% CL (*20*). Lower masses were already excluded by CERN's Large Electron Positron collider at the same CL (*14*).

More data are needed to establish whether this new particle has all the properties of the SM Higgs boson or whether some do not match. The latter may imply new physics beyond the SM. This particle has the potential to be a portal to a new landscape of physical phenomena that is still hidden from us. The CMS experiment is in an excellent position to undertake this research in the years to come.

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Supplementary Materials

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5.A.25. Search for Supersymmetry in Events with Opposite-Sign Dileptons and Missing Transverse Energy Using an Artificial Neural Network

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Search for supersymmetry in events with opposite-sign dileptons and missing transverse energy using an artificial neural network

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In this paper, a search for supersymmetry (SUSY) is presented in events with two opposite-sign isolated leptons in the final state, accompanied by hadronic jets and missing transverse energy. An artificial neural network is employed to discriminate possible SUSY signals from a standard model background. The analysis uses a data sample collected with the CMS detector during the 2011 LHC run, corresponding to an integrated luminosity of 4.98 fb^{-1} of proton-proton collisions at the center-of-mass energy of 7 TeV. Compared to other CMS analyses, this one uses relaxed criteria on missing transverse energy ($\not{E}_{\mathrm{T}} > 40$ GeV) and total hadronic transverse energy ($H_{\mathrm{T}} > 120$ GeV), thus probing different regions of parameter space. Agreement is found between standard model expectation and observations, yielding limits in the context of the constrained minimal supersymmetric standard model and on a set of simplified models.

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I. INTRODUCTION

One of the most natural extensions of the standard model (SM) of particle physics is supersymmetry (SUSY) [1–8]. Supersymmetry allows for gauge coupling unification at the energy of 10^{16} GeV, provides a good dark matter candidate [lightest supersymmetric particle (LSP)] [9], is a necessary component to explain quantum gravity in the framework of string theory, and automatically cancels the quadratic divergences in radiative corrections to the Higgs boson mass. For every particle in the standard model, SUSY introduces a superpartner, the "sparticle," with spin differing by $1/2$ unit from the SM particle. There are theoretical arguments that suggest sparticle masses could be less than $\sim$1 TeV [7,8] making the experiments at the Large Hadron Collider (LHC) an ideal place for their discovery.

With the successful 2011 LHC run, an integrated luminosity of 4.98 fb^{-1} in collisions at 7 TeV center-of-mass energy has been collected with the Compact Muon Solenoid (CMS) experiment. This data set is used to search for the presence of SUSY particles in events with two opposite-sign leptons (electrons and muons) in the final state, utilizing an artificial neural network (ANN). Two opposite-sign leptons can be produced in a SUSY cascade through the decay of neutralinos and charginos. Assuming that R parity is conserved [10], a stable, weakly interacting LSP exists, resulting in a missing transverse energy ($\not{E}_{\mathrm{T}}$) signature. The amount of missing transverse energy depends on the mass splittings among the heavier sparticles. So far, typical dilepton SUSY searches in CMS have required several jets with large transverse momentum, which correspond to large values of H_{T}, the scalar sum over the transverse momenta of all jets satisfying the jet selection, and large missing transverse energy to discriminate a SUSY signal from the very large SM backgrounds. Compared with previous CMS searches [11,12], this analysis uses relaxed criteria on missing transverse energy ($\not{E}_{\mathrm{T}} > 40$ GeV) and H_{T} ($H_{\mathrm{T}} > 120$ GeV). For SUSY models that yield events with large $\not{E}_{\mathrm{T}}$, the ANN's performance is comparable to the data analyses using large $\not{E}_{\mathrm{T}}$ and H_{T}. Hence, for such models the additional power of a multivariate technique is not required to discriminate between new physics and the SM backgrounds. However, for SUSY models that yield low-$\not{E}_{\mathrm{T}}$ or low-H_{T} signatures, the discriminating power of the ANN helps to suppress the large SM backgrounds.

The results are interpreted in the context of the constrained minimal supersymmetric standard model (CMSSM [13,14]), and a class of simplified model scenarios (SMS) [15,16]. For illustration purposes, the benchmark CMSSM point LM6 ($m_0 = 85$ GeV, $m_{1/2} = 400$ GeV, $\tan\beta = 10$, $A_0 = 0$ GeV) is used throughout the paper. In the class of SMS considered, gluinos are pair produced, with one of them decaying as $\tilde{g} \to \tilde{\chi}_2^0 jj \to \tilde{\chi}_1^0 \ell^+ \ell^- jj$ and the other as $\tilde{g} \to \tilde{\chi}_2^0 jj$. Here $\tilde{\chi}_2^0$ is the second-lightest neutralino, $\tilde{\chi}_1^0$ is the lightest neutralino, and the LSP, and $\ell = e$, μ, or τ with equal probability. This SMS thus always leads to a pair of opposite-sign leptons in the final state, in addition to the jets and $\not{E}_{\mathrm{T}}$. The SMS is fully described by the following parameters: the masses of the gluino ($m_{\tilde{g}}$), and the LSP (m_{LSP}), along with the neutralino mass in the gluino decay which is set to $m_{\tilde{\chi}_2^0} = (m_{\tilde{g}} + m_{\mathrm{LSP}})/2$.

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5.A.26. INTERPRETATION OF SEARCHES FOR SUPERSYMMETRY WITH SIMPLIFIED MODELS

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Interpretation of searches for supersymmetry with simplified models

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The results of searches for supersymmetry by the CMS experiment are interpreted in the framework of simplified models. The results are based on data corresponding to an integrated luminosity of 4.73 to 4.98 fb^{-1}. The data were collected at the LHC in proton–proton collisions at a center-of-mass energy of 7 TeV. This paper describes the method of interpretation and provides upper limits on the product of the production cross section and branching fraction as a function of new particle masses for a number of simplified models. These limits and the corresponding experimental acceptance calculations can be used to constrain other theoretical models and to compare different supersymmetry-inspired analyses.

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I. INTRODUCTION

The results of searches for supersymmetry (SUSY) [1] at particle colliders are often used to test the validity of a few, specific, theoretical models. These models predict a large number of experimental observables at hadron colliders as a function of a few theoretical parameters. Most of the SUSY analyses performed by the Compact Muon Solenoid (CMS) experiment present their results as an exclusion of a range of parameters for the constrained minimal supersymmetric standard model (CMSSM) [2–4]. However, the results of the SUSY analyses can be used to test a wide range of alternative models, since many SUSY and non-SUSY models predict a similar phenomenology. These similarities inspired the formulation of the simplified model framework for presenting experimental results [5–9]. Specific applications of these ideas have appeared in Refs. [10,11].

A simplified model is defined by a set of hypothetical particles and a sequence of their production and decay. For each simplified model, values for the product of the experimental acceptance and efficiency ($\mathcal{A} \times \epsilon$) are calculated to translate a number of signal events into a signal cross section. From this information, a 95% confidence level upper limit (UL) on the product of the cross section and branching fraction ($[\sigma \times \mathcal{B}]_{\mathrm{UL}}$) is derived as a function of particle masses. The simplified model framework can quantify the dependence of an experimental limit on the particle spectrum or a particular sequence of particle production and decay in a manner that is more general than the CMSSM. Furthermore, the values of $[\sigma \times \mathcal{B}]_{\mathrm{UL}}$ can be compared with theoretical predictions from a SUSY or non-SUSY model to determine whether the theory is compatible with data.

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This paper collects and describes simplified model interpretations of a large number of SUSY-inspired analyses performed on data collected by the CMS Collaboration in 2011 [12–26]. The simplified model framework was also applied by CMS to a limited number of analyses in 2010 [27]. The ATLAS Collaboration has published similar interpretations [28–34].

The paper is organized as follows. Section II provides a brief description of the CMS analyses considered here; Sec. III describes simplified models; Sec. IV demonstrates the calculation of the product of the experimental acceptance and efficiency and the upper limits on cross sections; Sec. V contains comparisons of the results for different simplified models and analyses; Sec. VI contains a summary.

II. THE CMS DETECTOR AND ANALYSES

The CMS detector consists of a silicon tracker, an electromagnetic calorimeter, and a hadronic calorimeter, all located within the field volume of a central solenoid magnet, and a muon-detection system located outside the magnet [35]. Information from these components is combined to define objects such as electrons, muons, photons, jets, jets identified as b jets (b-tagged jets), and missing transverse energy ($E\!\!\!/_{\mathrm{T}}$). The exact definition of these objects depends on the specific analysis, and can be found in the analysis references. The data were collected by the CMS experiment at the Large Hadron Collider in proton–proton collisions at a center-of-mass energy of 7 TeV. Unless stated otherwise, the data corresponds to an integrated luminosity of $4.98 \pm 0.11\ \mathrm{fb}^{-1}$ [36].

The descriptions of the analyses are categorized by the main features of the event selection. Detailed descriptions of these analyses can be found in Refs. [12–26]. The target of these analyses is a signal of the production of new, heavy particles that decay into standard model particles and stable, neutral particles that escape detection. The stable, neutral particles can produce a signature of large $E\!\!\!/_{\mathrm{T}}$. The standard model also produces $E\!\!\!/_{\mathrm{T}}$ in top quark, weak gauge

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light-flavor quark and a neutralino, a squark mass of approximately 800 GeV is excluded for a neutralino of mass 50 GeV, corresponding to an upper limit on the squark-antisquark production cross section of approximately 10 fb. The excluded mass for a single bottom-antibottom squark pair is 550 GeV. The comparable exclusion in mass for a single top-antitop squark pair is approximately 150 GeV lower. In the case of the electroweak production of a chargino-neutralino pair, the upper limit on the cross section is approximately 1 order of magnitude higher than the corresponding limit for gluino pair production at the same mass.

The predictions for experimental acceptance and exclusion limits on cross sections presented here for a range of simplified models and mass parameters can be used to constrain other theoretical models and compare different analyses.

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5.A.27. Search for new physics in events with same-sign dileptons and jets in pp collisions at sqrt s 8 TeV

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Search for new physics in events with same-sign dileptons and jets in pp collisions at $\sqrt{s} = 8$ TeV

The CMS collaboration

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Abstract: A search for new physics is performed based on events with jets and a pair of isolated, same-sign leptons. The results are obtained using a sample of proton-proton collision data collected by the CMS experiment at a centre-of-mass energy of 8 TeV at the LHC, corresponding to an integrated luminosity of $19.5\,\mathrm{fb}^{-1}$. In order to be sensitive to a wide variety of possible signals beyond the standard model, multiple search regions defined by the missing transverse energy, the hadronic energy, the number of jets and b-quark jets, and the transverse momenta of the leptons in the events are considered. No excess above the standard model background expectation is observed and constraints are set on a number of models for new physics, as well as on the same-sign top-quark pair and quadruple-top-quark production cross sections. Information on event selection efficiencies is also provided, so that the results can be used to confront an even broader class of new physics models.

Keywords: Supersymmetry, Hadron-Hadron Scattering

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5.A.28. Search for Physics Beyond the Standard Model in Events with Two Leptons Jets and Missing Transverse Momentum in pp Collisions at sqrt s 8 TeV

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Search for physics beyond the standard model in events with two leptons, jets, and missing transverse momentum in pp collisions at $\sqrt{s} = 8$ TeV

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The CMS collaboration

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Abstract: A search is presented for physics beyond the standard model in final states with two opposite-sign same-flavor leptons, jets, and missing transverse momentum. The data sample corresponds to an integrated luminosity of 19.4 fb^{-1} of proton-proton collisions at $\sqrt{s} = 8$ TeV collected with the CMS detector at the CERN LHC in 2012. The analysis focuses on searches for a kinematic edge in the invariant mass distribution of the opposite-sign same-flavor lepton pair and for final states with an on-shell Z boson. The observations are consistent with expectations from standard model processes and are interpreted in terms of upper limits on the production of supersymmetric particles.

Keywords: Supersymmetry, Hadron-Hadron Scattering

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5.A.29. Searches for Supersymmetry using the MT2 Variable in Hadronic Events Produced in pp Collisions at 8 TeV

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Searches for supersymmetry using the M_{T2} variable in hadronic events produced in pp collisions at 8 TeV

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Abstract: Searches for supersymmetry (SUSY) are performed using a sample of hadronic events produced in 8 TeV pp collisions at the CERN LHC. The searches are based on the M_{T2} variable, which is a measure of the transverse momentum imbalance in an event. The data were collected with the CMS detector and correspond to an integrated luminosity of 19.5 fb^{-1}. Two related searches are performed. The first is an inclusive search based on signal regions defined by the value of the M_{T2} variable, the hadronic energy in the event, the jet multiplicity, and the number of jets identified as originating from bottom quarks. The second is a search for a mass peak corresponding to a Higgs boson decaying to a bottom quark-antiquark pair, where the Higgs boson is produced as a decay product of a SUSY particle. For both searches, the principal backgrounds are evaluated with data control samples. No significant excess over the expected number of background events is observed, and exclusion limits on various SUSY models are derived.

Keywords: Supersymmetry, Hadron-Hadron Scattering

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Simplified model	Limit on parent particle mass at $m_{\tilde{\chi}_1^0} = 0$	Best limit on LSP mass	Limit on mass splitting
Direct squark production			
Single light squark	$m_{\tilde{q}} > 520\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 120\,\mathrm{GeV}$	$\Delta m(\tilde{q}, \tilde{\chi}_1^0) < 200\,\mathrm{GeV}$
8 degenerate light squarks	$m_{\tilde{q}} > 875\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 325\,\mathrm{GeV}$	$\Delta m(\tilde{q}, \tilde{\chi}_1^0) < 50\,\mathrm{GeV}$
Bottom squark	$m_{\tilde{b}} > 640\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 275\,\mathrm{GeV}$	$\Delta m(\tilde{b}, \tilde{\chi}_1^0) < 10\,\mathrm{GeV}$
Top squark			
$m_{\tilde{t}} > m_t + m_{\tilde{\chi}_1^0}$	$m_{\tilde{t}} > 450\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 60\,\mathrm{GeV}$	$\Delta m(\tilde{t}, \tilde{\chi}_1^0) < 230\,\mathrm{GeV}$
$m_{\tilde{t}} < m_t + m_{\tilde{\chi}_1^0}$	$m_{\tilde{t}} > 175\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 60\,\mathrm{GeV}$	$\Delta m(\tilde{t}, \tilde{\chi}_1^0) < 90\,\mathrm{GeV}$
Direct gluino production			
$\tilde{g} \to q\bar{q}\tilde{\chi}_1^0$	$m_{\tilde{g}} > 1225\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 510\,\mathrm{GeV}$	$\Delta m(\tilde{g}, \tilde{\chi}_1^0) < 25\,\mathrm{GeV}$
$\tilde{g} \to b\bar{b}\tilde{\chi}_1^0$	$m_{\tilde{g}} > 1300\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 740\,\mathrm{GeV}$	$\Delta m(\tilde{g}, \tilde{\chi}_1^0) < 50\,\mathrm{GeV}$
$\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$	$m_{\tilde{g}} > 1225\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 450\,\mathrm{GeV}$	$\Delta m(\tilde{g}, \tilde{\chi}_1^0) < 225\,\mathrm{GeV}$
$\tilde{g}_1 \to q\bar{q}\tilde{\chi}_2^0$, $\tilde{\chi}_2^0 \to h\tilde{\chi}_1^0$, $\tilde{g}_2 \to qq'\tilde{\chi}_1^{\pm}$, $\chi_1^{\pm} \to W^{\pm}\tilde{\chi}_1^0$	$m_{\tilde{g}} > 825\,\mathrm{GeV}$	$m_{\tilde{\chi}_1^0} > 410\,\mathrm{GeV}$	$\Delta m(\tilde{g}, \tilde{\chi}_1^0) < 225\,\mathrm{GeV}$
cMSSM/mSUGRA model	Mass limit for $m_{\tilde{q}} = m_{\tilde{g}}$	Gluino mass limit	Squark mass limit
	$m_{\tilde{g},\tilde{q}} > 1550\,\mathrm{GeV}$	$m_{\tilde{g}} > 1150\,\mathrm{GeV}$	$m_{\tilde{q}} > 1450\,\mathrm{GeV}$

Table 5. Summary of observed mass limits (at 95% CL) for different SUSY simplified models and for the cMSSM/mSUGRA model. The limits quoted are the observed limits using the signal cross section minus one standard deviation (σ_{theory}) of its uncertainty. For the simplified models, the limit on the mass of the parent particle is quoted for $m_{\tilde{\chi}_1^0} = 0$, while for the LSP the best limit on its mass is quoted. The best limit on the mass splitting between the parent particle mass and the LSP mass is also given. Finally, the absolute limits on the squark and gluino masses are quoted for the cMSSM/mSUGRA model.

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5.A.30. Search for supersymmetry in the multijet and missing transverse momentum final state in pp collisions at 13 TeV

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Search for supersymmetry in the multijet and missing transverse momentum final state in pp collisions at 13 TeV

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ABSTRACT

A search for new physics is performed based on all-hadronic events with large missing transverse momentum produced in proton–proton collisions at $\sqrt{s} = 13$ TeV. The data sample, corresponding to an integrated luminosity of 2.3 fb^{-1}, was collected with the CMS detector at the CERN LHC in 2015. The data are examined in search regions of jet multiplicity, tagged bottom quark jet multiplicity, missing transverse momentum, and the scalar sum of jet transverse momenta. The observed numbers of events in all search regions are found to be consistent with the expectations from standard model processes. Exclusion limits are presented for simplified supersymmetric models of gluino pair production. Depending on the assumed gluino decay mechanism, and for a massless, weakly interacting, lightest neutralino, lower limits on the gluino mass from 1440 to 1600 GeV are obtained, significantly extending previous limits.

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1. Introduction

The standard model (SM) of particle physics successfully describes a wide range of phenomena. However, in the SM, the Higgs boson mass is unstable to higher-order corrections, suggesting that the SM is incomplete. Many extensions to the SM have been proposed to provide a more fundamental theory. Supersymmetry (SUSY) [1–8], one such extension, postulates that each SM particle is paired with a SUSY partner from which it differs in spin by one-half unit. As examples, squarks and gluinos are the SUSY partners of quarks and gluons, respectively, while neutralinos $\widetilde{\chi}^0$ (charginos $\widetilde{\chi}^{\pm}$) arise from a mixture of the SUSY partners of neutral (charged) Higgs and electroweak gauge bosons. Radiative corrections involving SUSY particles can compensate the contributions from SM particles and thereby stabilize the Higgs boson mass. For this cancellation to be "natural" [9–12], the top squark, bottom squark, and gluino must have masses on the order of a few TeV or less, possibly allowing them to be produced at the CERN LHC.

Amongst SUSY processes, gluino pair production, typically yielding four or more hadronic jets in the final state, has the largest potential cross section, making it an apt channel for early SUSY searches in the recently started LHC Run 2. Furthermore, in R-parity [13] conserving SUSY models, as are considered here, the lightest SUSY particle (LSP) is stable and assumed to be weakly interacting, leading to potentially large undetected, or "missing", transverse momentum. Supersymmetry events at the LHC might thus be characterized by significant missing transverse momentum, numerous jets, and — in the context of natural SUSY — jets initiated by top and bottom quarks.

This Letter describes a search for gluino pair production in the all-hadronic final state. The data, corresponding to an integrated luminosity of 2.3 fb^{-1} of proton–proton collisions at a center-of-mass energy of $\sqrt{s} = 13$ TeV, were collected with the CMS detector in 2015, the initial year of the LHC Run 2. Recent searches for gluino pair production at $\sqrt{s} = 8$ TeV, based on data collected in LHC Run 1, are presented in Refs. [14–16]. Because of the large mass scales and their all-hadronic nature, the targeted SUSY events are expected to exhibit large values of H_{T}, where H_{T} is the scalar sum of the transverse momenta (p_{T}) of the jets. As a measure of missing transverse momentum, we use the variable $H_{\mathrm{T}}^{\mathrm{miss}}$, which is the magnitude of the vector sum of the jet p_{T}. We present a general search for gluino pair production leading to final states with large H_{T}, large $H_{\mathrm{T}}^{\mathrm{miss}}$, and large jet multiplicity. The data are examined in bins of N_{jet}, $N_{\text{b-jet}}$, H_{T}, and $H_{\mathrm{T}}^{\mathrm{miss}}$, where N_{jet} is the

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Table B.3
Observed numbers of events and prefit background predictions for $N_{\text{jet}} \geq 9$. These results are displayed in the rightmost section of Fig. 6. The first uncertainty is statistical and the second systematic.

Bin	$H_{\text{T}}^{\text{miss}}$ [GeV]	H_{T} [GeV]	$N_{\text{b-jet}}$	Lost-e/μ	$\tau \to$ had	$Z \to \nu\bar{\nu}$	QCD	Total Pred.	Obs.
49	200–500	500–800	0	$0.99^{+0.59}_{-0.45} \pm 0.21$	$0.61^{+0.52}_{-0.23} \pm 0.09$	$0.26 \pm 0.26^{+0.12}_{-0.00}$	$0.92^{+0.54+0.80}_{-0.35-0.57}$	$2.8^{+1.3}_{-0.8} \pm 0.7$	2
50	200–500	800–1200	0	$2.12^{+0.72}_{-0.62} \pm 0.33$	$3.9 \pm 1.2 \pm 0.4$	$2.14 \pm 0.81^{+0.81}_{-0.64}$	$0.78^{+0.31}_{-0.23} \pm 0.55$	$9.0 \pm 2.0 \pm 1.1$	12
51	200–500	1200+	0	$0.58^{+0.54}_{-0.35} \pm 0.08$	$1.05^{+0.76}_{-0.61} \pm 0.15$	$0.42 \pm 0.30^{+0.18}_{-0.12}$	$3.9 \pm 0.7 \pm 2.5$	$6.0^{+1.5}_{-1.2} \pm 2.5$	8
52	500–750	500–1200	0	$0.00^{+0.34}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.15 \pm 0.15^{+0.11}_{-0.00}$	$0.00^{+0.11+0.04}_{-0.00-0.00}$	$0.15^{+0.82+0.11}_{-0.15-0.00}$	0
53	500–750	1200+	0	$0.14^{+0.36+0.05}_{-0.14-0.00}$	$0.02^{+0.46+0.01}_{-0.02-0.00}$	$0.00^{+0.76}_{-0.00} \pm 0.00$	$0.00^{+0.09+0.04}_{-0.00-0.00}$	$0.2^{+1.1+0.1}_{-0.2-0.0}$	0
54	750+	800+	0	$0.00^{+0.28}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.00^{+0.79}_{-0.00} \pm 0.00$	$0.00^{+0.08+0.03}_{-0.00-0.00}$	$0.0^{+1.1+0.1}_{-0.0-0.0}$	0
55	200–500	500–800	1	$1.36^{+0.66}_{-0.53} \pm 0.19$	$1.58^{+0.71}_{-0.54} \pm 0.19$	$0.19 \pm 0.19^{+0.10}_{-0.00}$	$0.09^{+0.22+0.15}_{-0.07-0.02}$	$3.2^{+1.4}_{-1.1} \pm 0.3$	6
56	200–500	800–1200	1	$3.19^{+0.99}_{-0.91} \pm 0.52$	$4.1 \pm 1.2 \pm 0.4$	$1.57 \pm 0.64 \pm 0.68$	$0.88^{+0.34}_{-0.25} \pm 0.64$	$9.7 \pm 2.2 \pm 1.2$	4
57	200–500	1200+	1	$1.70^{+0.85}_{-0.73} \pm 0.25$	$1.41^{+0.79}_{-0.65} \pm 0.25$	$0.31 \pm 0.22^{+0.15}_{-0.08}$	$2.4 \pm 0.5 \pm 1.6$	$5.8 \pm 1.6 \pm 1.7$	3
58	500–750	500–1200	1	$0.00^{+0.40}_{-0.00} \pm 0.00$	$0.05^{+0.46+0.02}_{-0.05-0.00}$	$0.11 \pm 0.11^{+0.08}_{-0.00}$	$0.00^{+0.11+0.04}_{-0.00-0.00}$	$0.16^{+0.88+0.09}_{-0.12-0.00}$	0
59	500–750	1200+	1	$0.00^{+0.41}_{-0.00} \pm 0.00$	$0.15^{+0.48+0.04}_{-0.14-0.00}$	$0.00^{+0.66}_{-0.00} \pm 0.00$	$0.00^{+0.09+0.03}_{-0.00-0.00}$	$0.2^{+1.1+0.1}_{-0.1-0.0}$	1
60	750+	800+	1	$0.00^{+0.33}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.00^{+0.68}_{-0.00} \pm 0.00$	$0.00^{+0.08+0.03}_{-0.00-0.00}$	$0.0^{+1.1+0.1}_{-0.0-0.0}$	0
61	200–500	500–800	2	$1.38^{+0.74}_{-0.62} \pm 0.18$	$1.51^{+0.77}_{-0.61} \pm 0.15$	$0.10 \pm 0.10^{+0.07}_{-0.00}$	$0.00^{+0.22+0.11}_{-0.00-0.00}$	$3.0^{+1.5}_{-1.2} \pm 0.3$	3
62	200–500	800–1200	2	$1.39^{+0.68}_{-0.57} \pm 0.20$	$2.20^{+0.92}_{-0.80} \pm 0.20$	$0.87 \pm 0.41^{+0.54}_{-0.46}$	$0.26^{+0.22+0.24}_{-0.13-0.13}$	$4.7^{+1.7}_{-1.4} \pm 0.6$	1
63	200–500	1200+	2	$0.28^{+0.48}_{-0.20} \pm 0.04$	$1.40^{+0.83}_{-0.70} \pm 0.19$	$0.17 \pm 0.13^{+0.11}_{-0.04}$	$1.38^{+0.45}_{-0.35} \pm 0.95$	$3.2^{+1.4}_{-1.0} \pm 1.0$	2
64	500–750	500–1200	2	$0.00^{+0.36}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.06 \pm 0.06^{+0.05}_{-0.00}$	$0.00^{+0.11+0.04}_{-0.00-0.00}$	$0.06^{+0.83+0.07}_{-0.06-0.00}$	0
65	500–750	1200+	2	$0.00^{+0.45}_{-0.00} \pm 0.00$	$0.01^{+0.46}_{-0.01} \pm 0.00$	$0.00^{+0.52}_{-0.00} \pm 0.00$	$0.00^{+0.09+0.03}_{-0.00-0.00}$	$0.0^{+1.1+0.1}_{-0.0-0.0}$	0
66	750+	800+	2	$0.00^{+0.43}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.00^{+0.52}_{-0.00} \pm 0.00$	$0.00^{+0.08+0.03}_{-0.00-0.00}$	$0.0^{+1.0+0.1}_{-0.0-0.0}$	0
67	200–500	500–800	3+	$0.30^{+0.48}_{-0.21} \pm 0.05$	$1.13^{+0.79}_{-0.64} \pm 0.16$	$0.02^{+0.03+0.03}_{-0.02-0.00}$	$0.00^{+0.22+0.09}_{-0.00-0.00}$	$1.5^{+1.3}_{-0.9} \pm 0.2$	0
68	200–500	800–1200	3+	$1.9 \pm 1.4 \pm 0.3$	$0.70^{+0.60}_{-0.38} \pm 0.09$	$0.18 \pm 0.13^{+0.24}_{-0.06}$	$0.27^{+0.22+0.25}_{-0.13-0.14}$	$3.1^{+2.0}_{-1.7} \pm 0.5$	1
69	200–500	1200+	3+	$0.46^{+0.64+0.06}_{-0.46-0.00}$	$0.32^{+0.54}_{-0.28} \pm 0.04$	$0.04 \pm 0.03^{+0.05}_{-0.00}$	$0.04^{+0.10+0.07}_{-0.03-0.01}$	$0.9^{+1.2+0.1}_{-0.8-0.0}$	0
70	500–750	500–1200	3+	$0.13^{+0.47+0.05}_{-0.13-0.00}$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.01^{+0.02+0.02}_{-0.01-0.00}$	$0.00^{+0.11+0.04}_{-0.00-0.00}$	$0.14^{+0.93+0.04}_{-0.13-0.00}$	0
71	500–750	1200+	3+	$0.00^{+0.41}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.00^{+0.30}_{-0.00} \pm 0.00$	$0.00^{+0.09+0.02}_{-0.00-0.00}$	$0.00^{+0.93+0.02}_{-0.00-0.00}$	0
72	750+	800+	3+	$0.00^{+0.44}_{-0.00} \pm 0.00$	$0.00^{+0.46}_{-0.00} \pm 0.00$	$0.00^{+0.28}_{-0.00} \pm 0.00$	$0.00^{+0.08+0.03}_{-0.00-0.00}$	$0.00^{+0.95+0.03}_{-0.00-0.00}$	0

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5.A.31. Search for new physics in same-sign dilepton events in proton–proton collisions at sqrt s 13 TeV

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Search for new physics in same-sign dilepton events in proton–proton collisions at $\sqrt{s} = 13$ TeV

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Abstract A search for new physics is performed using events with two isolated same-sign leptons, two or more jets, and missing transverse momentum. The results are based on a sample of proton–proton collisions at a center-of-mass energy of 13 TeV recorded with the CMS detector at the LHC, corresponding to an integrated luminosity of 2.3 fb^{1}. Multiple search regions are defined by classifying events in terms of missing transverse momentum, the scalar sum of jet transverse momenta, the transverse mass associated with a W boson candidate, the number of jets, the number of b quark jets, and the transverse momenta of the leptons in the event. The analysis is sensitive to a wide variety of possible signals beyond the standard model. No excess above the standard model background expectation is observed. Constraints are set on various supersymmetric models, with gluinos and bottom squarks excluded for masses up to 1300 and 680 GeV, respectively, at the 95 % confidence level. Upper limits on the cross sections for the production of two top quark-antiquark pairs (119 fb) and two same-sign top quarks (1.7 pb) are also obtained. Selection efficiencies and model independent limits are provided to allow further interpretations of the results.

1 Introduction

Searches for new physics in final states with two leptons that have same-sign (SS) charges provide a powerful probe for searches of new physics, both because standard model (SM) processes with this signature are few and have low cross sections, and because this signature is produced in a large number of important new-physics scenarios. Examples of the latter include the production of supersymmetric (SUSY) particles [1,2], Majorana neutrinos [3], vector-like quarks [4], and SS top quark pairs [5,6]. In the SUSY framework [7–15], the SS signature can arise through gluino pair production. For example, the Majorana nature of the gluino allows gluino pairs to decay via SS charginos, yielding two SS W bosons. Gluino pair production can also yield four W bosons, e.g., from the decay of four top quarks, which may result in the SS dilepton final state. Alternatively, cascade decays of pair-produced squarks can lead to the SS dilepton signature. Searches for new physics in the SS channel have been previously performed at the CERN LHC by the ATLAS [16–18] and CMS [19–23] Collaborations.

This paper describes a search for new physics in the final state with two or more leptons and including a SS pair ($\mu^\pm\mu^\pm$, $\mu^\pm e^\pm$, or $e^\pm e^\pm$, where μ is a muon and e an electron). The analysis is based on proton–proton (pp) collision data at $\sqrt{s} = 13$ TeV, corresponding to an integrated luminosity of 2.3 fb^{-1} collected with the CMS detector in 2015. The search strategy resembles that used in our analysis of 19.5 fb^{1} of data collected at $\sqrt{s} = 8$ TeV [23], which excluded gluino masses in the four top quark signature up to about 1050 GeV. We design an inclusive analysis sensitive to a wide range of new-physics processes produced via strong interactions and yielding undetected particles in the final state. The interpretations of the results consider R-parity conserving SUSY models [24], as well as cross section limits on the production of two top quark-antiquark ($t\bar{t}$) pairs and of two SS top quarks. We also provide model independent limits to allow further interpretations of the results. With respect to Ref. [23], the kinematic regions are redefined and improvements in the event selection are implemented, both of which increase the sensitivity to new-physics scenarios at $\sqrt{s} = 13$ TeV.

2 The CMS detector

The central feature of the CMS apparatus is a superconducting solenoid of 6 m internal diameter, providing a magnetic field of 3.8 T. Within the field volume are several particle detection systems. Charged-particle trajectories are measured with silicon pixel and strip trackers, covering $0 \leq \phi < 2\pi$ in azimuth and $|\eta| < 2.5$ in pseudorapidity, where $\eta \equiv -\ln[\tan(\theta/2)]$ and θ is the polar angle of the

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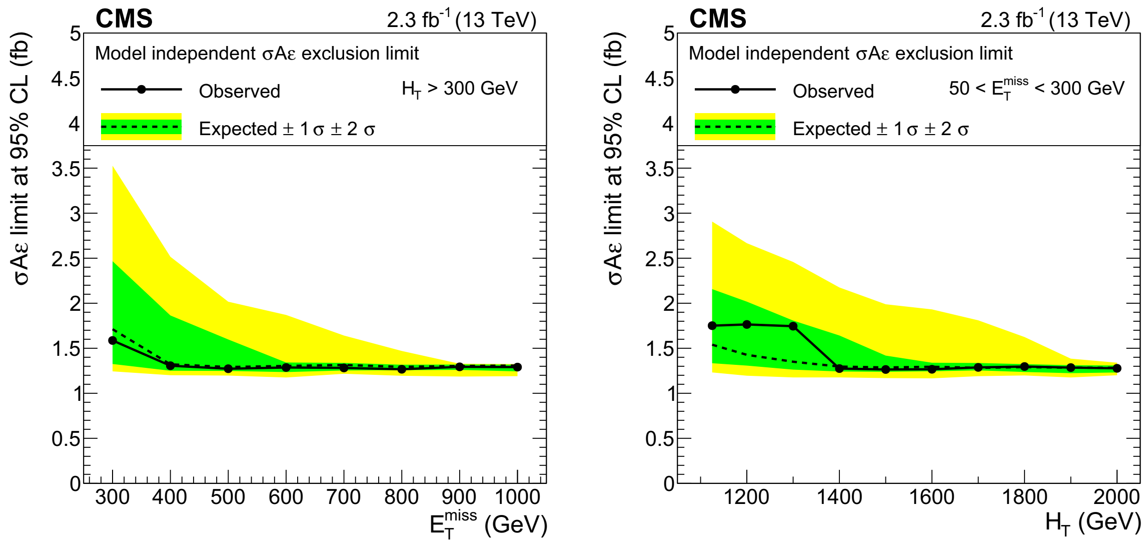

Fig. 8 Limits on the product of cross section, detector acceptance, and selection efficiency, $\sigma\mathcal{A}\epsilon$, for the production of an SS dilepton pair as a function of E_T^{miss} in HH SR31 (*left*) and of H_T in HH SR32 (*right*)

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5.A.32. Search for supersymmetry in pp collisions at sqrt s 13 TeV in the single-lepton final state using the sum of masses of large-radius jets

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Search for supersymmetry in pp collisions at $\sqrt{s} = 13$ TeV in the single-lepton final state using the sum of masses of large-radius jets

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Abstract: Results are reported from a search for supersymmetric particles in proton-proton collisions in the final state with a single, high transverse momentum lepton; multiple jets, including at least one b-tagged jet; and large missing transverse momentum. The data sample corresponds to an integrated luminosity of $2.3\,\mathrm{fb}^{-1}$ at $\sqrt{s} = 13\,\mathrm{TeV}$, recorded by the CMS experiment at the LHC. The search focuses on processes leading to high jet multiplicities, such as gluino pair production with $\tilde{\mathrm{g}} \to \mathrm{t}\bar{\mathrm{t}}\,\tilde{\chi}^0_1$. The quantity M_J, defined as the sum of the masses of the large-radius jets in the event, is used in conjunction with other kinematic variables to provide discrimination between signal and background and as a key part of the background estimation method. The observed event yields in the signal regions in data are consistent with those expected for standard model backgrounds, estimated from control regions in data. Exclusion limits are obtained for a simplified model corresponding to gluino pair production with three-body decays into top quarks and neutralinos. Gluinos with a mass below 1600 GeV are excluded at a 95% confidence level for scenarios with low $\tilde{\chi}^0_1$ mass, and neutralinos with a mass below 800 GeV are excluded for a gluino mass of about 1300 GeV. For models with two-body gluino decays producing on-shell top squarks, the excluded region is only weakly sensitive to the top squark mass.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.33. Search for new physics with the MT2 variable in all-jets final states produced in pp collisions at sqrt s 13 TeV

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Search for new physics with the M_{T2} variable in all-jets final states produced in pp collisions at $\sqrt{s} = 13$ TeV

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Abstract: A search for new physics is performed using events that contain one or more jets, no isolated leptons, and a large transverse momentum imbalance, as measured through the M_{T2} variable, which is an extension of the transverse mass in events with two invisible particles. The results are based on a sample of proton-proton collisions collected at a center-of-mass energy of 13 TeV with the CMS detector at the LHC, and that corresponds to an integrated luminosity of 2.3 fb^{-1}. The observed event yields in the data are consistent with predictions for the standard model backgrounds. The results are interpreted using simplified models of supersymmetry and are expressed in terms of limits on the masses of potential new colored particles. Assuming that the lightest neutralino is stable and has a mass less than about 500 GeV, gluino masses up to 1550–1750 GeV are excluded at 95% confidence level, depending on the gluino decay mechanism. For the scenario of direct production of squark-antisquark pairs, top squarks with masses up to 800 GeV are excluded, assuming a 100% branching fraction for the decay to a top quark and neutralino. Similarly, bottom squark masses are excluded up to 880 GeV, and masses of light-flavor squarks are excluded up to 600–1260 GeV, depending on the degree of degeneracy of the squark masses.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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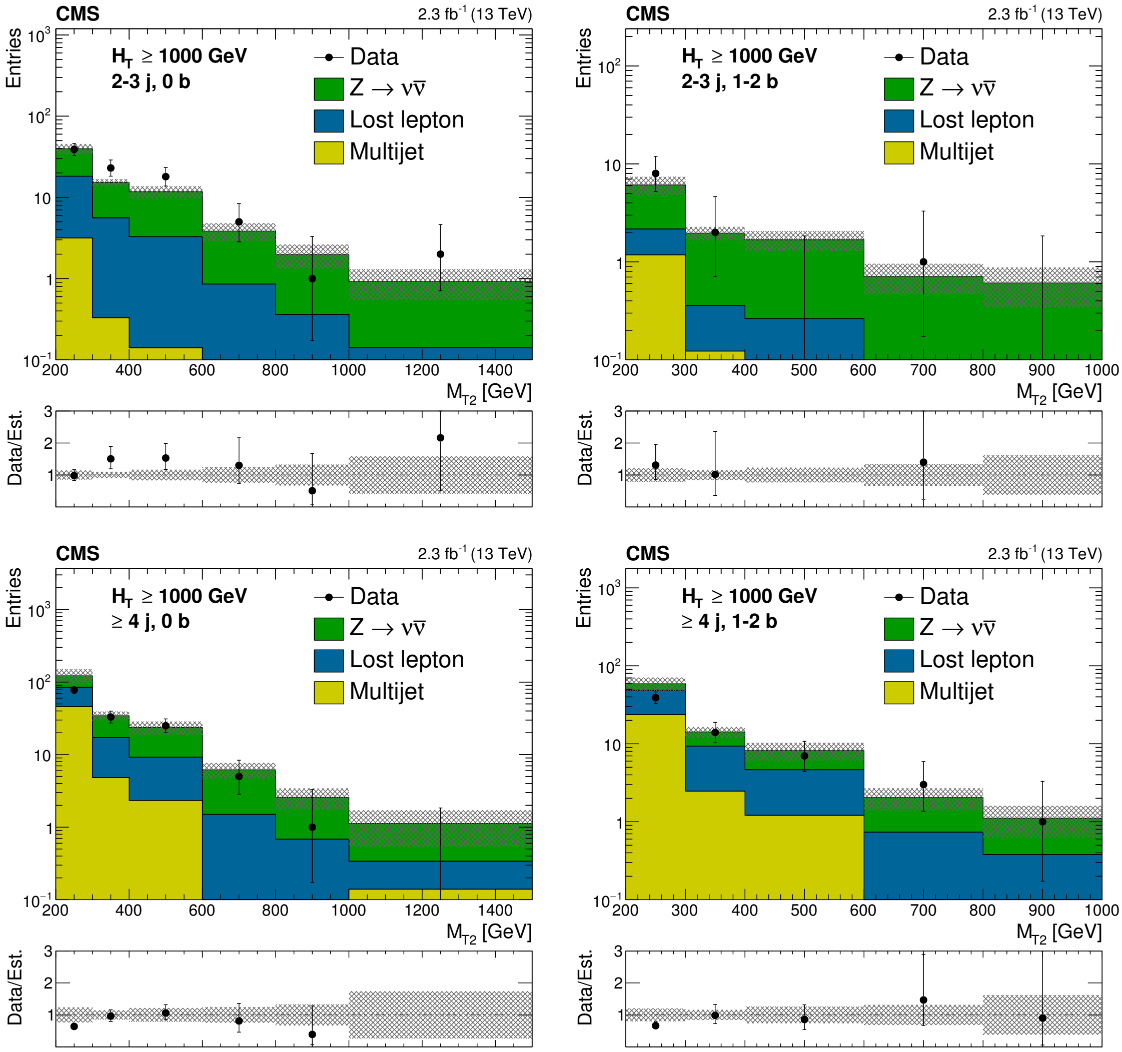

Figure 19. Comparison of estimated background and observed data events in inclusive topological regions, as labeled in the legends, as a function of M_{T2}, for events with $H_T > 1000$ GeV. The background prediction is formed by summing pre-fit values for all signal regions included in each plot. Hatched bands represent the full uncertainty in the background estimate.

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5.A.34. Phenomenological MSSM interpretation of CMS searches in pp collisions at sqrt s 7 and 8 TeV

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Phenomenological MSSM interpretation of CMS searches in pp collisions at $\sqrt{s} = 7$ and 8 TeV

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Abstract: Searches for new physics by the CMS collaboration are interpreted in the framework of the phenomenological minimal supersymmetric standard model (pMSSM). The data samples used in this study were collected at $\sqrt{s} = 7$ and 8 TeV and have integrated luminosities of 5.0 fb^{-1} and 19.5 fb^{-1}, respectively. A global Bayesian analysis is performed, incorporating results from a broad range of CMS supersymmetry searches, as well as constraints from other experiments. Because the pMSSM incorporates several well-motivated assumptions that reduce the 120 parameters of the MSSM to just 19 parameters defined at the electroweak scale, it is possible to assess the results of the study in a relatively straightforward way. Approximately half of the model points in a potentially accessible subspace of the pMSSM are excluded, including all pMSSM model points with a gluino mass below 500 GeV, as well as models with a squark mass less than 300 GeV. Models with chargino and neutralino masses below 200 GeV are disfavored, but no mass range of model points can be ruled out based on the analyses considered. The nonexcluded regions in the pMSSM parameter space are characterized in terms of physical processes and key observables, and implications for future searches are discussed.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.35. Search for new physics in final states with two opposite-sign same-flavor leptons jets and missing transverse momentum in pp collisions at sqrt s 13 TeV

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Search for new physics in final states with two opposite-sign, same-flavor leptons, jets, and missing transverse momentum in pp collisions at $\sqrt{s} = 13$ TeV

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Abstract: A search is presented for physics beyond the standard model in final states with two opposite-sign, same-flavor leptons, jets, and missing transverse momentum. The data sample corresponds to an integrated luminosity of 2.3 fb^{-1} of proton-proton collisions at $\sqrt{s} = 13$ TeV collected with the CMS detector at the LHC in 2015. The analysis uses the invariant mass of the lepton pair, searching for a kinematic edge or a resonant-like excess compatible with the Z boson mass. Both search modes use several event categories in order to increase the sensitivity to new physics. These categories are based on the rapidity of the leptons, the multiplicity of jets and b jets, the scalar sum of jet transverse momenta, and missing transverse momentum. The observations in all signal regions are consistent with the expectations from the standard model, and the results are interpreted in the context of simplified models of supersymmetry.

Keywords: Beyond Standard Model, Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.36. Inclusive search for supersymmetry using razor variables in pp collisions at sqrt s 13 TeV

PHYSICAL REVIEW D **95,** 012003 (2017)

Inclusive search for supersymmetry using razor variables in pp collisions at $\sqrt{s} = 13$ TeV

V. Khachatryan *et al.*[*]

(CMS Collaboration)

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An inclusive search for supersymmetry using razor variables is performed in events with four or more jets and no more than one lepton. The results are based on a sample of proton-proton collisions corresponding to an integrated luminosity of 2.3 fb^{-1} collected with the CMS experiment at a center-of-mass energy of $\sqrt{s} = 13$ TeV. No significant excess over the background prediction is observed in data, and 95% confidence level exclusion limits are placed on the masses of new heavy particles in a variety of simplified models. Assuming that pair-produced gluinos decay only via three-body processes involving third-generation quarks plus a neutralino, and that the neutralino is the lightest supersymmetric particle with a mass of 200 GeV, gluino masses below 1.6 TeV are excluded for any branching fractions for the individual gluino decay modes. For some specific decay mode scenarios, gluino masses up to 1.65 TeV are excluded. For decays to first- and second-generation quarks and a neutralino with a mass of 200 GeV, gluinos with masses up to 1.4 TeV are excluded. Pair production of top squarks decaying to a top quark and a neutralino with a mass of 100 GeV is excluded for top squark masses up to 750 GeV.

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I. INTRODUCTION

Supersymmetry (SUSY) is a proposed extended space-time symmetry that introduces a bosonic (fermionic) partner for every fermion (boson) in the standard model (SM) [1–9]. Supersymmetric extensions of the SM are particularly compelling because they yield solutions to the gauge hierarchy problem without the need for large fine-tuning of fundamental parameters [10–15], exhibit gauge coupling unification [16–21], and can provide weakly interacting particle candidates for dark matter [22,23]. For SUSY to provide a "natural" solution to the gauge hierarchy problem, the three Higgsinos, two neutral and one charged, must be light, and two top squarks, one bottom squark, and the gluino must have masses below a few TeV, making them potentially accessible at the CERN LHC. Previous searches for SUSY by the CMS [24–30] and ATLAS [31–37] collaborations have probed SUSY particle masses near the TeV scale, and the increase in the center-of-mass energy of the LHC from 8 to 13 TeV provides an opportunity to significantly extend the sensitivity to higher SUSY particle masses [38–51].

In R-parity [52] conserving SUSY scenarios, the lightest SUSY particle (LSP) is stable and assumed to be weakly interacting. For many of these models, the experimental signatures at the LHC are characterized by an abundance of jets and a large transverse momentum imbalance, but the exact form of the final state can vary significantly, depending on the values of the unconstrained model parameters. To ensure sensitivity to a broad range of SUSY parameter space, we adopt an inclusive search strategy, categorizing events according to the number of identified leptons and b-tagged jets. The razor kinematic variables M_{R} and R^2 [53,54] are used as search variables and are generically sensitive to pair production of massive particles with subsequent direct or cascading decays to weakly interacting stable particles. Searches for SUSY and other beyond the SM phenomena using razor variables have been performed by both the CMS [53–58] and ATLAS [59,60] collaborations in the past.

We interpret the results of the inclusive search using simplified SUSY scenarios for pair production of gluinos and top squarks. First, we consider models in which the gluino undergoes three-body decay, either to a bottom or top quark-antiquark pair and the lightest neutralino $\tilde{\chi}_1^0$, assumed to be the lightest SUSY particle, or to a bottom quark (antiquark), a top antiquark (quark), and the lightest chargino $\tilde{\chi}_1^{\pm}$, assumed to be the next-to-lightest SUSY particle (NLSP). The NLSP is assumed to have a mass that is 5 GeV larger than the mass of the LSP, motivated by the fact that in many natural SUSY scenarios the lightest chargino and the two lightest neutralinos are Higgsino-like and quasidegenerate [61]. The NLSP decays to an LSP and an off-shell W boson, the decay products of which mostly have too low momentum to be identifiable. The specific choice of the NLSP-LSP mass splitting does not have a large impact on the results of the interpretation. The full range of branching fractions to the three possible decay

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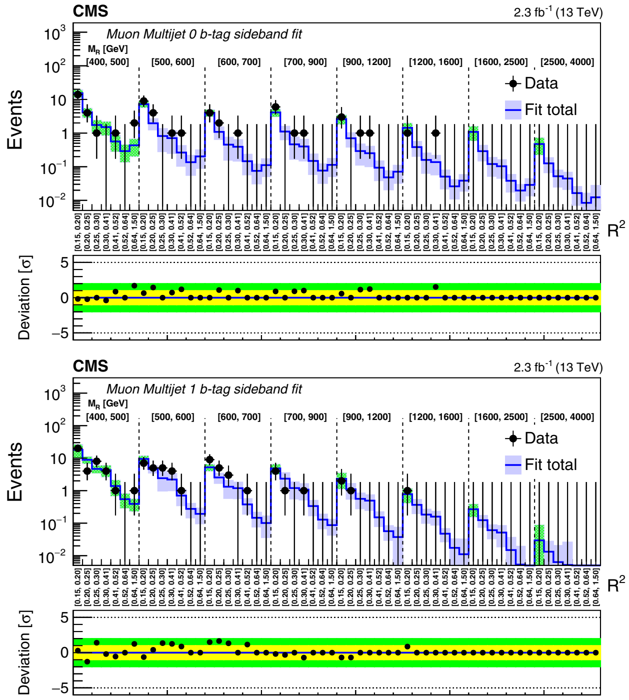

FIG. 19. Comparison of the predicted background with the observed data in bins of M_R and R^2 variables in the Muon Multijet category for the zero b-tag (upper) and 1 b-tag (lower) bins. A detailed explanation of the panels is given in the caption of Fig. 7.

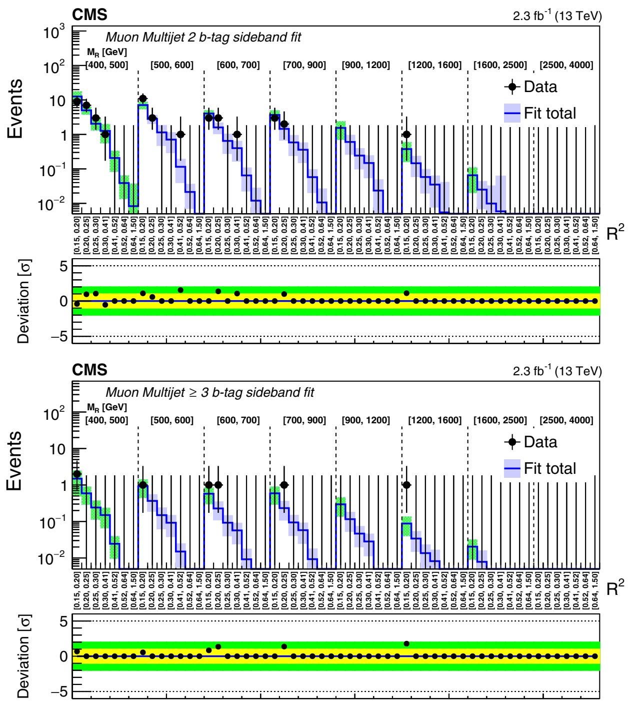

FIG. 20. Comparison of the predicted background with the observed data in bins of M_R and R^2 variables in the Muon Multijet category for the 2 b-tag (upper) and ≥ 3 b-tag (lower) bins. A detailed explanation of the panels is given in the caption of Fig. 7.

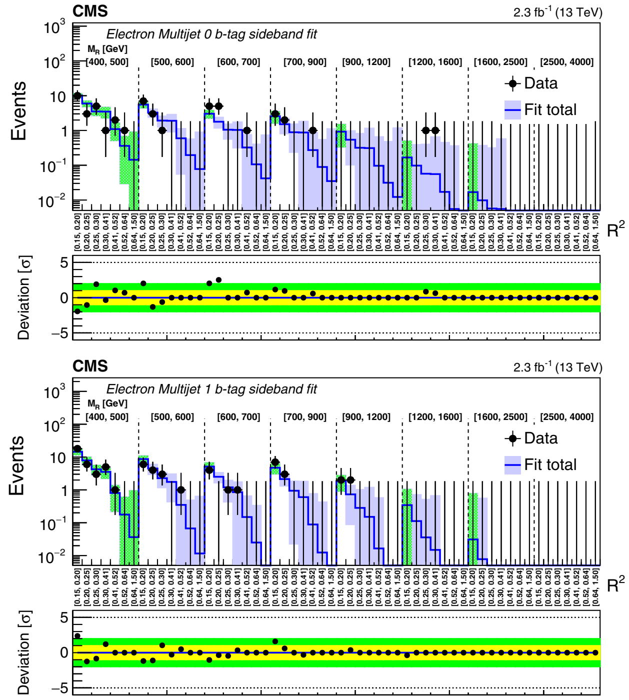

FIG. 21. Comparison of the predicted background with the observed data in bins of M_R and R^2 variables in the Electron Multijet category for the zero b-tag (upper) and 1 b-tag (lower) bins. A detailed explanation of the panels is given in the caption of Fig. 7.

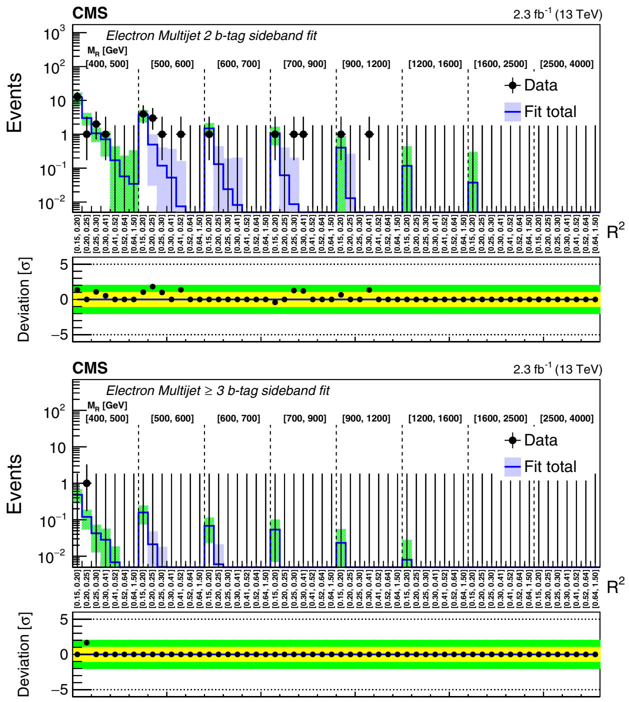

FIG. 22. Comparison of the predicted background with the observed data in bins of M_R and R^2 variables in the Electron Multijet category for the 2 b-tag (upper) and ≥ 3 b-tag (lower) bins. A detailed explanation of the panels is given in the caption of Fig. 7.

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5.A.37. The CMS Trigger System

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The CMS trigger system

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Abstract: This paper describes the CMS trigger system and its performance during Run 1 of the LHC. The trigger system consists of two levels designed to select events of potential physics interest from a GHz (MHz) interaction rate of proton-proton (heavy ion) collisions. The first level of the trigger is implemented in hardware, and selects events containing detector signals consistent with an electron, photon, muon, τ lepton, jet, or missing transverse energy. A programmable menu of up to 128 object-based algorithms is used to select events for subsequent processing. The trigger thresholds are adjusted to the LHC instantaneous luminosity during data taking in order to restrict the output rate to 100 kHz, the upper limit imposed by the CMS readout electronics. The second level, implemented in software, further refines the purity of the output stream, selecting an average rate of 400 Hz for offline event storage. The objectives, strategy and performance of the trigger system during the LHC Run 1 are described.

Keywords: Trigger concepts and systems (hardware and software); Trigger detectors; Data acquisition circuits

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5.A.38. Jet energy scale and resolution in the CMS experiment in pp collisions at 8 TeV

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Jet energy scale and resolution in the CMS experiment in pp collisions at 8 TeV

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ABSTRACT: Improved jet energy scale corrections, based on a data sample corresponding to an integrated luminosity of 19.7 fb^{-1} collected by the CMS experiment in proton-proton collisions at a center-of-mass energy of 8 TeV, are presented. The corrections as a function of pseudorapidity η and transverse momentum p_{T} are extracted from data and simulated events combining several channels and methods. They account successively for the effects of pileup, uniformity of the detector response, and residual data-simulation jet energy scale differences. Further corrections, depending on the jet flavor and distance parameter (jet size) R, are also presented. The jet energy resolution is measured in data and simulated events and is studied as a function of pileup, jet size, and jet flavor. Typical jet energy resolutions at the central rapidities are 15–20% at 30 GeV, about 10% at 100 GeV, and 5% at 1 TeV. The studies exploit events with dijet topology, as well as photon+jet, Z+jet and multijet events. Several new techniques are used to account for the various sources of jet energy scale corrections, and a full set of uncertainties, and their correlations, are provided.The final uncertainties on the jet energy scale are below 3% across the phase space considered by most analyses ($p_{\mathrm{T}} > 30$ GeV and $|\eta| < 5.0$). In the barrel region ($|\eta| < 1.3$) an uncertainty below 1% for $p_{\mathrm{T}} > 30$ GeV is reached, when excluding the jet flavor uncertainties, which are provided separately for different jet flavors. A new benchmark for jet energy scale determination at hadron colliders is achieved with 0.32% uncertainty for jets with p_{T} of the order of 165–330 GeV, and $|\eta| < 0.8$.

KEYWORDS: Large detector-systems performance; Performance of High Energy Physics Detectors

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5.A.39. A search for new phenomena in pp collisions at sqrt s 13 TeV in final states with missing transverse momentum and at least one jet using the aT variable

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A search for new phenomena in pp collisions at $\sqrt{s} = 13$ TeV in final states with missing transverse momentum and at least one jet using the α_{T} variable

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Abstract A search for new phenomena is performed in final states containing one or more jets and an imbalance in transverse momentum in pp collisions at a centre-of-mass energy of 13 TeV. The analysed data sample, recorded with the CMS detector at the CERN LHC, corresponds to an integrated luminosity of 2.3 fb^{-1}. Several kinematic variables are employed to suppress the dominant background, multijet production, as well as to discriminate between other standard model and new physics processes. The search provides sensitivity to a broad range of new-physics models that yield a stable weakly interacting massive particle. The number of observed candidate events is found to agree with the expected contributions from standard model processes, and the result is interpreted in the mass parameter space of fourteen simplified supersymmetric models that assume the pair production of gluinos or squarks and a range of decay modes. For models that assume gluino pair production, masses up to 1575 and 975 GeV are excluded for gluinos and neutralinos, respectively. For models involving the pair production of top squarks and compressed mass spectra, top squark masses up to 400 GeV are excluded.

1 Introduction

The standard model (SM) of particle physics is successful in describing a wide range of phenomena, although it is widely believed to be only an effective approximation of a more complete theory that supersedes it at a higher energy scale. Supersymmetry (SUSY) [1–4] is a modification to the SM that extends its underlying space-time symmetry group. For each boson (fermion) in the SM, a fermionic (bosonic) superpartner, which differs in spin by one-half unit, is introduced.

Experimentally, SUSY is testable through the prediction of an extensive array of new observable states (of unknown masses) [5,6]. In the minimal supersymmetric extension to the SM [6], the gluinos $\widetilde{\mathrm{g}}$, light- and heavy-flavour squarks $\widetilde{\mathrm{q}}$, $\widetilde{\mathrm{b}}$, $\widetilde{\mathrm{t}}$, and sleptons $\widetilde{\ell}$ are, respectively, the superpartners to gluons, quarks, and leptons. An extended Higgs sector is also predicted, as well as four neutralino $\widetilde{\chi}^0_{1,2,3,4}$ and two chargino $\widetilde{\chi}^{\pm}_{1,2}$ states that arise from mixing between the higgsino and gaugino states, which are the superpartners of the Higgs and electroweak gauge bosons. The assumption of R-parity conservation [7] has important consequences for cosmology and collider phenomenology. Supersymmetric particles are expected to be produced in pairs at the LHC, with heavy coloured states decaying, potentially via intermediate SUSY states, to the stable lightest SUSY particle (LSP). The LSP is generally assumed to be the $\widetilde{\chi}^0_1$, which is weakly interacting and massive. This SUSY particle is considered to be a candidate for dark matter (DM) [8], the existence of which is supported by astrophysical data [9]. Hence, a characteristic signature of R-parity-conserving coloured SUSY production at the LHC is a final state containing an abundance of jets, possibly originating from top or bottom quarks, accompanied by a significant transverse momentum imbalance, $\vec{p}_{\mathrm{T}}^{\mathrm{miss}}$.

The proposed supersymmetric extension of the SM is also compelling from a theoretical perspective, as the addition of superpartners to SM particles can modify the running of the gauge coupling constants such that their unification can be achieved at a high energy scale [10–12]. A more topical perspective, given the recently discovered Higgs boson [13–15], is the possibility that scale-dependent radiative corrections to the Higgs boson mass from loop processes can be largely cancelled through the introduction of superpartners, thus alleviating the gauge hierarchy problem [16,17]. Alternatively, these radiative corrections can be accommodated through an extreme level of fine tuning of the bare Higgs boson mass. A "natural" solution from SUSY, with minimal fine-tuning, implies that the masses of the $\widetilde{\chi}^0_1$, third-generation squarks, and the gluino are at or near the electroweak scale [18].

The lack of evidence to date for SUSY has also focused attention on regions of the natural parameter space with

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5.A.40. Search for supersymmetry in multijet events with missing transverse momentum in proton-proton collisions at 13 TeV

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Search for supersymmetry in multijet events with missing transverse momentum in proton-proton collisions at 13 TeV

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(Received 25 April 2017; published 25 August 2017)

A search for supersymmetry is presented based on multijet events with large missing transverse momentum produced in proton-proton collisions at a center-of-mass energy of $\sqrt{s} = 13$ TeV. The data, corresponding to an integrated luminosity of 35.9 fb^{-1}, were collected with the CMS detector at the CERN LHC in 2016. The analysis utilizes four-dimensional exclusive search regions defined in terms of the number of jets, the number of tagged bottom quark jets, the scalar sum of jet transverse momenta, and the magnitude of the vector sum of jet transverse momenta. No evidence for a significant excess of events is observed relative to the expectation from the standard model. Limits on the cross sections for the pair production of gluinos and squarks are derived in the context of simplified models. Assuming the lightest supersymmetric particle to be a weakly interacting neutralino, 95% confidence level lower limits on the gluino mass as large as 1800 to 1960 GeV are derived, and on the squark mass as large as 960 to 1390 GeV, depending on the production and decay scenario.

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I. INTRODUCTION

The standard model (SM) of particle physics describes many aspects of weak, electromagnetic, and strong interactions. However, it requires fine-tuning [1] to explain the observed value of the Higgs boson mass [2], and it does not provide an explanation for dark matter. Supersymmetry (SUSY) [3–10], a widely studied extension of the SM, potentially solves these problems through the introduction of a new particle, called a superpartner, for each SM particle, with a spin that differs from that of its SM counterpart by a half unit. Additional Higgs bosons and their superpartners are also introduced. The superpartners of quarks and gluons are squarks $\tilde{q}$ and gluinos $\tilde{g}$, respectively, while neutralinos $\tilde{\chi}^0$ and charginos $\tilde{\chi}^{\pm}$ are mixtures of the superpartners of the Higgs and electroweak gauge bosons. Provided that the masses of gluinos, top squarks, and bottom squarks are no heavier than a few TeV, SUSY can resolve the fine-tuning problem [1,11–13]. Furthermore, in R-parity [14] conserving SUSY models, the lightest SUSY particle (LSP) is stable and might interact only weakly, thus representing a dark matter candidate.

In this paper, we present a search for squarks and gluinos produced in proton-proton (pp) collisions at $\sqrt{s} = 13$ TeV. Squark and gluino production have large potential cross sections in pp collisions, thus motivating this search. The study is performed in the multijet final state, i.e., the visible elements consist solely of jets. Other $\sqrt{s} = 13$ TeV inclusive multijet SUSY searches were presented in Refs. [15–20]. We assume the conservation of R parity, meaning that the squarks and gluinos are produced in pairs. The events are characterized by the presence of jets and undetected, or "missing," transverse momentum, where the missing transverse momentum arises from the weakly interacting and unobserved LSPs. The data, corresponding to an integrated luminosity of 35.9 fb^{-1}, were collected in 2016 with the CMS detector at the CERN LHC. The analysis is performed in four-dimensional exclusive regions in the number of jets N_{jet}, the number of tagged bottom quark jets $N_{b\text{-jet}}$, the scalar sum H_{T} of the transverse momenta p_{T} of jets, and the magnitude $H_{\mathrm{T}}^{\mathrm{miss}}$ of the vector p_{T} sum of jets. The number of observed events in each region is compared with the expected number of SM events to search for excesses in the data.

The study is an extension of that presented in Ref. [17], using improved analysis techniques and around 16 times more data. Relative to Ref. [17], the following principal modifications have been made. First, the search intervals in N_{jet} and H_{T} are given by $N_{\mathrm{jet}} \geq 2$ and $H_{\mathrm{T}} > 300$ GeV, compared with $N_{\mathrm{jet}} \geq 4$ and $H_{\mathrm{T}} > 500$ GeV in Ref. [17]. Inclusion of events with $N_{\mathrm{jet}} = 2$ and 3 increases the sensitivity to squark pair production. The lower threshold in H_{T} provides better sensitivity to scenarios with small mass differences between the LSP and the squark or gluino. Second, the rebalance-and-smear technique [21,22] is introduced as a complementary means to evaluate the quantum chromodynamics (QCD) background, namely the background from SM events with multijet final states produced exclusively through the strong interaction. Third, the search interval in $H_{\mathrm{T}}^{\mathrm{miss}}$ is given by $H_{\mathrm{T}}^{\mathrm{miss}} > 300$ GeV,

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TABLE XI. Observed numbers of events and prefit background predictions in the aggregate search regions. The first uncertainty is statistical and the second is systematic.

Bin	$H_{\mathrm{T}}^{\mathrm{miss}}$ [GeV]	H_{T} [GeV]	N_{jet}	$N_{b\text{-jet}}$	Lost-e/μ	$\tau \to$ had	$Z \to \nu\bar{\nu}$	QCD	Total pred.	Obs.
1	>500	>500	≥2	0	842^{+25+48}_{-25-46}	753^{+16+65}_{-16-65}	$5968^{+48+360}_{-47-350}$	$21.4^{+0.6+8.5}_{-0.6-7.1}$	$7584^{+63+370}_{-62-360}$	7838
2	>750	>1500	≥3	0	$4.8^{+2.2+0.6}_{-1.6-0.6}$	$4.2^{+1.3+0.3}_{-0.9-0.3}$	$45.8^{+5.1+5.2}_{-4.3-4.9}$	$0.47^{+0.06+0.18}_{-0.06-0.16}$	$55.2^{+6.2+5.3}_{-5.0-4.9}$	71
3	>500	>500	≥5	0	$111.0^{+6.4+8.3}_{-6.3-7.9}$	$127.6^{+5.9+8.5}_{-5.7-8.6}$	558^{+15+36}_{-14-34}	$9.4^{+0.2+3.5}_{-0.2-3.1}$	806^{+19+38}_{-18-37}	819
4	>750	>1500	≥5	0	$1.82^{+0.82+0.26}_{-0.59-0.21}$	$2.8^{+1.1+0.2}_{-0.7-0.2}$	$18.1^{+3.3+2.7}_{-2.6-2.6}$	$0.37^{+0.06+0.15}_{-0.06-0.13}$	$23.0^{+3.8+2.7}_{-2.9-2.6}$	25
5	>750	>1500	≥9	0	$0.23^{+0.27+0.14}_{-0.17-0.07}$	$0.28^{+0.50+0.08}_{-0.21-0.07}$	$0.00^{+0.82+0.00}_{-0.00-0.00}$	$0.05^{+0.03+0.02}_{-0.03-0.02}$	$0.6^{+1.1+0.2}_{-0.4-0.1}$	1
6	>500	>500	≥2	≥2	$46.9^{+8.9+3.1}_{-5.9-3.0}$	$44.0^{+4.4+3.2}_{-3.4-3.2}$	102^{+2+14}_{-1-14}	$2.5^{+0.3+1.5}_{-0.2-1.3}$	196^{+13+15}_{-9-15}	216
7	>750	>750	≥3	≥1	$11.5^{+4.1+1.0}_{-2.2-0.9}$	$13.7^{+3.0+1.2}_{-2.0-1.2}$	87^{+3+10}_{-3-10}	$0.87^{+0.15+0.34}_{-0.11-0.31}$	113^{+8+10}_{-5-10}	123
8	>500	>500	≥5	≥3	$6.6^{+3.3+0.6}_{-2.3-0.6}$	$5.3^{+1.9+0.9}_{-1.1-0.9}$	$6.8^{+0.5+2.8}_{-0.3-2.8}$	$0.87^{+0.20+0.96}_{-0.17-0.70}$	$19.5^{+5.2+3.2}_{-3.4-3.1}$	17
9	>750	>1500	≥5	≥2	$1.3^{+1.4+0.2}_{-0.6-0.2}$	$1.8^{+1.3+0.4}_{-0.7-0.4}$	$1.20^{+0.41+0.33}_{-0.19-0.33}$	$0.13^{+0.07+0.06}_{-0.04-0.05}$	$4.4^{+2.8+0.6}_{-1.3-0.6}$	6
10	>750	>750	≥9	≥3	$0.00^{+0.66+0.00}_{-0.00-0.00}$	$0.00^{+0.65+0.00}_{-0.00-0.00}$	$0.00^{+0.15+0.00}_{-0.00-0.00}$	$0.03^{+0.07+0.04}_{-0.02-0.01}$	$0.0^{+1.3+0.0}_{-0.0-0.0}$	0
11	>300	>300	≥7	≥1	328^{+12+21}_{-12-20}	380^{+10+22}_{-9-22}	193^{+8+38}_{-6-38}	69^{+1+29}_{-1-26}	969^{+23+57}_{-22-55}	890
12	>750	>750	≥5	≥1	$7.2^{+2.8+0.8}_{-1.6-0.7}$	$7.7^{+2.4+0.8}_{-1.4-0.8}$	$26.6^{+2.4+3.9}_{-1.8-3.7}$	$0.65^{+0.14+0.26}_{-0.11-0.23}$	$42.2^{+5.7+4.0}_{-3.5-3.9}$	48

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5.A.41. Search for physics beyond the standard model in events with two leptons of same sign missing transverse momentum and jets in proton-proton collisions at sqrt s 13 TeV

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Search for physics beyond the standard model in events with two leptons of same sign, missing transverse momentum, and jets in proton–proton collisions at $\sqrt{s} = 13$ TeV

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Abstract A data sample of events from proton–proton collisions with two isolated same-sign leptons, missing transverse momentum, and jets is studied in a search for signatures of new physics phenomena by the CMS Collaboration at the LHC. The data correspond to an integrated luminosity of 35.9 fb^{-1}, and a center-of-mass energy of 13 TeV. The properties of the events are consistent with expectations from standard model processes, and no excess yield is observed. Exclusion limits at 95% confidence level are set on cross sections for the pair production of gluinos, squarks, and same-sign top quarks, as well as top-quark associated production of a heavy scalar or pseudoscalar boson decaying to top quarks, and on the standard model production of events with four top quarks. The observed lower mass limits are as high as 1500 GeV for gluinos, 830 GeV for bottom squarks. The excluded mass range for heavy (pseudo)scalar bosons is 350–360 (350–410) GeV. Additionally, model-independent limits in several topological regions are provided, allowing for further interpretations of the results.

1 Introduction

Final states with two leptons of same charge, denoted as same-sign (SS) dileptons, are produced rarely by standard model (SM) processes in proton–proton (pp) collisions. Because the SM rates of SS dileptons are low, studies of these final states provide excellent opportunities to search for manifestations of physics beyond the standard model (BSM). Over the last decades, a large number of new physics mechanisms have been proposed to extend the SM and address its shortcomings. Many of these can give rise to potentially large contributions to the SS dilepton signature, e.g., the production of supersymmetric (SUSY) particles [1,2], SS top quarks [3,4], scalar gluons (sgluons) [5,6], heavy scalar bosons of extended Higgs sectors [7,8], Majorana neutrinos [9], and vector-like quarks [10].

In the SUSY framework [11–20], the SS final state can appear in R-parity conserving models through gluino or squark pair production when the decay of each of the pair-produced particles yields one or more W bosons. For example, a pair of gluinos (which are Majorana particles) can give rise to SS charginos and up to four top quarks, yielding signatures with up to four W bosons, as well as jets, b quark jets, and large missing transverse momentum ($E_{\mathrm{T}}^{\mathrm{miss}}$). Similar signatures can also result from the pair production of bottom squarks, subsequently decaying to charginos and top quarks.

While R-parity conserving SUSY models often lead to signatures with large $E_{\mathrm{T}}^{\mathrm{miss}}$, it is also interesting to study final states without significant $E_{\mathrm{T}}^{\mathrm{miss}}$ beyond what is produced by the neutrinos from leptonic W boson decays. For example, some SM and BSM scenarios can lead to the production of SS or multiple top quark pairs, such as the associated production of a heavy (pseudo)scalar, which subsequently decays to a pair of top quarks. This scenario is realized in Type II two Higgs doublet models (2HDM) where associated production with a single top quark or a $\mathrm{t\bar{t}}$ pair can in some cases provide a promising window to probe these heavy (pseudo)scalar bosons [21–23].

This paper extends the search for new physics presented in Ref. [24]. We consider final states with two leptons (electrons and muons) of same charge, two or more hadronic jets, and moderate $E_{\mathrm{T}}^{\mathrm{miss}}$. Compared to searches with zero or one lepton, this final state provides enhanced sensitivity to low-momentum leptons and SUSY models with compressed mass spectra. The results are based on an integrated luminosity corresponding to 35.9 fb^{-1} of $\sqrt{s} = 13$ TeV proton–proton collisions collected with the CMS detector at the CERN LHC. Previous LHC searches in the SS dilepton channel have been performed by the ATLAS [25–27] and CMS [24,28–32] Collaborations. With respect to Ref. [24], the event categoriza-

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tracts Harmonia 2014/14/M/ST2/00428, Opus 2014/13/B/ST2/02543, 2014/15/B/ST2/03998, and 2015/19/B/ST2/02861, Sonata-bis 2012/07/E/ST2/01406; the National Priorities Research Program by Qatar National Research Fund; the Programa Clarín-COFUND del Principado de Asturias; the Thalis and Aristeia programs cofinanced by EU-ESF and the Greek NSRF; the Rachadapisek Sompot Fund for Postdoctoral Fellowship, Chulalongkorn University and the Chulalongkorn Academic into Its 2nd Century Project Advancement Project (Thailand); and the Welch Foundation, contract C-1845.

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5.A.42. Search for direct production of supersymmetric partners of the top quark in the all-jets final state in proton-proton collisions at sqrt s 13 TeV

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Search for direct production of supersymmetric partners of the top quark in the all-jets final state in proton-proton collisions at $\sqrt{s} = 13$ TeV

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Abstract: A search for direct production of top squark pairs in events with jets and large transverse momentum imbalance is presented. The data are based on proton-proton collisions at a center-of-mass energy of 13 TeV, collected with the CMS detector in 2016 at the CERN LHC, and correspond to an integrated luminosity of $35.9\,\mathrm{fb}^{-1}$. The search considers a variety of R-parity conserving supersymmetric models, including ones for which the top squark and neutralino masses are nearly degenerate. Specialized jet reconstruction tools are developed to exploit the unique characteristics of the signal topologies. With no significant excess of events observed above the standard model expectations, upper limits are set on the direct top squark pair production cross section in the context of simplified supersymmetric models for various decay hypotheses. Models with larger differences in mass between the top squark and neutralino are probed for masses up to 1040 and 500 GeV, respectively, whereas models with a more compressed mass hierarchy are probed up to 660 and 610 GeV, respectively. The smallest mass difference probed is for masses near to 550 and 540 GeV, respectively.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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In the regions of parameter space where the mass difference between the $\widetilde{t}_1$ and $\widetilde{\chi}_1^0$ is smaller than the mass of the W boson, we consider four-body decays of top squarks in which top squark masses up to 580 GeV are excluded for a neutralino mass of 540 GeV. An additional decay that is relevant in this parameter space is one in which the top squark decays to a bottom quark and a $\widetilde{\chi}_1^{\pm}$, that then decays to a virtual W boson and a $\widetilde{\chi}_1^0$. Here, top squark masses up to 660 GeV are excluded for a neutralino mass of 610 GeV. Finally, we consider decays through a flavor changing neutral current process where the $\widetilde{t}_1$ decays to a c quark and a $\widetilde{\chi}_1^0$. In this case, $\widetilde{t}_1$ and $\widetilde{\chi}_1^0$ masses up to 560 GeV and up to 520 GeV, respectively, are excluded.

In summary, we present a search that takes advantage of a large new set of data collected by the CMS experiment in 2016, as well as a variety of new methods that yield exclusion limits for a wide array of top squark decay modes in planes of $m_{\widetilde{\chi}_1^0}$ versus $m_{\widetilde{t}_1}$ and $m_{\widetilde{t}_1} - m_{\widetilde{\chi}_1^0}$ versus $m_{\widetilde{t}_1}$ that extend significantly beyond those obtained in previous searches.

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5.A.43. Search for top squark pair production in pp collisions at sqrt s 13 TeV using single lepton events

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Search for top squark pair production in pp collisions at $\sqrt{s} = 13$ TeV using single lepton events

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Abstract: A search for top squark pair production in pp collisions at $\sqrt{s} = 13$ TeV is performed using events with a single isolated electron or muon, jets, and a large transverse momentum imbalance. The results are based on data collected in 2016 with the CMS detector at the LHC, corresponding to an integrated luminosity of 35.9 fb^{-1}. No significant excess of events is observed above the expectation from standard model processes. Exclusion limits are set in the context of supersymmetric models of pair production of top squarks that decay either to a top quark and a neutralino or to a bottom quark and a chargino. Depending on the details of the model, we exclude top squarks with masses as high as 1120 GeV. Detailed information is also provided to facilitate theoretical interpretations in other scenarios of physics beyond the standard model.

Keywords: Beyond Standard Model, Hadron-Hadron scattering (experiments), Top physics

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5.A.44. Search for Supersymmetry in pp Collisions at sqrt s 13 TeV in the Single-Lepton Final State Using the Sum of Masses of Large-Radius Jets

Search for Supersymmetry in pp Collisions at $\sqrt{s} = 13$ TeV in the Single-Lepton Final State Using the Sum of Masses of Large-Radius Jets

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Results are reported from a search for supersymmetric particles in proton-proton collisions in the final state with a single lepton, multiple jets, including at least one b-tagged jet, and large missing transverse momentum. The search uses a sample of proton-proton collision data at $\sqrt{s} = 13$ TeV recorded by the CMS experiment at the LHC, corresponding to an integrated luminosity of 35.9 fb^{-1}. The observed event yields in the signal regions are consistent with those expected from standard model backgrounds. The results are interpreted in the context of simplified models of supersymmetry involving gluino pair production, with gluino decay into either on- or off-mass-shell top squarks. Assuming that the top squarks decay into a top quark plus a stable, weakly interacting neutralino, scenarios with gluino masses up to about 1.9 TeV are excluded at 95% confidence level for neutralino masses up to about 1 TeV.

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A central goal of the physics program of the CMS experiment at the CERN LHC [1] is the search for new particles and phenomena beyond the standard model (SM), in particular, for supersymmetry (SUSY) [2–9]. During 2016, CMS recorded a data sample of proton-proton collisions at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 35.9 fb^{-1}, significantly extending the sensitivity to the production of new heavy particles. The search described here focuses on a generically important experimental signature that is also strongly motivated by SUSY phenomenology. This signature includes a single lepton (an electron or a muon), several jets, arising from the hadronization of energetic quarks and gluons, at least one b-tagged jet, indicative of processes involving third generation quarks, and, finally, $\vec{p}_T^{\text{miss}}$, the missing momentum in the direction transverse to the beam. A large value of $p_T^{\text{miss}} \equiv |\vec{p}_T^{\text{miss}}|$ can arise from the production of high momentum, weakly interacting particles that escape detection. Searches for SUSY in the single-lepton final state have been performed by both ATLAS and CMS at $\sqrt{s} = 7$ and 8 TeV [10–13] and at $\sqrt{s} = 13$ TeV [14–17]. The present analysis, which introduces extended binning and other improvements, is based largely on methodologies described in detail in Ref. [16], which include the use of large-radius jets and related kinematic variables.

In models based on SUSY, new particles are introduced such that all fermionic (bosonic) degrees of freedom in the SM are paired with corresponding bosonic (fermionic) degrees of freedom in the extended theory. The discovery of a Higgs boson with low mass [18–23] provides a key motivation for SUSY. Stabilizing the Higgs boson mass at a low value, without invoking extreme fine-tuning of parameters, is a major theoretical challenge, referred to as the gauge hierarchy problem [24–29]. This stabilization can be achieved in so-called natural SUSY models [30–34], in which several of the SUSY partners are constrained to be light [33]: the top squarks $\tilde{t}_L$ and $\tilde{t}_R$, which have the same electroweak couplings as the left- (L-) and right- (R-) handed top quarks, respectively, the bottom squark with L-handed couplings, $\tilde{b}_L$, the gluino $\tilde{g}$; and the Higgsinos $\tilde{H}$. This search targets gluino pair production, which has a relatively large cross section for a given mass, with gluino decay $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$. This process can arise from $\tilde{g} \to \tilde{t}_1\bar{t}$, where the lighter top squark mass eigenstate $\tilde{t}_1$ is produced either on or off mass shell. The symbol $\tilde{\chi}_1^0$ denotes the lightest neutralino, an electrically neutral mass eigenstate that is in general a mixture of the Higgsinos and electroweak gauginos. In R-parity conserving SUSY models [35,36] in which the $\tilde{\chi}_1^0$ is the lightest supersymmetric particle, the $\tilde{\chi}_1^0$ is stable and can, in principle, account for some or all of the astrophysical dark matter [37–39]. The scenario with off-mass-shell top squarks is denoted as T1tttt [40] in simplified model scenarios [41–43]. In natural SUSY models, the top squark is typically lighter than the gluino, so we also search for scenarios with on-shell top squarks, denoted as T5tttt.

Simulated event samples for SM background processes are used to determine correction factors, typically near unity, that are used in conjunction with observed event yields in control regions to determine the SM background contribution in the signal regions. The production of $t\bar{t}$ + jets, W + jets, Z + jets, and QCD multijet events is simulated with the MC generator MadGraph5_aMC@NLO 2.2.2

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gluino decay $\tilde{g} \to \tilde{t}_1 \bar{t}$ with $\tilde{t}_1 \to t\tilde{\chi}_1^0$ (T5tttt model), the results are generally similar, except at low neutralino masses, where the excluded gluino mass is somewhat lower. These results extend previous gluino mass limits by about 300 GeV and are among the most stringent constraints on these simplified models of SUSY to date.

We congratulate our colleagues in the CERN accelerator departments for the excellent performance of the LHC and thank the technical and administrative staffs at CERN and at other CMS institutes for their contributions to the success of the CMS effort. In addition, we gratefully acknowledge the computing centers and personnel of the Worldwide LHC Computing Grid for delivering so effectively the computing infrastructure essential to our analyses. Finally, we acknowledge the enduring support for the construction and operation of the LHC and the CMS detector provided by the following funding agencies: BMWFW and FWF (Austria), FNRS and FWO (Belgium), CNPq, CAPES, FAPERJ, and FAPESP (Brazil), MES (Bulgaria), Conseil Européen pour la Recherche Nucléaire (CERN, Switzerland), CAS, MoST, and NSFC (China), COLCIENCIAS (Colombia), MSES and CSF (Croatia), RPF (Cyprus), SENESCYT (Ecuador), MoER, ERC IUT, and European Regional Development Fund ERDF (Estonia). Academy of Finland, MEC, and Helsinki Institute of Physics (HIP, Finland), CEA and CNRS/IN2P3 (France), BMBF, DFG, and HGF (Germany), GSRT (Greece), OTKA and NIH (Hungary), DAE and DST (India), IPM (Iran), SFI (Ireland), INFN (Italy), MSIP and NRF (Republic of Korea), LAS (Lithuania), Malaysia MOE and UM (Malaysia), BUAP, CINVESTAV, CONACYT, LNS, SEP, and UASLP-FAI (Mexico), MBIE (New Zealand), PAEC (Pakistan), MSHE and NSC (Poland), FCT (Portugal), JINR (Dubna), MON, RosAtom, RAS, RFBR, and RAEP (Russia), MESTD (Serbia), SEIDI and CPAN (Spain), Swiss Funding Agencies (Switzerland), Ministry of Science and Technology (MST Taipei), Thailand Center of Excellence in Physics (ThEPCenter), Institute for the Promotion of Teaching Science and Technology of Thailand (IPST), Special Task Force for Activating Research (STAR), and NSTDA (Thailand), TUBITAK and TAEK (Turkey), NASU and SFFR (Ukraine), STFC (United Kingdom), DOE and NSF (U.S.).

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5.A.45. Search for new phenomena with the MT2 variable in the all-hadronic final state produced in proton-proton collisions at sqrt s 13 TeV

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Regular Article - Experimental Physics

Search for new phenomena with the M_{T2} variable in the all-hadronic final state produced in proton–proton collisions at $\sqrt{s} = 13$ TeV

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Abstract A search for new phenomena is performed using events with jets and significant transverse momentum imbalance, as inferred through the M_{T2} variable. The results are based on a sample of proton–proton collisions collected in 2016 at a center-of-mass energy of 13 TeV with the CMS detector and corresponding to an integrated luminosity of 35.9 fb^{-1}. No excess event yield is observed above the predicted standard model background, and the results are interpreted as exclusion limits at 95% confidence level on the masses of predicted particles in a variety of simplified models of R-parity conserving supersymmetry. Depending on the details of the model, 95% confidence level lower limits on the gluino (light-flavor squark) masses are placed up to 2025 (1550) GeV. Mass limits as high as 1070 (1175) GeV are set on the masses of top (bottom) squarks. Information is provided to enable re-interpretation of these results, including model-independent limits on the number of non-standard model events for a set of simplified, inclusive search regions.

1 Introduction

We present results of a search for new phenomena in events with jets and significant transverse momentum imbalance in proton–proton collisions at $\sqrt{s} = 13$ TeV. Such searches were previously conducted by both the ATLAS [1–5] and CMS [6–9] Collaborations. Our search builds on the work presented in Ref. [6], using improved methods to estimate the background from standard model (SM) processes and a data set corresponding to an integrated luminosity of 35.9 fb^{-1} of pp collisions collected during 2016 with the CMS detector at the CERN LHC. Event counts in bins of the number of jets (N_j), the number of b-tagged jets (N_b), the scalar sum of the transverse momenta p_T of all selected jets (H_T), and the M_{T2} variable [6,10] are compared against estimates of the background from SM processes derived from dedicated data control samples. We observe no evidence for a significant excess above the expected background event yield and interpret the results as exclusion limits at 95% confidence level on the production of pairs of gluinos and squarks using simplified models of supersymmetry (SUSY) [11–18]. Model-independent limits on the number of non-SM events are also provided for a simpler set of inclusive search regions.

2 The CMS detector

The central feature of the CMS apparatus is a superconducting solenoid of 6 m internal diameter, providing a magnetic field of 3.8 T. Within the solenoid volume are a silicon pixel and strip tracker, a lead tungstate crystal electromagnetic calorimeter, and a brass and scintillator hadron calorimeter, each composed of a barrel and two endcap sections. Forward calorimeters extend the pseudorapidity (η) coverage provided by the barrel and endcap detectors. Muons are measured in gas-ionization detectors embedded in the steel flux-return yoke outside the solenoid. The first level of the CMS trigger system, composed of custom hardware processors, uses information from the calorimeters and muon detectors to select the most interesting events in a fixed time interval of less than 4 μs. The high-level trigger processor farm further decreases the event rate from around 100 kHz to less than 1 kHz, before data storage. A more detailed description of the CMS detector and trigger system, together with a definition of the coordinate system used and the relevant kinematic variables, can be found in Refs. [19,20].

3 Event selection and Monte Carlo simulation

Events are processed using the particle-flow (PF) algorithm [21], which is designed to reconstruct and identify all particles using the optimal combination of information

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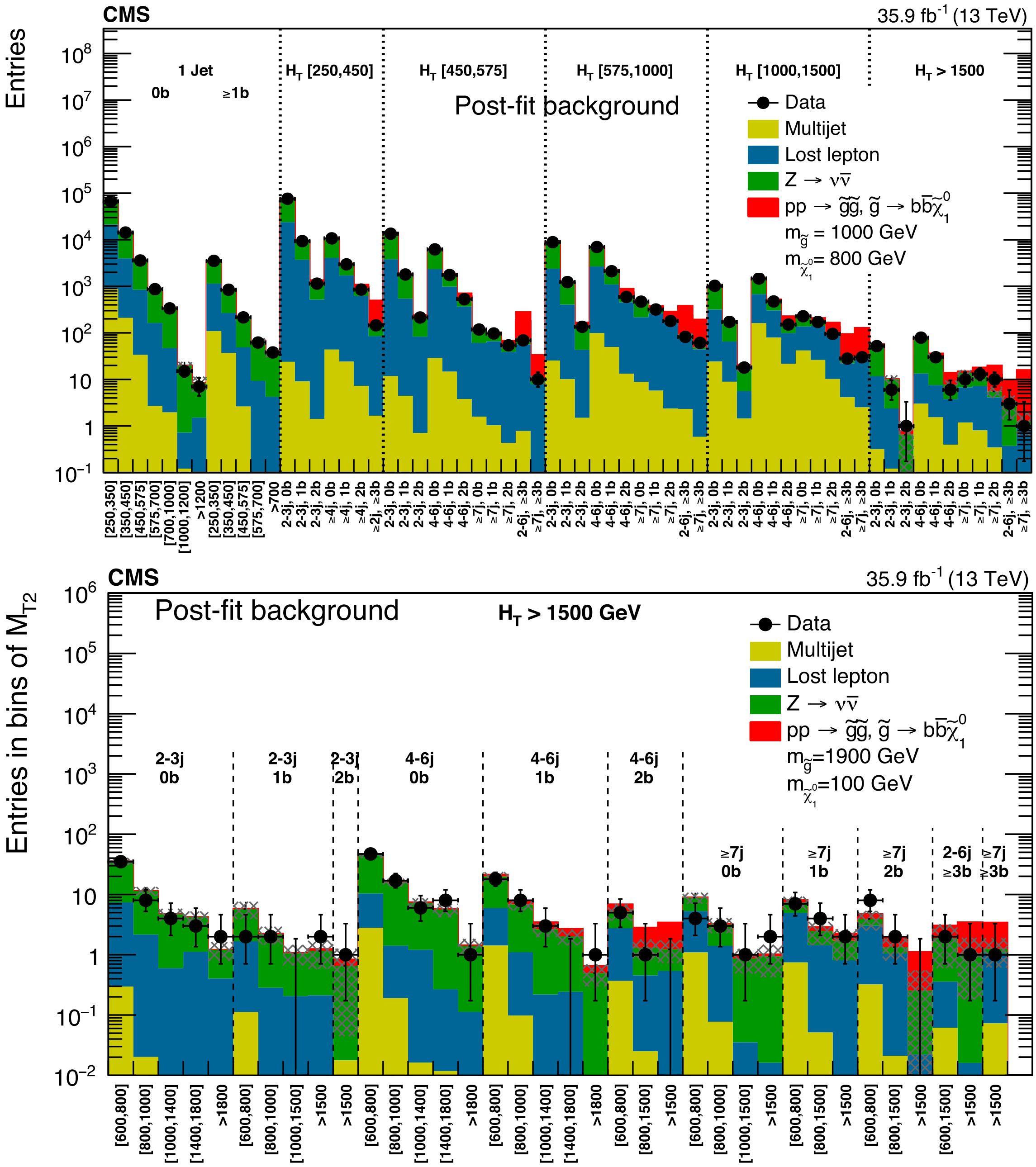

Fig. 14 (Upper) The post-fit background prediction and observed data events in the analysis binning, for all topological regions with the expected yield for the signal model of gluino mediated bottom-squark production ($m_{\tilde{g}} = 1000$ GeV, $m_{\tilde{\chi}^0_1} = 800$ GeV) stacked on top of the expected background. For the monojet regions, the p_T^{jet1} binning is in units of GeV. (Lower) Same for the extreme-H_T region for the same signal with ($m_{\tilde{g}} = 1900$ GeV, $m_{\tilde{\chi}^0_1} = 100$ GeV). On the x-axis, the M_{T2} binning is shown in units of GeV. The hatched bands represent the post-fit uncertainty in the background prediction. For the extreme-H_T region, the last bin is left empty for visualization purposes

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5.A.46. Search for electroweak production of charginos and neutralinos in WH events in proton-proton collisions at sqrt s 13 TeV

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Search for electroweak production of charginos and neutralinos in WH events in proton-proton collisions at $\sqrt{s} = 13\,\text{TeV}$

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Abstract: Results are reported from a search for physics beyond the standard model in proton-proton collision events with a charged lepton (electron or muon), two jets identified as originating from a bottom quark decay, and significant imbalance in the transverse momentum. The search was performed using a data sample corresponding to $35.9\,\text{fb}^{-1}$, collected by the CMS experiment in 2016 at $\sqrt{s} = 13\,\text{TeV}$. Events with this signature can arise, for example, from the electroweak production of gauginos, which are predicted in models based on supersymmetry. The event yields observed in data are consistent with the estimated standard model backgrounds. Limits are obtained on the cross sections for chargino-neutralino ($\widetilde{\chi}_1^{\pm}\widetilde{\chi}_2^0$) production in a simplified model of supersymmetry with the decays $\widetilde{\chi}_1^{\pm} \to \mathrm{W}^{\pm}\widetilde{\chi}_1^0$ and $\widetilde{\chi}_2^0 \to \mathrm{H}\widetilde{\chi}_1^0$. Values of $m_{\widetilde{\chi}_1^{\pm}}$ between 220 and 490 GeV are excluded at 95% confidence level by this search when the $\widetilde{\chi}_1^0$ is massless, and values of $m_{\widetilde{\chi}_1^0}$ are excluded up to 110 GeV for $m_{\widetilde{\chi}_1^{\pm}} \approx 450\,\text{GeV}$.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.47. Search for the pair production of third-generation squarks with two-body decays to a bottom or charm quark and a nuetralino in proton-proton collisions at sqrt s 13 TeV

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Search for the pair production of third-generation squarks with two-body decays to a bottom or charm quark and a neutralino in proton–proton collisions at $\sqrt{s} = 13\,\text{TeV}$

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ABSTRACT

Results are presented from a search for the pair production of third-generation squarks in proton–proton collision events with two-body decays to bottom or charm quarks and a neutralino, which produces a significant imbalance in the transverse momentum. The search is performed using a sample of proton–proton collision data at $\sqrt{s} = 13\,\text{TeV}$ recorded by the CMS experiment at the LHC, corresponding to an integrated luminosity of $35.9\,\text{fb}^{-1}$. No statistically significant excess of events is observed beyond the expected contribution from standard model processes. Exclusion limits are set in the context of simplified models of bottom or top squark pair production. Models with bottom squark masses up to 1220 GeV are excluded at 95% confidence level for light neutralinos, and models with top squark masses of 510 GeV are excluded assuming that the mass splitting between the top squark and the neutralino is small.

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1. Introduction

The standard model (SM) has been extremely successful in describing particle physics phenomena. Nevertheless, it suffers from shortcomings such as the hierarchy problem [1], the need for a fine-tuned cancellation of large quantum corrections to the Higgs mass to maintain a physical value at the observed electroweak scale. Supersymmetry (SUSY) [2–9] postulates a symmetry between bosons and fermions and provides a "natural" solution to the hierarchy problem through the cancellation of quadratic divergences in particle and SUSY particle loop corrections to the Higgs boson mass. In natural SUSY models, light top and bottom squarks are preferred with masses close to the electroweak scale [1,10]. In *R*-parity conserving SUSY models [11], SUSY particles are created in pairs, and the lightest SUSY particle (LSP) is stable. The LSP is assumed here to be the lightest neutralino ($\widetilde{\chi}^0_1$), which is both weakly interacting and stable and therefore has the properties of a dark matter candidate [12].

This letter presents searches for the direct production of pairs of bottom ($\widetilde{b}_1\overline{\widetilde{b}}_1$) and top ($\widetilde{t}_1\overline{\widetilde{t}}_1$) squarks, decaying to multijet final states with a large transverse momentum imbalance. The search is performed using $35.9\,\text{fb}^{-1}$ of data collected in proton–proton (pp) collisions by the CMS detector, at a centre-of-mass energy of 13 TeV, at the CERN LHC [13].

The search for bottom squark pair production is based on the decay mode $\widetilde{b}_1 \to b\widetilde{\chi}^0_1$. This study considers a scenario for top-squark decay that can arise when the mass splitting, $\Delta m \equiv m_{\widetilde{t}_1} - m_{\widetilde{\chi}^0_1}$ is below the mass of the W boson. The decay process $\widetilde{t}_1 \to t\widetilde{\chi}^0_1, t \to bW$ is then suppressed not only because the top quark must be virtual, but also because the W boson must be virtual as well. If flavor-changing neutral current decays $\widetilde{t}_1 \to c\widetilde{\chi}^0_1$ are allowed, then the branching fraction for the two-body decay $\widetilde{t}_1 \to c\widetilde{\chi}^0_1$ can in principle become substantial. Bottom and top squark pair productions are studied in the context of simplified models [14–16]. Fig. 1 illustrates the bottom and top squark decay modes explored in this letter.

The search techniques are based on the work presented in Ref. [17] but use improved discrimination tools to exploit specific kinematic characteristics of the signal models. A charm quark tagging algorithm is used in the top squark search to identify c quarks originating from top squark decays. In addition, specific object reconstruction tools are employed to improve sensitivity to compressed spectrum scenarios, where visible decay products carry low momenta. The new methods and discriminators, as well as the increase in integrated luminosity, lead to considerably improved sensitivity relative to previous searches. While the analysis improvement for compressed spectra is due to the charm and

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Table A.1
The bin number and definition for the compressed search region as shown in Fig. A.1 above.

Compressed region			
$N_{\text{b-tags}}$, $N_{\text{c-tags}}$, N_{SV}	$p_{\text{T}}^{\text{miss}}$ [GeV]	H_{T} (b- or c-tagged jets) [GeV]	Bin
$N_{\text{b-tags}} = 1$	250–300	<100	1
	300–500	<100	2
	500–750	<100	3
	750–1000	<100	4
	>1000	<100	5
$N_{\text{b-tags}} = 2$	250–300	<100	6
		100–200	7
	300–500	<100	8
		100–200	9
	>500	<100	10
		100–200	11
$N_{\text{c-tags}} = 1$	250–300	<100	12
	300–500	<100	13
	500–750	<100	14
	750–1000	<100	15
	>1000	<100	16
$N_{\text{c-tags}} = 2$	250–300	<100	17
		100–200	18
	300–500	<100	19
		100–200	20
	500–750	<100	21
		100–200	22
	>750	<100	23
		100–200	24
$N_{\text{b-tags}} + N_{\text{c-tags}} = 0$, $N_{\text{SV}} > 0$	250–300	–	25
	300–500	–	26
	500–750	–	27
	750–1000	–	28
	>1000	–	29
$N_{\text{b-tags}} + N_{\text{c-tags}} + N_{\text{SV}} = 0$	300–500	–	30
	500–750	–	31
	750–1000	–	32
	1000–1250	–	33
	>1250	–	34

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Appendix A. Correlation matrices for background estimates

To facilitate reinterpretation of the results in a broader range of beyond the standard model scenarios [77], the correlation matrices for the background estimates in the noncompressed and compressed search regions are provided in Figs. A.1 and A.2, respectively. The bin number in the compressed region is the same as in Table 5 of our paper and in the noncompressed region shown below in Table A.1.

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5.A.48. Search for supersymmetry in proton-proton collisions at sqrt s 13 TeV using identified top quarks

Search for supersymmetry in proton-proton collisions at 13 TeV using identified top quarks

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A search for supersymmetry is presented based on proton-proton collision events containing identified hadronically decaying top quarks, no leptons, and an imbalance $p_{\mathrm{T}}^{\mathrm{miss}}$ in transverse momentum. The data were collected with the CMS detector at the CERN LHC at a center-of-mass energy of 13 TeV, and correspond to an integrated luminosity of 35.9 fb^{-1}. Search regions are defined in terms of the multiplicity of bottom quark jet and top quark candidates, the $p_{\mathrm{T}}^{\mathrm{miss}}$, the scalar sum of jet transverse momenta, and the m_{T2} mass variable. No statistically significant excess of events is observed relative to the expectation from the standard model. Lower limits on the masses of supersymmetric particles are determined at 95% confidence level in the context of simplified models with top quark production. For a model with direct top squark pair production followed by the decay of each top squark to a top quark and a neutralino, top squark masses up to 1020 GeV and neutralino masses up to 430 GeV are excluded. For a model with pair production of gluinos followed by the decay of each gluino to a top quark-antiquark pair and a neutralino, gluino masses up to 2040 GeV and neutralino masses up to 1150 GeV are excluded. These limits extend previous results.

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I. INTRODUCTION

The observation [1–3] of a Higgs boson (H) has been the most significant discovery to date at the CERN LHC. However, its relatively small mass of about 125 GeV [4] can be understood in the context of the standard model (SM) only through fine tuning of the associated quantum loop corrections [5]. A compelling model that can account for the observed Higgs boson mass without this fine tuning is the extension to the SM called supersymmetry (SUSY) [6–14]. The main assertion of SUSY is the existence of one or more particles, called superpartners, for every SM particle, where the spin of a superpartner differs from that of its SM counterpart by a half integer. The superpartners of quarks, gluons, and Higgs bosons are squarks $\tilde{q}$, gluinos $\tilde{g}$, and Higgsinos, respectively, while neutralinos $\tilde{\chi}^0$ and charginos $\tilde{\chi}^{\pm}$ are mixtures of the superpartners of electroweak and Higgs bosons. In so-called natural models of SUSY [15], the top squark, bottom squark, gluino, and Higgsinos are required to have masses no larger, and often much smaller, than a few TeV, motivating searches for these particles at the LHC.

In this paper we present a search for top squarks and gluinos. The data were collected in 2016 by the CMS experiment at the LHC and correspond to an integrated luminosity of 35.9 fb^{-1} of proton-proton (pp) collisions at a center-of-mass energy of 13 TeV. The search is performed in all-hadronic events with a large imbalance $p_{\mathrm{T}}^{\mathrm{miss}}$ in transverse momentum, where by "all-hadronic" we mean that the final states are composed solely of hadronic jets. Recent searches for SUSY in a similar final state are presented in Refs. [16–20]. The current analysis is distinguished by the requirement that identified ("tagged") hadronically decaying top quarks be present. It represents an extension, using improved analysis techniques and a data sample 16 times larger, of the study in Ref. [20].

In the search, top squarks are assumed to be produced either through the direct production of a top squark-antisquark pair or in the decay of pair-produced gluinos. They are assumed to decay to the lightest neutralino $\tilde{\chi}_1^0$—taken to be a stable, weakly interacting, lightest SUSY particle (LSP)—and a quark. Since the LSP interacts only weakly, it does not produce a signal in the detector, thus generating $p_{\mathrm{T}}^{\mathrm{miss}}$. A novel top quark tagging algorithm is employed to identify hadronically decaying top quarks produced in the decay chains. The algorithm makes use of the facts that a top quark essentially always decays to a bottom quark and a W boson, and that—in hadronic decays—the W boson decays to a quark-antiquark ($q\bar{q}'$) pair. The algorithm recognizes three different types of decay topology for the top quark. In order of increasing Lorentz boost for the top quark, these are: (i) three distinct jets with no more than one of them identified as a bottom quark jet ("b jet"), where two non-b jets arise from the q

[*]Full author list given at the end of the article.

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TABLE IV. *(Continued)*

Search region	N_t	N_b	m_{T2} [GeV]	p_T^{miss} [GeV]	Data	Predicted background
60	2	2	200–300	350–450	11	$8.7^{+2.7}_{-1.9}{}^{+1.4}_{-1.3}$
61	2	2	200–300	450–600	1	$0.6^{+1.6}_{-0.4}{}^{+0.3}_{-0.2}$
62	2	2	200–400	$\geq$600	1	$0.6^{+1.7}_{-0.5} \pm 0.2$
63	2	2	300–400	250–350	28	$27^{+5}_{-4} \pm 3$
64	2	2	300–400	350–450	6	$4.9^{+2.9}_{-1.6} \pm 0.9$
65	2	2	300–400	450–600	3	$1.7^{+2.4}_{-1.0}{}^{+0.6}_{-0.5}$
66	2	2	400–500	250–450	4	$4.7^{+2.3}_{-1.2}{}^{+0.7}_{-0.8}$
67	2	2	400–500	450–600	1	$1.4^{+2.7}_{-0.7}{}^{+0.4}_{-0.6}$
68	2	2	$\geq$400	$\geq$600	1	$0.5^{+2.7}_{-0.1} \pm 0.2$
69	2	2	$\geq$500	250–450	0	$0.1^{+1.4}_{-0.1} \pm 0.1$
70	2	2	$\geq$500	450–600	2	$0.5^{+2.2}_{-0.1} \pm 0.1$
71	2	$\geq$3	300–900	250–350	3	$9.6^{+3.0}_{-2.1} \pm 1.7$
72	2	$\geq$3	300–900	350–500	2	$0.7^{+2.0}_{-0.4} \pm 0.2$
73	2	$\geq$3	300–1300	$\geq$500	0	$0.3^{+0.5}_{-0.3}{}^{+0.3}_{-0.2}$
74	2	$\geq$3	900–1300	250–350	6	$4.7^{+2.9}_{-1.7}{}^{+0.7}_{-0.9}$
75	2	$\geq$3	900–1300	350–500	3	$1.2^{+1.6}_{-0.7} \pm 0.4$
76	2	$\geq$3	$\geq$1300	250–350	3	$3.5^{+2.1}_{-1.2} \pm 1.4$
77	2	$\geq$3	$\geq$1300	350–500	2	$2.1^{+2.1}_{-1.0}{}^{+0.4}_{-0.5}$
78	2	$\geq$3	$\geq$1300	$\geq$500	0	$0.2^{+1.7}_{-0.3} \pm 0.2$
79	$\geq$3	1	$\geq$300	250–350	0	$0.3^{+2.0}_{-0.3} \pm 0.2$
80	$\geq$3	1	$\geq$300	$\geq$350	1	$0.6^{+1.6}_{-0.5} \pm 0.2$
81	$\geq$3	2	$\geq$300	250–400	1	$1.7^{+1.5}_{-0.7}{}^{+0.6}_{-0.5}$
82	$\geq$3	2	$\geq$300	$\geq$400	0	$0.1^{+2.2}_{-0.1} \pm 0.1$
83	$\geq$3	$\geq$3	$\geq$300	250–350	0	$0.5^{+1.5}_{-0.4} \pm 0.5$
84	$\geq$3	$\geq$3	$\geq$ 300	$\geq$350	0	$0.0^{+1.6}_{-0.0}{}^{+0.1}_{-0.0}$

TABLE V. The observed number of events and the total background prediction for the aggregate search regions. The first uncertainty in the background prediction is statistical and the second is systematic.

Search region	N_t	N_b	m_{T2} [GeV]	p_T^{miss} [GeV]	Data	Predicted background
1	$\geq$1	$\geq$1	$\geq$200	$\geq$250	4424	$4100 \pm 50^{+390}_{-340}$
2	$\geq$2	$\geq$2	$\geq$200	$\geq$250	124	$116 \pm 8^{+15}_{-12}$
3	$\geq$3	$\geq$1	$\geq$200	$\geq$250	2	$3.3^{+2.0}_{-1.1}{}^{+1.2}_{-1.1}$
4	$\geq$3	$\geq$3	$\geq$200	$\geq$250	0	$0.5^{+1.4}_{-0.4} \pm 0.5$
5	$\geq$2	$\geq$1	$\geq$200	$\geq$400	41	$30^{+4}_{-3}{}^{+5}_{-4}$
6	$\geq$1	$\geq$2	$\geq$600	$\geq$400	4	$7.5^{+2.1}_{-1.2}{}^{+2.0}_{-1.9}$

Search region	N_t	N_b	H_T [GeV]	p_T^{miss} [GeV]	Data	Predicted background
7	$\geq$1	$\geq$2	$\geq$1400	$\geq$500	6	$6.0^{+2.7}_{-1.5} \pm 1.5$
8	$\geq$2	$\geq$3	$\geq$600	$\geq$350	7	$3.9^{+2.1}_{-1.2} \pm 0.9$
9	$\geq$2	$\geq$3	$\geq$300	$\geq$500	0	$0.6^{+1.0}_{-0.4} \pm 0.4$
10	$\geq$2	$\geq$3	$\geq$1300	$\geq$500	0	$0.2^{+1.8}_{-0.3} \pm 0.2$

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5.A.49. Search for top squarks and dark matter particles in opposite-charge dilepton final states at sqrt s 13 TeV

Search for top squarks and dark matter particles in opposite-charge dilepton final states at $\sqrt{s} = 13$ TeV

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A search for new physics is presented in final states with two oppositely charged leptons (electrons or muons), jets identified as originating from b quarks, and missing transverse momentum (p_T^{miss}). The search uses proton-proton collision data at $\sqrt{s} = 13$ TeV amounting to 35.9 fb^{-1} of integrated luminosity collected using the CMS detector in 2016. Hypothetical signal events are efficiently separated from the dominant $t\bar{t}$ background with requirements on p_T^{miss} and transverse-mass variables. No significant deviation is observed from the expected background. Exclusion limits are set in the context of simplified supersymmetric models with pair-produced top squarks. For top squarks, decaying exclusively to a top quark and a neutralino, exclusion limits are placed at 95% confidence level on the mass of the lightest top squark up to 800 GeV and on the lightest neutralino up to 360 GeV. These results, combined with searches in the single-lepton and all-jet final states, raise the exclusion limits up to 1050 GeV for the lightest top squark and up to 500 GeV for the lightest neutralino. For top squarks undergoing a cascade decay through charginos and sleptons, the mass limits reach up to 1300 GeV for top squarks and up to 800 GeV for the lightest neutralino. The results are also interpreted in a simplified model with a dark matter (DM) particle coupled to the top quark through a scalar or pseudoscalar mediator. For light DM, mediator masses up to 100 (50) GeV are excluded for scalar (pseudoscalar) mediators. The result for the scalar mediator achieves some of the most stringent limits to date in this model.

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I. INTRODUCTION

The top quark couples to the Higgs boson more strongly than other fermions because of its large mass. As a result, it plays a prominent role in the so-called hierarchy problem [1,2] of the standard model (SM) of particle physics, since its dominant contribution in the loop corrections to the Higgs boson mass exposes the theory to higher energy scales present in nature. Supersymmetry (SUSY) [3–10] is a well-motivated theory beyond the SM that provides a solution to the hierarchy problem. In addition, in R-parity conserving SUSY [11], the lightest SUSY particle (LSP) is stable and can be a viable dark matter (DM) candidate, assuming it is neutral and weakly interacting. Presently, the lighter SUSY particles may have masses in the TeV range and therefore could be produced in proton-proton (pp) collisions at the CERN LHC. The scalar partners of the right- and left-handed top quarks, the top squarks $\tilde{t}_R$ and $\tilde{t}_L$, can be among these particles. These two states mix into the mass eigenstates $\tilde{t}_1$ and $\tilde{t}_2$. The lighter one, $\tilde{t}_1$, could be within the LHC energy reach to provide a natural solution to the hierarchy problem [12], which strongly motivates searches for top squark production.

In this paper, we present a search for top squark pair production in a final state with two leptons (electrons or muons), hadronic jets identified as originating from b quarks, and significant transverse momentum imbalance. The search is performed using data from pp collisions collected with the CMS detector at the LHC during 2016 at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 35.9 fb^{-1}. We employ an efficient background reduction strategy that suppresses the large background from SM $t\bar{t}$ events by several orders of magnitude through use of dedicated transverse-mass variables [13,14]. The predicted SM backgrounds in the various search regions are validated in data control samples orthogonal in selection to the signal regions in data.

The search is interpreted in simplified models [15–17] describing the strong production of pairs of top squarks. We consider different decay modes, following the naming convention in Ref. [18]. In the T2tt model (Fig. 1, upper left), each top squark decays into a top quark and the lightest neutralino $\tilde{\chi}_1^0$, which is the LSP. Alternatively, we consider the T2bW model (Fig. 1, upper right), where both top squarks decay into a b quark and an intermediate

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5.A.50. Search for new phenomena in final states with two opposite-charge same-flavor leptons jets and missing transverse momentum in pp collisions at sqrt s 13 TeV

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Search for new phenomena in final states with two opposite-charge, same-flavor leptons, jets, and missing transverse momentum in pp collisions at $\sqrt{s} = 13$ TeV

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Abstract: Search results are presented for physics beyond the standard model in final states with two opposite-charge, same-flavor leptons, jets, and missing transverse momentum. The data sample corresponds to an integrated luminosity of $35.9\,\mathrm{fb}^{-1}$ of proton-proton collisions at $\sqrt{s} = 13\,\mathrm{TeV}$ collected with the CMS detector at the LHC in 2016. The analysis uses the invariant mass of the lepton pair, searching for a kinematic edge or a resonant-like excess compatible with the Z boson mass. The search for a kinematic edge targets production of particles sensitive to the strong force, while the resonance search targets both strongly and electroweakly produced new physics. The observed yields are consistent with the expectations from the standard model, and the results are interpreted in the context of simplified models of supersymmetry. In a gauge mediated supersymmetry breaking (GMSB) model of gluino pair production with decay chains including Z bosons, gluino masses up to 1500–1770 GeV are excluded at the 95% confidence level depending on the lightest neutralino mass. In a model of electroweak chargino-neutralino production, chargino masses as high as 610 GeV are excluded when the lightest neutralino is massless. In GMSB models of electroweak neutralino-neutralino production, neutralino masses up to 500–650 GeV are excluded depending on the decay mode assumed. Finally, in a model with bottom squark pair production and decay chains resulting in a kinematic edge in the dilepton invariant mass distribution, bottom squark masses up to 980–1200 GeV are excluded depending on the mass of the next-to-lightest neutralino.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry, Beyond Standard Model, Lepton production

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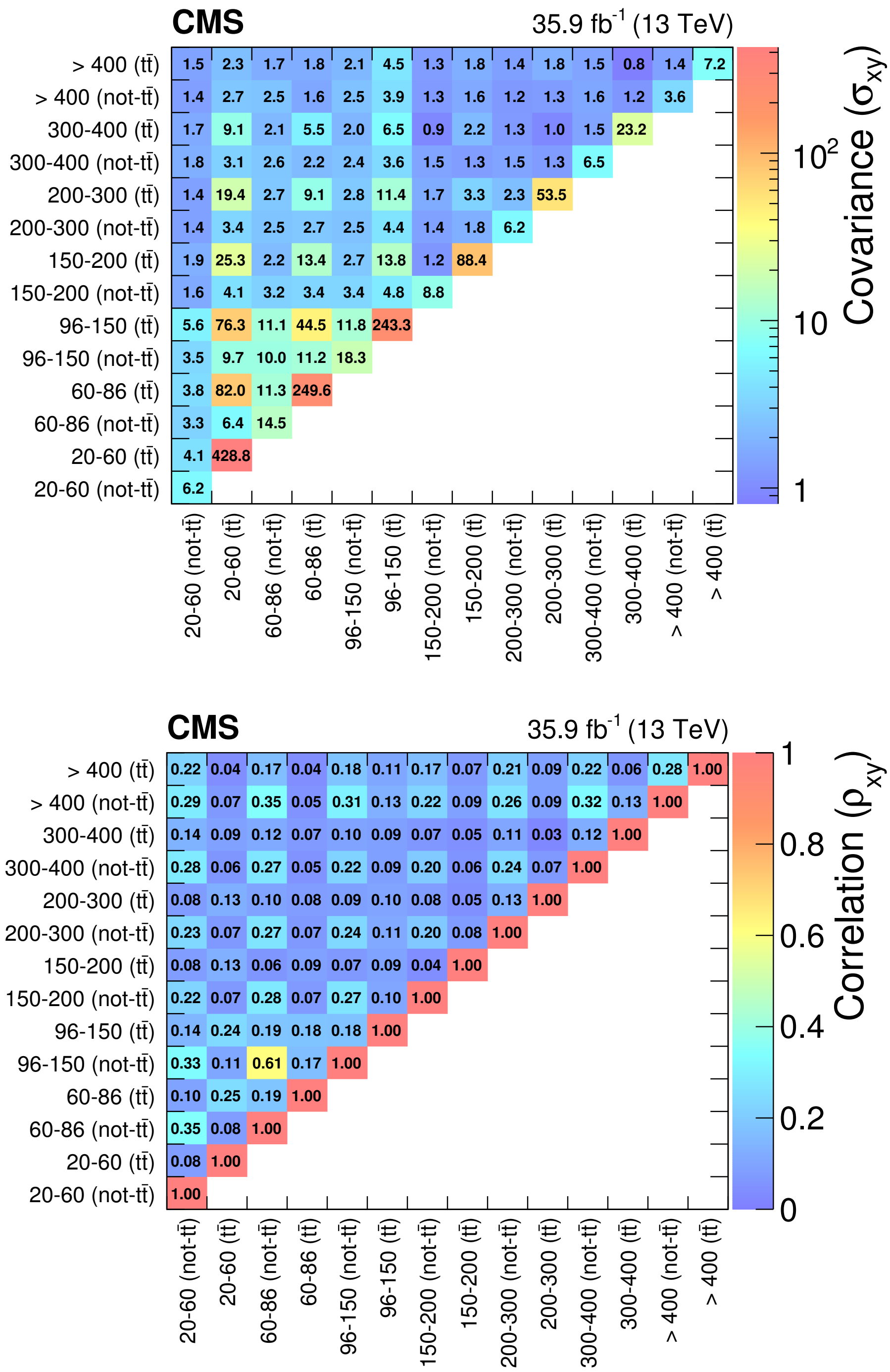

Figure 13. The covariance (upper) and correlation (lower) matrices for the background predictions in the edge strong-production SRs. The matrices are symmetric, but only the entries along and above the diagonal are shown for simplicity.

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5.A.51. Combined search for electroweak production of charginos and neutralinos in proton-proton collisions at sqrt s 13 TeV

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Combined search for electroweak production of charginos and neutralinos in proton-proton collisions at $\sqrt{s} = 13$ TeV

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Abstract: A statistical combination of several searches for the electroweak production of charginos and neutralinos is presented. All searches use proton-proton collision data at $\sqrt{s} = 13$ TeV, recorded with the CMS detector at the LHC in 2016 and corresponding to an integrated luminosity of 35.9 fb^{-1}. In addition to the combination of previous searches, a targeted analysis requiring three or more charged leptons (electrons or muons) is presented, focusing on the challenging scenario in which the difference in mass between the two least massive neutralinos is approximately equal to the mass of the Z boson. The results are interpreted in simplified models of chargino-neutralino or neutralino pair production. For chargino-neutralino production, in the case when the lightest neutralino is massless, the combination yields an observed (expected) limit at the 95% confidence level on the chargino mass of up to 650 (570) GeV, improving upon the individual analysis limits by up to 40 GeV. If the mass difference between the two least massive neutralinos is approximately equal to the mass of the Z boson in the chargino-neutralino model, the targeted search requiring three or more leptons obtains observed and expected exclusion limits of around 225 GeV on the second neutralino mass and 125 GeV on the lightest neutralino mass, improving the observed limit by about 60 GeV in both masses compared to the previous CMS result. In the neutralino pair production model, the combined observed (expected) exclusion limit on the neutralino mass extends up to 650–750 (550–750) GeV, depending on the branching fraction assumed. This extends the observed exclusion achieved in the individual analyses by up to 200 GeV. The combined result additionally excludes some intermediate gaps in the mass coverage of the individual analyses.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.52. Search for electroweak production of charginos and neutralinos in multi-lepton final states in proton-proton collisions at sqrt s 13 TeV

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Search for electroweak production of charginos and neutralinos in multilepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV

The CMS collaboration

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Abstract: Results are presented from a search for the direct electroweak production of charginos and neutralinos in signatures with either two or more leptons (electrons or muons) of the same electric charge, or with three or more leptons, which can include up to two hadronically decaying tau leptons. The results are based on a sample of proton-proton collision data collected at $\sqrt{s} = 13\,\text{TeV}$, recorded with the CMS detector at the LHC, corresponding to an integrated luminosity of $35.9\,\text{fb}^{-1}$. The observed event yields are consistent with the expectations based on the standard model. The results are interpreted in simplified models of supersymmetry describing various scenarios for the production and decay of charginos and neutralinos. Depending on the model parameters chosen, mass values between 180 GeV and 1150 GeV are excluded at 95% CL. These results significantly extend the parameter space probed for these particles in searches at the LHC. In addition, results are presented in a form suitable for alternative theoretical interpretations.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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Individuals have received support from the Marie-Curie program and the European Research Council and Horizon 2020 Grant, contract No. 675440 (European Union); the Leventis Foundation; the A. P. Sloan Foundation; the Alexander von Humboldt Foundation; the Belgian Federal Science Policy Office; the Fonds pour la Formation à la Recherche dans l'Industrie et dans l'Agriculture (FRIA-Belgium); the Agentschap voor Innovatie door Wetenschap en Technologie (IWT-Belgium); the Ministry of Education, Youth and Sports (MEYS) of the Czech Republic; the Council of Science and Industrial Research, India; the HOMING PLUS program of the Foundation for Polish Science, cofinanced from European Union, Regional Development Fund, the Mobility Plus program of the Ministry of Science and Higher Education, the National Science Center (Poland), contracts Harmonia 2014/14/M/ST2/00428, Opus 2014/13/B/ST2/02543, 2014/15/B/ST2/03998, and 2015/19/B/ST2/02861, Sonata-bis 2012/07/E/ST2/01406; the National Priorities Research Program by Qatar National Research Fund; the Programa Clarín-COFUND del Principado de Asturias; the Thalis and Aristeia programs cofinanced by EU-ESF and the Greek NSRF; the Rachadapisek Sompot Fund for Postdoctoral Fellowship, Chulalongkorn University and the Chulalongkorn Academic into Its 2nd Century Project Advancement Project (Thailand); the Welch Foundation, contract C-1845; and the Weston Havens Foundation (U.S.A.).

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5.A.53. Searches for pair production of charginos and top squarks in final states with two oppositely charged leptons in proton-proton collisions at sqrt s 13 TeV

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Searches for pair production of charginos and top squarks in final states with two oppositely charged leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV

The CMS collaboration

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Abstract: A search for pair production of supersymmetric particles in events with two oppositely charged leptons (electrons or muons) and missing transverse momentum is reported. The data sample corresponds to an integrated luminosity of $35.9\,\mathrm{fb}^{-1}$ of proton-proton collisions at $\sqrt{s} = 13\,\mathrm{TeV}$ collected with the CMS detector during the 2016 data taking period at the LHC. No significant deviation is observed from the predicted standard model background. The results are interpreted in terms of several simplified models for chargino and top squark pair production, assuming R-parity conservation and with the neutralino as the lightest supersymmetric particle. When the chargino is assumed to undergo a cascade decay through sleptons, with a slepton mass equal to the average of the chargino and neutralino masses, exclusion limits at 95% confidence level are set on the masses of the chargino and neutralino up to 800 and 320 GeV, respectively. For top squark pair production, the search focuses on models with a small mass difference between the top squark and the lightest neutralino. When the top squark decays into an off-shell top quark and a neutralino, the limits extend up to 420 and 360 GeV for the top squark and neutralino masses, respectively.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.54. Search for supersymmetry in events with a tau lepton pair and missing transverse momentum in proton-proton collisions at sqrt s 13 TeV

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Search for supersymmetry in events with a τ lepton pair and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV

The CMS collaboration

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Abstract: A search for the electroweak production of supersymmetric particles in proton-proton collisions at a center-of-mass energy of 13 TeV is presented in final states with a τ lepton pair. Both hadronic and leptonic decay modes are considered for the τ leptons. Scenarios involving the direct pair production of τ sleptons, or their indirect production via the decays of charginos and neutralinos, are investigated. The data correspond to an integrated luminosity of 35.9 fb^{-1} collected with the CMS detector in 2016. The observed number of events is consistent with the standard model background expectation. The results are interpreted as upper limits on the cross section for τ slepton pair production in different scenarios. The strongest limits are observed in the scenario of a purely left-handed low mass τ slepton decaying to a nearly massless neutralino. Exclusion limits are also set in the context of simplified models of chargino-neutralino and chargino pair production with decays to τ leptons, and range up to 710 and 630 GeV, respectively.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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SR label	$t\bar{t}$	DY+jets	WW+jets	WW+jets	Rest	QCD	Total Bkg	$\widetilde{\chi}_1^{\pm}\ \widetilde{\chi}_2^0$ (400,1)	$\widetilde{\chi}_1^{\pm}\ \widetilde{\chi}_2^0$ (400,175)	$\widetilde{\tau}_L$(90,1)	Observed
0j-1	$2.5 \pm 1.0 \pm 1.6$	<0.1	$0.6 \pm 0.3 \pm 0.4$	$0.6 \pm 0.4^{+0.7}_{-0.6}$	$0.1 \pm 0.1 \pm 0.1$	<0.1	$3.9 \pm 1.1 \pm 1.8$	<0.1	<0.1	<0.1	3
0j-2	$40.0 \pm 3.8 \pm 12.9$	$155.4 \pm 13.5 \pm 20.7$	$21.1 \pm 1.9 \pm 6.0$	$248.7 \pm 7.1 \pm 64.4$	$37.3 \pm 11.6 \pm 22.4$	$35.0 \pm 16.2 \pm 23.8$	$537.5 \pm 25.4 \pm 76.4$	<0.1	<0.1	$0.4 \pm 0.0^{+2.5}_{-0.4}$	584
0j-3	$21.3 \pm 2.8 \pm 7.1$	<0.1	$9.9 \pm 1.3 \pm 3.8$	$47.2 \pm 3.1 \pm 13.3$	$1.6^{+1.6}_{-1.6} \pm 3.9$	$4.3^{+5.1}_{-4.3} \pm 5.5$	$84.2 \pm 6.9 \pm 16.9$	<0.1	<0.1	$0.1 \pm 0.0^{+0.8}_{-0.1}$	105
0j-4	$0.4 \pm 0.4^{+0.8}_{-0.4}$	<0.1	$0.2 \pm 0.2^{+0.6}_{-0.2}$	$0.6 \pm 0.4 \pm 0.6$	$0.0^{+0.0}_{-0.0} \pm 2.3$	<0.1	$1.2 \pm 0.6 \pm 2.5$	<0.1	<0.1	<0.1	2
0j-5	$5.7 \pm 1.4 \pm 2.8$	$2.4 \pm 1.5 \pm 1.6$	$2.9 \pm 0.7 \pm 1.2$	$7.1 \pm 1.2 \pm 2.2$	$1.8 \pm 1.5^{+2.4}_{-1.8}$	<0.1	$20.0 \pm 2.9 \pm 4.8$	<0.1	<0.1	$0.2 \pm 0.0^{+1.2}_{-0.2}$	21
0j-6	$105.3 \pm 6.2 \pm 33.2$	<0.1	$66.2 \pm 3.4 \pm 18.8$	$302.9 \pm 7.8 \pm 79.8$	$16.1 \pm 5.6 \pm 10.7$	$22.6 \pm 11.2 \pm 15.9$	$513.1 \pm 16.4 \pm 90.6$	$0.2 \pm 0.0^{+0.6}_{-0.2}$	<0.1	<0.1	531
0j-7	$82.9 \pm 5.5 \pm 29.4$	$1.4 \pm 1.4^{+1.5}_{-1.4}$	$46.0 \pm 2.8 \pm 13.1$	$424.6 \pm 9.3 \pm 110.0$	$19.9 \pm 6.2 \pm 16.1$	$19.6 \pm 13.8 \pm 16.9$	$594.4 \pm 18.8 \pm 116.9$	$0.1 \pm 0.0^{+0.2}_{-0.1}$	<0.1	$0.3 \pm 0.0^{+1.8}_{-0.3}$	618
0j-8	$2.6 \pm 0.9^{+2.9}_{-2.6}$	<0.1	$0.6 \pm 0.3 \pm 0.6$	$1.9 \pm 0.6 \pm 1.5$	$0.1 \pm 0.1^{+0.2}_{-0.1}$	<0.1	$5.3 \pm 1.1 \pm 3.4$	<0.1	<0.1	<0.1	7
0j-9	$4.9 \pm 1.3 \pm 1.9$	<0.1	$1.6 \pm 0.5 \pm 0.8$	$1.7 \pm 0.6 \pm 1.4$	$0.4 \pm 0.3^{+0.7}_{-0.4}$	<0.1	$8.6 \pm 1.5 \pm 2.6$	<0.1	<0.1	<0.1	12
0j-10	$119.2 \pm 6.5 \pm 33.4$	$28.3 \pm 5.9 \pm 8.0$	$49.7 \pm 2.9 \pm 13.2$	$123.9 \pm 5.0 \pm 36.1$	$10.2 \pm 3.9 \pm 8.8$	$13.0 \pm 10.3 \pm 12.2$	$344.2 \pm 15.2 \pm 53.7$	$0.2 \pm 0.0^{+0.6}_{-0.2}$	<0.4	$0.9 \pm 0.0^{+6.1}_{-0.9}$	324
0j-11	$17.0 \pm 2.5 \pm 6.6$	<0.1	$10.5 \pm 1.3 \pm 3.4$	$21.4 \pm 2.1 \pm 6.3$	$1.6 \pm 1.0^{+3.3}_{-1.6}$	<0.1	$50.7 \pm 3.6 \pm 10.3$	<0.1	<0.1	<0.1	50
0j-12	$129.0 \pm 6.8 \pm 36.9$	$0.5 \pm 0.5 \pm 0.5$	$61.3 \pm 3.2 \pm 16.5$	$224.7 \pm 6.7 \pm 58.9$	$8.2 \pm 3.2 \pm 3.4$	$11.6 \pm 7.9 \pm 9.8$	$435.3 \pm 13.2 \pm 72.2$	$0.2 \pm 0.0^{+0.6}_{-0.2}$	<0.2	$0.4 \pm 0.0^{+2.4}_{-0.4}$	457
0j-13	$27.9 \pm 3.2 \pm 8.8$	<0.1	$10.7 \pm 1.3 \pm 3.7$	$29.2 \pm 2.4 \pm 8.9$	$1.0 \pm 0.2^{+1.5}_{-1.0}$	<0.1	$68.8 \pm 4.2 \pm 13.1$	$0.2 \pm 0.0^{+0.5}_{-0.2}$	<0.1	<0.1	77
0j-14	$4.6 \pm 1.2 \pm 2.1$	<0.1	$1.3 \pm 0.5 \pm 1.1$	$1.8 \pm 0.6 \pm 1.0$	$0.3 \pm 0.3^{+0.5}_{-0.3}$	<0.1	$8.1 \pm 1.5 \pm 2.6$	<0.1	<0.1	<0.1	9
0j-15	$40.2 \pm 3.7 \pm 12.7$	$4.8 \pm 2.3 \pm 2.4$	$14.3 \pm 1.5 \pm 4.0$	$27.8 \pm 2.3 \pm 7.6$	$2.8 \pm 1.4 \pm 1.9$	$0.7^{+4.1}_{-0.7} \pm 4.2$	$90.5 \pm 6.8 \pm 16.2$	$0.2 \pm 0.0^{+0.5}_{-0.2}$	<0.1	$0.2 \pm 0.0^{+1.6}_{-0.2}$	82
0j-16	$18.0 \pm 2.5 \pm 5.6$	<0.1	$8.1 \pm 1.2 \pm 2.8$	$11.4 \pm 1.5 \pm 3.4$	<0.1	$2.9^{+3.4}_{-2.9} \pm 3.7$	$40.5 \pm 4.7 \pm 8.1$	$0.1 \pm 0.0^{+0.2}_{-0.1}$	<0.1	<0.1	51
0j-17	$30.5 \pm 3.2 \pm 10.4$	<0.1	$13.5 \pm 1.5 \pm 4.0$	$15.2 \pm 1.7 \pm 4.9$	<0.1	<0.1	$59.3 \pm 4.0 \pm 12.2$	$0.1 \pm 0.0^{+0.3}_{-0.1}$	<0.2	<0.1	61
0j-18	$9.0 \pm 1.8 \pm 3.7$	<0.1	$2.2 \pm 0.6 \pm 1.0$	$1.1 \pm 0.5^{+1.2}_{-1.1}$	$0.2 \pm 0.1 \pm 0.1$	$1.9^{+1.9}_{-1.9} \pm 2.1$	$14.5 \pm 2.7 \pm 4.5$	<0.1	<0.1	<0.1	11
0j-19	$10.5 \pm 1.9 \pm 3.7$	<0.1	$5.1 \pm 0.9 \pm 1.7$	$8.7 \pm 1.3 \pm 3.2$	$0.6 \pm 0.4 \pm 0.5$	$0.7^{+2.0}_{-0.7} \pm 2.0$	$25.6 \pm 3.2 \pm 5.5$	$0.1 \pm 0.0^{+0.3}_{-0.1}$	<0.2	<0.1	30
0j-20	$1.4 \pm 0.7 \pm 1.0$	<0.1	$0.5 \pm 0.3 \pm 0.5$	$2.8 \pm 0.8 \pm 1.3$	$0.2 \pm 0.1 \pm 0.2$	<0.1	$4.9 \pm 1.1 \pm 1.7$	$0.1 \pm 0.0^{+0.3}_{-0.1}$	<0.1	<0.1	5
0j-21	$0.4 \pm 0.4^{+0.6}_{-0.4}$	<0.1	<0.4	$3.5 \pm 0.8 \pm 1.4$	$0.2 \pm 0.1 \pm 0.1$	$1.6^{+1.9}_{-1.6} \pm 2.1$	$5.6 \pm 2.1 \pm 2.6$	$0.3 \pm 0.0^{+0.6}_{-0.3}$	<0.1	<0.1	4
0j-22	$2.4 \pm 0.9 \pm 1.3$	<0.1	$0.7 \pm 0.3 \pm 0.5$	$0.9 \pm 0.4 \pm 0.5$	<0.1	<0.1	$4.1 \pm 1.0 \pm 1.4$	<0.1	<0.1	<0.1	2
1j-1	$1.0 \pm 0.6^{+1.1}_{-1.0}$	<0.1	$0.2 \pm 0.2^{+0.2}_{-0.2}$	$0.2 \pm 0.2^{+0.8}_{-0.2}$	$1.6 \pm 1.4^{+2.8}_{-1.6}$	$3.6 \pm 2.7 \pm 3.3$	$6.5 \pm 3.2 \pm 4.5$	<0.1	<0.1	<0.1	2
1j-2	$20.2 \pm 2.7 \pm 7.6$	<0.1	$6.3 \pm 1.0 \pm 2.4$	$10.1 \pm 1.4 \pm 3.1$	$1.8 \pm 0.5 \pm 1.0$	$0.3^{+5.3}_{-0.3} \pm 5.3$	$38.6 \pm 6.2 \pm 10.1$	<0.1	<0.1	<0.1	43
1j-3	$138.1 \pm 7.0 \pm 40.1$	$50.5 \pm 6.2 \pm 10.4$	$52.3 \pm 3.0 \pm 15.0$	$114.1 \pm 4.8 \pm 29.6$	$23.0 \pm 7.0 \pm 10.5$	<0.1	$378.0 \pm 13.0 \pm 54.1$	$0.0 \pm 0.0^{+0.2}_{-0.0}$	$0.2 \pm 0.1 \pm 0.1$	$0.2 \pm 0.0^{+1.1}_{-0.2}$	382
1j-4	$121.1 \pm 6.6 \pm 36.9$	$1.2 \pm 0.7 \pm 0.8$	$48.0 \pm 2.9 \pm 13.8$	$59.4 \pm 3.5 \pm 16.6$	$5.7 \pm 2.0 \pm 4.2$	<0.1	$235.3 \pm 8.3 \pm 43.0$	<0.1	$0.1 \pm 0.1 \pm 0.1$	<0.1	211
1j-5	$6.6 \pm 1.5 \pm 3.3$	$0.5 \pm 0.5^{+0.6}_{-0.5}$	$2.2 \pm 0.6 \pm 1.0$	$5.3 \pm 1.0 \pm 2.4$	$0.7 \pm 0.4 \pm 0.7$	$6.6 \pm 4.2 \pm 5.3$	$22.0 \pm 4.7 \pm 6.8$	<0.1	<0.1	<0.1	20
1j-6	$49.3 \pm 4.2 \pm 15.3$	$3.2 \pm 1.8 \pm 1.9$	$9.7 \pm 1.3 \pm 3.3$	$15.9 \pm 1.8 \pm 4.8$	$2.8 \pm 1.1^{+5.0}_{-2.8}$	<0.1	$80.8 \pm 5.2 \pm 17.3$	<0.1	<0.1	$0.0 \pm 0.0^{+0.2}_{-0.0}$	54
1j-7	$266.9 \pm 9.8 \pm 79.3$	$0.5 \pm 0.4 \pm 0.4$	$86.1 \pm 3.8 \pm 23.4$	$165.0 \pm 5.8 \pm 42.5$	$14.2 \pm 4.5 \pm 6.5$	$17.7 \pm 11.7 \pm 14.6$	$550.3 \pm 17.3 \pm 94.3$	$0.3 \pm 0.1^{+0.7}_{-0.3}$	<0.3	$0.1 \pm 0.0^{+0.7}_{-0.1}$	511
1j-8	$35.9 \pm 3.6 \pm 11.5$	<0.1	$6.4 \pm 1.0 \pm 3.0$	$9.4 \pm 1.4 \pm 3.0$	<0.1	<0.1	$51.7 \pm 4.0 \pm 12.3$	$0.1 \pm 0.0^{+0.2}_{-0.1}$	<0.1	<0.1	62
1j-9	$31.5 \pm 3.3 \pm 10.5$	<0.1	$7.1 \pm 1.1 \pm 2.9$	$9.9 \pm 1.4 \pm 3.1$	$0.6 \pm 0.5 \pm 0.6$	$2.0^{+2.8}_{-2.0} \pm 3.0$	$51.1 \pm 4.8 \pm 11.8$	$0.0 \pm 0.0^{+0.2}_{-0.0}$	<0.1	<0.1	40
1j-10	$68.1 \pm 4.9 \pm 21.3$	$0.4 \pm 0.4 \pm 0.4$	$20.7 \pm 1.9 \pm 5.9$	$14.1 \pm 1.7 \pm 4.1$	$1.4^{+1.8}_{-1.4} \pm 2.7$	<0.1	$104.8 \pm 5.8 \pm 22.7$	$0.2 \pm 0.0^{+0.4}_{-0.2}$	<0.1	<0.1	88
1j-11	$93.2 \pm 5.8 \pm 30.3$	<0.1	$28.8 \pm 2.2 \pm 9.0$	$25.8 \pm 2.3 \pm 7.4$	$1.7 \pm 0.7 \pm 1.7$	<0.1	$149.5 \pm 6.6 \pm 32.5$	$0.4 \pm 0.1^{+1.0}_{-0.4}$	$0.4 \pm 0.1 \pm 0.1$	<0.1	122
1j-12	<0.4	<0.1	<0.1	$0.4 \pm 0.3 \pm 0.4$	<0.1	<0.1	$0.5 \pm 0.3 \pm 0.6$	<0.1	<0.1	<0.1	0
1j-13	$2.6 \pm 0.9 \pm 1.2$	<0.1	$1.1 \pm 0.4 \pm 0.5$	$1.5 \pm 0.6 \pm 0.8$	<0.1	<0.1	$5.4 \pm 1.2 \pm 1.6$	<0.1	<0.1	<0.1	1
1j-14	$23.7 \pm 2.8 \pm 7.0$	<0.1	$6.1 \pm 1.0 \pm 2.0$	$6.4 \pm 1.1 \pm 2.1$	$0.3 \pm 0.1 \pm 0.3$	$2.8 \pm 2.8^{+3.1}_{-2.8}$	$39.4 \pm 4.2 \pm 8.2$	$0.1 \pm 0.0^{+0.3}_{-0.1}$	<0.1	<0.1	30
1j-15	$250.0 \pm 9.2 \pm 73.0$	$6.4 \pm 1.8 \pm 3.1$	$48.0 \pm 2.8 \pm 12.8$	$81.0 \pm 4.0 \pm 21.2$	$10.6 \pm 2.4 \pm 7.9$	$3.9^{+7.1}_{-3.9} \pm 7.3$	$399.8 \pm 13.0 \pm 77.9$	$0.9 \pm 0.1^{+2.3}_{-0.9}$	$1.0 \pm 0.1 \pm 0.2$	$0.5 \pm 0.0^{+3.1}_{-0.5}$	353
1j-16	$74.3 \pm 5.0 \pm 21.1$	<0.1	$21.1 \pm 1.9 \pm 6.1$	$15.9 \pm 1.8 \pm 4.6$	$1.7 \pm 0.7 \pm 0.7$	$2.8^{+4.1}_{-2.8} \pm 4.4$	$115.8 \pm 7.0 \pm 22.9$	$0.3 \pm 0.0^{+0.6}_{-0.3}$	<0.4	<0.1	93
1j-17	$124.7 \pm 6.6 \pm 35.9$	<0.1	$27.0 \pm 2.1 \pm 7.5$	$23.3 \pm 2.2 \pm 6.8$	$1.2 \pm 0.3 \pm 0.4$	$2.0^{+5.7}_{-2.0} \pm 5.8$	$178.2 \pm 9.2 \pm 37.7$	$0.3 \pm 0.0^{+0.7}_{-0.3}$	$0.3 \pm 0.1 \pm 0.1$	<0.1	158
1j-18	$60.7 \pm 4.6 \pm 17.8$	<0.1	$9.1 \pm 1.2 \pm 2.8$	$11.8 \pm 1.5 \pm 3.6$	$1.1 \pm 0.4 \pm 0.5$	$2.8^{+3.6}_{-2.8} \pm 3.9$	$85.5 \pm 6.2 \pm 18.8$	$0.1 \pm 0.0^{+0.3}_{-0.1}$	$0.2 \pm 0.1 \pm 0.1$	<0.1	70
1j-19	$39.4 \pm 3.6 \pm 12.2$	<0.1	$8.8 \pm 1.2 \pm 3.0$	$10.0 \pm 1.4 \pm 3.6$	<3.6	$1.3^{+2.9}_{-1.3} \pm 3.0$	$59.7 \pm 5.0 \pm 13.9$	$0.3 \pm 0.0^{+0.7}_{-0.3}$	<0.4	<0.1	57
1j-20	$5.2 \pm 1.3 \pm 3.3$	<0.1	$1.6 \pm 0.5 \pm 0.7$	$2.6 \pm 0.7 \pm 1.2$	$0.4 \pm 0.1 \pm 0.2$	<0.1	$9.8 \pm 1.6 \pm 3.6$	$0.3 \pm 0.1^{+0.8}_{-0.3}$	<0.2	<0.1	5
1j-21	$0.7 \pm 0.5^{+0.8}_{-0.7}$	<0.1	$0.2 \pm 0.2 \pm 0.2$	$2.6 \pm 0.7 \pm 1.0$	<0.1	<0.1	$3.6 \pm 0.9 \pm 1.3$	$0.6 \pm 0.1^{+1.5}_{-0.6}$	$0.3 \pm 0.1 \pm 0.1$	<0.1	5
1j-22	$0.4 \pm 0.4^{+0.7}_{-0.4}$	<0.1	<0.1	$0.7 \pm 0.4 \pm 0.5$	$0.3 \pm 0.1 \pm 0.2$	$1.9 \pm 1.9^{+2.1}_{-1.9}$	$3.3 \pm 2.0 \pm 2.3$	$0.2 \pm 0.0^{+0.4}_{-0.2}$	<0.1	<0.1	1

Table 14. Numbers of expected and observed events in the eμ channel. The total background includes the total uncertainty, while for each process the statistical and systematic uncertainties are quoted separately. The two numbers that are quoted for the benchmark signal models are the masses of the parent SUSY particle and the $\widetilde{\chi}_1^0$, respectively, in GeV. In the case of the chargino-neutralino signal models, the first number within parentheses indicates the common $\widetilde{\chi}_1^{\pm}$ and $\widetilde{\chi}_2^0$ mass in GeV.

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5.A.55. Non-destructive testing of industrial equipment using muon radiography

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Non-destructive testing of industrial equipment using muon radiography

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A new application of muon radiography (MR) is presented in the context of non-destructive testing of industrial equipment. The long-term operation of industrial facilities frequently involves the deterioration of critical components such as pipes and cauldrons due to corrosion and other processes. The precise determination of the inner state of this equipment is needed to ensure the integrity of the facility. MR can be used to infer the thickness of these components through the comparison and further classification of muon observables with respect to well-known templates. A simulation example is presented where the thickness of a pipe made of steel is studied using the Point of Closest Approach method and simple Kolmogorov–Smirnov statistical tests. A precision of about 2–4 mm is obtained using a simple detector with a spatial resolution of 4 mm and exposure times of about 2 h.

This article is part of the Theo Murphy meeting issue 'Cosmic-ray muography'.

1. Introduction

In 1912, Victor Hess initiated a series of balloon-flights over the roofs of Vienna to measure the intensity of the radiation in the atmosphere at different heights. He found that radiation was more intense at greater altitudes and concluded that the Earth was being bombarded by a flux of particles. These particles are nowadays known as cosmic rays and they are known to be composed mainly of protons which often interact with the atoms of the atmosphere producing large cascades

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Kolmogorov–Smirnov test can be performed to classify the target sample. It should be noted that more sophisticated classifiers based on machine learning techniques can be applied directly to the muon observables. This work is currently under investigation.

Table 1 shows the score obtained in the KS test when each of the test samples is compared with every template sample. These numbers show how in most of the cases the best compatibility between a test and a template sample occurs when the thickness of the pipes are coincident. This is strictly true for variations of the order of 2 cm. The cases in which a variation of 0.2 cm was performed are not so clear and some confusion can be observed with the neighbouring templates. A good discrimination at the level of 0.2–0.4 cm can be claimed.

5. Conclusion

This simulation study shows, using a simple mathematical apparatus, how statistical compatibility between muon observables can be used to classify the amount of wear suffered by a steel-made pipe. A simple set-up composed of four hybrid multiwire–multistrip chambers have been considered with a spatial resolution of 4 mm. Pipes with a different thickness have been modelled and MR simulations of 6900 s each have been produced. The distribution of the radius of the POCA scattering centres have been studied and compared to template simulations with different thicknesses. The results show how this procedure is able to discriminate between templates differing by 0.2–0.4 cm. New studies will be carried out to understand what resolution can be obtained with this technique, reducing the symmetry assumptions and using more sophisticated algorithms based on machine learning classifiers.

Authors' contributions. P.M.R.-d.A. conceived the study and performed most of the simulations, figures and mathematical analysis. P.G.G. and P.M.R.-d.A. drafted the manuscript, while C.D.G. and A.O.A. contributed to the preparation and maintenance of the computational infrastructure and have read the analysis and provided useful comments.

Competing interests. The authors declare that they have no competing interests.

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5.A.56. Search for dark matter particles produced in association with a top quark pair at sqrt s 13 TeV

Search for Dark Matter Particles Produced in Association with a Top Quark Pair at $\sqrt{s} = 13$ TeV

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A search is performed for dark matter particles produced in association with a top quark pair in proton-proton collisions at $\sqrt{s} = 13$ TeV. The data correspond to an integrated luminosity of 35.9 fb^{-1} recorded by the CMS detector at the LHC. No significant excess over the standard model expectation is observed. The results are interpreted using simplified models of dark matter production via spin-0 mediators that couple to dark matter particles and to standard model quarks, providing constraints on the coupling strength between the mediator and the quarks. These are the most stringent collider limits to date for scalar mediators, and the most stringent for pseudoscalar mediators at low masses.

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Astrophysical observations strongly motivate the existence of dark matter [1–4], which may originate from physics beyond the standard model. In a large class of models, dark matter consists of stable, weakly interacting massive particles (χ) [4], which may be pair produced at the CERN LHC via mediators that couple both to dark matter particles and to standard model quarks. The dark matter particles would escape detection, thereby creating a transverse momentum imbalance ($\vec{p}_T^{\,\mathrm{miss}}$) in the event. Searches at collider experiments can offer insights on the nature of the mediator and provide constraints on dark matter masses of $\mathcal{O}(10\ \mathrm{GeV})$ and below, a region that is difficult to explore both in direct and indirect searches for dark matter. A favored class of models proposes a spin-0 mediator with standard model Higgs-like Yukawa coupling to quarks, which therefore couples preferentially to the top quark [5–9]. Consequently, in this class of models dark matter production in association with a top quark pair ($t\bar{t}$) can offer better search sensitivity compared to other modes such as production in association with a jet [10–14]. At the LHC, the $t\bar{t}+\chi\bar{\chi}$ process is probed through the signature of $t\bar{t}$ accompanied by $\vec{p}_T^{\,\mathrm{miss}}$ [15,16].

The top quark almost always decays to a W boson and a b quark. The W boson can decay leptonically (to a charged lepton and a neutrino) or hadronically (to a quark pair). The signal regions (SRs) of the search cover three $t\bar{t}$ decay modes: the all-hadronic, lepton + jets (ℓ + jets where $\ell = e, \mu$), and dileptonic (ee, $e\mu$, $\mu\mu$) final states where neither, either, or both of the W bosons decay to leptons, respectively. This Letter presents a search for $t\bar{t}+\chi\bar{\chi}$ in pp collisions at $\sqrt{s} = 13$ TeV with data recorded by the CMS experiment in 2016, corresponding to an integrated luminosity of 35.9 fb^{-1}. The analysis strategy is similar to Ref. [17], but includes additional SRs for the dileptonic mode.

The central feature of the CMS detector is a superconducting solenoid providing a magnetic field of 3.8 T. Within the solenoid volume are the silicon pixel and strip trackers, a lead tungstate crystal electromagnetic calorimeter, and a brass and scintillator hadron calorimeter. A steel and quartz-fiber Cherenkov forward hadron calorimeter extends the pseudorapidity (η) coverage. The muon system consists of gas-ionization detectors embedded in the steel flux-return yoke outside the solenoid. A two-tiered trigger system [18] selects events at a rate of about 1 kHz for storage. A detailed description of the CMS detector is provided in Ref. [19].

The event reconstruction is based on the CMS particle-flow algorithm [20], which reconstructs and identifies individual particles using an optimized combination of the detector information. The $\vec{p}_T^{\,\mathrm{miss}}$ vector is computed as the negative vector sum of the transverse momenta ($\vec{p}_T$) of all the particles in an event. Jets are formed from particles using the anti-k_T algorithm [21,22] with a distance parameter of 0.4. Corrections are applied to calibrate the jet momentum [23] and to remove energy from additional collisions in the same or adjacent bunch crossings (pileup) [24]. Jets in the analysis are required to have $p_T > 30$ GeV and $|\eta| < 2.4$, and to satisfy identification criteria [25] that minimize spurious detector effects. A combined secondary vertex b tagging algorithm [26] is used to identify jets originating from b quarks (b-tagged jets). A multivariate discriminant, the “resolved top tagger” (RTT) [17], based

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for dark matter masses of $\mathcal{O}$ (10 GeV) and below. Over much of the parameter space, the $t\bar{t}+\chi\bar{\chi}$ signature has better sensitivity for spin-0 mediators than dark matter production in association with a jet [14]—previously considered to be the most sensitive signature. For the pseudoscalar model, the $t\bar{t}+\chi\bar{\chi}$ signature provides the most stringent cross section constraints for mediator masses of around 200 GeV and below. The observed (expected) limits exclude a pseudoscalar mediator with mass below 220 (320) GeV under the $g_q = g_\chi = 1$ benchmark scenario. The $t\bar{t}+\chi\bar{\chi}$ signature provides the best sensitivity for the scalar mediator model and is currently the only collider signature that is sufficiently sensitive to exclude regions of parameter space with these values of the couplings. The observed exclusion of a mediator with mass below 160 GeV (240 GeV expected) provides the most stringent constraint to date on this model.

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5.A.57. Search for supersymmetric partners of electrons and muons in proton–proton collisions at sqrt s 13TeV

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Search for supersymmetric partners of electrons and muons in proton–proton collisions at $\sqrt{s} = 13\,\text{TeV}$

The CMS Collaboration *

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ABSTRACT

A search for direct production of the supersymmetric (SUSY) partners of electrons or muons is presented in final states with two opposite-charge, same-flavour leptons (electrons and muons), no jets, and large missing transverse momentum. The data sample corresponds to an integrated luminosity of $35.9\,\text{fb}^{-1}$ of proton–proton collisions at $\sqrt{s} = 13\,\text{TeV}$, collected with the CMS detector at the LHC in 2016. The search uses the M_{T2} variable, which generalises the transverse mass for systems with two invisible objects and provides a discrimination against standard model backgrounds containing W bosons. The observed yields are consistent with the expectations from the standard model. The search is interpreted in the context of simplified SUSY models and probes slepton masses up to approximately 290, 400, and 450 GeV, assuming right-handed only, left-handed only, and both right- and left-handed sleptons (mass degenerate selectrons and smuons), and a massless lightest supersymmetric particle. Limits are also set on selectrons and smuons separately. These limits show an improvement on the existing limits of approximately 150 GeV.

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1. Introduction

The standard model (SM) of particle physics provides a description of the fundamental particles and their interactions, and its predictions have been confirmed experimentally with increasing precision over the last several decades. Supersymmetry (SUSY) [1–8], one of the most promising extensions of the SM, addresses several open questions for which the SM has no answer, such as the hierarchy problem and the origin of dark matter. The theory postulates a new fundamental symmetry that assigns to each SM particle a SUSY partner whose spin differs by one half, causing the SUSY partner of an SM fermion (boson) to be a boson (fermion). In addition to stabilising the Higgs boson (H) mass via cancellations between quantum loop corrections including the top quark and its superpartner, SUSY provides a natural dark matter candidate, if R-parity [9] is conserved, in the form of the lightest SUSY particle (LSP), which is assumed to be massive and stable.

SUSY particles (sparticles) that are coloured, the squarks and gluinos, are produced via the strong interaction with significantly larger cross sections than colourless sparticles of equal masses, at the Large Hadron Collider (LHC). However, if the squarks and gluinos are too heavy to be produced at the LHC, the direct production of colourless sparticles, such as the electroweak superpartners (charginos ($\widetilde{\chi}^{\pm}_1$), neutralinos ($\widetilde{\chi}^0_2$), and sleptons ($\widetilde{\ell}$)), would be the dominant observable SUSY process.

Supersymmetric models predict charged sleptons ($\widetilde{e}_{\mathrm{L}}$, $\widetilde{\mu}_{\mathrm{L}}$, $\widetilde{\tau}_{\mathrm{L}}$, $\widetilde{e}_{\mathrm{R}}$, $\widetilde{\mu}_{\mathrm{R}}$, $\widetilde{\tau}_{\mathrm{R}}$), the superpartners of the charged left-handed and right-handed SM leptons, which can be produced at proton–proton (pp) colliders in direct electroweak pair production. At sufficiently heavy slepton masses, the sleptons undergo a two-body decay into one of the heavier neutralinos or a chargino, while direct decays to a neutralino LSP are favoured for light slepton masses. This Letter presents a search for directly produced selectrons and smuons ($\widetilde{e}_{\mathrm{L}}$, $\widetilde{\mu}_{\mathrm{L}}$, $\widetilde{e}_{\mathrm{R}}$, $\widetilde{\mu}_{\mathrm{R}}$), under the assumption of direct decays $\widetilde{\ell} \to \ell \widetilde{\chi}^0_1$ with 100% branching ratio, as sketched in Fig. 1. The final state contains little or no hadronic activity and provides a clean signature composed of two opposite-charge (OC), same-flavour (SF) leptons

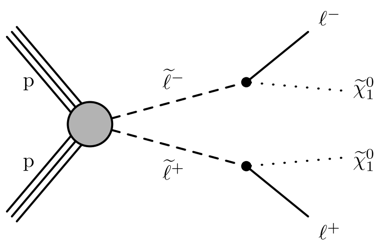

Fig. 1. Diagram of slepton pair production with direct decays into leptons and the lightest neutralino.

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5.A.58. Search for the pair production of light top squarks in the emu final state in proton-proton collisions at sqrt s 13 TeV

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Search for the pair production of light top squarks in the $e^{\pm}\mu^{\mp}$ final state in proton-proton collisions at $\sqrt{s} = 13$ TeV

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Abstract: A search for the production of a pair of top squarks at the LHC is presented. This search targets a region of parameter space where the kinematics of top squark pair production and top quark pair production are very similar, because of the mass difference between the top squark and the neutralino being close to the top quark mass. The search is performed with 35.9 fb^{-1} of proton-proton collisions at a centre-of-mass energy of $\sqrt{s} = 13$ TeV, collected by the CMS detector in 2016, using events containing one electron-muon pair with opposite charge. The search is based on a precise estimate of the top quark pair background, and the use of the M_{T2} variable, which combines the transverse mass of each lepton and the missing transverse momentum. No excess of events is found over the standard model predictions. Exclusion limits are placed at 95% confidence level on the production of top squarks up to masses of 208 GeV for models with a mass difference between the top squark and the lightest neutralino close to that of the top quark.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry, top squark

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5.A.59. Search for supersymmetry in final states with two oppositely charged same-flavor leptons and missing transverse momentum in proton-proton collisions at sqrt(s) = 13 TeV

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Abstract: A search for phenomena beyond the standard model in final states with two oppositely charged same-flavor leptons and missing transverse momentum is presented. The search uses a data sample of proton-proton collisions at $\sqrt{s} = 13\,\text{TeV}$, corresponding to an integrated luminosity of $137\,\text{fb}^{-1}$, collected by the CMS experiment at the LHC. Three potential signatures of physics beyond the standard model are explored: an excess of events with a lepton pair, whose invariant mass is consistent with the Z boson mass; a kinematic edge in the invariant mass distribution of the lepton pair; and the nonresonant production of two leptons. The observed event yields are consistent with those expected from standard model backgrounds. The results of the first search allow the exclusion of gluino masses up to 1870 GeV, as well as chargino (neutralino) masses up to 750 (800) Ge V, while those of the searches for the other two signatures allow the exclusion of light-flavor (bottom) squark masses up to 1800 (1600) GeV and slepton masses up to 700 GeV, respectively, at 95% confidence level within certain supersymmetry scenarios.

Keywords: Hadron-Hadron scattering (experiments), Supersymmetry

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5.A.60. Machine Learning Methods for the Prediction of the Inclusion Content of Clean Steel Fabricated by Electric Arc Furnace and Rolling

metals
Article

Machine Learning Methods for the Prediction of the Inclusion Content of Clean Steel Fabricated by Electric Arc Furnace and Rolling

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Abstract: Machine Learning classification models have been trained and validated from a dataset (73 features and 13,616 instances) including experimental information of a clean cold forming steel fabricated by electric arc furnace and hot rolling. A classification model was developed to identify inclusion contents above the median. The following algorithms were implemented: Logistic Regression, K-Nearest Neighbors, Decision Tree, Random Forests, AdaBoost, Gradient Boosting, Support Vector Classifier and Artificial Neural Networks. Random Forest displayed the best results overall and was selected for the subsequent analyses. The Permutation Importance method was used to identify the variables that influence the inclusion cleanliness and the impact of these variables was determined by means of Partial Dependence Plots. The influence of the final diameter of the coil has been interpreted considering the changes induced by the process of hot rolling in the distribution of inclusions. Several variables related to the secondary metallurgy and tundish operations have been identified and interpreted in metallurgical terms. In addition, the inspection area during the microscopic examination of the samples also appears to influence the inclusion content. Recommendations have been established for the sampling process and for the manufacturing conditions to optimize the inclusionary cleanliness of the steel.

Keywords: inclusion content; machine learning; classification; random forest

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1. Introduction

The steelmaking industry imposes tight controls on steel cleanliness because non-metallic inclusions (NMIs) negatively influence both the manufacture and the application of steel products. NMIs of different nature (mostly oxides, sulfides and nitrides) are always present in steel, but their amount and size greatly varies. They come from the combination between the low solubility metallic elements present in the liquid steel with elements such as oxygen, sulfur or nitrogen. The type, size, shape and quantity of NMIs depend on the steel grade and the details of the steelmaking and casting processes. NMIs are classified as "endogenous" or "exogenous". The former occurs within the liquid steel, precipitating out during cooling and solidification (for example, during deoxidation, because of the intentional addition of calcium to combine with sulfur). Exogenous inclusions are, in turn, entrapments of materials from refractory interfaces, slag or other materials in contact with the melt. Endogenous inclusions are typically more uniformly distributed than exogenous

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5.B. Publicaciones científicas no indexadas en JCR

5.B.1. Muon Reconstruction in the CMS Detector

Available on CMS information server **CMS AN 2008/097**

The Compact Muon Solenoid Experiment

Analysis Note

The content of this note is intended for CMS internal use and distribution only

July 8, 2009

Muon Reconstruction in the CMS Detector

G. Abbiendi[1], N. Adam[16], J. Alcaraz[2], N. Amapane[3], E. Antillon[4], R. Bellan[5], I. Belotelov[6], I. Bloch[7] C. Campagnari[8], T. Cox[9], A. Everett[4], A. Grelli[4], J. Goh[10], V. Halyo[16], A. Hunt[16], E. James[7], P. Kalavase[8], S.C. Kao[11], M. Konecki[12], D. Kovalskyi[8], V. Krutelyov[8], C. Liu [4], P. Martinez [17] D. Miller[4] M. Mulders[5], N. Neumeister [4], D. Pagano[4], J. Pivarski[14], J. Ribnik[8], S. Stoynev[13], P. Traczyk[5], D. Trocino[3], J.R. Vlimant[8], R. Wilkinson[15]

Abstract

The reconstruction of muons in CMS combining tracking and calorimeter information is described. The high-level muon physics objects are reconstructed in a multi-faceted way, with the final collection being comprised of three different muon types, Stand-alone, Global and Tracker muons. The reconstruction in the muon spectrometer starts with the reconstruction of hit positions in the DT, CSC and RPC subsystems. Hits within each DT and CSC chamber are then matched to form "segments" (track stubs). The segments are collected and matched to generate seeds that are used as a starting point for the actual track fit of DT, CSC and RPC hits. The result is a reconstructed track in the muon spectrometer, and is called "stand-alone muon". Stand-alone muon tracks are then matched with tracker tracks to generate "global muon" tracks, featuring the full CMS resolution. "Tracker muons" are muon objects reconstructed with an algorithm that starts from a silicon tracker track and looks for compatible segments in the muon chambers. A unique collection of muon objects is assembled from the stand-alone, global, and tracker muon collections. Muon isolation quantities using calorimeter information and tracker tracks for muons defined at the three different levels are combined into the muon objects.

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8 Conclusions

The ability to identify and reconstruct muons with high efficiency over the whole kinematic range of the LHC is the key to the success of the CMS experiment. This requires algorithms that are robust and flexible and use all the available detector information over the full geometrical acceptance of the CMS detector. We have shown that the current algorithims fulfill all the necessary requirements for the reconstruction of single muons with full detector simulation. Muons are identified and reconstructed with efficiencies of close to 99% with clearly defined understood efficiency losses due to the CMS detector geometry. Muons are reconstructed in three categories

- Stand-Alone muons using just muon detector information and the interaction point
- Global muons which match stand-alone muons with silicon tracker tracks.
- Tracker muons which match silicon tracker tracks with calorimeter energy deposits and muon system hits

The final output from the algorithms is a muon physics object together with a compatibility value indicating the probabilty of the track being a muon. These algorithms satisfy all of the requirements for robust high efficiency reconstruction. These algorithms are the foundation for real data taking and analysis and can be tuned for the more complex environments of real events and actual detector inefficiencies.

Acknowledgements

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5.B.2. Una visión global de la pandemia Covid-19: qué sabemos y qué estamos investigando desde el CSIC

UNA VISIÓN GLOBAL DE LA PANDEMIA COVID-19:

QUÉ SABEMOS Y QUÉ ESTAMOS INVESTIGANDO DESDE EL CSIC

Informe elaborado desde la Plataforma Temática Interdisciplinar Salud Global/Global Health del CSIC

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Rogelio Pujol, Estadístico y experto en Métodos Avanzados de Estadística Aplicada en el Instituto Nacional de Estadística (INE)

5.C. Libros y capítulos de libros

5.C.1. A MIP Timing Detector for the CMS Phase-2 Upgrade: Technical Design Report

ISBN: 978-92-9083-523-3

CMS

A MIP TIMING DETECTOR FOR THE CMS PHASE-2 UPGRADE
TECHNICAL DESIGN REPORT

CERN-LHCC-2019-003
ISBN: 978-92-9083-523-3

CERN European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

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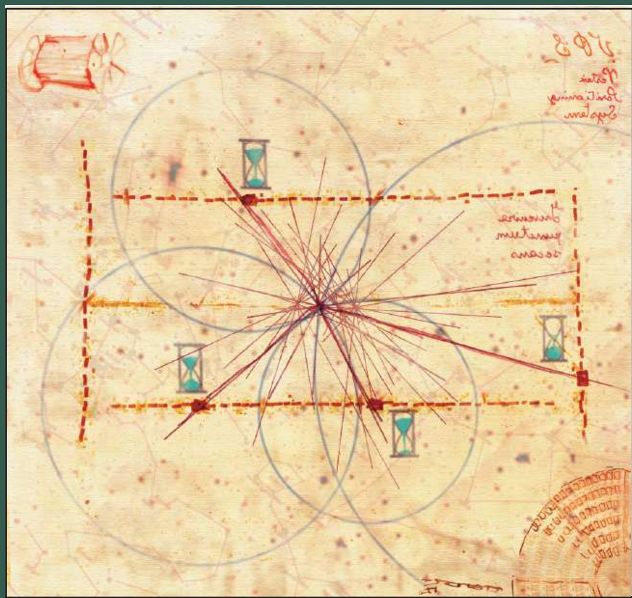
29 March 2019

CMS



A MIP Timing Detector

for the CMS Phase-2 Upgrade
Technical Design Report

Editors

J. Butler, T. Tabarelli de Fatis

Chapter Editors

A. Apresyan, J. Bendavid, A. Bornheim, J. Butler, N. Cartiglia, F. Golf, L. Gray, W. Li, T. Liu, M.T. Lucchini, S. Lusin, W. Lustermann, P. Martinez Ruiz del Arbol, P. Meridiani, I. Ojalvo, O. Sahin, D. Stuart, T. Tabarelli de Fatis, S. Tkaczyk, J. Varela

Cover Design

S. Cittolin

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The very useful input from the MTD collaboration, the CMS internal reviewers (Wolfgang Adam, Johan Borg, Tulika Bose, Didier Contardo, Karl Gill, Frank Hartmann, Jan Kieseler, Katja Klein, Frans Meijers, Michael Moll, Paolo Rumerio, Alexander Savin, Jeff Spalding, Roberto Tenchini, Wolfram Zeuner), and the chair of the Phase-2 TDRs editorial board (C. Lourenço) helped to improve the quality of this document and is greatly appreciated. We also thank the individual and institutional reviewers who participated in the Collaboration-Wide Review of the TDR.

We would like to acknowledge the support of the CMS Management, the Upgrade Project Coordination team as well as the many contributions from CMS Technical Coordination. We thank the Offline, Computing, Physics Performance and Datasets, Upgrade Physics Strategy Group, and all the Physics groups for their help in developing and executing the physics and performance studies. The CMS Tracker and Endcap Calorimeter Upgrade projects provided crucial support and advice on various inter-detector coordination issues.

Chapter 5

Reconstruction, performance and physics impact

5.1 Introduction

Studies have been performed on the impact of the MTD on the physics deliverables of CMS. The CMS event reconstruction relies on a Particle Flow algorithm [10] that provides the most global description of an event. With the addition of track-time information from the MTD, the event reconstruction is significantly improved. The time information from charged tracks is exploited in a space-time reconstruction of tracks and vertices (Section 5.2). Final state particles and observables are defined using vertices and track collections that are cleaned from spurious (pileup) tracks using space and time compatibility requirements (Section 5.3). The cumulative effect of the benefits on individual final state observables is quantified on a selected set of analyses of key physics processes of the HL-LHC program, such as precision measurements of the Higgs boson, the search for di-Higgs boson production, and the search for new signatures, including long-lived particles (Section 5.4). Particle identification from time-of-flight measurements with the MTD also provides unique opportunities in Heavy Ion physics.

Acceptance and efficiency studies, as well as the study of the track association with the time measurements in the MTD and the study of physics observables rely on a complete simulation of the MTD in the CMS Phase-2 detector using the GEANT package [113], with a detailed description of the MTD geometry (Section 5.2). The digitization process, with a complete simulation of the signal pulses, the leading edge discrimination and amplitude reconstruction, is based on the current design of the readout electronics and tuned using input from test beam data. The time information from the MTD, matched to the charged tracks and extrapolated to the vertex (Sections 5.2.5 and 5.2.6), is incorporated in the track information and used in a "time-aware" 4D-extension of the deterministic annealing technique of the CMS vertex reconstruction. Current results demonstrate that the back-propagation of the time information to the production vertex makes a negligible contribution to the time resolution and validate the reliability of the results from the fast-simulation approach adopted in the MTD Technical Proposal [8].

In this document, studies of the MTD impact on final state observables and on the analyses of specific physics processes rely either on full simulation or on the parametric fast-simulation model of Ref. [8], in which the time information is added to the CMS simulation and reconstruction workflow with an appropriate smearing of the simulated track time at the production vertex. The efficiency for track-time measurements is also included in the fast simulation. For some studies, the DELPHES simulation package [114] is used.

Where relevant – for example for final state observables such as particle isolation – the studies

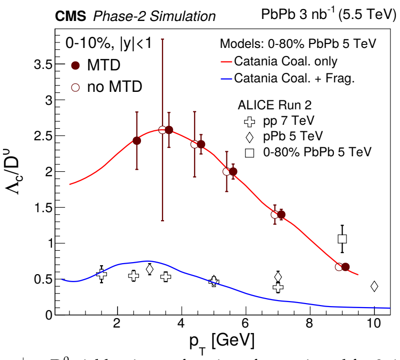

Figure 5.36: The Λ_c^+ to D^0 yield ratio as a function of p_T projected for 0–10% most central PbPb collisions at 5.5 TeV without (open circles) and with (filled circles) MTD, for rapidity range $|y| < 1$, corresponding to an integrated luminosity of 3 nb^{-1}. Only points with significance greater than 2 are shown. Curves represent theoretical calculations at midrapidity assuming scenarios of coalescence only and coalescence plus fragmentations [128]. Measurements in pp, pPb and 0–80% centrality PbPb at midrapidity by the ALICE collaboration [129, 130] are also shown.

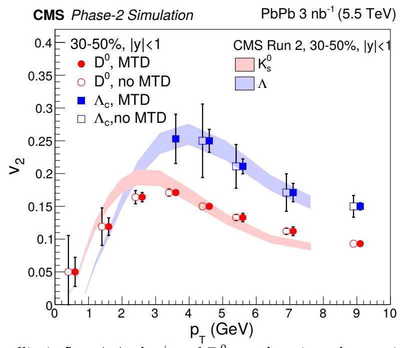

Figure 5.37: The elliptic flow (v_2) of Λ_c^+ and D^0 as a function of p_T projected for 30–50% centrality PbPb collisions at 5.5 TeV without (open markers) and with (filled makers) MTD, for rapidity range $|y| < 1$, corresponding to an integrated luminosity of 3 nb^{-1}. Only points with significance greater than 2 are shown. Measurements of strange meson and baryon v_2 for 30–50% centrality PbPb collisions from the CMS Run-2 are also shown (shaded bands) [131].

5.D. Trabajos presentados en congresos nacionales o internacionales

5.D.1. The CMS Muon System Alignment

The CMS Muon System Alignment

Parallel given at CHEP09: International Conference On Computing In High Energy Physics And Nuclear Physics, 21-27 Mar 2009, Prague (Czech Republic) The talk is selected (cms speaker).

Abstract *[preliminary, not approved yet]*

The alignment of the Muon System of CMS is performed using different techniques: photogrammetry measurements, optical alignment and alignment with tracks. For track-based alignment, several methods are employed, ranging from a hit-impact point (HIP) algorithm and a procedure exploiting chamber overlaps to a global fit method based on the Millepede approach. For start-up alignment, cosmic muon and beam halo signatures play a very strong role, in particular as long as available integrated luminosity is still significantly limiting the size of the muon sample from collisions. During the last commissioning runs the first aligned geometries have been produced and validated, and have been used at the CMS offline computing infrastructure in order to perform improved reconstructions. This presentation develops the computational aspects related to the calculation of alignment constants at the CERN Analysis Facility (CAF), the production and population of databases and the validation and performance in the official reconstruction. Also the integration of track-based and other sources of alignment is discussed.

Speakers

Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria)

Files

- CMSMuonAlignmentCHEP09.pdf (2701.7 kB) [Final draft approved by Rainer Mankel] ✖

Bibliography

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Certificate of Presence

We hereby certify that Pablo Martínez Ruiz del Árbol, member of the CMS Collaboration, has given the following oral presentations at conferences, workshops, and seminars on the dates and places indicated below:

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5.D.2. A software and computing prototype for CMS muon system alignment

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A software and computing prototype for CMS muon system alignment

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A software and computing prototype for CMS Muon System alignment

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Abstract. A precise alignment of Muon System is one of the requirements to fulfill the CMS expected performance to cover its physics program. A first prototype of the software and computing tools to achieve this goal has been successfully tested during the CSA06, Computing, Software and Analysis Challenge in 2006. Data was exported from Tier-0 to Tier-1 and Tier-2, where the alignment software was run. Re-reconstruction with new geometry files was also performed at remote sites. Performance and validation of the software has also been tested on cosmic data, taken during the MTCC in 2006.

1. Introduction

Since the early stages of design and development, it was well understood that a precise knowledge of the position of the different elements of CMS (Compact Muon Solenoid at LHC) Muon Spectrometer was necessary. To achieve this goal, different hardware, software and computing solutions were developed. We discuss in this article the present situation of the later two, covering diferent issues: the calculation of alignment constants from data, and implementation of the constants obtained by this or other methods into the track reconstruction, and the workflow and dataflow in a grid environment, including remote access to the alignment database. The existing tools were tested during two major challenges in 2006 for CMS, the CSA06 (Computing, Software and Analysis Challenge, described in [1]) and the MTCC06 (Magnet Test and Cosmic Challenge, where a fraction of the detector was operated taking cosmic data [2]).

2. Workflow at CSA06

As part of the general CSA06 challenge, the Muon System Offline Alignment was tested, emulating at smaller scale the expected situation during the real data taking, starting in 2008. After data processing at CERN a new stream known as ALCARECO was produced, selecting the muon track information relevant for alignment, reducing the size of the sample by two orders of magnitude. This data was then transferred to the Tier-2 where the analysis was to be performed. Full samples were also transferred for validation jobs. In all the cases the CMS schema for data transfers was followed.

Different type of jobs were run at the Tier-2 as the data arrived. Initially basic magnitudes were plotted, checking the quality of the data. Then, alignment jobs were executed using

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misaligned geometries and producing new geometry databases. The time interval between sample availability at CERN Tier-0 and first results was about 24 hours.

Finally re-reconstruction was performed on full validation samples, comparing its performance for different algorithms, samples and tunings.

3. Computing infrastructure at CSA06

The alignment analysis was mainly run in a computer cluster situated at IFCA (Instituto de Física de Cantabria) which is part of the Spanish Federated Tier2 for CMS [4]. A total of 90 CPUs (Xeon at 3.2 GHz, 1 GB RAM) were available during the CSA06 challenge. All of them could be fully dedicated to the alignment exercise during significant periods of time. The standard LCG [3] software was deployed in the site.

The storage system was based on DPM [5] with a total disk space of 12 TB. An important part of this space was reserved for the data samples associated to the alignment exercise. Data was moved from CERN with PhEDEx [7], which is a CMS tool that provides an efficient data placement and file transfer system based on FTS and SRM.

On the other hand, the alignment and calibration (Alicali) tasks need access to remote databases located at CERN where Alicali constants are stored and retrieved. Since many of these queries may take place concurrently and their values are unlikely to change so often a caching proxy system based on Squid was developed by CMS. Access is then performed using a local proxy server with the FroNTier [6] package installed so the load on the central CERN database is lowered.

Standard CMS software (CMSSW) was initially installed manually, and centrally at later stages once a procedure was developed within the collaboration. For this exercise a software installation area shared among WNs was used.

4. Alignment Software

The strategy defined for the alignment in CMS software (CMSSW) consists in reading a geometry file in the format of an ORACLE DB (that could be local or remote at Tier-0, with access through FroNTier), incorporating the corrections during track reconstruction, keeping local coordinates of detectors unchanged, and applying the corrections in the transformation to the global frame. The same tools are used to simulate misalignment, providing distorted geometry files also introduced during reconstruction. One of the advantages of this method is that fully simulated samples with a misaligned geometry are not required (samples are produced with the nominal geometry, and changes take place afterwards at reconstruction level).

In particular different misalignment scenarios were designed to provide a realistic picture of the expected situation in the detector. The ShortTerm scenario represents a detector not yet aligned, when a compresion of CMS due to the magnetic field, and an elliptical deformation induced by the weight of the detector are expected. And the LongTerm scenario refers to the situation of the detector after the expected alignment precision (from both hardware and software alignment systems) has been achieved. A specific software package known as MuonAlignment was developed in order to create and manage alignment databases inside the CMS software framework. The package supports a logical structure of components following the mechanical design of the detector, in order to allow correlated misalignments of many subdetectors. The description of each scenario is provided through configuration files, providing a fast and flexible access and modification procedure.

A package called MuonStandaloneAlgorithm (figure 1) implementing a track-based alignment algorithm following Blobel's method [8] has also been developed inside the framework.

The coordinates of a hit in a misaligned geometry can be expanded in a Taylor's series as a function of the increment of the track and alignment parameters. Provided that the value of these alignment parameters is small enough (and this is always true because of a first alignment

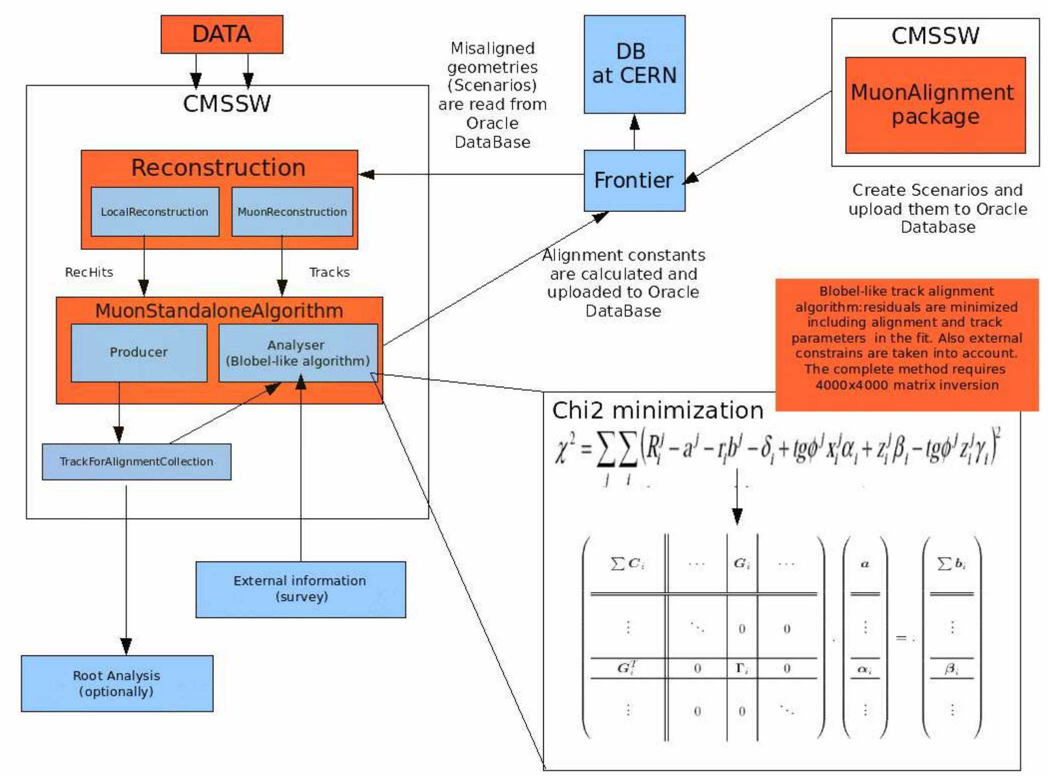
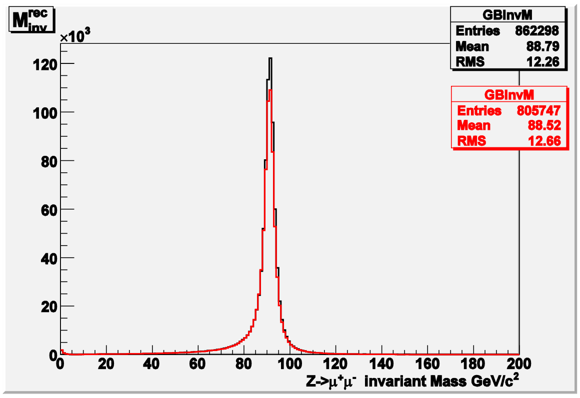


Figure 1. Alignment software framework for the offline alignment exercise during CSA06. The software is fully integrated inside CMSSW and makes use of standard reconstruction and database packages

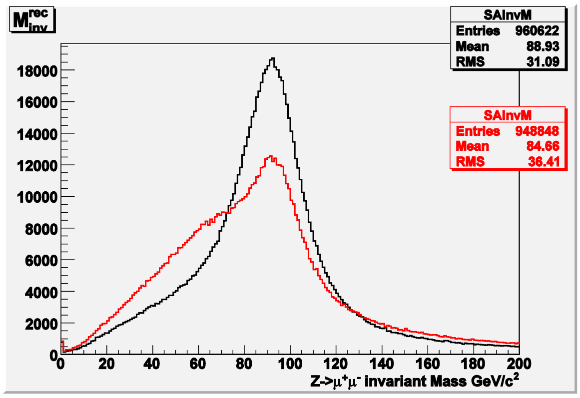
picture is given by photogrammetry measurements), the series can be truncated leaving only linear terms, and hence, the residuals (the difference between measured and expected spatial coordinates of a hit) are a linear function of both track and alignment parameters. A fit is then performed over the residuals in order to estimate these parameters. This minimization yields to a linear equations system with a number of unknowns equal to the number of alignment parameters plus the number of track parameters multiplied by the number of tracks. The size of this system is huge as the number of tracks is a large quantity. Fortunately, after some algebra and focussing only on the alignment parameters, the dimension of the system can be reduced to the number of alignment parameters. The matrix associated to this system is intrinsically non-invertible due to some degenerated degrees of freedom. External measurements are then added as constrains to the fit to fix an absolute reference and make the system regular. Additional terms added to the tracks-only χ^2 produce new terms that must be added to the linear system.

5. CSA06 Offline Muon alignment exercise

The software tools, the computing infrastructure and the algorithms described in the previous sections, were tested during the CSA06 with different samples. Most of the tests were done with 2 million proton-proton simulated collisions, in which a Z^0 was produced, and forced to decay to muon pairs. Two different exercises were performed. The first exercise emulated a prompt analysis so Global Muons (using both Muon and Tracker detector) and Standalone Muons (using only Muon detector) Muons were reconstructed for Z^0 decaying to dimuon samples



(a) Global Reconstruction



(b) Standalone Reconstruction

Figure 2. Di-muon invariant mass for Global (left) and Standalone (right) Muon Reconstruction, using the nominal geometry (black) and the ShortTerm scenario (red)

(figure 2), running locally at IFCA, and using different geometries, obtained via FroNTier from the DB at CERN. Global Muon reconstruction is not significantly affected by the Muon detector misalignment since nominal (ideal) Tracker detector geometry was considered for this test. On the other hand, Standalone reconstruction shows the expected P_T degradation for the ShortTerm scenario.

As a second exercise, a simple version of the track-based alignment algorithm was applied by considering only the displacement in the more sensitive coordinate (Rϕ). External measurements were mimicked to avoid the problem of degenerated degrees of freedom. The procedure followed was to perform the reconstruction over a geometry containing (simulated) corrections from photogrammetry, in such a way that external measurements in the algorithm were set to 0, and only the errors had to be included in the external associated matrix.

Once the algorithm has calculated the alignment corrections, a geometry database is created, and a track fit is performed using this new geometry in the so called re-reconstruction. Invariant Z^0 dimuon mass distribution for Standalone muons was obtained in order to see the performance of misalignments and corrections (figure 3). After the corrections are applied degradation in the mass dissapears.

6. Magnet Test and Cosmic Challenge

The Magnet Test and Cosmic Challenge took place during the summer and autumn of 2006. CMS magnet was switched on for the first time, and CMS performance was checked detecting muons from cosmic radiation. Cosmic data was made available for analysis using the Grid, with a selected collection of runs transferred from CERN to IFCA (about 10 TB).

The exercise was divided in two different sub-analysis. The first one was dedicated to the alignment of the internal layers inside every DT chamber, using pre-MTCC commissioning cosmic muons and external measurements obtained from the construction sites and survey measurements. A version of the alignment algorithm was successfully applied to the $R\phi$ layers, taken into account all the degrees of freedom. Misalignments found were of the order of 80 μm for displacements and 30 μrad for rotations, but also some outliers appeared with displacements up to 600 μm. Databases with the calculated corrections were created using again standard tools and validation was performed over cosmic muons taken during the MTCC for the DT chambers. The performance of reconstruction was studied with and without corrections, observing a clear centering of the residuals, as can be seen in figure 4, and an improvement of the local reconstruction χ^2.

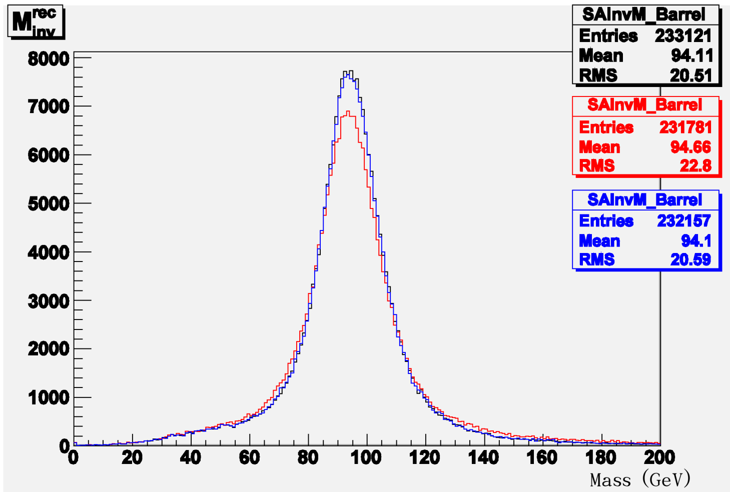


Figure 3. Di-muon invariant mass for muons contained in the region $|\eta| < 1.04$ (barrel), for the nominal geometry (black), using a simplified scenario (red) and after applying the corrections measured by the muon alignment algorithm (blue)

The second sub-analysis was related to the alignment of DT chambers inside the wheels of CMS. For this exercise only the $R\phi$ coordinate was taken into account. The algorithm made extensive use of external measurements provided by survey of the position and orientation of the chambers inside the wheel. Validation was also done and the performance of reconstruction was again studied. Results revealed misalignments of the order of 1 mm for the MTCC geometry, that were corrected to the 500 μm level using survey measurements, and finally to the 100 μm level using both survey and the alignment with tracks algorithm (figure 5).

In both cases the software chain was successfully completed: reconstruction was performed over real data, the alignment algorithm calculated alignment corrections and created the correspondient geometry databases, and finally re-reconstrucion was performed with the new geometries, resulting in clear improvements.

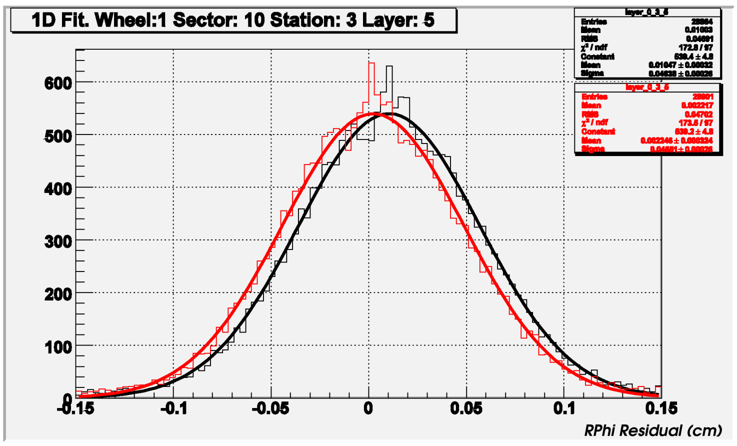


Figure 4. Residual distribution for one internal layer of a drift tube chamber. Black shows the distribution without any correction applied and red with corrections coming from alignment with tracks

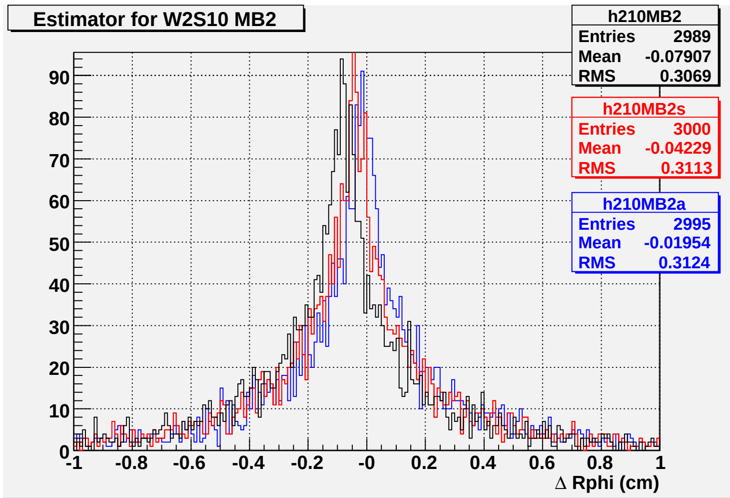


Figure 5. Estimator for the displacement of chambers in the most sensitive coordinate for one of the chambers instrumented in the MTCC. The black histogram shows the estimator when no correction is applied and the red and blue ones when corrections from photogrammetry and track alignment respectively are applied

7. Conclusions

An alignment exercise for the Muon System of CMS was developed and tested successfully during CSA06, at a scale corresponding to roughly 25% of that expected for the real data taking, confirming a correct performance of software and computing resources. The full dataflow was completed in about 24 hours, starting with the alignment and calibration stream availability at Tier-0, followed by data transfers to corresponding Tier-1 and Tier-2, and first prompt analysis and plots at Tier-2. Efficient access to remote databases was also tested, allowing the alignment algorithms to handle alignment constants from the official condition database at CERN without any significant delay.

The performance of a simplified version of the alignment algorithm was validated with simulated data (CSA06). It has also been validated in the MTCC, at a smaller scale, but with real data and realistic data-taking conditions.

Results showed that a significative improvement of muon reconstruction was achieved. A new improved version of the algorithm is now under development and will be tested during CSA07.

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5.D.3. THE CMS MUON SYSTEM ALIGNMENT FIRST RESULTS FROM COMMISSIONING RUNS

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$$|\vec{p}(t)|\nu sp_t(l) \qquad (4).$$

Con estas variables, comparamos la señal con el fondo y observamos escasas diferencias. En la variable (1), la señal posee cosenos cercanos al -1 y apenas existen sucesos con coseno igual a 1. En la variable (2), la señal posee mayor número de sucesos con diferencia nula. En la variable (3), es mayor el número de sucesos con coseno igual a 1 en la señal. En la variable (4), se observa la misma tendencia, aunque la señal posea mayor número de eventos, ésta no se destacaría al normalizar. Por tanto, se necesitará recontruir el bosón pesado Z_H para comprobar si es eficaz realizar cortes en base a las diferencias observadas con las nuevas variables.

En función de la identificación de los b-jets, realizamos la recontrucción del bosón pesado Z_H para 4 casos diferentes. Caso 1: sin ninguna identificación; caso 2: utilizando likelihood; caso 3: utilizando un parámetro composición de IP3D y SV1, con corte en '0'; caso 4: utilizando el mismo parámetro que caso 3 pero corte en '3'.

	Eventos Señal	Eventos Fondo	Eficiencia Señal	Eficiencia Fondo	N Señal	N Fondo	S/√B
Caso 1	17506	17252	0,88	0,86	24946,05	4656176,78	11,56
Caso 2	8486	6984	0,42	0,35	12092,55	1884925,73	8,81
Caso 3	2999	1795	0,15	0,09	4273,58	484456,14	6,14
Caso 4	1165	711	0,06	0,04	1660,13	191893,21	3,79

Tabla 1. *Valores obtenidos de los datos simulados para los diferentes casos.*

Para una luminosidad de $3{\cdot}10^5$ pb^{-1}, la sección eficaz para Z_H es de 19 pb y BR = 1/8 [2] y para el fondo irreducible la sección eficaz es de 833 pb con BR = 0.54. Considerando una eficiencia en la elección de los bjets de 20%, obtenemos una significancia mayor que 5 (véase la Tabla 1), excepto para el caso de corte 3 en IP3D+SV1.

En la figura 2, se observa la reconstrucción del Z_H para los diferentes casos descritos anteriormente. En todos ellos se aprecia ligeramente la señal respecto del fondo.

El objetivo ahora es mejorar la reconstrucción con el fin de discriminar la señal respecto de su fondo irreducible y los métodos se puedan utilizar para modelos teóricos con problemáticas similares.

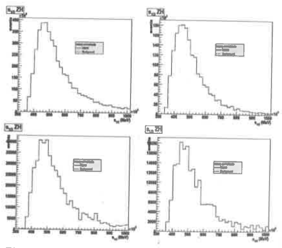

Figura 1. *Representación de las diferentes variables* (1), (2), (3) *y* (4). 20000 *eventos tanto para la señal como el fondo.*

Los autores agradecen la ayuda de Luis March por su anterior colaboración, así como al apoyo de la Agencia Financiadora (Plan Nacional de Altas Energías) procedente del proyecto de referencia FPA2007-66708-C03-01.

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The CMS Muon System Alignment: First results from commissioning runs

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For optimal performance of the CMS muon spectrometer over the entire momentum range up to the TeV range, the different muon chambers must be aligned with respect to each other and to the central tracking system to within a few hundred microns in the $r\phi$ plane.

The required alignment precision for the endcap chambers is 750 μm, while for the barrel the precision varies from 150 μm for the inner station to 350 μm for the outer station. To this end, after following strict chamber construction specifications, CMS combines precise survey and photogrammetry measurements, measurements from an opto-mechanical system, and the results of alignment algorithms based on muon tracks (both from cosmic rays, beam halo and from pp collisions) crossing the spectrometer.

There are several potential sources of misalignment in the muon spectrometer, from chamber production to final detector operating conditions, including:

- Chamber construction tolerances.
- Detector assembly, closing tolerances.
- Solenoid effects.
- Time-dependent effects.

The strategy for the alignment of the CMS muon spectrometer is to combine different sources of information: from the production phase of the muon chambers to the final monitoring during operation. The set of data comes from:

- Quality control data recorded during the construction of the chambers.
- Survey and photogrammetry measurements done at the different stages of chamber construction and detector assembly.
- Optical data provided by the optical muon alignment system.
- The information provided by the tracks (cosmic rays, beam halo, or collision tracks) crossing the detector.

During the last commissioning runs of CMS the different muon alignment techniques have been commissioned, resulting on the first steps towards the development of a start-up geometry intented for the first data taking of CMS when the LHC is ready.

In particular, the internal alignment of the drift tube chambers was calculated using an alignment with tracks algorithm constrained with information from the Quality Control checks at the construction sites and from photogrammetry measurements.

The position and orientation of the drift tube chambers in the CMS wheels was also calculated using photogrammetry measurements. A gravitational sag of about 1.2 cm was found in good agreement with the predictions of the finite element calculations. This new geometry, together with the internal geometry were uploaded into the CMS database (ORCON/ORCOFF) and used centrally in the reconstruction process.

In addition to these photogrammetry measurements, during the CRAFT run (Cosmic Run At Four Tesla) that took place in October and November of 2008, more than 300 million cosmic events were recorded, with a 3% of global muons (reconstructed by the tracker and the muon system. This allowed to perform a first alignment of the muon chambers with respect to the tracker using alignment with tracks techniques.

The optical alignment system worked during CRAFT, collecting up to 200 alignment

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5.D.4. Muon Alignment in ATLAS and CMS

Detector Understanding with First LHC Data

from 29 June 2009 to 03 July 2009 (Europe/Berlin) *DESY / Hamburg*
Europe/Berlin timezone

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Contribution List (38)

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Id	Date	Title	Presenter	Session	Files
20	30-Jun-2009 14:00	Tutorial: Muons (CMS)	BELLAN, Riccardo		
21	01-Jul-2009 17:00	Tau ID	LAI, Stan		
22	01-Jul-2009 09:00	Tracking Detectors	Dr. KLEIN, Katja		
23	01-Jul-2009 09:40	Tracking + Vertexing (1)	LIEBIG, Wolfgang		
24	01-Jul-2009 10:40	Tracking + Vertexing (2)	LIEBIG, Wolfgang		
25	01-Jul-2009 11:20	B Tagging	SAOUT, Christophe		
26	30-Jun-2009 09:45	Muon alignment in ATLAS and CMS	MARTINEZ, Pablo		
27		Muon reconstruction in CMS			
28	02-Jul-2009 15:05	Tutorial: Tau (ATLAS)	GOSDZIK, Bjoern		
29	01-Jul-2009 14:00	Tutorial: Tracking 1 (ATLAS)	LIEBIG, Wolfgang		
30	30-Jun-2009 14:00	Tutorial: Muons (ATLAS)	VAN ELDIK, Niels		

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5.D.5. Commissioning and performance of the CMS detector

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5.D.6. SUSY SEARCHES IN THE Z JETS MET FINAL STATE IN 7 TEV PP COLLISIONS WITH THE JET Z BALANCE METHOD

SANTANDER, 19-23 DE SEPTIEMBRE DE 2011

XXXIII

Reunión Bienal de la Real Sociedad Española de Física

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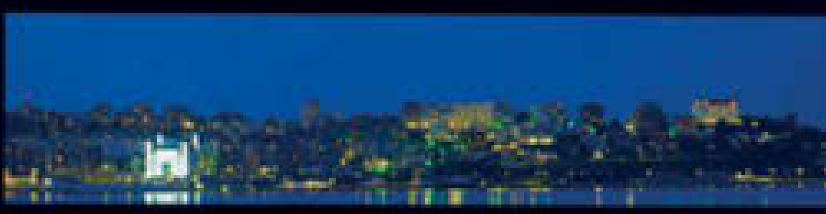

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SUSY searches in the Z+jets+MET final state in 7 TeV pp collisions with the Jet-Z balance method

Marco-Andrea Buchmann[1], Pablo Martinez Ruiz del Arbol[2]
Frederic Ronga[3], Konstantinos Theofilatos[4]

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[2]ETH Zurich; Pablo.Martinez@cern.ch
[3]ETH Zurich; Frederic.Ronga@cern.ch
[4]ETH Zurich; Konstantinos.Theofilatos@cern.ch

Introduction

The Z+jets+MET final state is a clean and distinct signature present in many models of physics beyond the SM (BSM), including SuperSYmmetry (SUSY). The production of a Z boson in the decay chain of the neutralinos is a direct implication of the gauge structure of SUSY and is realized whenever it is kinematically allowed, depending on the neturalino composition [1].

To first order the most significant background for this final state is the Standard Model Z+jets process, followed by top pair production. In such events, while the Z boson momentum is accurately measured from its leptonic decay products, the imperfect measurement of the jet energy scale (primarily due to miscalibration and detector resolutions) leads to instrumental MET mimicking signal events. The ability to observe an excess of signal over background therefore relies on the ability to accurately predict the missing energy "tail" of this background. The Jet-Z Balance (JZB) method has been devised to predict the MET contribution from mismeasured Z+jets events [2]. It has already been shown in various SUSY scenarios that this method offers strong signal discrimination against SM background [3]. The JZB observable is defined as the difference between the transverse momentum of the sum of the jets and the transverse momentum of the Z boson. This observable is distributed symmetrically around 0 for processes with instrumental MET, and is shifted to positive values for processes with real MET (see figure 1).

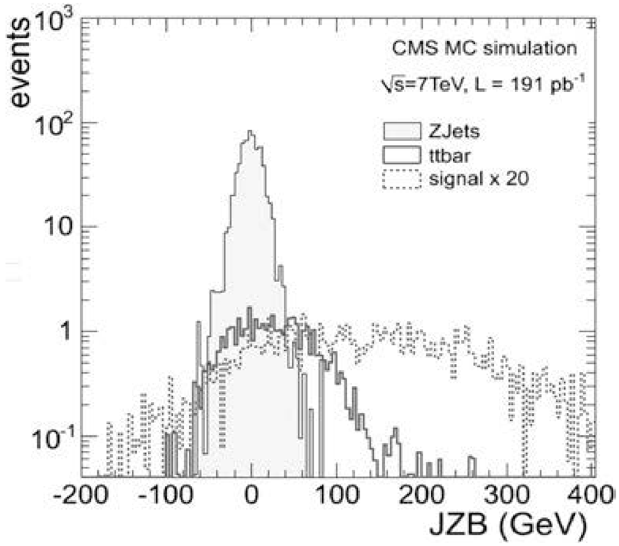

Figure 1. JZB distribution in MC simulation, for the signal (scaled by a factor 20) and the most important SM backgrounds.

Analysis steps

For a final state with a Z boson the background is naturally decomposed into two components:

– background with a real (visible) Z boson

– background without a Z boson, but with an opposite-sign, same-flavour lepton pair (with invariant mass consisten with Z mass). (This also includes events where a real Z boson decays into two neutrinos).

The first component (mainly Z+jets) is estimated using the region with JZB<0, while Physics processes that do not contain a Z boson (mainly top pair production) are estimated using eμ pairs.

The signal region is defined in the region JZB>50 GeV, while the background prediction is calculated as the number of dilepton events in the region JZB<-50 GeV, with the addition of the eμ pairs in the signal region, and with the substraction of the number of eμ pairs in the region JZB<-50 GeV.

Results

The number of observed and predicted events, using the data accumulated by CMS during the year 2010, with a total integrated luminosity of 34 inverse pb [4], is presented in table 1.

Observed events	Background prediction	MC expectation
4	8±3(stat)±1.0(peak)+1.6-3.2(sys)	5.5±0.2 (MC stat)

Table 1. Number of observed events, background prediction and MC expectation for the signal region with JZB>50 GeV.

Using bayesian inference [5] and a profile likelihood model for the nuisance parameters (uncertainty on the number of background events), a 95% C.L. Upper limit of 5.6 is set on the number of signal events. This limit is independent of any choice model.

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5.D.7. SEARCHES FOR SUSY IN EVENTS WITH TWO OR MORE LEPTONS AT CMS

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Pablo Martinez Ruiz del Arbol [Pablo.Martinez@cern.ch]

Sent: 21 May 2012 16:59
To: Guenther Dissertori
Cc: Rainer Wallny [rainer.wallny@phys.ethz.ch]

Hi Guenther,

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Cheers,

Pablo

On 05/21/2012 05:01 PM, Guenther Dissertori wrote:
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>
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>
> cheers
> G.
>
>
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> IMPORTANT: Please confirm or decline your availability for this talk by clicking on the Accept or Decline link from the "My Conferences" web page on CINCO: https://cms-mgt-conferences.web.cern.ch/cms-mgt-conferences/conferences/my_conferences.aspx
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PROCEEDINGS OF SCIENCE

Searches for SUSY in events with two or more leptons in CMS

P. Martinez Ruiz Del Arbol*
On behalf of the CMS Collaboration
Eidgenössische Technische Hochschule Zürich (ETH Zurich),
E-mail: pablom@cern.ch

We present results of searches for SUSY production at CMS in events with multiple lepton production. These include final states with Z bosons decaying to lepton pairs, non-resonant same- and opposite-sign lepton pairs, and three or more isolated leptons. The results are used to exclude previously unexplored regions of the supersymmetric parameter space assuming R-parity conservation with the lightest supersymmetric particle being either a neutralino or gravitino.

36th International Conference on High Energy Physics,
July 4-11, 2012
Melbourne, Australia

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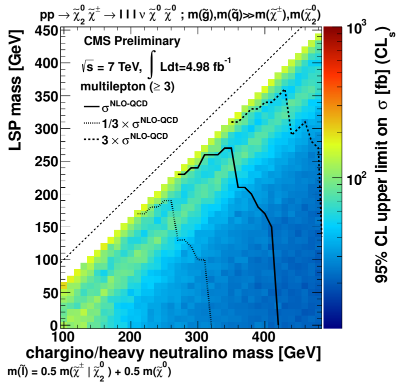

Figure 5: Upper limits on the masses of the chargino or the heavy neutralino and the lightest neutralino in an SMS with direct chargino and neutralino production.

5. Conclusions

Several searches for SUSY in events with two or more leptons have been performed using data collected by the CMS experiment at $\sqrt{S}$= 7 TeV and $\sqrt{S}$= 8 TeV. These include searches with two opposite sign leptons inside and outside the Z mass, searches with two same sign leptons, requiring also one b-tagged jet, and searches with three or more leptons. In all the cases the observation is in good agreement with the data driven predictions, and upper limits are set in terms of mSUGRA and simplified models.

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[3] The CMS Collaboration, "Search for physics beyond the standard model in events with a Z boson, jets, and missing transverse energy in pp collisions at $\sqrt{s} = 7TeV$", Physics Letters B, 716, 2, 260-284, doi:10.1016/j.physletb.2012.08.026

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PoS PROCEEDINGS OF SCIENCE

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ICHEP2012 - (other ichep conferences)

4-11 July 2012
Melbourne, Australia

The Australian particle physics community was honoured to host the 36th ICHEP conference in 2012 in Melbourne. This conference has long been the reference event for our international community. The announcement of the discovery of the Higgs boson at the LHC was a major highlight, with huge international press coverage. ICHEP2012 was described by CERN Director-General, Professor Rolf Heuer, as a landmark conference for our field.
In additional to the Higgs announcement, important results from neutrino physics, from flavour physics, and from physics beyond the standard model also provided great interest.
There were also updates on key accelerator developments such as the new B-factories, plans for the LHC upgrade, neutrino facilities and associated detector developments.
ICHEP2012 exceeded the promise expected of the key conference for our field, and really did provide a reference point for the future.

Many thanks to the contribution reviewers: Andy Bakich, Csaba Balazs, Nicole Bell, Catherine Buchanan, Will Crump, Cameron Cuthbert, Ben Farmer, Sudhir Gupta, Elliot Hutchison, Paul Jackson, Geng-Yuan Jeng, Archil Kobakhidze, Doyoun Kim, Tong Li, Antonio Limosani (Head Editor), Kristian McDonald, Nikhul Patel, Aldo Saavedra, Mark Scarcella, Geoff Taylor, Ian Watson, Graham White, Tony Williams and Bruce Yabsley.

Sessions

Plenary Session

DM Direct Searches

Jet Production and QCD at High Energy Colliders

Parallel Session 1 - The Standard Model

Parallel Session 2 - Beyond the Standard Model - SUSY

Parallel Session 3 - Beyond the Standard Model - Non-SUSY

Parallel Session 4 - Top Quark Physics

Parallel Session 5 - B-Physics

Parallel Session 6 - QCD, Jets, Parton Distributions

Parallel Session 7 - CP Violation, CKM and Rare Decays

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Rare and forbidden B decays at BaBar
PoS(ICHEP2012)333 *S. Robertson*

Charmonium-like states at BaBar
PoS(ICHEP2012)334 pdf *V. Santoro*

Charmless semileptonic B decays at BaBar
PoS(ICHEP2012)335 *F. Bernlochner*

Studies of the $\psi(2S)$ and $\psi(3770)$ at KEDR
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PoS(ICHEP2012)341 pdf *M. Barrett*

Y(5S) spectroscopy at Belle
PoS(ICHEP2012)342 pdf *A. Bondar, A. Garmash and P. Krokovny*

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PoS(ICHEP2012)343 pdf *W.M. Bonivento*

Study of dimuon final states in the decay of B and Y mesons.
PoS(ICHEP2012)344 *C. Buszello*

Measurement of φs at LHCb
PoS(ICHEP2012)345 *G. Cowan*

Radiative B decays at LHCb
PoS(ICHEP2012)346 *O. Deschamps*

Studies of the electroweak penguin transitions b\rightarrow s \mu + \mu – and b\rightarrow d \mu + \mu – at LHCb
PoS(ICHEP2012)347 *A. Gallas Torreira*

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PoS(ICHEP2012)348 pdf *J. Garra tico*

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PoS(ICHEP2012)355 *H. Miyake*

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PoS(ICHEP2012)357 pdf *T. Peng*

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PoS(ICHEP2012)358 pdf *M. Perrin-Terrin*

D+ Purely Leptonic and D0 Semi-leptonic Decays at BESIII
PoS(ICHEP2012)359 *R. Poling*

Measurements of B\rightarrow D K(*) decays to constrain the CKM unitarity triangle angle γ at LHCb
PoS(ICHEP2012)360 pdf *A. Powell*

CP violation in charm decays: Standard Model and Beyond
PoS(ICHEP2012)361 *A. Soni*

Parallel Session 8 - Neutrinos

Parallel Session 9 - Heavy Ion Collisions

Parallel Session 12 - Formal Theory Development

Parallel Session 13 - Detectors and Computing for HEP

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5.D.8. SEARCH FOR BEYOND THE STANDARD MODEL PHYSICS IN MULTILEPTONIC AND PHOTONIC FINAL STATES WITH THE CMS DETECTOR

Gmail

Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>

[CINCO] [ICHEP 2014] Pablo Martinez Ruiz Del Arbol (ETH Zürich) accepted invitation to give a talk at ICHEP 2014

[CINCO] Cms INformation on COnferences <cms-conf-cinco@cern.ch> Mon, May 26, 2014 at 2:07 PM
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Nuclear Physics B Proceedings Supplement

Search for Beyond the Standard Model Physics in multi-leptonic and photonic final states with the CMS detector

P. Martinez Ruiz Del Arbol on behalf of the CMS collaboration

Eidgenössische Technische Hochschule Zürich (ETH Zurich)

Abstract

In this talk, the latest results from CMS on searches for beyond the Standard Model physics in final states with 2, 3, 4 (or more) leptons and with photons are presented using 20 fb^{-1} of data from the 8 TeV LHC run. A variety of complementary final state signatures and methods are used to probe new physics.

Keywords: SUSY, Leptons, Photons, CMS, gluino

1. Introduction

Supersymmetry (SUSY) is one of the most appealing extensions to the Standard Model, solving the hierarchy problem, providing a path towards Unification of the fundamental forces, and predicting dark matter candidates. The Compact Muon Solenoid (CMS) [1] collaboration has executed a complete program of SUSY searches at $\sqrt{S}$= 7 TeV and $\sqrt{S}$= 8 TeV inspecting a large variety of final states. SUSY models usually involve the presence of heavy supersymmetric particles decaying in long decay chains that produce high hadronic activity. In the case of R-parity-conserving SUSY, supersymmetric decay chains end with the production of an invisible, stable particle (LSP) that remains undetected producing high transverse missing energy ($\not{E}_T$) in the event. The inclusion of leptons and photons in the final state strongly supresseses backgrounds and provides effective methods for estimating the remaining contribution, using data control regions.

This document focuses in a subset of SUSY searches performed by the CMS collaboration at $\sqrt{S}$= 8 TeV, using two or more leptons, and photons. Other CMS searches using leptons are reported elsewhere in the context of third generation production, electroweak production and R-parity-violating SUSY searches. The interpretation of the results is performed in terms of the so called simplified models (SMS)[2], with stress in gluino production for the leptonic searches.

2. Search with two opposite-sign leptons

This search [3] looks for SUSY signatures in events with two opposite-sign leptons (electron or muon) for both same and different flavor pairs. Events are required to contain at least five jets, where the two with higher momentum are required to be central ($|\eta| < 1$), and at least two of them must be b-tagged. In addition, the event should contain $\not{E}_T > 180$ GeV. This selection targets signatures with multi-top production and heavy invisible particles (LSP).

Background prediction is based in data control samples. In particular the centrality of the jets is inverted, and the resulting yields are multiplied by a forward-to-central factor calculated using a third sample in which two b-tagged jets are not required. Figure 1 shows the observation and the background prediction for the signal region. No significant excess is observed over the background prediction. Figure 2 shows the upper limits on a simplified model based on gluino production, with

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them agrees well with the observation and upper limits have been set in a large variety of models. This result focuses in strong production of gluinos, sbottoms and stops, where masses below 1050 GeV, 575 GeV and 380 GeV respectively have been excluded.

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5.D.9. Review of Supersymmetry Searches at 13 TeV with the CMS experiment

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Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) [logout]

Review of Supersymmetry Searches at 13 TeV with the CMS experiment

Plenary given at DM2016: Dark Matter 2016: From the smallest to the largest scales, 27 Jun-1 Jul 2016, Santander (Spain) The talk is selected (cms speaker).

Abstract

The CMS experiment has designed an ambitious program of Supersymmetry searches using the data collected at 13 TeV during the year 2015. Most of these searches focus in the production of gluino or squark pairs undertaking long decay chains finalizing with the production of the lightest neutralino which is assumed to be stable conforming an excellent candidate for Dark Matter. Different analysis have been conducted in a broad collection of final states and the experimental results have been interpreted in the context of Simplified Models of Supersymmetry, scanning over the masses of the gluino/squarks and the lightest neutralino. Mass upper limits have been largely extended with respect to 8 TeV data. Special attention is dedicated to the di-lepton opposite sign analysis where CMS and ATLAS reported excesses at 8 TeV (CMS and ATLAS) and 13 TeV (only ATLAS).

Speakers

Pablo Martinez Ruiz Del Arbol (ETH Zürich)

Files

- CMSDarkMatter.pdf (6313.7 kB) [Final draft approved by Claudio Campagnari] ✖

Bibliography

Note: PAG and POG related abstracts require bibliography of relevant PAS notes, CMS notes and possibly journal references. Click Update Bibliography link from Presentations menu to add references.

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5.D.10. Searches for BSM physics in the 2 leptons y MET final state

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Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>

[CINCO] [IX CPAN days] Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) accepted invitation to give a talk at IX CPAN days

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5.D.11. Dark Matter at the LHC

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CMS Secretariat

CMS Collaboration
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5.D.12. Application of muon tomography to the industry

Certificado

Pablo Martinez Ruiz Del Arbol ha impartido una charla el 30 de octubre de 2018 titulada “Tomografía Muónica aplicada al mantenimiento preventivo de equipos industriales.”

Antonio Pich Zardoya
En nombre de los organizadores

Salamanca, a 31 de octubre de 2018

5.D.13. Precision timing with the CMS MIP Timing Detector

Gmail

Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>

[CINCO] [LP2019] Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) accepted invitation to give a talk at LP2019

1 message

[CINCO] Cms INformation on COnferences <cms-conf-cinco@cern.ch> Sun, May 19, 2019 at 12:10 PM
Reply-To: "Automatic message: do not Reply" <noreply@cern.ch>
To: pablo.martinez@cern.ch
Cc: toyoko.orimoto@cern.ch, chris.tully@cern.ch, lindsey.gray@cern.ch, francesco.santanastasio@cern.ch, david.winn@cern.ch, tommaso.tabarelli@cern.ch, brad.cox@cern.ch, ketino.kaadze@cern.ch, arnd.meyer@cern.ch, somnath.choudhury@cern.ch

Dear Committee,

Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) [mailto:Pablo.Martinez@cern.ch] just accepted to give a talk "Precision Timing with the CMS MIP Timing Detector"
https://cms-mgt-conferences.web.cern.ch/cms-mgt-conferences/conferences/pres_display.aspx?cid=2470&pid=19968

at "LP2019: 29th International Symposium on Lepton Photon Interactions at High Energies, 5-10 Aug 2019, University of Toronto, Toronto (Canada)"
https://cms-mgt-conferences.web.cern.ch/cms-mgt-conferences/conferences/conf_display.aspx?cid=2470

CMS

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COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

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CH - 1211 GENEVA 23

Tel. *+41 22 767 2277*
Fax *+41 22 767 8940*
E-mail *cms.secretariat@cern.ch*

To Whom It May Concern

Geneva, 07.01.2010

Votre référence / Your reference :
Notre référence / Our reference : CMS-Z.G

Certificate of Presence

We hereby certify that Pablo Martínez Ruiz del Árbol, member of the CMS Collaboration, has given the following oral presentations at conferences, workshops, and seminars on the dates and places indicated below:

"Precision Timing with the CMS MIP Timing Detector" at "LP2019: 29th International Symposium on Lepton Photon Interactions at High Energies, 5-10 Aug 2019, University of Toronto, Toronto (Canada)".

"Dark matter at LHC" at "Split2018: 2018 LHC days in Split, 17-22 Sep 2018, University of Split - FESB and Faculty of Science, Split (Croatia)".

"Searches for BSM physics in the 2 leptons y MET final state" at "IX CPAN days: IX CPAN days, Centro Nacional de Partículas, Astropartículas y Nuclear, 23-25 Oct 2017, CPAN, Santander (Spain)".

"Review of Supersymmetry Searches at 13 TeV with the CMS experiment" at "DM2016: Dark Matter 2016: From the smallest to the largest scales, 27 Jun-1 Jul 2016, Santander (Spain)".

"CMS SUSY searches at 13 TeV" at "LPCC Seminar: CERN LPCC EP-LHC Seminar Series, 9 Feb 2016, Geneva (Switzerland)".

"Search for Beyond the Standard Model Physics in multi-leptonic and photonic final states with the CMS detector" at "ICHEP 2014: 37th International Conference on High Energy Physics, 2-9 Jul 2014, Valencia (Spain)".

"Searches for SUSY in events with two or more leptons at CMS" at "ICHEP 2012: International Conference on High Energy Physics, 4-12 Jul 2012, Melbourne, VIC (Australia)".

"Susy searches in the Z+Jets+MET final state in 7 TeV pp collisions with the jet-z balance method" at "Bienal RSEF: XXXIII Reunión Bienal de la Real Sociedad Española de Física, 19-23 Sep 2011, Universidad de Cantabria, Santander (Spain)".

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PROCEEDINGS OF SCIENCE

Precision timing with the CMS MIP timing detector

Pablo Martinez Ruiz del Arbol* **on behalf of the CMS Collaboration**
Instituto de Fisica de Cantabria
E-mail: parbol@ifca.unican.es

The Compact Muon Solenoid detector at the CERN Large Hadron Collider is undergoing an extensive Phase II upgrade program to prepare for the challenging conditions of the High-Luminosity LHC. In particular, a new timing layer with hermetic coverage up to a pseudo-rapidity of $|\eta|$=3 will measure minimum ionizing particles with a time resolution of 30 ps. This MIP Timing Detector will consist of a central barrel region based on LYSO:Ce crystals read out with SiPMs and two end-caps instrumented with radiation-tolerant Low Gain Avalanche Detectors. The precision time information from the MTD will reduce the effects of the high levels of pile-up expected at the HL-LHC and will bring new and unique capabilities to the CMS detector. The time information assigned to each track will enable the use of 4D reconstruction algorithms and will further discriminate interaction vertices within the same bunch crossing to recover the track purity of vertices in current LHC conditions. For instance, in the analysis of di-Higgs boson production, a timing resolution of 30-40 ps is expected to improve the effective luminosity by about 25% through gains in b-tagging and isolation efficiency. We present motivations for precision timing at the HL-LHC and overview the MTD design, while also highlighting specific physics studies benefiting from the improved timing information.

XXIX International Symposium on Lepton Photon Interactions at High Energies - LeptonPhoton2019
August 5-10, 2019
Toronto, Canada

*Speaker.

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PoS(LeptonPhoton2019)100

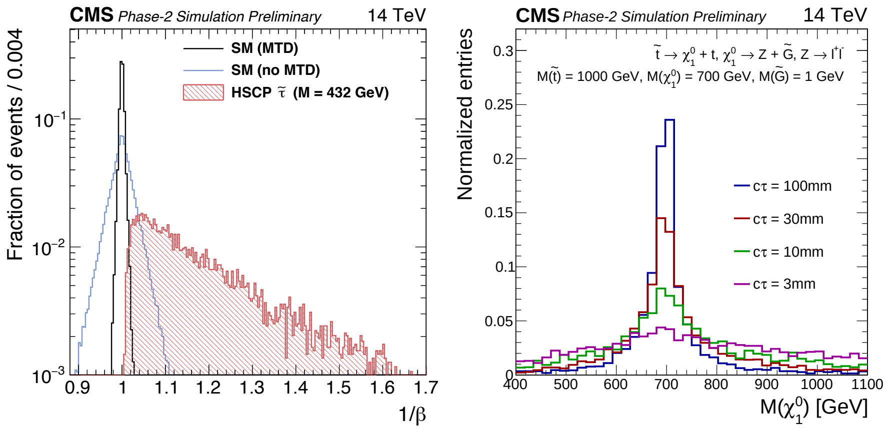

Figure 6: Distribution of the inverse of the particle velocity for the HSCP signal, the background, and the background estimated with the MTD (left), and neutralino mass estimated using the timing information for a SUSY GMSB model with different lifetimes (right).

tion. This detector will be composed of two parts: the Barrel Timing Layer based on LYSO crystals and the Endcap Timing Layer based on silicon sensors (LGADs). The inclusion of timing information is expected to have a strong impact in the mitigation of the harsh pile-up conditions at the HL-LHC. By associating a time stamp to the tracks, the number of spurious tracks not compatible in time with the primary vertex will be reduced improving the physics object performance for jet reconstruction, b-tagging algorithms, lepton isolation, transverse missing momentum resolution, etc. These improvements will translate into a sensitivity increase for important analyses such as the double Higgs search, and will also bring unique physics potential for complicated topologies such as those involving the production of long-lived particles.

References

[1] Apollinari, G. and Bruning, O. and Nakamoto, T. and Rossi, Lucio. *High Luminosity Large Hadron Collider HL-LHC*. CERN Yellow Rep. 5 1-19, 2015. 10.5170/CERN-2015-005.1.

[2] Chatrchyan, S. and others. *The CMS experiment at the CERN LHC*. JINST, 3 S08004, 2008, 10.1088/1748-0221/3/08/S08004.

[3] D. Anderson et al. *On timing properties of LYSO-based calorimeters*. Nucl. Instrum. Meth. A 794 (2015) 7, doi:10.1016/j.nima.2015.04.013.

[4] G. Pellegrini et al. *Technology developments and first measurements of Low Gain Avalanche Detectors (LGAD) for high energy physics applications*. Nucl. Instrum. Meth. A 765 (2014) 12, doi:10.1016/j.nima.2014.06.008.

PoS(LeptonPhoton2019)100

PROCEEDINGS OF SCIENCE

XXIX International Symposium on Lepton Photon Interactions at High Energies

LeptonPhoton2019 - (other lp conferences)

August 5-10, 2019
Toronto, Canada

Entries on ADS

The 29th International Symposium on Lepton Photon Interactions at High Energies will take place in Toronto, Canada between August 5-10, 2019. The Conference follows the tradition of a long series of high energy physics conferences, the International Symposia on Lepton and Photon Interactions at High Energies. The program features plenary sessions covering topics of major interest to the particle physics community. New this year will be two (or three) tracks of parallel sessions for one day, that will provide an opportunity for additional presenters to give a more in-depth presentation of individual physics results. We will also organise poster sessions where additional researchers may present their work.

The conference is hosted by the University of Toronto, and will take place at the Westin Harbour Castle Hotel on the lakefront in downtown Toronto.

LP2019

Sessions

Collider SM

Status and Plans for CERN Accelerator Complex
PoS(LeptonPhoton2019)002 **pdf** *P. Collier*

CKM and CP Constraints from B-Decays
PoS(LeptonPhoton2019)006 **pdf** *S. Nishida*

New Physics Searches with Top Quarks
PoS(LeptonPhoton2019)012 **pdf** *S. Westhoff*

Collider BSM

Rare decays of B-hadrons
PoS(LeptonPhoton2019)014 **pdf** *C. Marin Benito and on behalf of the LHCb collaboration*

Constraints on New Physics from B Mesons
PoS(LeptonPhoton2019)015 **pdf** *M. Blanke*

Intensity Frontier

Atmospheric Neutrinos and Proton Decay
PoS(LeptonPhoton2019)028 **pdf** *R. Wendell*

Astroparticle physics

Traditional talks

Future Projects

Parallel Sessions

Posters

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5.D.14. Muography applied to the preventive maintenance of industrial equipment

CERTIFICADO

Pablo Martínez Ruiz del Árbol ha impartido la charla: "**Muography applied to the preventive maintenance of industrial equipment**" y la charla plenaria "**COMCHA: Computing Challenges for the HL-LHC and beyond**".

Alberto Ruiz Jimeno en nombre de los organizadores

5.D.15. COMCHA: Computing Challanges for the HLLHC and beyond

CERTIFICADO

Pablo Martínez Ruiz del Árbol ha impartido la charla: "**Muography applied to the preventive maintenance of industrial equipment**" y la charla plenaria **"COMCHA: Computing Challenges for the HL-LHC and beyond"**.

Alberto Ruiz Jimeno en nombre de los organizadores

5.D.16. Timing for the CMS PhaseII Upgrade

Gmail

Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>

[CINCO] [LHCP2020] Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) accepted invitation to give a talk at LHCP2020

[CINCO] Cms INformation on COnferences <cms-conf-cinco@cern.ch> Thu, Mar 12, 2020 at 5:34 PM
Reply-To: noreply@cern.ch
To: pablo.martinez@cern.ch
Cc: toyoko.orimoto@cern.ch, chris.tully@cern.ch, stuart@hep.physics.ucsb.edu, adolf.bornheim@cern.ch, francesco.santanastasio@cern.ch, marco.toliman.lucchini@cern.ch, joel.butler@cern.ch, david.winn@cern.ch, ketino.kaadze@cern.ch, tommaso.tabarelli@cern.ch, brad.cox@cern.ch, paolo.meridiani@cern.ch, jyothsna.rani.komaragiri@cern.ch, didier.claude.contardo@cern.ch, frank.hartmann@cern.ch, paolo.rumerio@cern.ch, jan.kieseler@cern.ch, alexander.savin@cern.ch, elisabetta.gallo@cern.ch

Dear Committee,

Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria) [mailto:Pablo.Martinez@cern.ch] just accepted to give a talk "Timing for the CMS Phase-II Upgrade"
https://cms-mgt-conferences.web.cern.ch/conferences/pres_display.aspx?cid=2817&pid=21804

at "LHCP2020: The Eighth Annual Conference on Large Hadron Collider Physics (LHCP2020), 25-30 May 2020, Paris (France)"
https://cms-mgt-conferences.web.cern.ch/conferences/conf_display.aspx?cid=2817

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : http://cms.cern.ch

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E-mail *cms.secretariat@cern.ch*

To Whom It May Concern

Geneva, 28 August 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-28/08/2018/eo

PARTICIPATION CERTIFICATE

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Instituto de Física de Cantabria (IFCA)CSIC-Universidad de Cantabria , Santander, Spain gave the following presentation on behalf of the CMS Collaboration:

- Talk "Timing for the CMS Phase-II Upgrade" at "LHCP2020: The Eighth Annual Conference on Large Hadron Collider Physics (LHCP2020), 25-30 May 2020, Video-only (Virtual World)".

CMS Secretariat

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5.D.17. Summary of SUSY searches

5th Colombian Meeting on High Energy Physics (COMHEP)
30 November – 4 December, 2020
https://indico.cern.ch/e/comhep5

Professor
Pablo Martínez Ruiz del Árbol
Instituto de Física de Cantabria
Universidad de Cantabria

Dear Professor Pablo,

On behalf of the organizing committee, I am pleased to invite you to the **Fifth Colombian Meeting on High Energy Physics** (COMHEP), to take place from November 30 to December 4, 2020. Given the actual worldwide travel restrictions, the conference will be held online.

The goal of the Colombian Meeting on High Energy Physics is to bring together young and senior scientists, theorists and experimentalists, to discuss recent progress in particle physics, cosmology and related areas. The program of the meeting will address a broad range of topics, such as: Standard Model and beyond, neutrino physics, hadron and flavor physics, dark matter, cosmology and cosmic rays.

We would like to invite you to give a 30 minutes talk on searches for supersymmetry at the LHC. Your talk will be part of a session devoted to beyond the standard model physics, where we expect local physicists to also share their latest work. This will provide the opportunity for a discussion after the talks, centered around the main developments in the field.

Should you wish to accept this invitation, please let us know as soon as possible to confirm your attendance.

We look forward to hearing from you.

Best regards,

Jose David Ruiz
(On behalf of the Organizing Committee)

COMHEP

5th Colombian Meeting
on High Energy Physics

30 November - 4 December, 2020
Colombia

conhep@gmail.com
https://indico.cern.ch/e/comhep5

This is to certify that

Pablo Martínez Ruiz del Árbol

Participated as a speaker with the talk
Summary of SUSY searches

in the 5th Colombian Meeting on High Energy Physics,
from 30th November to 4th December of 2020

Gabriela Navarro
On behalf of the Organizing Committee

ITM Institución Universitaria Acreditada en Alta Calidad

UAN UNIVERSIDAD ANTONIO NARIÑO

UNIVERSIDAD DE ANTIOQUIA

Universidad de los Andes Facultad de Ciencias

Universidad del Atlántico

UNIVERSIDAD NACIONAL DE COLOMBIA

Universidad de Medellín Ciencia y Libertad

Universidad del Valle

UNIVERSIDAD SERGIO ARBOLEDA

ICTP The Abdus Salam International Centre for Theoretical Physics

IAEA

5.E. Trabajos presentados en seminarios

5.E.1. CMS SUSY SEARCHES AT 13 TEV

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

Adresse postale / Mailing address*:
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Fax *+41 22 767 8940*
E-mail *cms.secretariat@cern.ch*

To Whom It May Concern

Geneva, 07.01.2010

Votre référence / Your reference :
Notre référence / Our reference : CMS-Z.G

Certificate of Presence

We hereby certify that Pablo Martínez Ruiz del Árbol, member of the CMS Collaboration, has given the following oral presentations at conferences, workshops, and seminars on the dates and places indicated below:

"Precision Timing with the CMS MIP Timing Detector" at "LP2019: 29th International Symposium on Lepton Photon Interactions at High Energies, 5-10 Aug 2019, University of Toronto, Toronto (Canada)".

"Dark matter at LHC" at "Split2018: 2018 LHC days in Split, 17-22 Sep 2018, University of Split - FESB and Faculty of Science, Split (Croatia)".

"Searches for BSM physics in the 2 leptons y MET final state" at "IX CPAN days: IX CPAN days, Centro Nacional de Partículas, Astropartículas y Nuclear, 23-25 Oct 2017, CPAN, Santander (Spain)".

"Review of Supersymmetry Searches at 13 TeV with the CMS experiment" at "DM2016: Dark Matter 2016: From the smallest to the largest scales, 27 Jun-1 Jul 2016, Santander (Spain)".

"CMS SUSY searches at 13 TeV" at "LPCC Seminar: CERN LPCC EP-LHC Seminar Series, 9 Feb 2016, Geneva (Switzerland)".

"Search for Beyond the Standard Model Physics in multi-leptonic and photonic final states with the CMS detector" at "ICHEP 2014: 37th International Conference on High Energy Physics, 2-9 Jul 2014, Valencia (Spain)".

"Searches for SUSY in events with two or more leptons at CMS" at "ICHEP 2012: International Conference on High Energy Physics, 4-12 Jul 2012, Melbourne, VIC (Australia)".

"Susy searches in the Z+Jets+MET final state in 7 TeV pp collisions with the jet-z balance method" at "Bienal RSEF: XXXIII Reunión Bienal de la Real Sociedad Española de Física, 19-23 Sep 2011, Universidad de Cantabria, Santander (Spain)".

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CMS SUSY searches at 13 TeV

Plenary given at LPCC Seminar: CERN LPCC EP-LHC Seminar Series, 9 Feb 2016, Geneva (Switzerland) The talk is selected (cms speaker).

Abstract

We present first results on searches for SUSY at a center of mass energy of 13 TeV with the CMS detector

Speakers

Pablo Martinez Ruiz Del Arbol (ETH Zürich)

Files

- CMSSUSY.pdf (15705.0 kB) [Final draft approved by Claudio Campagnari]

Bibliography

Note: PAG and POG related abstracts require bibliography of relevant PAS notes, CMS notes and possibly journal references. Click Update Bibliography link from Presentations menu to add references.

Content Review

The content of this talk is related to the activities of one or more CMS groups listed below. The conveners or conference committee representatives of these groups have enhanced CINCO administrative rights. They will be informed by e-mail about any changes and updates to the presentation title, abstract or file upload.

- CMS: SUSY

Instructions

You are allowed to modify this presentation. You can download and upload any file. This talk was originally created by Claudio Campagnari on 1/20/2016.

5.E.2. ActividadCientificaYTecnologica/Comparación de estrategias de control epidemiológico basadas en simulaciones con agentes autónomos y énfasis en el impacto del uso de aplicaciones de rastreo

A quien corresponda,

En calidad de coordinadora del área temática transversal de la PTI Salud Global de TRATAMIENTO Y ANÁLISIS DE DATOS E INTELIGENCIA ARTIFICIAL del CSIC, certifico por la presente que Dr. Pablo Martínez Ruiz del Árbol impartió el seminario online titulado **MODELOS PREDICTIVOS/MODELIZACIÓN EPIDEMIOLÓGICA DE LA PANDEMIA** el 3 de junio de 2020.

Y para que conste a los efectos oportunos, firmo la presente en Santander a 19 de agosto del 2020

LLORET IGLESIAS LARA - 53554665Q

Firmado digitalmente por LLORET IGLESIAS LARA - 53554665Q
Fecha: 2020.08.19 12:53:11 +02'00'

Lara Lloret Iglesias

Coordinadora del Área Transversal:

Tratamiento y análisis de datos e Inteligencia Artificial

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

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CSIC comunicación
Tel.: 91 568 14 72 / 618 40 95 65
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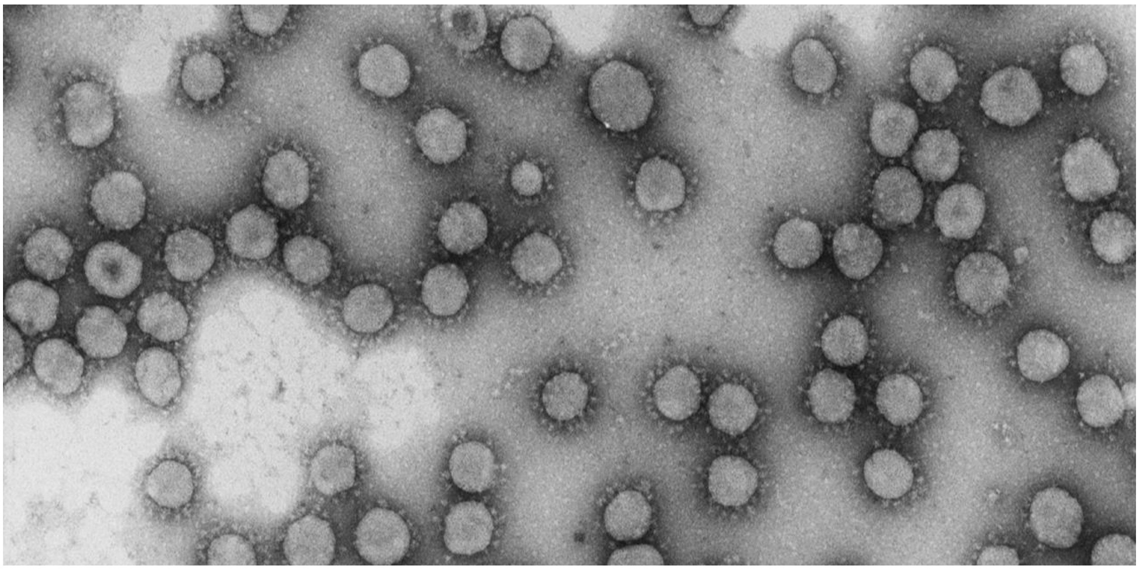
www.csic.es

Madrid, martes 9 de junio de 2020

Los expertos del CSIC abordan los modelos epidemiológicos de la pandemia de Covid-19

- **Científicos de varias áreas de investigación han analizado el funcionamiento de las predicciones en la prevención, los efectos de la cuarentena y en los parámetros de contención**
- **El webinar ha reunido a los investigadores del CSIC Diego Ramiro, Susanna Manrubia, Pablo Martínez Ruiz del Árbol y José Javier Ramasco**



Virus de la familia *Coronaviridae*. / Luis Enjuanes CNB-CSIC

Investigadores del Consejo Superior de Investigaciones Científicas (CSIC) han participado este miércoles 3 de junio en «Modelos predictivos/Modelización epidemiológica de la pandemia», un webinar sobre la Covid-19 organizado por la Plataforma Temática Interdisciplinar (PTI) Salud Global/Global Health del Consejo Superior de Investigaciones Científicas (CSIC). El encuentro, moderado por **Catalina Martínez**, vocal asesora de la Vicepresidencia de Organización y Relaciones

Institucionales del CSIC, ha contado con la participación del investigador **Diego Ramiro**, del Instituto de Economía, Geografía y Demografía (IEGD-CSIC); la científica **Susanna Manrubia**, del Centro Nacional de Biotecnología (CNB-CSIC); **Pablo Martínez Ruiz del Árbol**, investigador en el Instituto de Física de Cantabria (IFCA-CSIC-UNICAN), y **José Javier Ramasco**, científico del Instituto de Física Interdisciplinar y Sistemas Complejos (IFISC-CSIC-UIB). El seminario web se enmarca en una serie de seminarios online en los que se presentan los avances de las actividades de los diferentes grupos de la PTI.

Los investigadores han analizado el funcionamiento de las predicciones desde diferentes puntos de vista, atendiendo a las diversas temáticas de la PTI. Así, se han abordado desde la prevención hasta el impacto, cómo modelar los efectos de la cuarentena y la vuelta a la normalidad, poniendo énfasis también en los parámetros de contención, y cumpliendo con el desafío de trazar las directrices hacia un programa de modelización en salud global.

El demógrafo **Diego Ramiro**, del IEGD-CSIC, ha presentado *Una revisión de los modelos de predicción de evolución de Covid-19*. En su intervención ha destacado la importancia de contar con datos fiables para tener capacidad de predecir la evolución y fatalidad de las epidemias. Y tras un repaso por las epidemias de finales del siglo XIX y principios del siglo XX, ha destacado que “la debilidad de la gran mayoría de los modelos está en la hipótesis de homogeneidad, ya que la realidad suele ser heterogénea y, por tanto, no puede ser simplificada con unos pocos parámetros, que es lo que precisan la mayoría de los modelos dinámicos para ser operativos”.

Por su parte, **Susanna Manrubia**, investigadora del CNB-CSIC, ha dado la charla *No es posible predecir con certeza ni el pico ni el final de una epidemia*. “Predecir el futuro no es lo mismo que predecir el pasado”, ha señalado Manrubia. Las predicciones, ha destacado, constan de tres vértices: la calidad de los datos, la calidad de los modelos y la incertidumbre. “Los modelos de predicción de epidemias, como la Covid-19, solo pueden producir predicciones probabilísticas, no deterministas. No es posible predecir la evolución de la pandemia a medio o largo plazo”. La científica ha apuntado también la importancia del comportamiento de la sociedad en los modelos de predicción.

El investigador **Pablo Martínez Ruiz del Árbol**, del IFCA-CSIC-UNICAN, ha presentado una *Comparación de estrategias de control epidemiológico basadas en simulaciones con agentes autónomos y énfasis en el impacto del uso de aplicaciones de rastreo*. Martínez Ruiz del Árbol ha explicado que estos modelos, utilizados desde 1970 en campos como la ecología, la biología y la economía, representan una alternativa a la analítica. Desde el IFCA-CSIC se comparan diferentes estrategias de confinamiento, usando un modelo espacial dividido en un conjunto de edificios con pisos y apartamentos. “Aunque es un trabajo en fase preliminar todavía, los resultados muestran que hay una fuerte dependencia del impacto de las estrategias con el tiempo de aparición de síntomas y las herramienta de rastreo pueden ser muy útiles”.

El físico **Jose Javier Ramasco**, científico del IFISC-CSIC-UB, ha insistido en la importancia de la movilidad de las personas como vehículo de transmisión de las enfermedades en su presentación sobre *Cómo construir modelos epidémicos globales*. “La movilidad es la clave y las nuevas fuentes de datos de movilidad nos han permitido

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www.csic.es/prensa

hacer un seguimiento mucho más directo de la propagación de la epidemia", ha señalado el investigador. Ramasco ha destacado que hay tres tipos de datos fundamentales para poder elaborar modelos epidémicos globales: de población y demográficos, de movilidad a diferentes escalas, y clínicos y biomédicos. "Se pueden mejorar los modelos y se pueden mejorar los datos pero tendremos que seguir contando con grados de incertidumbre".

El debate se ha abierto a los más de 70 asistentes que, con sus preguntas y contribuciones, han destacado la importancia de la interdisciplinariedad para el éxito de la investigación en la modelización epidemiológica de una pandemia. Asimismo, se ha destacado el papel de las PTIs como un instrumento para lograr este objetivo, que dota al CSIC de una posición más fuerte frente a desafíos tan complejos.

CSIC Comunicación

5.E.3. ActividadCientificaYTecnologica/MAINTENANCE OF CRITICAL INDUSTRIAL EQUIPMENT USING COSMIC MUON RADIATION (Zurich)

To whom it may concern,

This document certifies that **Dr. Pablo Martínez Ruiz del Árbol** gave the **“Experimental Particle and Astro-Particle Physics Seminar”** at the **University of Zürich** with title: **“Muon Tomography”** on the 27th of May of 2019.

In Zürich, on the 28th of May of 2019,

Annapaola De Cosa

(Organizer of the seminar)

		to Ho-implanted gold absorbers. Its target activity of 300 Bq/detector poses serious experimental challenges both in detector and readout performance. I will try to give an overview of the neutrino mass searches, focusing on the direct mass measurements with HOLMES and other competitor experiments.		
27 May	Pablo Martinez Ruiz Del Arbol (ICFA, SPain)	**Muon Tomography** The Earth is being constantly bombarded by high energy protons interacting with the atmosphere and producing a flux of 10000 muons per minute and squared meter. These muons interact with matter through ionization and multiple scattering being these processes highly dependent on the properties of the material they are crossing. The measurement of the attenuation and angular deviation of the muons can be used to infer the geometry and densities of the materials. This new technique is being used nowadays in applications such as volcanology, archeology, civil engineering, security, nuclear industry and the heavy industry. In this context, Muon Systems emerged as a company to apply these principles to the industry, and more particularly to the preventive maintenance of critical industrial equipment such as pipes and cauldrons. After working during 2 years in the development of suitable muon detectors and algorithms, the company will start its first pilot project measuring the thickness of pipes in a petrol processing factory in the north of Spain. This seminar will review the principles of muon tomography, its applications and how it can be used to improve several industrial processes.	talk (PDF, 12179 KB)	Annapaola de Cosa

Directions	Contact: Alison.Mitchell@physik.uzh.ch	Room Connection Instructions (PDF, 3950 KB)

5.E.4. ActividadCientificaYTecnologica/MAINTENANCE OF CRITICAL INDUSTRIAL EQUIPMENT USING COSMIC MUON RADIATION (CIEMAT)

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

EXCELENCIA MARÍA DE MAEZTU

cfp CIEMAT física de partículas

Yo, Nicanor Colino Arriero, Director Científico de la Unidad de Excelencia María de Maeztu CIEMAT – Física de Partículas (MDM-2015-0509),

CERTIFICO

que D. Pablo Martínez Ruiz del Árbol con DNI nº 72058705G ha impartido el seminario titulado "Maintenance of critical industrial equipment using cosmic muon radiation". Este seminario ha sido organizado por el Departamento de Investigación Básica del CIEMAT, y ha tenido lugar el día 14 de enero de 2019 de 11.30 a 13.00 h.

Madrid, 14 de enero de 2019

CENTRO DE INVESTIGACIONES ENERGÉTICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS
UNIDAD DE EXCELENCIA MARÍA DE MAEZTU
Física de Partículas
- C.I.E.M.A.T. -

Nicanor Colino Arriero
Director Científico de la
Unidad de Excelencia María de Maeztu
CIEMAT-Física de Partículas

5.E.5. ActividadCientificaYTecnologica/SUSY SEARCHES WITH TWO OPPOSITE SIGN LEPTONS

To whom it may concern,

With this document, I would like to certify that **Dr. Pablo Martínez Ruiz del Árbol** contributed to the **“Experimental Particle and Astro-Particle Physics Seminar”** series at the **University of Zürich** with a seminar titled: **“SUSY searches with opposite sign leptons”** on the 18th of March of 2015.

In Zürich, on the 19th of March of 2015,

Florencia Canelli

(Organizer of the seminar)

5.F. Trabajos presentados en workshops

5.G. Otras actividades de Divulgación

5.G.1. Café con Ciencia: Tomografía muónica: unha ollada ao interior da materia

Artabro Tech S.L.
CIF: B70530795
c/ de la Iglesia 13, 5
15402 Ferrol

Certificado de asistencia de D. Pablo Martinez Ruíz del Árbol al ciclo de seminarios **“Café con Ciencia”** como ponente para impartir el seminario **“Tomografía muónica: unha ollada ao interior da materia”** el día 11 de marzo de 2020 en Ferrol.

El ciclo de seminarios **“Café con Ciencia”** está organizado de forma conjunta por la Universidad de la Coruña y la empresa Ártabro Tech S.L.

Miguel Vidal Maroño
CTO de Ártabro Tech S.L.

En Ferrol, 8 de junio de 2020

5.G.2. Tardes Con Ciencia: Un universo supersimétrico: explorando las fronteras de la física de partículas

Rocio Vilar Cortabitarte, con cargo de Vicedirectora del Instituto de Física de Cantabria (IFCA) en tareas de difusión y divulgación;

HACE CONSTAR:

Que **Don Pablo Martinez del Árbol** ha participado en la actividad de divulgación del IFCA titulada "**Tardes Con Ciencia**" el 21 de Mayo de 2020 con una charla titulada **"Un Universo Supersimétrico: explorando las fronteras de la Física de Partículas"**.

El Instituto de Física de Cantabria (IFCA, CSIC-UC) ha organizado el ciclo de conferencias online '**Tardes con Ciencia**' para acercar la física de forma amena y divulgativa a público a partir de la educación secundaria debido a las circunstancias de la pandemia. En esta serie de charlas que se impartieron los martes y jueves del mes de mayo, siete investigadores del IFCA presentarón parte de su trabajo, de sus investigaciones o curiosidades de distintas ramas de la ciencia. Tras las ponencias se pasará a un turno de preguntas para que se resuelvan las dudas que hayan podido surgir.

Fdo.:

Santander, a 1 de Septiembre del 2020

EDIF. JUAN JORDÁ
CAMPUS UNIVERSITARIO
UNIVERSIDAD DE CANTABRIA
AVDA. DE LOS CASTROS, s/n
39005 - SANTANDER - ESPAÑA
PHONE: +34 942 201 459
FAX: +34 942 200 935

vilar@ifca.unican.es

5.G.3. Expandiendo la Ciencia: siete charlas en instutos y colegios de Cantabria

Instituto de Física de Cantabria — EXCELENCIA MARÍA DE MAEZTU — CSIC Consejo Superior de Investigaciones Científicas — UC Universidad de Cantabria

Rocio Vilar Cortabitarte, con cargo de Vicedirectora del Instituto de Física de Cantabria (IFCA) en tareas de difusión y divulgación;

HACE CONSTAR:

Que **Don Pablo Martinez del Árbol** ha participado en la actividad de divulgación del IFCA titulada "**Expandiendo la Ciencia**" que se realizó durante los cursos 2018-2020 en varios IES y CEIP de Santander y la región dando diferentes charlas para los alumnos de Primaria, ESO y Bachiller :

- "**Cómo cambia tu vida la física de partículas**", 27 de enero de 2020, CEIP María Torner en Mompía.
- "**Antimateria en aceleradores, hospitales y supermercados**", 9 de enero de 2020, IES Torres Quevedo, Santander.
- "**Cómo cambia tu vida la física de partículas**", 17 de diciembre de 2020, IES, Muriedas.
- "**Cómo cambia tu vida la física de partículas**", 17 de diciembre de 2019, IES, Muriedas.
- "**Antimateria en aceleradores, hospitales y supermercados**", 11 de febrero de 2019, Colegio Calasanz, Santander.
- "**Cómo cambia tu vida la física de partículas**", 13 de diciembre de 2018, IES, Muriedas.
- "**En busca de lo desconocido**", 27 de noviembre de 2018, CEIP José Ramón Sanchez, Astillero.

Esta actividad permite a los institutos y colegios de Cantabria **solicitar que un investigador del Instituto de Física de Cantabria (IFCA, CSIC-UC) se desplace a su centro educativo para impartir seminarios** sobre diversas ramas de la Física. Así, el IFCA procura incentivar el interés por la ciencia entre el alumnado de Cantabria, acercándoles a los científicos/intelectuales más punteros.

Fdo.:

Santander, a 1 de Septiembre del 2020

EDIF. JUAN JORDÁ
CAMPUS UNIVERSITARIO
UNIVERSIDAD DE CANTABRIA
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PHONE: +34 942 201 459
FAX: +34 942 200 935

vilar@ifca.unican.es

5.G.4. Participación en la noche de los investigadores durante los años 2017, 2018, y 2019

La Noche europea de l@s investigador@s

UC UNIVERSIDAD DE CANTABRIA

GOBIERNO DE ESPAÑA · MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD · FECYT FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA · RED DE UNIDADES DE CULTURA CIENTÍFICA Y DE LA INNOVACIÓN

Científic@s para un futuro mejor

Javier León Serrano,
vicerrector de Investigación y Transferencia del Conocimiento
de la Universidad de Cantabria

CERTIFICA que

Pablo Martinez del Árbol

Instituto de Física de Cantabria (IFCA)

Ha participado como investigador en la V edición de la **"Noche Europea de los Investigadores"** de la Universidad de Cantabria, (proyecto asociado a la acción Marie Sklodowska-Curie, Horizon 2020) bajo el proyecto número 633243, y titulado *European Researchers´ Night: Researchers for a better future*, organizada por la Unidad de Cultura Científica y de la Innovación (UCC+i) de la UC y celebrada en Santander el 29 de septiembre de 2017.

Y para que conste y surta los efectos oportunos, se expide la presente certificación, en Santander, a 2 de octubre de 2017.

El vicerrector de Investigación
y Transferencia del Conocimiento,

Javier León Serrano

D. Javier León Serrano, Vicerrector de Investigación y Transferencia del Conocimiento de la Universidad de Cantabria

CERTIFICA

que

Pablo Martínez

IFCA

ha participado como investigador/a en la **VI Noche Europea de los Investigadores** de la Universidad de Cantabria (UC) (acción Marie Skłodowska-Curie, Horizonte 2020 – Noche Europea de los Investigadores asociada), organizada por la Unidad de Cultura Científica y de la Innovación (UCC+i) de la Universidad de Cantabria (UC) y celebrada en Santander el **28 de septiembre de 2018**.

Y para que conste y surta los efectos oportunos, se expide la presente certificación, en Santander, a 1 de octubre de 2018.

El Vicerrector de Investigación y Transferencia de conocimiento,

UNIVERSIDAD DE CANTABRIA

D. Javier León Serrano

Marta Seror García

CERTIFICA

que

Pablo Martínez Ruiz del Árbol

ha participado como investigador en la VII Noche Europea de los Investigadores organizada por la Unidad de Cultura Científica y de la Innovación (UCC+i) de la Universidad de Cantabria (UC) y celebrada el 27 de septiembre de 2019 con la siguiente actividad:

Stands en la plaza Pombo – "Conociendo la Naturaleza en el IFCA"

Duración de la actividad: 4 horas

Y para que conste y surta los efectos oportunos, se expide la presente certificación, en Santander, a 11/10/2019.

UNIVERSIDAD DE CANTABRIA VICERRECTORADO DE INVESTIGACIÓN Y TRANSFERENCIA DEL CONOCIMIENTO

Vº Bº de:

D. Javier León Serrano
Vicerrector de Investigación y Transferencia del Conocimiento
Universidad de Cantabria

Firmado:

Marta Seror García
Coordinadora de la actividad
Difusión y Divulgación del IFCA

5.G.5. Conferencia en el Ateneo de Santander: Un universo supersimétrico: explorando las fronteras de la física de partículas

MANUEL ÁNGEL CASTAÑEDA PÉREZ, PRESIDENTE DEL ATENEO DE SANTANDER

CERTIFICA que, P**ablo Martínez Ruiz del Árbol** ha dado la conferencia **"Un Universo Supersimétrico: explorando las fronteras de la física de partículas"** el 20 de septiembre de 2019 en el **Ateneo de Santander.**

Lo cual certifico a los efectos oportunos en Santander a cuatro de septiembre de dos mil veinte.

Gómez Oreña, 5-1º - 39003 Santander. Tfno: 942.212.820. E-mail admon@atesant.es.
Web: http://www.atesant.es/

5.G.6. Pint of Science: Un universo extraño

PINT OF SCIENCE ESPAÑA

Otorga este

DIPLOMA

a

Pablo Martínez Ruiz del Árbol

Instituto de Física de Cantabria (IFCA)

Por su colaboración como **ponente** en el **Festival Pint of Science España**, celebrado en ***Santander del 14 al 16 de mayo de 2018***

Jorge Bueno Gómez
Coordinador Nacional de Pint of Science España

Beatriz Salas Vegue
Coordinadora Pint of Science Santander

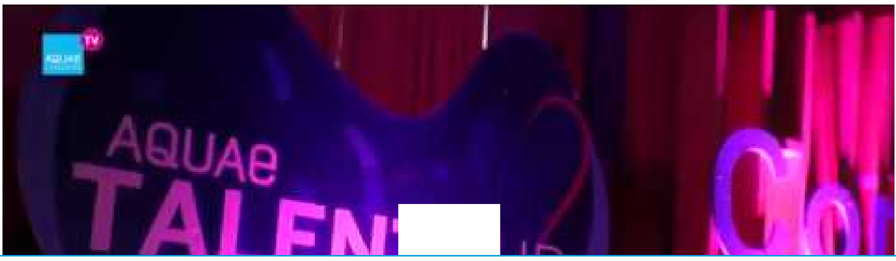
5.G.7. Las nubes de la Física, Aquae Talent Hub

Se ha celebrado un nuevo Aquae Talent Hub, esta vez en Ourense

La fundadora de la Mandarina de Newton, Irene Lapuente y el científico Pablo Martínez Ruíz del Árbol han sido los ponentes de la jornada itinerante por excelencia sobre innovación, emprendimiento y talento de Fundación Aquae, el Aquae Talent Hub, esta vez en Ourense en el Salón Marie Curie de la Universidad de Vigo. La jornada ha estado dividida en dos partes, un taller a cargo de Irene Lapuente y una Master Class liderada por Pablo Martínez Ruiz del Árbol en la que nos habló de su trabajo, en qué consiste buscar materia oscura en el universo y además nos habló de cómo se puede llegar a trabajar en el CERN, uno de los centros de investigación más importantes del mundo. Un encuentro dirigido a personas con interés por aprender sobre innovación, compartir sus conocimientos y ampliar su red de contactos.

La fundadora de la Mandarina de Newton, **Irene Lapuente** y el científico **Pablo Martínez Ruíz del Árbol** han sido los ponentes de la jornada itinerante por excelencia sobre innovación, emprendimiento y talento de **Fundación Aquae**, el **Aquae Talent Hub**, esta vez en Ourense en el Salón Marie Curie de la Universidad de Vigo.
La jornada ha estado dividida en dos partes, un taller a cargo de Irene Lapuente y una Master Class liderada por Pablo Martínez Ruiz del Árbol en la que nos habló de su trabajo, en qué consiste buscar materia oscura en el universo y además nos habló de cómo se puede llegar a trabajar en el CERN, uno de los centros de investigación más importantes del mundo.

Un encuentro dirigido a personas con interés por aprender sobre innovación, compartir sus conocimientos y ampliar su red de contactos.



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5.G.8. La gravedad de lo invisible, Aquae Campus 2018

Más de 700 personas acuden en Cartagena al Aquae Campus 2017, centrado en lo 'Visible Invisible'

- ***Fundación Aquae e Hidrogea organizan la IV edición de este evento de innovación y emprendimiento pensado para mentes inquietas***

- ***Un panel interdisciplinar de expertos de primer nivel ha compartido con el público sus ideas y proyectos transformadores***

- ***Durante el evento se han entregado los premios de Fundación Aquae***

Madrid, 20 de octubre de 2017.- **Hoy la Facultad de Empresa de la Universidad Politécnica de Cartagena se ha llenado de talento e innovación gracias a Aquae Campus, un lugar de encuentro, reflexión y debate que ha congregado a más de 700 personas** en torno al lema 'La revolución de las ideas' y el concepto 'Visible IInvisible'. Este evento, impulsado por Fundación Aquae en colaboración con Hidrogea, sirve de espacio de aprendizaje, intercambio y divulgación del conocimiento gracias a un panel multidisciplinar de expertos de proyección internacional que ha compartido con el público sus ideas y proyectos transformadores.

Este evento de innovación y emprendimiento, que ha sido *trending topic* durante su desarrollo y se ha retransmitido por *streaming*, ha contado con Belén Viloria, Embajadora de TEDx para España, como maestra de ceremonia.

En la primera parte de esta jornada, los asistentes han podido disfrutar de estimulantes ponencias de la mano de expertos como el ingeniero químico experto en olores **Luciano Vera,** que llamó nuestra atención sobre la importancia que tienen los olores en nuestro día a día, en nuestras emociones, e incluso en nuestra toma de decisiones; **Marta Peirano**, ensayista, periodista y escritora, que nos ha hecho reflexionar sobre el hecho de que Internet esté en manos privadas; **Miguel Ángel Hernández**, profesor de Arte Contemporáneo de la Universidad de Murcia, escritor y crítico de arte, que nos ha acercado su visión del arte como resistencia ante la hipervisualidad contemporánea donde nuestra intimidad se encuentra ya totalmente expuesta; y **Carlos Vara,** Doctor en Humanidades y Licenciado en Biología, que nos ha explicado que olvidar es necesario si queremos experimentar la creatividad.

Estas **conferencias breves e inspiradoras** se han sumado a diálogos colaborativos entre expertos de diversos campos, monólogos científicos y entrevistas. Todo ello dinamizado con vídeos interactivos y *perfomances,* como 'Las ideas cambian el mundo', una obra de arte única, pintada con chocolate, que ha realizado en tiempo real el artista plástico Diego Zappa.

Pablo Martínez Ruíz del Árbol, físico del Laboratorio Europeo de Física de Partículas Elementales (CERN), nos ha explicado cómo en el acelerador de partículas del CERN (Ginebra, Suiza) él y su equipo están intentando producir posibles nuevas partículas candidatas a conformar la materia oscura que inunda nuestro Universo (esta masa transparente es cinco veces más abundante que la materia ordinaria). Un experimento que realizan utilizando el Gran Colisionador de Hadrones, una máquina que acelera y hace colisionar protones para crear densidades de energía tan grandes que permitan la producción de estas partículas.

Los acordes de la guitarra de **Miriam Albusac**, experta en neurociencia de la música, investigadora y profesora en la Universidad de Jaén, han dado paso a su charla, centrada en la conexión entre música y cerebro: «*La música es un elemento muy útil para promover la plasticidad cerebral, es decir, para provocar modificaciones*».

Los asistentes han compartido el entusiasmo de **Luz Rello**, lingüista, doctora en Ciencia Computacional y emprendedora social, que nos hablado de su proyecto, basado en inteligencia artificial, para detectar en 15 minutos la dislexia, un trastorno oculto que afecta a más del 10% de la población mundial; y de **David Calle**, uno de los diez mejores profesores del mundo según el Global Teacher Prize 2017, que nos ha explicado cómo se enseña a través de Youtube. Los últimos ponentes han sido la editora neoyorquina **Valerie Miles**, cofundadora de la revista Granta en español; y **Eduardo Sáenz de Cabezón**, doctor en Matemáticas y monologuista científico, que ha cerrado esta edición de Aquae Campus arrancado las risas del público.

Como cada año, **Aquae Campus ha contado con una zona experiencial donde el público ha convertido lo invisible en visible y se ha dejado llevar** por elementos como un cubo que en 120 segundos cambiaba nuestra visión de la Tierra; y una pintura en 3D, en el que los ojos nos han engañado a todos. Los asistentes también han podido conocer de cerca los proyectos, actividades, publicaciones y objetivos de Fundación Aquae en la zona de Hosting.

Durante esta jornada **también se han entregado los premios de Fundación Aquae: 'Innova', 'Diseña', 'Árbol de la vida', 'Photoaquae', 'Microrrelatos científicos'** y **'Monólogos científicos'**.

El compromiso social de Fundación Aquae también se ha reflejado en el catering, a cargo de la Escuela de Hostelería de Cáritas-Cartagena. *Eh!* es el nombre de este proyecto social, que corresponde al acrónimo de "Escuela de Hostelería" pero que también pretende ser una llamada de atención para que no nos olvidemos de las personas con dificultades que viven a nuestro alrededor.

Eh! es un proyecto de Cáritas-Cartagena que une formación y empleo: los alumnos de esta escuela desarrollan sus prácticas en un entorno profesional y protegido dentro de la Empresa de Inserción Ehlaboras, donde perfeccionan y amplían sus habilidades laborales, creando un puente que facilite la inserción laboral real. Desde su inauguración, por las aulas de la Escuela de Hostelería *Eh!* ya han pasado 160 alumnos. Además de servicios de catering para eventos y colectividades, *Eh!* también dispone de un restaurante y cafetería abiertos al público.

Aquae Campus se celebra anualmente desde 2014 en diferentes puntos de la geografía española. Hasta la fecha, en Las Palmas, Valladolid y Granada.

Una vez finalizado este evento, Fundación Aquae plantará en la ciudad de Cartagena tantos árboles como personas asistan a él compensando así la huella de carbono de su participación y compensaremos el CO2 emitido durante la celebración del Aquae Campus (en 2016 ya plantamos 700 árboles en Granada, donde se celebró la anterior edición). Esta iniciativa se enmarca dentro del proyecto 'Sembrando O2', cuyo objetivo es luchar contra el cambio climático.

ACCESO A LAS FOTOS DE AQUAE CAMPUS:
https://drive.google.com/drive/folders/0B_aWU3kVD1IvV2FTSVh0Y3Fzc00

Sobre Fundación Aquae

FUNDACIÓN AQUAE es una entidad privada independiente y sin ánimo de lucro que apoya y promueve el talento emprendedor, la investigación, la innovación, la cooperación y la integración social en los campos de la ciencia, el conocimiento, la sostenibilidad y la cultura. Creada en 2013, Fundación Aquae trabaja como un *think tank* que aspira a despertar la inquietud, la creatividad y el espíritu colaborativo para conseguir un modelo de desarrollo social, económico y medioambiental sostenible. Objetivo que consigue gracias a iniciativas como Aquae Campus, Aquae Talent Hub, la Cátedra Aquae de Economía del Agua o la Red de Impulsores del Cambio.

Más: http://www.fundacionaquae.org/

Sobre Hidrogea

HIDROGEA es la empresa del sector del medioambiente que gestiona todos los procesos relacionados con el ciclo integral del agua: la captación, la potabilización, el transporte y la distribución para el consumo ciudadano con absolutas garantías sanitarias. También se ocupa del saneamiento, la depuración, la devolución del agua tratada al medio natural y la reutilización del gas y del fango que se generan durante el tratamiento.
En Cartagena abastece a 215.000 ciudadanos y a más de un millón en la Región de Murcia.

Más: http://www.hidrogea.es/es

5.H. Otras méritos asociados a la calidad y difusión de resultados de la actividad investigadora

5.H.1. Memorandum de la European Physical Society acerca de la evaluación de Físicos de Partículas Experimentales

ECFA/15/291
Original: English
7 May 2015

ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

Memorandum on the evaluation of Experimental Particle Physicists

Joint ECFA/HEPP-EPS Document

Memorandum on the evaluation of Experimental Particle Physicists

Joint ECFA/HEPP-EPS Document

Motivation and purpose of this document

The difficulty to properly evaluate particle physicists especially for panel members from other fields of research has increased significantly over the last ten years, due to the growth of the size of experimental collaborations and hence the length of the publication author lists. This trend is not unique to particle physics (also known as High-Energy Physics, or HEP) – indeed it may be observed to variable extents in related as well as unrelated fields. In particle physics, it has become prevalent because of the size and complexity of the needed experiments and the time necessary to build experimental facilities and then to acquire and analyze the data. As a result, particle physics publications are authored by all collaboration members, listed in alphabetical order. Members of large collaborations are therefore authors of hundreds of papers with very similar author lists.
Whereas satisfactory evaluation procedures are used within the Particle Physics Community, these informal but efficient recipes are not fully known or easily usable for evaluations outside the community or for comparison with scientists from other disciplines competing for the same positions. This document, elaborated by a joint ECFA/HEPP-EPS committee after consultations within and outside the HEP community, aims to give some guidelines for non-expert panel members to efficiently evaluate experimental particle physicists. In the last section, recommendations are made to help particle physicists in preparing for evaluations.

Section 1. INFORMATION FOR EVALUATORS FROM FIELDS OTHER THAN HEP

This section summarizes the criteria that are helpful in evaluating experimental HEP colleagues working in large collaborations.

1.1 Publications in refereed journals

A widely used and publicly available source to find publications in refereed journals and other information is the high-energy physics information system (http://inspirehep.net) developed jointly by CERN (Conseil Européen pour la Recherche Nucléaire, Geneva), DESY (Deutsches Elektronen-Synchrotron, Hamburg), FNAL (Fermi National Accelerator Laboratory, Batavia, Illinois) and SLAC (Stanford Linear Accelerator Center, Palo Alto, California)..

In this regard, it should be noted that papers by large collaborations, covering the full spectrum of activities from physics analyses to technical developments, are usually published in a few high-impact journals. With only a few exceptions, particle physics papers are not published in highest-impact multidisciplinary journals such as Nature or Science.

Given the publication practices mentioned above, the usual indicators such as citation index, h index, ranking in the author lists, etc., are not useful in the field and can be misleading. Evaluators should rather focus on the most significant publications indicated by the candidates and look in detail for the specific role they have played in each of them. Have they been authors of the analysis that led to the publication (quite often, several analyses compete within a collaboration but only a single result is published based on the best tools and ideas used in these different approaches) or worked on a key technical contribution for that paper? Have they defended the final analyses in front of the collaboration? Have they been selected as a contact person for the journal reviewers? It is important to notice that even in such papers there is often a significant number of people entitled to claim a crucial role. This is a fact and necessity of our field, which does not diminish the merits of individual contributors.

It is also important to note that given the very long construction time of the large experiments, an individual's publication rate can be quite low during the construction period only to suddenly become quite high once the data become available. Therefore these fluctuations may be completely uncorrelated with the candidate's scientific achievements.

1.2 Visibility within large collaborations

An important criterion to evaluate experimental scientists in HEP is their visibility within their collaboration. In general the collaborations are structured in different work areas such as detector R&D, construction and operation, trigger, data preparation, physics analysis, and computing. These areas are led by coordinators, who together with the collaboration management have important responsibilities. Areas are usually organized in a hierarchical structure with conveners of working groups. For example in physics analyses of the LHC experiments, all major topics like Standard Model physics, Higgs boson searches and measurements, Searches for Supersymmetry etc. have co-leaders. Such (co)-convenerships represent top-level positions within the collaborations and are very sought after. They are assigned to highly respected people and confer significant recognition to those who get them.
Still on matters of visibility, due to strong internal competition, being selected to present the result of an analysis in a collaboration meeting's plenary session is a significant achievement. For more senior people, managerial positions, like chairpersons of collaboration boards, sub detector coordinators, and membership of publication, authorship or speaker committees are of added value. The collaborations are encouraged to keep a public record of these positions.

1.3 Participation in committees and boards as chair or members

The large collaborations have a sizeable number of committees, e.g. speaker committee or publication committee, and boards. As an example of the latter, the Editorial Boards that review and scrutinize analyses before publication do very delicate work. Appointments to such boards acknowledge the scientific competence and critical judgment of their members.

1.4 Presentations at conferences on behalf of the collaboration

Talks at international conferences and workshops, where individual candidates present the results in plenary or parallel talks on behalf of the collaboration are very important. These talks are assigned by the speaker committees of the collaborations. In the selection procedure the contributions of the candidates to all relevant experimental areas (detector construction, commissioning, operation, software, reconstruction of particle signatures and data analysis) are taken into account. The selection is highly competitive and provides an important acknowledgment of the contributions of individuals to the large experiments, as well as their scientific competence.

1.5 Seminars

Invitations for seminars at research institutes or universities constitute another significant acknowledgment because very often speakers are invited by researchers from within the collaboration who have exact knowledge of the merits of the individual.

1.6 Prizes, awards and distinctions

As in any other discipline, prizes and awards are also important in HEP. In addition to the usual prizes and awards, a few large collaborations have established annual prizes for the best theses. Such awards mark a significant distinction, especially because there are many theses to choose from.

1.7 International recognition by membership in committees

Major HEP labs have high-level scientific councils to which key members of the community are invited to contribute their expertise. Such international or national recognition is highly valued in the field.

1.8 More subjective criteria

Specific HEP contributions are the work of many people. Therefore it is quite important to assess to what extent a candidate took initiatives and contributed original ideas. The diversity of skills (theoretical knowledge, experimental analysis, instrumentation, computing) is a great asset, given the tendency towards narrow specialization. Leadership positions and leadership capabilities, the aptitude for team work, language and communication skills, as well as the ability to work under pressure, should be highly considered.

1.9 Letters of recommendation

Carefully composed letters of recommendation may provide a solid basis for a comparative assessment. Very often, the author will be part of the same collaboration and sometimes will be in a very senior position. Of course, a spokesperson's letter can attract more attention but may not display sufficient familiarity with the candidate's work. A letter from a convener may bring precise and unique information on the personal impact of the candidate's work in the experimental results. Such a letter may be more useful than one from a referee not from the same collaboration.

Section 2. RECOMMENDATIONS FOR THE HEP COMMUNITY

The following recommendations are intended for candidates applying for positions (in particular those not specifically earmarked for particle physics), for experimental collaborations and for authors of reference letters, in order to maximize the chances of success of HEP members.

RECOMMENDATIONS FOR CANDIDATES

- Personal webpage
A link to a well-structured, up-to-date personal webpage should be provided for complementary information, as application documents are often required to conform to a specific format or are restricted in length.

- Specific information on publications and other documents
Given that it is virtually impossible for an external reviewer to assess the role of candidates in dozens of publications with many authors, it is recommended to single out those to which candidates have contributed in a significant way, and to describe the nature of these contributions. In addition, documents not always publicly available, such as analysis or detector notes, which are generally signed by a small number of authors, should be listed if allowed by the collaboration. The number of authors contributing to a specific analysis or development, and the degree of competitiveness, could be mentioned. Contributions may include performing an analysis, defending it in internal reviews, presenting it at important meetings, editing a paper or note, or interacting with a journal.

- Specific information on conference contributions
Given that there is a large number of HEP conferences and many potential speakers, it is recommended that candidates mention the level of competition in the assignment of talks or posters, and the significance and size of a conference.

RECOMMENDATIONS FOR COLLABORATIONS

- Author identification scheme
In the very long author lists of many HEP publications, different authors have the same name or the spelling of an author's name is not identical across publications, which makes it hard to unambiguously identify authorship. It is therefore recommended to adopt a recognized author identification scheme.

- Record of organizational structure and position holders
Given the importance of high-level positions for a candidate's career, collaborations should provide current and past information about their organizational structure and the names of the most important position holders on their websites. Their history should be kept over time and be publicly available.

RECOMMENDATIONS FOR AUTHORS OF REFERENCE LETTERS

Reference letters are of prime importance to support applications in the field of HEP.

- Content of reference letters
Authors should describe their position and relationship to the candidate, in particular within large collaborations, followed by a description of the work performed by the candidate and other factual information, an assessment of the candidate in the context of the evaluation criteria, and finally, more subjective comments.

5.H.2. Carta de Filip Moorgart: coordinador de búsquedas de Supersimetría de CMS

European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

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EP Department
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Geneva, January 28th, 2020

Letter supporting dr. Pablo Martinez Ruiz del Arbol in his application to become a member of the Young Academy of Spain.

Distinguished colleagues,

I am writing to you in support of the application of dr. Pablo Martinez Ruiz del Arbol to become a member of the Young Academy of Spain.

I have known Pablo since 2010, soon after he started his postdoctoral research position in the Institute for Particle Physics at ETH Zurich, where I was a senior scientist at the time. On numerous occasions over the past 10 years, Pablo impressed me with his analytical skills and his strong work ethic. His ability to identify problems and to suggest innovative solutions is remarkable. He is an experienced team player, and is able to lead a project towards success. He has made several significant contributions to the state of the art in particle physics, as I will illustrate below.

As a particle physicist, Pablo has been an active member of the CMS experiment, one of the two general-purpose experiments at CERN's Large Hadron Collider (LHC). The CMS Collaboration consists of about 3000 physicists and engineers from 200 institutes from 50 different countries. During his PhD at the University of Cantabria, Pablo developed a novel method to align the CMS muon system and was responsible for the geometry databases. This was an important ingredient to be able to analyze the first data of the CMS experiment. He received several awards in recognition of the importance of his contribution to the CMS experiment.

At ETH Zurich, Pablo took charge of the analysis team (~10 students/postdocs from various universities) that was carrying out one of the flagship searches for supersymmetry (SUSY). This particular analysis attracted a lot of attention inside and outside of CMS because of a significant excess in the Run 1 data, and was therefore thoroughly vetted for several months (probably the most scrutinized analysis in the CMS SUSY group to date), which lead to heavy pressure on the analysis team for an extended period of time. Pablo handled the scrutiny of his colleagues in an exemplary way. No mistakes in the analysis were found and the excess later disappeared in the

Run 2 data (it seemed to be purely a statistical fluctuation). All of this further strengthened Pablo's reputation as a very reliable physicist.

In 2013, Pablo was appointed as co-convener of the Monte Carlo and Trigger subgroup of the SUSY group in CMS. As CMS SUSY convener between 2014 and 2016, I can attest to the impressive contributions that Pablo has made here. The load on his group was extremely heavy, since both the Trigger menu development and the preparation for the 13 TeV Monte Carlo production were very active fields in view of the upcoming run of the LHC. I can say with confidence that Pablo's vision, leadership and work ethic have been absolutely critical to ensuring our readiness for the 13 TeV supersymmetry searches. In recognition of his talents, he was appointed him as co-convener of the Third Generation subgroup of the SUSY group (~ 50 physicists) in 2016 where he was responsible for reviewing the results of the various analysis teams.

Recently, Pablo was asked to lead the novel CMS Timing Detector performance studies, an innovative but very challenging project aiming at using precise timing information (~ 50 picosecond precision) in order to get extra constraints to determine the properties of the particles coming out of the LHC collisions.

I will not go into further details of Pablo's analysis and detector work, since it is not particularly relevant to his membership of the Young Academy. However, I believe that the above examples illustrate clearly that Pablo has an extensive experience in state-of-the-art scientific research and in international scientific collaboration, both at CERN and in ETH Zurich, which he would bring to the Young Academy.

In summary, I believe that Pablo has demonstrated great potential as a research leader in our field. He has made important contributions to the commissioning of the muon detectors in the CMS experiment, to the search for supersymmetry and currently in studying the performance of the innovative CMS timing detector. I have worked closely with Pablo in the past 10 years, and I can attest to the fact that he is a smart and efficient physicist, determined to bring his projects to a successful completion. He has creative ideas and is able to lead a team. He is very enthusiastic and has outstanding social skills. He will bring with him a broad international experience, having worked in world-leading universities and research centers. Therefore, without the slightest hesitation, I strongly recommend that Pablo is considered as a member of the Young Academy of Spain. I am absolutely certain that he will make a most valuable asset to the academy.

With my best regards,

Filip Moortgat

CERN Staff Research Physicist
Deputy LHC Programme Coordinator
Co-convener of the CMS supersymmetry group 2014-2016 & 2019

5.H.3. Carta de Wolfgang Adam: Physics Coordinator de CMS

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Austrian Academy of Sciences

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Wolfgang Adam
Institute of High Energy Physics of
the Austrian Academy of Sciences
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CH-1211 Genève 23

To the members of the
selection committee of the
Young Academy of Spain

CERN, Jan. 30, 2020

Subject: Letter of reference for Dr. Pablo Martinez Ruiz del Arbol

To whom it may concern,

it is a pleasure for me to provide a letter of reference in strong support of the application of Dr. Pablo Martinez Ruiz del Arbol for membership in the Young Academy of Spain. I am an experimental particle physicist, senior staff at the Institute of High Energy Physics of the Austrian Academy of Sciences, and I know Dr. Martinez since many years from my activities and coordination roles in the CMS Collaboration, in particular in the area of searches for new phenomena beyond the currently established standard model of particle physics.

In order to set the scale, I would like to start by saying that the CMS Collaboration is one of largest scientific collaborations worldwide, with about 3000 physicists (including about 1000 PhD students) members, working for more than 200 institutions in 55 countries around the globe. Performing research in this environment requires not only to deal with the complexity of the experimental apparatus, operating at CERN's

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LHC, but also to face challenges due to strong competition both internal in the collaboration, and from other experiments, and also organizational challenges.

During the preparation for data taking and the first years of operation, Dr. Martinez made strong contributions to the calibration of the measurements of different objects used in the analysis of LHC data, in particular muons, and energy calibration of jets initiated from b-quarks. These are essential elements in most analysis efforts in CMS.

His research with CMS data is mainly targeting searches for new phenomena beyond the predictions of the current standard model of particle physics. These searches are motivated by the deficiencies of the latter, in particular, the open questions of the nature of dark matter, and of hierarchies of particle masses. Much of his work is motivated by supersymmetry, a global and promising extension of the standard model that constitutes one of the research priorities in the sector. I followed his work as coordinator of the corresponding CMS working group. Dr. Martinez was a driving force of early searches using events with two charged leptons, one of the cleanest and most promising channels in these searches. He then moved his focus to experimentally more challenging categories of collision events in order to investigate scenarios that might have been missed in data taken in the first years of LHC running, such as searches for supersymmetric partners of leptons or top quarks, again at the leading edge of research in the sector.

Dr. Martinez performed many of these analyses while holding a position at the prestigious Swiss Federal Institute of Technology Zurich (ETHZ). His expertise in the field, and his organizational skills, were recognized by the collaboration by entrusting him successively with the leadership of two working groups related to searches for supersymmetry. In the first of these positions he had the task to coordinate and review work on the selection of candidate signal events during data taking - critical tasks that determine which data will be available for future analysis, performed under strict timing constraints. The second position was the responsibility of the working group covering all searches for supersymmetric partners of tau leptons, beauty, and top quarks, one of the most thriving sectors in the last years. In the latter role, he was in charge of coordinating the work of researchers from some 20 institutions, giving advice on the priorities, and performing the first stages of the review process leading to submission of the results to scientific journals, and publication. Most recently, Dr. Martinez is leading a group evaluating the performances of a novel timing detector system that is part of an ambitious upgrade programme that will prepare CMS for a decade of operations at the High-Luminosity LHC.

In large collaborations in high energy physics, the experience and leadership of individuals is recognized by selecting them for coordinating roles as described above. Credit is given to members of the collaboration also via the attribution of talks at conferences, where they are representing the experiment. Dr. Martinez was chosen by the CMS collaboration to present physics results in some of the most important conferences in the field, such as the "International conference on high energy physics" in 2012 and 2014.

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In summary I can say that Dr. Martinez has shown a steady evolution in his scientific career, with several important contributions to the research programme of the CMS collaboration. He has increasingly taken leadership in different groups and guided many younger members of the collaboration. Therefore, I would like to express my strong support for his application for membership in in the Young Academy of Spain.

Sincerely yours,

W. Adam

Wolfgang Adam

Senior staff scientist, Institute of High Energy Physics, Austrian Academy of Sciences

CMS physics co-coordinator, former co-convener of the CMS SUSY group

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5.I. Organización de actividades de I+D+i

5.I.1. CMS workshop at Santander, Organizador del workshop

CMS SUSY WORKSHOP 2019

18th-20th September
Santander (Spain)

For details and registration: https://indico.cern.ch/event/828287

Contacts:

Organization:

cms-susy19-santander@cern.ch

Scientific programme:

cms-pag-conveners-susy@cern.ch

International and local organizing committee:

Pieter Everaerts (Imperial College)
Filip Moortgat (CERN)
Seema Sharma (IISERs)

Pablo Martínez Ruiz del Árbol (IFCA)
Luca Scodellaro (IFCA)

CMS CERN IFCA Instituto de Física de Cantabria

5.I.2. CMS workshop at Viena, Comité científico del workshop

© NHM Wien, Kristin Rupp

13-15 June 2018
Technische Universität Wien
Europe/Vienna timezone

Contact
cms-susy18-vienna@ce...

Session

Subgroups

13 Jun 2018, 16:15

Boecklsaal (Technische Universität Wien)

Conveners

Subgroups: Future

- Anadi Canepa (Fermi National Accelerator Lab. (US))

Subgroups: Leptonic

- Basil Schneider (Fermi National Accelerator Lab. (US))
- Giovanni Zevi Della Porta (Univ. of California San Diego (US))

Subgroups: Trigger

- Andrew Warren Askew (Florida State University (US))
- Laurent Thomas (Universite Libre de Bruxelles (BE))

Subgroups: Photons

- Rishi Gautam Patel (University of Colorado Boulder (US))
- Marc Gabriel Weinberg (Carnegie-Mellon University (US))

Subgroups: TBT

- Pablo Martinez Ruiz Del Arbol (Universidad de Cantabria (ES))
- Hannsjorg Weber (Fermi National Accelerator Lab. (US))

Subgroups: Inclusive (part I)

- Ana Ovcharova (Univ. of California Santa Barbara (US))
- Claudia Seitz (Universitaet Zuerich (CH))

5.I.3. CMS workshop at Ghent, Comité científico del workshop

10-12 April 2017
Ghent
Europe/Brussels timezone

Search...

Timetable
Contribution List
My Conference
My Contributions
Registration
Participant List
Videoconference Rooms
Venue
Accomodation
Travel information
Workshop dinner

Support
cms-susy-ghent-2017@...

Timetable

Mon 10/04 | Tue 11/04 | Wed 12/04 | All days

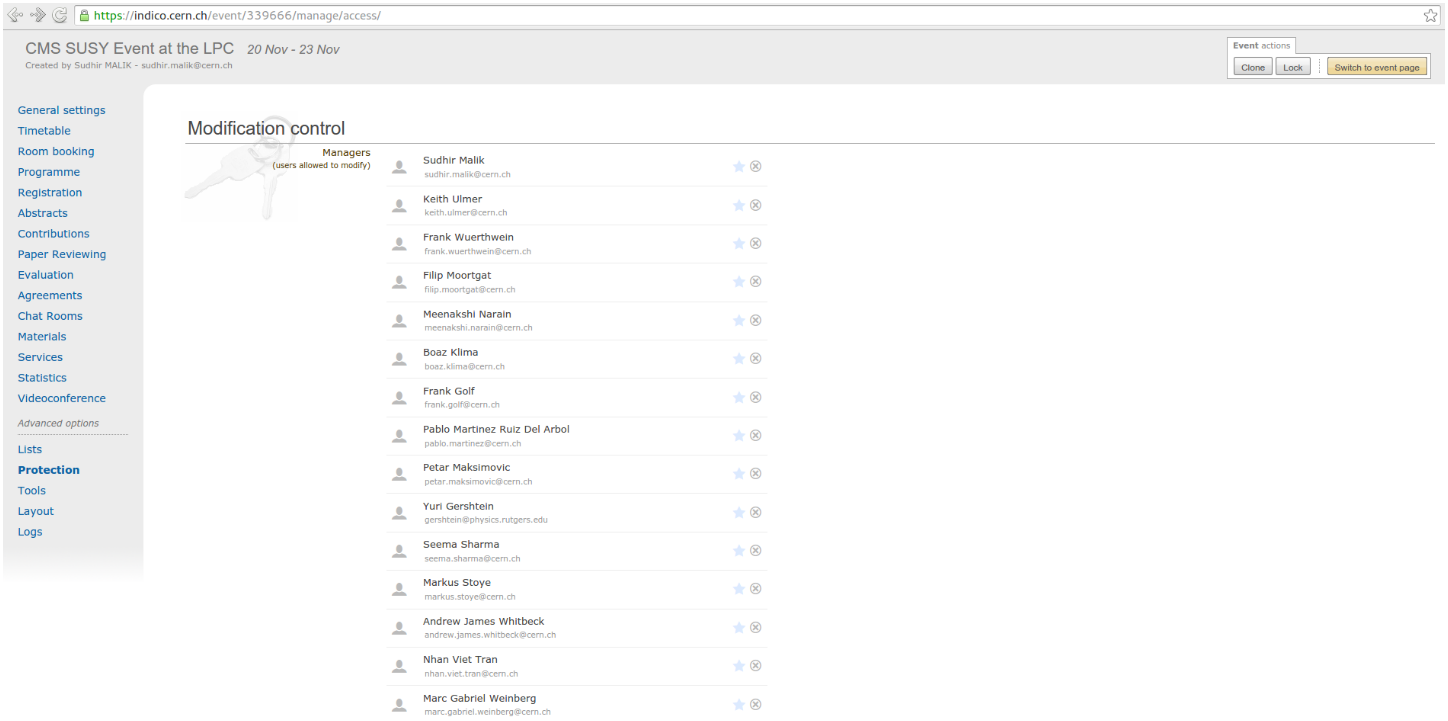
Print | PDF | Full screen | Detailed view | Filter

Session legend

General | General | Photonic Searches | TBT

09:00	**Overview TBT group**	*Pablo Martinez et al.*	*Ghent*	09:00 - 09:15
	Top/W tagging	*Loukas Gouskos et al.*	*Ghent*	09:15 - 09:30
	Top corridor	*Frank Golf*	*Ghent*	09:30 - 10:00
10:00	**Third generation searches: missing things and new ideas**	*Filip Moortgat*	*Ghent*	10:00 - 10:30
	Coffee break		*Ghent*	10:30 - 11:00
11:00	**Review of RPV**	*Claudia Seitz*	*Ghent*	11:00 - 11:25
	Review of long-lived, stopped, EXO stuff	*Isabell Melzer-Pellmann*	*Ghent*	11:25 - 11:50
	Combinations	*Pieter Everaerts*	*Ghent*	11:50 - 12:10
12:00				
	Experience with HepData	*Jae Hyeok Yoo*	*Ghent*	12:10 - 12:30

5.I.4. CMS workshop at Chicago, Comité científico del workshop


https://indico.cern.ch/event/339666/manage/access/
CMS SUSY Event at the LPC 20 Nov - 23 Nov
Created by Sudhir MALIK - sudhir.malik@cern.ch
Event actions
Clone
Lock
Switch to event page
General settings
Timetable
Room booking
Programme
Registration
Abstracts
Contributions
Paper Reviewing
Evaluation
Agreements
Chat Rooms
Materials
Services
Statistics
Videoconference
Advanced options
Lists
Protection
Tools
Layout
Logs
Modification control
Managers
(users allowed to modify)
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5.I.5. CMS workshop at Lisboa, Comité científico del workshop

5.I.6. Muon workshop at CERN, Comité científico del workshop

5.J. Gestión de I+D+i

5.J.1. Co-coordinador (L2) del Data Performance Group (DPG) del MTD (2021-2023)

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

Adresse postale / Mailing address*:
Dr. Luca Malgeri
CMS Spokesperson
CERN - EP Department
CH - 1211 GENEVA 23
Switzerland

Tel. *+41 75 411 5888*
E-mail *Luca.Malgeri@cern.ch*

To Whom It May Concern

Geneva, 11 October 2021

Votre référence / Your reference :
Notre référence / Our reference : CMS-11/10/2021

ATTESTATION

This is to certify that Pablo Martínez Ruiz del Árbol has been selected for the position of L2 co-convener of the MTD DPG in the term Sep. 2021 - Aug. 2023.

Yours Sincerely,

Dr. Luca Malgeri
CMS Spokesperson

5.J.2. Co-coordinador (L2) del Data Performance Group (DPG) del MTD (2019-2021)

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

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E-mail ***cms.secretariat@cern.ch***

To Whom It May Concern

Geneva, 17 August 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-17/08/2020

PARTICIPATION CERTIFICATE

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander (Spain) has performed the following research activities in the CMS collaboration:

- L3 convener of the SUSY MC, Trigger and Interpretations subgroup (2014-2016)

- L3 convener of the SUSY Third Generation Searches (TBT) group (2016-2018)

- L3 convener of the Muon Validation, Certification and DQM group (2017-2018)

- L3 convener within the MTD DPG "Physics contact at UPSG" (2018-2019)

- L2 convener of the MTD DPG (2019-present)

CMS Secretariat

CERN
CMS
CMS Collaboration

5.J.3. Co-coordinador (L3) del grupo UPSG Contact and Physics Case del DPG del MTD

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
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To Whom It May Concern

Geneva, 17 August 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-17/08/2020

P A R T I C I P A T I O N   C E R T I F I C A T E

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander (Spain) has performed the following research activities in the CMS collaboration:

- L3 convener of the SUSY MC, Trigger and Interpretations subgroup (2014-2016)

- L3 convener of the SUSY Third Generation Searches (TBT) group (2016-2018)

- L3 convener of the Muon Validation, Certification and DQM group (2017-2018)

- L3 convener within the MTD DPG "Physics contact at UPSG" (2018-2019)

- L2 convener of the MTD DPG (2019-present)

CMS Secretariat

5.J.4. Representante español del Financial Board del MTD

Instituto de Física de Cantabria

CERTIFICADO

Pablo Martínez Ruiz del Árbol ejerce como representante español en el **"MTD financial board"** del MIPs Timing Detector, sub-detector del experimento CMS del CERN, desde el 1/10/2019 hasta la actualidad.

En Santander a 31 de agosto de 2020,

MARTINEZ RIVERO CELSO - 09394558R

Firmado digitalmente por MARTINEZ RIVERO CELSO - 09394558R
Fecha: 2020.08.31 19:27:43 +02'00'

Celso Martínez Rivero
Representante del detector CMS en España

5.J.5. Representante del IFCA en el Institutional Board del MTD

Instituto de Física de Cantabria

CERTIFICADO

Pablo Martínez Ruiz del Árbol ejerce como representante del Instituto de Física de Cantabria, en el **"MTD Institutional Board"** del MIPs Timing Detector, sub-detector del experimento CMS del CERN, desde el 1/10/2018 hasta la actualidad.

En Santander a 31 de agosto de 2020,

Signed by VILA ALVAREZ IVAN - 11072904Z the day 31/08/2020 with a certificate issued by AC FNMT Usuarios

Iván Vila Álvarez

Jefe del grupo de Física de Partículas e Instrumentación del Instituto de Física de Cantabria

5.J.6. Co-coordinador (L3) del grupo DQM, Validation and Certification del grupo de muones de CMS

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

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To Whom It May Concern

Geneva, 17 August 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-17/08/2020

P A R T I C I P A T I O N   C E R T I F I C A T E

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander (Spain) has performed the following research activities in the CMS collaboration:

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- L2 convener of the MTD DPG (2019-present)

CMS Secretariat

CERN CMS Collaboration

5.J.7. Co-coordinador (L3) del Third Generation Searches del SUSY group de CMS

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

Adresse postale / Mailing address*:

CMS Secretariat
CERN – EP Department
CH - 1211 GENEVA 23

Tel. ***+41 22 767 2277***
Fax ***+41 22 767 8940***
E-mail ***cms.secretariat@cern.ch***

To Whom It May Concern

Geneva, 17 August 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-17/08/2020

PARTICIPATION CERTIFICATE

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander (Spain) has performed the following research activities in the CMS collaboration:

- L3 convener of the SUSY MC, Trigger and Interpretations subgroup (2014-2016)

- L3 convener of the SUSY Third Generation Searches (TBT) group (2016-2018)

- L3 convener of the Muon Validation, Certification and DQM group (2017-2018)

- L3 convener within the MTD DPG "Physics contact at UPSG" (2018-2019)

- L2 convener of the MTD DPG (2019-present)

CERN CMS Collaboration

CMS Secretariat

5.J.8. Co-coordinador (L3) del Trigger, MonteCarlo and Interpretations del SUSY group de CMS

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : https://cms.cern/

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- L3 convener of the Muon Validation, Certification and DQM group (2017-2018)

- L3 convener within the MTD DPG "Physics contact at UPSG" (2018-2019)

- L2 convener of the MTD DPG (2019-present)

CMS Secretariat

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CMS Collaboration

5.K. Foros y comités nacionales e internacionales

5.K.1. Carta de designación como participante en el meeting: Technical Meeting on Non-Destructive Testing Using Muon Radiography: Present Status and Emerging Applications

IAEA
Atoms for Peace and Development
الوكالة الدولية للطاقة الذرية
国际原子能机构
International Atomic Energy Agency
Agence internationale de l'énergie atomique
Международное агентство по атомной энергии
Organismo Internacional de Energía Atómica

Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Phone: (+43 1) 2600 • Fax: (+43 1) 26007
Email: Official.Mail@iaea.org • Internet: https://www.iaea.org

Mr Pablo Martinez Ruiz Del Arbol

Institute of Physics of Cantabria (IFCA)
University of Cantabria
Edificio Juan Jorda, Avenida de los Castros s/n
39005 SANTANDER
SPAIN

In reply please refer to: EVT1805403
Dial directly to extension: (+43 1) 2600-28231

2019-07-18

Dear Mr Martinez Ruiz Del Arbol,

The Secretariat of the International Atomic Energy Agency (IAEA) is pleased to inform you that you have been designated by your Government as a participant in the **Technical Meeting on Non-destructive Testing Using Muon Radiography: Present Status and Emerging Applications** (hereinafter referred to as "event") to be held at the IAEA's Headquarters in Vienna, Austria, from **9 to 12 September 2019**.

The purpose of the event is to assess the current status and potential applications of muon radiography, and to elaborate an action plan to develop and facilitate its utilization.

The event will be held in English.

The event will commence at 09:30 on Monday, 9 September 2019, in Room C0343, Building C, of the Vienna International Centre (VIC). You are requested to arrive at Checkpoint 1/Gate 1 of the VIC one hour before the start of the event on the first day, in order to allow sufficient time for your grounds pass to be issued, as such passes are necessary for official visitors to the VIC.

We understand that all expenses incurred in connection with your participation in the event will be paid by your authorities.

It should be noted that compensation is not payable by the IAEA for any damage to or loss of personal property.

The IAEA also does not provide health insurance coverage for participants in IAEA events. Arrangements for private insurance coverage on an individual basis should therefore be made. The IAEA will, however, provide insurance coverage for accidents and illnesses that clearly result from any work performed for the IAEA.I would be grateful to receive a reply at your earliest convenience as to whether you are in a position to accept this invitation.

Yours sincerely,

Francois Foulon
Scientific Secretary
Division of Physical and Chemical Sciences
Department of Nuclear Sciences and Applications

5.L. Evaluación y revisión de proyectos y artículos de I+D+i

5.L.1. Referee de European Physics Journal C

Gmail

Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>

THE EUROPEAN PHYSICAL JOURNAL C, Referee request: EPJC-14-07-027

1 message

marco@ifca.unican.es <marco@ifca.unican.es> Tue, Jul 15, 2014 at 10:51 AM
To: Pablo.Martinez@cern.ch

Date: 15-Jul-2014

Dear Dr. Martinez Ruiz del Arbol,

Thank you for agreeing to evaluate the enclosed paper

Title :"Search for contact interactions and large extra dimensions in the dilepton channel using proton-proton collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector"
Authors: Ms. ATLAS Publications
Manuscript No: EPJC-14-07-027

and examine whether it is suitable for publication in The European Physical Journal C (Particles and Fields). In your evaluation, please keep in mind the high standards of the journal.

You may have a direct access to the article and to the review form by clicking on this link: https://mc.manuscriptcentral.com/epjc?URL_MASK=c4d694216bf84f44871cd7badc40c9dd

To view the article click on the PDF icon: the manuscript will open in a new window. To view the author's reply to your comments click on the "Author's Response" icon.
Please follow the instructions for reviewers provided under the Instructions tab, then switch back to the Score Sheet tab to submit your report.

In your review, please answer all questions. On the review page, there is a space for "Comments to Editor" and a space for "Comments to the Author.": please be sure to put your comments to the author in the appropriate box. We strongly encourage you to elaborate on your review in the space provided, your specific comments will offer valuable feedback to improve future work. It is essential that you click the "Save" button if you wish to exit the review before you submit it to the Editor, otherwise, none of the information that you have entered will be saved in the system. When you have completed your review and you are ready to submit it to the Editor, click on "Submit."

To view any other reviews you submitted in the past or to update your personal or contact information you may access the Review Center on Manuscript Central via https://mc.manuscriptcentral.com/epjc.
(Login credentials are not displayed in this message for security reasons. You can recover your account information by entering your e-mail address in the Password Help section of the Manuscript Central homepage. If you experience any problems logging onto the system, please contact the Editorial Office at epjc.bologna@sif.it).

All communications regarding this manuscript are privileged. Any conflict of interest, suspicion of duplicate publication, fabrication of data or plagiarism must immediately be reported.

We kindly request you to send us your evaluation of the manuscript in about two weeks (29-Jul-2014).
We will send you a reminder in due time. Please contact me or the Editorial Office if you need more time to complete the review.

We would like to thank you in advance for your valuable help in reviewing this manuscript.

With very kind regards,
Jesus Marco
Associate Editor
European Physical Journal C

THE EUROPEAN PHYSICAL JOURNAL C, Editorial Office
Societa' Italiana di Fisica
Via Saragozza 12
40123 Bologna, Italy

Tel.: +39 051 581569
Fax.: +39 051 581340
E-Mail: epjc.bologna@sif.it

CERTIFICATE

This is to certify, after detailed check (see below), that P**ablo Martínez Ruiz del Árbol** participated as reviewer of the article "**Search for contact interactions and large extra dimensions in the dilepton channel using proton-proton collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector"** with reference **EPJC-14-07-027.R1** for the **European Physics Journal C**.

MARCO LUCAS JESUS EUGENIO - DNI 13740242L
Firmado digitalmente por MARCO LUCAS JESUS EUGENIO - DNI 13740242L
Fecha: 2020.09.04 18:05:50 +02'00'

Jesús Marco de Lucas
Associate Editor, European Physical Journal C (2012-2016)

Detailed check:

29-Sep-2014

Dear Prof. Marco,

we would like to inform you that one of the invited referees (Dr. Pablo Martinez Ruiz del Arbol) has agreed to review the manuscript "Search for contact interactions and large extra dimensions in the dilepton channel using proton-proton collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector" by Ms. Publications et al.

Yours sincerely,
EPJC Editorial Office

5.L.2. Participación en paneles de evaluación del plan nacional de I+D

JULIO BRAVO DE PEDRO, JEFE DE LA SUBDIVISIÓN DE COORDINACIÓN Y EVALUACIÓN

CERTIFICA:

Que D/Dª **PABLO MARTÍNEZ RUIZ DEL ARBOL**, con D.N.I.: 72058705G, Contratado Ramon y Cajal de Física de Partículas de Instituto de Fisica de Cantabria de UNIVERSIDAD DE CANTABRIA, ha colaborado en el proceso de evaluación para esta Agencia, habiendo realizado las siguientes evaluaciones:

2017: 2 evaluaciones
2018: 2 evaluaciones
2019: 6 evaluaciones
2021: 1 evaluaciones

NOTA. En este certificado constan únicamente las evaluaciones realizadas a partir de 2006.

Y para que así conste se expide este certificado, a petición del interesado.

Madrid, 09 de noviembre de 2021

SUBDIVISIÓN DE COORDINACIÓN
Y EVALUACIÓN
DIVISION DE COORDINACIÓN,
EVALUACIÓN Y SEGUIMIENTO
CIENTÍFICO Y TÉCNICO
Calle Torrelaguna 58 bis. Planta 5ª
28027 Madrid

5.M. Estancias en centros de I+D públicos y privados

5.M.1. Estancia en el Centro Europeo de Investigación de Partículas (CERN) Junio 2006 - Agosto 2006

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION
URL : http://cms.cern.ch

Mrs Kirsti Aspola
CMS Team Leader and Resources Office
CERN – PH Department
CH - 1211 GENEVA 23

Tel. *+41 22 767 4608*
Fax *+41 22 766 9355*
E-mail *Kirsti.Aspola@cern.ch*

To Whom It May Concern

Geneva, May 11, 2015

Votre référence / Your reference :
Notre référence / Our reference : CMS-2015/KA/ay

A T T E S T A T I O N

This is to certify that **Mr. Pablo Martinez Ruiz Del Arbol,** date of birth 26 October 1982, was working as an Associated Member of the Personnel of the European Organization for Nuclear Research (CERN) within Compact Muon Solenoid (CMS) Collaboration 100% of his time during listed below periods and performing the described activities:

* From June 1st to August 31st, 2006
Employed by the Institute of Physics of Cantabria, Spain
Participated in the commissioning of the CMS detector, in particular in the alignment of the muon system in the Magnet Test and Cosmic Challenge (MTCC)

* From June 1st to August 31st, 2007
Employed by the Institute of Physics of Cantabria, Spain.
Worked in the track-based alignment of the muon system for the CSA07 campaign.

* From March 1st, 2008 to October 30th, 2009
Employed by the Institute of Physics of Cantabria, Spain.
Involved in various activities related to the alignment of the muon system of CMS during the first data taking of cosmic rays (CRAFT).

* From October 1st, 2010 to May 10th, 2015
Employed by the Swiss Federal Institute of Technology Zurich (ETHZ), Switzerland.
Working mainly in data analysis of super-symmetry searches.

Kirsti Aspola

CERN CMS Collaboration

5.M.2. Estancia en el Centro Europeo de Investigación de Partículas (CERN) Junio 2007 - Agosto 2007

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION
URL : http://cms.cern.ch

Mrs Kirsti Aspola
CMS Team Leader and Resources Office
CERN – PH Department
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E-mail *Kirsti.Aspola@cern.ch*

To Whom It May Concern

Geneva, May 11, 2015

Votre référence / Your reference :
Notre référence / Our reference : CMS-2015/KA/ay

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Working mainly in data analysis of super-symmetry searches.

Kirsti Aspola

CERN
CMS
CMS Collaboration

5.M.3. Estancia en el Centro Europeo de Investigación de Partículas (CERN) Marzo 2008 - Octubre 2009

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : http://cms.cern.ch

Mrs Kirsti Aspola
CMS Team Leader and Resources Office
CERN – PH Department
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E-mail *Kirsti.Aspola@cern.ch*

To Whom It May Concern

Geneva, May 11, 2015

Votre référence / Your reference :
Notre référence / Our reference : CMS-2015/KA/ay

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Involved in various activities related to the alignment of the muon system of CMS during the first data taking of cosmic rays (CRAFT).

* From October 1st, 2010 to May 10th, 2015
Employed by the Swiss Federal Institute of Technology Zurich (ETHZ), Switzerland.
Working mainly in data analysis of super-symmetry searches.

Kirsti Aspola

CERN CMS Collaboration

5.M.4. Estancia en el Centro Europeo de Investigación de Partículas (CERN) Octubre 2010 - Febrero 2017

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION
URL : http://cms.cern.ch

Mrs Kirsti Aspola
CMS Team Leader and Resources Office
CERN – PH Department
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To Whom It May Concern

Geneva, May 11, 2015

Votre référence / Your reference :
Notre référence / Our reference : CMS-2015/KA/ay

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CERN
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CH - 1211 GENEVA 23

Tel. *+41 22 767 2277*
E-mail *cms.secretariat@cern.ch*

To Whom It May Concern

Geneva, 02 September 2020

Votre référence / Your reference :
Notre référence / Our reference : CMS-02/09/2020

PARTICIPATION CERTIFICATE

This is to certify that Dr. Pablo Martinez Ruiz del Arbol from Institute for Particle Physics, ETH Zurich, Zurich (Switzerland) has stayed at CERN, Switzerland as from 11 May 2015 to 28 February 2017 to take part in the research work for the CMS Collaboration.

CMS Secretariat

CERN
CMS
CMS Collaboration

*Adresse postale pour le courrier posté en France : CERN : Site de Prévessin, F-01631 CERN Cedex

5.N. Ayudas y becas obtenidas

5.N.1. Contrato Ramón y Cajal Marzo 2017

FIRMADO por : ISRAEL MARQUES MARTIN. A fecha : 14/10/2016 09:47:07
El documento consta de un total de 6 folios. Folio 1 de 6 - Código Seguro de Verificación: 618737-77074815.Verificable en sede electrónica según Orden Ministerial del 24/2/2011

Propuesta de Resolución Definitiva de la convocatoria 2015 de las Ayudas Ramón y Cajal del Ministerio de Economía y Competitividad.

Por Resolución de 2 de diciembre de 2015 de la Secretaría de Estado de Investigación, Desarrollo e Innovación, modificada por la Resolución de 24 de junio de 2016 de la Secretaria de Estado de Investigación, Desarrollo e Innovación y Presidenta de la Agencia Estatal de Investigación por la que se acuerda la modificación de resoluciones de convocatorias de ayudas aprobadas en el año 2015, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016, para su adaptación a la estructura orgánica de la Agencia Estatal de Investigación, se aprobó la convocatoria, correspondiente al año 2015, de diversas actuaciones contempladas en el Subprograma Estatal de Formación y en el Subprograma Estatal de Incorporación, del Programa Estatal de Promoción del Talento y su Empleabilidad, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016, entre las que se encuentran las ayudas Ramón y Cajal.

Por Resolución de 23 de mayo de 2016 de la Subdirección General de Recursos Humanos para la Investigación se publicó la relación de Centros de I+D elegibles, en el marco de las ayudas Ramón y Cajal.

Por Resolución de 31 de agosto de 2016 de la Subdivisión de Planificación y Gestión Administrativa se publicó la relación de candidatos seleccionados y reserva de la convocatoria 2015 de las ayudas Ramón y Cajal.

De acuerdo con lo establecido en el artículo 32.7 de la mencionada Resolución de convocatoria, este órgano instructor acuerda:

1º. Dictar propuesta de resolución definitiva de las Ayudas Ramón y Cajal donde se incluyen los candidatos seleccionados y el centro de I+D con el que han firmado un acuerdo de incorporación. El listado anexo de esta propuesta de resolución definitiva contiene la relación de candidatos seleccionados, indicando para cada uno de ellos el área temática y el Centro de I+D de incorporación.

2º. Ordenar la publicación de esta propuesta de resolución definitiva en la sede electrónica del Ministerio de Economía y Competitividad (https://sede.micinn.gob.es). En virtud de lo previsto en los artículos 58 y 59 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común, esta publicación surtirá todos los efectos de notificación practicada.

Madrid, 14 de octubre de 2016

El órgano instructor

Israel Marqués Martín
Jefe de la Subdivisión de Planificación y Gestión Administrativa

FIRMADO por : ISRAEL MARQUES MARTIN. A fecha : 14/10/2016 09:47:07
El documento consta de un total de 6 folios. Folio 2 de 6 - Código Seguro de Verificación: 618737-77074815.Verificable en sede electrónica según Orden Ministerial del 24/2/2011
FIRMADO

MINISTERIO
DE ECONOMÍA
Y COMPETITIVIDAD

AGENCIA ESTATAL DE INVESTIGACIÓN

DIVISIÓN DE PROGRAMACIÓN Y GESTIÓN ECONÓMICA Y ADMINISTRATIVA

SUBDIVISIÓN DE PLANIFICACIÓN Y GESTIÓN ADMINISTRATIVA

AYUDAS PARA CONTRATOS RAMÓN Y CAJAL CONVOCATORIA 2015
PROPUESTA DE RESOLUCIÓN DEFINITIVA
RELACIÓN DE CANDIDATOS SELECCIONADOS QUE HAN ALCANZADO UN ACUERDO DEFINITIVO DE INCORPORACIÓN

Nombre de Organismo firma acuerdo de incorporación	Area Evaluacion	Nombre	Apellido 1	Apellido 2
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Agricultura	MONICA	FERNANDEZ-APARICIO	RUIZ
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Agricultura	RAQUEL	SANCHEZ	PEREZ
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Biología Fundamental y de Sistemas	ERNESTO	ARIAS	PALOMO
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Biología Vegetal, Animal y Ecología	JOAN	NAVARRO	
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Biomedicina	JOSE PASCUAL	LOPEZ-ATALAYA	MARTINEZ
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Biomedicina	PABLO	MENDEZ	GARCIA
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ciencia y Tecnología de los Alimentos	MANUEL	PAZOS	PALMEIRO
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ciencia y Tecnología de Materiales	JAVIER	CARRETERO	GONZALEZ
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ciencia y Tecnología de Materiales	FELIPE	GANDARA	BARRAGAN
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ciencias de la Tierra	MARIA	IZQUIERDO	RAMONET
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ciencias de la Tierra	MARIA CRUZ	MINGUILLON	BENGOCHEA
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Filología y Filosofía	JAN	THIELE	
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Física y Ciencias del Espacio	PAU	AMARO	SEOANE
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Física y Ciencias del Espacio	MATTIAS	BLENNOW	
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Física y Ciencias del Espacio	JOSE IGNACIO	MARTINEZ	RUIZ
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Ingeniería Eléctrica, Electrónica y Automática	STELLA	VALLEJOS	VARGAS
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Tecnología Química	MARTA	GONZALEZ	PLAZA
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Tecnología Electrónica y de las Comunicaciones	DANIEL	RAMOS	VEGA
ASOC BCBL BASQUE CENTER ON COGNITION BRAIN AND LANGUAGE	Ciencias de la Educación	MARIE	LALLIER	
ASOC INSTITUTO BIODONOSTIA	Biomedicina	MARIA JESUS	PERUGORRIA	MONTIEL
ASOCIACION CENTRO DE INVESTIGACION COOP EN BIOCIENCIAS CIC BIOGUNE	Química	ALBERTO	FERNANDEZ	TEJADA
BARCELONA SUPERCOMPUTING CENTER CENTRO NACIONAL DE SUPERCOMPUTACION	Ciencias de la Tierra	CARLOS	PEREZ	GARCIA-PANDO
BARCELONA SUPERCOMPUTING CENTER CENTRO NACIONAL DE SUPERCOMPUTACION	Ingeniería Mecánica, Naval y Aeronáutica	FRANCISCO JAVIER	ROCA	NAVARRO
CENTRE D ESTUDIS DEMOGRÀFICS	Ciencias Sociales	SERGI	VIDAL	TORRE
CENTRE DE RECERCA EN AGRIGENOMICA CSIC-IRTA-UAB-UB (CRAG)	Agricultura	IGNACIO	RUBIO	SOMOZA
CENTRO DE INVESTIGACION ECOLOGIA Y APLICACIONES FORESTALES CCT	Biología Vegetal, Animal y Ecología	XAVIER	ARNAN	VIADIU
CENTRO DE VISION POR COMPUTADOR	Ciencias de la Computación y Tecnología Informática	JOSE	ALVAREZ	LOPEZ
CONSORCI CENTRE DE RECERCA MATEMÀTICA	Biomedicina	KLAUS	WIMMER	
FUNDACIÓ INSTITUT CATALÀ DE NANOCIÈNCIA I NANOTECNOLOGIA	Ciencia y Tecnología de Materiales	FREDERIC	BONELL	
FUNDACIÓ INSTITUT CATALÀ DE NANOCIÈNCIA I NANOTECNOLOGIA	Ciencia y Tecnología de Materiales	PEDRO DAVID	GARCIA	FERNANDEZ
FUNDACIÓ INSTITUT CATALA DE RECERCA DE L AIGUA	Ingeniería Civil y Arquitectura	MARIA JOSE	FARRE	OLALLA
FUNDACIO INSTITUT DE BIOENGINYERIA DE CATALUNYA	Biomedicina	JUAN JOSE	MONTERO	BORONAT
FUNDACIO INSTITUT DE BIOENGINYERIA DE CATALUNYA	Química	LORENZO	ALBERTAZZI	
FUNDACIO INSTITUT DE RECERCA BIOMEDICA (BARCELONA)	Biología Fundamental y de Sistemas	FRAN	SUPEK	
FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA	Ciencias Sociales	ISABEL	RUIZ	MALLEN

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AYUDAS PARA CONTRATOS RAMÓN Y CAJAL CONVOCATORIA 2015
PROPUESTA DE RESOLUCIÓN DEFINITIVA
RELACIÓN DE CANDIDATOS SELECCIONADOS QUE HAN ALCANZADO UN ACUERDO DEFINITIVO DE INCORPORACIÓN

Nombre de Organismo firma acuerdo de incorporación	Area Evaluacion	Nombre	Apellido 1	Apellido 2
FUNDACIO UNIVERSITARIA BALMES DE VIC	Biología Fundamental y de Sistemas	CARLO	MANZO	
FUNDACIO UNIVERSITARIA BALMES DE VIC	Biomedicina	NARCISO	FERNANDEZ	FUENTES
FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	Biomedicina	ALBERTO	JIMENEZ	SCHUHMACHER
FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	Medicina Clínica y Epidemiología	DAVID	OLMOS	HIDALGO
FUNDACION IMDEA ALIMENTACION	Ciencia y Tecnología de los Alimentos	JOSE MOISES	LAPARRA	LLOPIS
FUNDACION IMDEA ENERGIA	Ciencia y Tecnología de Materiales	MARTA ANGELA	LIRAS	TORRENTE
FUNDACION IMDEA SOFTWARE	Ciencias de la Computación y Tecnología Informática	OLEXIY	GOTSMAN	
FUNDACION PARA LA INVESTIGACION HOSPITAL UNIVERSITARIO LA FE	Biomedicina	ALEJANDRA	SANJUAN	PLA
FUNDACION PARA LA INVESTIGACION MEDICA APLICADA	Biomedicina	XABIER	ARANGUREN	LOPEZ
FUNDACION PARA LA INVESTIGACION MEDICA APLICADA	Biomedicina	ANA	PARDO	SAGANTA
FUNDACION PRIVADA INSTITUTO DE SALUD GLOBAL BARCELONA	Medicina Clínica y Epidemiología	ORIOL	MITJA	VILLAR
FUNDACION PRIVADA INSTITUTO DE SALUD GLOBAL BARCELONA	Medicina Clínica y Epidemiología	CATHRYN	TONNE	
FUNDACIÓN UNIVERSIDAD LOYOLA ANDALUCIA	Tecnología Química	JUAN CARLOS	SERRANO	RUIZ
INSTITUT CATALÀ DE PALEONTOLOGIA	Ciencias de la Tierra	ALBERT	PRIETO	MARQUEZ
INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES (IRTA)	Ganadería y Pesca	FRANCOIS	CHAUVIGNE	
INSTITUTO DE ASTROFISICA DE CANARIAS (IAC)	Física y Ciencias del Espacio	CLAUDIO	DALLA VECCHIA	
INSTITUTO DE ASTROFISICA DE CANARIAS (IAC)	Física y Ciencias del Espacio	SAVITA	MATHUR	
INSTITUTO DE ASTROFISICA DE CANARIAS (IAC)	Física y Ciencias del Espacio	TEODORO	MUÑOZ	DARIAS
INSTITUTO DE ASTROFISICA DE CANARIAS (IAC)	Física y Ciencias del Espacio	MANUEL ANGEL	PEREZ	TORRES
INSTITUTO DE CIENCIAS FOTONICAS	Física y Ciencias del Espacio	LETICIA	TARRUELL	
INSTITUTO DE CIENCIAS FOTONICAS	Tecnología Electrónica y de las Comunicaciones	EMILIO JOSE	GUALDA	MANZANO
INSTITUTO ESPAÑOL DE OCEANOGRAFIA (IEO)	Ganadería y Pesca	JOSE MANUEL	HIDALGO	ROLDAN
INSTITUTO MURCIANO DE INVESTIGACION Y DESARROLLO AGRARIO Y ALIMENTARIO (IMIDA)	Agricultura	JUAN GABRIEL	PEREZ	PEREZ
UNIVERSIDAD AUTONOMA DE BARCELONA	Filología y Filosofía	SILVIA	DE BIANCHI	
UNIVERSIDAD AUTONOMA DE BARCELONA	Ganadería y Pesca	MARTI	CORTEY	MARQUES
UNIVERSIDAD AUTONOMA DE BARCELONA	Historia y Arte	LINO	CAMPRUBI	BUENO
UNIVERSIDAD AUTONOMA DE BARCELONA	Matemáticas	MARC	MASDEU	SABATE
UNIVERSIDAD AUTONOMA DE BARCELONA	Química	ALBERT	RIMOLA	GIBERT
UNIVERSIDAD AUTONOMA DE MADRID	Biomedicina	JOHAN	GARAUDE	
UNIVERSIDAD AUTONOMA DE MADRID	Biomedicina	FRANCISCA	GONZALEZ	TRAVES
UNIVERSIDAD AUTONOMA DE MADRID	Biomedicina	MARIA VICTORIA	LLORENS	MARTIN
UNIVERSIDAD AUTONOMA DE MADRID	Biomedicina	DIEGO	VILLAR	LOZANO
UNIVERSIDAD AUTONOMA DE MADRID	Ciencia y Tecnología de Materiales	EDUARDO JIAN HUA	LEE	
UNIVERSIDAD AUTONOMA DE MADRID	Física y Ciencias del Espacio	LUCA	MERLO	
UNIVERSIDAD AUTONOMA DE MADRID	Física y Ciencias del Espacio	OSCAR	VARELA	RIZO

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FIRMADO

AYUDAS PARA CONTRATOS RAMÓN Y CAJAL CONVOCATORIA 2015
PROPUESTA DE RESOLUCIÓN DEFINITIVA
RELACIÓN DE CANDIDATOS SELECCIONADOS QUE HAN ALCANZADO UN ACUERDO DEFINITIVO DE INCORPORACIÓN

Nombre de Organismo firma acuerdo de incorporación	Area Evaluacion	Nombre	Apellido 1	Apellido 2
UNIVERSIDAD CARLOS III DE MADRID	Economía	ANTOINE	LOEPER	
UNIVERSIDAD CARLOS III DE MADRID	Tecnología Electrónica y de las Comunicaciones	ANGEL	CUEVAS	RUMIN
UNIVERSIDAD COMPLUTENSE DE MADRID	Biología Fundamental y de Sistemas	SERGIO	GASCON	JIMENEZ
UNIVERSIDAD COMPLUTENSE DE MADRID	Biomedicina	JAVIER RUBEN	CASO	FERNANDEZ
UNIVERSIDAD COMPLUTENSE DE MADRID	Biomedicina	YULIA A.	NEVZOROVA	
UNIVERSIDAD COMPLUTENSE DE MADRID	Biomedicina	JAVIER	REDONDO	MUÑOZ
UNIVERSIDAD COMPLUTENSE DE MADRID	Ingeniería Mecánica, Naval y Aeronáutica	FERNANDO	MARTINEZ	PEDRERO
UNIVERSIDAD DE ALCALA	Historia y Arte	ANTONIO JAVIER	MORALES	RONDAN
UNIVERSIDAD DE ALCALA	Química	BEATRIZ	JURADO	SANCHEZ
UNIVERSIDAD DE ALMERIA	Química	MARIA JOSE	GOMEZ	RAMOS
UNIVERSIDAD DE BARCELONA	Ciencias de la Educación	LAURA	RUIZ	EUGENIO
UNIVERSIDAD DE BARCELONA	Ciencias de la Tierra	MARC	OLIVA	FRANGANILLO
UNIVERSIDAD DE BARCELONA	Ciencias Sociales	SILVIA	DE ZORDO	
UNIVERSIDAD DE BARCELONA	Historia y Arte	JOAN	DAURA	LUJAN
UNIVERSIDAD DE BARCELONA	Matemáticas	MARTI	LAHOZ	VILALTA
UNIVERSIDAD DE BARCELONA	Química	FEDERICO	CALLE	VALLEJO
UNIVERSIDAD DE CADIZ	Ingeniería Eléctrica, Electrónica y Automática	MARTA	VIVAR	GARCIA
UNIVERSIDAD DE CADIZ	Psicología	JAVIER JESUS	GONZALEZ	ROSA
UNIVERSIDAD DE CANTABRIA	Física y Ciencias del Espacio	PABLO	MARTINEZ	RUIZ DEL ARBOL
UNIVERSIDAD DE CANTABRIA	Tecnología Química	JONATHAN	ALBO	SANCHEZ
UNIVERSIDAD DE CASTILLA-LA MANCHA	Biología Vegetal, Animal y Ecología	MANUEL ELOY	ORTIZ	SANTALIESTRA
UNIVERSIDAD DE CORDOBA	Ciencias de la Tierra	ANA MARIA	BALLESTEROS	GOMEZ
UNIVERSIDAD DE CORDOBA	Tecnología Química	LUIS	SERRANO	CANTADOR
UNIVERSIDAD DE EXTREMADURA	Biología Fundamental y de Sistemas	JOSE MARIA	CARVAJAL	GONZALEZ
UNIVERSIDAD DE EXTREMADURA	Biología Vegetal, Animal y Ecología	CHRISTIAN	SCHOB	
UNIVERSIDAD DE GRANADA	Biología Vegetal, Animal y Ecología	MARCOS	MOLEON	PAIZ
UNIVERSIDAD DE GRANADA	Biomedicina	PEDRO JOSE	REAL	LUNA
UNIVERSIDAD DE GRANADA	Ciencia y Tecnología de los Alimentos	ANA MARIA	GOMEZ	CARAVACA
UNIVERSIDAD DE GRANADA	Ciencia y Tecnología de los Alimentos	VITO	VERARDO	
UNIVERSIDAD DE GRANADA	Ciencias de la Computación y Tecnología Informática	SIHAM	TABIK	
UNIVERSIDAD DE GRANADA	Ciencias de la Tierra	ANTONIO	GARCIA-ALIX	DAROCA
UNIVERSIDAD DE GRANADA	Ciencias de la Tierra	JOSE MARIA	GONZALEZ	JIMENEZ
UNIVERSIDAD DE GRANADA	Filología y Filosofía	ERIKA	MARTINEZ	CABRERA
UNIVERSIDAD DE GRANADA	Historia y Arte	BILAL	SARR	MARROCO
UNIVERSIDAD DE GRANADA	Matemáticas	PIERALBERTO	SICBALDI	

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AYUDAS PARA CONTRATOS RAMÓN Y CAJAL CONVOCATORIA 2015
PROPUESTA DE RESOLUCIÓN DEFINITIVA
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Nombre de Organismo firma acuerdo de incorporación	Area Evaluacion	Nombre	Apellido 1	Apellido 2
UNIVERSIDAD DE GRANADA	Psicología	LEANDRO LUIGI	DI STASI	
UNIVERSIDAD DE LA LAGUNA	Biología Vegetal, Animal y Ecología	NATACHA	AGUILAR	DE SOTO
UNIVERSIDAD DE LA LAGUNA	Biomedicina	MARIA DEL MAR	DEL PINO	YANES
UNIVERSIDAD DE LA LAGUNA	Física y Ciencias del Espacio	FRANCISCO SHU	KITAURA	JOYANES
UNIVERSIDAD DE LA LAGUNA	Psicología	MARKUS	CONRAD	
UNIVERSIDAD DE LA RIOJA	Agricultura	MARIA PAZ	DIAGO	SANTAMARIA
UNIVERSIDAD DE LAS ISLAS BALEARES	Agricultura	AMPARO	LAZARO	CASTILLO
UNIVERSIDAD DE LAS ISLAS BALEARES	Ciencia y Tecnología de Materiales	ROBERTO	DE LA RICA	QUESADA
UNIVERSIDAD DE LAS ISLAS BALEARES	Física y Ciencias del Espacio	MIGUEL	CORNELLES	SORIANO
UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Historia y Arte	JACOB	MORALES	MATEOS
UNIVERSIDAD DE LEON	Ganadería y Pesca	PABLO	GUTIERREZ	TORAL
UNIVERSIDAD DE LEON	Ganadería y Pesca	MARIA	MARTINEZ	VALLADARES
UNIVERSIDAD DE LLEIDA	Agricultura	JONAS	OLIVA	PALAU
UNIVERSIDAD DE MALAGA	Ciencia y Tecnología de Materiales	ANTONIA	INFANTES	MOLINA
UNIVERSIDAD DE MURCIA	Ciencias de la Computación y Tecnología Informática	FELIX	GOMEZ	MARMOL
UNIVERSIDAD DE NAVARRA	Ciencias Sociales	DAVID	THUNDER	
UNIVERSIDAD DE OVIEDO	Agricultura	LUIS	VALLEDOR	GONZALEZ
UNIVERSIDAD DE OVIEDO	Biología Vegetal, Animal y Ecología	JOSE VICENTE	LOPEZ	
UNIVERSIDAD DE SEVILLA	Biología Fundamental y de Sistemas	SILVIA	JIMENO	GONZALEZ
UNIVERSIDAD DE SEVILLA	Biología Fundamental y de Sistemas	IVAN	VALLE	ROSADO
UNIVERSIDAD DE VALENCIA	Biomedicina	MIREIA	COSCOLLA	DEVIS
UNIVERSIDAD DE VALENCIA	Biomedicina	RON	GELLER	
UNIVERSIDAD DE VALENCIA	Biomedicina	CRISTINA	GIL	SANZ
UNIVERSIDAD DE VALENCIA	Ciencia y Tecnología de Materiales	RAFAEL	ABARGUES	LOPEZ
UNIVERSIDAD DE VALENCIA	Ciencia y Tecnología de Materiales	PABLO	PEREZ	BOIX
UNIVERSIDAD DE VALENCIA	Física y Ciencias del Espacio	PABLO	CERDA	DURAN
UNIVERSIDAD DE VALENCIA	Química	DANIEL	ROCA	SANJUAN
UNIVERSIDAD DE VALENCIA	Tecnología Electrónica y de las Comunicaciones	MARIA	PILES	GUILLEM
UNIVERSIDAD DE VALLADOLID	Química	RAUL	GARCIA	RODRIGUEZ
UNIVERSIDAD DE VIGO	Biología Fundamental y de Sistemas	MIGUEL	ARENAS	BUSTO
UNIVERSIDAD DE VIGO	Biología Vegetal, Animal y Ecología	SIN-YEON	KIM	
UNIVERSIDAD DE VIGO	Ciencia y Tecnología de los Alimentos	JORGE EDUARDO	REGUEIRO	TATO
UNIVERSIDAD DE ZARAGOZA	Química	JESUS	DEL BARRIO	LASHERAS
UNIVERSIDAD DE ZARAGOZA	Química	RALUCA MARIA	FRATILA	
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	Ciencia y Tecnología de Materiales	MIGUEL	MORENO	UGEDA

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AYUDAS PARA CONTRATOS RAMÓN Y CAJAL CONVOCATORIA 2015
PROPUESTA DE RESOLUCIÓN DEFINITIVA
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Nombre de Organismo firma acuerdo de incorporación	Area Evaluacion	Nombre	Apellido 1	Apellido 2
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	Filología y Filosofía	ARGYRIOS	ARNELLOS	
UNIVERSIDAD NACIONAL DE EDUCACION A DISTANCIA	Derecho	JOAQUIN	SARRION	ESTEVE
UNIVERSIDAD POLITÉCNICA DE CARTAGENA	Agricultura	RAUL	ZORNOZA	BELMONTE
UNIVERSIDAD POLITECNICA DE MADRID	Tecnología Electrónica y de las Comunicaciones	ELISA	ANTOLIN	FERNANDEZ
UNIVERSIDAD POLITECNICA DE MADRID	Tecnología Electrónica y de las Comunicaciones	JORGE	PEDROS	AYALA
UNIVERSIDAD ROVIRA I VIRGILI	Ciencia y Tecnología de Materiales	NICOLAS	PAZOS	PEREZ
UNIVERSIDAD ROVIRA I VIRGILI	Química	OMAR	BOUTUREIRA	MARTIN
UNIVERSIDADE DA CORUÑA	Psicología	LAURA	LORENZO	LOPEZ
UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	Física y Ciencias del Espacio	DIEGO	GONZALEZ	DIAZ
UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	Tecnología Electrónica y de las Comunicaciones	PABLO	AGUIAR	FERNANDEZ
UNIVERSITAT POLITECNICA DE CATALUNYA	Ciencia y Tecnología de Materiales	CARLOS	MAS	MORUNO
UNIVERSITAT POLITECNICA DE CATALUNYA	Ingeniería Civil y Arquitectura	JOAN	BAIGES	AZNAR
UNIVERSITAT POLITECNICA DE CATALUNYA	Matemáticas	MARCEL	GUARDIA	MUNARRIZ
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Física y Ciencias del Espacio	JUAN ANGEL	SANS	TRESSERRAS
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Química	IGNACIO	VAYA	PEREZ
UNIVERSITAT POMPEU FABRA CCT	Biología Fundamental y de Sistemas	MARC	GUELL	CARGOL
UNIVERSITAT POMPEU FABRA CCT	Ciencias de la Computación y Tecnología Informática	VICENTE	GOMEZ	CERDA
UNIVERSITAT POMPEU FABRA CCT	Ciencias de la Computación y Tecnología Informática	KARIM	LEKADIR	
UNIVERSITAT POMPEU FABRA CCT	Ciencias Sociales	CHRISTOS	ZOGRAFOS	
UNIVERSITAT POMPEU FABRA CCT	Economía	CHRISTIAN	FONS	ROSEN
UNIVERSITAT POMPEU FABRA CCT	Economía	ALBRECHT	GLITZ	
UNIVERSITAT POMPEU FABRA CCT	Economía	FILIPPO	IPPOLITO	
UNIVERSITAT POMPEU FABRA CCT	Filología y Filosofía	GEMMA	BOLEDA	TORRENT
UNIVERSITAT POMPEU FABRA CCT	Filología y Filosofía	MIREIA	FARRUS	CABECERAN
UNIVERSITAT POMPEU FABRA CCT	Historia y Arte	MARIA JESUS	ALBARRAN	MARTINEZ
UNIVERSITAT POMPEU FABRA CCT	Historia y Arte	TOMAS	MACSOTAY	BUNT
UNIVERSITAT POMPEU FABRA CCT	Ingeniería Mecánica, Naval y Aeronáutica	JEROME	NOAILLY	
UNIVERSITAT POMPEU FABRA CCT	Matemáticas	DAVID	ROSSELL	RIBERA

MINISTERIO
DE EMPLEO Y
SEGURIDAD SOCIAL

SERVICIO PÚBLICO
DE EMPLEO ESTATAL

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CONTRATO DE TRABAJO TEMPORAL

DATOS DE LA EMPRESA

CIF/NIF/NIE	Q3918001C

D./DNA.	NIF./NIE	EN CONCEPTO (1)
ÁNGEL PAZOS CARRO	32618701D	RECTOR

NOMBRE O RAZÓN SOCIAL DE LA EMPRESA	DOMICILIO SOCIAL
UNIVERSIDAD DE CANTABRIA	AVENIDA DE LOS CASTROS, S/N

PAIS		MUNICIPIO		C. POSTAL
ESPAÑA	7 2 4	SANTANDER	3 9 0 7 5	3 9 0 0 5

DATOS DE LA CUENTA DE COTIZACIÓN

RÉGIMEN	COD. PROV.	NÚMERO	DIG. CONTR.	ACTIVIDAD ECONÓMICA	
0 1 1 1	3 9	0 0 3 5 4 7 0	5 1	EDUCACIÓN	8 5

DATOS DEL CENTRO DE TRABAJO

PAIS		MUNICIPIO	
ESPAÑA	7 2 4	SANTANDER	3 9 0 7 5

DATOS DEL/DE LA TRABAJADOR/A

D./DNA.			NIF./NIE (2)	FECHA DE NACIMIENTO
PABLO	MARTÍNEZ	RUIZ DEL ÁRBOL	72058705G	26/10/1982

Nº AFILIACIÓN S.S.	NIVEL FORMATIVO		NACIONALIDAD	
39 10194811 69	DOCTORADO UNIVERSITA	6 1	ESPAÑA	7 2 4

MUNICIPIO DEL DOMICILIO		PAIS DOMICILIO	
SANTANDER	3 9 0 7 5	ESPAÑA	7 2 4

con la asistencia legal, en su caso, de D./Dña. ....

con N.I.F/N.I.E. ...., en calidad de (2) ....

DECLARAN

Que reúnen los requisitos exigidos para la celebración del presente contrato y, en su consecuencia, acuerdan formalizarlo con arreglo a las siguientes:

CLÁUSULAS

PRIMERA: El/la trabajador/a prestará sus servicios como (3) ....INVESTIGADOR.., incluido en el grupo profesional de..TITULADO UNIVERSITARIO.., para la realización de las funciones (4)...........................

.........................de acuerdo con el sistema de clasificación profesional vigente en la empresa.

En el centro de trabajo ubicado en (calle, nº y .localidad).AVENIDA DE LOS CASTROS, S/N, SANTANDER (CANTABRIA)..............

....

☐ A DISTANCIA, en el domicilio ubicado en (calle, nº y localidad)..

SEGUNDA:: La jornada de trabajo será:(5)

☒ **A tiempo completo**: la jornada de trabajo será de ....40.................. horas semanales, prestadas de .MAÑANA Y TARDE...., a ...., con los descansos establecidos legal o convencionalmente(6).

☐ **A tiempo parcial**: la jornada de trabajo ordinaria será de ....horas ☐ al día, ☐ a la semana ☐ al mes, ☐ al año(6),siendo esta jornada inferior a la de un trabajador a tiempo completo comparable (7)
La distribución del tiempo de trabajo será de (8)...
conforme a lo previsto en el convenio colectivo
En el caso de la jornada a tiempo parcial, existe pacto sobre la realización de horas complementarias(9).

SI ☐ NO ☐

TERCERA: La duración del presente contrato se extenderá desde 01/03/2017..............................., hasta ..28/02/2022.............................. . Se establece un período de prueba de (10) ..2 MESES.. .
Cuando el convenio colectivo permita una duración mayor a la establecida legalmente, señálelo con una X:

CUARTA: El/la trabajador/a percibirá una retribución total de ....31.600..........euros brutos(11)..ANUALES.......................que se distribuyen en los siguientes conceptos salariales (12).......SALARIO BASE..

QUINTA: La duración de las vacaciones anuales será de (13) 30 DÍAS NATURALES..

SEXTA: A la finalización del contrato de obra o servicio, eventual por circunstancias de la producción y temporal de fomento de empleo para personas con discapacidad, el/la trabajador/a tendrá derecho a recibir una indemnización de acuerdo con la D. Transitoria 8ª del Estatuto de los Trabajadores, o con la Disposición Adicional primera de la ley 43/2006. En el supuesto de extinción por desistimiento en la relación laboral de Empleados/as de Hogar se tendrá derecho a la indemnización prevista en el Art. 11.3 del R.D 1620/2011.

SÉPTIMA: El presente contrato se regulará por lo dispuesto en la legislación vigente que resulte de aplicación y particularmente,por el artículo 15 del Estatuto de los Trabajadores , aprobado por R.D. Legislativo 2/2015, de 23 de octubre, (BOE de 24 de octubre). y Real Decreto 2.720/1998 de 18 de diciembre (BOE. de 8 de enero) y en su caso Disposición Adicional Primera y de la Ley 43/2006, y en su caso por el Convenio Colectivo de. Ley 14/2011, de 1 de junio (BOE de 2 de junio) de la Ciencia, la Tecnología y la Innovación..

OCTAVA: El contenido del presente contrato se comunicará al Servicio Público de Empleo de ....SANTANDER... , en el plazo de los 10 días siguientes a su concertación .

NOVENA: ESTE CONTRATO PODRÁ SER COFINANCIADO POR EL FONDO SOCIAL EUROPEO.

DÉCIMA : PROTECCIÓN DE DATOS : Los datos consignados en el presente modelo tendrán la protección derivada de la Ley Organica 15/1999 de 13 de dicembre (B.O.E. de 14 de diciembre)

(1) Director/a, Gerente, etc.
(2) Padre, madre, tutor/a o persona o institución que le tenga a su cargo.
(3) Indicar profesión.
(4) Señalar el grupo profesional y la categoría o nivel profesional que corresponda, según el sistema de clasificación profesional vigente en la empresa.
(5) Marque con una X lo que corresponda.
(6) Indique la jornada del trabajador
(7) Se entenderá por "trabajador a tiempo completo comparable" a un trabajador a tiempo completo de la misma empresa y centro de trabajo, con el mismo tipo de contrato de trabajo y que realice un trabajo idéntico o similar. Si en la empresa no hubiera ningún trabajador comparable a tiempo completo, se considerará la jornada a tiempo completo prevista en el convenio colectivo de aplicación o, en su defecto, la jornada máxima legal.
(8) Indique las distribución del tiempo de trabajo según el convenio colectivo.
(9) Señálese lo que proceda y en caso afirmativo, adjúntese el anexo si hay horas complementarias.
(10) Respetando lo establecido en el art. 14.1 del Texto refundido de la Ley del Estatuto de los Trabajadores, aprobado por R.D. Legislativo 2/2015, de 23 de octubre (BOE de 24 de octubre).
(11) Diarios, semanales, o mensuales.
(12) Salario base y complementos salariales.
(13) Mínimo: 30 días naturales.

Que el contrato temporal que se celebra (marque la casilla que corresponda), se realiza con las siguientes cláusulas específicas:

y cumple los requisitos establecidos en la norma reguladora.

MINISTERIO
DE EMPLEO Y
SEGURIDAD SOCIAL

SERVICIO PÚBLICO
DE EMPLEO ESTATAL

☒ CLAÚSULAS ESPECÍFICAS DE INVESTIGADORES

☒ TIEMPO COMPLETO

CÓDIGO DE CONTRATO

◉ 4 0 1

◉ PARA LA REALIZACIÓN DE UN PROYECTO ESPECÍFICO DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA

○ 4 2 0

○ PERSONAL INVESTIGADOR EN FORMACIÓN (R.D. 63/2006) (1)

○ DE ACCESO AL SISTEMA ESPAÑOL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN. (1)

○ PREDOCTORAL (1)

☐ TIEMPO PARCIAL

CÓDIGO DE CONTRATO

○ 5 0 1

○ PARA LA REALIZACIÓN DE UN PROYECTO ESPECÍFICO DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA

○ 5 2 0

○ DE ACCESO AL SISTEMA ESPAÑOL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN. (1) Y (2) .

○ PERSONAL INVESTIGADOR EN FORMACIÓN (R.D. 63/2006) (1)

Que el/la empleador/a es (3) :

○ Organísmo Público de investigación de la Administración General del Estado.
○ Organísmo de Investigación de otra Administración Pública.

◉ Universidad Pública, perceptora de fondos cuyo destino incluya la contratación de personal investigador o para el desarrollo de los programas propios I+D+I.
○ Universidades privadas y Universidades de la Iglesia Católica, cuando perciban fondos cuyo destino incluya la la contratación de personal investigador.

○ Entidades privadas sin animo de lucro que realicen actividades I+D técnológico en los terminos de la D.A. 1ª de la Ley 14/2011.

○ Consorcios públicos y fundaciones del sector público en los términos de la D.A. 1ª de la Ley 14/2011.

○ Otros organismos de investigación de la A.G. cuando realicen actividad investigadora y sean beneficiarios de ayudas y subvencion es que incluyan personal investigador.

○ Organismo de la A.G. del Estado de los contemplados en la D.A. 14ª de la Ley 14/2011 de 1 de junio.

○ Otros

Indiquese la opción elegida :

A ◉ Que el/la trabajador/a para la realización de un proyecto especifico de investigación científica y técnica es :

◉ Personal investigador
○ Personal científico o técnico

B ○ Que el/la trabajador/a para ser personal investigador predoctoral en formación esta en posesión de :
Titulo de Licenciado, Arquitecto, Graduado Universitario de al menos 300 créditos o máster universitario o equivalente y hayan sido admitidos a un progrma de doctorado(5).

C ○ Que el/la trabajador/a para ser personal investigador en formación del R.D. 63/2006 está en posesión del Titulo.................................... ....que le/a capacitan para la práctica profesional objeto del contrato. Y no ha estado contratado/a en prácticas en este u otro Organismo por tiempo superior a 2 años.

D ○ Que el/la trabajador/a que accede al Sistema español de Ciencia,Tecnología e Innovación:

Está en posesión del título de Doctor o equivalente (3) ...., que le capacitan para la práctica profesional objeto de este contrato (4).
Que no ha estado contratado/a bajo esta modalidad en este u otro Organismo por tiempo superior a cinco años.

○ Que el trabajador este admitido en el Programa de Activación para el Empleo y esta en posesión del documento acreditativo o resolución del SEPE (R.D. Ley 16/2014).

(1) Predoctoral, Personal Investigador en formación (R.D. 63/2006) y de acceso al Sistema Español de Ciencia, Tecnología e Innovación no se les aplica la D.T. 8ª del E. de los Trabajadores.
(2) Se aplicará lo establecido en el art. 11.1 del Estatuto de los Trabajadores, aprobado por Real Decreto Legislativo 2/2015 de 23 de octubre, (BOE de 24 de octubre).(Contrato en prácticas)
(3) Indicar la disciplina que corresponda.
(4) Indicar la disciplina que corresponda.
(5) El/la trabajador/a deberá entregar al empresario fotocopia compulsada del titulo, certificación de su solicitud o certificación acreditativa de la terminación de los estudios.
(6) Deberá acompañar el escrito de admisión al programa de doctorado expedido por la unidad responsable de dicho programa o por la escuela de doctorado.

CLÁUSULAS ADICIONALES

Al investigador le ha sido concedida subvención para su contratación por Resolución de 17 de noviembre de 2016 de la presidencia de la agencia estatal de investigación por la que se conceden subvenciones para la contratación laboral de doctores por Centros de Investigación y Desarrollo (Ayudas Ramón y Cajal), en el marco del Programa Estatal de Promoción del Talento y su Empleabilidad del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016, del Ministerio de Economía, Industria y Competitividad.

Estas ayudas destinadas a financiar la contratación de doctores están cofinanciadas por el Fondo Social Europeo.

Y para que conste, se extiende este contrato por triplicado ejemplar en el lugar y fecha a continuación indicados, firmando las partes interesadas.
En ....Santander........ a ....5...... de ....diciembre........ de 20 16..........

El/la trabajador/a	El/la representante de la Empresa	El/la representante legal del/de la menor, si procede
	P/D (RR.489/16) EL VICERRECTOR DE INVESTIGACIÓN Y TRANSFERENCIA DEL CONOCIMIENTO	
Fdo.: Pablo Martínez Ruiz del Árbol	Fdo.: Javier León Serrano	

*** IMPORTANTE**

(TODAS LAS PÁGS; CUMPLIMENTADAS EN ESTE CONTRATO DEBERÁN IR FIRMADAS EN EL MARGEN IZQUIERDO PARA MAYOR SEGURIDAD JURÍDICA)

5.N.2. Beca de Formación del Personal Universitario (FPU) (BECA RECHAZADA VOLUNTARIAMENTE POR HABER RECIBIDO DE FORMA SIMULTANEA OTRA MAS BENEFICIOSA)

MINISTERIO
DE EDUCACIÓN
Y CIENCIA

SECRETARÍA DE ESTADO DE
UNIVERSIDADES E INVESTIGACIÓN

DIRECCIÓN GENERAL
DE UNIVERSIDADES

BECAS DE POSGRADO PARA LA

FORMACION DE PROFESORADO UNIVERSITARIO

Convocatoria publicada por Resolución de 8 de septiembre de 2005

CREDENCIAL DE CONCESIÓN DE BECA

Sr(a).D(a). **MARTINEZ RUIZ DEL ARBOL, PABLO**
Referencia de becario: **AP2005-1849**

Por resolución de 30 de marzo de 2006, de la Secretaria de Estado de Universidades e Investigación (pendiente de publicar en el BOE), le ha sido concedida una beca del Programa Nacional de Formación de Profesorado Universitario, cuya convocatoria fue publicada por Resolución de 8 de septiembre de 2005 (B.O.E. de 16 de septiembre de 2005).

El periodo de los efectos administrativos y económicos de la beca es de **1 de abril de 2006** hasta **31 de diciembre de 2006**, sin perjuicio de que la fecha real de incorporación se puede producir dentro del mes siguiente al de la publicación de la resolución de concesión en el B.O.E. o, en su caso, obtenga de la Dirección General de Universidades autorización de aplazamiento para su incorporación. La beca podrá ser renovada por periodos anuales de doce meses como máximo, hasta completar un total de 48 meses, todo ello de conformidad con las bases de la convocatoria que lo regulan.

Dicha beca ha quedado adscrita a **UNIVERSIDAD DE CANTABRIA** y como centro de aplicación **INSTITUTO DE FISICA DE CANTABRIA (IFC),** siendo el Director de la tesis doctoral **MATORRAS WEINING, FRANCISCO**, que actuará como tutor durante el periodo de disfrute de la beca.

En aplicación de la Disposición transitoria única del Real Decreto 63/2006, de 27 de enero, por la que se aprueba el estatuto del personal investigador en formación, se realizarán las actuaciones oportunas para que en el plazo señalado en dicha disposición se produzca la aplicación del referido real decreto a los beneficiarios de becas concedidas por la presente resolución.

Lo que le comunico para su conocimiento y efectos, sin perjuicio de lo establecido en las bases de la convocatoria y, así mismo, de las instrucciones que figuran en el "Cuaderno del becario", donde se especifican los aspectos que deberán tenerse en cuenta para la correcta tramitación de las diferentes situaciones administrativas que afectan a los beneficiarios de becas del Programa Nacional de Formación de Profesorado Universitario y que podrá consultar y obtener los impresos precisos en la siguiente dirección de Internet: **http://www.univ.mecd.es/**

Madrid, 6 de abril de 2006,
EL SUBDIRECTOR GENERAL DE FORMACION
Y MOVILIDAD EN POSGRADO Y POSDOCTORADO

Fdo.: José Luis Hernández Vázquez

NOTA: Si necesita dirigirse a esta Dirección General de Universidades, deberá identificarse con su Referencia.

5.N.3. Becas predoctorales para el desarrollo de tesis doctorales en líneas de investigación con interés para el sector industrial.

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
14	MARISCAL COPANO, CRISTINA MARIA.	GARCIA MARTOS, JOSE MARIA.	INST. DE LA GRASA.
15	ALONSO GONZALEZ, ANGEL LUIS.	LOPEZ CABO, MARTA.	INST. DE INVESTIGACIONES MARINAS (VIGO).

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ LOPEZ, INES.	COFRADES BARBERO, SUSANA.	INST. DEL FRIO.
2	LAMA MUÑOZ, ANTONIO.	FERNANDEZ-BOLAÑOS GUZMAN, JUAN.	INST. DE LA GRASA.

Área 8: Ciencias y Tecnologías Químicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GONZALEZ VERA, JUAN ANTONIO.	HERRANZ HERRANZ, MARIA DEL ROSARIO.	INST. DE QUIMICA MEDICA.
2	SANCHEZ BARRENA, MARIA JOSE.	ALBERT DE LA CRUZ, ARMANDO JOAQUIN.	INST. DE QUIMICA FISICA «ROCASOLANO».
3	ABAD VALLE, PATRICIA.	MARTINEZ TARAZONA, MARIA ROSA.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
4	CANO MERCADO, ALMUDENA.	CAMPOS MARTIN, JOSE MIGUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
5	MARTINEZ AVILA, OLGA MARIA.	PENADES ULLATE, SOLEDAD.	INST. DE INVESTIGACIONES QUIMICAS.
6	PINILLA IBARZ, JOSE LUIS.	MOLINER ALVAREZ, RAFAEL.	INST. DE CARBOQUIMICA.
7	RUBIO MORENO, MIGUEL.	PIZZANO MANCERA, ANTONIO JOSE.	INST. DE INVESTIGACIONES QUIMICAS.
8	LOPEZ SANTOS, LAURA.	CARMONA GUZMAN, ERNESTO.	INST. DE INVESTIGACIONES QUIMICAS.
9	VALLES CALLIZO, CRISTINA MARIA.	MASER, WOLFGANG.	INST. DE CARBOQUIMICA.
10	RENDON MARQUEZ, NURIA.	PANEQUE SOSA, MARGARITA ISABEL.	INST. DE INVESTIGACIONES QUIMICAS.
11	BARBA ALBANELL, CLARA.	CODERCH NEGRA, MARIA LUISA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
12	MARTRAT SOTIL, BELEN.	GRIMALT OBRADOR, JUAN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
13	SAMPEDRO TEJEDOR, PATRICIA.	SASTRE DE ANDRES, ENRIQUE.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	BATALLA BOSQUET, PILAR.	GUISAN SEIJAS, JOSE MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
15	ORTEGA ORTEGA, REBECA.	SANZ APARICIO, JULIANA.	INST. DE QUIMICA FISICA «ROCASOLANO».
16	CASTRILLO CARREIRA, INES.	BRUIX BAYES, MARTA.	INST. DE QUIMICA FISICA «ROCASOLANO».
17	ALONSO DE LA CRUZ, CARMEN ROSA.	SUAREZ LOPEZ, ERNESTO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
18	MATAS RUIZ, INMACULADA.	CAMPORA PEREZ, JUAN.	INST. DE INVESTIGACIONES QUIMICAS.
19	AGUILAR MONCAYO, MATILDE.	GARCIA FERNANDEZ, JOSE MANUEL.	INST. DE INVESTIGACIONES QUIMICAS.
20	TRASTOY BELLO, BEATRIZ.	CHIARA ROMERO, JOSE LUIS.	INST. DE QUIMICA ORGANICA GENERAL.
21	SAAVEDRA FERNANDEZ, CARLOS JAVIER.	HERNANDEZ GONZALEZ, ROSENDO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
22	HERRERA CARRILLO, ELENA.	HARO VILLAR, ISABEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
23	ARREGUI VELAZQUEZ, ANDRES.	NALDA MINGUEZ, REBECA DE.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	HORNES MARTINEZ, AITOR.	MARTINEZ ARIAS, ARTURO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
2	MAGRIZ TASCON, ANTONIO.	LASSALETTA SIMON, JOSE MARIA.	INST. DE INVESTIGACIONES QUIMICAS.
3	SALVADOR VICO, JUAN PABLO.	MARCO COLAS, MARIA PILAR.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
4	JIMENEZ RODRIGUEZ, AURORA.	CLAPES SABORIT, PERE.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
5	FERNANDEZ AROJO, LUCIA.	BALLESTEROS OLMO, ANTONIO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
6	NAVAS GARCIA, RAQUEL.	KHIAR EL WAHABI, NOUREDDINE.	INST. DE INVESTIGACIONES QUIMICAS.
7	LOPEZ CHOCARRO, AZUCENA.	ANDRES GIMENO, JOSE MANUEL.	INST. DE CARBOQUIMICA.
8	QUINTANA HERNANDEZ, NAYRA.	FRAGA GONZALEZ, BRAULIO MANUEL.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
9	MARTIN BENITO, DARIO.	GONZALEZ COLOMA, ANA AZUCENA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
10	TORRES GUZMAN, RICARDO.	BAÑARES GONZALEZ, MIGUEL ANGEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
11	GONZALEZ JIMENEZ, INES DACIL.	ALVAREZ GALVAN, MARIA CONSUELO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
12	ORTIZ DE LA TABLA GONZALEZ, LAURA.	CAMPORA PEREZ, JUAN.	INST. DE INVESTIGACIONES QUIMICAS.

Segundo.-Ordenar la publicación de la presente Resolución a los efectos previstos por el artículo 59.6.b) de la Ley 30/1992, de 26 de noviembre.

La presente resolución, que pone fin a la vía administrativa, podrá ser recurrida potestativamente en reposición, en el plazo de un mes contado a partir del día siguiente a la fecha de su notificación, ante esta Presidencia, de conformidad con lo establecido por los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra esta resolución cabe interponer recurso contencioso administrativo ante el Juzgado Central de lo Contencioso Administrativo en el plazo de dos meses contado a partir del día siguiente a la fecha de su notificación, conforme a lo dispuesto por la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso Administrativa.

No podrá interponerse recurso contencioso administrativo hasta que sea resuelto expresamente o se haya producido la desestimación presunta del recurso de reposición interpuesto.

Madrid, 29 de noviembre de 2005.–El Presidente, Carlos Martínez Alonso

21015 *RESOLUCIÓN de 29 de noviembre, de 2005, del Consejo Superior de Investigaciones Científicas, por la que se conceden becas predoctorales para el desarrollo de tesis doctorales en líneas de investigación con interés para el sector industrial.*

Por Resolución del Consejo Superior de Investigaciones Científicas de 27 de julio de 2005 (Boletín Oficial del Estado de 19 de agosto de 2005) se convocaron becas predoctorales para el desarrollo de Tesis Doctorales en Líneas de investigación con interés para el sector industrial.

Vista la propuesta formulada por la Comisión de selección prevista en la expresada convocatoria, esta Presidencia, en ejercicio de las competencias que tiene atribuidas en virtud de lo establecido por el artículo 15.1 del Estatuto del Organismo Autónomo Consejo Superior de Investigaciones Científicas, aprobado por Real Decreto 1945/2000, de 1 de diciembre, y de conformidad con lo previsto por el artículo 81.3 del texto refundido de la Ley General Presupuestaria, aprobado por Real Decreto Legislativo 1091/1988, de 23 de septiembre, ha resuelto:

Primero.–Adjudicar las becas y designar como suplentes a los candidatos siguientes:

Becas CSIC Predoctorales

Área 1: Humanidades y Ciencias Sociales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GRUBER, DIEGO.	BURGUET VERDE, ROBERTO.	INST. DE ANALISIS ECONOMICO.
2	OSUNA LOPEZ, MARIA DEL CARMEN.	SANZ MENENDEZ, LUIS VICENTE.	UNIDAD DE POLITICAS COMPARADAS.
3	SALGADO CARMONA, JOSE ANGEL.	CELESTINO PEREZ, SEBASTIAN.	INST. DE ARQUEOLOGIA.
4	BECERRA SOLA, MALENA.	GONZALEZ LEANDRI, RICARDO OMAR.	ESCUELA DE ESTUDIOS HISPANOAMERICANOS.
5	JUAREZ, SOL PIA.	RAMIRO FARIÑAS, SOL PIA.	INST. DE ECONOMIA Y GEOGRAFIA.
6	PARGA DANS, EVA.	CRIADO BOADO, FELIPE.	INST. DE ESTUDIOS GALLEGOS P. SARMIENTO.
7	FUENTES ARCOS, REBECA.	SERRANO RUANO, DELFINA.	INST. DE FILOLOGIA.
8	TELLEZ DELGADO, VIRTUDES.	SANCHEZ CARRETERO, CRISTINA.	INST. DE LA LENGUA ESPAÑOLA.
9	MERCHAN HERNANDEZ, CARMEN.	FERNANDEZ ESQUINAS, MANUEL.	INST. EST. SOCIALES AVANZADOS ANDALUCIA.
10	MONTEIRA ARIAS, INES.	CABALLERO ZOREDA, LUIS.	INSTO. HISTORIA.
11	SANZ FUENTES, ANA.	ECHEVERRIA EZPONDA, JAVIER.	INST. DE FILOSOFIA.
12	YEGROS YEGROS, ALFREDO.	FERNANDEZ DE LUCIO, IGNACIO.	INST. GESTION INNOVACION Y CONOCIMIENTO.
13	ACERO PEREZ, JESUS.	MATEOS CRUZ, PEDRO.	INST. DE ARQUEOLOGIA.
14	GONZALEZ ALCAIDE, GREGORIO.	VALDERRAMA ZURIAN, JUAN CARLOS.	INST. DE HIST. DE LA CC. Y DOC. L.PIÑERO.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LIESE, CARSTEN.	PONSATI OBIOLS, CLARA.	INST. DE ANALISIS ECONOMICO.
2	CABRERIZO HURTADO, JORGE JESUS.	NAVARRO PALAZON, JULIO.	ESCUELA DE ESTUDIOS ARABES.
3	CRUZ VALLES, ANTONIO DE LA.	MATE RUPEREZ, MANUEL REYES.	INST. DE FILOSOFIA.
4	OSUNA NEVADO, MARIA DEL CARMEN.	IRUROZQUI VICTORIANO, MARTA.	INSTO. HISTORIA.
5	GONZALEZ CAMARA, NOELIA.	VELASCO ARROYO, JUAN CARLOS.	INST. DE FILOSOFIA.

Área 2: Biología y Biomedicina

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	ROSELLO DIEZ, ALBERTO.	TORRES SANCHEZ, MIGUEL.	CTRO. NAL. DE BIOTECNOLOGIA.
2	CASTRILLO JIMENEZ, BEATRIZ.	ROMERO RODRIGUEZ, JOSE MARIA.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
3	FUSTER ORTUÑO, JOSE JAVIER.	ANDRES GARCIA, VICENTE.	INST. DE BIOMEDICINA DE VALENCIA.
4	AQUIZU LOPEZ, NAIARA.	MARTINEZ BALBAS, MARIA ANGELES.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
5	GARCIA GARCIA, CELINA.	LOPEZ RIVAS, ABELARDO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
6	CECI, MARIA LAURA.	DE CARLOS SEGOVIA, JUAN ANDRES.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
7	ESCUDERO GONZALEZ, BEATRIZ.	SAMPER RODRIGUEZ, ENRIQUEZ.	CTRO. NAL. DE BIOTECNOLOGIA.
8	MOLINA FUENTES, AGUEDA.	NAVARRO CARRETERO, MIGUEL ANGEL.	INST. PARASITOL.Y BIOMED. «LOPEZ NEYRA».
9	UHIA CASTRO, IRIA.	GARCIA LOPEZ, JOSE LUIS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
10	RAMOS FERNANDEZ, ANTONIO.	VAZQUEZ COBOS, JESUS MARIA.	CTRO. DE BIOLOGIA MOLECULAR.
11	ESCOLANO ARTIGAS, AMELIA.	DIAZ-MECO CONDE, MARIA TERESA.	CTRO. DE BIOLOGIA MOLECULAR.
12	DIEZ NUÑO, HECTOR.	CARRION VAZQUEZ, MARIANO SIXTO.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
13	MORENO ANDRES, DANIEL.	SANZ BIGORRA, PASCUAL FELIPE.	INST. DE BIOMEDICINA DE VALENCIA.
14	ELIAS VILLALOBOS, ALBERTO.	IBEAS CORCELLES, JOSE IGNACIO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
15	VIDAL SERNANDEZ, ISORA.	MARTINEZ ALONSO, CARLOS.	CTRO. NAL. DE BIOTECNOLOGIA.
16	FERNANDEZ-TRESGUERRES TORRECILLAS, BEATR.	MARTINEZ FERRER, ANGEL TOMAS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
17	AMICH ELIAS, JORGE.	CALERA ABAD, JOSE ANTONIO.	INST. DE MICROBIOLOGIA BIOQUIMICA.
18	FERNANDEZ FERNANDEZ, ISABEL.	LAZO-ZBIKOWSKI TARACENA, PEDRO ALFONSO.	INSTO.BIOL.MOL.CEL. CANCER DE SALAMANCA.
19	MUÑOZ GALVAN, SANDRA.	AGUILERA LOPEZ, ANDRES.	CTRO.ANDALUZ DE BIOL.MOL.(CABIMER).
20	FANO BILBAO, OIHANE.	RODRIGUEZ DE CORDOBA, SANTIAGO.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
21	DOMINGUEZ CANTERO, MARIA DEL PILAR.	DOMINGUEZ OLAVARRI, ANGEL.	INST. DE MICROBIOLOGIA BIOQUIMICA.
22	LOPEZ GARAULET, DANIEL.	SANCHEZ-HERRERO ARBIDE, ERNESTO.	CTRO. DE BIOLOGIA MOLECULAR.
23	ROJAS RIOS, PATRICIA.	GONZALEZ REYES, ALFONSO ACAIMO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
24	FERNANDEZ MUÑOZ, BEATRIZ.	QUINTANILLA AVILA, MIGUEL.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
25	ESCRIBANO DIAZ, MARIA CRISTINA.	BERNAD MIANA, ANTONIO.	CTRO. NAL. DE BIOTECNOLOGIA.
26	JARAMILLO MERCHAN, JESUS A.	RAMON CUETO, MARIA ALMUDENA.	INST. DE BIOMEDICINA DE VALENCIA.
27	MARTIN SANCHEZ, IKER.	SANCHEZ RODRIGUEZ, LUCAS.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
28	QUINTERO RUIZ, MARIA CRISTINA.	SANCHEZ SANZ, MARIA JOSE.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
29	MONTE NIETO, GONZALO DEL.	POMPA MINGUEZ, JOSE LUIS DE LA.	CTRO. NAL. DE BIOTECNOLOGIA.
30	FERNANDEZ NOHALES, PEDRO.	MADUEÑO ALBI, FRANCISCO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
31	LOPEZ SANCHEZ, ANA.	VARA VERA, PABLO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
32	FUENTE ARTEAGA, SARA ANDREA.	JIMENEZ CUENCA, BENILDE.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	RESA INFANTE, PATRICIA.	ORTIN MONTON, JUAN.	CTRO. NAL. DE BIOTECNOLOGIA.
2	SAN MARTIN URIZ, PATXI.	AMILS PIBERNAT, RICARDO.	CTRO. DE BIOLOGIA MOLECULAR.
3	ESTEBAN SAÑUDO, ANA.	SANTAMARIA SANCHEZ, RAMON IGNACIO.	INST. DE MICROBIOLOGIA BIOQUIMICA.
4	BUSTOS SANMAMED, MARIA DEL PILAR.	VALDIVIESO MONTERO, MARIA HENAR.	INST. DE MICROBIOLOGIA BIOQUIMICA.
5	CASAÑAS ADAM, ARNAU.	VERDAGUER MASSANA, NURIA.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
6	ABREU DE FELIPE, MIGUEL.	FERNANDEZ LOBATO, MARIA.	CTRO. DE BIOLOGIA MOLECULAR.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
7	LOZANO ROSAS, VIRGINIA.	RAMIREZ ORTIZ, ANGEL.	CTRO. DE BIOLOGIA MOLECULAR.
8	GIL RODRIGUEZ, MARIA CONCEPCION.	JUAN JOSE GARRIDO JURADO.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
9	SILIO CASTREJON, VIRGINIA.	FRADE LOPEZ, JOSE MARIA.	INST. NEUROBIOLOGIA «RAMON Y CAJAL».
10	CAMPOS MUELAS, PEDRO MANUEL.	MAYOR MENENDEZ, FEDERICO.	CTRO. DE BIOLOGIA MOLECULAR.
11	MESEGUER LLOPIS, SALVADOR.	BARETTINO FRAILE, DOMINGO.	INST. DE BIOMEDICINA DE VALENCIA.
12	NAVARRETE GOMEZ, MARIA LUISA.	FERRANDIZ MAESTRE, CRISTINA.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
13	ORDOÑO BALLESTEROS, DESIDERIO.	CASASNOVAS SUELVES, JOSE MARIA.	CTRO. NAL. DE BIOTECNOLOGIA.
14	AMADOR HIERRO, CRISTINA.	SANTERO SANTURINO, EDUARDO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
15	REDONDO MUÑOZ, JAVIER.	GARCIA PARDO, MARIA DE LOS ANGELES.	CTRO. DE INVESTIGACIONES BIOLOGICAS.
16	GUTIERREZ BELTRAN, EMILIO.	VALVERDE ALBACETE, FEDERICO.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
17	YEPES GARCIA, ANA.	FERNANDEZ ABALOS, JOSE MANUEL.	INST. DE MICROBIOLOGIA BIOQUIMICA.
18	TARDAGUILA SANCHO, MANUEL.	SANCHEZ PACHECO, AURORA.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
19	SHLEVKOV, EVGENY.	MORATA PEREZ, GINES.	CTRO. DE BIOLOGIA MOLECULAR.
20	LAGARES SALTO, DAVID.	LACAL SANJUAN, JUAN CARLOS.	INST. INVEST. BIOMEDICAS ALBERTO SOLS.
21	ROLDAN RIVERO, ISAAC.	MERIDA BERLANGA, ANGEL.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
22	FERNANDEZ CORDERO, BALDOMERO.	RODRIGUEZ MARTINEZ, HERMINIA.	INST. BIOQUIMICA VEGETAL Y FOTOSINTESIS.
23	BARZI DIEGUEZ, MARIA MERCEDES.	PONS FUXA, SEBASTIAN.	INST. DE INVEST. BIOMEDICAS BARCELONA.
24	RINCON GILA, ESTHER.	MERIDA DE SAN ROMAN, ISABEL.	CTRO. NAL. DE BIOTECNOLOGIA.
25	SANCHEZ RUIZ, JESUS.	GONZALEZ GARCIA, ANA.	CTRO. NAL. DE BIOTECNOLOGIA.
26	CASTELLANOS MOLINA, MILAGROS.	GARCIA MATEU, MAURICIO.	CTRO. DE BIOLOGIA MOLECULAR.
27	MARTIN MARTIN, ANA ISABEL.	TAMAME GONZALEZ, MARIA MERCEDES.	INST. DE MICROBIOLOGIA BIOQUIMICA.
28	GONZALEZ PRIETO, ROMAN.	MIRANDA VIZUETE, ANTONIO.	CTRO. ANDALUZ DE BIOLOGIA DEL DESARROLLO.
29	FERNANDEZ MARTIN, AMELIA.	DELGADO MORA, MARIO.	INST. PARASITOL.Y BIOMED. «LOPEZ NEYRA».

Área 3: Recursos Naturales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PEDRAZA LARA, CARLOS SALVADOR.	DOADRIO VILLAREJO, JOSE IGNACIO.	MUSEO NACIONAL DE CIENCIAS NATURALES.
2	SERRANO MUELA, MARIA PILAR.	REGUES MUÑOZ, DAVID.	INST. PIRENAICO DE ECOLOGIA.
3	KALMAN, JUDIT.	BLASCO MORENO, JULIAN.	INST. DE CIENCIAS MARINAS DE ANDALUCIA.
4	MARTINEZ GARCIA, PEDRO.	SOTO HERMOSO, JUAN IGNACIO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
5	FERNANDEZ PIÑAR, REGINA.	SAINZ DIAZ, CLARO IGNACIO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
6	CABEZAS PADILLA, PATRICIA.	MACHORDOM BARBE, ANNIE.	MUSEO NACIONAL DE CIENCIAS NATURALES.
7	GORI, ANDREA.	GILI SARDA, JOSE MARIA.	INST. DE CIENCIAS DEL MAR.
8	PEREZ RAMIREZ, ELISA.	GORTAZAR SCHMIDT, CHRISTIAN.	INST. DE INV. EN RECURSOS CINEGETICOS.
9	SETTANNI, CHIARA.	GARCIA PARIS, MARIO.	MUSEO NACIONAL DE CIENCIAS NATURALES.
10	RUIZ CONSTAN, ANA.	SANZ DE GALDEANO EQUIZA, CARLOS MANUEL.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
11	SAÑE SCHEPISI, ELISABET.	ALONSO MARTINEZ, MARIA BELEN.	INST. DE CIENCIAS DEL MAR.
12	FLORENCIO DIAZ, MARGARITA PATRICIA.	DIAZ PANIAGUA, MARIA DEL CARMEN.	ESTACION BIOLOGICA DE DOÑANA.
13	FONOLLA ARAUJO, PAULA.	MARTI ROCA, EUGENIA.	CTRO. DE ESTUDIOS AVANZADOS DE BLANES.
14	IRLES IVANAC, PAULA.	PIULACHS BAGA, MARIA DOLORES.	INST. BIOLOGIA MOLECULAR DE BARCELONA.
15	SICILIA GARCIA, MARISA.	CASSINELLO ROLDAN, JORGE.	INST. DE INV. EN RECURSOS CINEGETICOS.
16	PASTOR MOLLA, MARIA VIRTUDES.	PELEGRI LLOPART, JOSE LUIS.	INST. DE CIENCIAS DEL MAR.
17	FERNANDEZ GOMEZ, BEATRIZ.	PEDROS ALIO, CARLOS.	INST. DE CIENCIAS DEL MAR.
18	VILLAMOR MARTIN-PRAT, ADRIANA.	BECERRO GARCIA, MIKEL AINGERU.	CTRO. DE ESTUDIOS AVANZADOS DE BLANES.
19	RODRIGUEZ JORDA, MARIA PAZ.	GARCIA GONZALEZ, MARIA TERESA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
20	TORRECILLA RIBALTA, ELENA.	PIERA FERNANDEZ, JAUME.	CTRO.MEDIT.INV.MARINAS Y AMBIENTALES.
21	TORAL JIMENEZ, GREGORIO MAGNO.	FIGUEROLA BORRAS, JORDI.	ESTACION BIOLOGICA DE DOÑANA.
22	LLEBOT LORENTE, CLARA.	ESTRADA MIYARES, MARTA.	INST. DE CIENCIAS DEL MAR.
23	VAZQUEZ RODRIGUEZ, MARCOS.	FERNANDEZ PEREZ, FIZ.	INST. DE INVESTIGACIONES MARINAS (VIGO).
24	CANAL PIÑA, DAVID.	POTTI SANCHEZ, JAIME.	ESTACION BIOLOGICA DE DOÑANA.
25	MARTIN PEREZ, ANDREA.	ALONSO ZARZA, ANA MARIA.	INST. DE GEOLOGIA ECONOMICA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ LLANDRES, ANA.	ABAIGAR ANCIN, TERESA.	ESTACION EXPERIMENTAL DE ZONAS ARIDAS.
2	NIETO MORENO, ANA.	DELGADO HUERTAS, ANTONIO LUIS.	ESTACION EXPERIMENTAL DEL ZAIDIN.
3	ECHEVESTE DE MIGUEL, PEDRO.	AGUSTI REQUENA, SUSANA.	INST. MEDITERRANEO DE ESTUDIOS AVANZADOS.
4	PEREZ RODRIGUEZ, ALFONSO.	VAZQUEZ RODRIGUEZ, ANTONIO.	INST. DE INVESTIGACIONES MARINAS (VIGO).
5	GALINDO RUEDA, MARIA DEL MAR.	LOPEZ GALINDO, ALBERTO.	INST. ANDALUZ DE CIENCIAS DE LA TIERRA.
6	OLLERO VILA, MARIA INMACULADA.	MOLINA DONATE, MARIA JOSEFA.	CTRO. DE INVESTIG. SOBRE DESERTIFICACION.
7	FERNANDEZ DOCASAL, SANDRA.	MURADO GARCIA, MIGUEL.	INST. DE INVESTIGACIONS MARINAS (VIGO).
8	MARTINEZ HARO, MONICA.	MATEO SORIA, RAFAEL.	INST. DE INV. EN RECURSOS CINEGETICOS.
9	MILLAN SCHEIDING, CRISTINA.	ANTOLIN TOMAS, CARMEN.	CTRO. DE INVESTIG. SOBRE DESERTIFICACION.
10	GARAGORRI ATRISTAIN, PILAR.	MUÑOZ FUENTE, JESUS.	REAL JARDIN BOTANICO.
11	SCHIAFFINO, CHIARA.	GUILLEN ARANDA, JORGE BENITO.	INST. DE CIENCIAS DEL MAR.
12	CRUZ FOLCH, ANTONIO.	DEMESTRE ALTED, MONTSERRAT.	INST. DE CIENCIAS DEL MAR.
13	MUZYLO, ALEKSANDRA.	LLORENS GARCIA, MARIA DEL PILAR.	INST. DE CIENCIAS DE LA TIERRA»J.ALMERA».
14	FERNANDEZ DE LA REGUERA TAYA, DIANA.	SARASQUETE REIRIZ, MARIA DEL CARMEN.	INST. DE CIENCIAS MARINAS DE ANDALUCIA.

Área 4: Áreas Agrarias

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	GARCIA VILA, MARGARITA.	FERERES CASTIEL, ELIAS.	INST. DE AGRICULTURA SOSTENIBLE.
2	ZAFRA GOMEZ, AMELIA.	GIRALDEZ CERVERA, JUAN V.	INST. DE AGRICULTURA SOSTENIBLE.
3	PEREZ TIENDA, JACOB RAFAEL.	FERROL GONZALEZ, NURIA.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
4	RUIZ NAVARRO, ANTONIO.	ALBALADEJO MONTORO, JUAN.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
5	TORRES CORTES, GLORIA.	MARTINEZ-ABARCA PASTOR, FRANCISCO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
6	RUBIO NOVELLA, SILVIA.	RODRIGUEZ EGEA, PEDRO.	INST. BIOL. MOL. Y CEL. PLANTAS P.YUFERA.
7	GAGO MONTAÑA, PILAR.	MARTINEZ RODRIGUEZ, MARIA DEL CARMEN.	MISION BIOLOGICA DE GALICIA.
8	RUIZ MIRAZO, JABIER.	GONZALEZ REBOLLAR, JOSE LUIS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
9	ARANDA SILICIA, MARIA DE LAS NIEVES.	RODRIGUEZ ROSALES, MARIA DEL PILAR.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
10	LOPEZ MONDEJAR, RUBEN.	PASCUAL VALERO, JOSE ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
11	ORTEGA MADUEÑO, ISABEL.	LUCAS SANCHEZ, MARIA MERCEDES.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
12	PEREZ MARTIN, ALFONSO.	DIAZ ESPEJO, ANTONIO.	INST. DE REC.NAT. Y AGROBIOL. SEVILLA.
13	SAGARDOY CALDERON, RUTH.	MORALES IRIBAS, FERMIN.	ESTACION EXPERIMENTAL «AULA DEI».
14	DIAZ RODRIGUEZ, ROSARIO.	GARCIA ROMERA, INMACULADA.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
15	ALEMAN GUILLEN, FERNANDO.	RUBIO MUÑOZ, FRANCISCO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
16	MARTINEZ MEDINA, AINHOA.	ROLDAN GARRIGOS, ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	SARRIA VILLADA, EMILIO.	LOPEZ SESE, ANA ISABEL.	ESTACION EXPERIMENTAL «LA MAYORA».
2	TOMAS GARCIA, DIEGO MIGUEL.	MORIONES ALONSO, ENRIQUE.	ESTACION EXPERIMENTAL «LA MAYORA».
3	FUENTES PANIAGUA, SARA.	MUÑIZ DAZA, MARIANO.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.
4	ROCA HERNANDEZ, AMALIA.	RAMOS MARTIN, JUAN LUIS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
5	CONDE AGUILERA, JOSE ALBERTO.	FERNANDEZ-FIGARES IBAÑEZ, IGNACIO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
6	MACIAS HUETE, FRANCISCO.	CASTRO LOPEZ, ANTONIO JESUS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
7	ANDREU GARGALLO, VANESA.	ALFONSO LOZANO, MIGUEL.	ESTACION EXPERIMENTAL «AULA DEI».
8	GARCIA SANCHEZ, MERCEDES.	OCAMPO BOTE, JUAN ANTONIO.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
9	IGLESIA FERNANDEZ, MANUEL.	BALLESTER ALVAREZ-PARDIÑAS, ANTONIO.	INST. DE INVEST. AGROBIOL. DE GALICIA.
10	SANZ CEBALLOS, LAURA.	SANZ SAMPELAYO, MARIA REMEDIOS.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
11	DIAZ VIVANCOS, PEDRO.	HERNANDEZ CORTES, JOSE ANTONIO.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
12	LOPEZ GARRIDO, ROSA.	CABRERA CAPITAN, FRANCISCO DE PAULA.	INST. DE REC.NAT. Y AGROBIOL. SEVILLA.
13	DORADO PANIAGUA, MARIA DEL CARMEN.	SANCHEZ MARTIN, MARIA JESUS.	INST. DE REC.NAT. Y AGROBIOL. SALAMANCA.
14	EXPOSITO HARRIS, RUTH.	GALLEGOS FERNANDEZ, MARIA TRINIDAD.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
15	MARIN PIQUERAS, MARIA DEL CARMEN.	SAHRAWY BARRAGAN, MARIAM.	ESTACION EXPERIMENTAL DEL «ZAIDIN».
16	AREVALO MARIN, LAURA.	MARTINEZ LOPEZ, VICENTE.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
17	VALDERRAMA TRASLAVIÑA, JONATHAN ANDRES.	BEDMAR GOMEZ, EULOGIO JOSE.	ESTACION EXPERIMENTAL DEL «ZAIDIN».

Área 5: Ciencia y Tecnologías Físicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	RUBIO NUÑEZ, ROBERTO.	GARCIA PRADA, OSCAR SEGUNDO.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
2	GOMEZ VERGEL, DANIEL.	BARBERO GONZALEZ, JESUS FERNANDO.	INST. DE ESTRUCTURA DE LA MATERIA.
3	SANZ RUIZ, MIKEL.	CABRILLO GARCIA, CARLOS.	INST. DE ESTRUCTURA DE LA MATERIA.
4	MARTINEZ RUIZ DEL ARBOL, PABLO.	MATORRAS WEINIG, FRANCISCO.	INST. DE FISICA DE CANTABRIA.
5	MUÑOZ MARTIN, DAVID.	GONZALO DE LOS REYES, JOSE.	INST. DE OPTICA «DAZA DE VALDES».
6	SEVILLA RUIZ, JUAN FRANCISCO.	GONZALEZ DE SANTOS, PABLO.	INST. DE AUTOMATICA INDUSTRIAL.
7	PAN COLLANTES, ANTONIO JESUS.	MUÑOZ VELAZQUEZ, VICENTE.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
8	CASAL LARAÑA, BRUNO.	RUIZ JIMENO, ALBERTO.	INST. DE FISICA DE CANTABRIA.
9	PRIETO HONORATO, JOSE CARLOS.	JIMENEZ RUIZ, ANTONIO RAMON.	INST. DE AUTOMATICA INDUSTRIAL.
10	LEÑERO BARDALLO, JUAN ANTONIO.	LINARES BARRANCO, BERNABE.	INST. DE MICROELECTRONICA DE SEVILLA.
11	DIEGO MARTINEZ, RAUL DE.	GARRIDO BELLIDO, EDUARDO.	INST. DE ESTRUCTURA DE LA MATERIA.
12	VIEJO CORTES, JULIAN.	BELLIDO DIAZ, MANUEL JESUS.	INST. DE MICROELECTRONICA DE SEVILLA.
13	PERREAU DE PINNINCHK BAS, ADRIAN.	SIERRA GARCIA, CARLOS ALBERTO.	INST. DE INV. INTELIGENCIA ARTIFICIAL.
14	GIL ORTIZ, ALEJANDRO.	DIAZ MEDINA, JOSE.	INST. DE FISICA CORPUSCULAR.
15	MALDONADO LOPEZ, ROCIO.	LIÑAN CEMBRANO, GUSTAVO.	INST. DE MICROELECTRONICA DE SEVILLA.
16	LOPEZ RUIZ, FRANCISCO FELIPE.	ALDAYA VALVERDE, VICTOR.	INST. DE ASTROFISICA DE ANDALUCIA.
17	GODINO AMADO, NIEVES.	MUÑOZ PASCUAL, FRANCISCO JAVIER.	INST. DE MICROELECTRONICA DE BARCELONA.
18	HUSAR, ATTILA PETER.	RIERA COLOMER, JORGE.	INST. DE ROBOTICA E INFORMATICA INDUST.
19	MARTINEZ GARRIDO, RAMSES VALENTIN.	GARCIA GARCIA, RICARDO.	INST. DE MICROELECTRONICA DE MADRID.
20	JANNES, GIL.	BARCELO SERON, CARLOS.	INST. DE ASTROFISICA DE ANDALUCIA.
21	SANCHEZ CONDE, MIGUEL ANGEL.	PRADA MARTINEZ, FRANCISCO.	INST. DE ASTROFISICA DE ANDALUCIA.
22	GARCIA FERNANDEZ, MARIO.	ALVAREZ CONSUL, LUIS.	INST. DE MATEMAT. Y FISICA FUNDAMENTAL.
23	FERRARIO, PAOLA.	RODRIGO GARCIA, GERMAN VICENTE.	INST. DE FISICA CORPUSCULAR.
24	CASTRO ARRIBAS, ALBERTO DE.	MARCOS CELESTINO, SUSANA.	INST. DE OPTICA «DAZA DE VALDES».

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	ALONSO GONZALEZ, PABLO.	GONZALEZ SOTOS, LUISA.	INST. DE MICROELECTRONICA DE MADRID.
2	SOLANS SANCHEZ, CARLOS.	EMILIO HIGON RODRIGUEZ.	INST. DE FISICA CORPUSCULAR.
3	RUIZ OLAYA, ANDRES FELIPE.	CALDERON ESTEVEZ, LEOPOLDO.	INST. DE AUTOMATICA INDUSTRIAL.
4	HUSSEIN HASSAN, NASHAAT MOHAMED.	BARRIGA BARROS, ANGEL.	INST. DE MICROELECTRONICA DE SEVILLA.
5	GOMEZ DIAZ, JAIME.	NOGALES RUIZ, AURORA.	INST. DE ESTRUCTURA DE LA MATERIA.
6	GILLI, GABRIELLA.	LOPEZ VALVERDE, MIGUEL ANGEL.	INST. DE ASTROFISICA DE ANDALUCIA.
7	BURSET ATIENZA, PABLO.	GONZALEZ CARMONA, JOSE.	INST. DE ESTRUCTURA DE LA MATERIA.
8	CARRASCO GONZALEZ, CARLOS.	ANGLADA PONS, GUILLEM JOSEP.	INST. DE ASTROFISICA DE ANDALUCIA.
9	ATENCIA ARCAS, MANUEL.	AGUSTI CULLEL, JAIME.	INST. DE INV. INTELIGENCIA ARTIFICIAL.
10	PELAEZ MACHADO, SAMUEL.	SERENA DOMINGO, PEDRO AMALIO.	INST. DE CIENCIA DE MATERIALES MADRID.
11	VIVES TORRESCASANA, ROGER.	FUSTER VERDU, JUAN ANTONIO.	INST. DE FISICA CORPUSCULAR.
12	GERBER, DANIEL.	FERNANDEZ BARBON, JOSE LUIS.	INST. DE FISICA TEORICA.
13	MARTIN FERNANDEZ, IÑIGO.	GODIGNON, PHILIPPE.	INST. DE MICROELECTRONICA DE BARCELONA.
14	MARTIN MARTIN, RUBEN.	CEBOLLADA NAVARRO, ALFONSO.	INST. DE MICROELECTRONICA DE MADRID.
15	PERALTA CHANA, CELIA.	PONS AGLIO, ALICIA.	INST. DE FISICA APLICADA.
16	DOMINGUEZ REYES, RICARDO.	GARCIA BORGE, MARIA JOSE.	INST. DE ESTRUCTURA DE LA MATERIA.
17	CARRANZA HERREZUELO, NOEMI.	CRISTOBAL PEREZ, GABRIEL.	INST. DE OPTICA «DAZA DE VALDES».

Área 6: Ciencia y Tecnología de Materiales

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	BARRIO LAS HERAS, JESUS DEL.	ORIOL LANGA, LUIS TEODORO.	INST. DE CIENC. DE MATERIALES DE ARAGON.
2	GARCIA GONZALEZ, CARLOS A.	DOMINGO PASCUAL, CONCEPCION.	INST. DE CIENCIA DE MATERIALES BARNA.
3	FERREIRO GARZON, SERGIO.	FRIAS ROJAS, MOISES.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.
4	ODRIOZOLA LLORET, CARLOS PATRICIO.	JUSTO ERBEZ, ANGEL.	INST. DE CIENCIA DE MATERIALES SEVILLA.
5	CESPEDES MONTOYA, EVA.	PRIETO DE CASTRO, CARLOS ANDRES.	INST. DE CIENCIA DE MATERIALES MADRID.
6	RIGATO, FRANCO.	FONTCUBERTA GRIÑO, JOSE.	INST. DE CIENCIA DE MATERIALES BARNA.
7	MARTI ROVIROSA, XAVIER.	SANCHEZ BARRERA, FLORENCIO.	INST. DE CIENCIA DE MATERIALES BARNA.
8	GOMEZ AVILES, ALMUDENA.	ARANDA GALLEGO, MARIA PILAR.	INST. DE CIENCIA DE MATERIALES MADRID.
9	CARRETERO DEL POZO, PAULA.	ABAJO GONZALEZ, FRANCISCO JAVIER DE.	INST. DE CIENCIA Y TECNOLOGIA POLIMEROS.
10	LUCCAS, ROBERTO FABIAN.	PUIG MOLINA, MARIA TERESA.	INST. DE CIENCIA DE MATERIALES BARNA.
11	HIDALGO MANRIQUE, PALOMA.	RUANO MARIÑO, OSCAR ANTONIO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
12	CANO TORRES, JOSE MARIA.	SERRANO HERNANDEZ, MARIA DOLORES.	INST. DE CIENCIA DE MATERIALES MADRID.
13	FARRAS COSTA, PAU.	TEIXIDOR BOMBARDO, FRANCESC.	INST. DE CIENCIA DE MATERIALES BARNA.
14	PEREÑIGUEZ RODRIGUEZ, ROSA MARIA.	HOLGADO VAZQUEZ, JUAN PEDRO.	INST. DE CIENCIA DE MATERIALES SEVILLA.
15	LLORDES GIL, ANNA.	OBRADORS BERENGUER, FRANCISCO JAVIER.	INST. DE CIENCIA DE MATERIALES BARNA.
16	RANCEL GIL, LUCIA.	MEDINA MARTIN, SEBASTIAN FLORENCIO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
17	GARCIA VILCHEZ, ANTONIO JESUS.	FERNANDEZ LOZANO, JOSE FRANCISCO.	INST. DE CERAMICA Y VIDRIO.
18	TOCADO MARTINEZ, LETICIA.	BURRIEL LAHOZ, RAMON.	INST. DE CIENC. DE MATERIALES DE ARAGON.
19	BLANCO DOMINGUEZ, MANUEL.	FUENTE LEIS, GERMAN FRANCISCO DE LA.	INST. DE CIENC. DE MATERIALES DE ARAGON.
20	SABIO GONZALEZ, JAVIER.	GUINEA LOPEZ, FRANCISCO.	INST. DE CIENCIA DE MATERIALES MADRID.
21	GARCIA GIL, SANDRA.	ORDEJON RONTOME, PABLO JESUS.	INST. DE CIENCIA DE MATERIALES BARNA.
22	TORO VALDERRANA, LINA MARIA.	FULLEA GARCIA, JOSE.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LOPEZ PEREZ, JORGE.	CANADELL CASANOVA, ENRIC.	INST. DE CIENCIA DE MATERIALES BARNA.
2	GIL LUNA, MARIA DOLORES.	MONTE MUÑOZ DE LA PEÑA, FRANCISCO DEL.	INST. DE CIENCIA DE MATERIALES MADRID.
3	FRUTOS ROZAS, MANUEL DE.	GUARROTXENA ARLUNDUAGA, MIREN NEKANE.	INST. DE CIENCIA Y TECNOLOGIA POLIMEROS.
4	GARCERA JULIA, JUDIT.	MOLINS GRAU, ELIES.	INST. DE CIENCIA DE MATERIALES BARNA.
5	GALAN GARCIA, ISABEL.	RIO SUAREZ, OLGA ISABEL.	INST. DE CIENCIAS DE LA CONST. E.TORROJA.
6	DONOSO LISBOA, WILLIAMS.	GARCIA CARCEDO, FERNANDO.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
7	PAVON GONZALEZ, ESPERANZA.	CASTRO ARROYO, MIGUEL ANGEL.	INST. DE CIENCIA DE MATERIALES SEVILLA.
8	BELLO MERAYO, LAURA.	BASTIDAS RULL, JOSE MARIA.	CTRO. NAL. DE INVESTIGACIONES METALURGIC.
9	BEDOYA MARTINEZ, OLGA NATALIA.	HERNANDEZ, EDUARDO.	INST. DE CIENCIA DE MATERIALES BARNA.
10	RODRIGUEZ GARCIA, YOLANDA.	MARTINEZ FERNANDEZ, JULIAN.	INST. DE CIENCIA DE MATERIALES SEVILLA.
11	GARCIA FERNANDEZ, PEDRO DAVID.	LOPEZ FERNANDEZ, CEFERINO.	INST. DE CIENCIA DE MATERIALES MADRID.
12	SANCHEZ SANCHEZ, CARLOS.	LOPEZ FAGUNDEZ, MARIA FRANCISCA.	INST. DE CIENCIA DE MATERIALES MADRID.
13	GARCIA MARIN, HECTOR.	GARCIA LAUREIRO, JOSE IGNACIO.	INST. DE CIENC. DE MATERIALES DE ARAGON.

Área 7: Ciencia y Tecnología de Alimentos

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PEREZ TRAVES, LAURA.	QUEROL SIMON, AMPARO MERCEDES.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
2	BAUERL, CHRISTINE.	PEREZ MARTINEZ, GASPAR.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
3	PROL GARCIA, MARIA JESUS.	PINTADO VALVERDE, JOSE.	INST. DE INVESTIGACIONES MARINAS (VIGO).
4	GAÑAN MARTINEZ-BALLESTA, MONICA.	CARRASCOSA SANTIAGO, ALFONSO VICENTE.	INST. DE FERMENTACIONES INDUSTRIALES.
5	RUIZ GARCIA, LORENA.	MARGOLLES BARROS, ABELARDO.	INST. DE PRODUCTOS LACTEOS DE ASTURIAS.
6	LOPEZ GALVEZ, FRANCISCO.	GIL MUÑOZ, MARIA ISABEL.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
7	GONZALEZ MELLADO, DAMIAN.	MARTINEZ FORCE, ENRIQUE.	INST. DE LA GRASA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
8	ROMERO SEGURA, ANA JESUS.	CERT VENTULA, ARTURO.	INST. DE LA GRASA.
9	CONTRERAS APARICIO, PATRICIA.	LOPEZ-ALONSO FANDIÑO, ROSINA.	INST. DE FERMENTACIONES INDUSTRIALES.
10	GOMEZ PASTOR, ROCIO.	FERNANDEZ-ESPINAR GARCIA, TERESA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
11	SUAREZ PANTALEON, CELIA.	ABAD FUENTES, ANTONIO.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	TEJEDOR CANO, JAVIER.	GOYA SUAREZ, LUIS.	INST. DEL FRIO.
2	ELAZAQUIVEL BARCENAS, PATRICIA.	AZNAR NOVELLA, ROSA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
3	CARLAVILLA MARTINEZ, DAVINIA.	MORENO ARRIBAS, MARIA VICTORIA.	INST. DE FERMENTACIONES INDUSTRIALES.
4	CARBONELL ADROVER, LEIRE.	IZQUIERDO FAUBEL, LUIS JOAQUIN.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
4	FERRER BERNAT, CARMEN.	MARTINEZ LOPEZ, ANTONIO.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
6	SERRANO MARTINEZ, ANA.	GARCIA VIGUERA, MARIA CRISTINA.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.
7	SANCHEZ GARCIA, MARIA DOLORES.	LAGARON CABELLO, JOSE MARIA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
8	GOMEZ ESTACA, JOAQUIN.	MONTERO GARCIA, MARIA DEL PILAR.	INST. DEL FRIO.
9	BRUNI, GIOVANNI.	RANDEZ GIL, MARIA FRANCISCA.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
10	ROMERO DE LA FUENTE, IRENE.	MERODIO MORENO, CARMEN.	INST. DEL FRIO.
11	HERNANDEZ HARO, CAROLINA TERESA.	BRAVO CLEMENTE, LAURA.	INST. DEL FRIO.
12	LOPEZ DE DICASTILLO BERGAMO, ANA CAROLINA.	GAVARA CLEMENTE, RAFAEL JOSE.	INST. DE AGROQUIM. Y TECNOL. ALIMENTOS.
13	TRUCHADO GAMBAO, PILAR.	TOMAS BARBERAN, FRANCISCO ABRAHAM DE.	CTRO. DE EDAF.Y BIOL.APLICADA DEL SEGURA.

Área 8: Ciencia y Tecnología Químicas

Orden	Titulares	Director de Trabajo	Centro / Instituto CSIC
1	PINAR PRIETO, ANA BELEN.	PEREZ PARIENTE, JOAQUIN.	INST. DE CATALISIS Y PETROLEOQUIMICA.
2	RADJENOVIC, JELENA.	BARCELO CULLERES, DAMIA.	CTRO. DE INVESTIGACION Y DESARROLLO.
3	GONZALEZ SANTANA, ANDRES.	GARCIA FRANCISCO, COSME.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
4	ROHACOVA, JANA.	MIRANDA ALONSO, MIGUEL ANGEL.	INST. DE TECNOLOGIA QUIMICA.
5	DIAZ MOSCOSO, ALEJANDRO.	GARCIA FERNANDEZ, JOSE MANUEL.	INST. DE INVESTIGACIONES QUIMICAS.
6	PEREZ FAGINAS, PAULA.	GONZALEZ MUÑIZ, MARIA DEL ROSARIO.	INST. DE QUIMICA MEDICA.
7	VALDIVIA GIMENEZ, VICTORIA.	KHIAR EL WAHABI, NOUREDDINE.	INST. DE INVESTIGACIONES QUIMICAS.
8	ZUBIZARRETA SAENZ DE ZAITEGUI, LEIRE.	PIS MARTINEZ, JOSE JUAN.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
9	MOURE FERNANDEZ, MARIA ALEJANDRA.	MESSEGUER PEYPOCH, ANGEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
10	ONGAY CAMACHO, SARA.	FRUTOS GOMEZ, MARIA MERCEDES DE.	INST. DE QUIMICA ORGANICA GENERAL.
11	CASANOVA NAVARRO, ONOFRE.	CORMA CANOS, AVELINO.	INST. DE TECNOLOGIA QUIMICA.
12	GARCIA DOYAGUEZ, ELISA.	FERNANDEZ-MAYORALAS ALVAREZ, ALFONSO.	INST. DE QUIMICA ORGANICA GENERAL.
13	GURBANI GURBANI, ANA.	LOPEZ GRANADOS, MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	SANCHEZ NAVARRO, MACARENA.	ROJO MARCOS, FRANCISCO JAVIER.	INST. DE INVESTIGACIONES QUIMICAS.
15	TSIOUVARAS GATOS, NIKOLAOS.	GARCIA FIERRO, JOSE LUIS.	INST. DE CATALISIS Y PETROLEOQUIMICA.
16	DIEZ TORRUBIA, ALBERTO.	VELAZQUEZ DIAZ, MARIA SONSOLES.	INST. DE QUIMICA MEDICA.
17	VICO RUIZ, EMILIO JOSE.	BAÑARES GONZALEZ, MIGUEL ANGEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.
18	REY BARROSO, ANA.	BAHAMONDE SANTOS, ANA MARIA.	INST. DE CATALISIS Y PETROLEOQUIMICA.
19	GONZALEZ PLAZA, MARTA.	RUBIERA GONZALEZ, FERNANDO.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
20	RODENAS TORRALBA, TANIA.	SABATER PICOT, MARIA JOSE.	INST. DE TECNOLOGIA QUIMICA.
21	BATALLA BOSQUET, PILAR.	GUISAN SEIJAS, JOSE MANUEL.	INST. DE CATALISIS Y PETROLEOQUIMICA.

Orden	Suplentes	Director de Trabajo	Centro / Instituto CSIC
1	LLANILLO DEL RIO, PEDRO.	BAYONA TERMENS, JOSE MARIA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
2	HERRERA CARRILLO, ELENA.	HARO VILLAR, ISABEL.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
3	NAJAR MALAGARRIGA, JORDI.	GRIMALT OBRADOR, JUAN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
4	SOLIS FERNANDEZ, PABLO.	DIEZ TASCON, JUAN MANUEL.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
5	GARCIA RODRIGUEZ, SERGIO.	PEÑA JIMENEZ, MIGUEL ANTONIO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
6	LOZANO VALDES, NEUS.	PINAZO GASSOL, AURORA.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
7	GARCIA DE LA CALLE, RUTH.	RODRIGUEZ RAMOS, INMACULADA.	INST. DE CATALISIS Y PETROLEOQUIMICA.
8	SANTOS EXPOSITO, ALICIA.	GARCIA TELLADO, FERNANDO.	INST. DE PRODUCTOS NATURALES Y AGROBIOL.
9	TRASTOY BELLO, BEATRIZ.	CHIARA ROMERO, JOSE LUIS.	INST. DE QUIMICA ORGANICA GENERAL.
10	CALVILLO LAMANA, LAURA.	LAZARO ELORRI, MARIA JESUS.	INST. DE CARBOQUIMICA.
11	MONTESA SERRANO, ISABEL.	MARTINEZ FERNANDEZ DE LANDA, TERESA.	INST. DE CARBOQUIMICA.
12	CUADROS DOMENECH, SARA.	MARSAL MONGE, AGUSTIN.	INST. INV. QUIM. Y AMB. J. PASCUAL VILA.
13	SAMPEDRO TEJEDOR, PATRICIA.	FERNANDEZ GARCIA, MARCOS.	INST. DE CATALISIS Y PETROLEOQUIMICA.
14	CASTRILLO CARREIRA, INES.	BRUIX BAYES, MARTA.	INST. DE QUIMICA FISICA «ROCASOLANO».
15	GUERRA ALVAREZ, ANGELA.	PAEZ PROSPER, JUAN ANTONIO.	INST. DE QUIMICA MEDICA.
16	TORRES SALAS, PAMELA.	PLOU GASCA, FCO. JOSE.	INST. DE CATALISIS Y PETROLEOQUIMICA.
17	HORNES MARTINEZ, AITOR.	MARTINEZ ARIAS, ARTURO.	INST. DE CATALISIS Y PETROLEOQUIMICA.
18	FERMOSO DOMINGUEZ, JAVIER.	ARENILLAS DE LA PUENTE, ANA.	INST. NAL. DEL CARBON «FCO. PINTADO FE».
19	MARTIN BENITO, DARIO.	GONZALEZ COLOMA, ANA AZUCENA.	CTRO. DE CIENCIAS MEDIOAMBIENTALES.

Segundo.–Ordenar la publicación de la presente Resolución a los efectos previstos por el artículo 59.6.b) de la Ley 30/1992, de 26 de noviembre.

La presente resolución, que pone fin a la vía administrativa, podrá ser recurrida potestativamente en reposición, en el plazo de un mes contado a partir del día siguiente a la fecha de su notificación, ante esta Presidencia, de conformidad con lo establecido por los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra esta resolución cabe interponer recurso contencioso administrativo ante el Juzgado Central de lo Contencioso Administrativo en el plazo de dos meses contado a partir del día siguiente a la fecha de su notificación, conforme a lo dispuesto por la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso Administrativa.

No podrá interponerse recurso contencioso administrativo hasta que sea resuelto expresamente o se haya producido la desestimación presunta del recurso de reposición interpuesto.

Madrid, 29 de noviembre de 2005.–El Presidente, Carlos Martínez Alonso

21016 *RESOLUCIÓN de 14 de noviembre de 2005, de la Presidencia del Consejo Superior de Deportes, por la que se convocan los Campeonatos de España Universitarios correspondientes al año 2006 y se hace pública la convocatoria de las correspondientes subvenciones.*

La Ley 10/1990, de 15 de octubre, del Deporte establece que la actuación de la Administración del Estado en el ámbito del deporte corresponde y será ejercida directamente por el Consejo Superior de Deportes, a cuyo efecto corresponde en virtud del art. 8, aptdo. J), coordinar con las Comunidades Autónomas la programación del deporte escolar y universitario cuando tenga proyección nacional e internacional.

El Real Decreto 286/1999, de 22 de febrero, sobre estructura orgánica y funciones del Consejo Superior de Deportes, dice en su art. 6.1.i) que corresponde a la Dirección General de Deportes impulsar las acciones organizativas y de promoción desarrolladas por las asociaciones deportivas y organizar, en colaboración con las Comunidades Autónomas, competiciones deportivas escolares y universitarias de ámbito nacional e internacional.

El Real Decreto 2069/1985, de 9 de octubre, sobre articulación de competencias en materia de actividades deportivas universitarias, atribuye al Consejo Superior de Deportes en su artículo 4.2.a) la organización de competiciones y demás actividades deportivas de carácter nacional e internacional.

Asimismo, la Orden de 3 de febrero de 2004, por la que se regula el Comité Español del Deporte Universitario (CEDU), establece en su apartado segundo, punto a), que el Comité Español del Deporte Universitario presentará al Consejo Superior de Deportes un plan anual de competiciones y actividades deportivas de carácter nacional.

A la vista de la normativa anterior, las Comunidades Autónomas adquieren cada vez más, un mayor protagonismo en la colaboración y coordinación de las competiciones deportivas dentro de su ámbito. La distribución territorial de nuestro país, hace necesario contemplar a las CC.AA. como punto de partida para la estructura deportiva. Este hecho aconseja la participación del conjunto de las CC.AA. del territorio nacional en las diferentes competiciones universitarias. Esto nos lleva a una necesaria revisión y modificación de la estructura anterior de la competición universitaria, que quedará regulada conforme a esta Resolución, al Reglamento General y a los Reglamentos Técnicos de los Campeonatos de España Universitarios elaborados por el Consejo Superior de Deportes oída la Comisión Permanente del CEDU.

Por otra parte, con motivo de la celebración de los Campeonatos de España Universitarios, se vienen realizando en los últimos años actividades organizadas por las universidades, como jornadas, seminarios, foros de discusión, estudios, actividades de promoción y difusión, etc. que tienen como objetivo reunir a los sectores involucrados en este ámbito con el fin de tratar temas relacionados con el deporte universitario que redunden en beneficio de la actividad deportiva universitaria a nivel nacional.

Por ello y, teniendo en cuenta el ya citado Real Decreto 286/1999 en el que se establece que corresponde a la Dirección General de Deportes impulsar acciones organizativas y de promoción, este Organismo considera que este tipo de actividades deben ser susceptibles de subvención a través de esta convocatoria.

En consecuencia este Consejo Superior de Deportes resuelve convocar los Campeonatos de España Universitarios correspondientes al año 2006 con la normativa siguiente:

Primera. *Deportes.*–Los deportes de estos Campeonatos de España Universitarios serán los siguientes:

Deportes Individuales: ajedrez, atletismo, badminton, campo a través, golf, judo, karate, orientación, padel, natación, taekwondo, tenis, tenis de mesa, triatlón y voleiplaya.

Deportes de equipo: baloncesto (masculino y femenino), balonmano (masculino y femenino), fútbol (masculino), fútbol sala (masculino y femenino), rugby (masculino y femenino), voleibol (masculino y femenino).

Los Campeonatos de España Universitarios de Deportes de Equipo se desarrollarán en fases interzonales y finales. Las fases finales de estos deportes serán, en principio, a ocho (8) equipos.

El Consejo Superior de Deportes podrá convocar, además de los anteriormente citados, hasta dos deportes considerados de interés para este Organismo.

Segunda. *Participantes.*

2.1 En estos campeonatos podrán tomar parte todos aquellos que acrediten ser estudiantes de 1.º, 2.º ó 3.º ciclo de los títulos que tengan carácter oficial y validez en todo el territorio nacional a los que se refiere el art. 34.1). 2) y los arts. 36 y 37 de la Ley Orgánica 6/2001 de 21 de diciembre de Universidades, pertenecientes a cualquier universidad reconocida y representada en el C.E.D.U., nacidos con posterioridad al 31 de diciembre de 1977.

2.2 Participación por deportes: Cada universidad podrá inscribir como máximo, en cada deporte, los siguientes participantes:

2.2.1 En Deportes Individuales:

Ajedrez: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Atletismo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Badminton: Tres deportistas masculinos y tres femeninas.
Un Entrenador/Delegado.
Total: Siete participantes máximo.
Campo a Través: Cuatro deportistas masculinos y cuatro femeninas.
Un Entrenador/Delegado.
Total: Nueve participantes máximo.
Golf: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Judo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Kárate: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/Delegados si excede este número.
Orientación: tres deportistas masculinos y 3 deportistas femeninas.
Un Entrenador/delegado
Total: siete participantes máximo.
Padel: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Natación: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Taekwondo: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado hasta diez deportistas inscritos y dos Entrenadores/ Delegados si excede este número.
Tenis: Todos los deportistas que establezcan las normas técnicas de la competición.
Un Entrenador/Delegado.
Total: Siete participantes máximo.
Tenis de Mesa: Dos deportistas masculinos y dos femeninas.
Un Entrenador/Delegado.
Total: cinco participantes máximo.
Triatlón: Cuatro deportistas masculinos y cuatro femeninos.
Un Entrenador/Delegado.
Total: nueve participantes máximo.
Voleiplaya: Las universidades podrán inscribir un equipo masculino y/o femenino, y se acreditarán un máximo de dos (2) deportistas y un (1) oficial (entrenador/delegado). En el caso de presentar equipos masculino y femenino, podrán inscribir dos y dos deportistas y un oficial (entrenador/delegado).

5.N.4. Beca de introducción a la investigación para alumnos de último curso de carrera

MINISTERIO
DE EDUCACION
Y CIENCIA

CONSEJO SUPERIOR
DE INVESTIGACIONES
CIENTIFICAS
CSIC

CONSEJO SUPERIOR
DE INVESTIGACIONES CIENTIFICAS
REGISTRO GENERAL
7 MAY 2004
ENTRADA ....
SALIDA ....4406....

El Consejo Superior de Investigaciones Científicas, por Resolución de la Presidencia de 5 de mayo de 2004, a propuesta de la Comisión de Selección establecida en la convocatoria (B.O.E. 8 de agosto de 2003) acordó conceder a Vd., la Beca de Introducción a la Investigación para alumnos de Penúltimo curso de carrera que había solicitado.

Esta beca, dotada con la suma de 1104 Euros, debe disfrutarse obligatoriamente en los meses de julio y septiembre próximos, tal como establece el punto 6.1 de la convocatoria.

Lo que comunico a Vd. a los efectos oportunos, con el ruego de que cumplimente los impresos de acta de toma de posesión (dos ejemplares) y el de los datos bancarios que se acompañan y los remita al Departamento de Postgrado y Especialización del CSIC, C/ Serrano, 113, 28006-Madrid. La fecha límite es el 22 de mayo de 2004. Recibida esta documentación el Departamento de Postgrado y Especialización le convocará a una reunión previa a la asignación del Centro de disfrute de la beca.

En el caso de que decida no aceptar la Beca, le ruego lo comunique **por escrito dentro del mismo plazo** al Departamento de Postgrado y Especialización.

Madrid, 6 de mayo de 2004
EL SECRETARIO GENERAL

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS

Eusebio Jiménez Arroyo

MARTINEZ RUIZ DEL ARBOL, PABLO

Serrano 113
28006 Madrid (España)
Telf. 91 585 50 00
Fax: 91 585 52 87

5.N.5. Beca de Colaboración con grupos de Investigación.

CREDENCIAL BECA-COLABORACION CURSO 2004/2005

N.I.F.:72058705G

Pongo en su conocimiento que de conformidad con lo dispuesto en la Convocatoria de Beca-Colaboración, Orden Ministerial de 14 de junio de 2004 (B.O.E. de 12 de julio de 2004), y disposiciones complementarias, le ha sido concedida una Beca para el presente curso académico 2004/2005 con las características que se especifican:

CLASE DE AYUDA : **BECA - COLABORACION**
CUANTIA : **2.341,00 €**
CURSO Y ESTUDIOS : **5 - Licenciado en Física**
UNIVERSIDAD: **UNIVERSIDAD DE CANTABRIA**
DEPARTAMENTO DE COLABORACION: **FISICA MODERNA**

El importe de la beca le será ingresado en la cuenta y entidad bancaria indicada por Vd. en la solicitud de la ayuda, cuyos datos son los siguientes:

ENTIDAD: 2066 OFICINA: 0015 DC: 14 CUENTA: 0900102771

Como alumno beneficiario tiene las obligaciones que se especifican en el artículo undécimo de la citada Orden Ministerial que convoca las ayudas al estudio de carácter especial denominadas beca-colaboración.

La presente ayuda es incompatible con cualquier otra beca o ayuda al estudio de carácter público o privado, excepto con las becas y ayudas al estudio de carácter general y con las becas de movilidad convocadas por el Ministerio de Educación y Ciencia para el curso 2004/2005.

Contra la Resolución de la Dirección General de Cooperación Territorial y Alta Inspección, por la que se concede esta ayuda, podrá interponer recurso contencioso-administrativo en el plazo de dos meses, a contar desde la fecha de la mencionada Resolución, ante la Sala de lo contencioso-administrativo de la Audiencia Nacional, sin perjuicio del recurso potestativo de reposición que podrá interponerse según lo dispuesto en los artículos 116 y 117 de la Ley 30/92 en la redacción dada por la Ley 4/99.

Madrid,22 de noviembre de 2004

DIRECCIÓN GENERAL DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

MINISTERIO DE EDUCACIÓN Y CIENCIA
Dirección General de Cooperación Territorial y Alta Inspección

PABLO MARTINEZ RUIZ DEL ARBOL
Ps. CANALEJAS, 21 -7 D
39004 - SANTANDER
CANTABRIA

Conserve la presente credencial

5.N.6. Beca de introducción a la investigación para alumnos de penúltimo curso de carrera.

MINISTERIO
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Y CIENCIA

SECRETARÍA GENERAL
DE EDUCACIÓN

DIRECCIÓN GENERAL
DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

CREDENCIAL BECA-COLABORACION CURSO 2004/2005

N.I.F.:72058705G

Pongo en su conocimiento que de conformidad con lo dispuesto en la Convocatoria de Beca-Colaboración, Orden Ministerial de 14 de junio de 2004 (B.O.E. de 12 de julio de 2004), y disposiciones complementarias, le ha sido concedida una Beca para el presente curso académico 2004/2005 con las características que se especifican:

CLASE DE AYUDA : BECA - COLABORACION
CUANTIA : 2.341,00 €
CURSO Y ESTUDIOS : 5 - Licenciado en Física
UNIVERSIDAD: UNIVERSIDAD DE CANTABRIA
DEPARTAMENTO DE COLABORACION: FISICA MODERNA

El importe de la beca le será ingresado en la cuenta y entidad bancaria indicada por Vd. en la solicitud de la ayuda, cuyos datos son los siguientes:

ENTIDAD: 2066 OFICINA: 0015 DC: 14 CUENTA: 0900102771

Como alumno beneficiario tiene las obligaciones que se especifican en el artículo undécimo de la citada Orden Ministerial que convoca las ayudas al estudio de carácter especial denominadas beca-colaboración.

La presente ayuda es incompatible con cualquier otra beca o ayuda al estudio de carácter público o privado, excepto con las becas y ayudas al estudio de carácter general y con las becas de movilidad convocadas por el Ministerio de Educación y Ciencia para el curso 2004/2005.

Contra la Resolución de la Dirección General de Cooperación Territorial y Alta Inspección, por la que se concede esta ayuda, podrá interponer recurso contencioso-administrativo en el plazo de dos meses, a contar desde la fecha de la mencionada Resolución, ante la Sala de lo contencioso-administrativo de la Audiencia Nacional, sin perjuicio del recurso potestativo de reposición que podrá interponerse según lo dispuesto en los artículos 116 y 117 de la Ley 30/92 en la redacción dada por la Ley 4/99.

Madrid,22 de noviembre de 2004

DIRECCIÓN GENERAL DE COOPERACIÓN TERRITORIAL
Y ALTA INSPECCIÓN

MINISTERIO DE EDUCACIÓN Y CIENCIA
Dirección General de Cooperación Territorial y Alta Inspección

PABLO MARTINEZ RUIZ DEL ARBOL
Ps. CANALEJAS, 21 -7 D
39004 - SANTANDER
CANTABRIA

Conserve la presente credencial

5.Ñ. Premios, menciones y distinciones

5.Ñ.1. Premio de la colaboración CMS Achievement Award

The Compact Muon Solenoid Collaboration
confers on

Pablo Martinez Ruiz del Arbol

the

CMS 2010 Achievement Award

For

Outstanding Contributions to the Muon Alignment Program

The Collaboration Board Chairperson
(Dan Green)

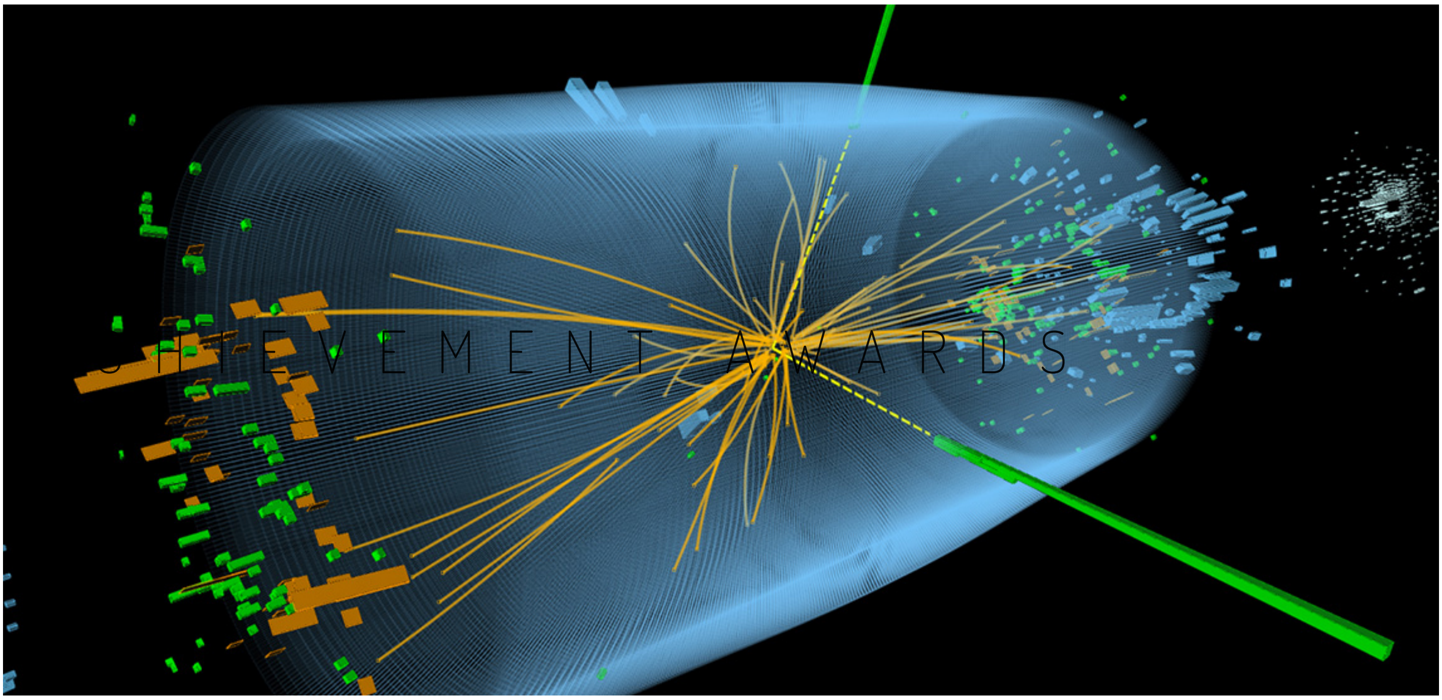
The Experiment Spokesperson
(Guido Tonelli)

December 6th, 2010

REDMI NOTE8 PRO
AI QUAD CAMERA

CERN Accelerating science (//home.cern) Sign in (/user/login) Directory (//cern.ch/directory)

(/)



ACHIEVEMENT AWARDS

Begun in 2007, the annual Achievement Awards honor individuals who have distinguished themselves by performing significant and lasting contributions to different components of the CMS experiment.

On the right, you can find the names and citations of all awardees, organized by year.

Printer-friendly version (/book/export/html/1652)

- Achievement Awards for CMS Construction 2010 (/content/achievement-awards-cms-construction-2010)
- Achievement Awards 2007 (/content/achievement-awards-2007)
- Achievement Awards 2008 (/content/achievement-awards-2008)
- Achievement Awards 2009 (/content/achievement-awards-2009)
- Achievement Awards 2010 (/content/achievement-awards-2010)

COLLABORATION

CMS Institutes

Organisation

People Statistics

History of CMS

Awards

Achievement Awards

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

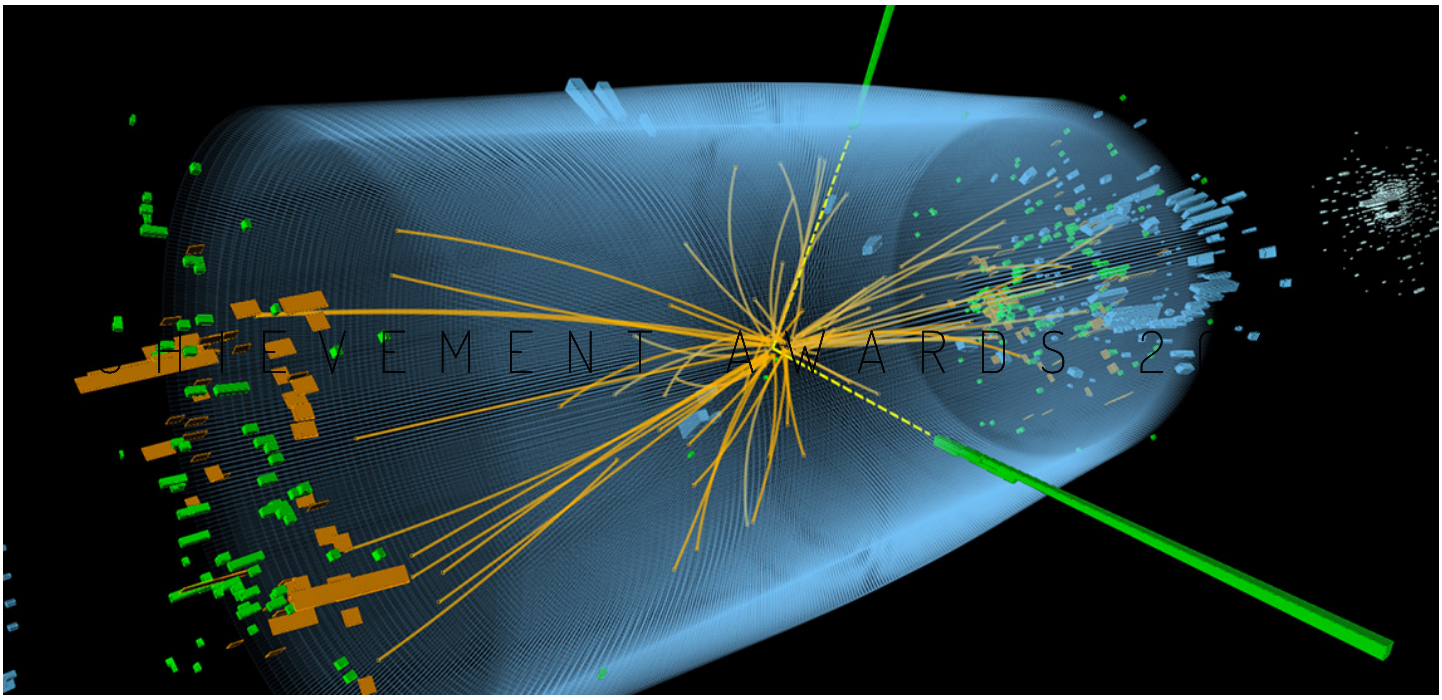
- Achievement Awards 2011 (/content/achievement-awards-2011)
- Achievement Awards 2012 (/content/achievement-awards-2012)
- Achievement Awards 2013 (/content/achievement-awards-2013-0)
- Achievement Awards 2014 (/content/achievement-awards-2014-0)
- Achievement Awards 2015 (/content/achievement-awards-2015)
- Achievement Awards 2016 (/content/achievement-awards-2016)
- Achievement Awards 2017 (/content/achievement-awards-2017)
- Achievement Awards 2018 (/content/achievement-awards-2018)
- Achievement Awards 2019 (/content/achievement-awards-2019)
- Achievement Awards for CMS Construction (/content/achievement-awards-cms-construction)

Book traversal links for Achievement Awards

- ‹ CMS Awards (/collaboration/cms-awards)
- Up (/collaboration/cms-awards)
- Achievement Awards for CMS Construction 2010 › (/content/achievement-awards-cms-construction-2010)

CERN Accelerating science (//home.cern) Sign in (/user/login) Directory (//cern.ch/directory)

(/)



Name	Institution	System	Citation - "For"
Gordon Kaussen	Cornell	Tracking	outstanding contributions to the calibration of the strip tracker
Joshua Thompson	Hamburg	Tracking	outstanding contributions to the operations of the pixel tracker
Syue-Wei Li	NCU Taiwan	ECAL	outstanding contributions to the Preshower detector
Rachel Yohay	Virginia	ECAL	outstanding contributions to the Preshower detector
Ted Laird	Princeton	HCAL	outstanding contributions to the HCAL technical trigger system

COLLABORATION

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Achievement Awards

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

Achievement Awards 20

Jeff Temple	Maryland	HCAL	outstanding contributions to the HCAL Data Quality Monitoring system
Amanda Deisher	UCLA	Muon	outstanding contributions to the Cathode Strip Chamber trigger and timing
Carlo Battilana	Madrid - CIEMAT	Muon	outstanding contributions to the timing of the Muon Drift Tubes
Pablo Martinez Ruiz del Arbol	ETH - Zurich	Muon	outstanding contributions to the Muon alignment program
Jessica Leonard	Wisconsin	Tridas	outstanding work on the Regional Calorimeter Trigger and emulation
Anton Myttrov	Bari - INFN	Commissioning	outstanding contributions to commissioning the RPC system
Adam Hunt	Princeton	Commissioning	outstanding contributions to the luminosity system
Annapaola de Cosa	Napoli - INFN	SWC	outstanding contributions to the Analysis Tools project
Daniele Spiga	CERN	SWC	taking major responsibility for the CRAB project.

Photos from the Achievement Awards 2010 ceremony: https://cds.cern.ch/record/1249313 (https://cds.cern.ch/record/1249313)

Printer-friendly version (/book/export/html/1658)

Book traversal links for Achievement Awards 2010

- ‹ Achievement Awards 2009 (/content/achievement-awards-2009)
- Up (/content/achievement-awards-0)
- Achievement Awards 2011 › (/content/achievement-awards-2011)

Achievement Awards 201

Achievement Awards 201

Achievement Awards 201

Achievement Awards 201

Achievement Awards 201

Achievement Awards 200

Achievement Awards 200

Achievement Awards 200

Achievement Awards for CMS Construction

Detector Awards

PhD Thesis Awards

Young Researcher’s Medals and Prizes

Industry Awards

Named Lectures

How to Join CMS

25 years of CMS

CMS Women Scientists

5.Ñ.2. Premio extraordinario de doctorado

Juan Carlos I, Rey de España

y en su nombre

el Rector de la Universidad de Cantabria

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Don Pablo Martínez Ruiz del Árbol

nacido el día 26 de octubre de 1982 en Santander (Cantabria), de nacionalidad española,

y Licenciado en Física el día 13 de julio de 2005 por la Universidad de Cantabria, ha superado los estudios de Doctorado en los Departamentos de Ciencias de la Tierra y Física de la Materia Condensada, de Física Aplicada y de Física Moderna, dentro del Programa de Física y Ciencias de la Tierra, y ha hecho constar su suficiencia en esta Universidad, con la calificación de SOBRESALIENTE "CUM LAUDE" y PREMIO EXTRAORDINARIO, el día 25 de junio de 2010, expide el presente título de

Doctor por la Universidad de Cantabria

con carácter oficial y validez en todo el territorio nacional, que faculta al interesado para disfrutar los derechos que a este título otorgan las disposiciones vigentes.

Dado en Santander, a 17 de diciembre de 2012

El interesado,   ***El Rector,***   ***El Jefe del Servicio de Gestión Académica,***

Este título es un duplicado del expedido con fecha 29 de junio de 2010 y clave alfanumérica 1-BD-406991 y se expide para hacer constar la obtención del Premio Extraordinario.

016A-000210

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2011/017362		000037673

SIGNE, S.A.

CLAVE ALFANUMERICA:	Nº REGISTRO NAL. DE TITULOS:	CODIGO DE CENTRO:	REGISTRO UNIV. DE TITULOS:	NRO. EXP. UNIV.
016A-000210	2011/017362		000037673	10DOC00001005

TITULO OFICIAL TITULO OFICIAL TITULO OFICIAL

SIGNE, S.A.

5.Ñ.3. Premio extraordinario de fin de carrera

EL RECTOR MAGNÍFICO
DE LA
UNIVERSIDAD DE CANTABRIA

en cumplimiento del acuerdo de la Comisión Permanente del Consejo de Gobierno del día veinte de diciembre de dos mil cinco, a propuesta de la Junta de Centro, otorga el Premio Extraordinario Fin de Carrera del curso académico 2004-2005, a

D. Pablo Martínez Ruiz del Árbol

en la LICENCIATURA EN FÍSICA

como reconocimiento a su excelente aprovechamiento académico.

Santander, 27 de enero de 2006.

FEDERICO GUTIÉRREZ-SOLANA SALCEDO

REDMI NOTE8 PRO
AI QUAD CAMERA

5.Ñ.4. Premio extraordinario de bachillerato unificado polivalente

GOBIERNO DE CANTABRIA
CONSEJERÍA DE EDUCACIÓN Y JUVENTUD

Sofía Juaristi Zalduendo, Consejera de Educación y Juventud del Gobierno de Cantabria,

C E R T I F I C A

Que, una vez realizadas las pruebas convocadas por la Orden de 27 de diciembre de 1999 de la Consejería de Educación y Juventud y en reconocimiento a sus méritos y especial preparación académica, ha obtenido:

PREMIO EXTRAORDINARIO DE BACHILLERATO UNIFICADO POLIVALENTE

D. PABLO MARTÍNEZ RUIZ DEL ÁRBOL

Lo que se hace constar en Santander a dos de mayo de dos mil

GOBIERNO DE CANTABRIA
CONSEJERÍA DE EDUCACIÓN Y JUVENTUD

5.Ñ.5. Mención de honor en la Olimpiada de Física Nacional

Olimpiada
Española de Física
INTERNACIONAL

La REAL SOCIEDAD ESPAÑOLA DE FÍSICA

y, en su nombre, la Comisión de la XI Olimpiada Española de Física (XXXI Olimpiada Internacional de Física), celebrada con la colaboración de la Universidad de Granada

CERTIFICA:

Que D/Dña. **PABLO MARTÍNEZ RUIZ DEL ÁRBOL**

ha participado en esta competición representando al

Distrito Universitario de CANTABRIA

y ha obtenido DIPLOMA en la categoría de

MENCIÓN DE HONOR

Granada, 26 de marzo de 2000

Cristóbal Fernández Pineda
Vicepresidente

José Mª Pastor Benavides
Director

5.Ñ.6. Ganador de la Olimpiada de Física Local en Cantabria

XI Olimpiada ESPAÑOLA DE FÍSICA
XXXI INTERNACIONAL

XI OLIMPIADA ESPAÑOLA DE FÍSICA

Fase local de Cantabria
Facultad de Ciencias. Universidad de Cantabria

El Comité Local de Cantabria de la Olimpiada Internacional de Física, tras las pruebas celebradas entre los alumnos de COU, FP y Bachillerato de la región, ha designado a:

D. Pablo Martínez Ruiz del Arbol

del **Colegio Calasanz (P.P. Escolapios)** *de Santander, como* **1er Clasificado** *de la competición.*

Santander, 25 de Febrero de 2000

El Presidente del Comité Local de la O.I.F.,

E Santos

D. Emilio Santos Corchero

El Secretario del Comité Local de la O.I.F.,

D. Ernesto Anabitarte Cano

Capítulo 6

Actividad docente

6.A. Puestos docentes ocupados

6.A.1. Profesor asistente en la ETH Zurich (2010-2014)

This document certifies the involvement of **Dr. Pablo Martinez Ruiz del Arbol** as teaching assistant (TA) within the education program of the **Department of Physics (D-PHYS)** of the **Swiss Federal Institute of Technology Zürich (ETH Zürich)**. As a TA, Dr. Martinez has devoted approximately 25% of his time to teaching activities that include not only giving classes, but also actively contributing to the preparation of the teaching material and the evaluation of the examinations. A detailed list of the courses to which Dr. Martinez has significanty contributed are listed below.

R Wallny

27.8.2015

Director of Studies, D-PHYS

Prof. Rainer Wallny
ETH Zürich
Institut für Teilchenphysik
Otto-Stern-Weg 5
CH-8093 Zürich

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2011. **Responsible:** Prof. K.S. Kirch.

Number of Credits: 12. Number of teaching hours: 32 hours.

Course: Physics I.

Period: Autumn Semester 2011. **Responsible:** Prof. G. Dissertori.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Course: Physics II.

Period: Spring Semester 2012. **Responsible:** Prof. R. Wallny.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Evaluation: Yes. **Score:** 4.6/5.0.

Course: Physics Lab I.

Period: Autumn Semester 2012. **Responsible:** Prof. A. Biland, Prof. B. Schonfeld.

Number of Credits: 4. **Number of teaching hours:** 64 hours.

Course: Physics II.

Period: Spring Semester 2013. **Responsible:** Prof. R. Wallny.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Evaluation: Yes. **Score:** 4.8/5.0.

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2014. **Responsible:** Prof. G. Dissertori.

Number of Credits: 10. **Number of teaching hours:** 32 hours.

Course: Advanced Physics Laboratory I.

Period: Autumn Semester 2014**. Responsible:** Prof. C. Graph, T.M. Ihn.

Number of Credits: 10. **Number of teaching hours:** 64 hours.

Sincerely,

6.A.2. Profesor asistente en la ETH Zurich (2014-2017)

This document certifies the involvement of **Dr. Pablo Martinez Ruiz del Arbol** as teacher assistant (TA) within the education program of the **Department of Physics** of the **Swiss Federal Institute of Technology Zürich (ETH)**. As a TA, Dr. Martinez has devoted approximately 20% of his time to teaching activities, not only giving classes, but also actively contributing to the preparation of teaching material and examinations. A detailed list of the courses where Dr. Martinez has been involved in can be found in the following:

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2015. **Responsible:** Prof. Guenther Dissertori

Number of Credits: 12. Number of teaching hours: 32 hours.

Course: Physics Lab I.

Period: Autumn Semester 2015. **Responsible:** Prof. A. Biland, Prof. B. Schonfeld.

Number of Credits: 4. **Number of teaching hours:** 64 hours.

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2016. **Responsible:** Prof. G. Dissertori.

Number of Credits: 12. **Number of teaching hours:** 32 hours.

Course: Physics Lab I.

Period: Autumn Semester 2016. **Responsible:** Prof. A. Biland, Prof. M. Doebeli

Number of Credits: 10. **Number of teaching hours:** 64 hours.

Sincerely,

R Wallny

ETH Zürich
Prof. Rainer Wallny
Institut für Teilchen- u. Astrophysik
Otto-Stern-Weg 5
CH-8093 Zürich

6.A.3. Ramón y Cajal en la Universidad de Cantabria (2017-presente)

Universidad de Cantabria

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UC UNIVERSIDAD DE CANTABRIA

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Código Seguro de Verificación: UC3YoLIC-B1MrIJnI-G7A01Hg9-Pg#cWJfc **Página** 1 **de** 3

Firmas
ERNESTO ANABITARTE CANO (VICERRECTOR) 21/09/2021 18:02:03

La autenticidad de este documento puede ser contrastada a través de la siguiente dirección: https://sede.unican.es/valida/

DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

Universidad de Cantabria

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Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

Código Seguro de Verificación: UC3YoLIC-B1MrIJnI-G7A01Hg9-Pg#cWJfc **Página** 3 **de** 3

Firmas

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6.B. Tesis doctorales dirigidas

6.B.1. Búsqueda de materia oscura en asociación con pares de quarks top en el experimento CMS

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
					Total de horas impartidas.................	**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas.................	**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas.................	**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria
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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Año Fecha de Lectura 2018

Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.C. Tesis doctorales dirigidas actualmente

6.C.1. Búsqueda de materia oscura en asociación con pares de quarks top y single top en el experimento CMS

CERTIFICACIÓN DE DIRECCIÓN DE TESIS

Dª MARÍA PILAR ALESON LLAMAS, Directora de la Escuela de Doctorado de la Universidad de Cantabria,

CERTIFICA: Que según consta en esta Escuela **D. PABLO MARTINEZ RUIZ DEL ARBOL** dirige las tesis de los siguientes doctorandos:

Codirige la tesis de la siguiente doctoranda, junto con el profesor Celso Martínez Rivero:

- CELIA FERNANDEZ MADRAZO

Codirige las tesis del siguiente doctorando, junto con el profesor Jonatán Piedra Gómez:

- CEDRIC GERALD M. PRIEELS

Codirige la tesis del siguiente doctorando, junto con el profesor Pablo Gómez García:

- AITOR ORIO ALONSO

Lo que certifico, a petición del interesado, con el Vº Bº de la Directora de la Escuela de Doctorado, en Santander a 18 de agosto de 2020.

UNIVERSIDAD DE CANTABRIA
ESCUELA DE DOCTORADO

Vº Bº
Directora de la Escuela de Doctorado

María del Mar Marcos Sánchez

6.C.2. Búsqueda de partículas de larga vida media en el experimento CMS

UC UNIVERSIDAD DE CANTABRIA Escuela de Doctorado

CANTABRIA CAMPUS INTERNACIONAL

CERTIFICACIÓN DE DIRECCIÓN DE TESIS

Dª MARÍA PILAR ALESON LLAMAS, Directora de la Escuela de Doctorado de la Universidad de Cantabria,

CERTIFICA: Que según consta en esta Escuela **D. PABLO MARTINEZ RUIZ DEL ARBOL** dirige las tesis de los siguientes doctorandos:

Codirige la tesis de la siguiente doctoranda, junto con el profesor Celso Martínez Rivero:

- CELIA FERNANDEZ MADRAZO

Codirige las tesis del siguiente doctorando, junto con el profesor Jonatán Piedra Gómez:

- CEDRIC GERALD M. PRIEELS

Codirige la tesis del siguiente doctorando, junto con el profesor Pablo Gómez García:

- AITOR ORIO ALONSO

Lo que certifico, a petición del interesado, con el Vº Bº de la Directora de la Escuela de Doctorado, en Santander a 18 de agosto de 2020.

UNIVERSIDAD DE CANTABRIA ESCUELA DE DOCTORADO

Vº Bº
Directora de la Escuela de Doctorado

M. M L

María del Mar Marcos Sánchez

6.C.3. Desarrollo de algoritmos de reconstrucción para tomografía muónica

UC UNIVERSIDAD DE CANTABRIA — Escuela de Doctorado

CANTABRIA CAMPUS INTERNACIONAL

CERTIFICACIÓN DE DIRECCIÓN DE TESIS

Dª MARÍA PILAR ALESON LLAMAS, Directora de la Escuela de Doctorado de la Universidad de Cantabria,

CERTIFICA: Que según consta en esta Escuela **D. PABLO MARTINEZ RUIZ DEL ARBOL** dirige las tesis de los siguientes doctorandos:

Codirige la tesis de la siguiente doctoranda, junto con el profesor Celso Martínez Rivero:

- CELIA FERNANDEZ MADRAZO

Codirige las tesis del siguiente doctorando, junto con el profesor Jonatán Piedra Gómez:

- CEDRIC GERALD M. PRIEELS

Codirige la tesis del siguiente doctorando, junto con el profesor Pablo Gómez García:

- AITOR ORIO ALONSO

Lo que certifico, a petición del interesado, con el Vº Bº de la Directora de la Escuela de Doctorado, en Santander a 18 de agosto de 2020.

UNIVERSIDAD DE CANTABRIA — ESCUELA DE DOCTORADO

Vº Bº
Directora de la Escuela de Doctorado

M. ML

María del Mar Marcos Sánchez

6.D. Dirección de proyectos fin de carrera, tesinas, trabajo fin de máster, máster, DEA, etc

6.D.1. TFG: Mejora de la discriminación de señal y fondo en una búsqueda de materia oscura producida en asociación con un par de quarks top- antitop

Universidad de Cantabria
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UC UNIVERSIDAD DE CANTABRIA
VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018						Número de horas de docencia					
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019						Número de horas de docencia					
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020						Número de horas de docencia					
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)						Número de horas de docencia					
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Universidad de Cantabria
Validez del documento:
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Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.2. TFG: Simulaciones realistas de colisiones protón - protón en el Large Hadron Collider LHC usando una red convolucional extractora de correlaciones locales

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
					Total de horas impartidas.................	**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas.................	**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas.................	**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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DT-FISIMATE [curs.5]												
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

Universidad de Cantabria

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Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.3. TFM: Higgs production cross section at 13 TeV and prospects on BSM searches for the HL-LHC

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VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

Universidad de Cantabria

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CERTIFICADO DE DOCENCIA

Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.4. TFG: APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria

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Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

Universidad de Cantabria

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CERTIFICADO DE DOCENCIA

Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

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6.D.5. TFG: Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria
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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

Universidad de Cantabria

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CERTIFICADO DE DOCENCIA

Año Fecha de Lectura 2018				
Título	**Titulación**	**Nota**	**Directores**	**Distinciones**
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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Universidad de Cantabria

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6.D.6. TFM: Desarrollo de un entorno de análisis estadístico en el contexto de la muografía aplicada a la industria

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Universidad de Cantabria
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VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia: Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
					Total de horas impartidas................	**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia: Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia: Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia: Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.7. TFM: Estudio de técnicas de computación cuántica para la resolución de problemas de optimización

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
					Total de horas impartidas................	**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Universidad de Cantabria
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Año Fecha de Lectura 2018

Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.8. TFM: Development of a new background rejection and estimation methods in a search for BSM physics with two leptons, jets, and missing transverse momentum using the CMS detector

D. Rafel Escribano Carrascosa, coordinador del máster oficial de Física de Altas Energías, Astrofísica y Cosmología de la Universitat Autònoma de Barcelona, organizado por el IFAE y el ICE (CSIC), certifica que D. Pablo Martínez Ruiz del Árbol ha ejercido de supervisor del trabajo de fin de máster titulado "Development of new background rejection and estimation methods in a search for BSM physics with two leptons, jets and missing transverse momentum using the CMS detector" del estudiante D. Sergio Sánchez Cruz durante el curso académico 2015-16.

Y para que así conste y a los efectos oportunos, expido y firmo el presente certificado en Bellaterra, a 27 de julio de 2017,

Fdo. Rafel Escribano Carrascosa

6.D.9. TFM: Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC

Universidad de Cantabria

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VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)

Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021

Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Año Fecha de Lectura 2018

Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

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6.D.10. TFM: Búsquedas de s-top supersimétrico en el LHC del CERN y proyecciones para el HL-LHC

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CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Teor.	Prac.	Lab.	Clin.	Virt.	Total horas
DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Universidad de Cantabria

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Año Fecha de Lectura 2018

Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.11. TFM: Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops tilizando una red neuronal artificial

Universidad de Cantabria
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CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................		**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i											

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.12. TFG: Reconstruccion del momento transverso de un mediador de materia oscura utilizando una red neuronal artificial

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas.................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas.................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas.................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director

TESIS DOCTORALES DIRIGIDAS

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CERTIFICADO DE DOCENCIA

Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
DT-FISIMATE	Doble Grado en Física y Matemáticas
G-FISICA	Grado en Física (2010)
M1-COSMOS	Máster Universitario en Física de Partículas y del Cosmos (2018)
M1-INSTRUMEN	Máster Universitario en Física, Instrumentación y Medio Ambiente (2014)
M1-SCIENCE	Máster Universitario en Ciencia de Datos / Master in Data Science (2018)

NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

(2) Asignatura impartida en lengua inglesa.

Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.D.13. TFM: Estudios del fill factor y software de robot para el endcap timing layer introducido en CMS

VICERRECTORADO DE ORDENACIÓN ACADÉMICA Y PROFESORADO

CERTIFICADO DE DOCENCIA

Dº/Dª. ERNESTO ANABITARTE CANO, VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO DE LA UNIVERSIDAD DE CANTABRIA,

CERTIFICA

Que Dº/Dª. PABLO MARTINEZ RUIZ DEL ARBOL, con D.N.I. nº 72058705G, de acuerdo con la información existente en esta universidad, ha desempeñado la actividad docente que se especifica a continuación:

DOCENCIA IMPARTIDA

Curso académico 2017/2018											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	1,8	28,8	0	0	**35,6**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	20	10	0	0	0	**30**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	12,5	0	12,5	0	0	**25**
Total de horas impartidas................						**37,5**	**11,8**	**41,3**	**0**	**0**	**90,6**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2018/2019											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.4]	1º	G79 Advanced Experimental Techniques (1C) (2)	Presencial	6,0	N	5	3	23,2	0	0	**31,2**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**41**	**3**	**31,2**	**0**	**0**	**75,2**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2019/2020											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	0	0	0	0	**28**
M1-COSMOS [curs.1]	1º	M1993 Modelo Estándar de Física de Partículas	Presencial	6,0	N	13	7	0	0	0	**20**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
Total de horas impartidas................						**49**	**7**	**8**	**0**	**0**	**64**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2020/2021											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**

Universidad de Cantabria

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DT-FISIMATE [curs.5]											
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i										

Curso académico 2021/2022 (1)											
Título [curso]	Cuatr.	Asignatura	Modal.	Créd BOE/ECTS	Resp.	Número de horas de docencia					Total horas
						Teor.	Prac.	Lab.	Clin.	Virt.	
DT-FISIMATE [curs.5] G-FISICA [curs.4]	1º	G68 Mecánica Cuántica	Presencial	6,0	N	13	12	0	0	0	**25**
G-FISICA [curs.4] DT-FISIMATE [curs.5]	1º	G71 Física de Partículas Elementales	Presencial	6,0	S	28	16	0	0	0	**44**
M1-SCIENCE [curs.1]	1º	M1965 Estadística para la Ciencia de Datos	Presencial	6,0	N	8	0	8	0	0	**16**
					Total de horas impartidas................	**49**	**28**	**8**	**0**	**0**	**85**
Puestos ocupados:	1.: Programas de RR.HH. I+D+i hasta 28/02/2022										

DIRECCIÓN DE TRABAJOS ACADÉMICOS

Curso académico 2017/2018					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	Mejora de la Discriminación de Señal de fondo en una Búsqueda de Materia Oscura Producida en Asociación con un par de Quarks Top-Antitop	G-FISICA	9,5	Director
G82 Trabajo Fin de Grado	18,0	Simulacones Realistas de Colisiones Protón-Protón en el LHC Usando una Red Neuronal Convolucional Extractora de Correlaciones Locales	G-FISICA	7,5	Director
M1556 Trabajo Fin de Máster	15,0	MEDIDA DE LA SECCION EFICAZ DE PRODUCCION DE UN BOSON DE HIGGS Y PROYECCIONES FUTURAS PARA BUSQUEDAS BSM EN EL HL-LHC	M1-INSTRUMEN	9,5	Codirector

Curso académico 2019/2020					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	APLICACIÓN A FÍSICA DE PARTÍCULAS DE MÉTODOS DE CLASIFICACIÓN MULTIDIMENSIONALES EN PRESENCIA DE ERRORES SISTEMÁTICOS	DT-FISIMATE	9,6	Codirector
G82 Trabajo Fin de Grado	18,0	Software de robot para el ensamblado de módulos del Endcap Timing Layer del detector CMS.	G-FISICA	7,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Estudio de técnicas de computación cuántica para la resolución de problemas de optimización.	M1-SCIENCE	9,5	Codirector
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	Técnicas de aprendizaje automático profundo para la asignación de momento a muones altamente energéticos en el experimento CMS del LHC.	M1-SCIENCE	9,5	Director
M1988 Trabajo Fin de Máster (Especialidad en Inteligencia en Ciencia de Datos)	6,0	DESARROLLO DE UN ENTORNO DE ANALISIS ESTADISTICO EN EL CONTEXTO DE LA MUOGRAFIA APLICADA A LA INDUSTRIA	M1-SCIENCE	10,0	Director
M2012 Trabajo Fin de Máster	18,0	BÚSQUEDAS DE S-TOP SUPERSIMÉTRICO EN EL LHC DEL CERN Y PROYECCIONES PARA EL HL-LHC	M1-COSMOS	8,0	Codirector
M2012 Trabajo Fin de Máster	18,0	Discriminación de eventos de producción de pares de quarks top del Modelo Estándar, de la producción de materia oscura en asociación con un par de quark tops utilizando una red neuronal artificial	M1-COSMOS	6,0	Director

Curso académico 2020/2021					
Tipo	Créditos BOE/ECTS	Título	Titulación	Nota	Resp.
G82 Trabajo Fin de Grado	18,0	RECONSTRUCCION DEL MOMENTO TRANSVERSO DE UN MEDIADOR DE MATERIA OSCURA UTILIZANDO UNA RED NEURONAL ARTIFICIAL	DT-FISIMATE	9,5	Director
M2012 Trabajo Fin de Máster	18,0	ESTUDIO DEL FILL FACTOR Y SOFTWARE DE ROBOT PARA EL ENDCAP TIMING LAYER INTRODUCIDO EN CMS	M1-COSMOS	7,0	Director

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TESIS DOCTORALES DIRIGIDAS

Año Fecha de Lectura 2018				
Título	Titulación	Nota	Directores	Distinciones
Búsqueda de materia oscura en asociación con pares de quark top en el canal dileptónico en el experimento CMS	D9-CIENCIA	SOBRESALIENTE CUM LAUDE	JONATAN PIEDRA GOMEZ PABLO MARTINEZ RUIZ DEL ARBOL	Mención Internacional

DESCRIPCIÓN DE LOS PLANES DE ESTUDIO

D9-CIENCIA	Doctorado en Ciencia y Tecnología (2015)
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NOTAS ADICIONALES

(1) La información de actividad docente correspondiente al presente curso académico tiene carácter provisional hasta el cierre de la información del Plan Docente Anual.

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Lo que firmo electrónicamente, a petición del interesado y a los efectos oportunos.

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6.E. Otros méritos relacionados con la actividad docente

6.E.1. Calidad de la actividad docente

6.E.1.1. Evaluación de la calidad docente en la Universidad de Cantabria

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Universidad de Cantabria
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CERTIFICADO
VALORACIÓN DE LOS ESTUDIANTES SOBRE LA DOCENCIA

D. ERNESTO ANABITARTE CANO,
VICERRECTOR DE ORDENACIÓN ACADÉMICA Y PROFESORADO
DE LA UNIVERSIDAD DE CANTABRIA

CERTIFICA QUE:

► D. **PABLO MARTINEZ RUIZ DEL ARBOL** con NIF **72058705G**, conforme a la encuesta de opinión de los estudiantes sobre la actividad docente del profesorado, ha obtenido la siguiente valoración global media:

4,7 MUY FAVORABLE

Periodo evaluado: 2017-2021
Promedio anual de créditos evaluados: 7,12

Valoración global media obtenida de acuerdo a la siguiente escala:

ESCALA DE VALORACIÓN: De 0 a 5.

0 a 2,5	*Desfavorable*
2,6 a 3,5	*Favorable*
3,6 a 5	*Muy Favorable*

Y para que así conste, a los efectos oportunos, y a petición del interesado, lo firmo en Santander a fecha 01 de octubre de 2021.

La autenticidad de este documento puede ser contrastada a través de la siguiente dirección: https://sede.unican.es/valida/

6.E.1.2. Evaluación de la calidad docente en la ETH Zurich

This document certifies the involvement of **Dr. Pablo Martinez Ruiz del Arbol** as teaching assistant (TA) within the education program of the **Department of Physics (D-PHYS)** of the **Swiss Federal Institute of Technology Zürich (ETH Zürich)**. As a TA, Dr. Martinez has devoted approximately 25% of his time to teaching activities that include not only giving classes, but also actively contributing to the preparation of the teaching material and the evaluation of the examinations. A detailed list of the courses to which Dr. Martinez has significanty contributed are listed below.

Prof. Rainer Wallny
ETH Zürich
Institut für Teilchenphysik
Otto-Stern-Weg 5
CH-8093 Zürich

R Wallny

27.8.2015

Director of Studies, D-PHYS

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2011. **Responsible:** Prof. K.S. Kirch.

Number of Credits: 12. Number of teaching hours: 32 hours.

Course: Physics I.

Period: Autumn Semester 2011. **Responsible:** Prof. G. Dissertori.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Course: Physics II.

Period: Spring Semester 2012. **Responsible:** Prof. R. Wallny.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Evaluation: Yes. **Score:** 4.6/5.0.

Course: Physics Lab I.

Period: Autumn Semester 2012. **Responsible:** Prof. A. Biland, Prof. B. Schonfeld.

Number of Credits: 4. **Number of teaching hours:** 64 hours.

Course: Physics II.

Period: Spring Semester 2013. **Responsible:** Prof. R. Wallny.

Number of Credits: 7. **Number of teaching hours:** 24 hours.

Evaluation: Yes. **Score:** 4.8/5.0.

Course: Introduction to Nuclear and Particle Physics.

Period: Spring Semester 2014. **Responsible:** Prof. G. Dissertori.

Number of Credits: 10. **Number of teaching hours:** 32 hours.

Course: Advanced Physics Laboratory I.

Period: Autumn Semester 2014**. Responsible:** Prof. C. Graph, T.M. Ihn.

Number of Credits: 10. **Number of teaching hours:** 64 hours.

Sincerely,

6.E.2. Profesor en el CMS Data Analysis School in Pisa

INFN
Istituto Nazionale
di Fisica Nucleare

CMS

TO WHOM IT MAY CONCERN

This is to certificate that

Pablo Martinez Ruiz Del Arbol

has participated to the **CMS Data Analysis School in Europe 2012**, held in Pisa (Italy) from 23 to 27 January 2012.

For the Organizers

Fabrizio Palla

Dr. Fabrizio Palla

Leptonic SUSY	Pablo Martinez (ETH Zurich)	Jacopo Bernardini (Wisconsin)	Simone Coscetti (Pisa)	
Top Cross Section	Freya Blekman (Brussels)	Andrea Giammanco (Pisa)		
Jets	Kalanand Mishra (Fermilab)	Dan Duggan (Rutgers)	Suvadeep Bose (Nebraska)	
Physics with Taus	Lorenzo Bianchini (Ecole)	Simone Coscetti (Pisa)	Giuseppe Bagliesi (Pisa)	
Displaced Vertices	Nuno Leonardo (Purdue)	Ian Shipsey (Purdue)	Marco De Mattia (Purdue)	Sudhir Malik (FNAL)
Higgs high mass	Nicola De Filippis (INFN Bari)	Marco Meneghelli (Bologna)		
Higgs low mass	Andrea Rizzi (Pisa)	Pierluigi Bortignon (ETHZurich)		
MC generators	Fabio Cossutti (Trieste)			
Tracking	Kevin Burkett (Fermilab)	Jim Pivarski (Fermilab)	Andrea Venturi (Pisa)	
Muon	Adam Everett (Purdue)	Martijn Mulders (CERN)		
Electrons	Paolo Meridiani (INFN Rome)	Daniele Benedetti (Purdue)		
Pflow	Rick Cavanaugh (Fermilab)			
Btag&Vertexing	Tommaso Boccali	Andrea Rizzi.		
Jets	Kalanand Mishra (Fermilab)	Suvadeep Bose (Nebraska)	Dan Duggan (Rutgers)	
Roostats	Mario Pelliccioni (Torino)	Luca Lista (Napoli)		
Photons	Andrew Askew (FSU)	Yuri Gershtein (Rutgers)		
Visualization	Liz Kennedy (Fermilab)	Francesco Fiori	Sudhir Malik (FNAL)	

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CMS Data Analysis School in Europe 2012

23-27 January 2012
INFN Pisa
Europe/Zurich timezone

Search...

- Overview
- Scientific Programme
- Local Organizing Committee
- Timetable
- Registration
- Participant List
- Instructions
- Twiki to the short and long exercises
- INFN First Floor Plan and Rooms
- Short Exercises Students Assignment List
- Long Exercises Students Assignment List
- Facilitators
- Photos

Timetable

Mon 23/01 | Tue 24/01 | Wed 25/01 | Thu 26/01 | Fri 27/01 | **All days**

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Session legend

Mon 23/1

08:00	**Registration and Tutorial Preparation**		*Sala Azzurra, Scuola Normale Pisa*	08:00 - 09:00
09:00	**Welcome and practicalities**	*Prof. Claudio Ciociola et al.*	*CERN*	09:00 - 09:20
	Introduction and Goals of the School	*Ian Shipsey*	*Sala Azzurra, Scuola Normale Pisa*	09:20 - 09:50
10:00	**CMS Physics Results**	*Gigi Rolandi*	*Sala Azzurra, Scuola Normale Pisa*	09:50 - 10:30
	Coffee break		*Scuola Normale Pisa*	10:30 - 10:50
11:00	**Physics at the ElectroWeak scale after the first five inverse femtobarn of the LHC**	*Riccardo Barbieri*	*Sala Azzurra, Scuola Normale Pisa*	10:50 - 11:50
12:00	**Introduction to the CMS offline and computing model**	*Elizabeth Sexton-Kennedy*	*Sala Azzurra, Scuola Normale Pisa*	11:50 - 12:20
	Physics Analysis Tools	*Prof. Sudhir Malik*	*Sala Azzurra, Scuola Normale Pisa*	12:20 - 12:50
13:00	Lunch		*Bars/Pizzerie*	12:50 - 14:05
14:00	**The Pisa computing environment**	*Tommaso Boccali*	*131, INFN Pisa*	14:05 - 14:30

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Time					
14:30 - 16:30	**Photons** *Dr Andrew Warren Askew et al.* *230, INFN Pisa* 14:30 - 16:30	**Electrons** *Paolo Meridiani* *248, INFN Pisa* 14:30 - 16:30	**Tracking** *Andrea Venturi et al.* *133, INFN Pisa* 14:30 - 16:30	**RooStats** *Luca Lista et al.* *250, INFN Pisa* 14:30 - 16:30	**Monte Carlo Generators** *Fabio Cossutti et al.* *241, INFN Pisa* 14:30 - 16:30
16:30 - 17:00	**Coffee Break** *-2 (underground), INFN Pisa* 16:30 - 17:00				
17:00 - 19:00	**PFlow** *Dr Richard Cavanaugh* *248, INFN Pisa* 17:00 - 19:00	**Monte Carlo Generators** *241, INFN Pisa* 17:00 - 19:00	**RooStats** *Luca Lista et al.* *250, INFN Pisa* 17:00 - 19:00	**Muons** *Dr Adam Everett et al.* *133, INFN Pisa* 17:00 - 19:00	**Jets** *Robert Harris et al.* *230, INFN Pisa* 17:00 - 19:00

Tue 24/1

Time						
08:30 - 10:30	**Electrons** *248, INFN Pisa* 08:30 - 10:30	**Monte Carlo Generators** *241, INFN Pisa* 08:30 - 10:30	**Roostats** *250, INFN Pisa* 08:30 - 10:30	**PFlow** *230, INFN Pisa* 08:30 - 10:30	**Muons** *133, INFN Pisa* 08:30 - 10:30	
10:30 - 11:00	**Coffee Break** *131, INFN Pisa* 10:30 - 11:00					
11:00 - 13:00	**Muons** *133, INFN Pisa* 11:00 - 13:00	**Visualization** *Elizabeth Sexton-Kennedy et al.* *241, INFN Pisa* 11:00 - 13:00	**Jets** *230, INFN Pisa* 11:00 - 13:00	**Monte Carlo Generators** *248, INFN Pisa* 11:00 - 13:00	**Electrons** *CMS-Centre, INFN Pisa* 11:00 - 13:00	**RooStats** *250, INFN Pisa* 11:00 - 13:00

11:00 - 13:00 11:00 - 13:00

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13:00

Lunch

14:00

131, INFN Pisa 13:00 - 14:30

Tracking	**Muons**	**Photons**	**PFlow**	**RooStats**
133, INFN Pisa	*248, INFN Pisa*	*230, INFN Pisa*	*241, INFN Pisa*	*250, INFN Pisa*
14:30 - 16:30	14:30 - 16:30	14:30 - 16:30	14:30 - 16:30	14:30 - 16:30

15:00

16:00

Coffee break

131, INFN Pisa 16:30 - 17:00

17:00

BTag & Vertexing	**Visualization**	**Jets**	**Electrons**	**RooStats**
133, INFN Pisa	*248, INFN Pisa*	*230, INFN Pisa*	*241, INFN Pisa*	*250, INFN Pisa*
17:00 - 19:00	17:00 - 19:00	17:00 - 19:00	17:00 - 19:00	17:00 - 19:00

18:00

19:00

20:00

Social Event

21:00

22:00

www.bazeel.it 20:00 - 22:30

Wed 25/1

08:00

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08:30	**Tracking**	*133, INFN Pisa*	08:30 - 10:30
08:30	**Visualization**	*248, INFN Pisa*	08:30 - 10:30
08:30	**Jets**	*230, INFN Pisa*	08:30 - 10:30
08:30	**PFlow**	*241, INFN Pisa*	08:30 - 10:30
08:30	**Monte Carlo Generators**	*CMS Centre, INFN Pisa*	08:30 - 10:30
08:30	**RooStats**	*250, INFN Pisa*	08:30 - 10:30
10:30	**Coffee break**	*131, INFN Pisa*	10:30 - 11:00
11:00	**BTag & Vertexing**	*133, INFN Pisa*	11:00 - 13:00
11:00	**Visualization**	*248, INFN Pisa*	11:00 - 13:00
11:00	**Photons**	*230, INFN Pisa*	11:00 - 13:00
11:00	**Muons**	*241, INFN Pisa*	11:00 - 13:00
11:00	**Monte Carlo Generators**	*CMS Centre, INFN Pisa*	11:00 - 13:00
11:00	**RooStats**	*250, INFN Pisa*	11:00 - 13:00
13:00	**Lunch**	*131, INFN Pisa*	13:00 - 14:30
14:30	**CMS Upgrade** — *Didier Claude Contardo*	*Aula Dini, Scuola Normale Pisa*	14:30 - 15:30
15:30	**Top Cross Section** — *Andrea Giam… et al.*	*133, INFN Pisa*	15:30 - 19:30
15:30	**New Physics with Jets** — *Dr Daniel Duggan et al.*	*163, INFN Pisa*	15:30 - 19:30
15:30	**Physics with Taus** — *Lorenzo Bianc…*	*230, INFN Pisa*	15:30 - 19:30
15:30	**New Physics with Displaced Vertices** — *Marco De Mattia et al.*	*CMS Centre, INFN Pisa*	15:30 - 19:30
15:30	**High Mass Higgs** — *Nicola De Filippis et al.*	*248, INFN Pisa*	15:30 - 19:30
15:30	**Low Mass Higgs** — *Andrea Rizzi et al.*	*250, INFN Pisa*	15:30 - 19:30
15:30	**Leptonic SUSY** — *Pablo Marti… Ruiz Del Arbol*	*241, INFN Pisa*	15:30 - 19:30

Restricted | Europe/Zurich | L. Lloret Iglesias

Thu 26/1

08:00

Long Exercises

09:00

10:00

11:00

12:00

131, INFN Pisa 08:30 - 13:00

13:00

Lunch

14:00

131, INFN Pisa 13:00 - 15:00

15:00

Long Exercises

16:00

17:00

18:00

Restricted | Europe/Zurich | L. Lloret Iglesias

131, INFN Pisa 15:00 - 19:00

19:00

Fri 27/1

08:00

Long Exercises

09:00

10:00

131, INFN Pisa 08:00 - 11:00

11:00

Coffee Break

131, INFN Pisa 11:00 - 11:15

Teams write up on long exercises

12:00

INFN 11:15 - 12:45

13:00

14:00

Taus	**Top**	**Jets**	**Exotica**	**H->ZZ**	**H->bb**	**Leptonic SU**

15:00

16:00

Coffee break

CERN 16:00 - 16:30

Restricted | Europe/Zurich | L. Lloret Iglesias

17:00

School facts and pictures

Aula Dini, Scuola Normale Pisa 17:30 - 17:50

Winner announcement and Closeout

18:00

CERN 17:50 - 18:30

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6.E.3. Profesor en el First Computing Challenges (COMCHA) school

laSalle
UNIVERSITAT RAMON LLULL

LaSalle
Universities

1st COMCHA School

La Salle, Universitat Ramon Llull

Certificate of Contribution

This is to certify that Dr. Pablo Martínez Ruiz del Árbol has contributed to the 1st COMCHA School in La Salle, Universitat Ramon Llull, Barcelona, from the 3rd to the 9th of October 2019 with a talk with title "Use of deep convolutional neural networks for classification of muon tomography images".

Xavier Vilasís Cardona,
For the Organizing Committee.

St. Joan de La Salle, 42.
08022 Barcelona, Spain.
Tel (+34) 932 902 400
Fax (+34) 932 902 416
www.salleurl.edu

6.E.4. Participación en tribunales de trabajos de fin de grado

Facultad de Ciencias

CONVOCATORIA de la DEFENSA de TRABAJOS FIN DE GRADO

GRADO en FÍSICA, Convocatoria Septiembre 2018

De acuerdo con la Normativa general de la Universidad de Cantabria y con la aprobada por la Facultad de Ciencias, se convoca la Defensa de los trabajos fin de grado del Grado en Física, en la convocatoria de Septiembre de 2018

Teniendo en cuenta los trabajos presentados en la Secretaría de la Facultad de Ciencias hasta el día 19 de Octubre de 2018, a las 14:00, se convoca al alumnado para la defensa pública de los mismos, de acuerdo con la siguiente distribución:

Tribunal A
Diego Pazó Bueno (P) Pablo González Fernández (V) Pablo Martínez Ruíz del Arbol (S)
Aula Multimedia, Facultad de Ciencias
Viernes 26 de Octubre, 2018. 9:30

1.- Cecilia Crespo Vega, "Estadística de eventos extremos en sistemas complejos"

2.- Estíbaliz Echevarría Guerrero, "Prospect of future CTA observation of young SNR/ Perspectivas del futuro CTA en la observación de supernovas jóvenes"

3.- Sara Ruiz Daza, MEJORA DEL B-TAGGING EN EL HLT PARA LA FASE-1 DEL DETECTOR DE PÍXELES (Improvement of tracking for b-tagging at HLT by exploiting phase-1 pixel detector)

El alumnado dispondrá de un tiempo máximo de 20 minutos para realizar su exposición.

De acuerdo con la Normativa, "entre los criterios de valoración estarán, al menos, los siguientes: la calidad científica y técnica del TFG presentado, la calidad del material entregado, la claridad expositiva, y la capacidad de debate y de defensa argumental".

Santander, 23 de Octubre de 2018

Ángel Mañanes Pérez
Presidente de la Comisión de Trabajos Fin de Grado en Física

Gmail **Pablo Martinez Ruiz del Arbol <pablo.martinez.ruizdelarbol@gmail.com>**

Tribunal TFG Fisica Septiembre

Mañanes Perez, Angel <angel.mananes@unican.es> Thu, Sep 12, 2019 at 10:23 AM
To: "Carrera Troyano, Francisco Jesus" <francisco.carrera@unican.es>, "Valle Gutierrez, Angel Alberto" <angel.valle@unican.es>, "Martinez Ruiz Del Arbol, Pablo" <pablo.martinez@unican.es>
Cc: "FW carreratf@unican" <carreraf@ifca.unican.es>, "Valle, Angel" <valle@ifca.unican.es>, "Ortiz Marquez, Maria Dolores" <dolores.ortiz@unican.es>

Finalmente (salvo avalancha de TFGs el próximo Martes día 17 que es la fecha límite) tenemos seguros estos TRES trabajos en vuestro Tribunal:

ATENCIÖN porque os tocaría **el JUEVES 26 de Septiembre a partir de las 9:30**

Tribunal: Francisco Carrera Troyano (P), Angel Valle Gutierrez (V), Pablo Martinez Ruiz del Arbol (S)

26 de Septiembre, 9:30, Aula Multimedia, Facultad de Ciencias

1.- ANDRES ARNAIZ, PABLO ***26 Jueves ***

RESPUESTA DE UN BIOSENSOR PLASMONICO METÁLICO NANOAGUJEREADO PARA LA MONITORIZACIÓN DE CÉLULAS BIOLÓGICAS

Directores: Francisco González Fernández y Fernando Moreno Gracia

2.- Balbás Gutierrez, David (2GFyM) ***26 Jueves ***

Aplicación de técnicas de *Machine and Deep Learning* al problema de la separación de componentes del cielo de microondas

Directores: Patricio Vielva Martinez y Biuse Casaponsa Galí

3.- Martín Vega, María (2GFyM) ***26 Jueves ***

Detección de cuerdas cósmicas en mapas del fondo cósmico de microondas

Director: Patricio Vielva Martinez

Es posible que os corresponda este cuarto trabajo (pero ahora mismo NO es seguro, lo siento). Sólo puedo confirmarlo el día 17 martes

4.- Gonzalez Ruiz, Iñigo

Simulación de un modelo simple de celdas compresibles para el estudio del acoplamiento volumen-energía

Director: Julio Largo Maeso

Si hay algún inconveniente, por favor hacédnoslo llegar cuanto antes.

Saludos y muchas gracias de nuevo por vuestra cooperación.

Ángel Mañanes Pérez

Profesor de Física Atómica, Molecular y Nuclear

Departamento de Física Moderna

Facultad de Ciencias

Avda. de los Castros, s/n. 39005 Santander

UNIVERSIDAD DE CANTABRIA

Tel. + 34 942 20 14 54

Email: angel.mananes@unican.es

Antes de imprimir este mensaje, asegúrate de que es necesario. Proteger el medio ambiente está en tus manos.

Defensa Trabajos Fin de Grado en Física, curso 2019/2020
Facultad de Ciencias. Universidad de Cantabria.
Convocatoria de junio (1ª tanda, defensa 26 de junio 2020)

Tribunal A
Manuel Pérez Cagigal (P), Maria Dolores Ortiz Márquez (V), Álvaro Gómez Gómez (S)
Skype, viernes 26 de junio 2020; 9:30

1. Darío Alonso Martinez (dario.alonso@alumnos.unican.es) *Nanoestructuras en la naturaleza: estudio de conchas marinas*

   Director: Rafael Valiente Barroso rafael.valiente@unican.es

2. Pablo Echegoyen Ruiz (pablo.echegoyen@alumnos.unican.es) *Estudio de la dinámica del transporte turbulento generado por ondas de deriva en plasmas de fusión nuclear*

   Director: Jose Angel Mier Maza joseangel.mier@unican.es

3. Pablo Ortega Ruiz (pablo.ortegar@alumnos.unican.es) *Detección de microplásticos en el agua de mar con espectroscopía Raman*

   Director: Adolfo Cobo Garcia adolfo.cobo@unican.es

4. Miriam Cobo Cano (miriam.cobo@alumnos.unican.es)
   Desarrollo de un refractómetro basado en el análisis de imágenes.

   Director: Saiz Vega, Jose Maria josemaria.saiz@unican.es

Tribunal B
Ignacio González Serrano (P) Patricio Vielva Martínez (V) Pablo Martinez Ruiz del Árbol (S)
Skype, viernes 26 de junio 2020; 9:30

5. Frank Alonso Narganes (frank.alonso@alumnos.unican.es) *¿De qué depende que algunos cuásares se detecten en rayos X y otros no?*

   Director: Francisco Jesus Carrera Troyano francisco.carrera@unican.es

6. Oliver Legarreta García (oliver.legarreta@alumnos.unican.es) *Detección y clasificación de incendios mediante métodos de aprendizaje automático sobre imágenes de Sentinel2*

   Co-director: Daniel Garcia (IFCA) garciad@ifca.unican.es

7. Ignacio Ruiz García (ignacio.ruizga@alumnos.unican.es) *Cosmological Evolution of Energy Density and Power Density Perturbations (Evolución cosmológica de perturbaciones de densidad de energía y de potencia)*

   Director: Diego Herranz Muñoz diego.herranz@unican.es

Tribunal C
Angel Valle Gutierrez (P) Javier Junquera Quintana (V) Diego Pazó Bueno (S)
Skype, viernes 26 de junio 2020; 9:30

8. Luis Crespo Ruiz (luis.crespor@alumnos.unican.es) Aplicación a Física de Partículas de métodos de clasificación multidimensionales

Director: Francisco Matorras Weinig francisco.matorras@unican.es

9. Carmen García Bermejo (carmen.garciabe@alumnos.unican.es) Clasificación de imágenes médicas utilizando técnicas de Deep Learning (Classification of medical images using Deep Learning techniques)

Codirectora: Diana Tordesillas Gutierrez (Idival)

Directora: Lara Lloret Iglesias lara.lloret@unican.es

10. Guillermo Ruiz Laborda (guillermo.ruizl@alumnos.unican.es) Second principles simulation of the electronic state of CuO_2 layers. (Simulación de segundos principios del estado electrónico de láminas de CuO_2)

Director: Pablo Garcia Fernandez pablo.garciafernandez@unican.es

Santander, 19 de Junio 2020

A Mañanes

Presidente de la Comisión de Trabajos fin de Grado en Física

6.E.5. Participación en tribunales de trabajos de fin de máster

Instituto de Física de Cantabria

CERTIFICADO

Pablo Martínez Ruiz del Árbol ha ejercido como tribunal de los siguientes trabajos de fin de máster presentados el 10 de julio de 2019:

Estela Ruiz Martínez, "Machine Learning methods for the prediction of non-mettalic inclusions in steel wires for tire reinforcement";

Diego Ferreño Blanco, "Optimization of the fabrication of cold drawn steel wire through classification and clustering machine learning algorithms";

LLORET IGLESIAS LARA - 53554665Q

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Lara Lloret Iglesias

Directora del Máster de Ciencia de Datos, UC-UIMP

UC
UNIVERSIDAD
DE CANTABRIA
Facultad de Ciencias

Convocatoria para la defensa de TFM

Máster en Física de Partículas y del Cosmos

Se convoca al alumno:

Efrén Navarrete Ramos

a la defensa de su TFM en la sala de Claustro del "Marie Curie" del IFCA, el día 24 de julio a las 12.30.

El tribunal estará formado por: Rocío Vilar Cortabitarte (Presidenta), Jordi Duarte Campderros (Vocal)), Pablo Martínez Ruíz del Árbol (Secretario).

19 de julio de 2019

Patricio Vielva Martínez
Coordinador del Máster

Facultad de Ciencias

Convocatoria para la defensa de TFM

Máster en Física de Partículas y del Cosmos

Se convoca a los alumnos:

Hamza Hanif

Guillermo Pascual Cisneros

a la defensa de su TFM el día 22 de julio a las 12.30. Dicha defensa tendrá lugar a través de videoconferencia. Los detalles de la misma le serán enviados a ellos y a sus supervisores/as de manera directa (dichos detalles no deberán ser difundidos a terceros).

El tribunal estará formado por: Iván Vila Álvarez (Presidente), Rita Belén Barreiro Vilas (Vocal), Pablo Martínez Ruíz del Árbol (Secretario).

La defensa es pública. Si alguien quiere asistir, debe informar de ello y solicitar el enlace de conexión (que no debe ser difundido) a ciencias@unican.es

15 de julio de 2020

Firmado digitalmente por VIELVA MARTINEZ PATRICIO - 20204786E
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Patricio Vielva Martínez
Coordinador del Máster

6.E.6. Participación en tribunales de tesis doctorales

UNIVERSIDAD DE CANTABRIA
Pabellón de Gobierno
Avda. Los Castros, s/n
39005 Santander

De conformidad con el Real Decreto 99/2011, y la propuesta de la Comisión de Doctorado, el Sr. Rector Magfco. de esta Universidad, ha resuelto nombrarle SUPLENTE del Tribunal encargado de juzgar la Tesis Doctoral presentada por

D. NICOLÒ TREVISANI

titulada: "BÚSQUEDA DE MATERIA OSCURA PRODUCIDA JUNTO A UN BOSÓN DE HIGGS EN EL CANAL DE DESINTEGRACIÓN A DOS BOSONES W+W- EN COLISIONES DE PROTONES A VS=13 TEV DE ENERGÍA DEL CENTRO DE MASA EN EL LHC CON EL EXPERIMENTO CMS"

DIRIGIDA POR: DÑA. ROCÍO VILAR CORTABITARTE
DÑA. ALICIA CALDERÓN TAZÓN

PRESIDENTE	DÑA. BEGOÑA DE LA CRUZ MARTÍNEZ Investigación Básica - División de Física Experimental Altas Energías CIEMAT
SECRETARIO	DÑA. MARÍA TERESA RODRIGO ANORO DPTO. FÍSICA MODERNA UNIVERSIDAD DE CANTABRIA
VOCAL	D. ANDREA MASSIRONI PHYSICS DEPARTMENT INFN (Istituto Nazionale di Fisica Nucleare) and CERN
SUPLENTE	D. PABLO MARTÍNEZ RUIZ DEL ÁRBOL INSTITUTO DE FÍSICA DE CANTABRIA UNIVERSIDAD DE CANTABRIA
SUPLENTE	D. GUILLELMO GOMEZ-CEBALLOS RETUERTO Laboratory for Nuclear Science MIT
SUPLENTE	D. FRANCISCO JAVIER CUEVAS MAESTRO FÍSICA UNIVERSIDAD DE OVIEDO

lo que traslado a Vd. para su conocimiento.

Santander, 10 de abril de 2019

EL RECTOR,
P.D. (R.R. 489/16).Vicerrector de Doctorado y Relaciones Institucionales

Fdo.: Alberto Ruiz Jimeno

D. PABLO MARTÍNEZ RUIZ DEL ÁRBOL. UNIVERSIDAD DE CANTABRIA.

UC UNIVERSIDAD DE CANTABRIA

Pabellón de Gobierno
Avda. Los Castros, s/n
39005 Santander

De conformidad con el art. 9 del R.D. 778/1998, de 30 de Abril, y la propuesta de la Comisión de Doctorado, el Sr. Rector Magfco. de esta Universidad, ha resuelto nombrarle VOCAL del Tribunal encargado de juzgar la Tesis Doctoral presentada por

D./DÑA. ENRIQUE CALVO ALAMILLO

titulada: "CARACTERIZACIÓN DE LAS PROPIEDADES MECÁNICAS DE UNIONES PEGADAS SOMETIDAS A AMBIENTES RADIACTIVOS EN SISTEMAS DE ALINEACIÓN DE DETECTORES DE PARTÍCULAS."

DIRIGIDA POR: D./DÑA. RAMON SANCIBRIAN HERRERA
D./DÑA. FERNANDO VIADERO RUEDA

PRESIDENTE	D./DÑA. MARCOS CERRADA CANALES DPTO. INVESTIGACIÓN BASICA CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS
SECRETARIO	D./DÑA.PABLO GARCIA FERNANDEZ DPTO. INGENIERIA ESTRUCTURAL Y MECANICA UNIVERSIDAD DE CANTABRIA
VOCAL	D./DÑA. PABLO MARTINEZ RUIZ DEL ARBOL ETH ZURICH PARTICLE PHYSICS GROUP
SUPLENTE	D./DÑA. NICANOR COLINO ARRIERO DPTO. INVESTIGACION BASICA CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLÓGICAS
SUPLENTE	D./DÑA.ALFONSO FERNANDEZ DEL RINCON DPTO. INGENIERIA ESTRUCTURAL Y MECANICA UNIVERSIDAD DE CANTABRIA

lo que traslado a Vd. para su conocimiento.

Santander, 19 de enero de 2016

EL RECTOR,
P.D. (R.R. 268/12). El Vicerrector de Ordenación Académica

Fdo.: Ernesto Anabitarte Cano

UNIVERSIDAD DE CANTABRIA VICERRECTORADO DE ORDENACIÓN ACADÉMICA

D./DÑA. PABLO MARTINEZ RUIZ DEL ARBOL. ETH ZURICH PARTICLE PHYSICS GROUP.

UNIVERSIDAD COMPLUTENSE
MADRID
COMISION DE DOCTORADO

D. PABLO MARTÍNEZ RUIZ DEL ÁRBOL

ETH-CERN (EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH)
ETH-SWISS FEDERAL INSTITUTE OF TECHNOLOGY ZURICH
BLDG. 32-3/C21
CH-1211 GENEVE 23 (SUIZA)

Madrid, 10/4/2012

Le comunico que, de acuerdo con lo indicado en los art. 21 y 22, del R.D. 1393/2007, de 29 de Octubre de 2007, y el art. 5, de la Normativa de desarrollo de la Universidad Complutense, la Comisión de Doctorado de esta Universidad en su reunión de 20/03/12 ha resuelto nombrar a usted **VOCAL SUPLENTE** del Tribunal y autorizar la defensa pública de la Tesis Doctoral presentada por **D. JAVIER SANTAOLALLA CAMINO** en la FACULTAD DE CIENCIAS FISICAS, **conforme a la mención 'Doctor Europeo'**, con el Título:

Medida de procesos electrodébiles con muones en el estado final en colisiones protón-protón a sqrt(s)=7 TeV en el experimento CMS DEL LHC/Measurement of Electroweak processes in moun decay channels, in pp collisons at sprt(s)=7 TeV, in the CMS experi

Directores/res - Dª. María Isabel Josa Mutuberría
- D. Juan Alcaraz Maestre
- Dª. Begoña De La Cruz Martínez

Composición del Tribunal encargado de juzgarla:

Miembros titulares:

Presidente/a: Dª. Victoria Fonseca González
FACULTAD DE CIENCIAS FISICAS, UNIVERSIDAD COMPLUTENSE DE MADRID

Vocales:
- D. Luca Lista
ISTITUTO NAZIONALE FISICA NUCLEARE (NÁPOLI), ISTITUTO NAZIONALE FISICA NUCLEARE (NÁPOLI)
- D. Marcos Cerrada Canales
CIEMAT, CIEMAT
- Dª. María De La Cruz Fouz Iglesias
CIEMAT, CIEMAT

Secretario/a: - D. Juan Abel Barrio Uña
FACULTAD DE CIENCIAS FISICAS, UNIVERSIDAD COMPLUTENSE DE MADRID

UNIVERSIDAD COMPLUTENSE MADRID SALIDA 10 ABR 2012 Nº 191 TERCER CICLO

Miembros suplentes:

Presidente/a: D. Fernando Arqueros Martínez
FACULTAD DE CIENCIAS FISICAS, UNIVERSIDAD COMPLUTENSE DE MADRID

Vocales:
- D. Pablo Martínez Ruiz Del Árbol
ETH-CERN (EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH), ETH-SWISS FEDERAL INSTITUTE OF TECHNOLOGY ZURICH
- D. Juan Pablo Fernández Ramos
CIEMAT, CIEMAT
- D. Jesús Puerta Pelayo
CIEMAT, CIEMAT

Secretario/a: - D. Ignazio Scimemi
FACULTAD DE CIENCIAS FISICAS, UNIVERSIDAD COMPLUTENSE DE MADRID

Transcurridos **diez días hábiles** desde la notificación de este nombramiento, el Presidente del Tribunal deberá convocar el acto de defensa de la tesis, debiéndose realizar esta en los **sesenta días hábiles** siguientes. En todo caso, entre la fecha de la convocatoria y el acto de defensa deberá mediar, al menos, **quince días naturales**. El Centro/Departamento/Instituto Universitario responsable del Programa de Doctorado le remitirá un ejemplar de la Tesis Doctoral junto con el "currículum vitae" del doctorando. El Secretario del Tribunal le comunicará la fecha, hora prevista del acto y lugar de celebración.

Sección de Tercer Ciclo. Edificio de Alumnos. Avda. Complutense, s/n. Ciudad Universitaria (28040 MADRID). Tfno.91 394 13 90 / 13 95 / 14 08. Fax: 91 394 14 03