



Real
Sociedad
Española de
Física



**Bienal de la Real Sociedad Española de
19^o Encuentro Ibérico de Enseñanza de la**



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**COMUNICACIONES
CIENTÍFICAS**

Ciudad Real, 7 al 11 de Septiembre de 2009

 **UCLM**
UNIVERSIDAD DE CASTILLA-LA MANCHA



$$|\vec{p}(t)| \nu_{sp_i}(t) \quad (4).$$

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 reconstruir 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 reconstrucción 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 $3 \cdot 10^5 \text{ pb}^{-1}$, la sección eficaz para Z_H es de 19 pb y $\text{BR} = 1/8$ [2] y para el fondo irreducible la sección eficaz es de 833 pb con $\text{BR} = 0.54$. 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.

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.

Referencias

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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 $750 \mu\text{m}$, while for the barrel the precision varies from $150 \mu\text{m}$ for the inner station to $350 \mu\text{m}$ 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 intended 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

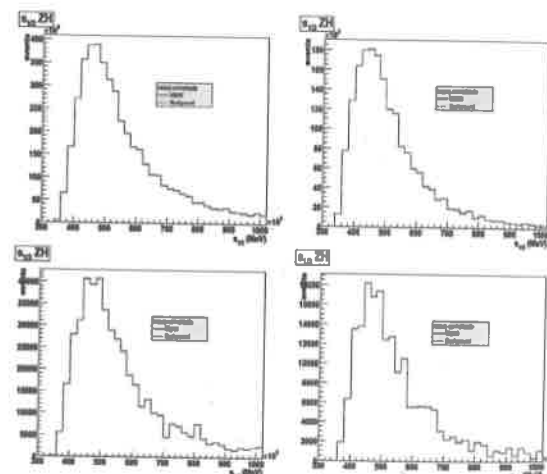


Figura 1. Representación de las diferentes variables (1), (2), (3) y (4). 20000 eventos tanto para la señal como el fondo.



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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:

"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)".

"Commissioning and Performance of the CMS Detector" at "Blois2010: 22nd Rencontres de Blois on "Particle Physics and Cosmology; First Results from the LHC", 15-20 Jul 2010, Blois (France)".

"The CMS Muon System Alignment: First results from commissioning runs " at "BIENALFISICA09: XXXII Bienal de Física, 7-11 Sep 2009, Ciudad Real (Spain)".

"Muon Alignment in ATLAS and CMS" at "Detector Understanding with First LHC Data, 29 Jun-3 Jul 2009, DESY, Hamburg (Germany)".

"The CMS Muon System Alignment" at "CHEP09: International Conference On Computing In High Energy Physics And Nuclear Physics, 21-27 Mar 2009, Prague (Czech Republic)".


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