

ALBA synchrotron

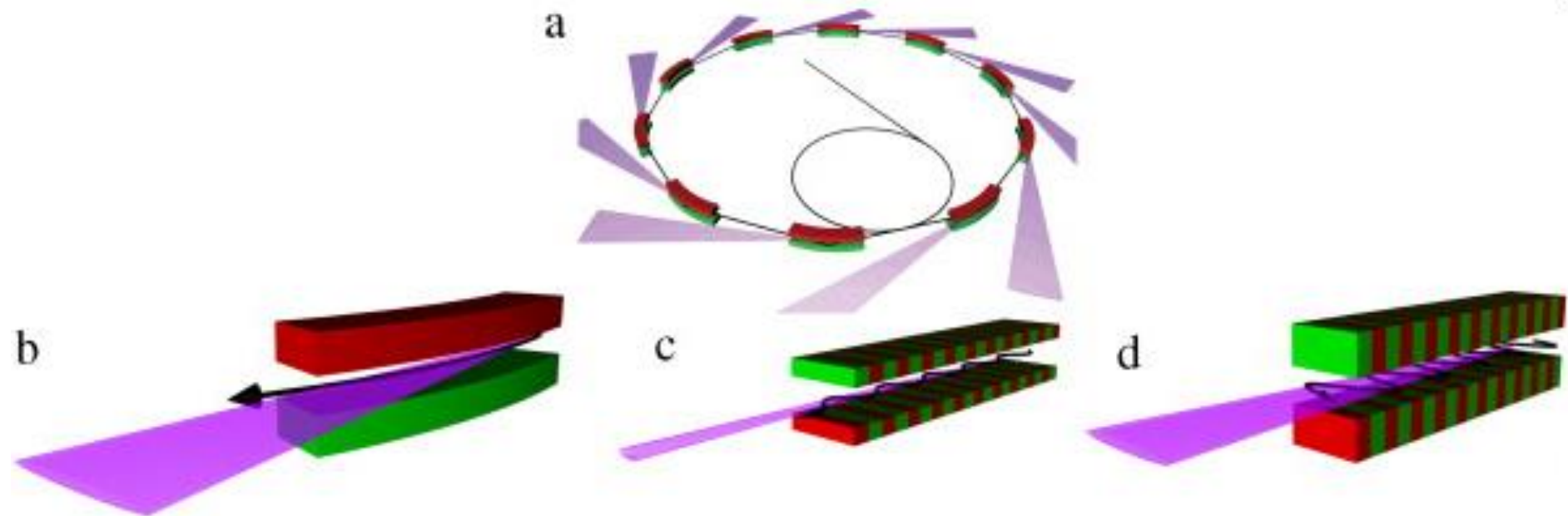
and its analytical techniques

Miguel Angel Garcia Aranda
CELLS-ALBA Scientific Director
g.aranda@cells.es

A **Synchrotron** Large Facility is:

- i) A complex of *accelerators* devoted to produce synchrotron radiation
- ii) A set of instrumentation to carry out cutting-edge **analytical measurements** and research
- iii) A interdisciplinary human group devoted to give service to academic and industrial users in their respective fields (chemistry, physics, materials, biology, etc.)

ALBA synchrotron is not a collider but a Facility to produce photons used in research and development mainly for state-of-the-art analytical techniques



Accelerators: Linac, Booster and Synchrotron



LINAC: 3GHz structure, beam acceleration to 100 MeV

Bending

RF cavities

In vacuum undulator



Synchrotron
Ring
3 GeV

Booster
0.1 – 3 GeV

Booster: 250 m of circumference, one rf cavity at 500 MHz which in 145 msec accelerates beam from 100 MeV to 3GeV

Synchrotron ring: 270 m, 32 dipoles, 112 quadrupoles and 120 sextupoles. Six rf cavities maintain beam energy and lifetime



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A large facility to study the structure and the interior of matter



1st

SCIENCE FACILITY
IN SOUTH-WEST EUROPE
(in terms of investments)

220 M€

PUBLIC INVESTMENT
(2012)

>1700

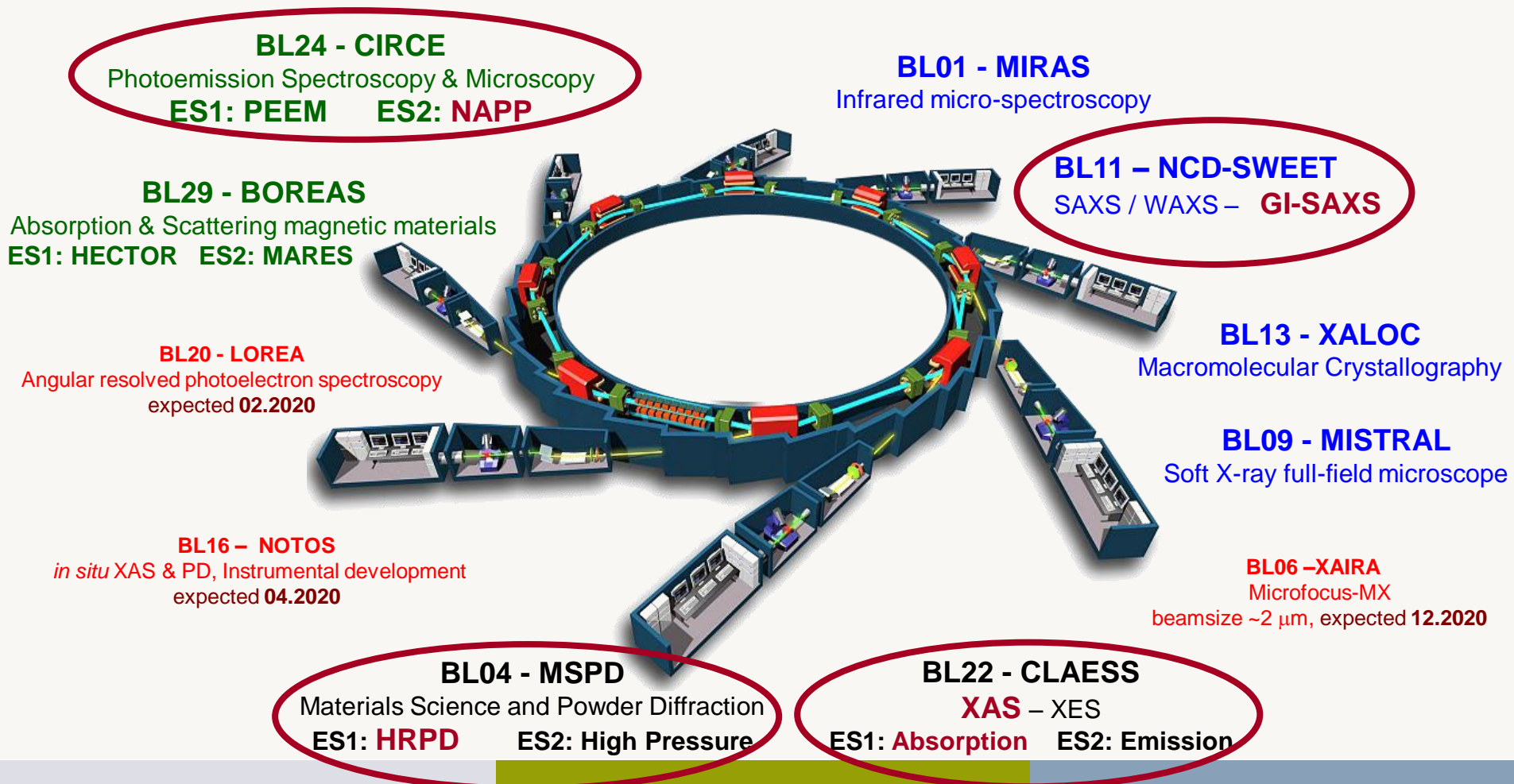
Users/Researches
per year (2017)

~ **210** staff (May-2018)

TOP-NOTCH RESEARCH IN:

- LIFE SCIENCES, including DRUG DESIGN
- CULTURAL HERITAGE
- MICROELECTRONICS
- NANOTECHNOLOGY
- ENVIRONMENT AND ENERGY
- **MATERIALS**, CATALYSIS,
- FOOD SCIENCES

1. Chemistry & Material Science Section: **BL04-MSPD** & **BL22-CLAESS**
2. Electronic & Magnetic Structure of Matter Section: **BL24-CIRCE** & **BL29-BOREAS**
3. Life Science & Soft Condensed Matter Section: **BL13-XALOC**, **BL11-NCD**, **BL09-MISTRAL** & **BL01-MIRAS**
4. Optics, Metrology & Support Section (constructing BLs): **BL20-LOREA**, **BL16-NOTOS** & **BL06-μ-MX**



Main synchrotron techniques applied to metallurgy

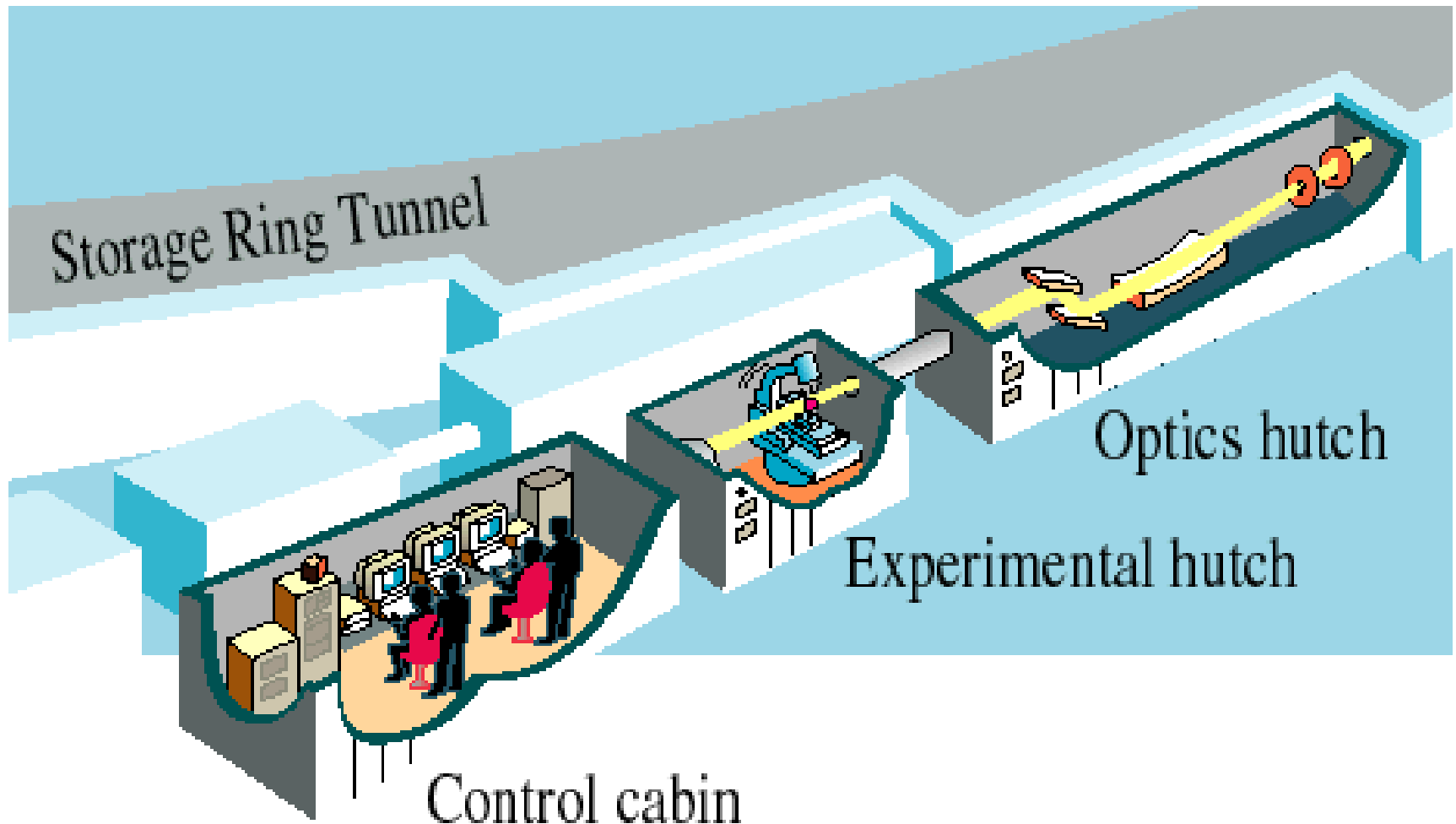
- i) **XAS** (X-ray Absorption Spectroscopy) @ BL22-CLAEISS
mainly to determine/quantify the metal oxidation states (valence).
- ii) **HRPD** (High-Resolution Powder Diffraction) @ BL04-MSPD
mainly to determine/quantify the crystalline phases.
- iii) **GI-SAXS** (Grazing-Incident Small Angle X-ray Scattering)
@ BL11-NCD-SWEET
mainly to study thin layers on a substrate.
- iv) **NAPP** (Near Ambient Pressure Photoemission) @ BL24-CIRCE
mainly to determine/quantify the elements (and oxidation states)
at the surfaces of the samples.

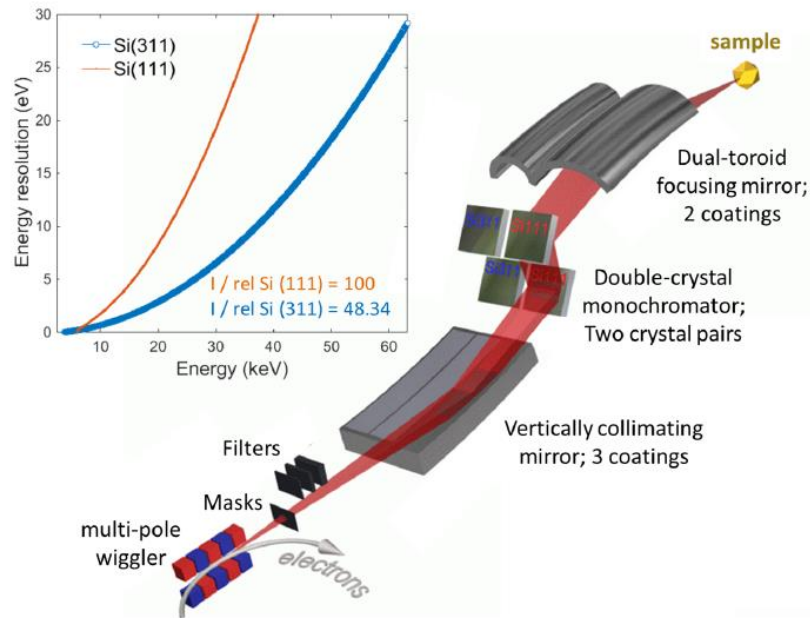
A BeamLine gives service in a given technique (or two) that it may helps in several scientific fields.

For instance **BL22-CLAESS**

Technique(s): X-ray Absorption Spectroscopies (XAS)

Fields: Materials science (inc. metallurgy), Cultural Heritage, Food sciences, etc.





X-ray absorption edges accessible at CLAESS

K-edges ($2.35 \leq E \leq 63.2$ keV)

L-edges ($2.35 \leq E \leq 63.2$ keV)

<div><div>K-edges ($2.35 \leq E \leq 63.2 \text{ keV}$)</div><div>L-edges ($2.35 \leq E \leq 63.2 \text{ keV}$)</div></div>																																		neon 10	
																	He		He																

* Lanthanide series

** Actinide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm 145	samarium 62 Sm 150.36	europtium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac 227	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np 237	plutonium 94 Pu 244	americium 95 Am 243	curium 96 Cm 247	berkelium 97 Bk 247	californium 98 Cf 251	einsteinium 99 Es 252	fermium 100 Fm 257	mendelevium 101 Md 258	nobelium 102 No 259

BL22 CLAESS Absorption & Emission Spectroscopies

- *Simultaneous & unified access to complementary techniques: Absorption and emission spectroscopies.*
- *Quick EXAFS.*
- *Photon energy range 2.4 – 65 keV.*

Staff:

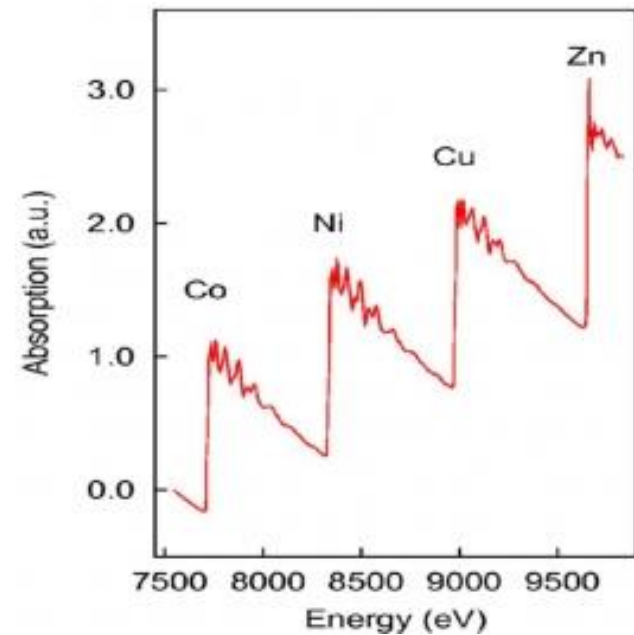
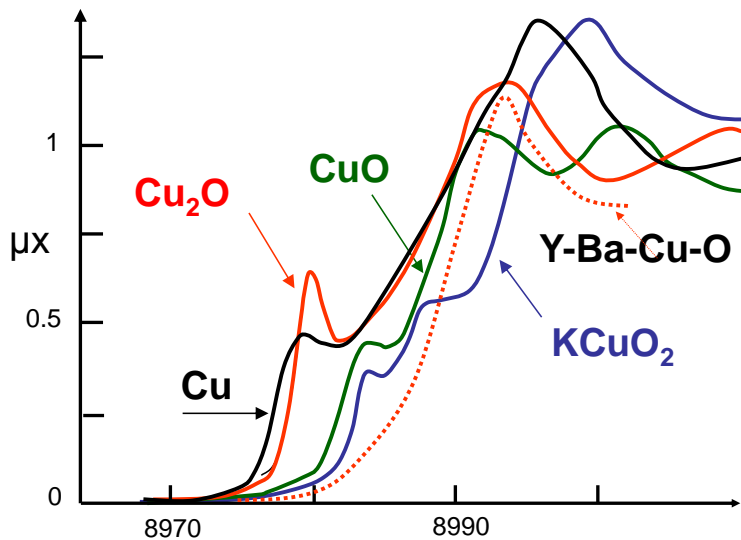
Laura Simonelli (Italian)

Carlo Marini (Italian)

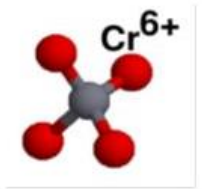
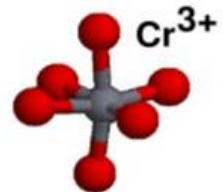
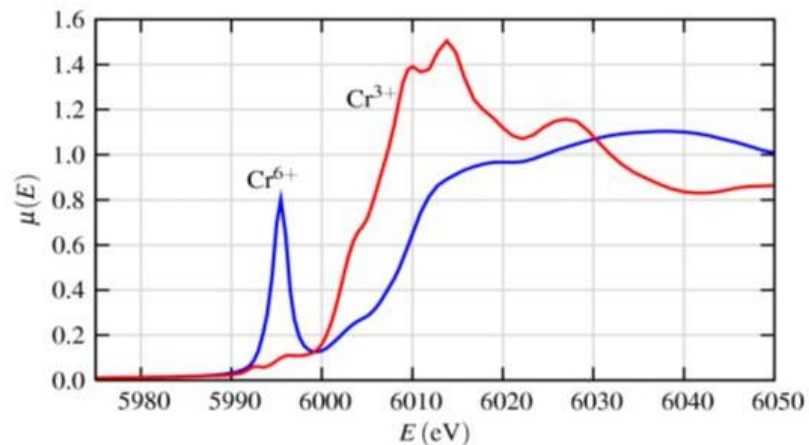
Wojciech Olszewski (Polish)

Nitya Ramanan (Indian)

Roberto Boada (Spanish)























































































XANES: Oxidation State and Coordination Chemistry



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 Director: Caterina Biscari						
Accelerator	Administration	Computing	Engineering	Experiments	Safety	Management
 Head: Francisco José Pérez Rodríguez	 Head: Edgar Aigner	 Head: David Fernández Carneiras	 Head: Joan Casas Bullich	 Head: Miguel Ángel García Aranda	 Amaud Devienne	 Alejandro Sánchez Grueso
 Andriy Nosych	 Clara Reyero	 Abel Fontserè	 Alejandro Crisol	 Alejandro Enrique	 Carme Marmol Moreno	 Ana Belén Martínez Bonillo
 Ángel Olmos	 Concepción Girbau	 Alberto Ruz	 Antonio Carballedo	 Aleksandr Missiul	 Cristina Massa Calpe	 Gastón García López
 Ángela Salom	 Daimí Pérez	 Alberto Rubio	 Artur Gevorgyan	 Ana Joaquina Pérez	 José Aguilar Mena	 Laia Torres Anibau
 Beatriz Bravo	 Eduardo Moreno	 Àlex Camps	 Carles Colldelram	 Andres Sorrentino	 José	 Marta Ávila Pérez
 David Yépez	 Elisenda Sanchis	 Antoni Pérez	 Cristina Orozco	 Antonello Rizzo	 Alcobendas García	 Nuria Valls Vidal
 Davide Lanza	 Enric Vinyals	 Antonio Camps	 David Calderón	 Bárbara Machado	 Maria Garcia Fusté	 Raquel Jimenez Alvarez
 Emilio José Morales	 Inmaculada Hernández	 Bern Saló	 Esteban Criado	 Carlo Marini	 Victor Garrido Mateo	 Salvador Ferrer Fábregas
 Ferran Fernández	 Irene Sánchez	 Bernat Molas	 Francisco Alejandro Trujillo	 Carlos Escudero		
 Gabriele Benedetti	 Meritxell Rodríguez	 Carlos Pascual	 Gabriel Peña	 Catalin Alexandru Popescu		
 Jenne Holma	 Núria Madrid	 Carlos Manuel Falcon	 Ignasi Bellafont	 Christina Kamma-Lorger		
 Jesús Ocampo	 Teresa Pla	 Cristian Pérez	 Ignasi Serra	 Clara Anduix		
 Jordi Marcos	 Vanessa Faro	 Daniel Sánchez	 Joan Vilanova	 Damià Garriga		
 Josep Campmany	 Victoria Belmonte	 Daniel Roldán	 Joaquín Benchohra González	 Daniel Ruano		
 Juan Carlos Giraldo	 Yolanda Ruiz	 Daniel Salvat	 Jon Ladrera	 Debora Pierucci		

As 2018/05/17
Structural staff

Experiments Division #61
M.A.G. Aranda

User Office #4
Inma Ramos
MPC, MJS, **NM**

**Chemistry & Material
Science section #8**
Francois Fauth

- **BL04 MSPD #4**
FF, CP, **AM**, AM₂
- **BL22 CLAESS #4**
LS, CM, NR₃, WO₄
- ◆ **Chemistry lab** (FF)
- ◆ **High-pres. lab** (CP)

**Electronic & Magnetic
Structure
of Matter section #9**
Eric Pellegrin

- **BL24 CIRCE #4**
LA, VP, MF, CE,
- **BL29 BOREAS #4**
MV, JH, PG, HB₅
- ◆ **Material lab** (EP)

**Life Science & Soft
Condensed Matter
section #18**
Jordi Juanhuix

- **BL09 MISTRAL #4**
EP, AP, AS, JC₆,
- **BL11 NCD #4**
MM, CK, JC, ES₁₁
- **BL13 XALOC #4**
RB, FG, XC, BC₇,
- **BL01 MIRAS #4**
IY, MK, TD, NB₀₉
- **BL06 XAIRA**
#2: JJ, D.G.
- ◆ **Biology labs** (RB)
- ↳ **Cell culture lab** (CK)

**Optics & Metrology
section #9**
Josep Nicolas

- **BL20 LOREA #3**
MT, FB, DP
- **BL16 NOTOS #3**
OV, DH, GA
- **Scientists #2**
IS, PP₀₈
- ◆ **Optics lab** (JN)

**Support to
Beamline section
#12**
Edmundo Fraga

- **Technicians #5**
FF, JP, RV, JP, AE
- **Floor
coordinators #6**
RO, ID, IG, PR, AR,
FM
- ◆ **Prox. mechanic
lab** (EF)



Industry as a supplier

Synchrotron

Industry
as a partner

Industry
as a customer