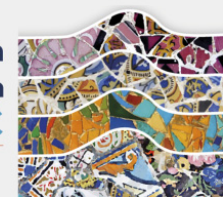




WELCOME

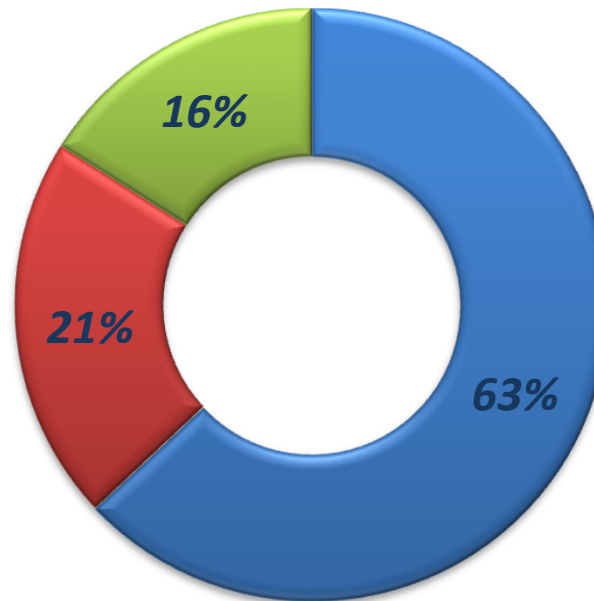
International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona





WELCOME

to ≈ 350 participants



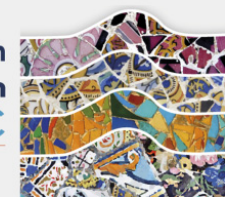
■ Europe ■ America ■ Asia



WELCOME

to 32 industrial exhibitors

International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona



Stand 1:



Stand 2:



Stand 3:



Stand 4:



Stand 17:



Stand 18:



Stand 19:



Stand 20:



Stand 5:



Stand 6:



Stand 7:



Stand 8:



Stand 21:



Stand 22, 23 & 24:



Stand 25:



Stand 9:



Stand 10:



Stand 11:



Stand 12:



Stand 13:



Stand 14:



Stand 15:



Stand 16:



Stand 27:

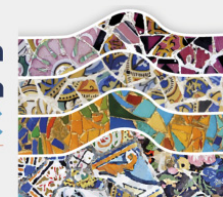


Stand 28:

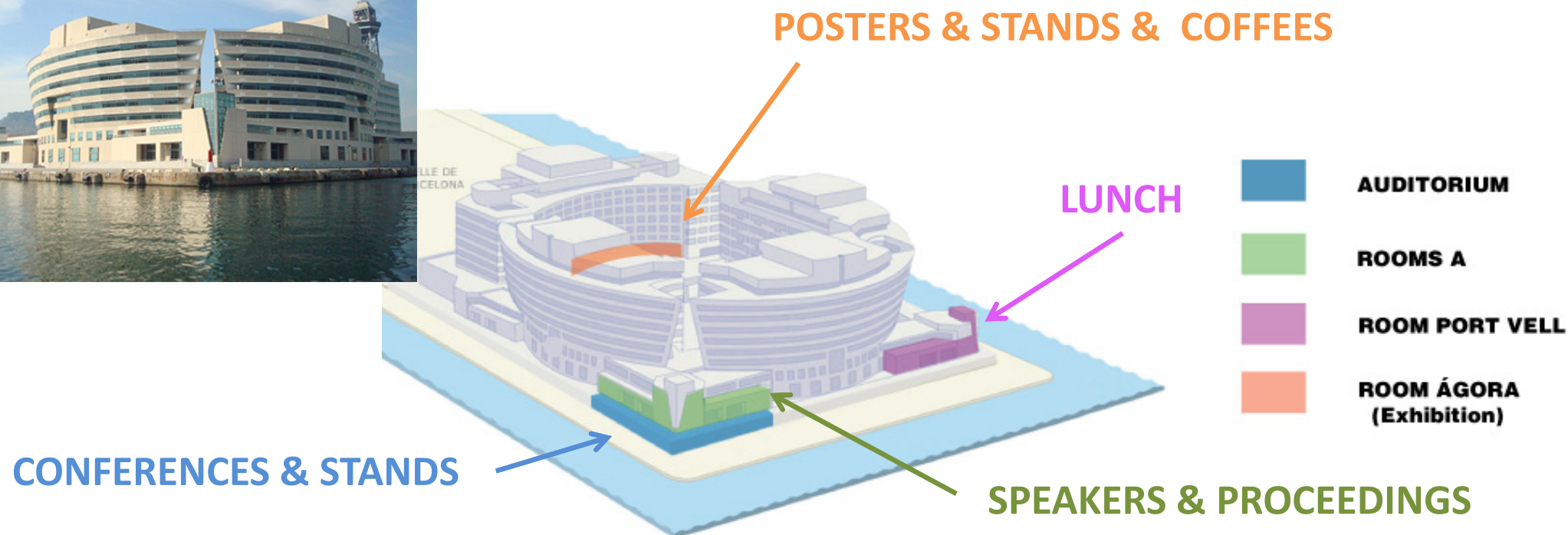


Stand 29:





WELCOME to the World Trade Center





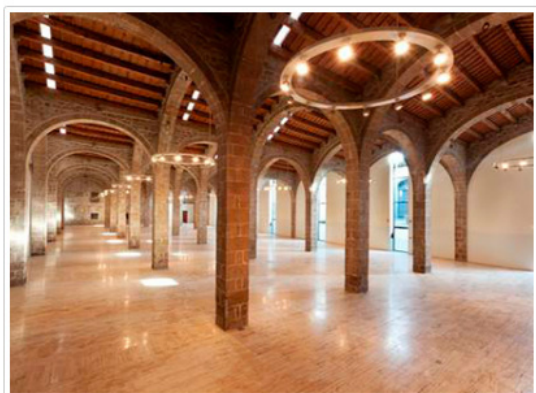
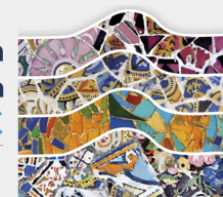
261 contributions



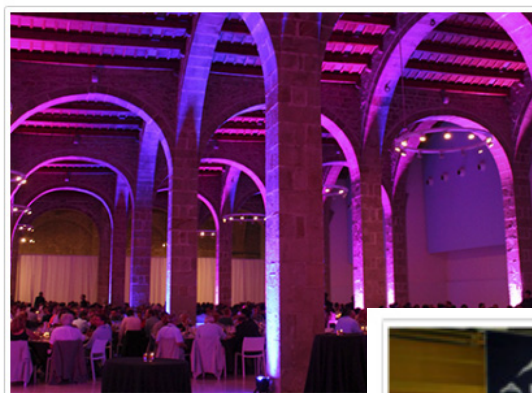


WELCOME to enjoy

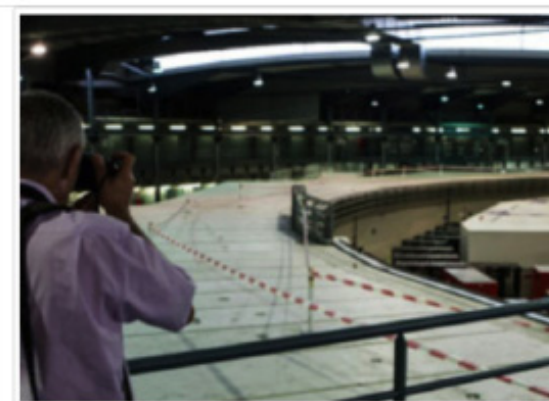
International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona



Banquet



ALBA Visit





WELCOME
to

International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona



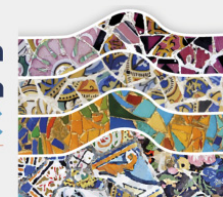
International Beam
Instrumentation
Conference **IBIC**

11 - 15 September 2016 Barcelona





International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona



Accelerator R&D in Spain

Caterina Biscari
ALBA-CELLS



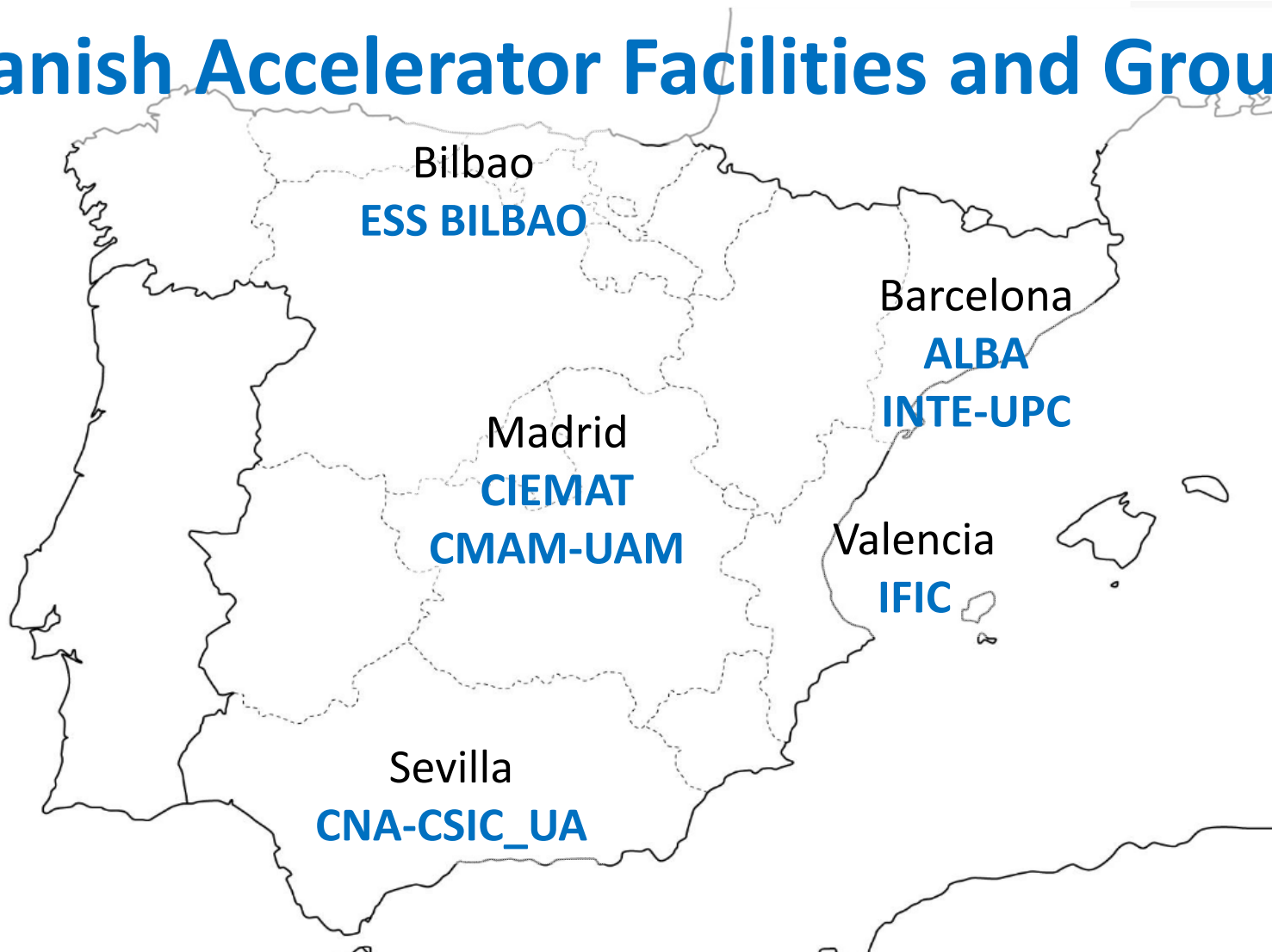
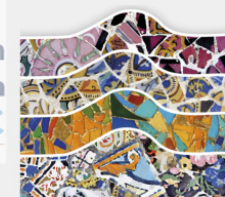
IBIC 2016 – Barcelona – 11-15 September 2016





Spanish Accelerator Facilities and Groups

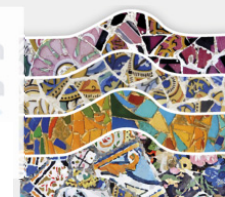
al Beam
tation
le IBIC
Barcelona



CONECTA – Coordination of activities of the Accelerator Community in Spain

Operating/in commissioning Accelerators

International Beam
tion
BIC



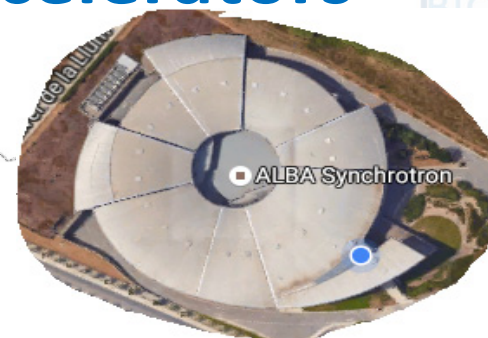
SC Cyclotron- construction at CIEMAT



Tandem at CMAM-UAM



Microtron UPC



ALBA - Light source



**Tandem
Cyclotron,
Tandetron at CNA**

Main contributions to other projects

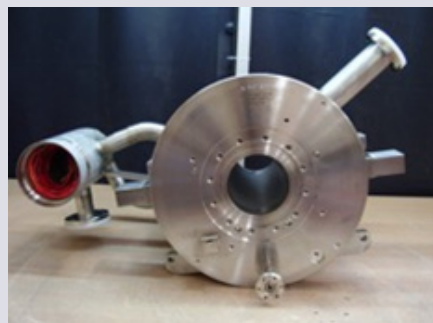
Electrical Engineering Division

International Beam Instrumentation Conference IBIC
September 2016 Barcelona



E-XFEL

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



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

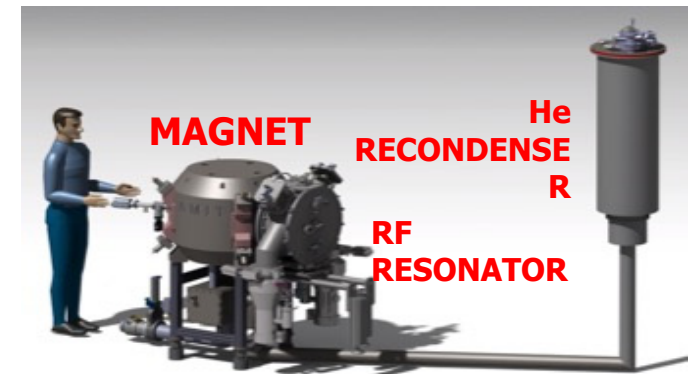


Calculations, Engineering design, Prototyping, Tests



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



FUSION
FOR
ENERGY



Laboratorio
Nacional
de Fusión
Ciemat

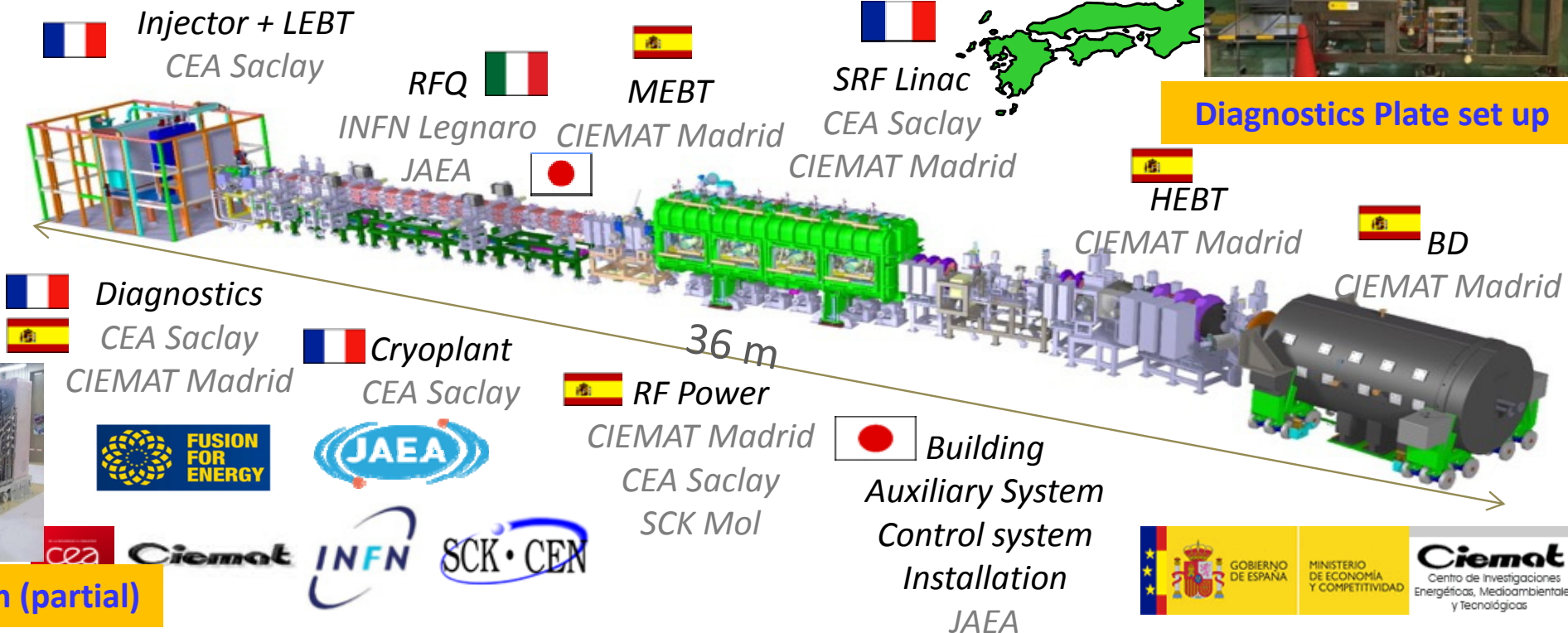


11 - 13 September 2010 Barcelona

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



Diagnostics Plate set up



RF power system (partial)



IFMIF-DONES

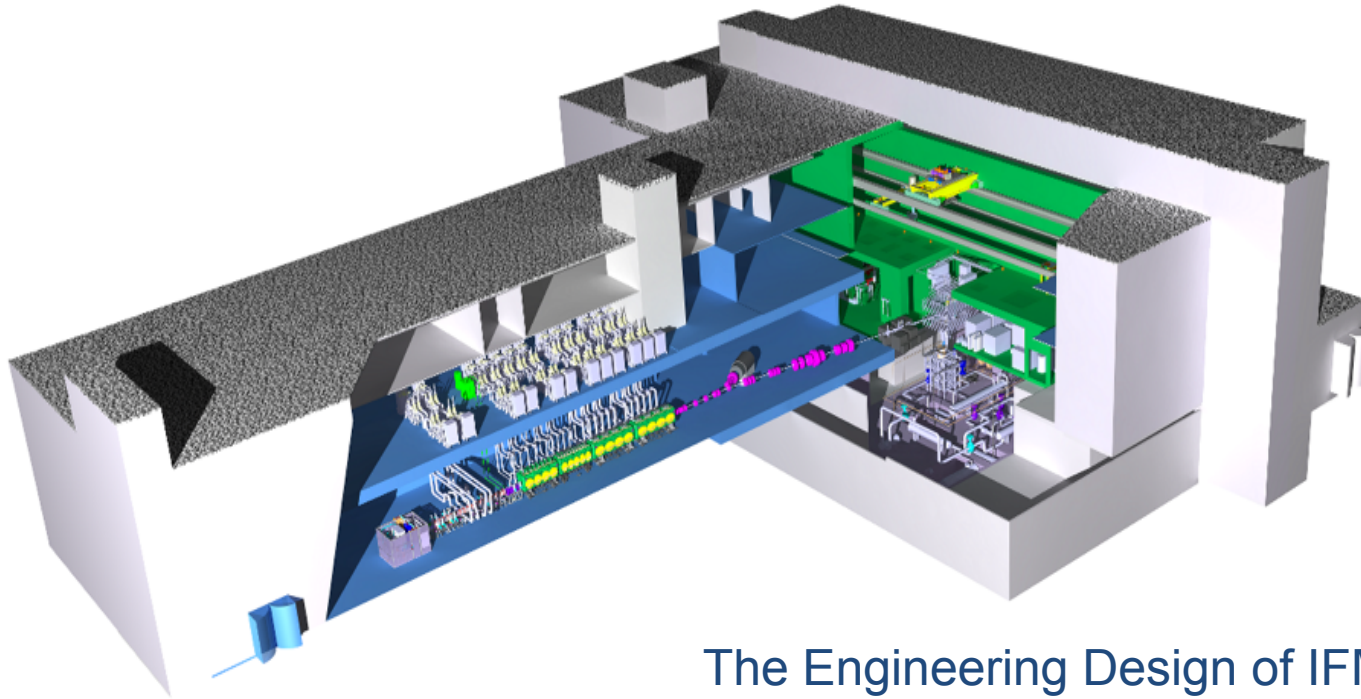


11-15 September 2016 Barcelona



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/>

International Beam
Instrumentation
Conference IBIC

11 - 15 September 2016 Barcelona

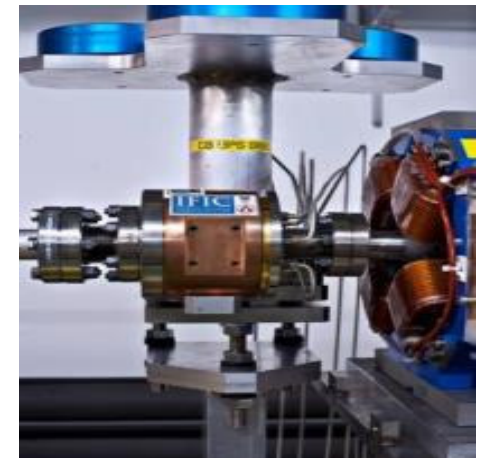
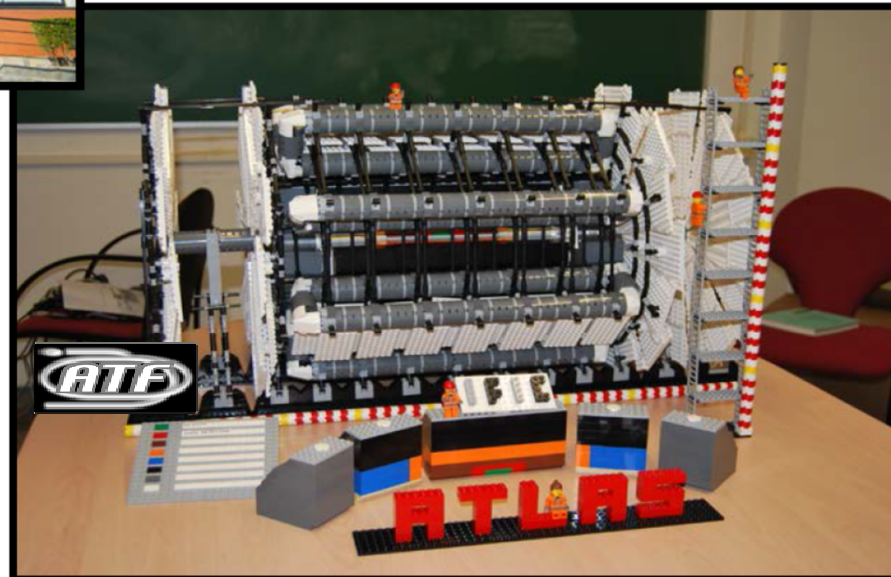
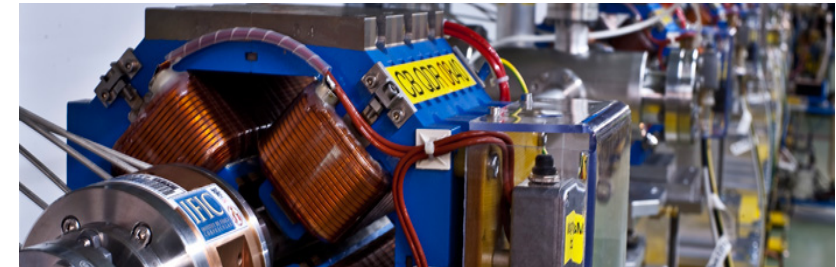


Several
COLLABORATORS



9 PEOPLE

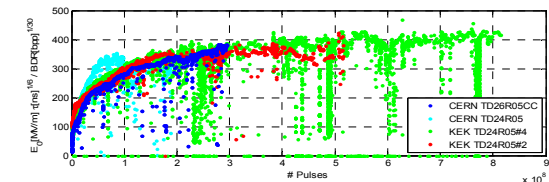
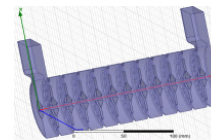
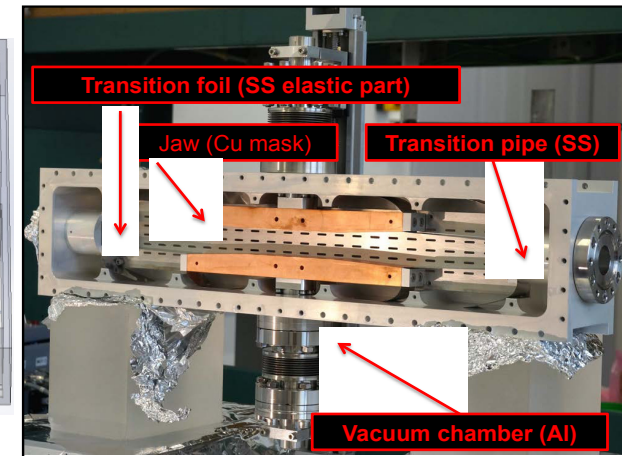
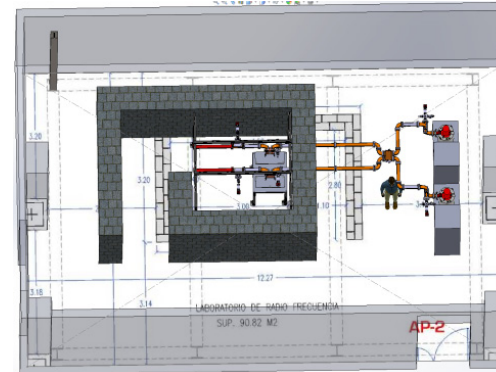
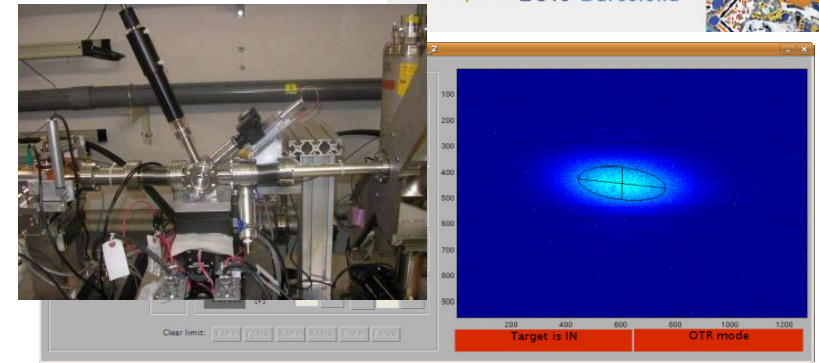
Beam optics
Beam instrumentation





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

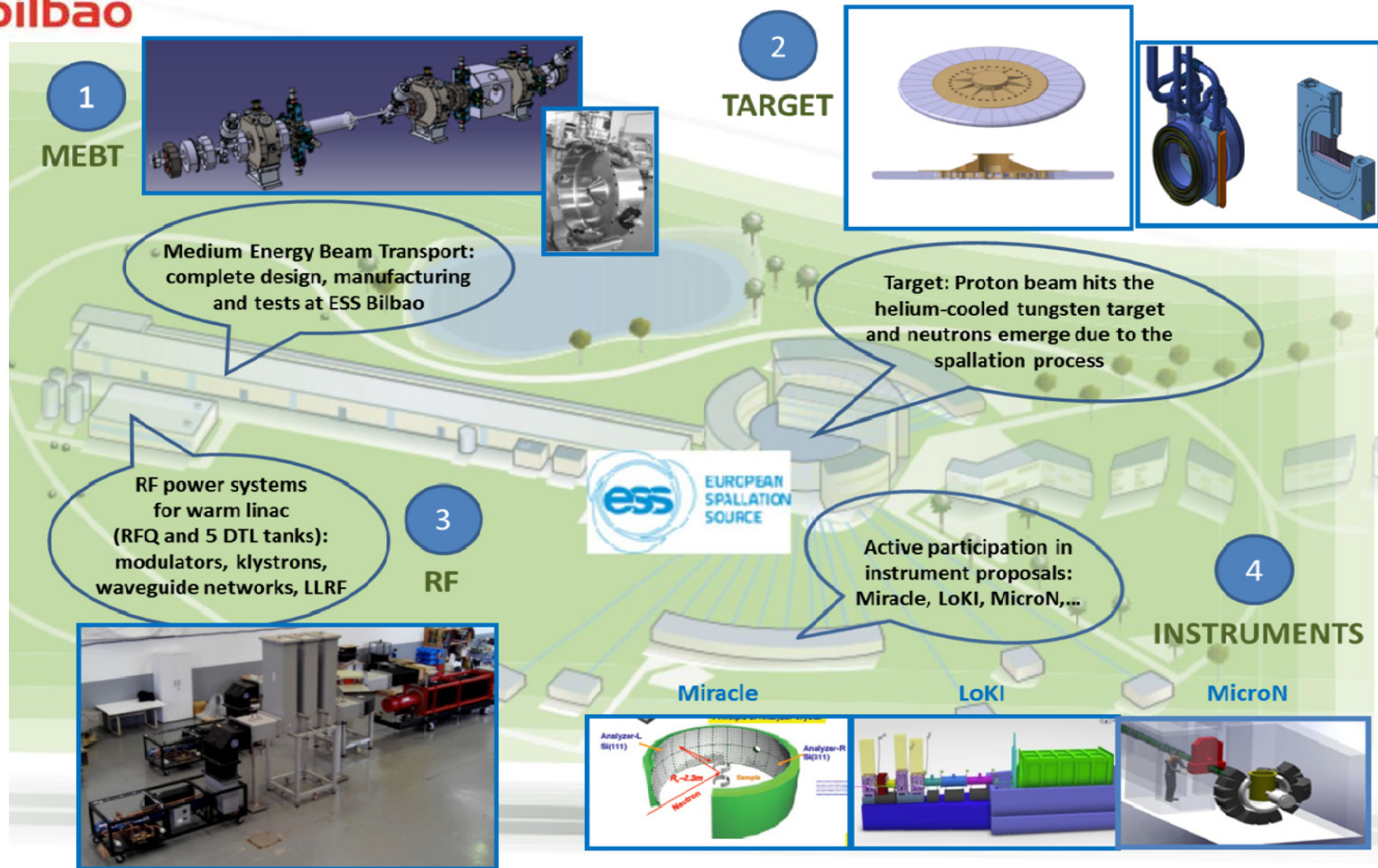
- ❖ **CAPABILITIES:** design, prototyping, manufacturing and test
- ❖ **FIELDS:** Accelerator, Target, Neutron Instruments
- ❖ **TECHNOLOGIES:** ion sources, cavities, magnets, RF design and test, control and diagnostics, high vacuum, neutronic design, mechanical design and manufacturing, welding,...



ESS
bilbao

SPANISH CONTRIBUTION TO ESS

eam
ion
BIC
lona





Centro de Micro Análisis de Materiales

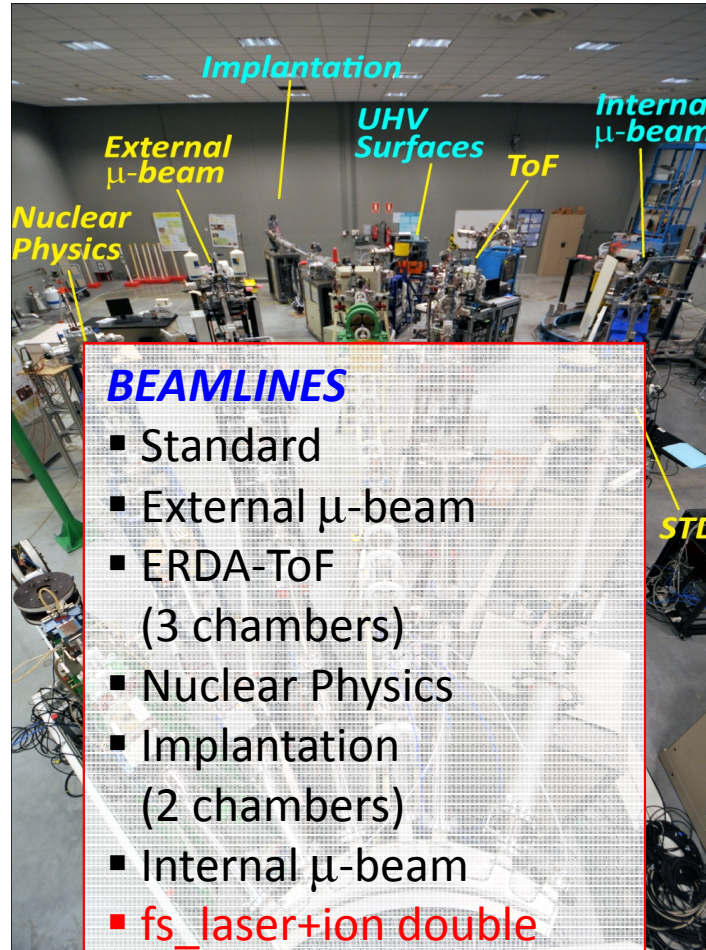
International Beam
Instrumentation
Conference IBIC



A team of 24

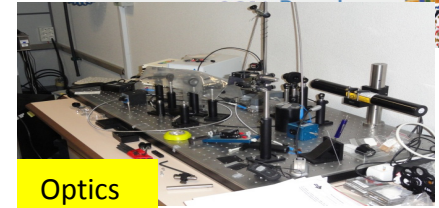


5MV CW tandem

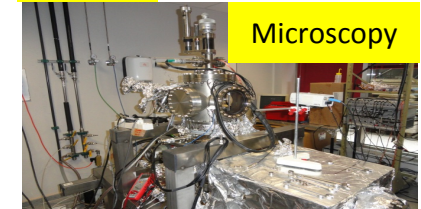


BEAMLINES

- Standard
- External μ -beam
- ERDA-ToF (3 chambers)
- Nuclear Physics
- Implantation (2 chambers)
- Internal μ -beam
- fs_laser+ion double irradiation (in commiss.)



Optics



Microscopy

ANCILLARY LABS

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

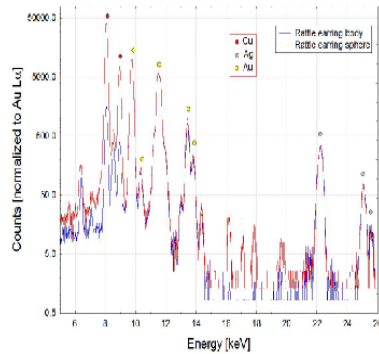


Our Research

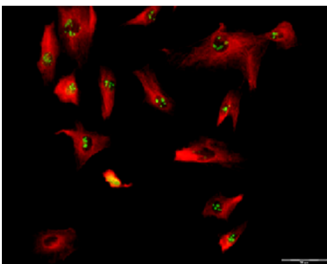
Accelerator
Technology



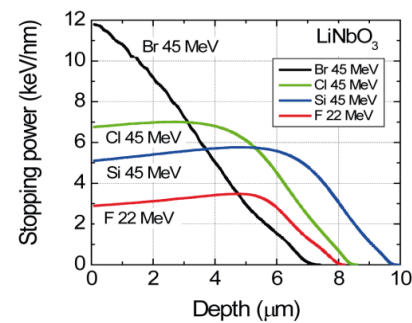
Archaeometry



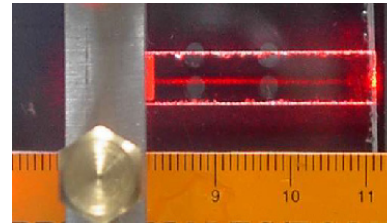
Biophysics



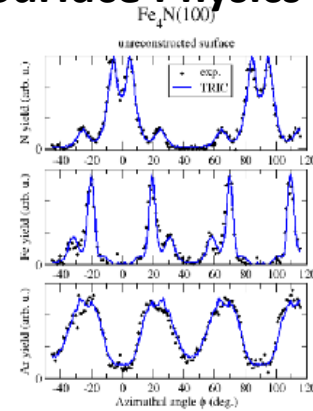
Ion-Solid Interactions



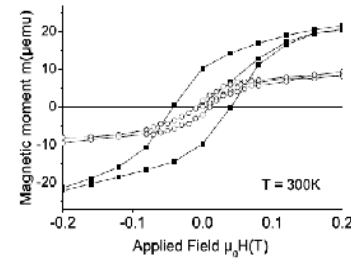
Photonics



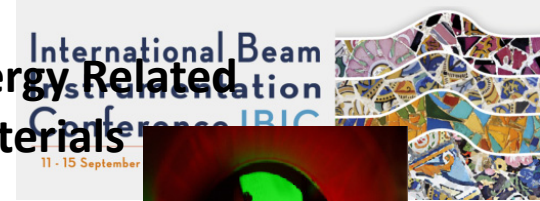
Surface Physics



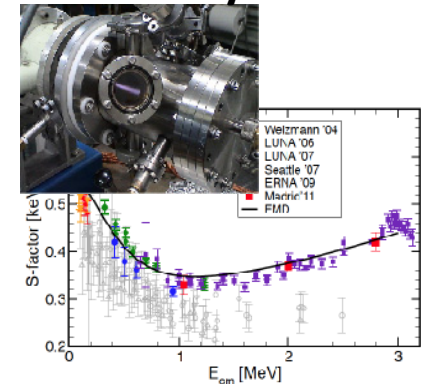
Solid State Physics



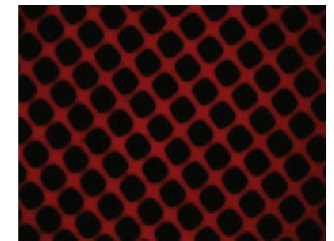
Energy Related
Materials



Nuclear Physics

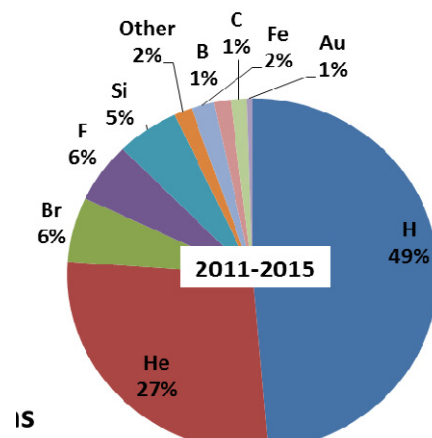
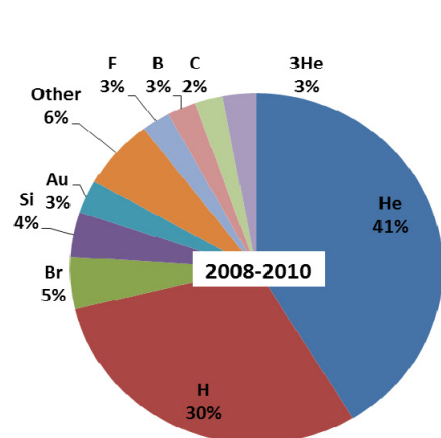
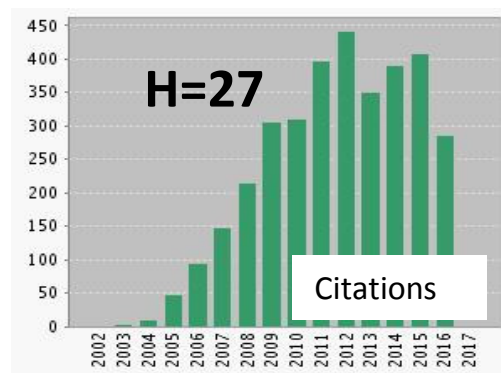
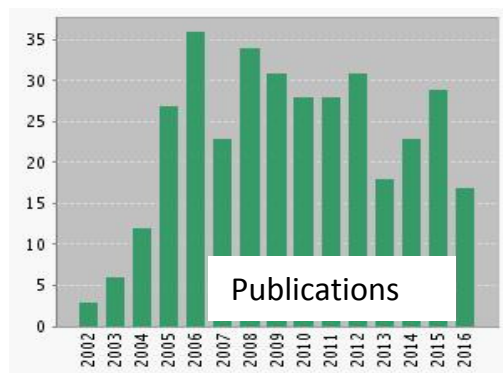


Micro-patterning

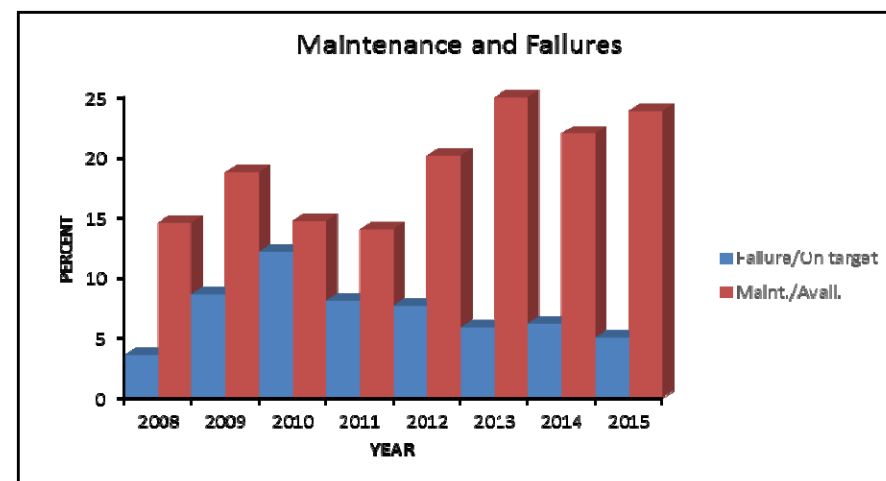
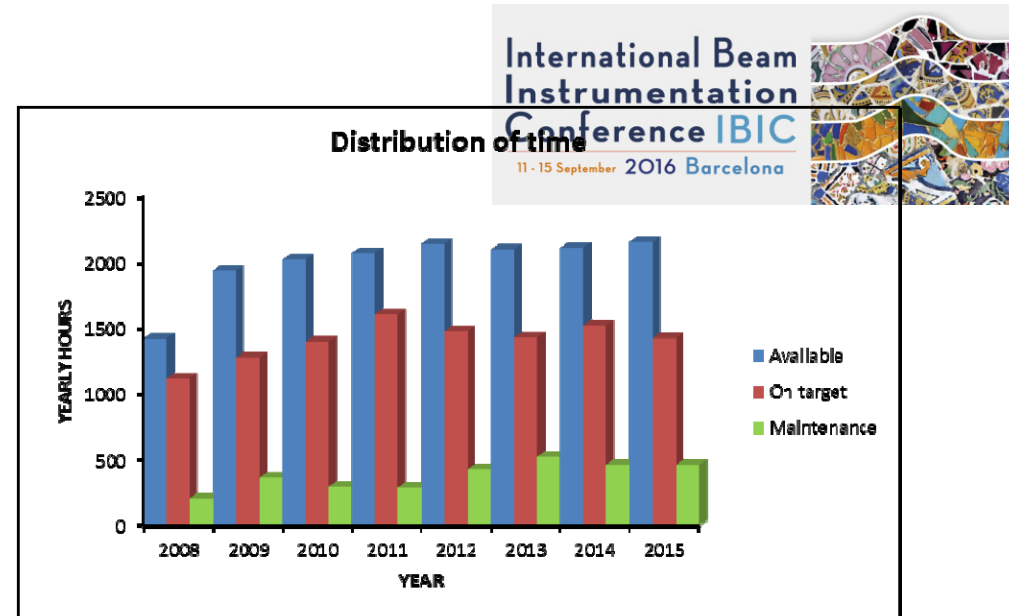


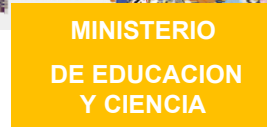


Some Statistics



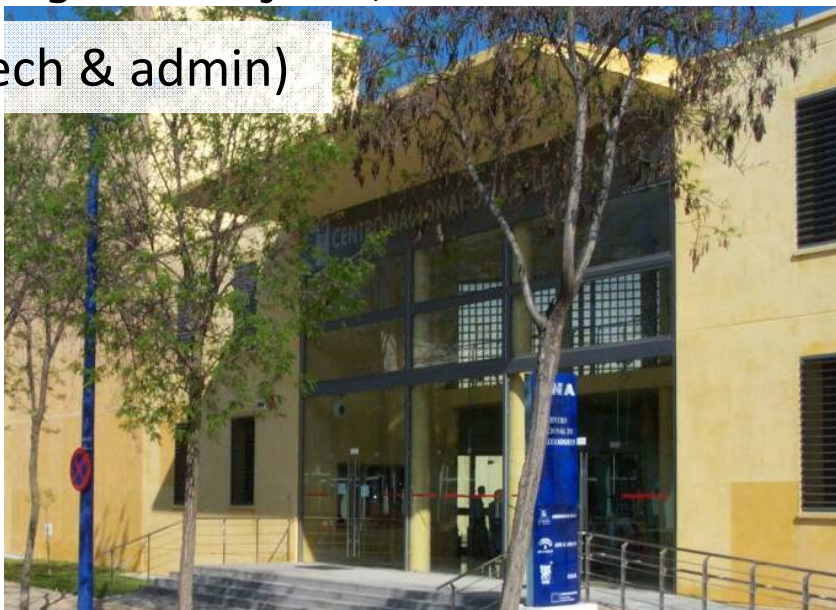
Ions produced





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, ICMIM-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)**

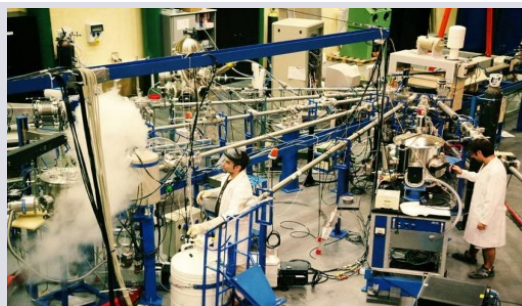
Main utilization of the 4 accelerators

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
archaeology and
cultural heritage

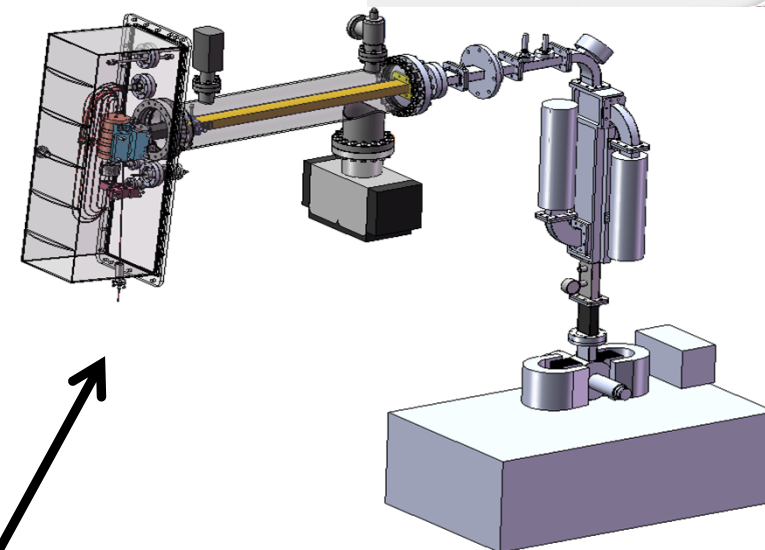


Microtron project at the INTE-UPC

- 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



3D image of the interior of the accelerator head / vacuum chamber



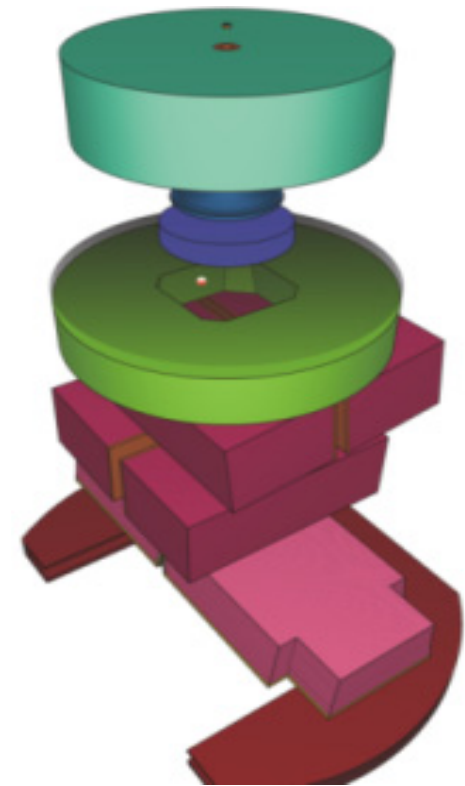
Parameters principals	
Beam energies	6, 8, 10, 12 MeV
Operating frequency	5712 MHz
Energy gain per turn	2 MeV
Fields in the end magnets	0.8 T
Pulsed RF power	<750 kW
RTM head dimensions	578×200×123 mm
RTM head weight	~ 100 kg

- 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

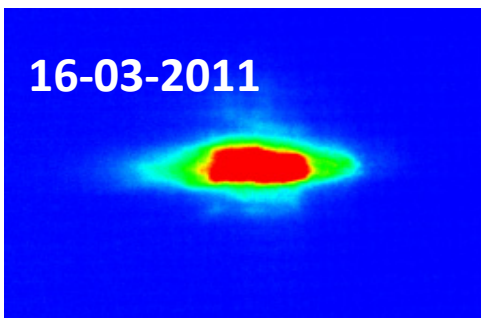




International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona



16-03-2011



7-05-2012

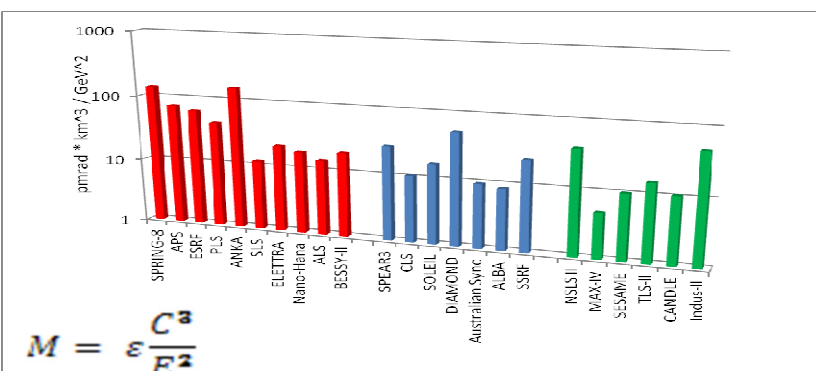
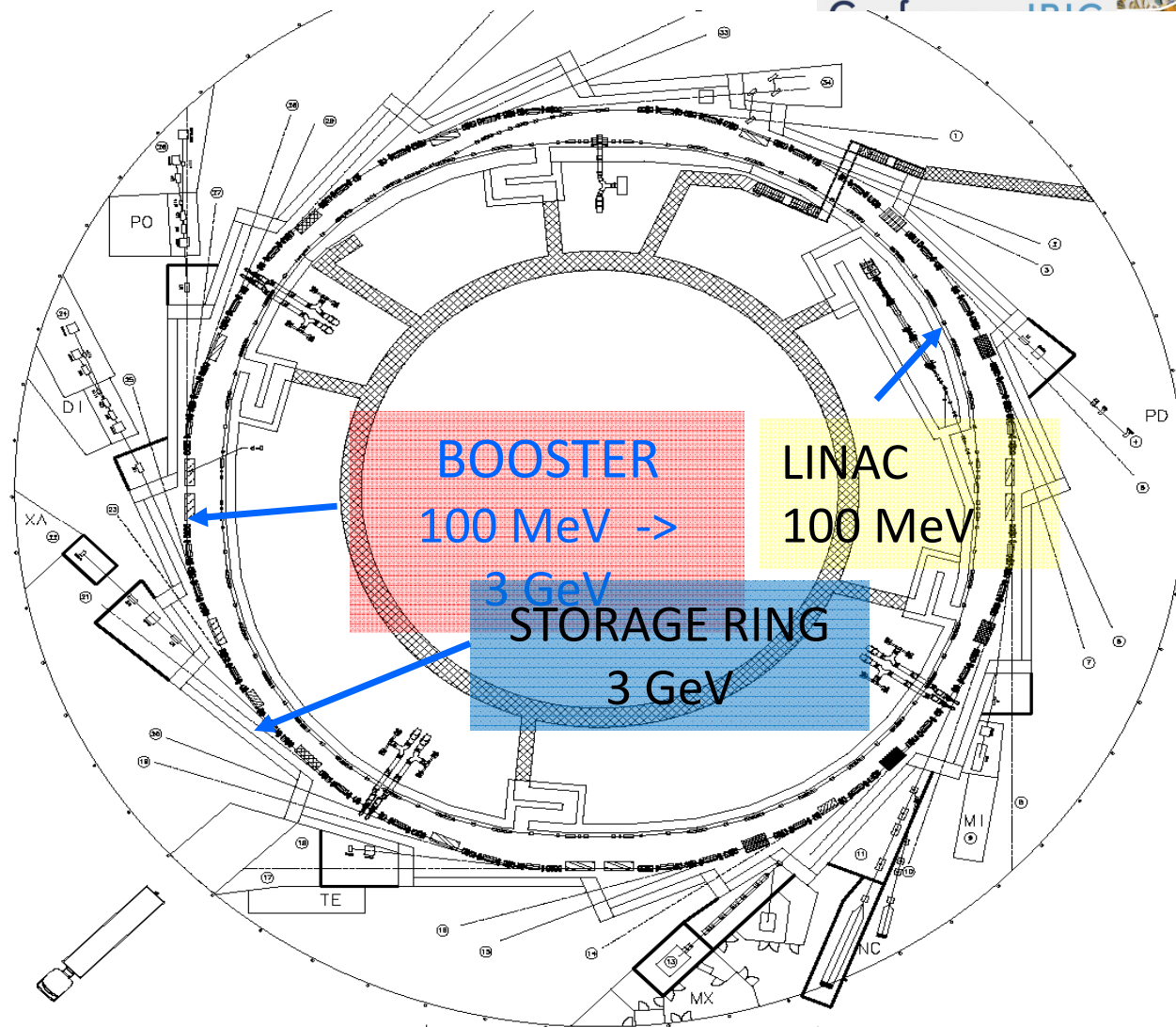


ALBA Accelerators

International Beam
Instrumentation

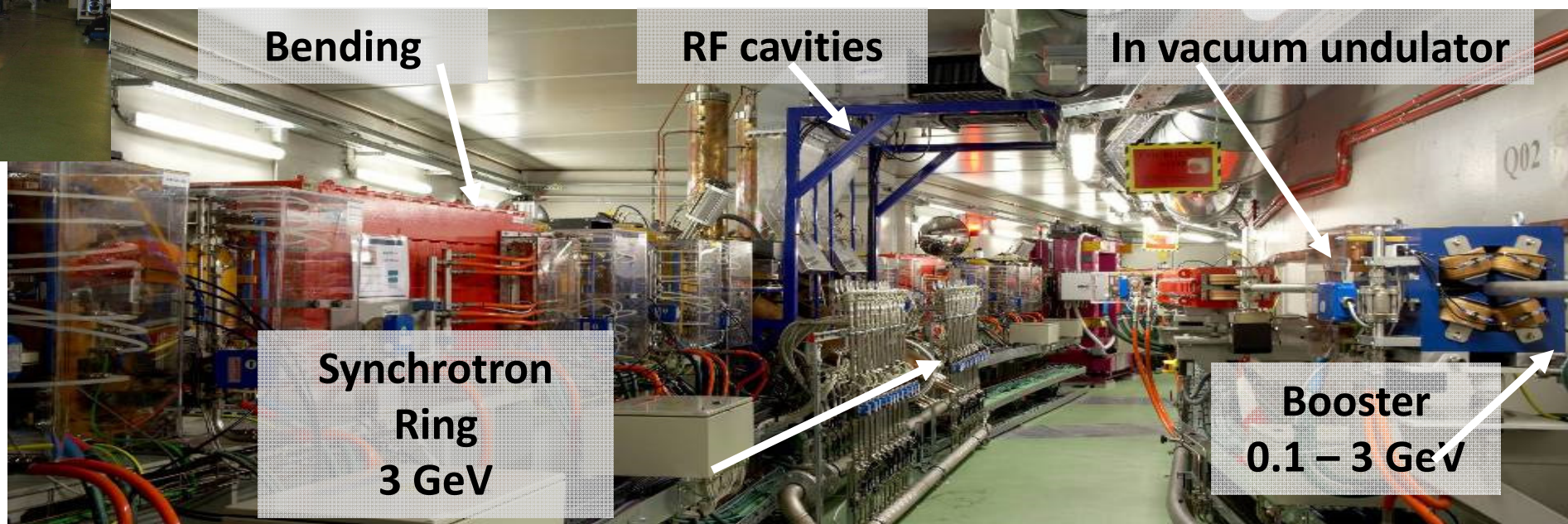


Parameter	Value
Energy	3 GeV
Circumference	269 m
Emittance	4.3 n mrad
Nominal Current	250 mA
Rf frequency	500 MHz
# cavities	6
Long straights	4 (8 m)
Medium straights	12 (4 m)





International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona



Bending

RF cavities

In vacuum undulator

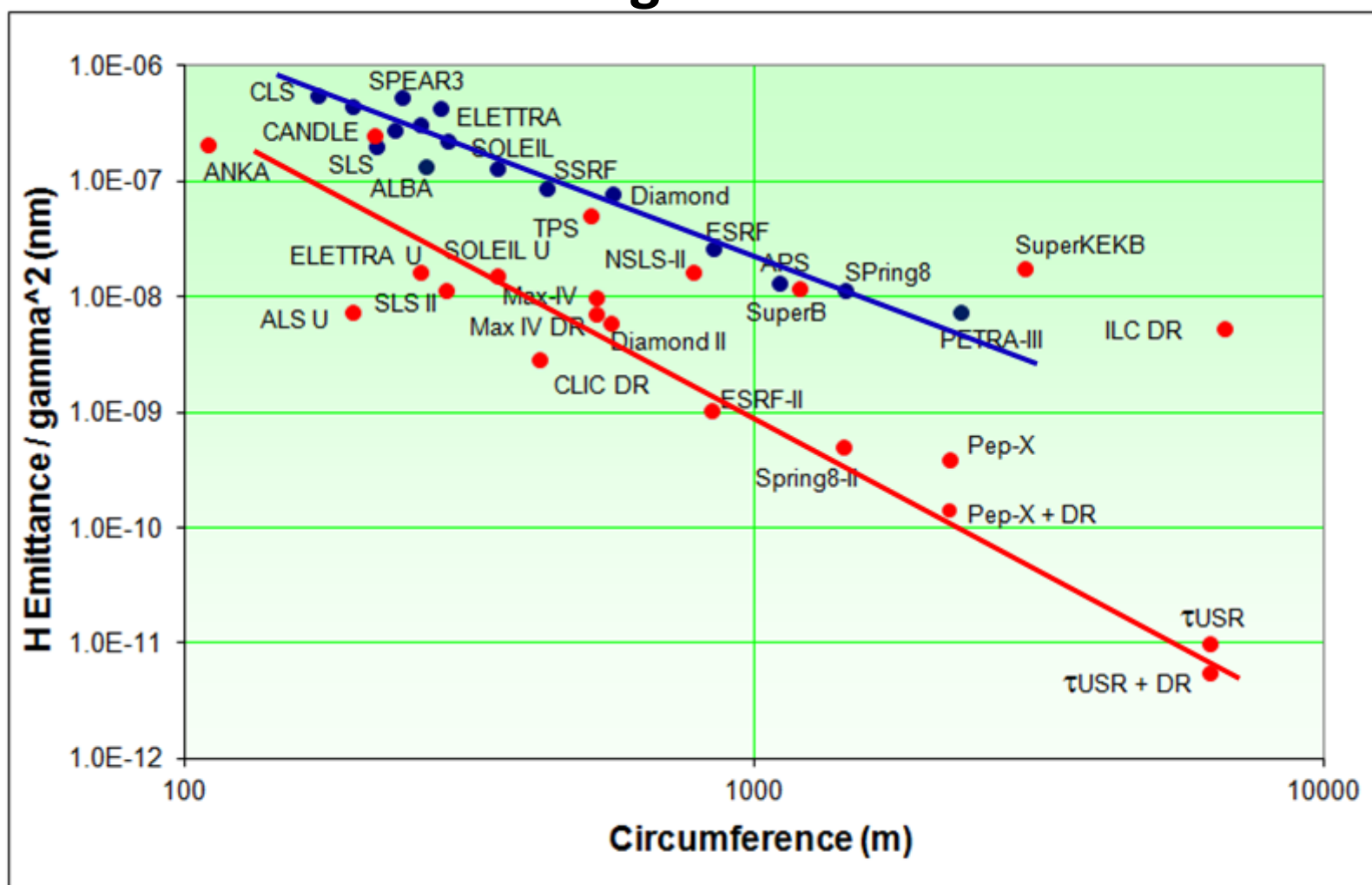
Synchrotron
Ring
3 GeV

Booster
0.1 - 3 GeV

Emittance of 3rd generation and DL SL

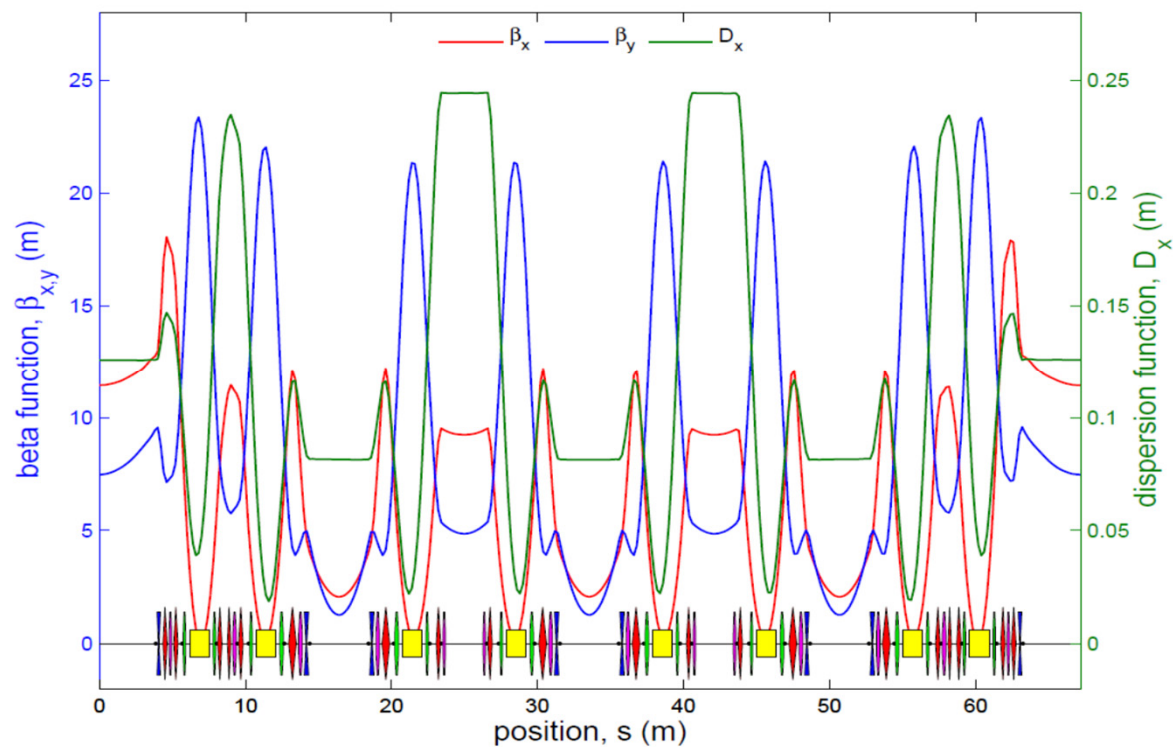
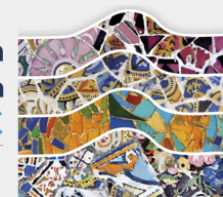
International Beam

tion
BIC
celona



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

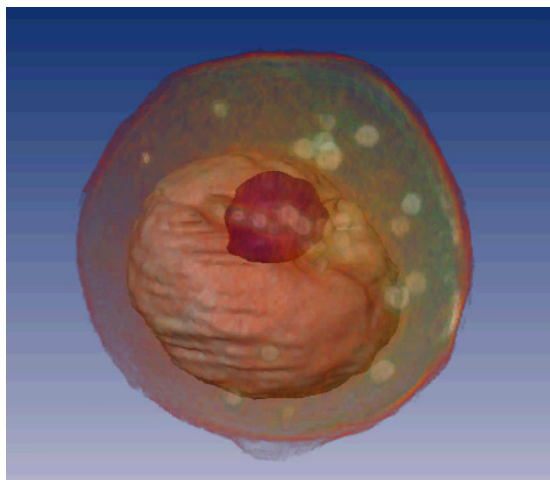


by D.Einfeld

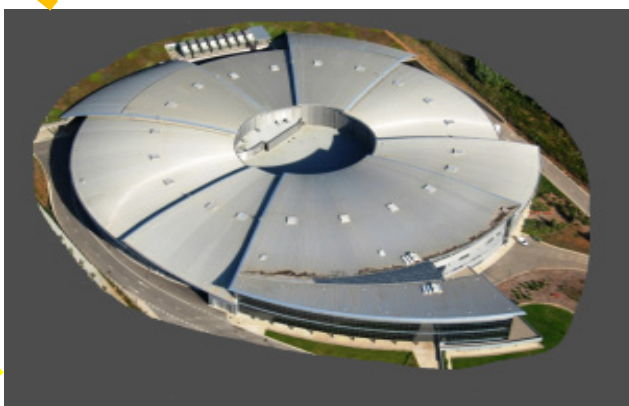
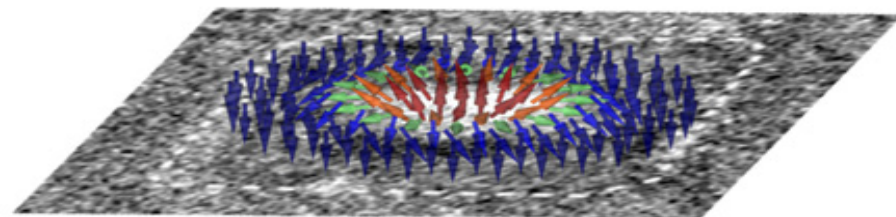
E [GeV]	3
C [m]	268.8
Q_x	18.19
Q_y	8.24
ϵ_x [nm rad]	4.3
ξ_x	-34
ξ_y	-24.5
α_p	8.4×10^{-4}
a_2	2.5×10^{-3}
$\delta E/E$	1.05×10^{-3}
$J_x/J_y/J_E$	1.3/1/1.7
$t_x/t_y/t_E$ [ms]	4.0/5.3/3.1



International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona



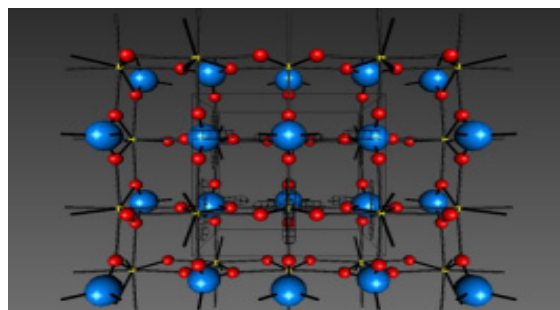
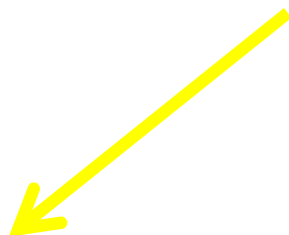
**LIFE
SCIENCE**



**CONDENSED
MATTER**



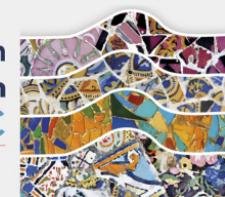
CHEMISTRY



Beamlines

In operation
In construction

eam
ion
BIC



11 - 13 September 2010 Barcelona

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

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

BL22: CLÆSS
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

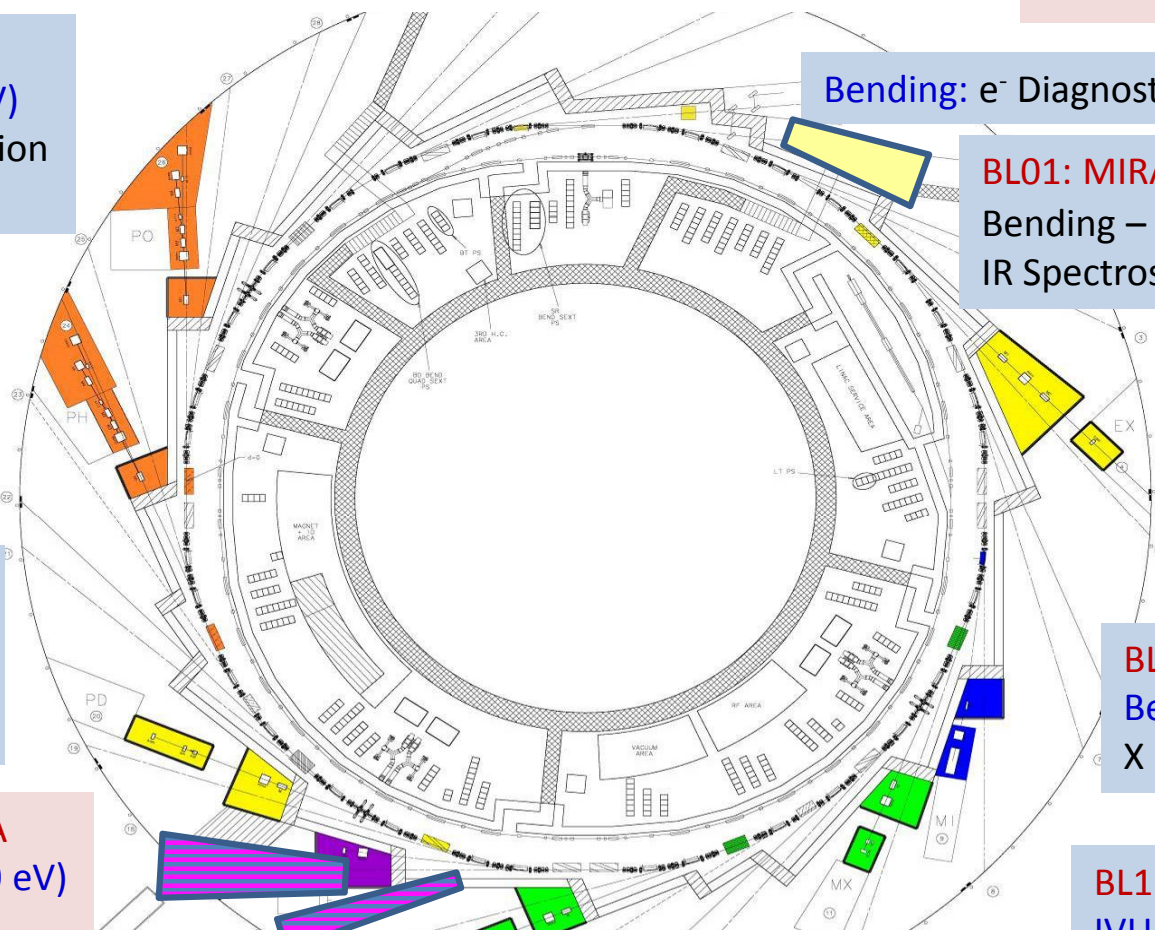
BL01: MIRAS
Bending – (0.4-100 μm)
IR Spectroscopy

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

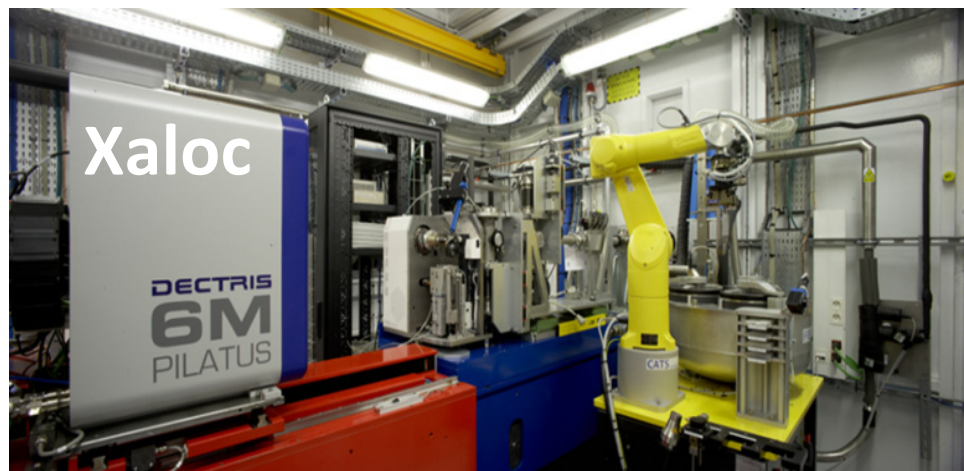
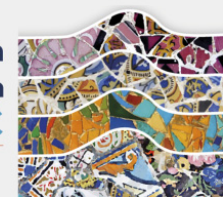
BL13: XALOC
IVU21 – (5-22 keV)
Macromolecular Cristallography





ALBA BEAMLINES

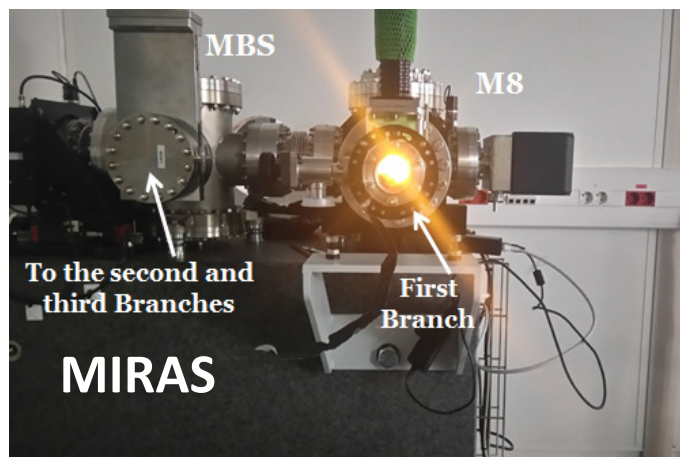
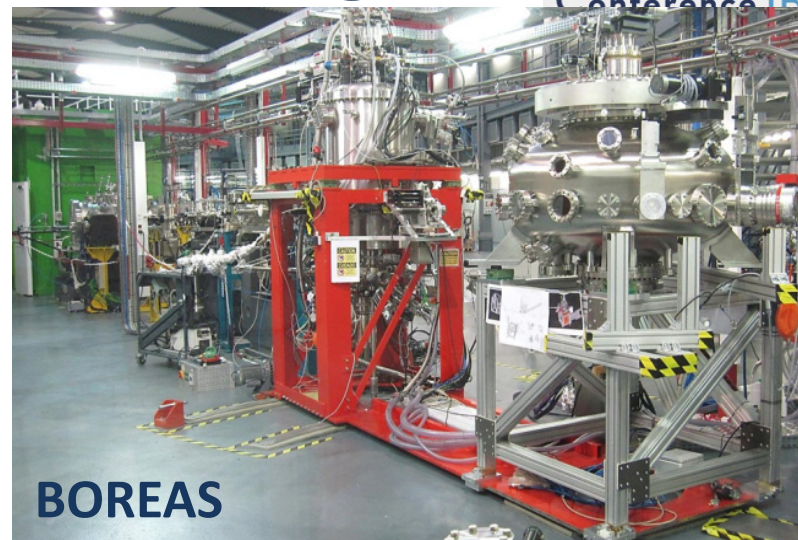
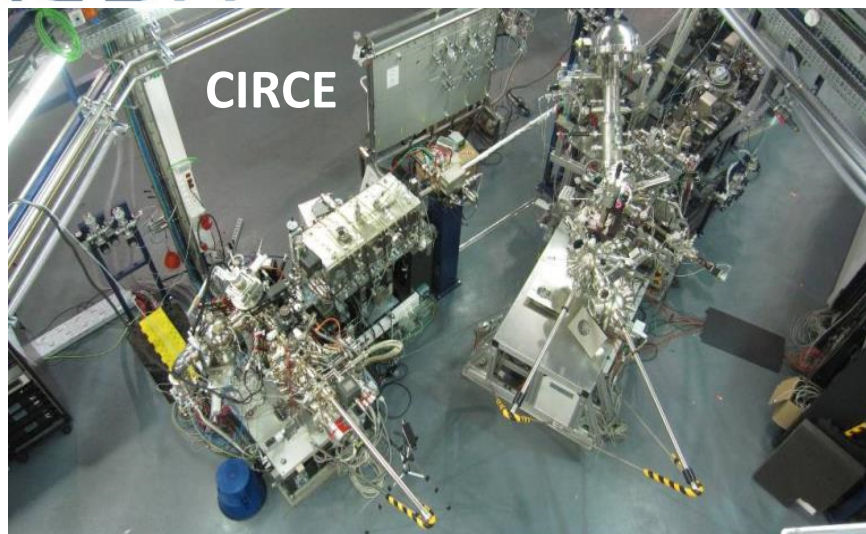
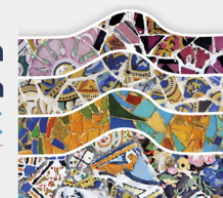
International Beam
Instrumentation
Conference **IBIC**
11 - 15 September 2016 Barcelona





ALBA BEAMLINES

International Beam
Instrumentation
Conference IBIC





Beam Instrumentation at ALBA

International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona



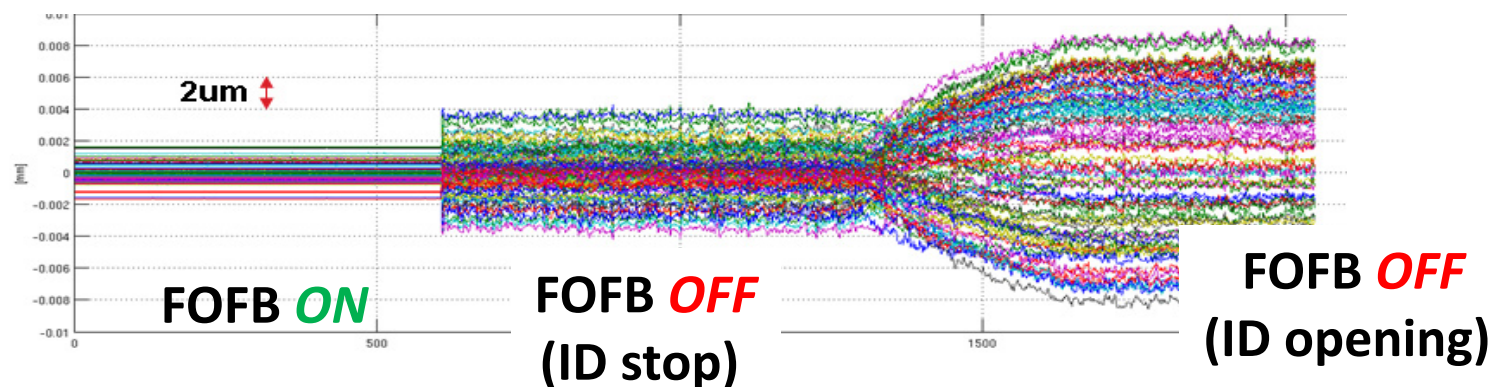
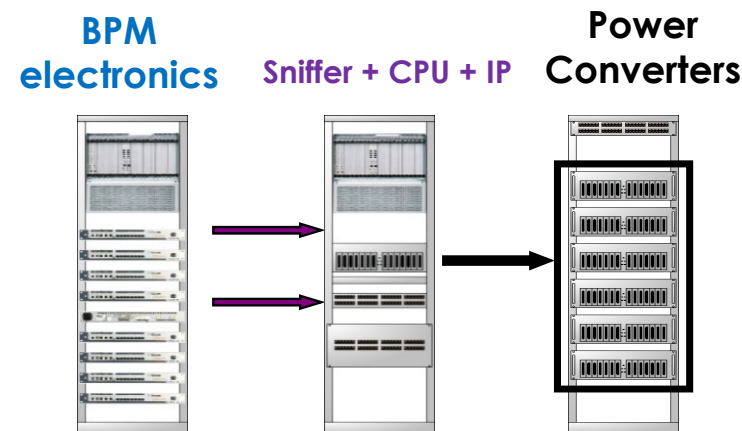
GOAL 1) Guarantee machine operation combining of off-the-shelf products with home-made designs to **optimize** resources

Example: Fast Orbit Feedback

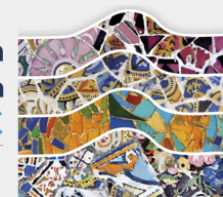
Commercially available BPM electronics /PS control +
Timing boards recycled as position reading nodes

=

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



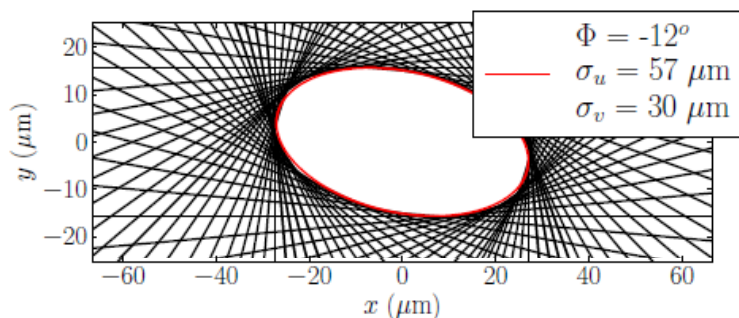
→ See contributions:
WEPD23 (IBIC14)
TUPB046 (IBIC15)
WEPG14 (IBIC16)



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

WEBL03: Own R&D projects

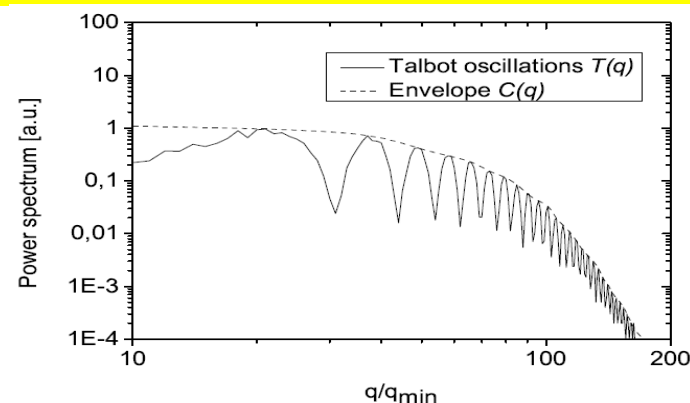
Beam shape reconstruction using interferometry



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

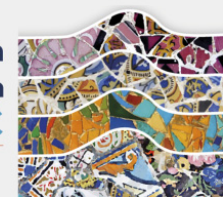


Similar to speckle analysis performed using undulators, now trying to measure the beam size using a dipole source



Beam Instrumentation at ALBA

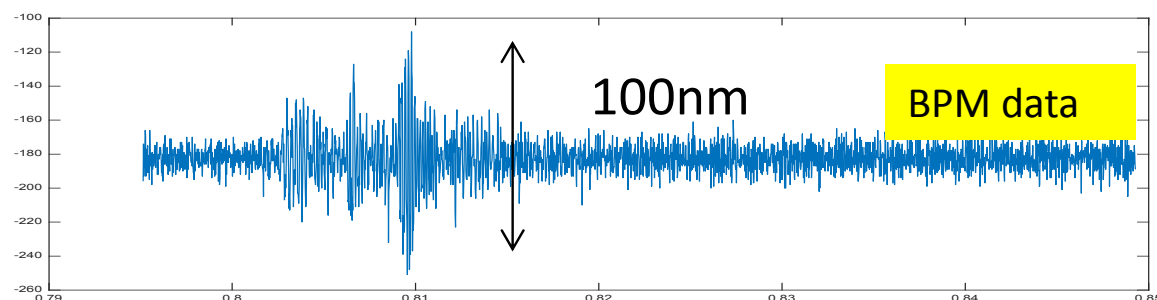
International Beam
Instrumentation
Conference IBIC
11 - 15 September 2016 Barcelona



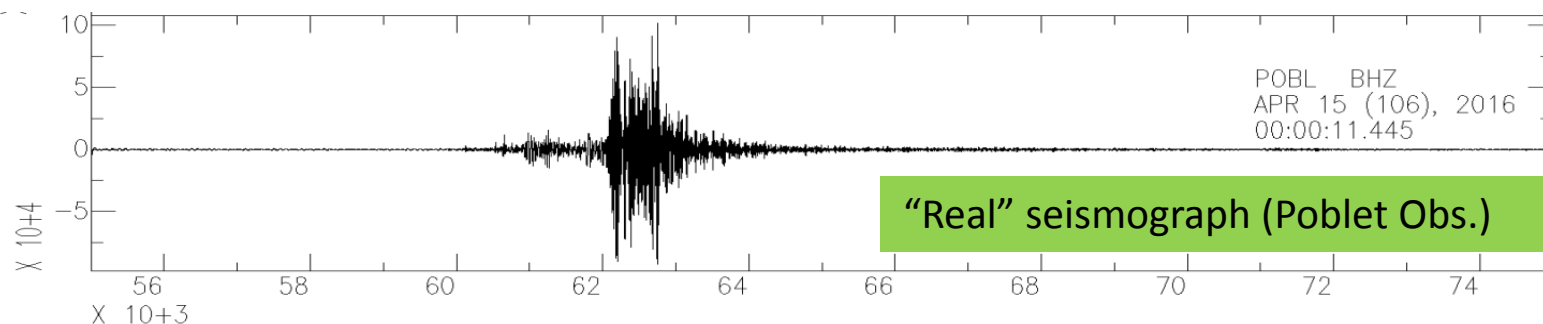
Furthermore... proud to use the whole machine as an instrument

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*

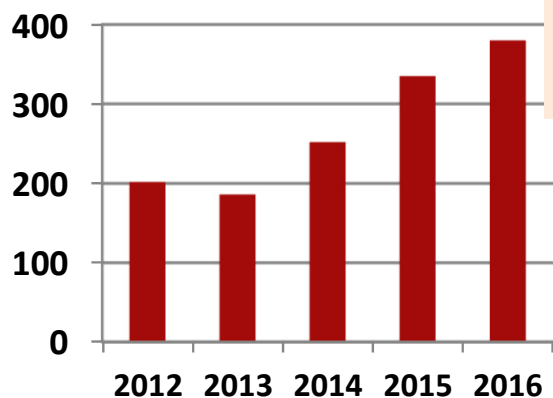
The ALBA Team

We are today 205



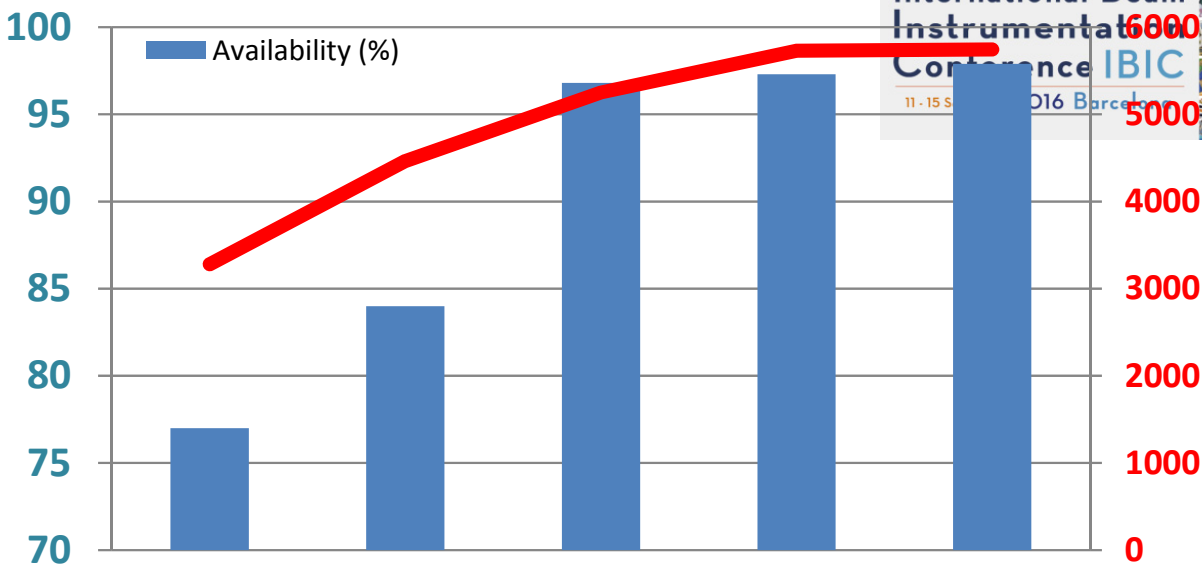
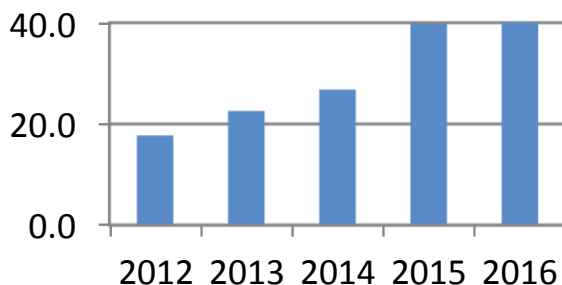
Beam for users

of proposals



Average
overbooking
factor ~ 2

International percentage



International Beam
Instrumental
Conference IBIC
11-15 September 2016 Barcelona



	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*

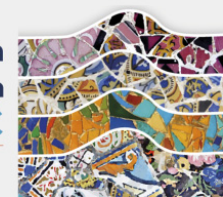
* Until August 16



The ALBA Accelerator Team Expertise

Inside ALBA Dampy Cavity

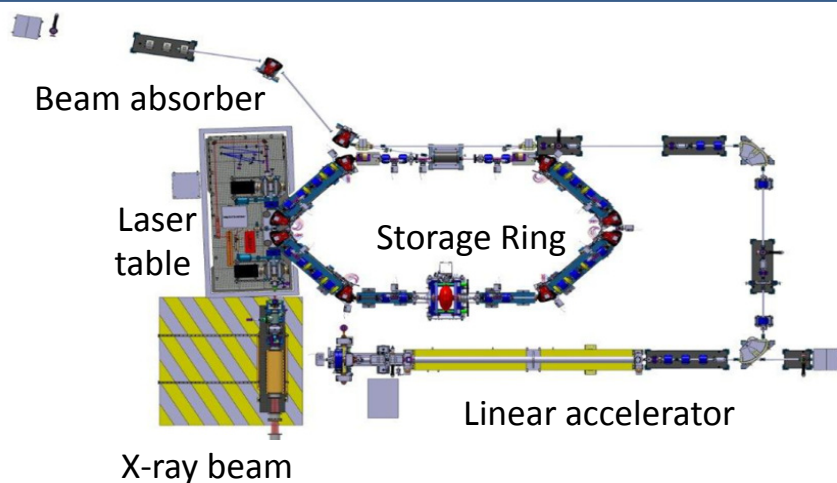
International Beam
Instrumentation
Conference IBIC
September 2016 Barcelona



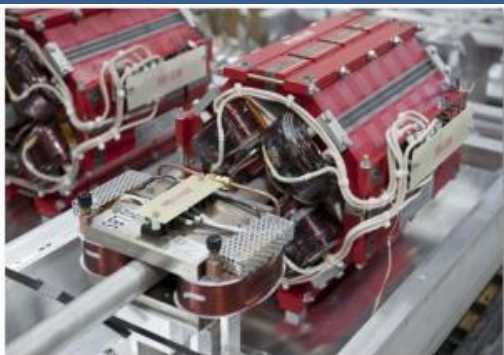
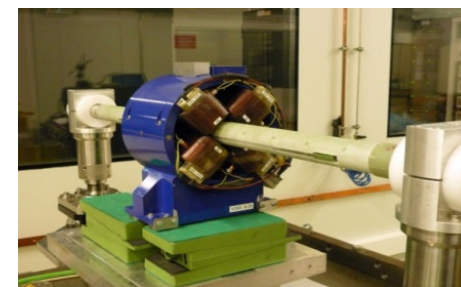
- Accelerator beam dynamics
 - Accelerators operation
- RF systems and test laboratory
- Magnetic structures design and measurements laboratory
- Ultra High Vacuum systems design and test laboratory
 - Beam diagnostics and test laboratory
- Real time control systems and data acquisition
- High power 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...)



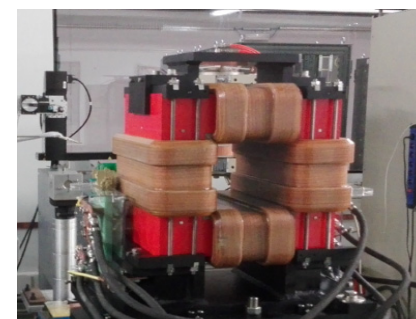
Measurement of ThomX project dipoles and quadrupoles



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.”

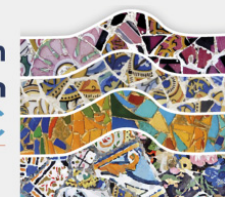
This is a “Coordination and Support Action” thus with a reimbursement rate of 100 % of eligible costs. Discussion at the end of 2015 with the European Commission confirmed a certain number of points:

- 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.



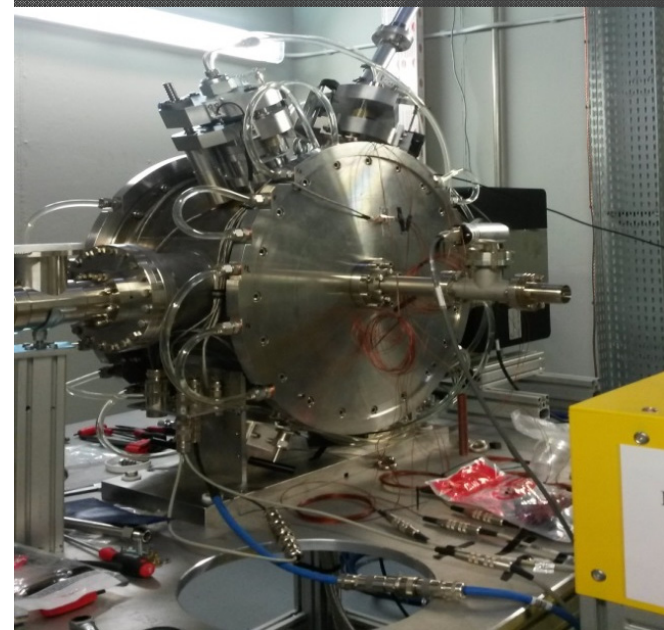
High Power RF Laboratory



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



Cavity inside the Bunker



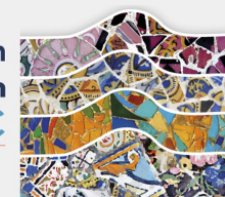


Specialized in **Ultra High Vacuum: design, construction and tests.**

Vacuum Laboratory

International Beam
Circulation
Experiment
IBIC

11 - 15 September 2016 Barcelona

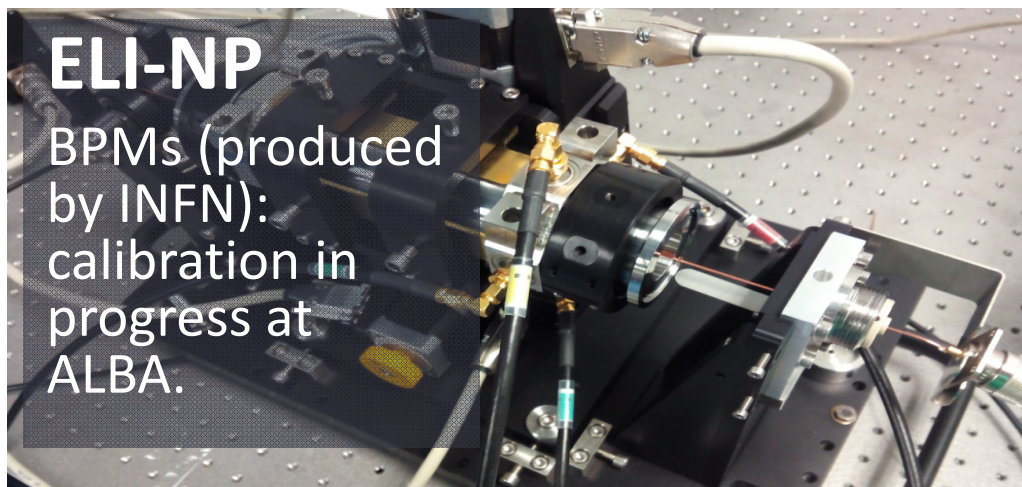


*Collaboration
with other
research
centers, as
MaxIV, CLPU,
ELI-NP*





International and national on-going collaborations - examples



ELI-NP

BPMs (produced by INFN): calibration in progress at ALBA.

Accelerator
Research and
Innovation for
European
Science and Society

On EuCARD2 wake



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
Instrumentation
Conference
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

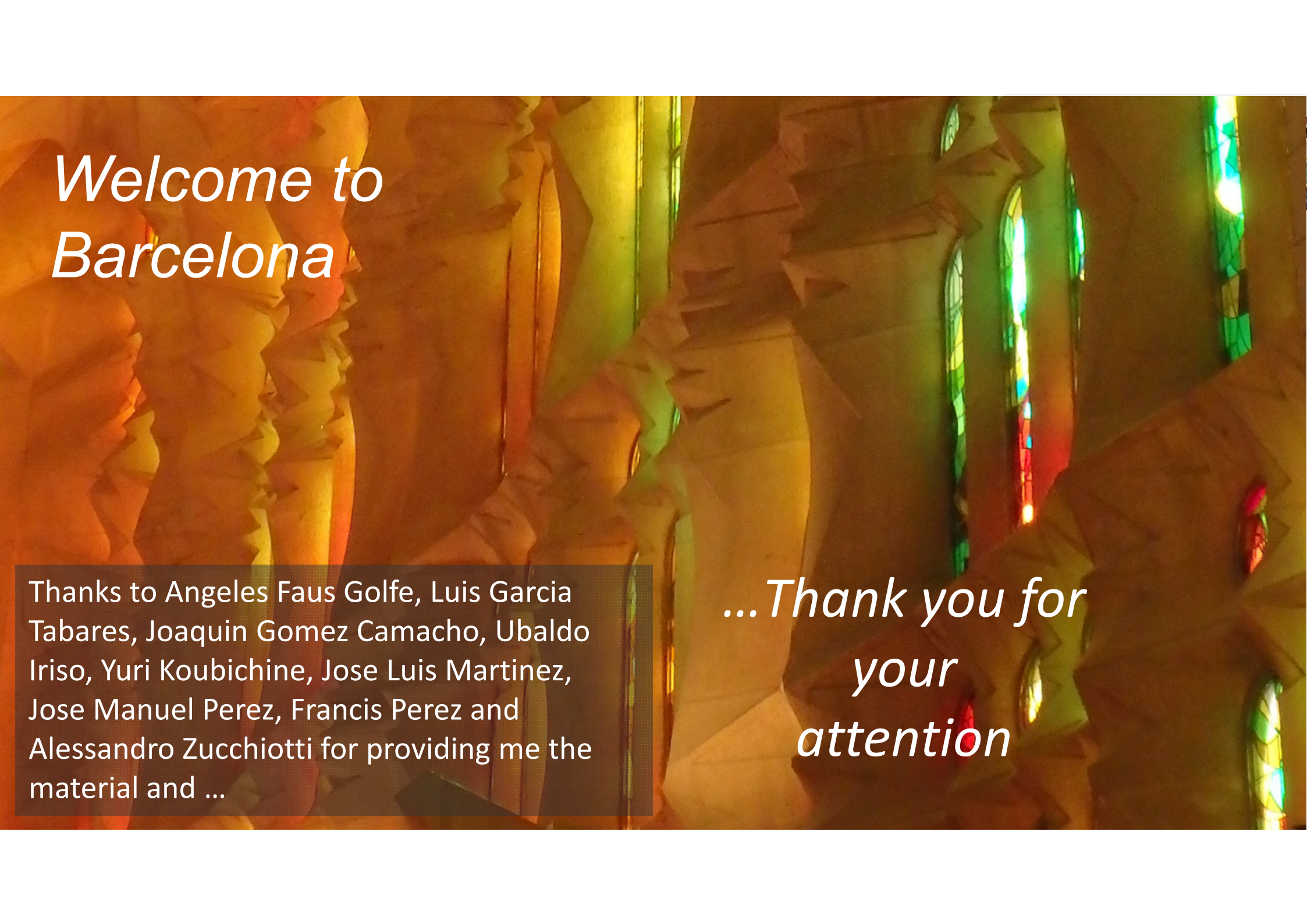
⇒ You are warmly welcome to propose subjects, to contribute to the workshops, strengthen the collaboration and enlarge the knowledge within our community

Spanish Accelerator R&D

The background image shows a large, industrial-scale facility, likely an accelerator. On the left, there are blue and red machinery components, possibly part of a particle beam transport system. On the right, there are large, green, cylindrical structures, possibly cryogenic storage or transport vessels. The floor is green, and the ceiling has exposed pipes and lighting fixtures.

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 of the slide is a photograph of the interior of a church. The ceiling is a complex, vaulted structure with a warm, golden-brown color. Several stained glass windows are visible, featuring colorful patterns in shades of green, blue, and red. The lighting is soft and ambient, creating a serene atmosphere.

*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*