



WELCOME

to
BARCELONA

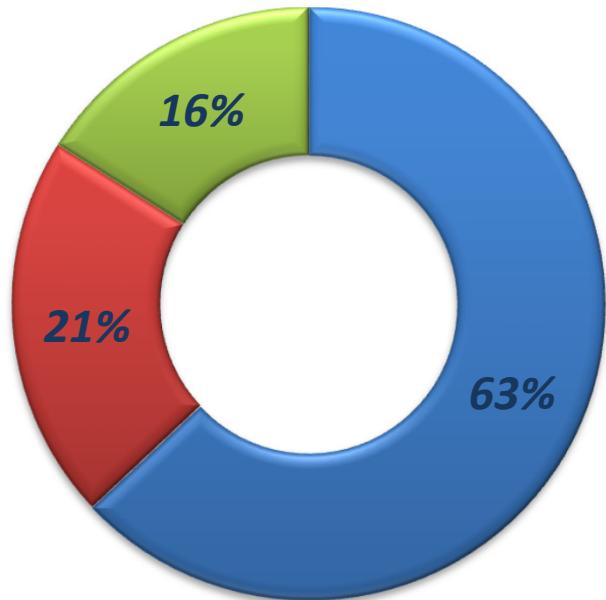


International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona



WELCOME

to ≈350 participants



■ Europe ■ America ■ Asia



WELCOME

International Beam
Instrumentation
Conference IBIC

11 - 15 September 2016 Barcelona



to 32 industrial exhibitors

Stand 1:



Stand 2:



Stand 3:



Stand 4:



Stand 17:



Stand 18:



Stand 19:



Stand 20:



Stand 5:



Stand 6:



Stand 7:
PHOTONIS



Stand 21:



Stand 22, 23 & 24:



Stand 25:



Stand 9:
Instrumentation
Technologies



The Cockcroft Institute
of Accelerator Science and Technology

Stand 13:
Optronis



Stand 14:



Stand 15:



Stand 16:



Stand 27:



Stand 28:



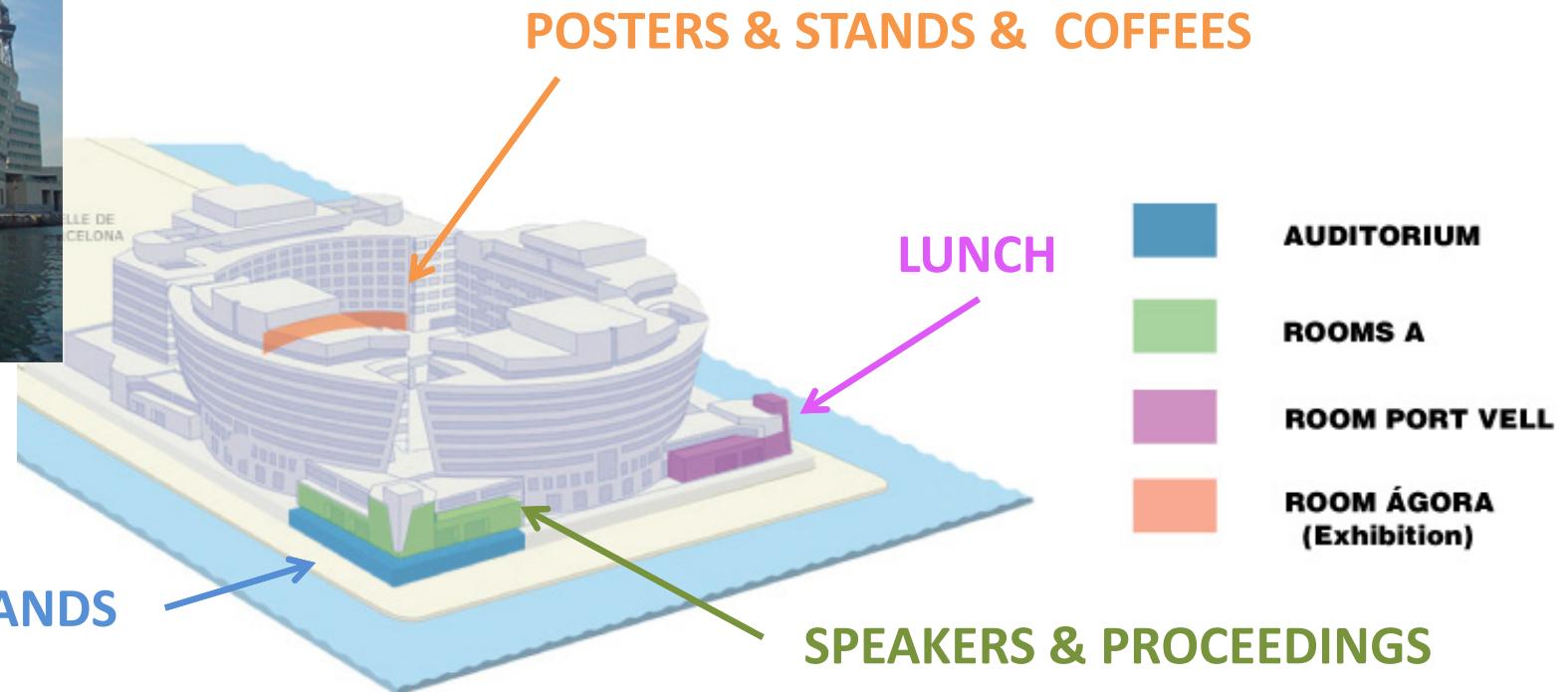
Stand 29:





WELCOME

to the World Trade Center





WELCOME to share

**International Beam
Instrumentation
Conference IBIC**

11 - 15 September 2016 Barcelona



MONDAY 12 TH		TUESDAY 13 TH	
MDAL: Welcome and Overview Chair: F. Perez (ALBA)	TUAL: Beam Loss Detection Chair: D. Gassner		
9:00 WELCOME - F. Perez (ALBA)	9:10 Microbunching Measurement Techniques in Storage Rings, A. Müller (ANKA)		
9:10 Accelerator R&D in Spain - C. Biscari (ALBA)	9:20 Longitudinal Diagnostics Methods and Limits for Hadron Linacs, A. Shishio (ORNL)		
9:30 Diagnostics at the Max-IV 3 GeV Storage Ring During Commissioning, A. Anderson (Max-IV)	9:40 A New BLM Concept Based on Fast Neutron Detection and Very Low Photon Sensitivity, J. Marroncle (CEA)		
9:50	10:00 Beam Loss and Aborn Diagnostics during SuperKEKB Phase-I Operation, H. Seida (KEK)		
10:00 Beam commissioning of Super KEKB rings at Phase I, M. Tobiyama (KEK)	10:10 Discussion		
10:20	10:30 COFFEE		
MOBL: Overview II and Machine Params Meas Chair: M. Isoland	TUBL: Time Resolv Di and Instr Chair: M. Ferlanti		
11:00 Commissioning of PAL-XFEL Beam Diagnostics System, C. Kim (PAL)	11:10 SEMINAR: Beam Diagnostics Challenges in Plasma Wakefield Acceleration, J. Osterhoff (DESY)		
11:20	11:30 First Experience with the Standard Diagnostics at the European XFEL Injector, D. Lipka (DESY)		
11:40	11:50 Temporal Profile Measurements of Relativistic Electron Bunch Based on Wakefield Generation, S. Bettone (PSI)		
12:00	12:10 Four and Higher Dimensional Emittance Determination for Hadron LINACs, A. Aleksandrov (ORNL-SNS)		
12:20 Attosecond Precision Multi-km Laser-Microwave Network, K. Shafik (CFL)	12:30 LHC Online Chromaticity Measurements, K. Fuchtbauer (CERN)		
12:40 Electro-Optical Methods for Multipurpose Diagnostics, R. Pomioli (INFN)	12:50 Discussion		
13:00 Group Photo	LUNCH		
MOCL: FCUP & Speakers Corner Chair: K. Wittberg	TUCL: BPM and Beam Stability Chair: S. Marques		
14:30 FCUP Award	Wideband Stripline BPM for Precise Measurements of Internal Bunch Motion in Proton Synchrotrons, T. Toyama (J-PARC)		
14:40	Novel Accelerator Physics Measurements Enabled by NSLS-II RF BPM Receivers, B. Podobedov (BNL)		
14:50 Measurements of Longitudinal Coupled Bunch Instabilities and Status of New Feedback System, G. Rahm (DLS)	15:00 Discussion		
15:10	15:20 Mix & Mingle		
15:30	15:40 Poster Session - MOPG		
15:50	16:00 Poster Session - TUPG		
16:00	16:10 Public Lecture: Detection of Gravitational Waves, E. Coccia (INFN)		
16:20	16:30 CONFERENCE DINNER		

WEDNESDAY 14 TH		THURSDAY 15 TH	
WEAL: Beam charge monitors and other instr Chair: S. Lidia	THAL: Instrumentation News Chair: P. Forck		
Longitudinal Diagnostics Methods and Limits for Hadron Linacs, A. Shishio (ORNL)	Temporal Diagnostics From Photons: The Experience with the PALM, P. Juranic (PSI)		
A New Wall Current Transformer for Precise Bunch-by-Bunch Intensity Measurements of LHC Beams, M. Krupa (CERN)	Recent Developments for Instability Monitoring at the LHC, T.E. Levens (CERN)		
Diagnostic Data Acquisition Strategies at FRIB, S. Cogan (FRIB)	Multi-Laser-Wire Diagnostic for the Beam Profile Measurement of Negative Hydrogen Ion Beam in the J-PARC LINAC, A. Miura (J-PARC)		
Discussion	Discussion		
BREAK	WEBLI Transverse Profile Monitors Chair: T. Mitashita	THBL: Closing remarks Chair: U. Iriso	
SEMINAR: Beam Diagnostics Challenges for Beam Dynamics Studies, R. Jones (CERN)	SIPMs for Beam Instrumentation: Ideas From High Energy Physics, D. Gascon (UB)		
Beam Size Measurements Using Interferometry at LHC, G. Trad (CERN)	Why and how international collaborations on beam instrumentation, H. Schmitz (CERN)		
Beam Shape Reconstruction Using Synchrotron Radiation Interferometry, L. Torino (ALBA)	IBIC16 Summary, U. Iriso (ALBA)		
The New Optical Device for Turn to Turn Beam Profile Measurement, V. Dorokhov (BIPM)	Visit to ALBA		
Discussion	Departure at 12h30 from the venue		
WECL: Machine Parameters Meas II Chair: Y. Leng	Lunch and visit from 13h00 to 17h00		
Longitudinal Phase Space Diagnostics for Ultrashort Bunches With a Plasma Deflector, J. Dommert (CERN/UHH)	Bus back to the venue departing at 17h00		
Accurate Measurement of the MLS Electron Storage Ring Parameters, R. M. Klein (FBK)			
Measurement of the Beam Response to Quadrupole Kick by Using Stripline Pickup Monitor at J-PARC Main Ring, Y. Nakashita (J-PARC)			
Discussion			
Poster Session - WEPG			

261 contributions



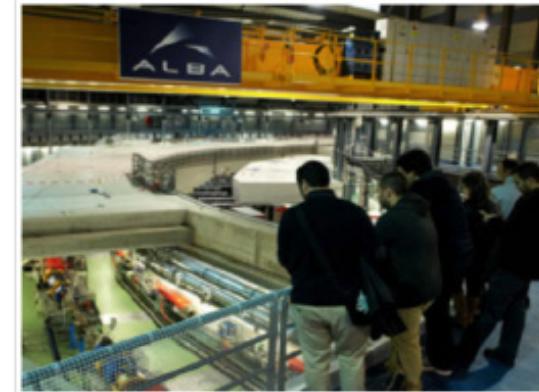
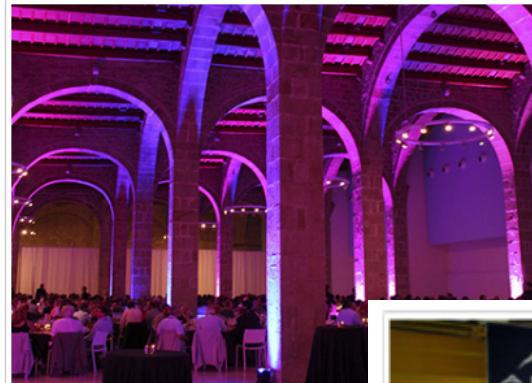


WELCOME

to enjoy



Banquet



ALBA Visit

International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona





WELCOME
to

International Beam Instrumentation Conference IBIC

11 - 15 September 2016 Barcelona

International Beam
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Accelerator R&D in Spain



Caterina Biscari
ALBA-CELLS



IBIC 2016 – Barcelona – 11-15 September 2016



Spanish Accelerator Facilities and Groups



CONECTA – Coordination of activities of the Accelerator Community in Spain

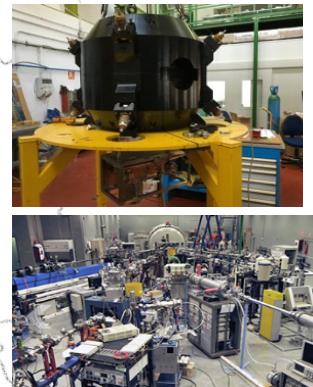


Operating/in commissioning Accelerators

International Beam
Line Commissioning



SC Cyclotron- construction at CIEMAT



Tandem at CMAM-UAM



Microtron UPC



ALBA - Light source



**Tandem
Cyclotron,
Tandetron at CNA**

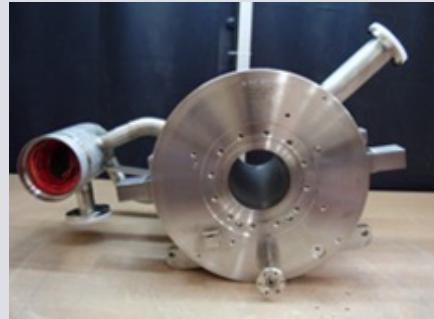
E-XFEL

103 Combined SC Magnets
101 Moving Tables
3 Phase Shifters
101 Electronic Control Racks

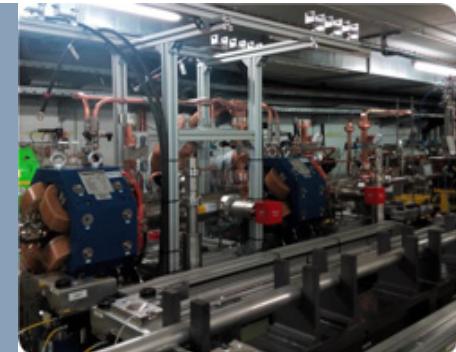
Main contributions to other projects Electrical Engineering Division



CLIC



12 PETs for CTF3
1 Double Length Power Extraction Transfer Structure
1 Accelerating Structure
1 Damping Ring Gradient Dipole



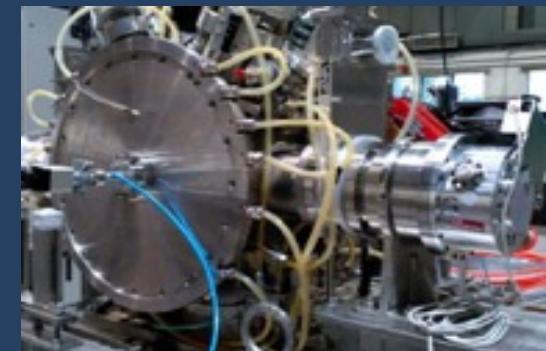
LHC-HiLumi & FCC

RR high aperture SC sextupole & octupole
Combined Corrector
Dipole for LHC-HL
Participation in FCC Vacuum
Beam Screen Design



IFMIF

2 RF Buncher Cavities
13 Combined Resistive Magnets
BPMs & Scrapers
MEBT integration

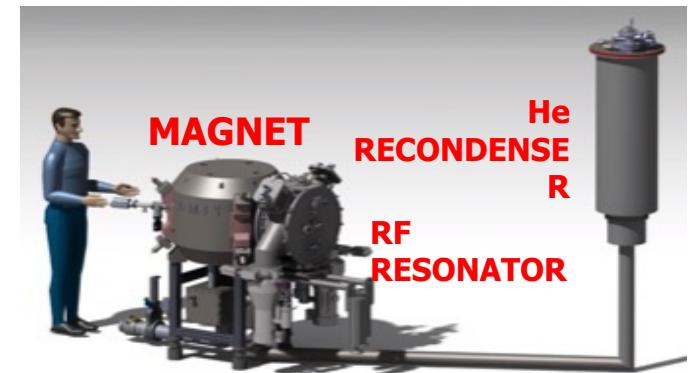


Calculations, Engineering design, Prototyping, Tests



A Compact Superconducting Cyclotron for Radioisotope Production

GENERAL	
Cyclotron Type	Classical
Energy	>8.5 MeV
Current	>10 μ A
MAGNET	
Type	Low Tc Superconductor
Configuration	Warm Iron
Superconductor	NbTi
Central Field	4 T
Focusing type	Radially decreasing (1.5%@extraction radius)
RF SYSTEM	
Configuration	One 180° Dee
Peak Voltage	60 kV
RF frequency	~ 60 MHz
ION SOURCE	
Type	Internal
Ions	H ⁻
EXTRACTION	
Extraction	Stripping foil at 110 mm
Target	Nitrogen gas (¹¹ C), ¹⁸ O enriched water (¹⁸ F)
Position	External



General lay out of the accelerator (up) and complete superconducting magnet (down)



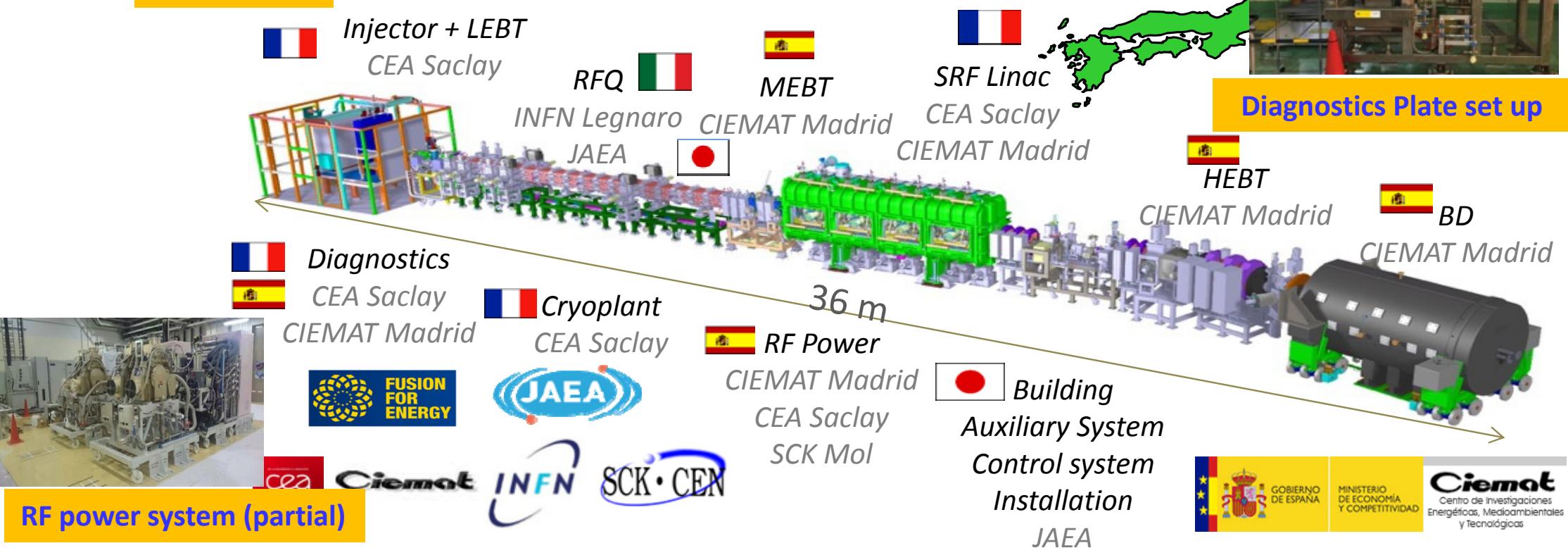


IFMIF/EVEDA Project

Fusion Technology Division



CIEMAT is heavily involved in the
IFMIF/EVEDA project, included in the EU-JA
Broader Approach Agreement



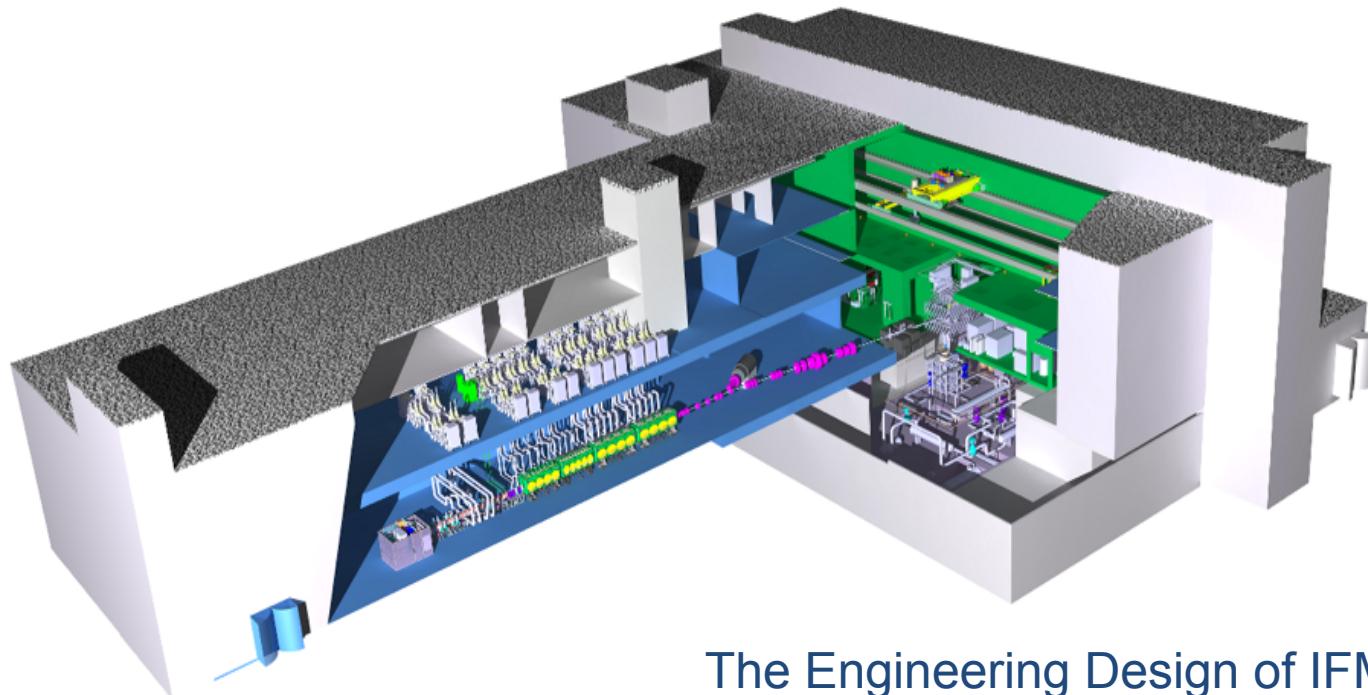


IFMIF-DONES



Based on IFMIF/EVEDA work, CIEMAT is leading the activities for the preparation of the IFMIF-DONES project....

IFMIF-DONES is a fusion-like high intensity neutron source for materials testing



IFMIF/DONES site is not yet decided: can be JA (Rokkasho) or EU
Several EU possible sites have been identified

CIEMAT is involved in the preparation of a Spanish proposal to host this facility in the Granada region

The Engineering Design of IFMIF-DONES is being developed including facility configuration, systems design, preliminary safety evaluation, 3D CAD,....

Accelerator R&D, IFIC

<http://gap.ific.uv.es/>
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9 PEOPLE

Beam optics
Beam instrumentation



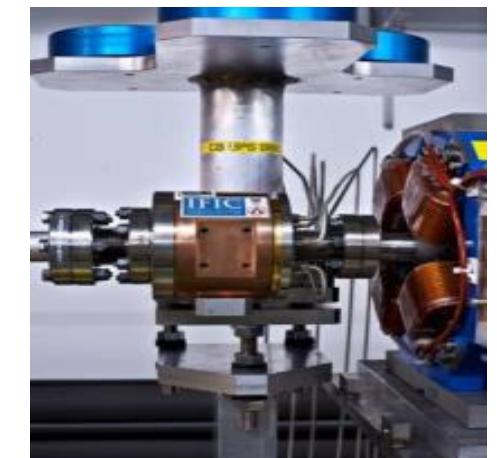
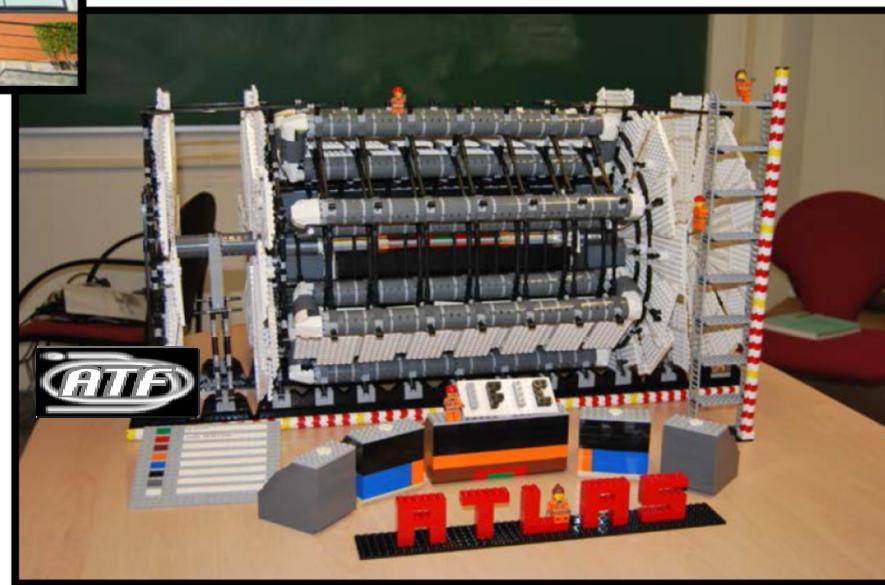
**Several
COLLABORATORS**



UNIVERSITAT POLITÈCNICA
DE CATALUNYA

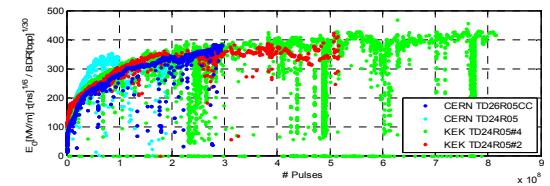
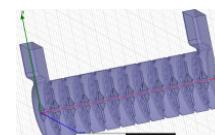
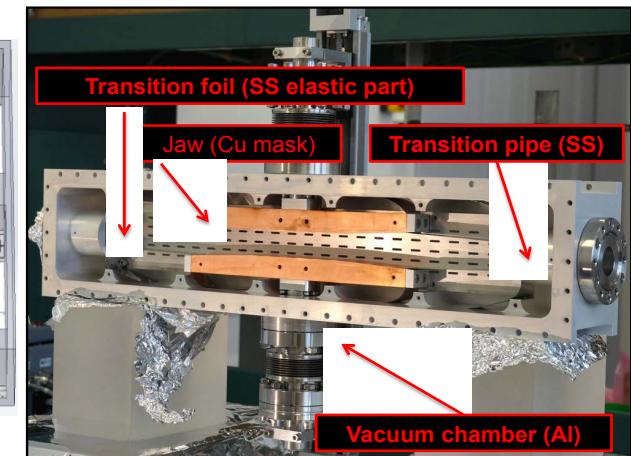
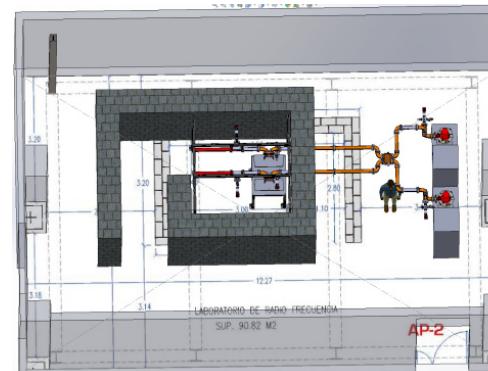
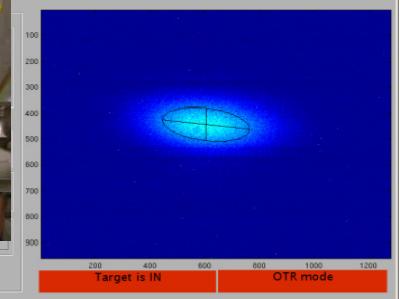
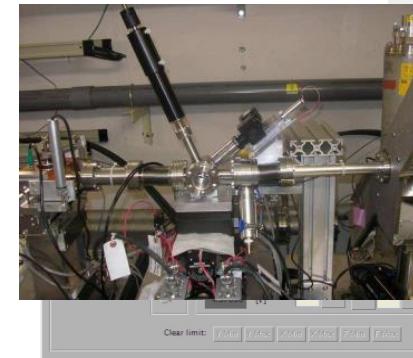


Ciemat
Centro de Investigaciones
Energéticas, Medioambientales
y Tecnológicas



RESEARCH ACTIVITIES

- Collimation systems studies for Circular Colliders (LHC) and Future Linear Colliders (CLIC and ILC)
- Optics Design and Beam Instrumentation studies for the Beam Delivery System of Future Linear Colliders
 - Design and Construction of Beam Instrumentation:
 - Optical Transition Radiation Monitors for ATF-ATF2
 - Beam Position Tuning for Hadrontherapy Facilities
 - Stripline Kickers for CLIC Damping and pre-Damping Rings
 - Beam Position Monitors studies for the Drive Beam of CTF3
- Cyclinacs for Hadrontherapy applications and High-Gradient RF structures





ESS
bilbao

ESS BILBAO

- Funded by the Spanish and Basque Country Governments (90 M€)
- Main Objective: Spanish in-kind contribution to European Spallation Source, located at Lund, Sweden (around 70 M€: 50% accelerator/target systems, 50% neutron instruments)
- A team of ~60 (including researchers, technicians, administration)
- Close collaboration with University and Industry



ESS Bilbao headquarters

- ❖ **CAPABILITIES:** design, prototyping, manufacturing and test
- ❖ **FIELDS:** Accelerator, Target, Neutron Instruments
- ❖ **TECHNOLOGIES:** ion sources, cavities, magnets, RF design and test, control and diagnostics, high vacuum, neutronic design, mechanical design and manufacturing, welding,...

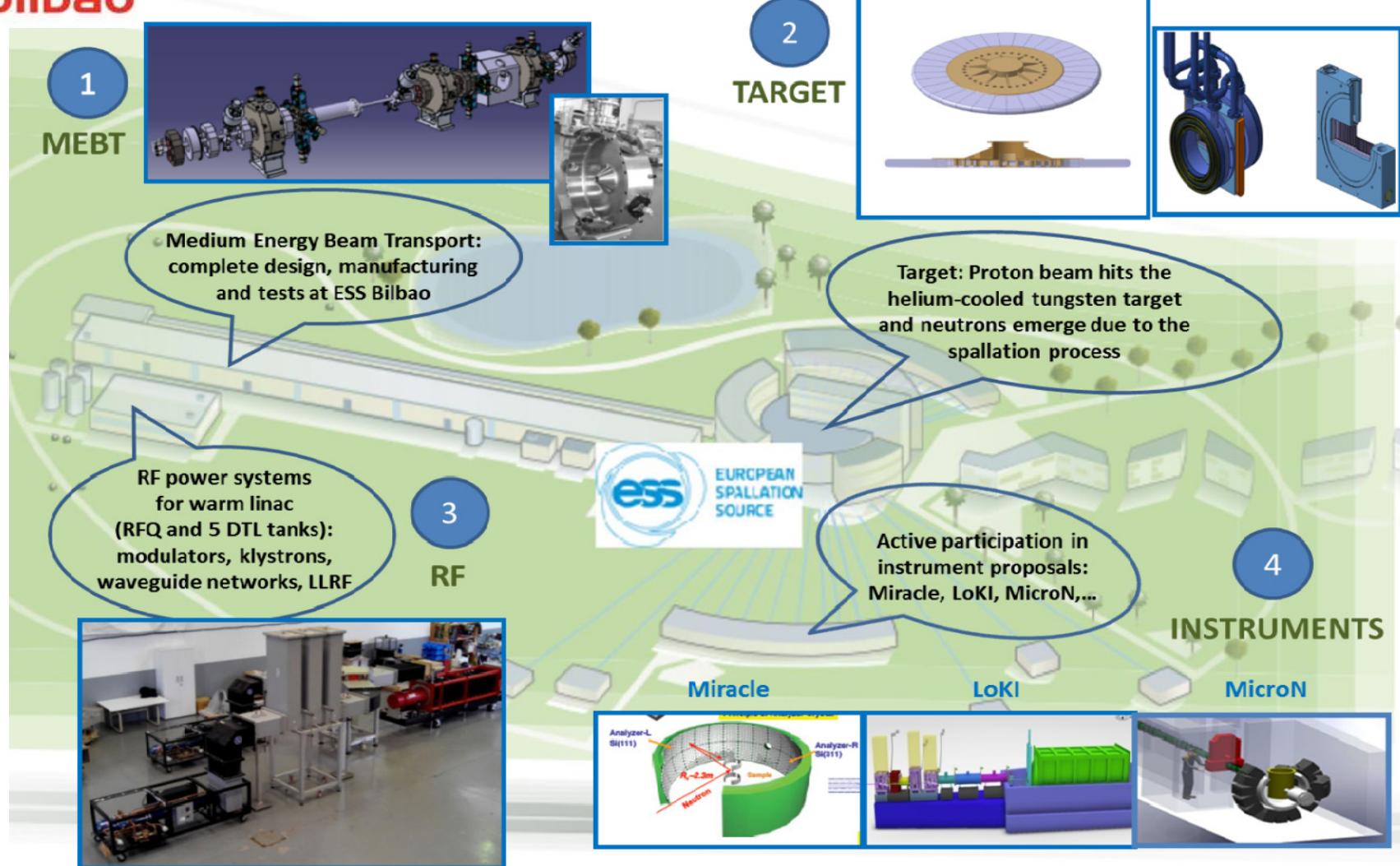
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ESS
Bilbao

SPANISH CONTRIBUTION TO ESS





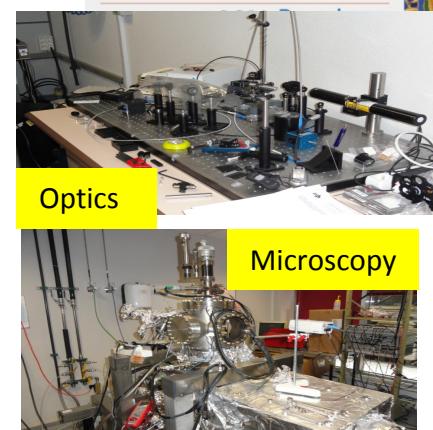
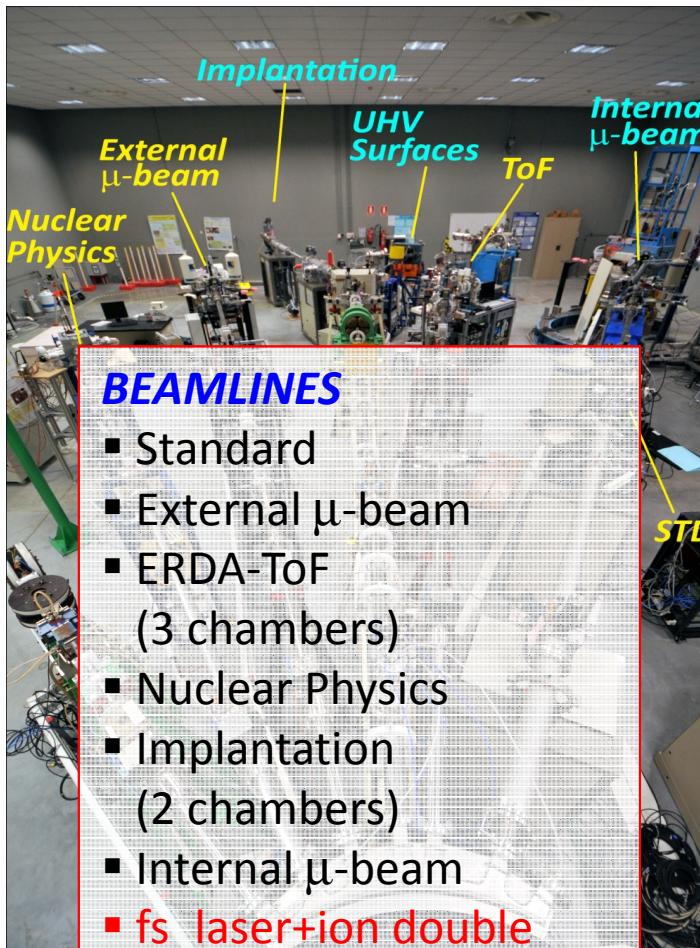
Centro de Micro Análisis de Materiales



A team of 24



5MV CW tandem



ANCILLARY LABS

- Microscopy
- Sputtering
- Target Fabrication
- Optics
- Mechanics
- Electronics
- Data centre



Archaeometry

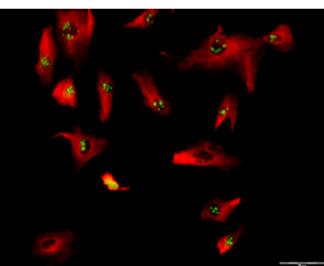


Our Research

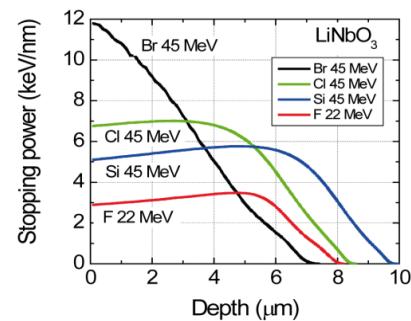
Accelerator Technology



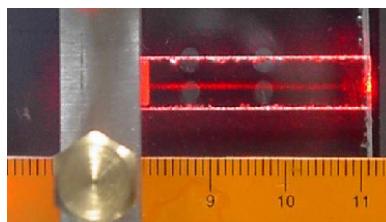
Biophysics



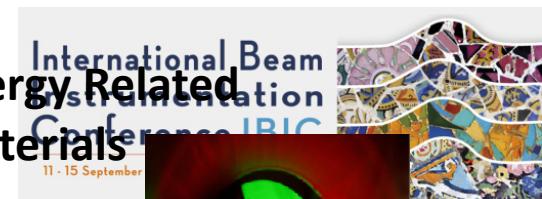
Ion-Solid Interactions



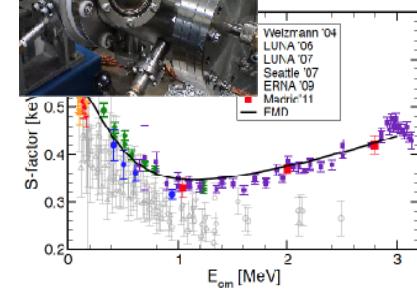
Photonics



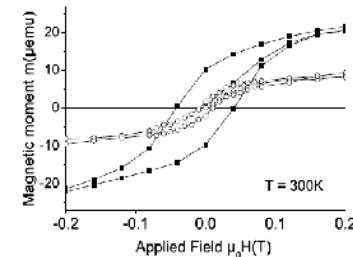
Energy Related Materials



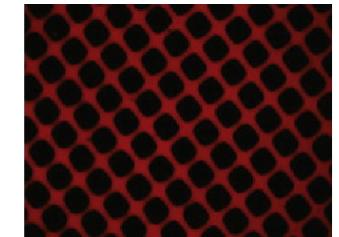
Nuclear Physics



Solid State Physics

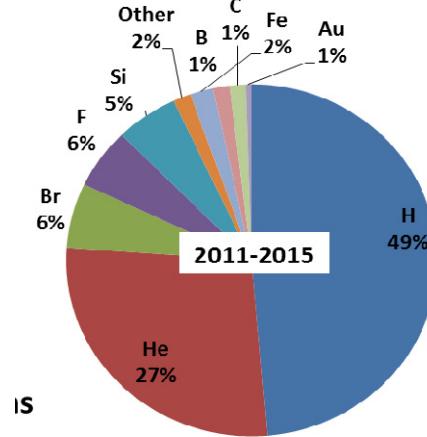
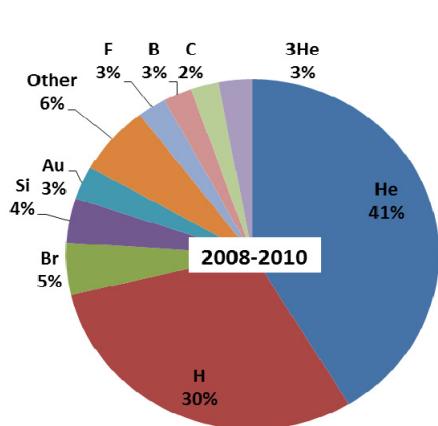
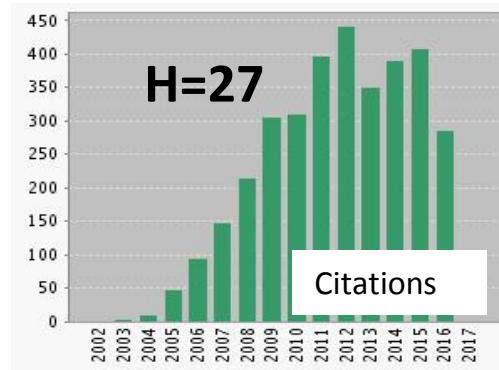
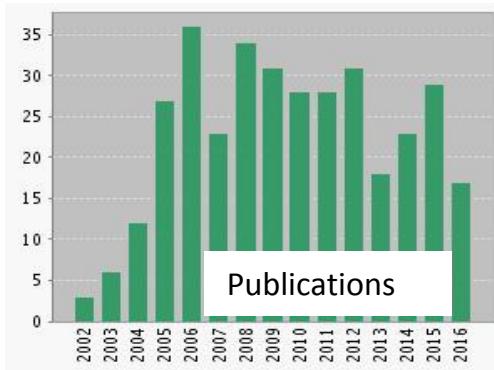


Micro-patterning

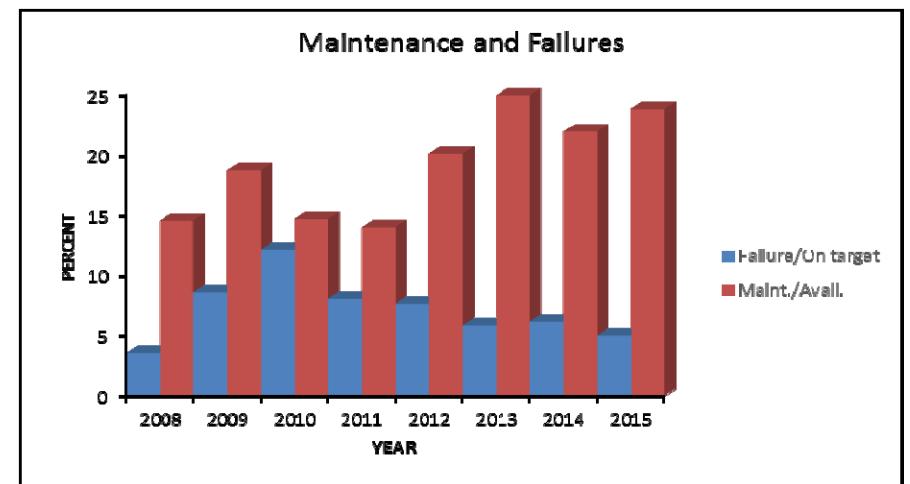
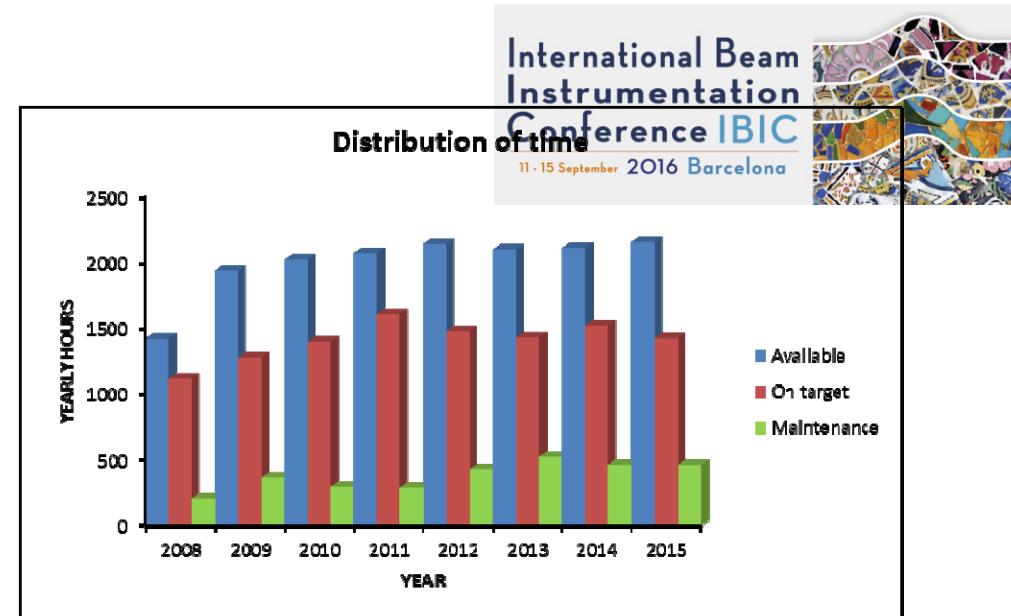




Some Statistics



Ions produced

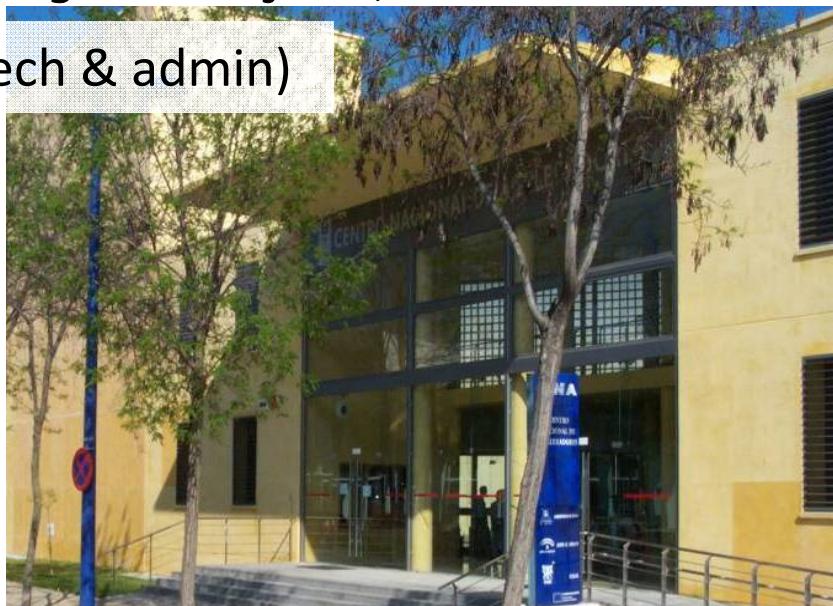




MINISTERIO
DE EDUCACION
Y CIENCIA

Parque Tecnológico Cartuja'93, Sevilla cna@us.es

56 staff (24 PhD, 16 training, 16 Tech & admin)



- 4 accelerators
- 1 Irradiator
- 1 PET/CT

Users Facility
(100 applications per year)

USERS/COLLABORATORS (not exhaustive)

IEM-CSIC, IFCA-CSIC, IFIC-CSIC, I3M-CSIC, IO-CSIC, ICMSE-CSIC, ICMM-CSIC, ICMB-CSIC, U-Huelva, U-Granada
TRINOS, AVS, CRIOLAB, ATI-Sistemas, INDO, ACERINOX, IAEA, ALTER, TRAD, INTA, ENRESA, DUCARES, CIEMAT, UAB, UEX, U-Lund, ETH Zurich, CERN, GANIL, GSI, LNL (Legnaro)



Main utilization of the 4 accelerators



3MV Tandem

IBA techniques
(Material Science)

Nuclear physics and Instrumentation

Use by companies and Research institutions



Cyclotron

18 MeV p, 9 MeV (d)

Radiopharmaceutical
production

Irradiation (Space technology)



SARA, AMS system
AMS isotope
measurements
(Nuclear physics applied
to environment)



MICADAS compact 14C

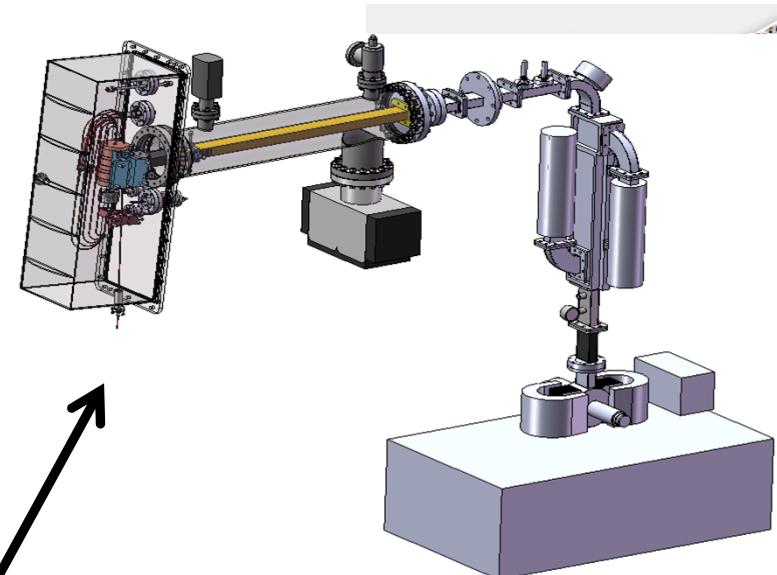
14C dating

Nucl Phys applied to
archeology and
cultural heritage



Microtron project at the INTE-UPC

- Design and construction of a compact race-track microtron of electrons
- Possible applications: Intraoperative Radiation Therapy, industrial radiography, cargo inspection
- Collaboration with CIEMAT and Skobeltsyn Institute of Nuclear Physics of Moscow State University



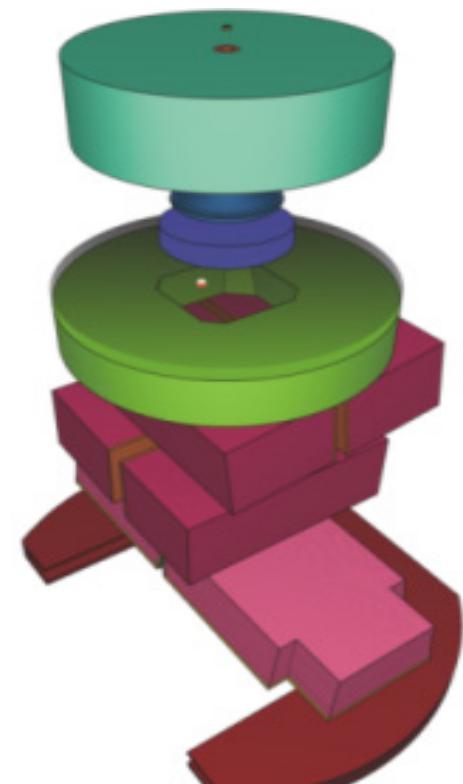
Parameters principals	
Beam energies	6, 8, 10, 12 MeV
Operating frequency	5712 MHz
Energy gain per turn	2 MeV
Fields in the end magnets	0.8 T
Pulsed RF power	<750 kW
RTM head dimensions	578×200×123 mm
RTM head weight	~ 100 kg

- Permanent magnets (NdFeB)
- Fully in-vacuum solution
- Energy switch by change of extraction orbit



PRIMO - Advanced tool for linac simulation

- PRIMO is a software tool for the Monte Carlo simulation of most Varian and Elekta models of clinical linacs.
- The dose distribution in voxelized patients, or homogeneous phantoms, is also determined. Tools to perform the analysis of these distributions (e.g., dose volume histograms, gamma index) are included.
- It includes a graphical user interface similar to those found in commercial treatment planning systems.
- In collaboration with Universitätsklinikum, Essen
- **Freely available at**
<http://www.primoproject.net>



ALBA Synchrotron Light Source

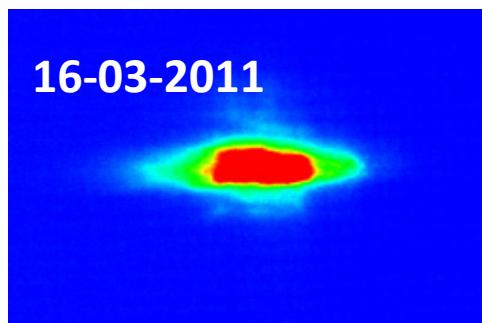
- ✓ 3 GeV electron accelerator
- ✓ 8 operating beam lines
- ✓ 2 beamlines in construction
- ✓ Funding 50% Spanish – 50% Catalan Governments
- ✓ 2003 - Project approval
- ✓ 2003-2006 – Design
- ✓ 2006-2010 – Construction
- ✓ 2011 - Commissioning
- ✓ 2012 - First beam for users May 2012

June 2006



2011





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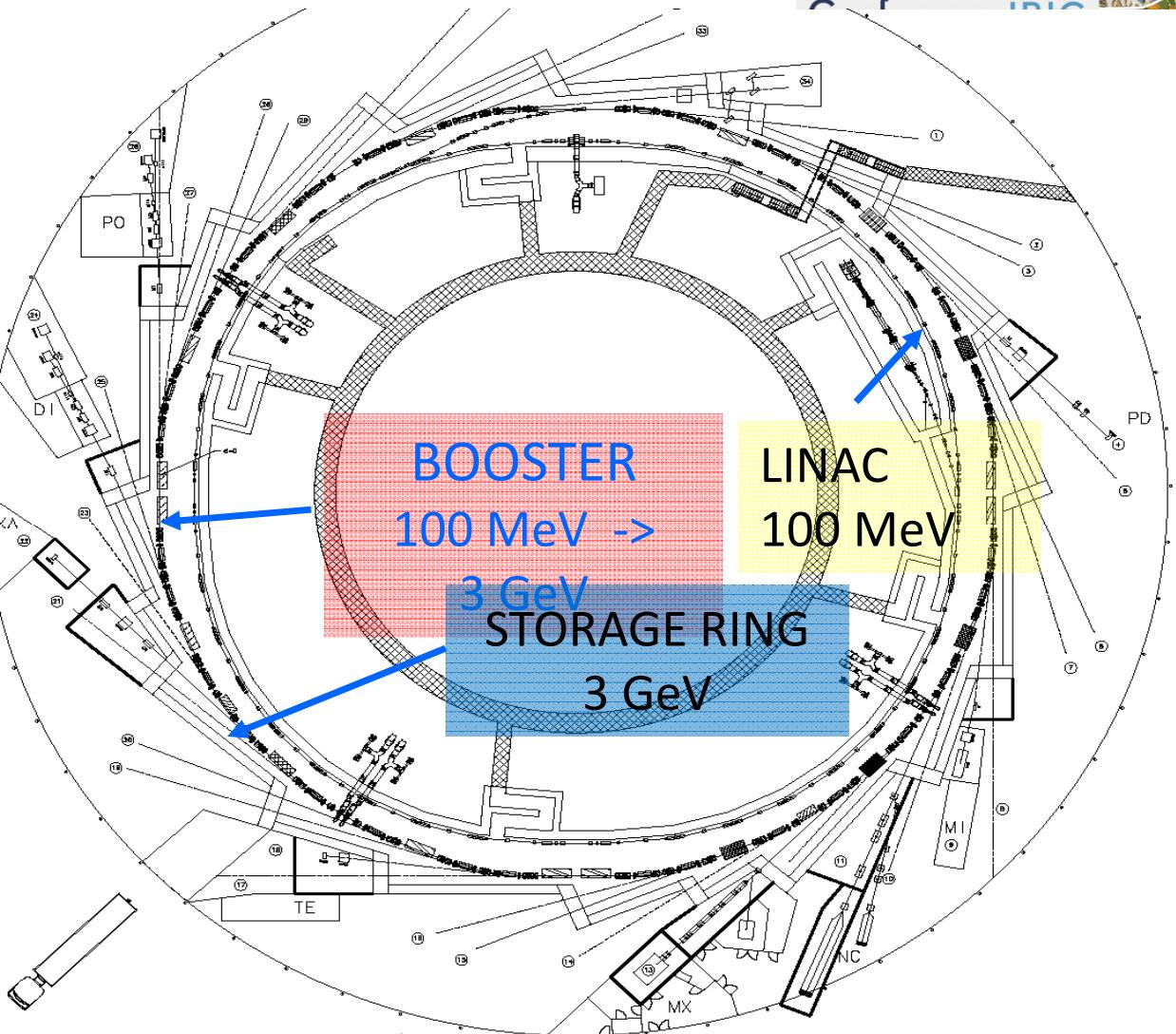
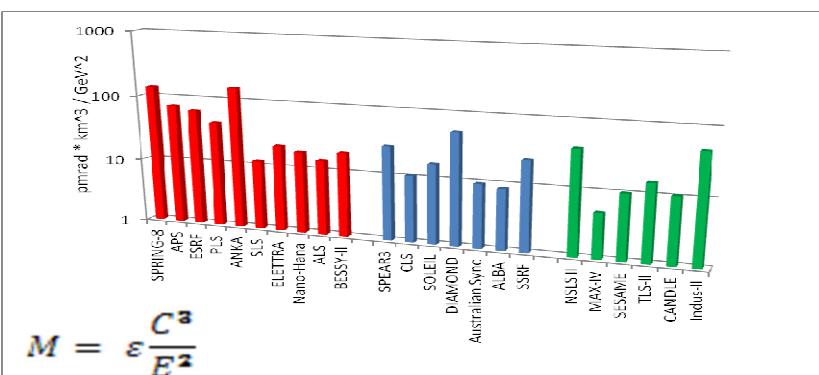


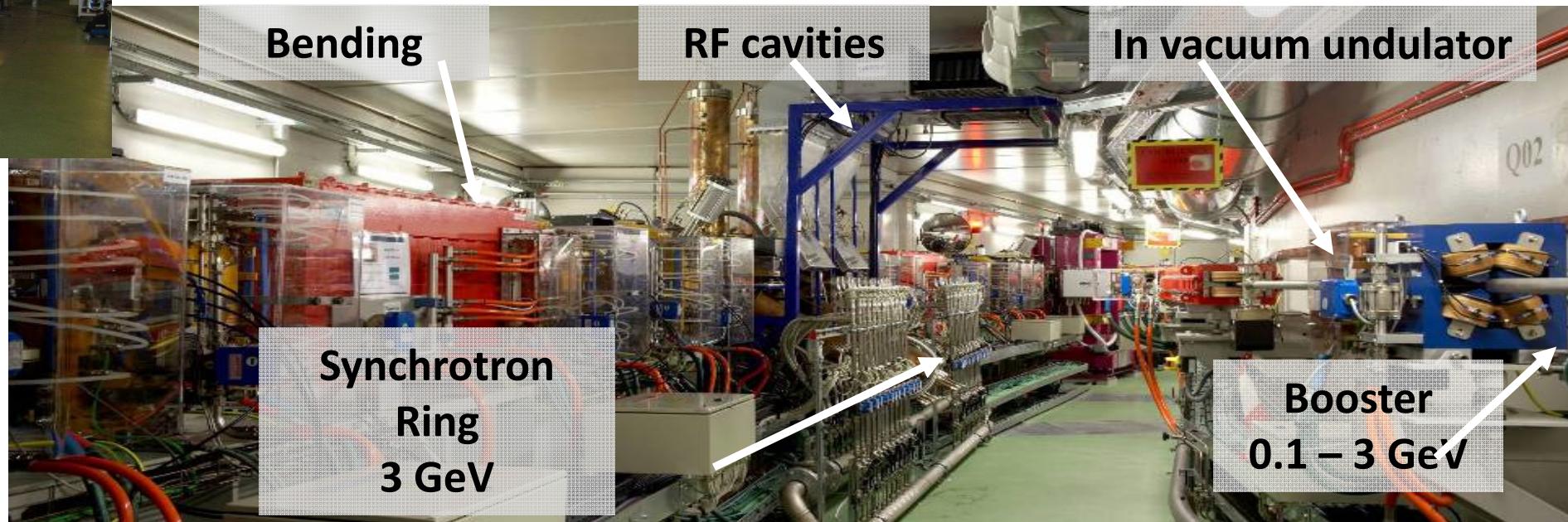


ALBA Accelerators



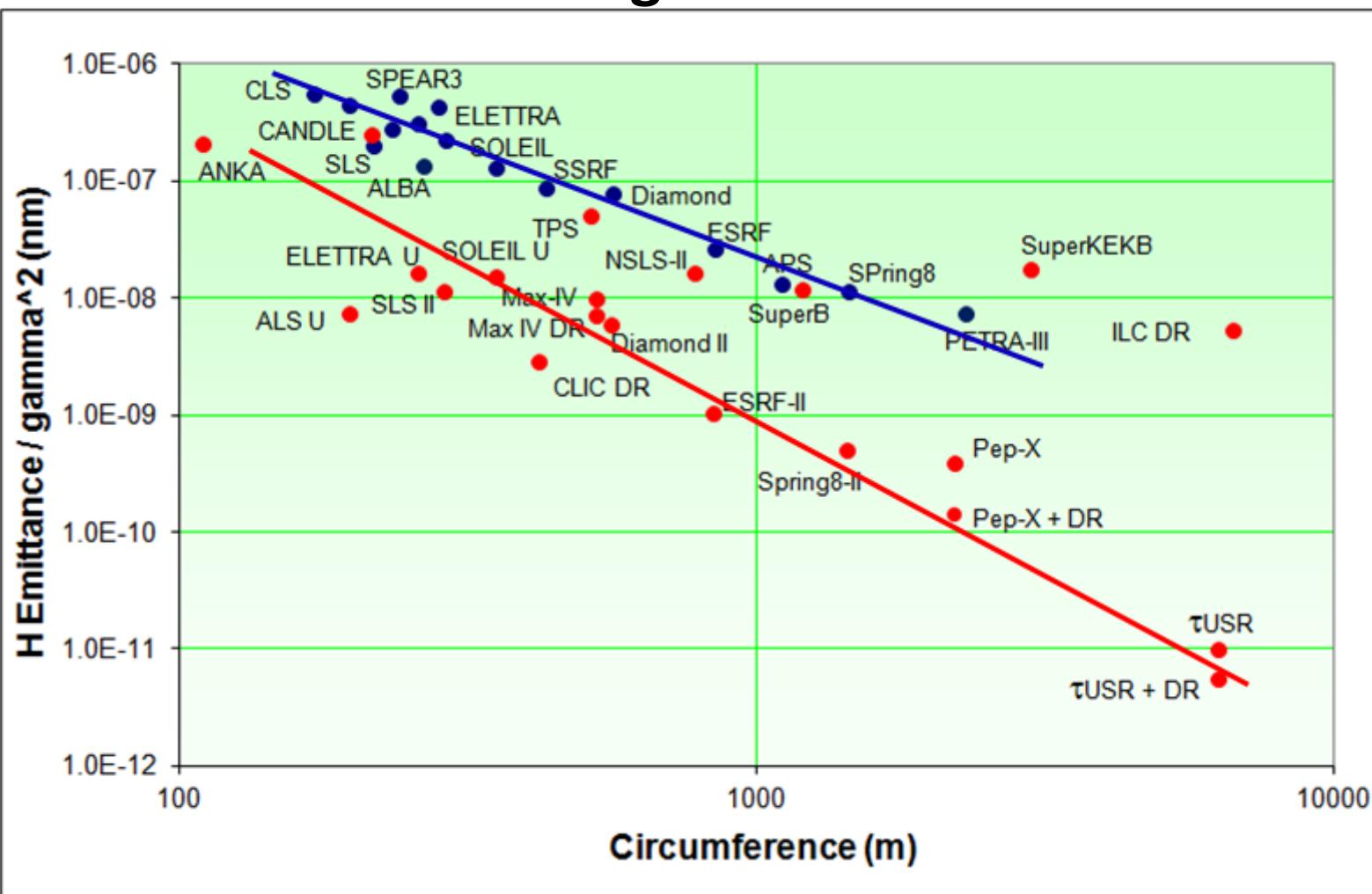
Parameter	Value
Energy	3 GeV
Circumference	269 m
Emittance	4.3 n mrad
Nominal Current	250 mA
Rf frequency	500 MHz
# cavities	6
Long straights	4 (8 m)
Medium straights	12 (4 m)





Emittance of 3rd generation and DL SL

International Beam
Generation
BIC

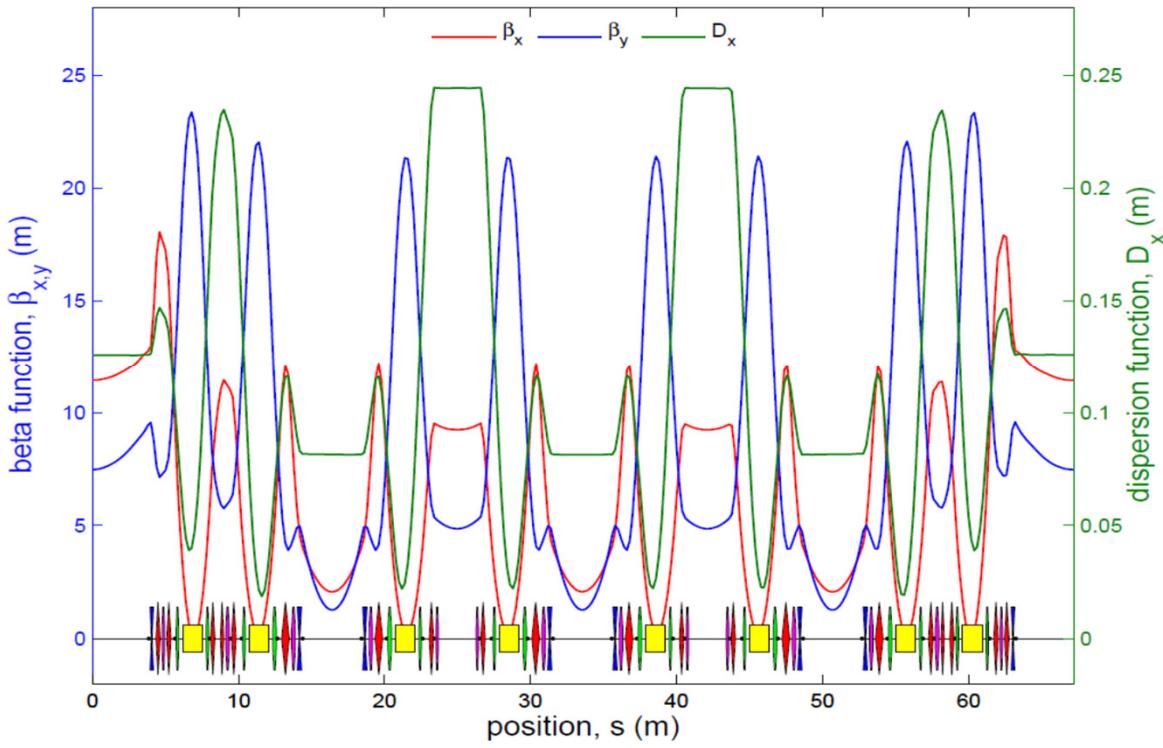


Emittance normalized to beam energy vs. circumference for storage rings in operation (blue dots) and under construction or being planned (red dots). The ongoing generational change is indicated by the transition from the blue line to the red line. (R. Bartolini, LER-2014)



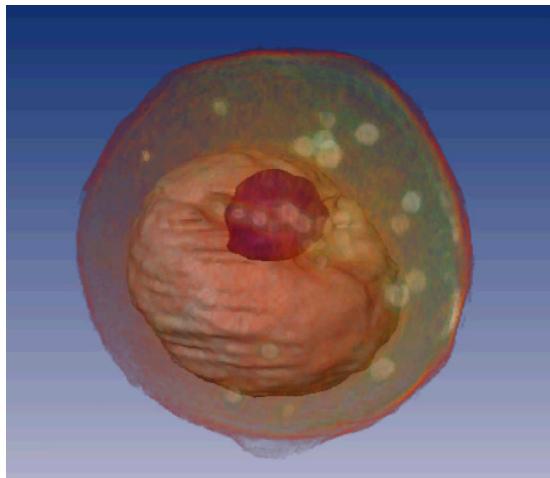
ALBA Storage Ring

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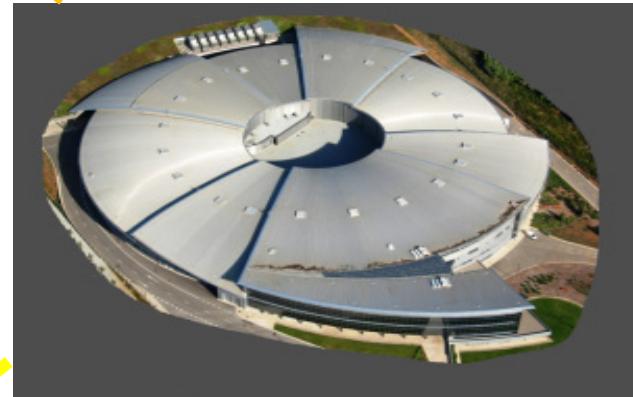


E [GeV]	3
C [m]	268.8
Q_x	18.19
Q_y	8.24
ϵ_x [nm rad]	4.3
ξ_x	-34
ξ_y	-24.5
a_p	8.4×10^{-4}
a_2	2.5×10^{-3}
$\delta E/E$	1.05×10^{-3}
$J_x/J_y/J_E$	1.3/1/1.7
$t_x/t_y/t_E$ [ms]	4.0/5.3/3.1

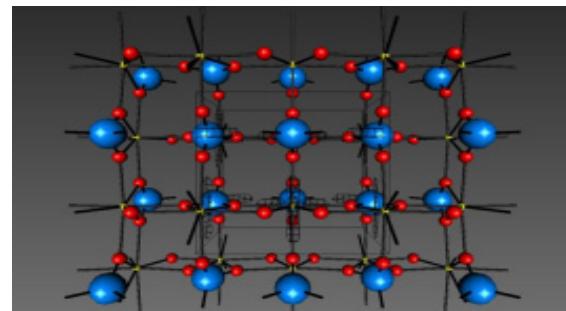
by D.Einfeld



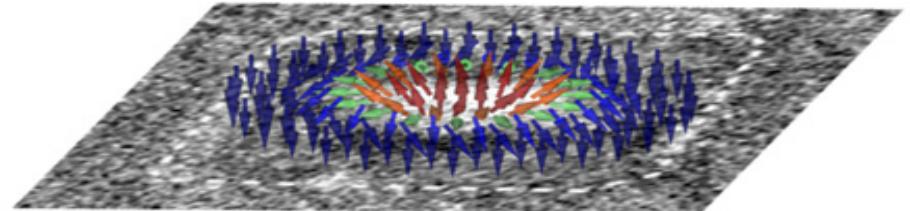
**LIFE
SCIENCE**



CHEMISTRY



**CONDENSED
MATTER**





Beamlines

In operation
In construction



BL29: BOREAS
EU71– (0.08-3 keV)
REsonant Absorption
and Scattering

BL24: CIRCE
EU62– (0.1-2 keV)
Photoemission
spectroscopies

BL22: CLAESST
MPW80– (2-63 keV)
Absorption &
Emission Spectroscopies

BL20: LOREA
EU– (10-450 eV)
ARPES

BLXX- XAIRA
IVUXX (~5-25 keV)
Macromolecular Cristallography

Bending: e⁻ Diagnostics

BL01: MIRAS
Bending – (0.4-100 μm)
IR Spectroscopy

BL04: MSPD
SCW31 – (8-50 keV)
HP/HR
Powder Diffraction

BL09: MISTRAL
Bending– (0.27-2.6 keV)
X ray Microscopy

BL11: NCD
IVU21– (6-13 keV)
Non Cristalline Diffraction
SAXS/WAXS

BL13: XALOC
IVU21 – (5-22 keV)
Macromolecular Cristallography



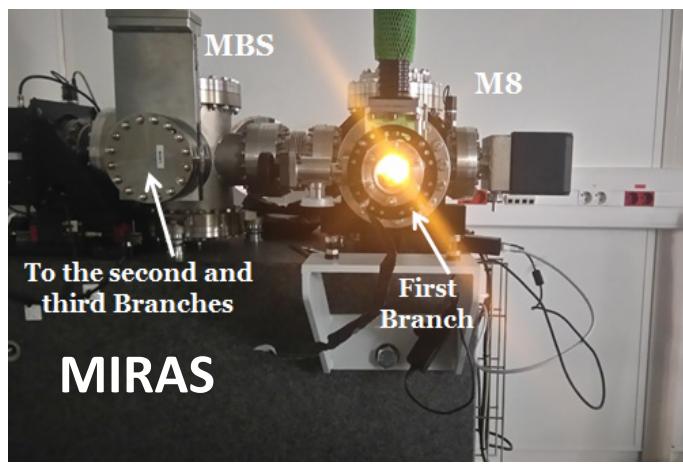
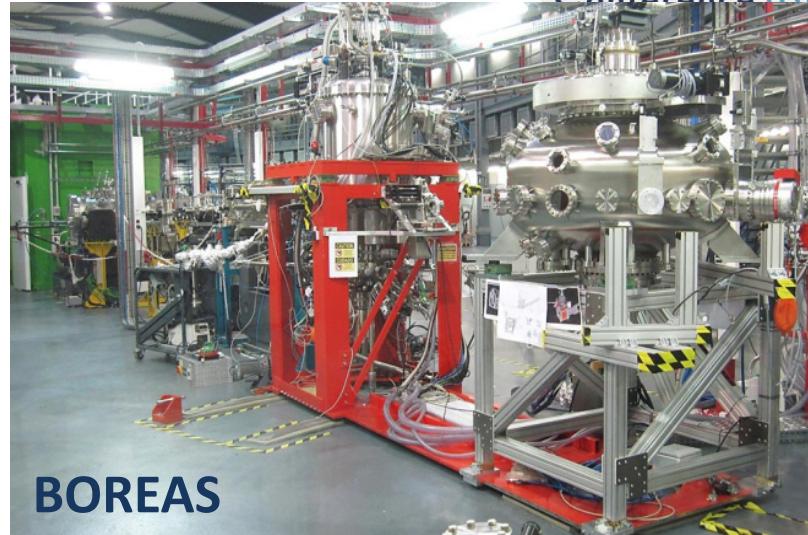
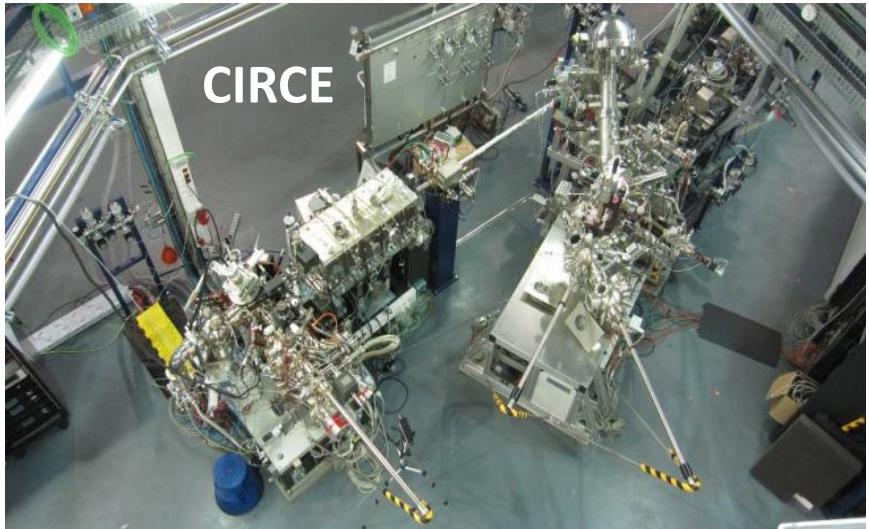
ALBA BEAMLINES

International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona





ALBA BEAMLINES



International Beam
Instrumentation
Conference IBIC
Barcelona, Spain



Beam Instrumentation at ALBA

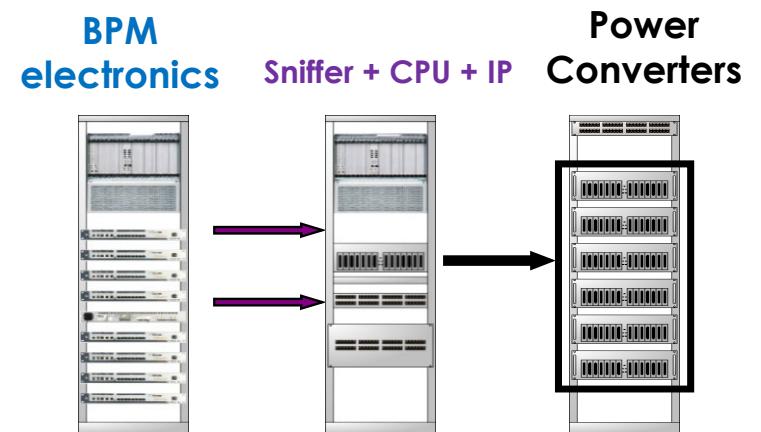
GOAL 1) Guarantee machine operation combining of off-the-shelf products with home-made designs to **optimize** resources

Example: Fast Orbit Feedback

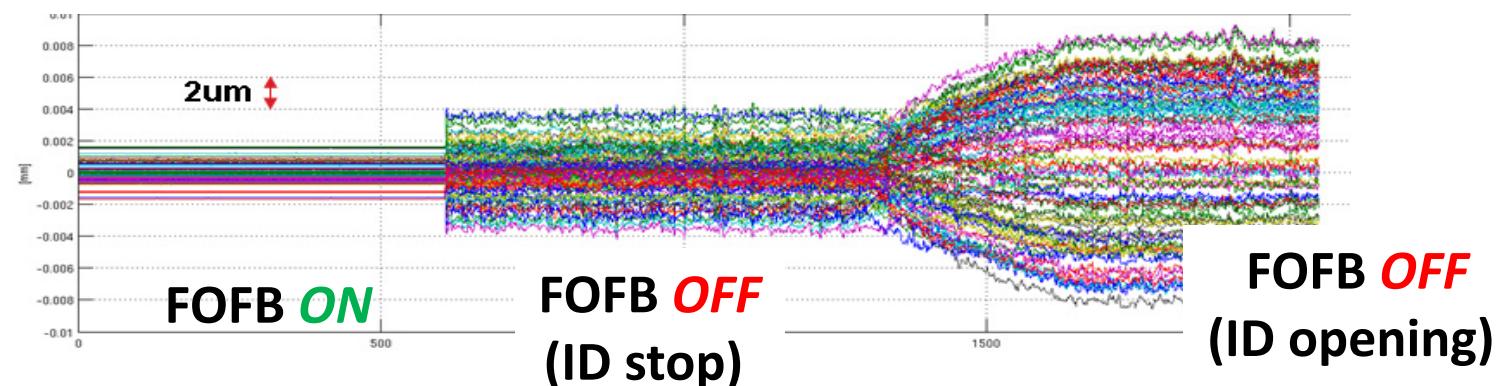
Commercially available BPM electronics /PS control +
Timing boards recycled as position reading nodes

=

Orbit Stability <um level up to frequencies of 100Hz
(many thanks to DLS colleagues)



→ See contributions:
WEPD23 (IBIC14)
TUPB046 (IBIC15)
WEPEG14 (IBIC16)

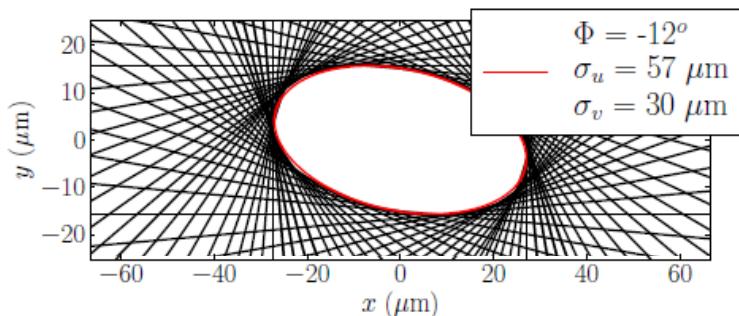


Beam Instrumentation at ALBA



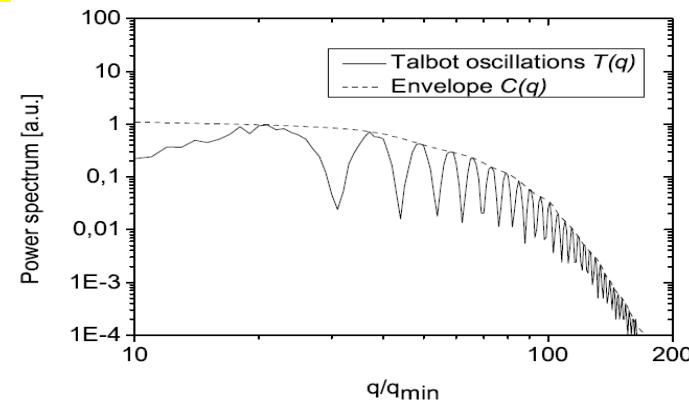
GOAL 2) Diagnostics R&D: getting ready for new demands and/or developing systems through international collaborations

WEBL03: Own R&D projects
Beam shape reconstruction using interferometry



Furthermore, developed a new technique to measure beam sizes beyond the limits of standard interferometry

MOPG73: CLIC Collaboration
Transverse beam size diagnostics using brownian particles at ALBA



Similar to speckle analysis performed using undulators, now trying to measure the beam size using a dipole source



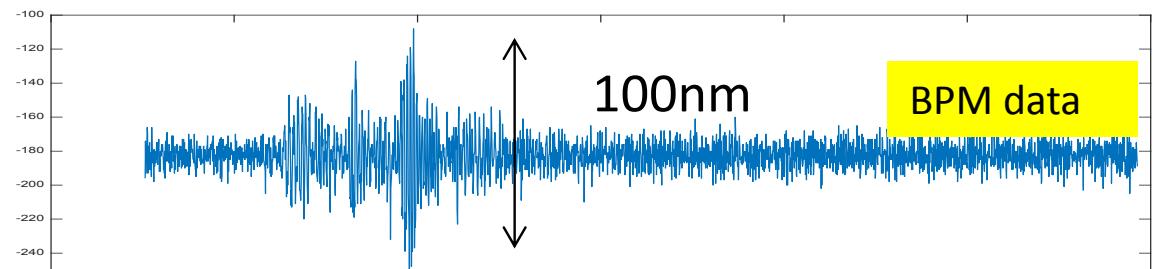
Beam Instrumentation at ALBA

Furthermore... proud to use the whole machine as an instrument

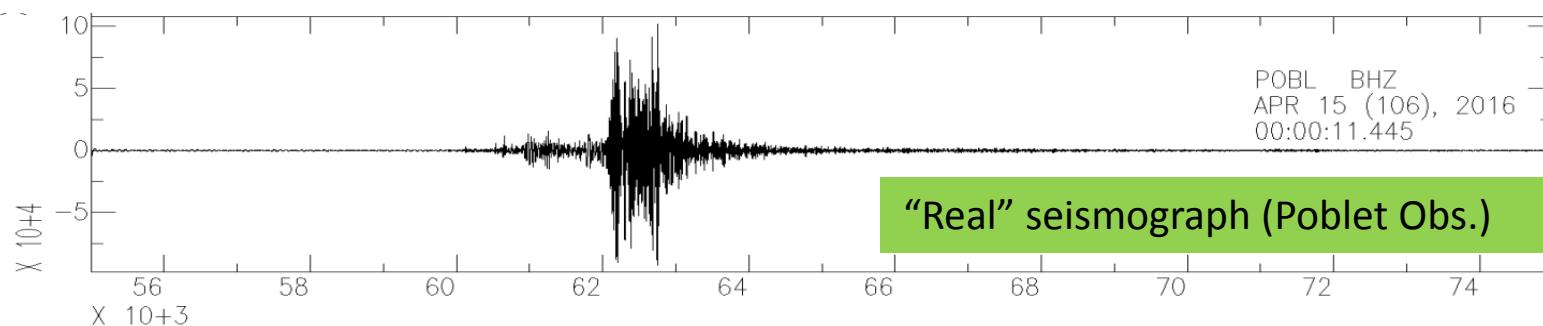


The ALBA Seismograph!

If an earthquake is produced anywhere in the world, can be detected using the FOFB



So far, detected
earthquakes in
Japan, Chile, Spain...



Crosschecking data
with *Laboratori
d'Estudis Geofísics
Eduard Fontserè*

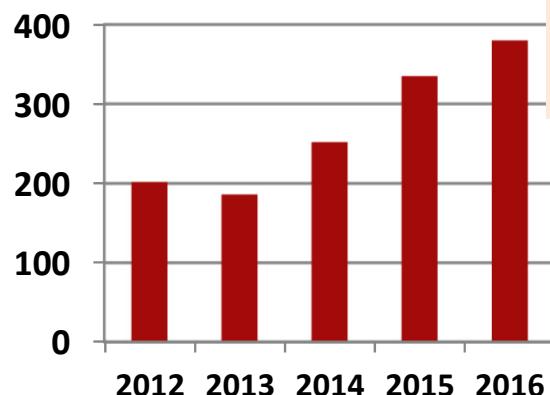


The ALBA Team
We are today 205



Beam for users

of proposals



Average overbooking factor ~ 2

100

90

80

70

Availability (%)

100

95

90

85

80

75

70

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6000

5000

4000

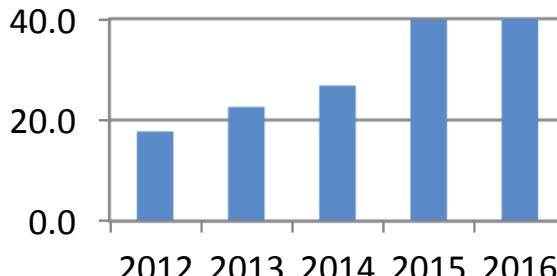
3000

2000

1000

0

International percentage



	2012	2013	2014	2015	2016
Accelerator operation [h]	3280	4464	5250	5730	5744
Scheduled user beam [h]	2387	3540	3888	4320	4368
Availability [%]	76.7	83.8	96.8	97.3	97.9*
MTBF [h]	21.0	25.0	33.7	51.4	48.9*
MTTR [h]	1.0	0.8	1.1	1.4	1.0*

* Until August 16



The ALBA Accelerator Team Expertise

Inside ALBA Dampy Cavity

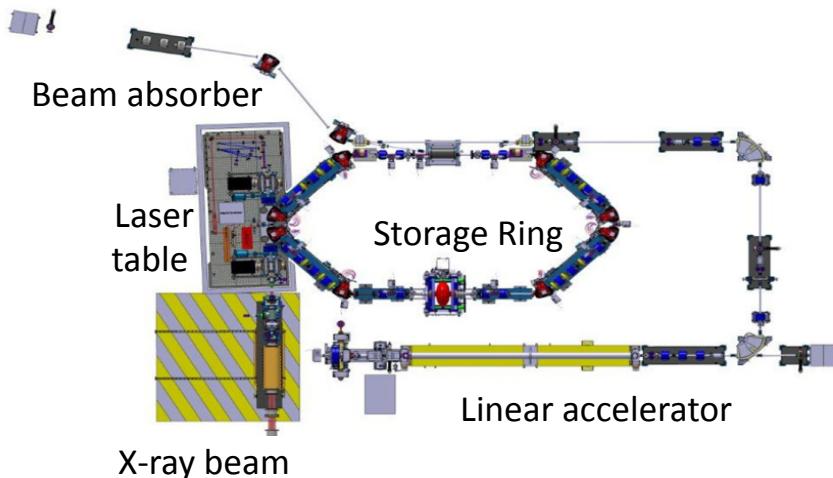
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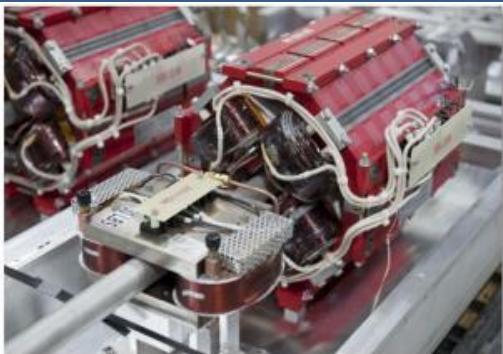
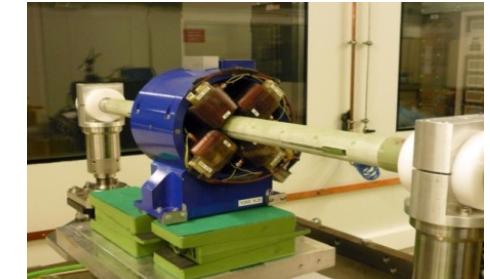
- Accelerator beam dynamics
 - Accelerators operation
- RF systems and test laboratory
- Magnetic structures design and measurements laboratory
 - Ultra High Vacuum systems design and test laboratory
 - Beam diagnostics and test laboratory
- Real time control systems and data acquisition
- High power and high stability power supplies
 - High precision mechanics
- High speed electronics and precise synchronisation and timing systems
- Survey, alignment and vibrational measurements

Magnetic measurement laboratory

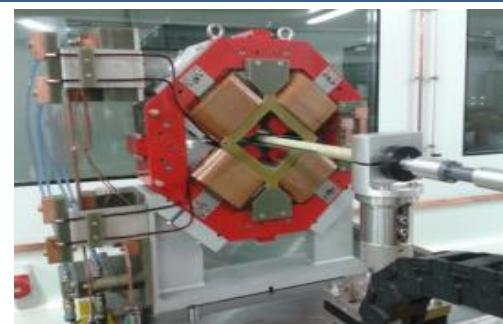
Used during ALBA construction and installation – up to 2 m long structures
Used thereafter for collaborations (Ciemat, ESRF, ESS, SESAME, ThomX...)



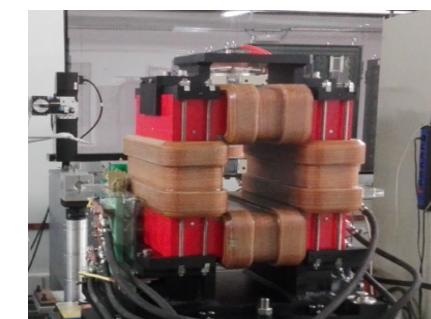
Measurement of ThomX project dipoles and quadrupoles



Magnets built by industry



CIEMAT magnets for IFMIF



CNAO Magnets
for experimental beamline



SESAME



All dipoles measured in our magnetic measurement lab and shipped to Jordan: view at SESAME hall (30-11-15)



Feb 16 - First SR arc installed in the tunnel
SR installation in progress



1. INFRASUPP-01-2016: call reminder

FOCUS: “Support the training needs of the Synchrotron light for Experimental Science and Applications (SESAME) facility located in Jordan and the staff exchange with other European light source infrastructures to ensure its optimal use by the research community for world-class research.”

This is a “Coordination and Support Action” thus with a reimbursement rate of 100 % of eligible costs. Discussion at the end of 2015 with the European Commission confirmed a certain number of points:

- The activities undertaken in the frame of the project must be useful to SESAME and the region in which it is situated, as well as being of interest to the project partners thereby providing a two-way benefit;
- EC funds available for call: up to **2 M€**;
- The duration of the project is expected to be of up to four years (four years also covers partly SESAME phase two beamlines).

Call deadline is 30 March 2016. If funded, work could start early 2017.

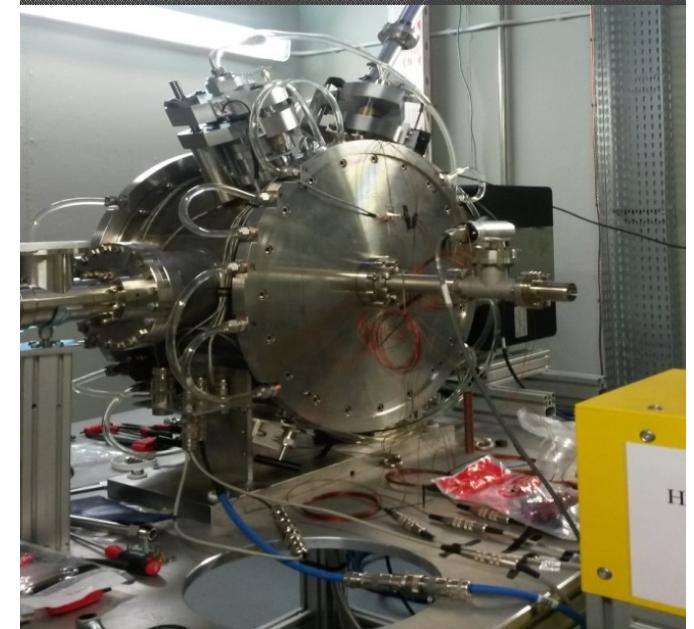
High Power RF Laboratory

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Cavity inside the Bunker

**IFMIF Buncher cavity built
by CIEMAT
in ALBA RF Lab (2014)**



Vacuum Laboratory

Specialized in Ultra High Vacuum: design, construction and tests.

nal Beam
ntation
ce IBIC

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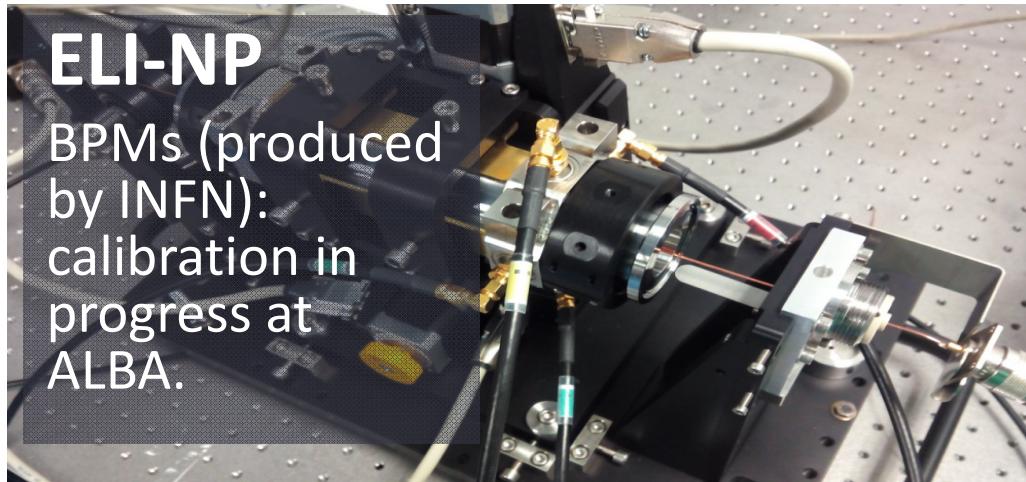


*Collaboration
with other
research
centers, as
MaxIV, CLPU,
ELI-NP*





International and national on-going collaborations - examples



Accelerator
Research and
Innovation for
European
Science and Society

On EuCARD2 wake

International Beam
Instrumentation
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EU H2020 Project EuroCirCol

- WP4: Cryogenic Beam Vacuum System



Collaboration with CLIC-CERN:

- | | |
|------|------------------------------------|
| WP1: | Damping Ring Stripline Kicker test |
| WP2: | Collective Effects |
| WP3: | Beam Instrumentation & Diagnostics |
| WP4: | 1.5 GHz RF System |





ARIES - ADA

International
Instrument
Conferenc
11 - 15 September 2016



European Union funded Topical Workshops on actual Beam Diagnostics Issues

ARIES: Accelerator Research and Innovation for European Science and Society

➤ Covering many innovative topics within the entire accelerator science (2017-2021)

ADA: Advanced Diagnostics at Accelerators

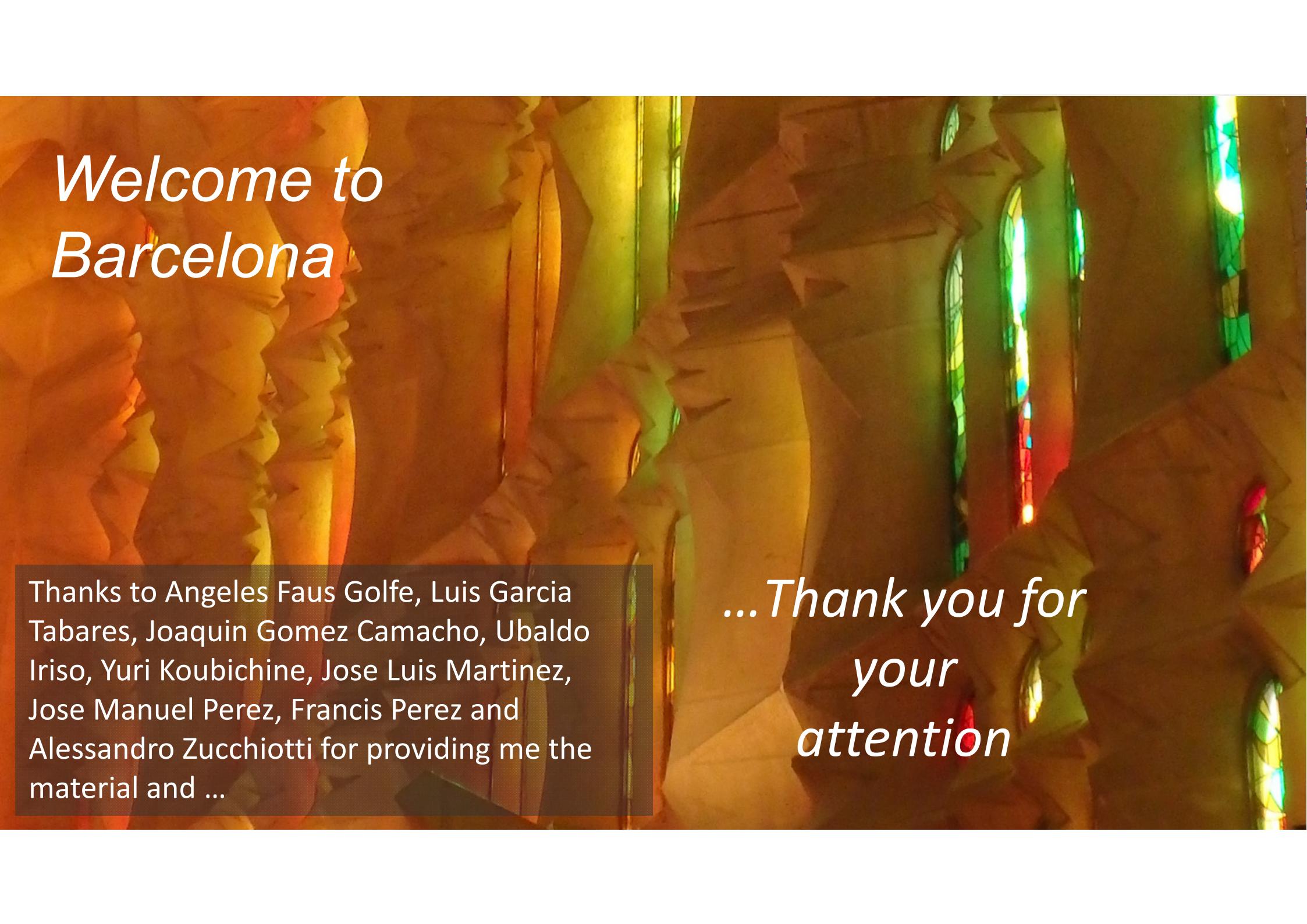
Network on innovative diagnostics – TASKs:

- ***hadron LINACs***: Peter Forck, GSI
 - ***hadron synchrotrons*** : Rhodri Jones, CERN
 - ***synchrotron based light sources***: Francis Perez, ALBA
 - ***LINAC based light sources***: Kay Wittenburg, DESY
- ⇒ Your are warmly welcome to propose subjects, to contribute to the workshops, strengthen the collaboration and enlarge the knowledge within our community

Spanish Accelerator R&D

In conclusion:

*User facilities, R&D groups, University groups, proposals for new facilities, large number of international and national collaborations, sharing of laboratories and infrastructures
About 200 people working in accelerator science*

The background image shows the interior of the Sagrada Família, featuring Gaudí's signature organic architecture with large, undulating columns and walls. Sunlight streams through numerous stained-glass windows in various colors like red, green, blue, and yellow, creating a vibrant play of light and shadow throughout the space.

Welcome to Barcelona

Thanks to Angeles Faus Golfe, Luis Garcia Tabares, Joaquin Gomez Camacho, Ubaldo Iriso, Yuri Koubichine, Jose Luis Martinez, Jose Manuel Perez, Francis Perez and Alessandro Zucchiotti for providing me the material and ...

*...Thank you for
your
attention*