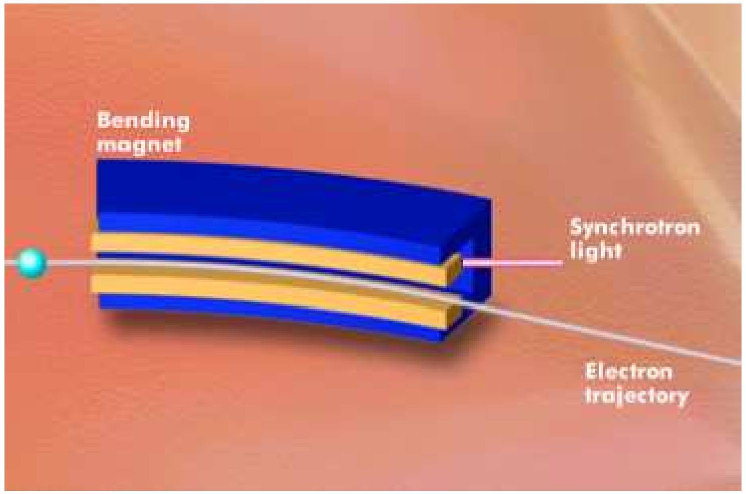
ALBA
Synchrotron Light Source

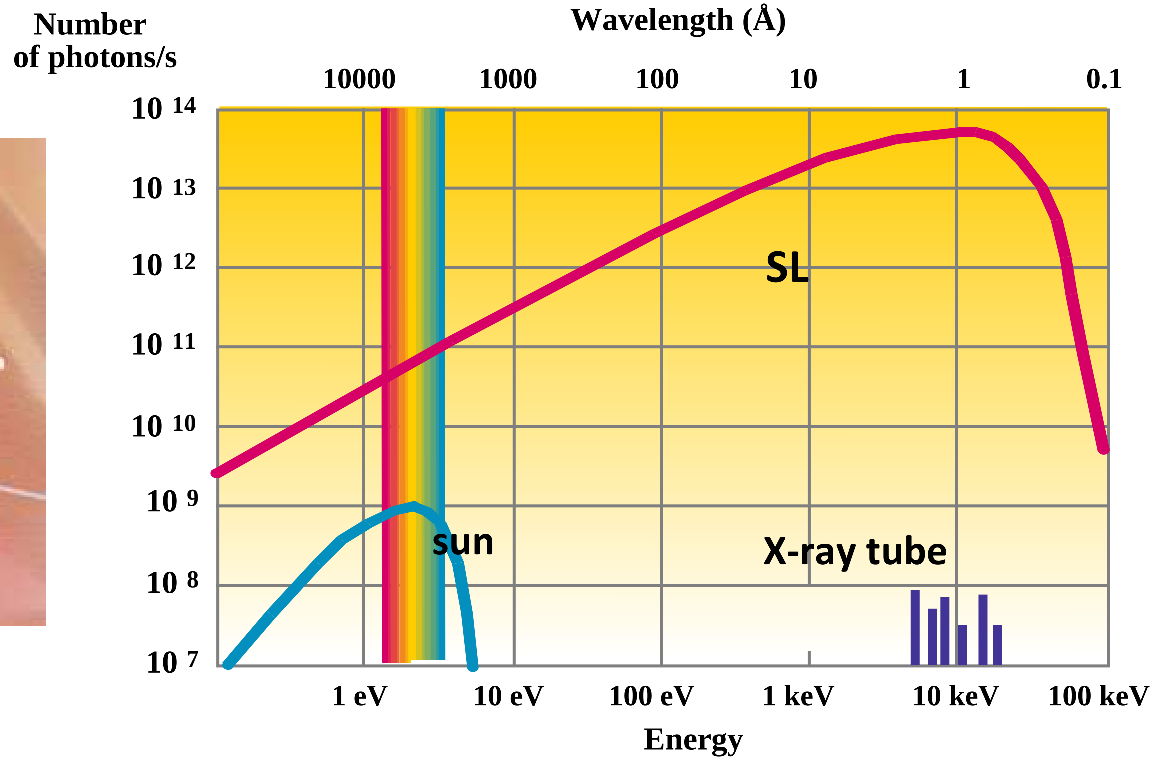
Francis Perez

ALBA location

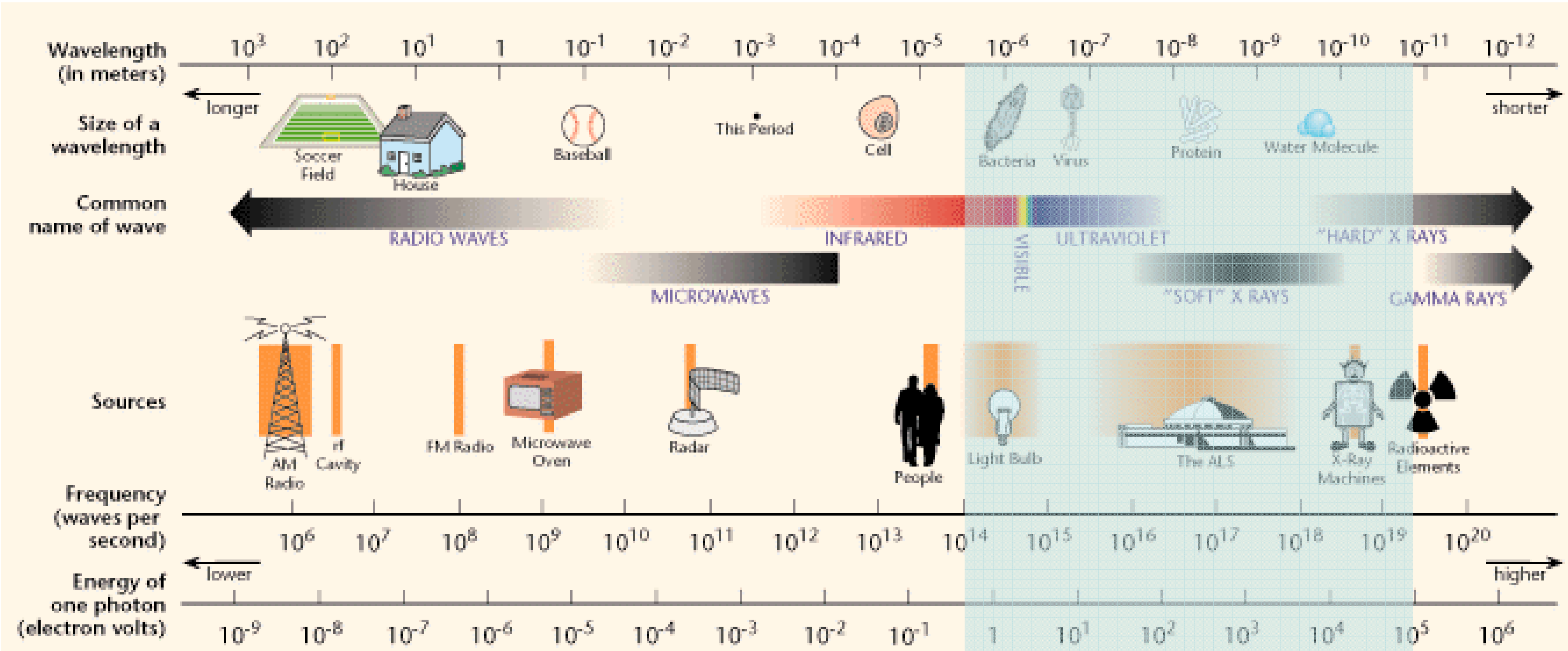
Producing the light

electrons in a magnetic field are bent and emit photons (SL)
covering a wide range of wavelengths
depending on e- energy + magnetic field strength



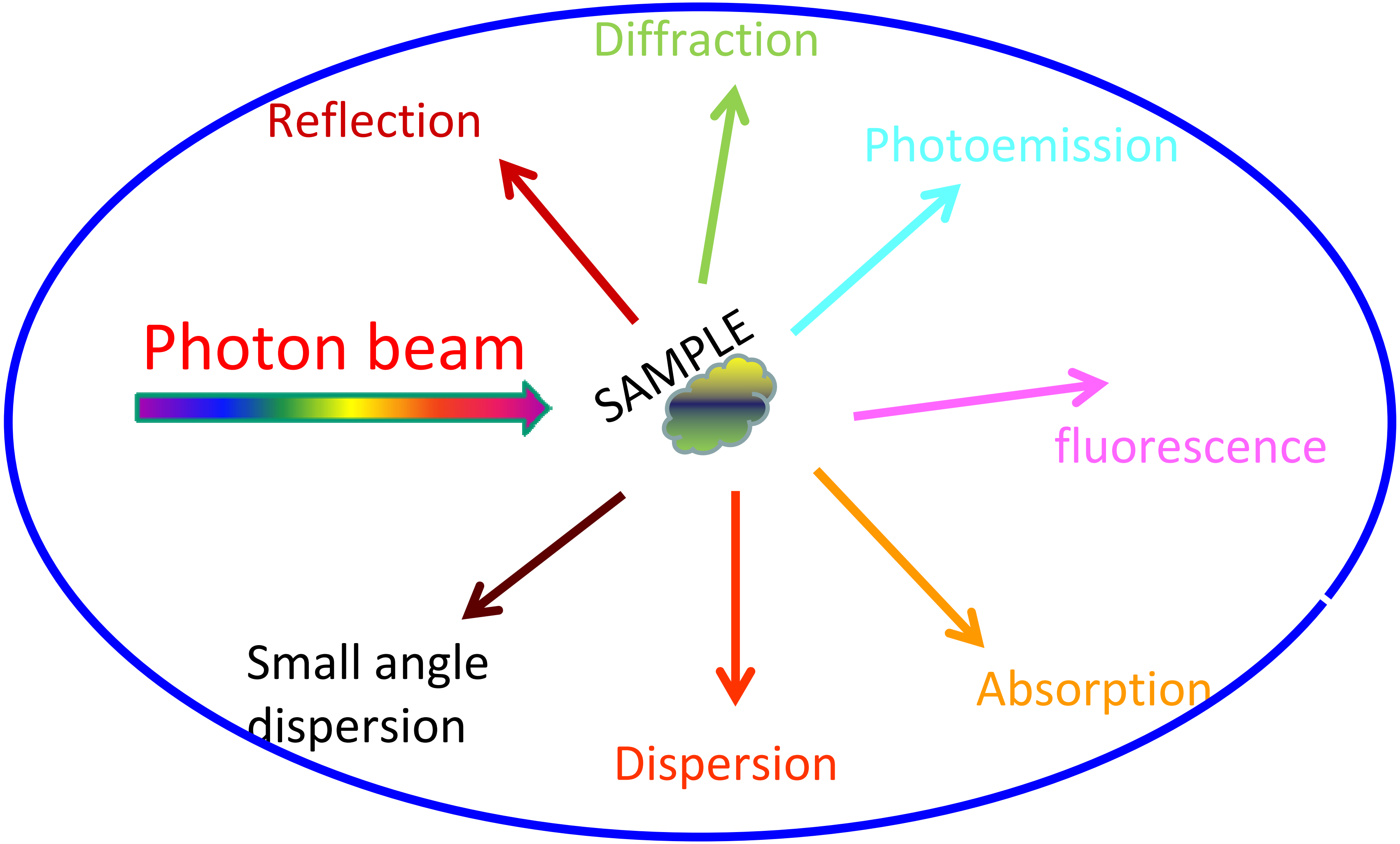


Synchrotron light is electromagnetic radiation



Why light?

Interaction photons with matter



Information about sample properties

Why synchrotron light?

- Continuous Spectrum: From infrared to X-rays

  E_{crit} (keV) = 0.665 E^2 (GeV) B(T)

- Intense

- Highly collimated: as a narrow beam

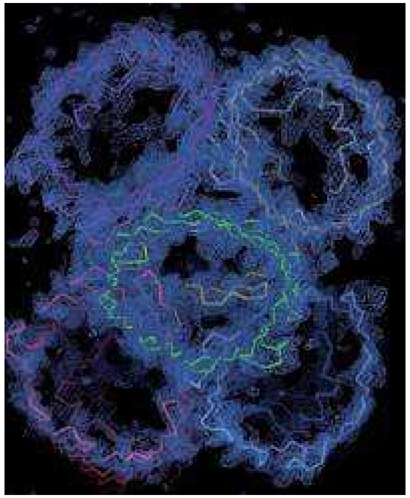
  Θ(rad) = 0.51/E (MeV)

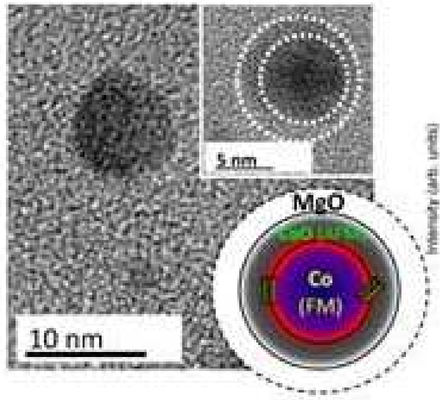
- Polarized in the orbital plane

- With temporal structure

Scientific areas in ALBA

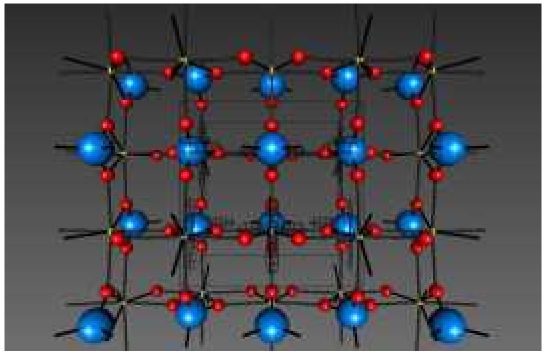
LIFE SCIENCE





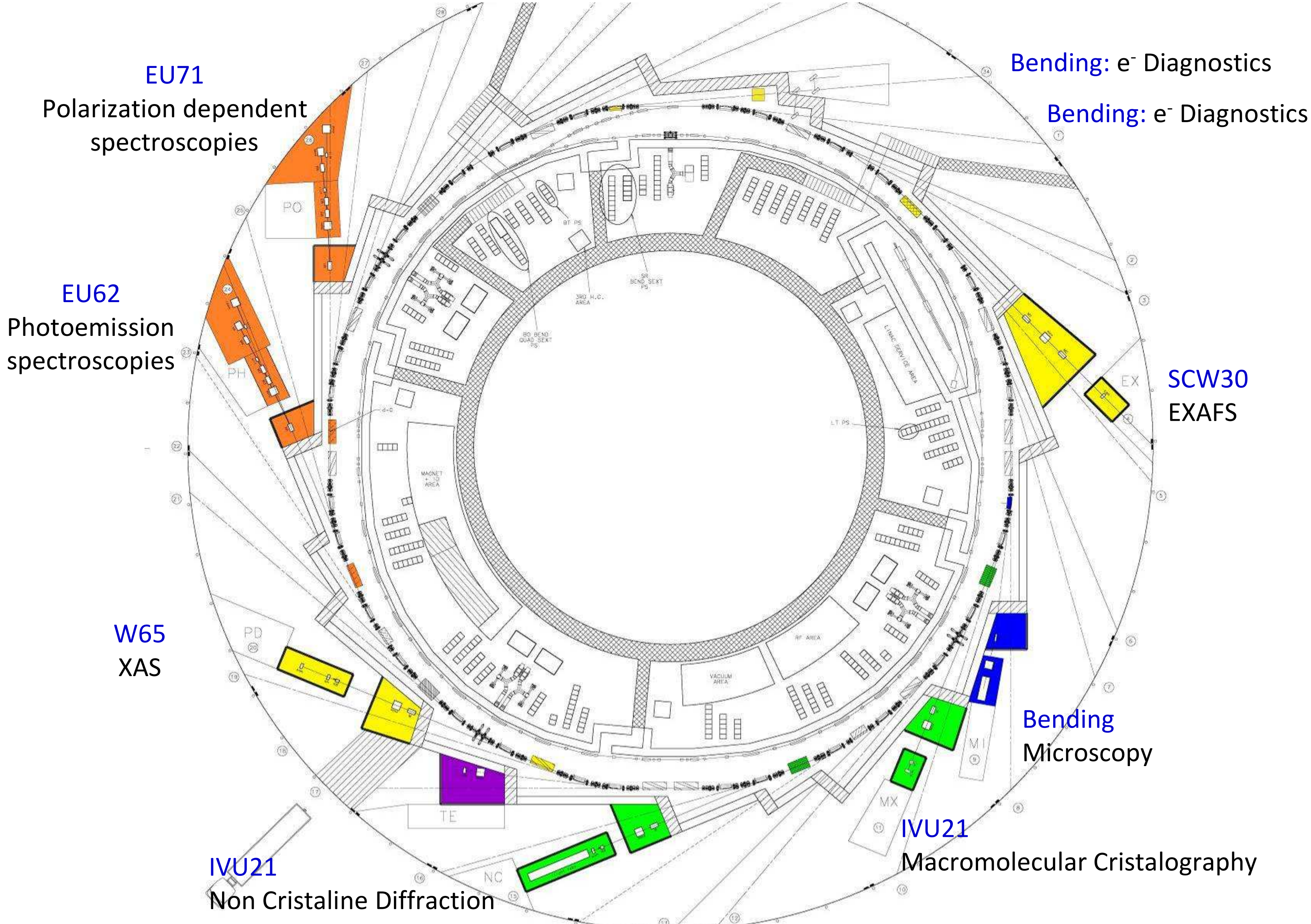
CONDENSED MATTER

CHEMISTRY



photon energy:
from UV up to hard
X-ray of tens of keV

ALBA BEAMLINES



ALBA BEAMLINES

Table 4 - Main characteristics of ALBA Phase I Beamlines

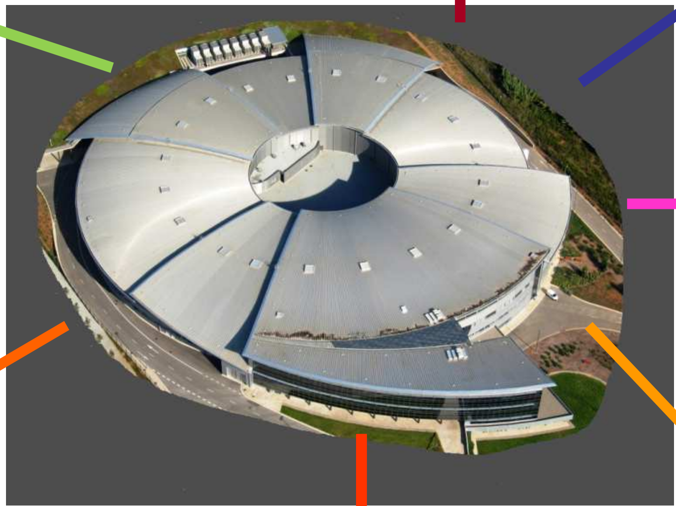
Port	Name	End stat	Sect	Experimental techniques	Scientific applications	Light source
4	**MSPD**	2	Chem	High resolution powder diffraction High pressure diffraction	Structure of materials, Time resolved diffraction, High pressure experiments	SC wiggler
9	**MISTRAL**	1	Life	Soft X-ray full field transmission X-ray microscope.	Cryogenic tomography of biological objects. Spatially resolved spectroscopy	Dipole
11	**NCD**	1	Life	High resolution small and wide angle X-ray scattering/diffraction, protein scattering experiments	Structure and phase transformations of biological fibres, polymers, solutions. Time resolved X-ray studies	In vacuum und
13	**XALOC**	1	Life	X-ray diffraction from crystals of biological macromolecules	Macromolecular crystallography	In vacuum und
22	**CLÆSS**	1	Chem	EXAFS, XANES, Quick-EXAFS	Materials science, chemistry, time resolved studies, cultural heritage	MP wiggler
24	**CIRCE**	2	Phys	Photoemission microscopy (PEEM) Near atmospheric pressure photo-emission (NAPP)	Nano-science and magnetic domain imaging (PEEM), Surface chemistry (NAPP)	Apple II und
29	**BOREAS**	2	Phys	Circular Magnetic Dichroism Resonant Magnetic Diffraction	Magnetism, surface magnetism and magnetic structures	Apple II und

Phase I Instruments

Resonant Absortion and Scattering
BOREAS: Hector & MARES

Photoemission Spectroscopy and Microscopy
CIRCE: PEEM & NAPP

Material Science & Powder Diffraction
MSPD: HR & HP



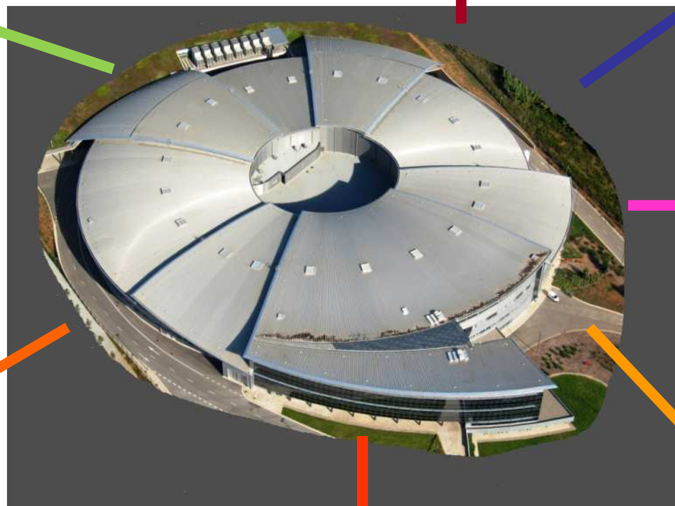
Non cristalline Diffraction
NCD

Soft X-Ray Microscopy
MISTRAL

Macromolecular Cristallography
XALOC

Core Level Absorption and Emission Spectroscopy
CLAESS

Scientific applications



Magnetism, magnetic structures
BOREAS: Hector & MARES

Nanoscience, Magnetic domains, Surface Chemistry
CIRCE: PEEM & NAPP

Material Structure, High Pressure
MSPD: HR & HP

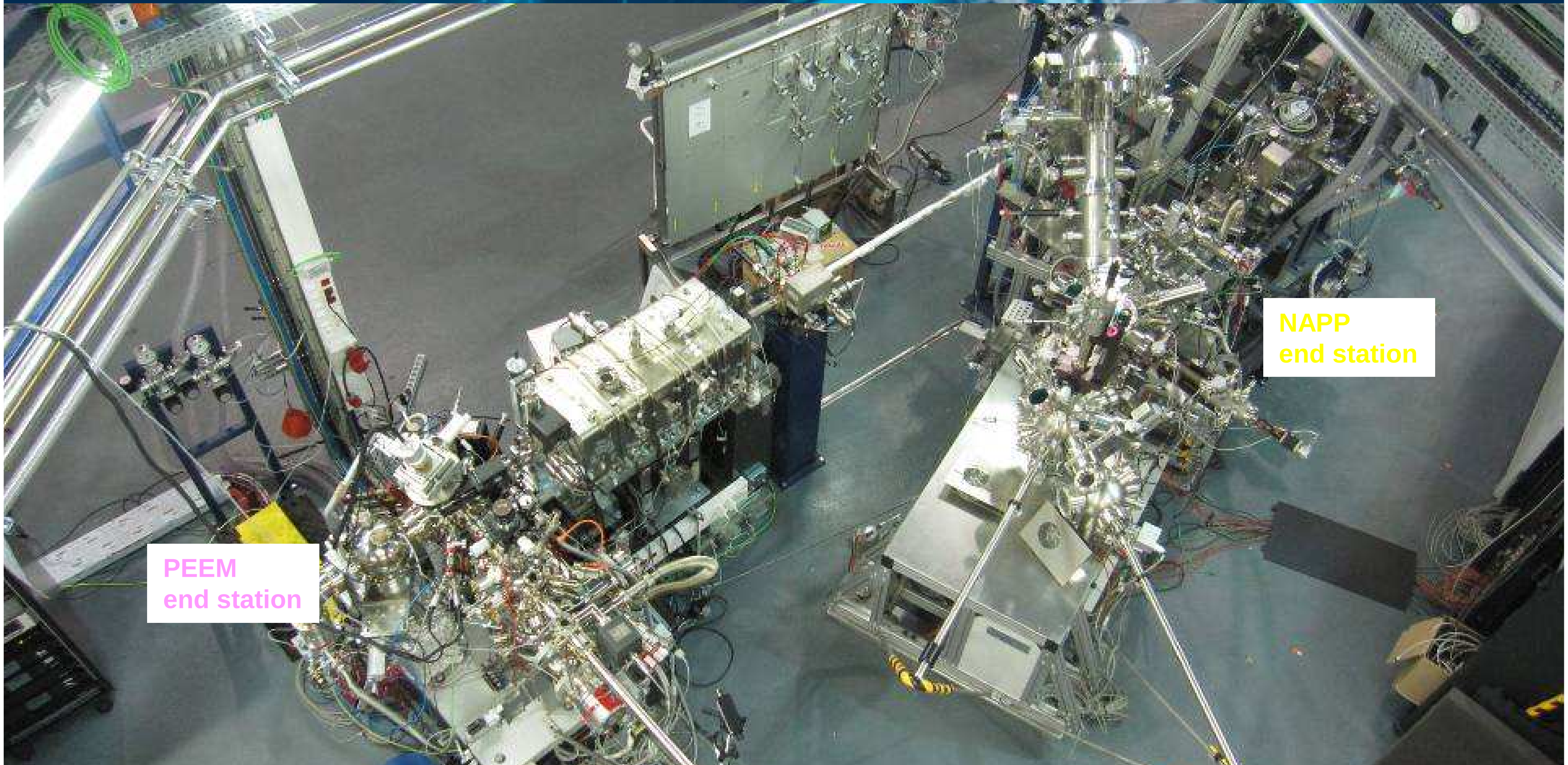
biological fibres, polymers, solutions. NCD

Cryogenic tomography of biological objects and magnetic domains
MISTRAL

Protein Macromolecular Cristallography
XALOC

Materials science, chemistry, time resolved studies, cultural heritage,
CLAESS

Example of BeamLine : BL24 - CIRCE



- *Variable polarization BL dedicated to advanced photoemission microscopy and spectroscopy.*
  - ✓ *PEEM (photoemission electron microscopy)*
  - ✓ *NAPP (near ambient pressure photoemission).*
- *Photon energy range: 100 - 2000 eV*

ALBA Synchrotron Light Source

Approved in 2003

First users in 2012

ALBA History

ALBA founded	April 2003
ALBA 1st worker	Dec 2003
Design work	2004-2005
Start main building works	July 2006
Start Linac installation	Feb 2008
Linac commissioning	Sept - Oct 2008
Booster and SR installation	Feb – Dec 2009
Booster commissioning	Jan – Oct 2010
SR Installation	Feb – Dec 2010
Storage Ring commissioning	March – Nov 2011
Beamlines commissioning	Oct 2011 – Feb 2012
Start of Users Operation	**May 2012**

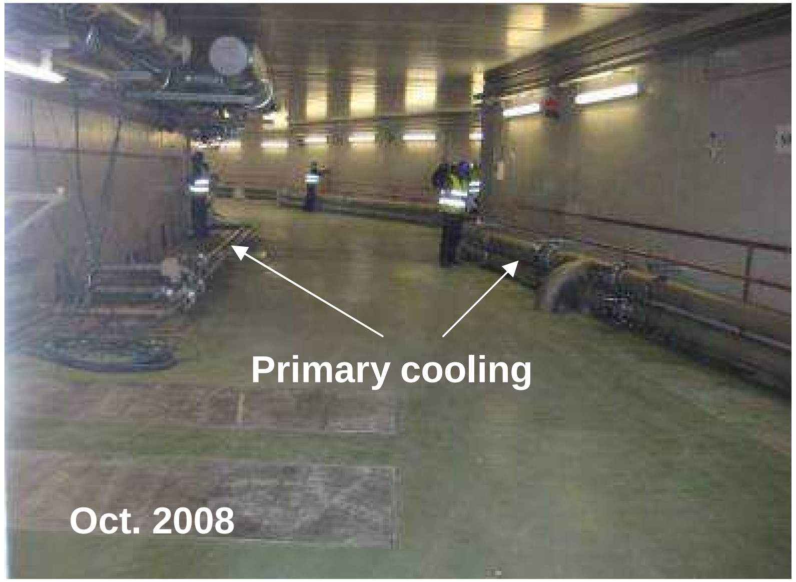
June 2006

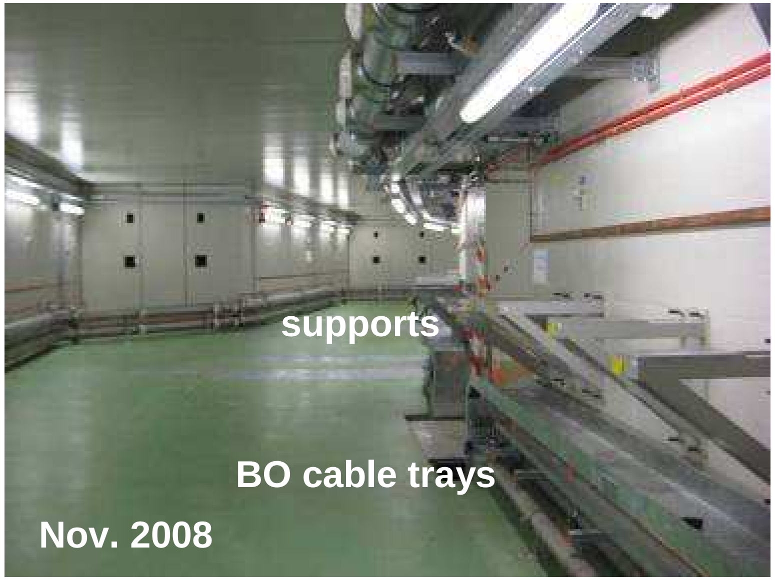
2007

2008


20-01-08


23-07-08


Primary cooling
Oct. 2008


supports
BO cable trays
Nov. 2008

2009

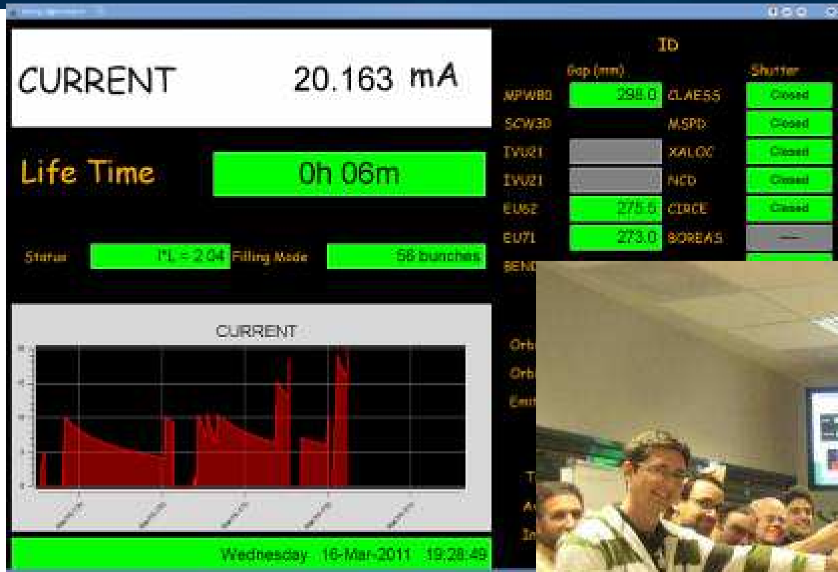
2010

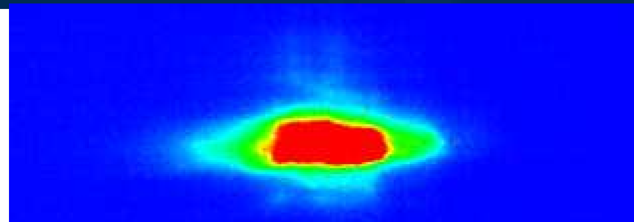
2011

Synchrotron Light Source
in Cerdanyola (Barcelona, Spain)

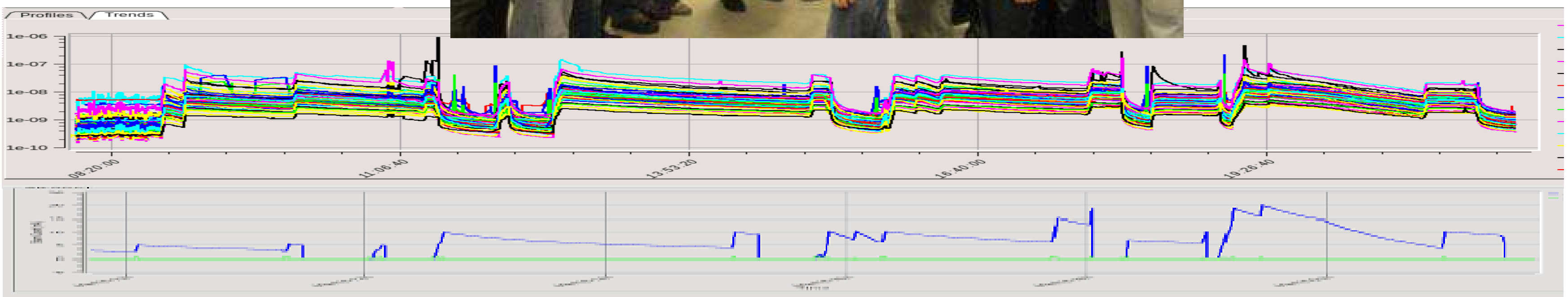

The ALBA Team
We are today ~170

16th March 2011





1st synchrotron light outside the tunnel



7th May 2012: First users

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navigation

- All events
- All news
  - The first users have started their experiments at ALBA

The first users have started their experiments at ALBA

Created by Anne-Cécile KLORA — last modified May 17, 2012 12:52 PM

BOREAS is the first of ALBA 7 beamlines to be available to users.

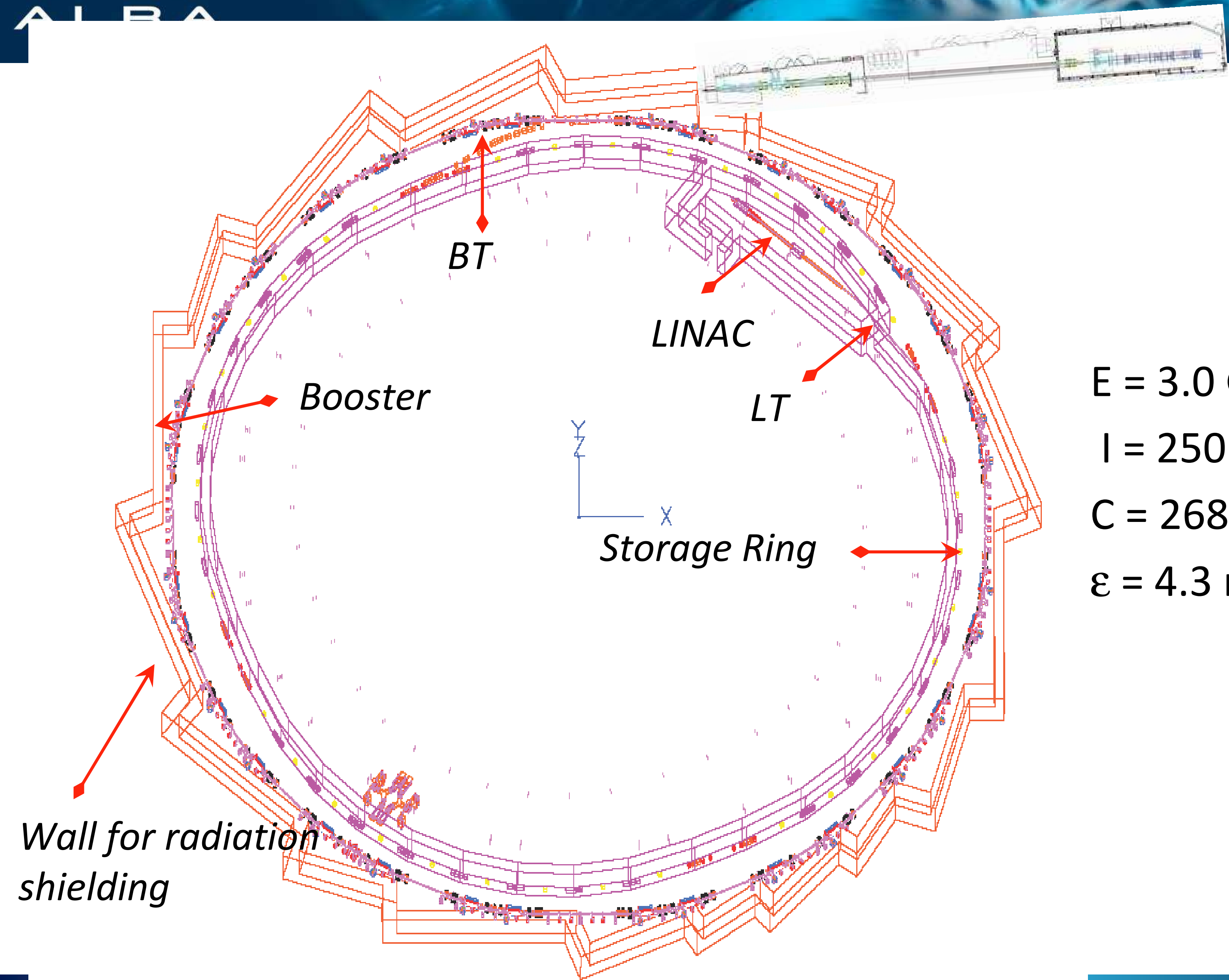
The standard proposal 'Ferrite magnetic nanoparticles and hybrid superconducting layers: a XMCD spectroscopic study', granted with 18 shifts, started running experiments at ALBA on May 7th, 2012.

The aim of the experiment is to clarify and characterize the atomic origin of the magnetism in different ferrite nanoparticles, both in assynthetized form as well as embedded in high temperature superconductor (HTS) thin films.

Alba would like to thank all participants in this call for proposals for their interest in our Facility and the high level of scientific proposals, as acknowledged by the Scientific Panel.

ALBA acting Director, the User Office team, the BOREAS beamline team and the first external users from Unidad de Química Inorgánica- Departamento de Química- UAB, Barcelona.

ALBA ACCELERATORS



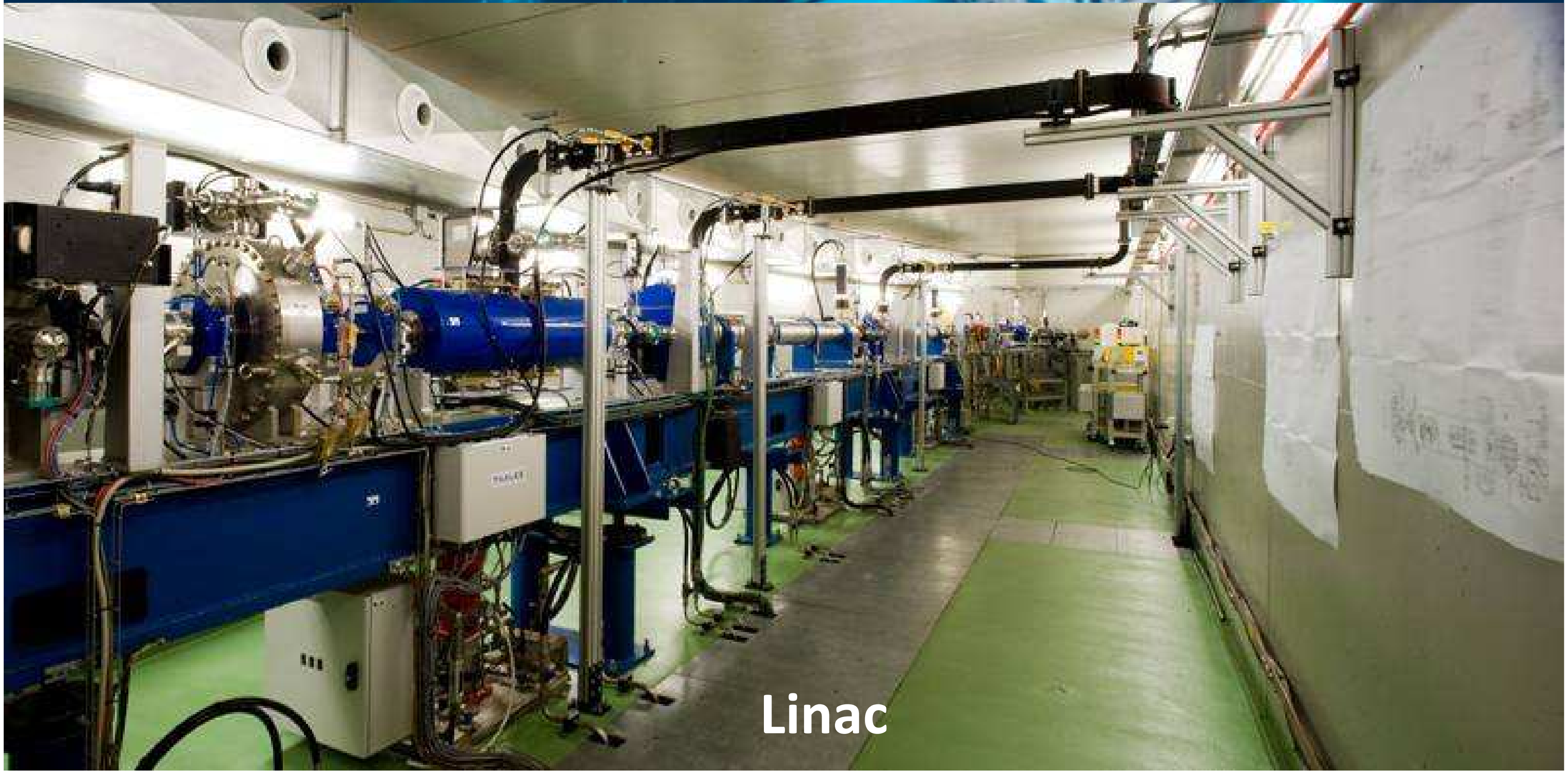
E = 3.0 GeV

I = 250 mA

C = 268.8 m

ε = 4.3 nm.rad

ALBA ACCELERATORS



Accelerate electrons from rest to 100 MeV in 10 m

RF cavities 3 GHz, magnets to keep the trajectory

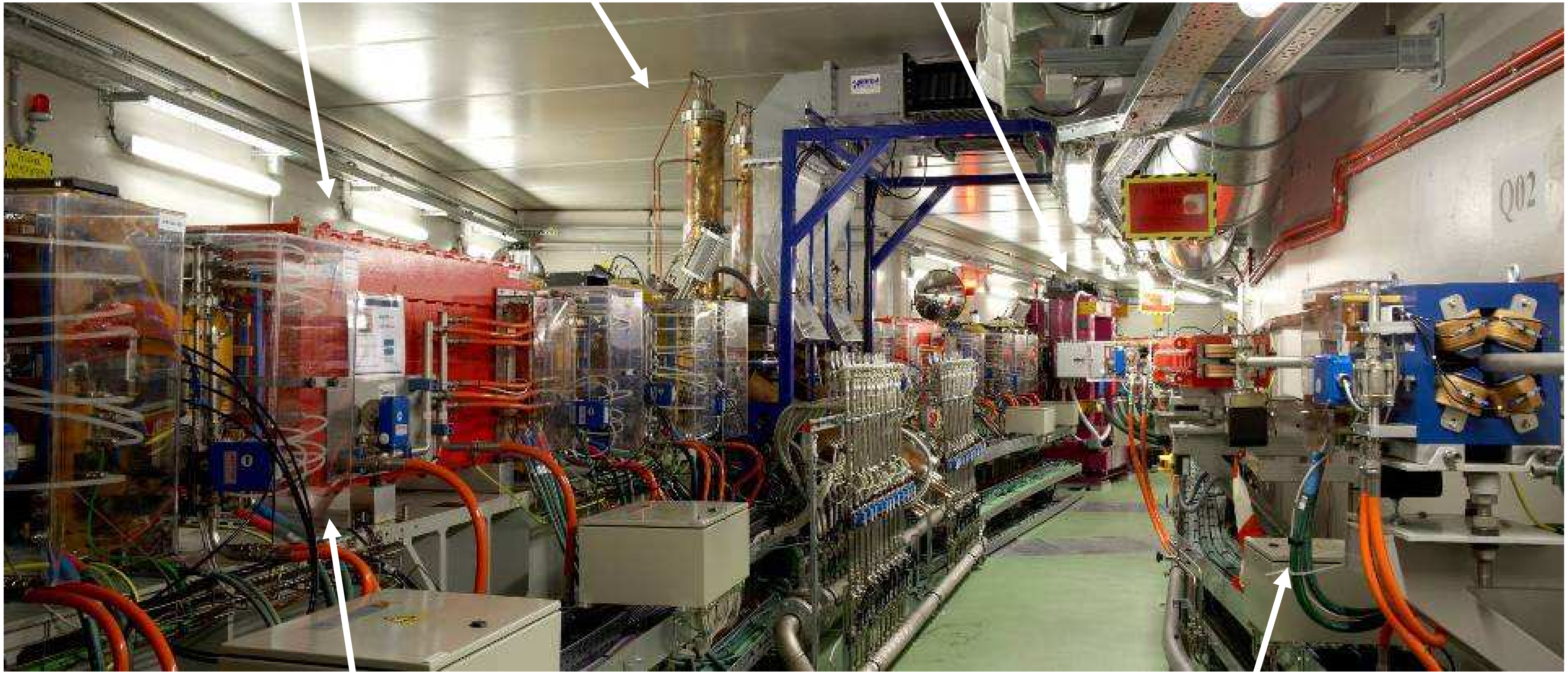
Repetition rate of 3 Hz

ALBA ACCELERATORS

Bending

RF cavities

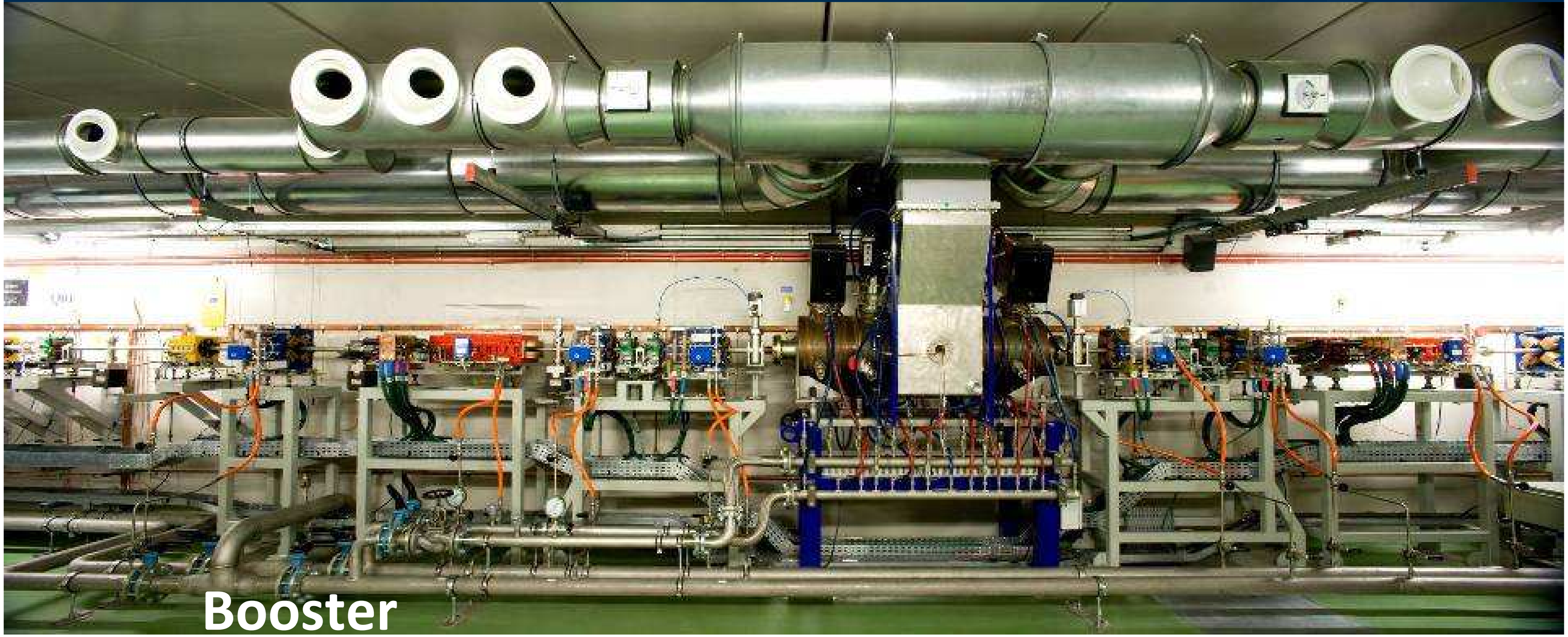
In vacuum undulator



SR
3 GeV

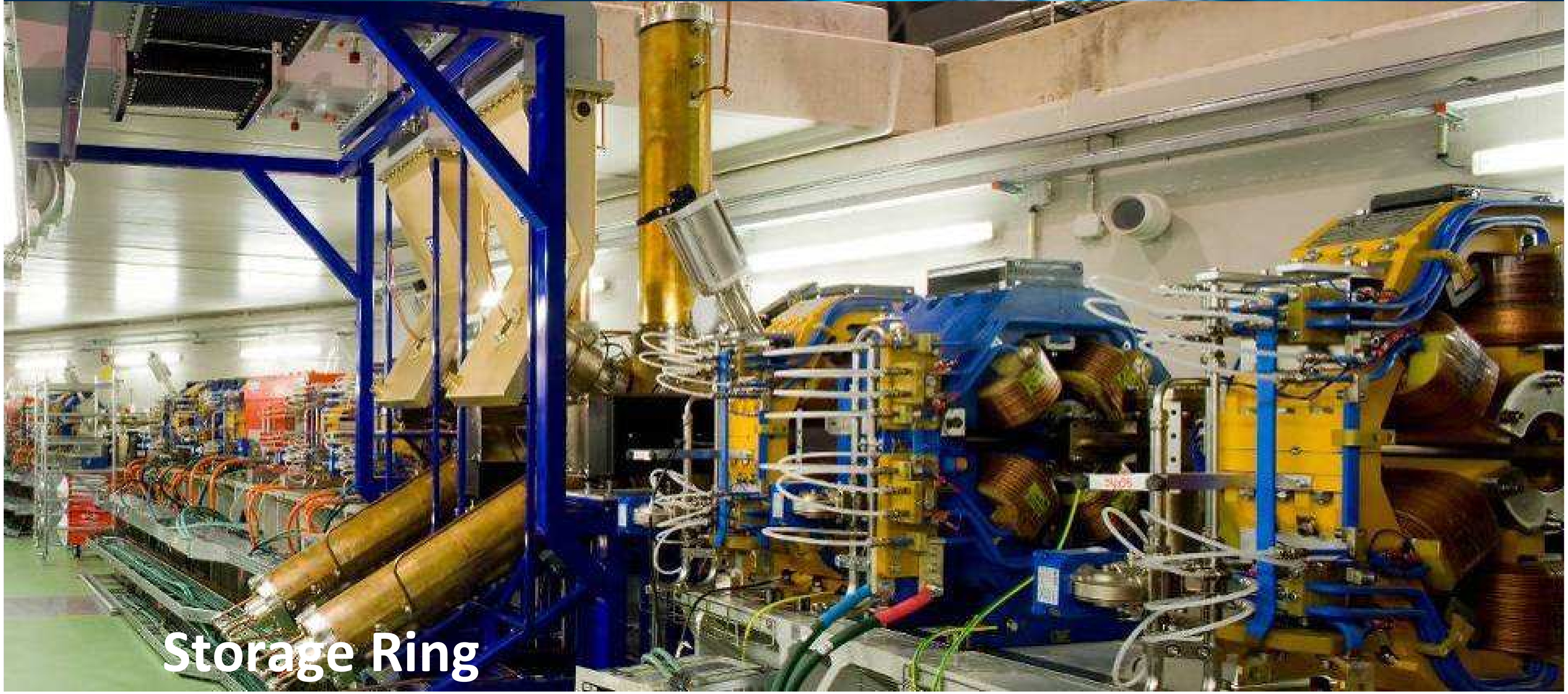
Booster
0.1 – 3 GeV

BOOSTER



Accelerate electrons (1 mA) from 100 MeV to 3 GeV
Magnets to keep electrons in orbit
1 x RF cavity at 500 MHz
Repetition rate of 3 Hz

STORAGE RING



Keep electrons at 3.0 GeV

Magnets to keep the orbit

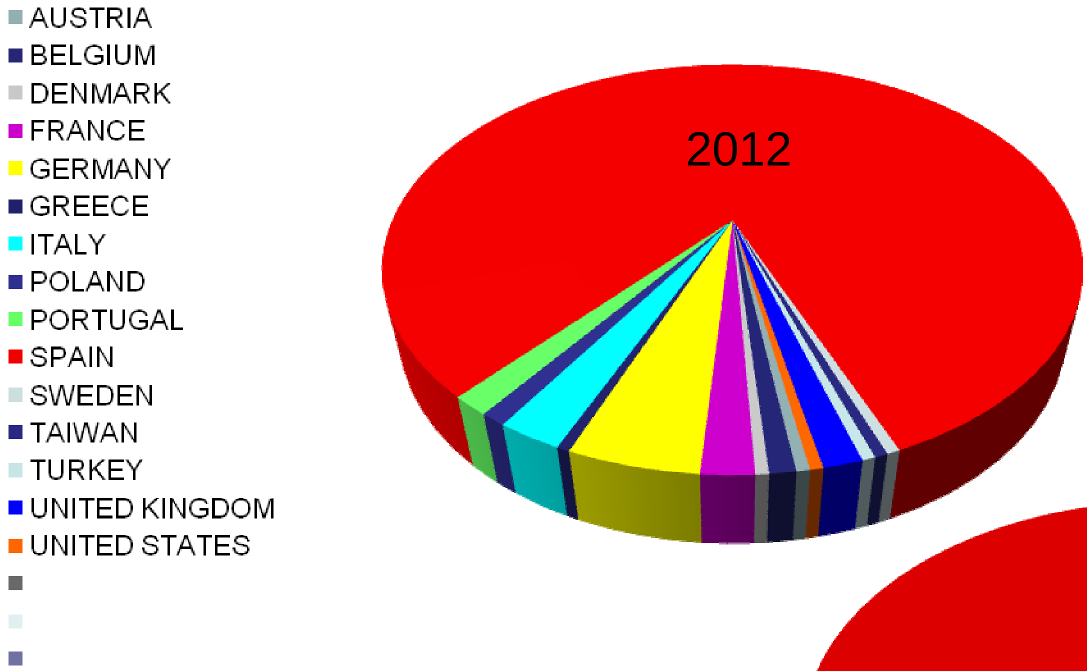
Pumps to keep vacuum (10^{-10} mbar)

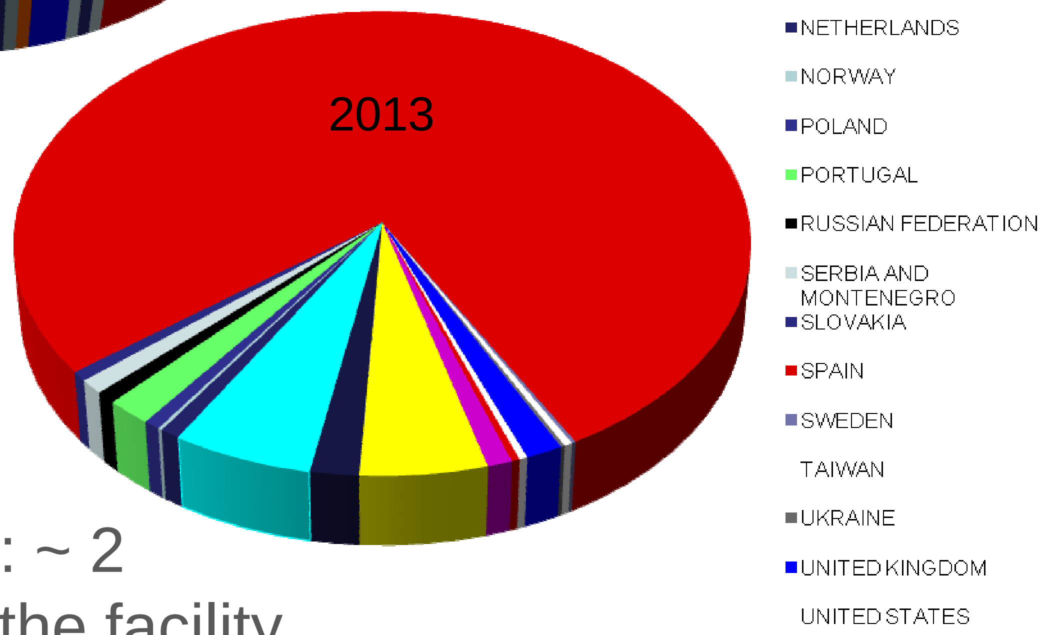
6 x RF cavities at 500 MHz to restore energy lost by radiating

Up to 250 mA

OPERATION 2013

2012 & 2013: ~200 proposals per call





Average Overbooking factor: ~ 2

Industrial Users start to use the facility

OPERATION 2013

	January					February					March					April				
			Shift					Shift					Shift					Shift		
Weekday	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N
Mo		1														1	14	W	W	W
Tu	1		Off	Off	Off											2		W	W	W
We	2		W	W	W											3		W	W	W
Th	3		W	W	W											4		W	W	W
Fr	4		W	W	W	1		BL	BL	BL	1		BL	BL	BL	5		M	M	M
Sa	5		W	W	W	2		BL	BL	BL	2		BL	BL	BL	6		M	M	M
Su	6		W	W	W	3		BL	BL	BL	3		BL	BL	BL	7		M	M	M
Mo	7	2	W	W	W	4	6	M	M	M	4	10	M	M	M	8	15	M	M	M
Tu	8		W	W	W	5		BL	BL	BL	5		BL	BL	BL	9		BL	BL	BL
We	9		W	W	W	6		BL	BL	BL	6		BL	BL	BL	10		BL	BL	BL
Th	10		W	W	W	7		BL	BL	BL	7		BL	BL	BL	11		BL	BL	BL
Fr	11		W	W	W	8		BL	BL	BL	8		BL	BL	BL	12		BL	BL	BL
Sa	12		W	W	W	9		BL	BL	BL	9		BL	BL	BL	13		BL	BL	BL
Su	13		W	W	W	10		BL	BL	BL	10		BL	BL	BL	14		BL	BL	BL
Mo	14	3	M	M	M	11	7	M	M	M	11	11	M	M	M	15	16	M	M	M
Tu	15		M	M	M	12		BL	BL	BL	12		BL	BL	BL	16		BL	BL	BL
We	16		M	M	M	13		BL	BL	BL	13		BL	BL	BL	17		BL	BL	BL
Th	17		M	M	M	14		CSN	CSN	CSN	14		BL	BL	BL	18		BL	BL	BL
Fr	18		M	M	M	15		CSN	CSN	CSN	15		BL	BL	BL	19		BL	BL	BL
Sa	19		M	M	M	16		W	W	W	16		BL	BL	BL	20		BL	BL	BL
Su	20		M	M	M	17		W	W	W	17		BL	BL	BL	21		BL	BL	BL
Mo	21	4	M	M	M	18	8	W	W	W	18	12	M	M	M	22	17	M	M	M
Tu	22		BL	BL	BL	19		W	W	W	19		BL	BL	BL	23		BL	BL	BL
We	23		BL	BL	BL	20		W	W	W	20		BL	BL	BL	24		BL	BL	BL
Th	24		BL	BL	BL	21		W	W	W	21		BL	BL	BL	25		BL	BL	BL
Fr	25		BL	BL	BL	22		W	W	W	22		BL	BL	BL	26		CSN	CSN	CSN
Sa	26		BL	BL	BL	23		W	W	W	23		W	W	W	27		W	W	W
Su	27		BL	BL	BL	24		W	W	W	24		W	W	W	28		W	W	W
Mo	28	5	M	M	M	25	9	M	M	M	25	13	W	W	W	29	18	W	W	W
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Th	31		BL	BL	BL	28		BL	BL	BL	28		W	W	W					
Fr											29		W	W	W					
Sa											30		W	W	W					
Su											31		W	W	W					
Mo																				
Tu																				
We																				
Th																				

	May					June					July					August				
			Shift					Shift					Shift					Shift		
Weekday	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N
Mo											1	27	M	M	M					
Tu											2		M	M	M					
We	1		W	W	W						3		BL	BL	BL					
Th	2		W	W	W						4		BL	BL	BL	1		Off	Off	Off
Fr	3		W	W	W						5		BL	BL	BL	2		Off	Off	Off
Sa	4		W	W	W	1		W	W	W	6		BL	BL	BL	3		Off	Off	Off
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Sa						29		W	W	W						31		W	W	W
Su						30		W	W	W										
Mo																				
Tu																				
We																				
Th																				

	September					October					November					December				
			Shift					Shift					Shift					Shift		
Weekday	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N	Day	Week	M	A	N
Mo																				
Tu						1		BL	BL	BL										
We						2		BL	BL	BL										
Th						3		BL	BL	BL										
Fr						4		BL	BL	BL	1		BL	BL	BL					
Sa						5		W	W	W	2		BL	BL	BL					
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Th	5		M	M	M	10		W	W	W	7		BL	BL	BL	5		BL	BL	BL
Fr	6		M	M	M	11		W	W	W	8		BL	BL	BL	6		W	W	W
Sa	7		M	M	M	12		W	W	W	9		W	W	W	7		W	W	W
Su	8		M	M	M	13		W	W	W	10		W	W	W	8		W	W	W
Mo	9	37	M	M	M	14	42	M	M	M	11	46	W	W	W	9	50	W	W	W
Tu	10		M	M	M	15		M	M	M	12		W	W	W	10		PSS	PSS	W
We	11		M	M	M	16		BL	BL	BL	13		W	W	W	11		PSS	PSS	W
Th	12		M	M	M	17		BL	BL	BL	14		W	W	W	12		W	W	W
Fr	13		M	M	M	18		BL	BL	BL	15		W	W	W	13		W	W	W
Sa	14		M	M	M	19		BL	BL	BL	16		W	W	W	14		W	W	W
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Mo	16	38	M	M	M	21	43	M	M	M	18	47	M	M	M	16	51	Off	Off	Off
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Th	19		BL	BL	BL	24		BL	BL	BL	21		BL	BL	BL	19		Off	Off	Off
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Mo	23	39	M	M	M	28	44	M	M	M	25	48	M	M	M	23	52	Off	Off	Off
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We	25		BL	BL	BL	30		BL	BL	BL	27		BL	BL	BL	25		Off	Off	Off
Th	26		BL	BL	BL	31		BL	BL	BL	28		BL	BL	BL	26		Off	Off	Off
Fr	27		BL	BL	BL						29		BL	BL	BL	27		Off	Off	Off
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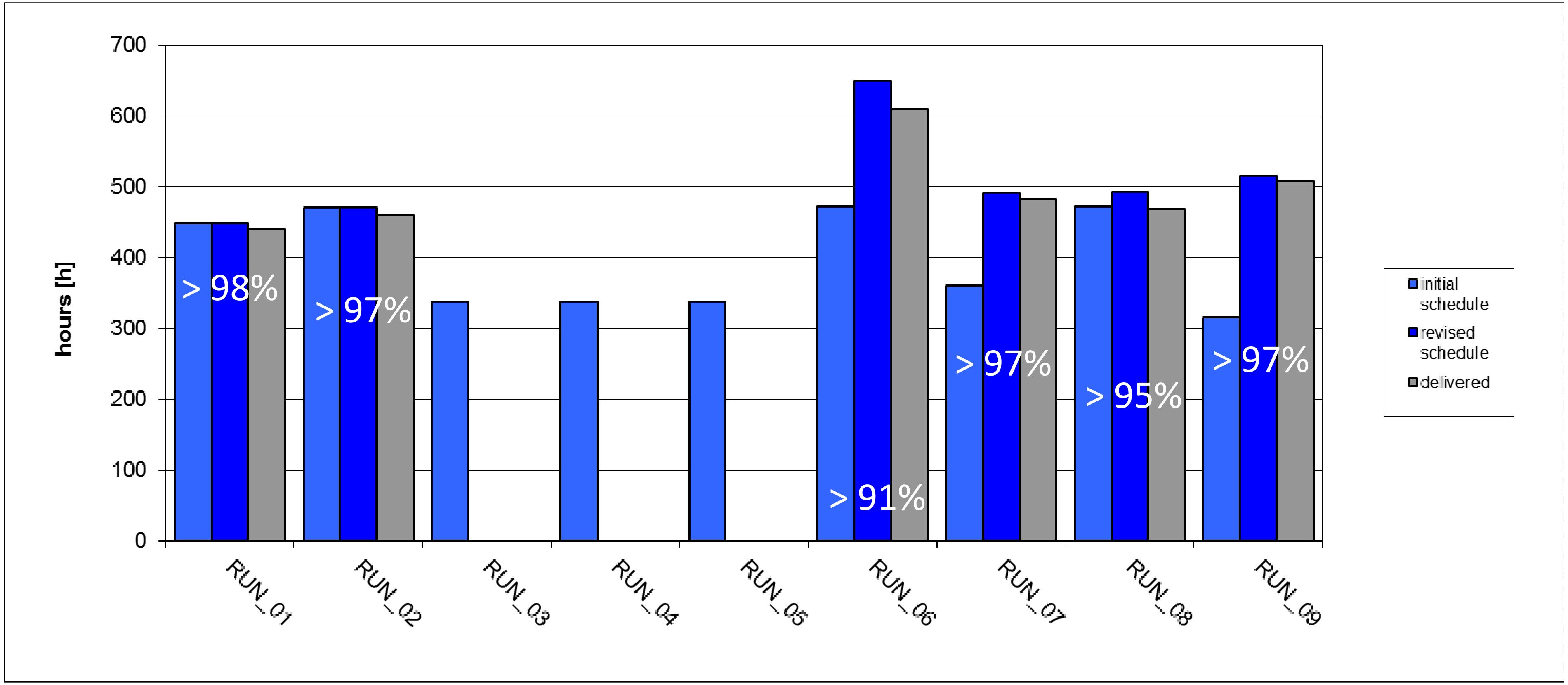
Su	29		BL	BL	BL											29		Off	Off	Off
Mo	30	40	M	M	M											30		Off	Off	Off
Tu																31		Off	Off	Off
We																				
Th																				

Total schedule h of operation: 5200 h

Scheduled h for experiments: 3792 h

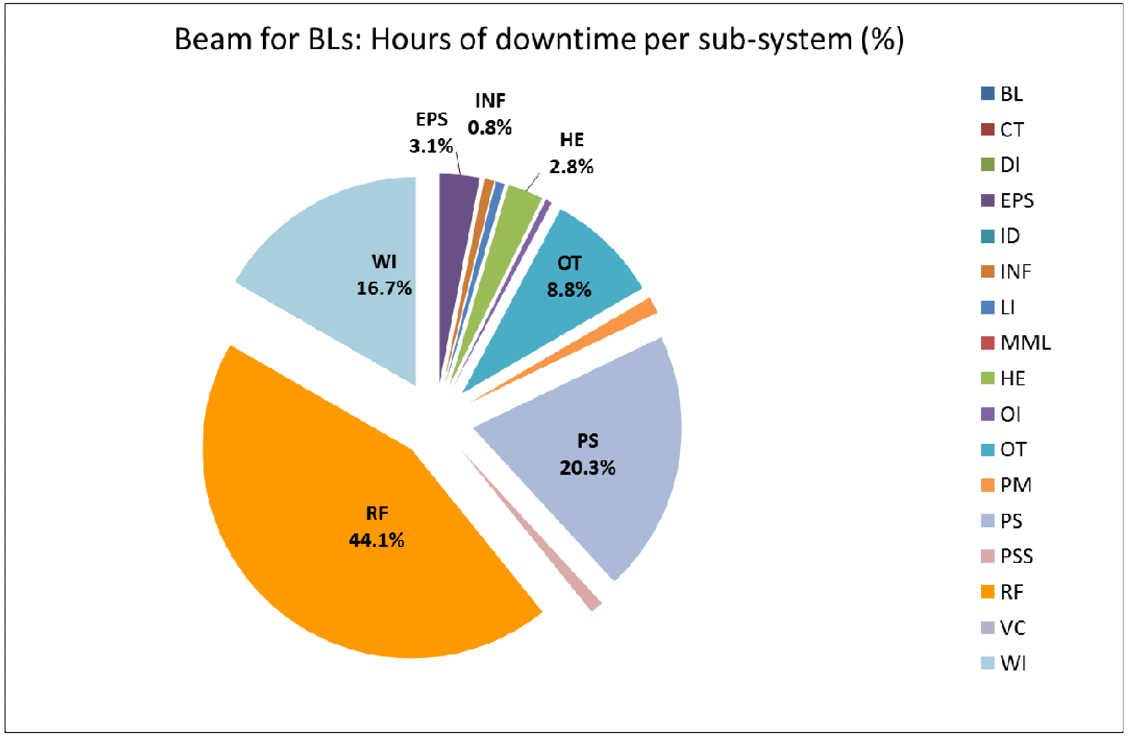
Beam availability in 2013



96.8 % average over revised schedule

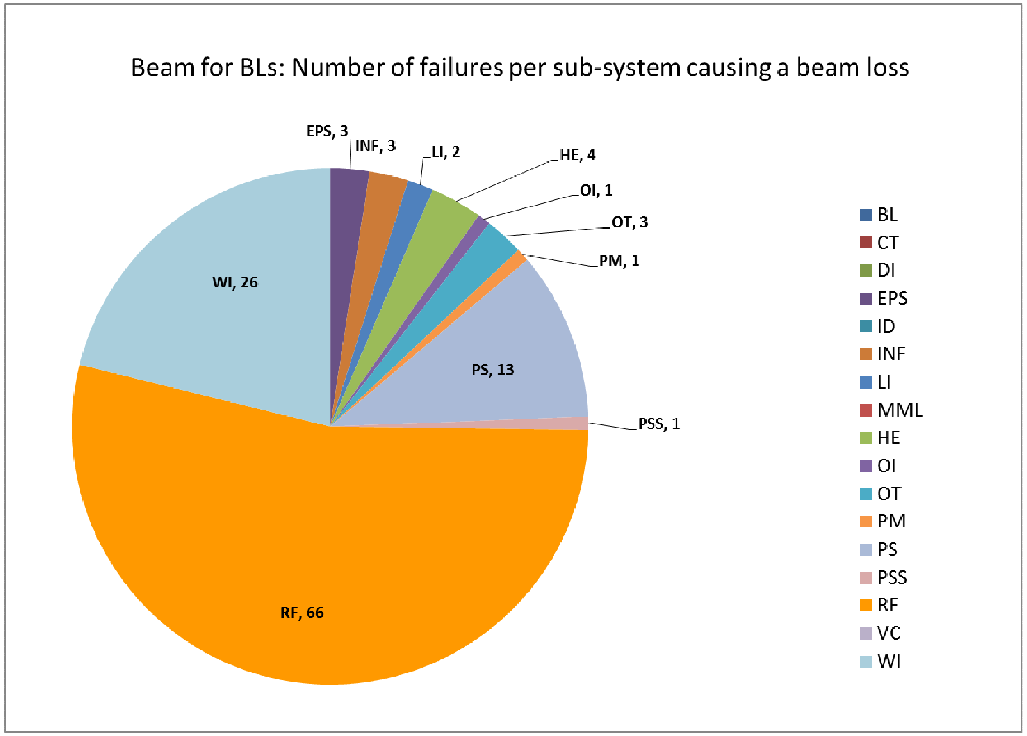
Analysis of failures per sub-system w/o cooling & MPW chamber replacement

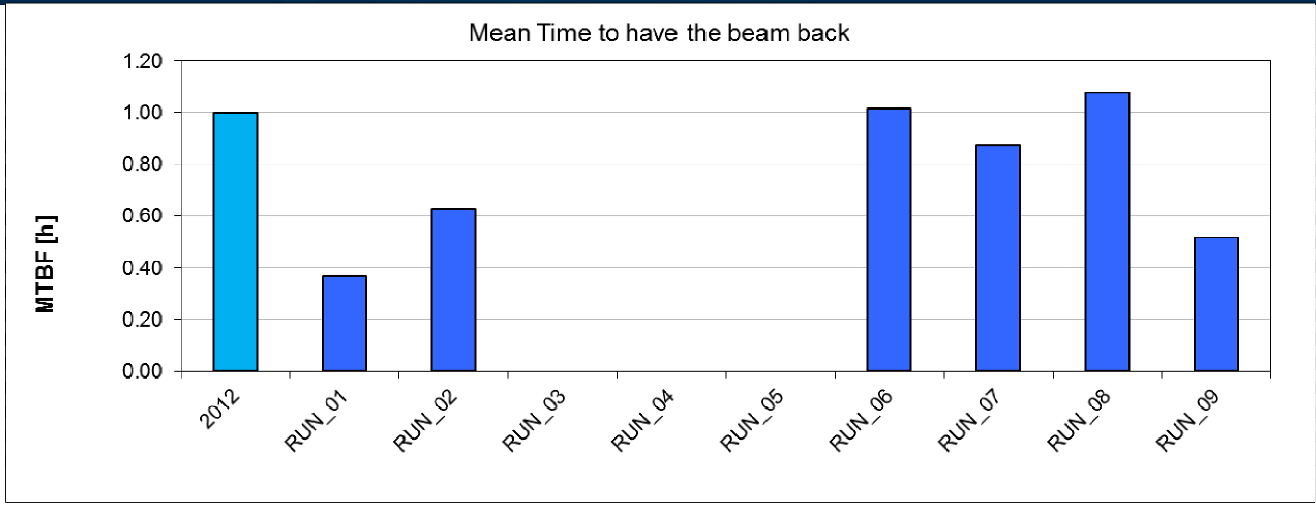
Total of 97 h of beam downtime → ≈ 0.7 h/BL day



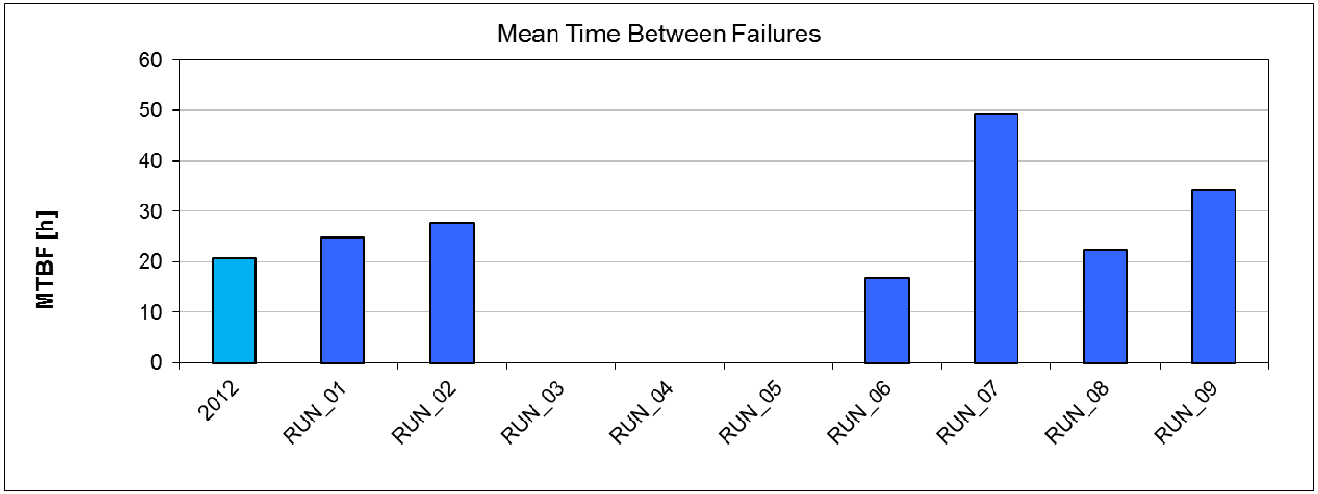
Analysis of failures per sub-system

Total of 123 failures causing a beam dump → ≈ 0.9 failure/BL day





0.8 h/failure, average for 2013



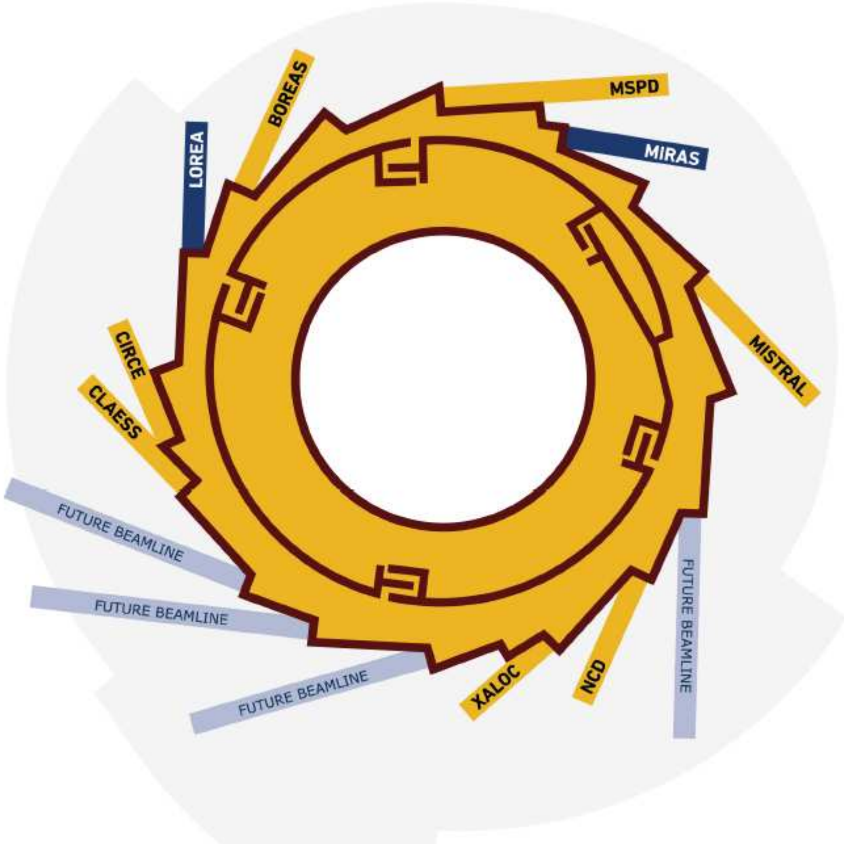
25 h average for 2013

FUTURE

ACELERATORS PROJECTS 2014

- Top-up
- FOFB
- Bunch by bunch feedback (BbB)
- Injector stability
- Increase current

New Beamlines




PHASE-III BEAMLINES
Workshop
10th April 2014
ALBA Synchrotron
Call for phase-III beamlines proposals
opened till 30th March 2014
More information
http://indico.cells.es/indico/event/ALBAPhaseIIIWorkshop
LOREA
MIRAS
ABSORPTION
DIFFRACTION
INSTRUMENT
DEVELOPMENT
MICRO PX

Table 13 - Proposed new beamlines at ALBA

Proposed order	Beamline	Source	Energy/ wavelength	Experimental techniques	Scientific field	Cost	note
8-2013	MIRAS	bending magnet	IR: 10-100 μm	spectroscopy, imaging	biosciences, material science	low	(1)
9-2014	Instrument developm.	bending magnet (8)	5-20 keV	optics detector development	instrumentation: mirrors, detectors	low	(2)
10-2014	Nano-focusing	in vacuum undulator (9)	5-20 keV	spectroscopy, imaging	materials science, environment	very high	(3)
11-2015	LOREA	long period undulator	4 -100 eV	angular resolved photoemission	nanoscience, cond. mat. physics	high	(4)
12-2015	Absorption Diffraction	bending magnet	5-20 keV	absorption, diffraction	cultural heritage, material science industrial research	med	(5)
13-2016	Coherent-diffraction	in vacuum undulator (9)	5-20 keV	coherent diffraction, μ-diffraction	biosciences, material science	high	(6)
14-2016	Micro PX	in vacuum undulator (9)	5-20 keV	micro crystallography	biosciences	high	(7)

Future Acelerators Projects

- Femto Slicing
- 3rd Harmonic Cavity
- Low alfa – Teraherzt coherent radiation

- Compton backscattering
- VUV FEL

- Collaborating with CERN and other labs

Thank you