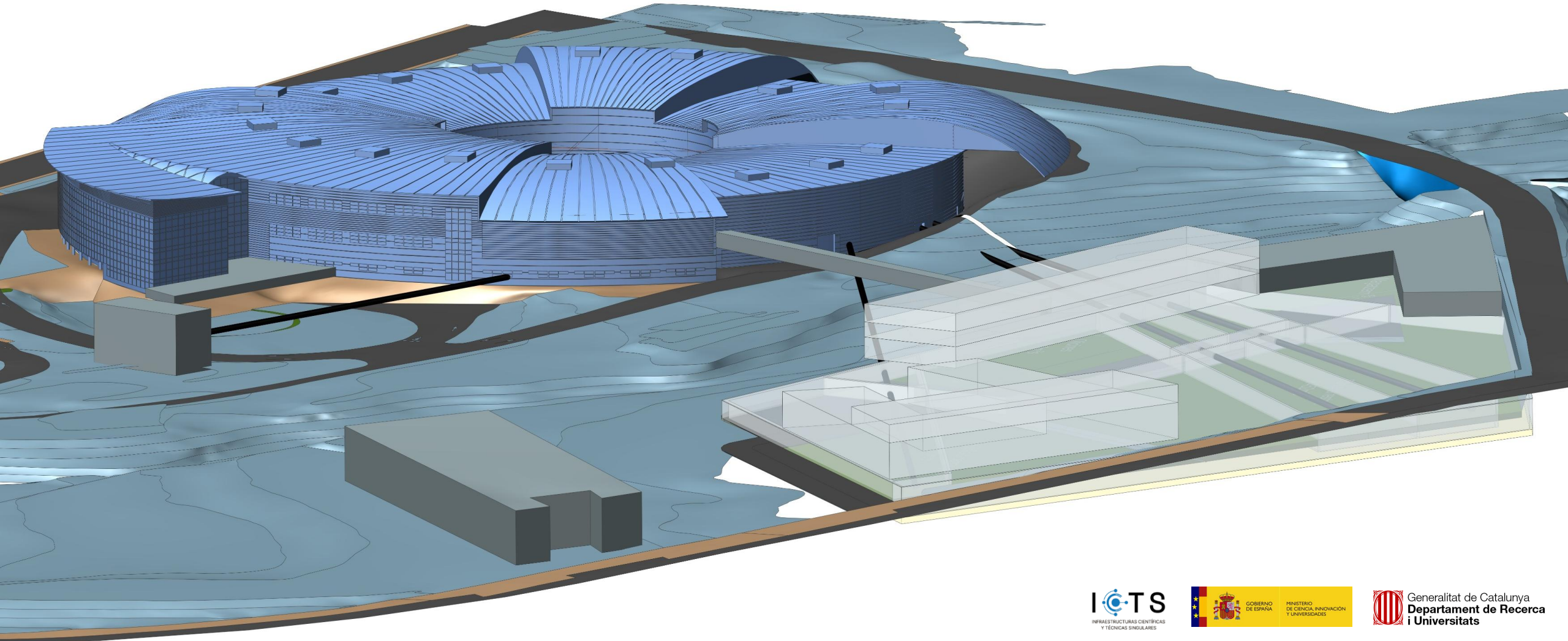
ALBA II Project

Francis Perez

October 21st, 2026



I CTS INFRAESTRUCTURAS CIENTÍFICAS Y TÉCNICAS SINGULARES
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
Generalitat de Catalunya Departament de Recerca i Universitats

ALBA Synchrotron Light Facility

National Public institution with funding 50%/50% from the **Spanish** *Ministerio de Ciencia, Innovación y Universidades* and the **Catalan** *Department de Recerca i Universitats*

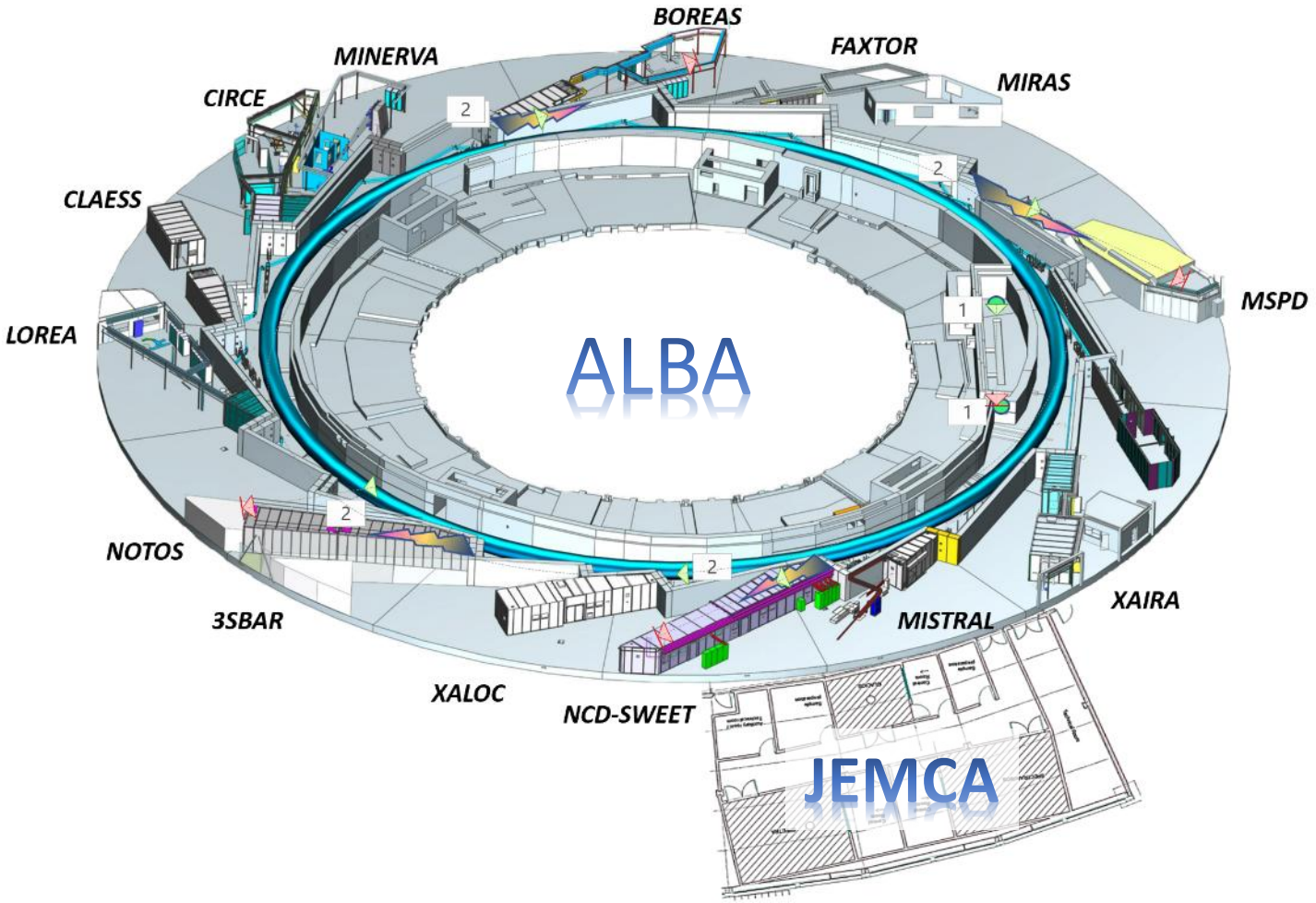
National and international (~30%) staff . Total of ~300 staff.

National and international (~40%) users.

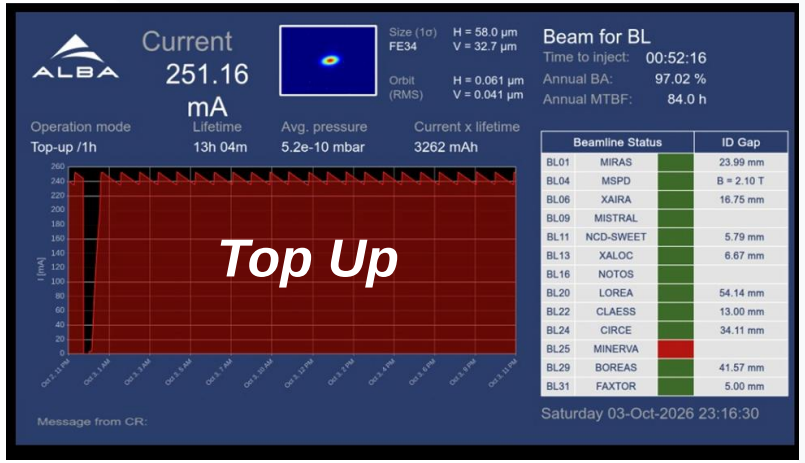
National and international collaborations.



ALBA key parameters



- **LINAC**: 100 MeV
- **BOOSTER**: 100 MeV-3 GeV, 249.6 m.
  ε = 10 nm·rad, same tunnel than SR.
- **STORAGE RING**: 3 GeV, 268.8 m.
  ε = 4.5 nm·rad



13 operating BLs
1 in construction
1 in renovation
2 for acc. diagnostics

Joint Electron Microscope Center at ALBA

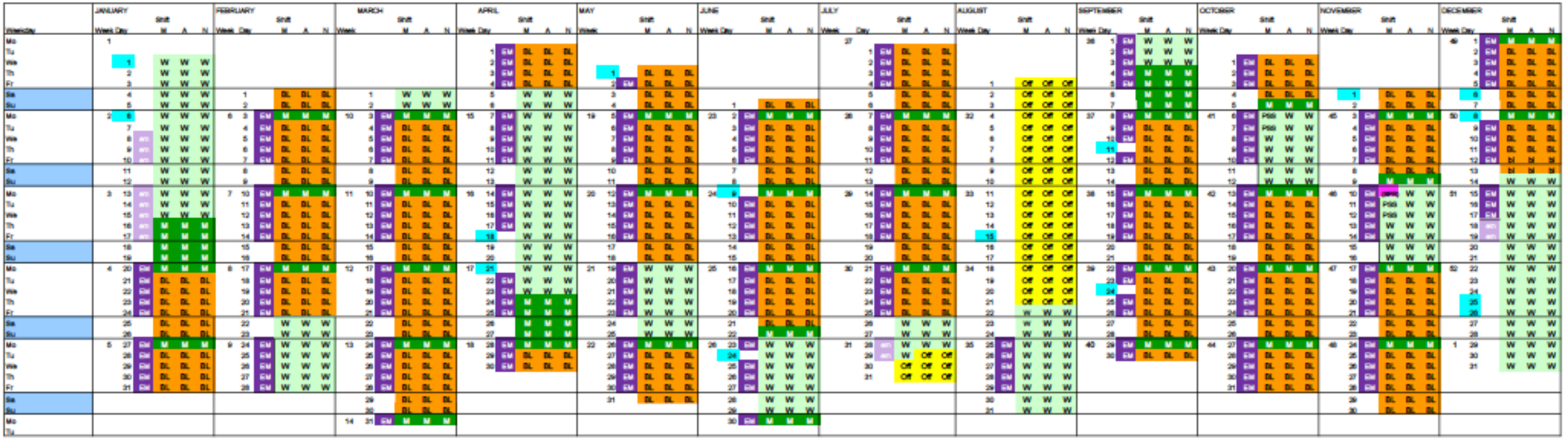
2 x TEMs in operation
1 x TEM under commissioning
1 x TEM under construction
1 x set of Scanning Probe Microscopes under commissioning

ALBA Operation

	Yearly Operation
M	1.152 h
BL	4.512 h
TOTAL	**5.664 h**

ALBA Operations Calendar, January 2025-December 2025

BL operation	BL	BL users (external, friendly, in-house & commissioning)
bl operation	bl	BL/FE/ID Commissioning & Accelerator Optimization for BLs
Start-up	M	Start up of accelerators with beam & Accelerator's Studies
Warm-up	W	Warm: Linac & RF & magnets & sub-systems maintenance and optimisation
Shutdown	Off	Civil Engineering, Accelerators and BL maintenance with no beam, installations and upgrades
Public & CELLS holiday		
Microscope commissioning	EM	
Microscope Operation	EM	



In operation since 2012

ALBA is delivering 5.600 hour/year with a beam for users **availability of ~98%**

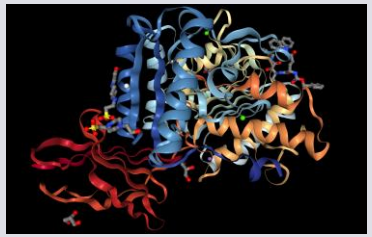


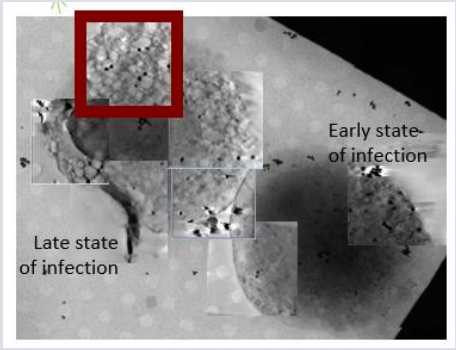
ALBA Synchrotron Research Infrastructure

Four Scientific Sections

Life Science

From the protein, to cell, to tissues

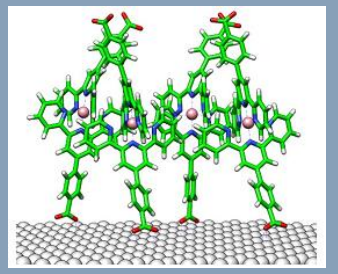




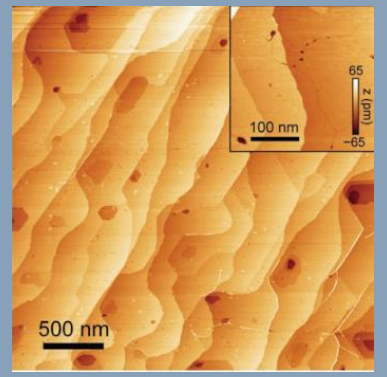
Cell infected by covid-19

Electronic and Magnetic Structure of Matter

Advanced materials

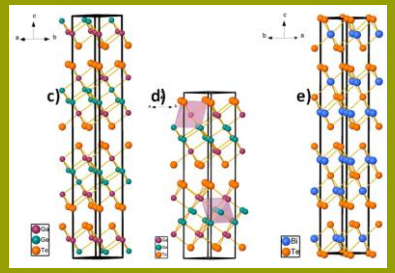


DOI: 10.1002/adfm.20230035

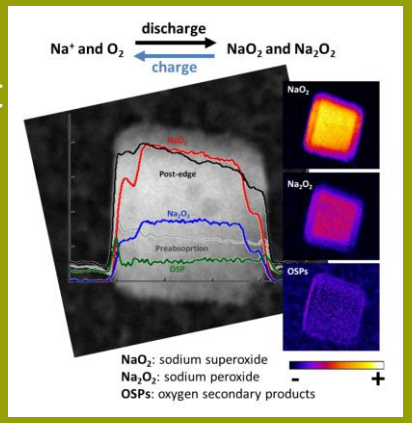


Chemistry and Material Science

Energy material, catalysts, environment



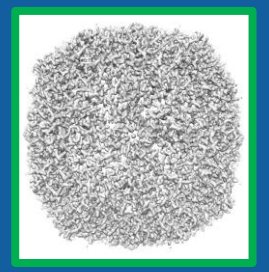
doi.org/10.1016/j.mtadv.2023.100403

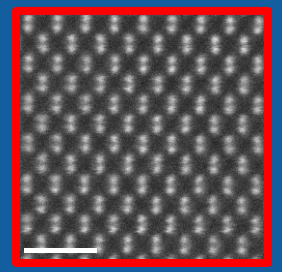


Battery developments

Interdisciplinary and Multimodal Section

Includes contribution to JEMCA and Data science

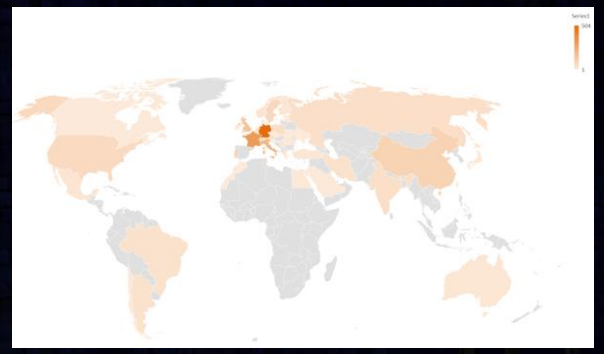




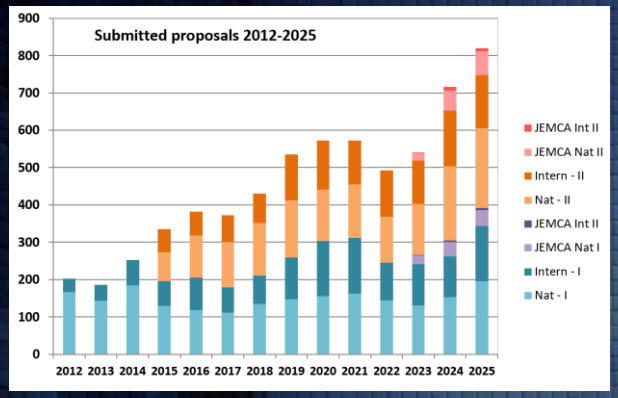
Nanomaterials for data storage

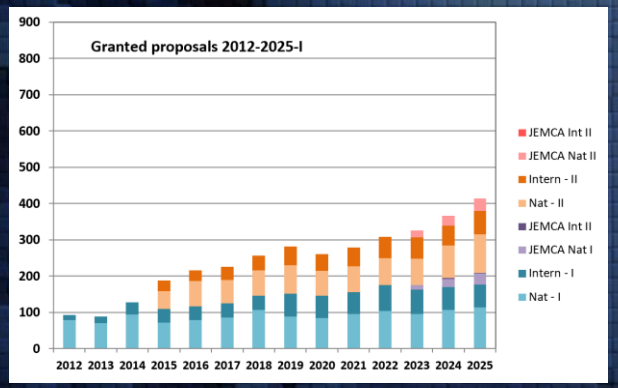
Our USERS (more than 8500)





Academic proposals
(5777 submitted/2928 granted)







Academic

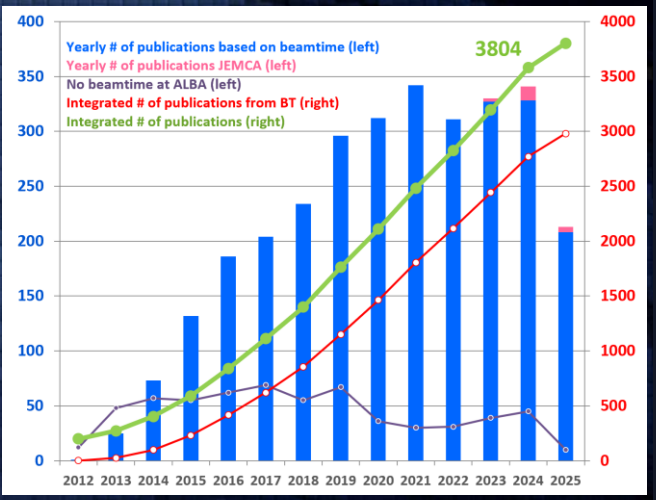
Joint academic and industrial

Private

Competitive and free access
Public results

Direct access covering operational costs
Results can be confidential

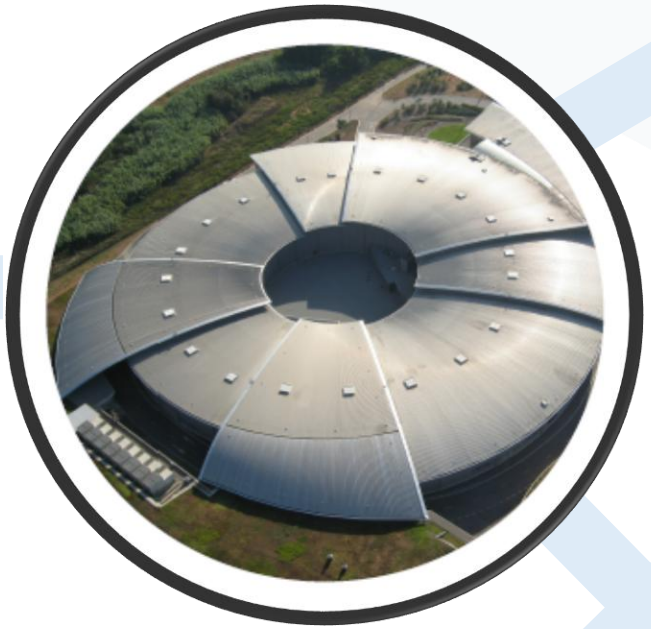
+90 companies using our instruments



Industry: partner and user

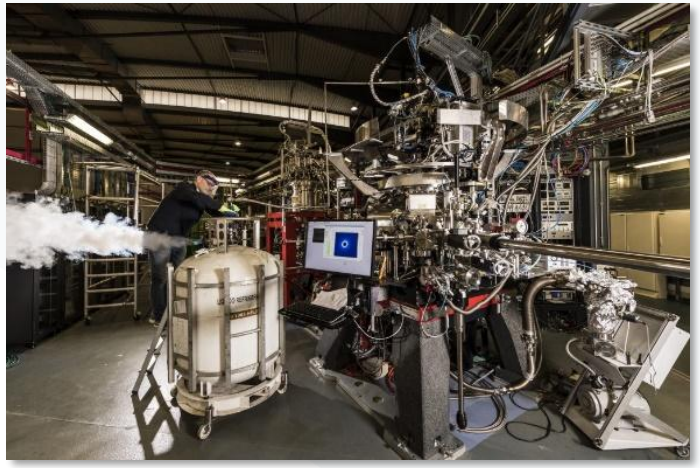


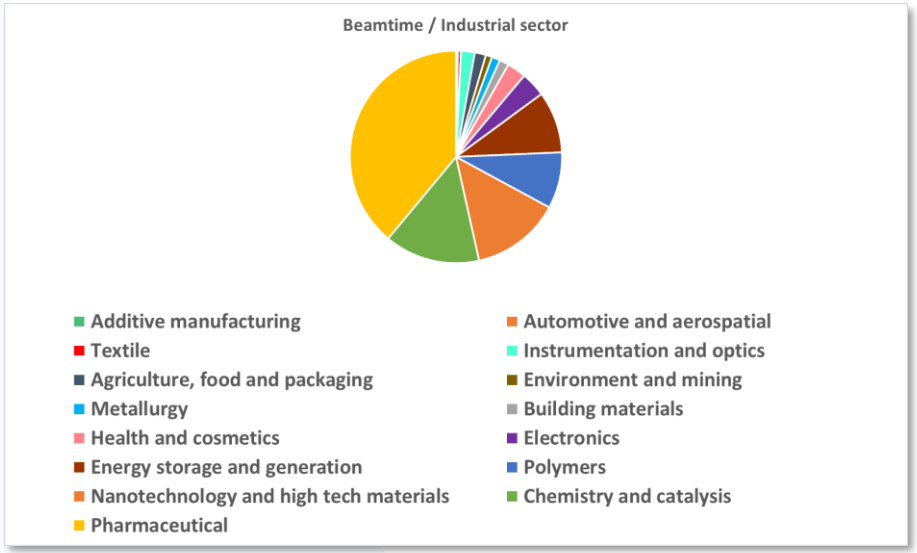
User and Innovation Partner



Supplier

Industry of science





IP and Technology Transfer



ALBA
key numbers

+3500 yearly user visits

+450 yearly experiments

+4500 national and +4500 international users

+3800 publications

<IF> >9

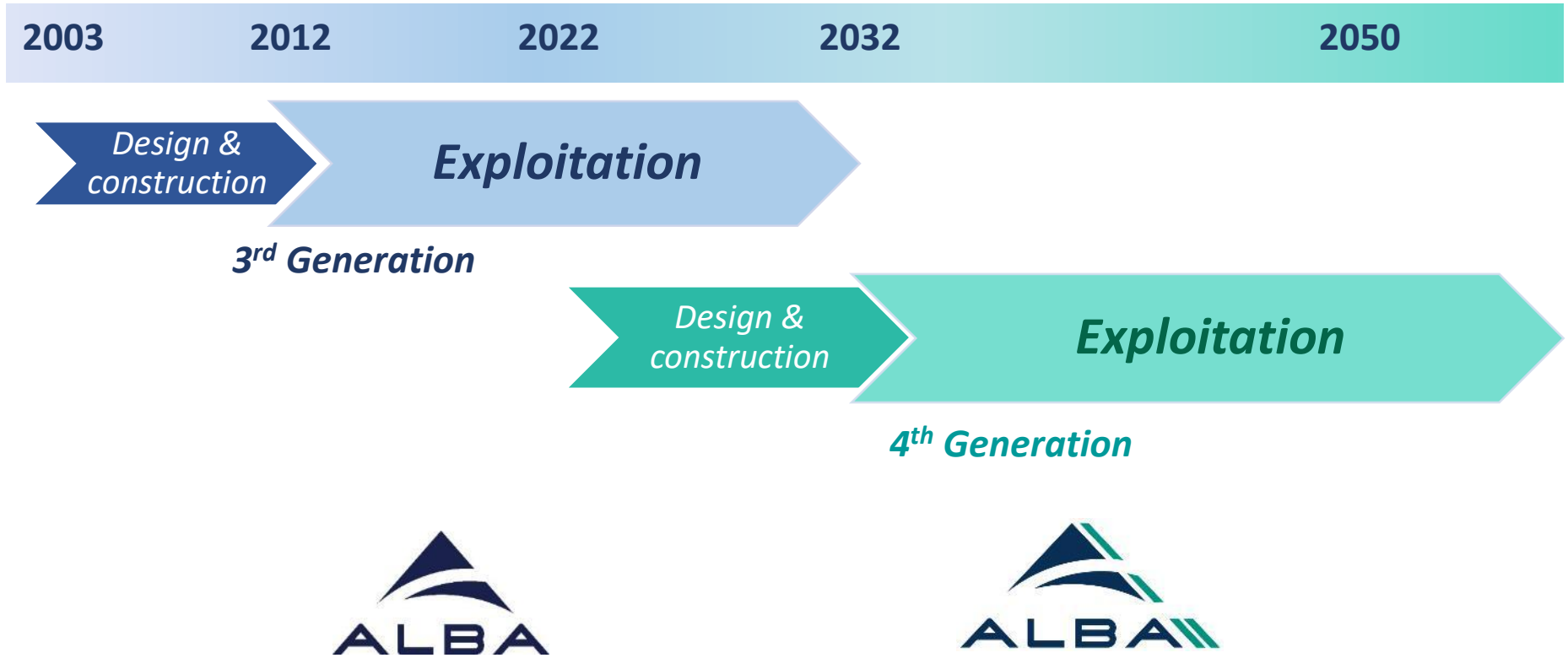
+3500 public experiments

+700 industrial experiments

+1100 Proteins in PDB

~300 staff

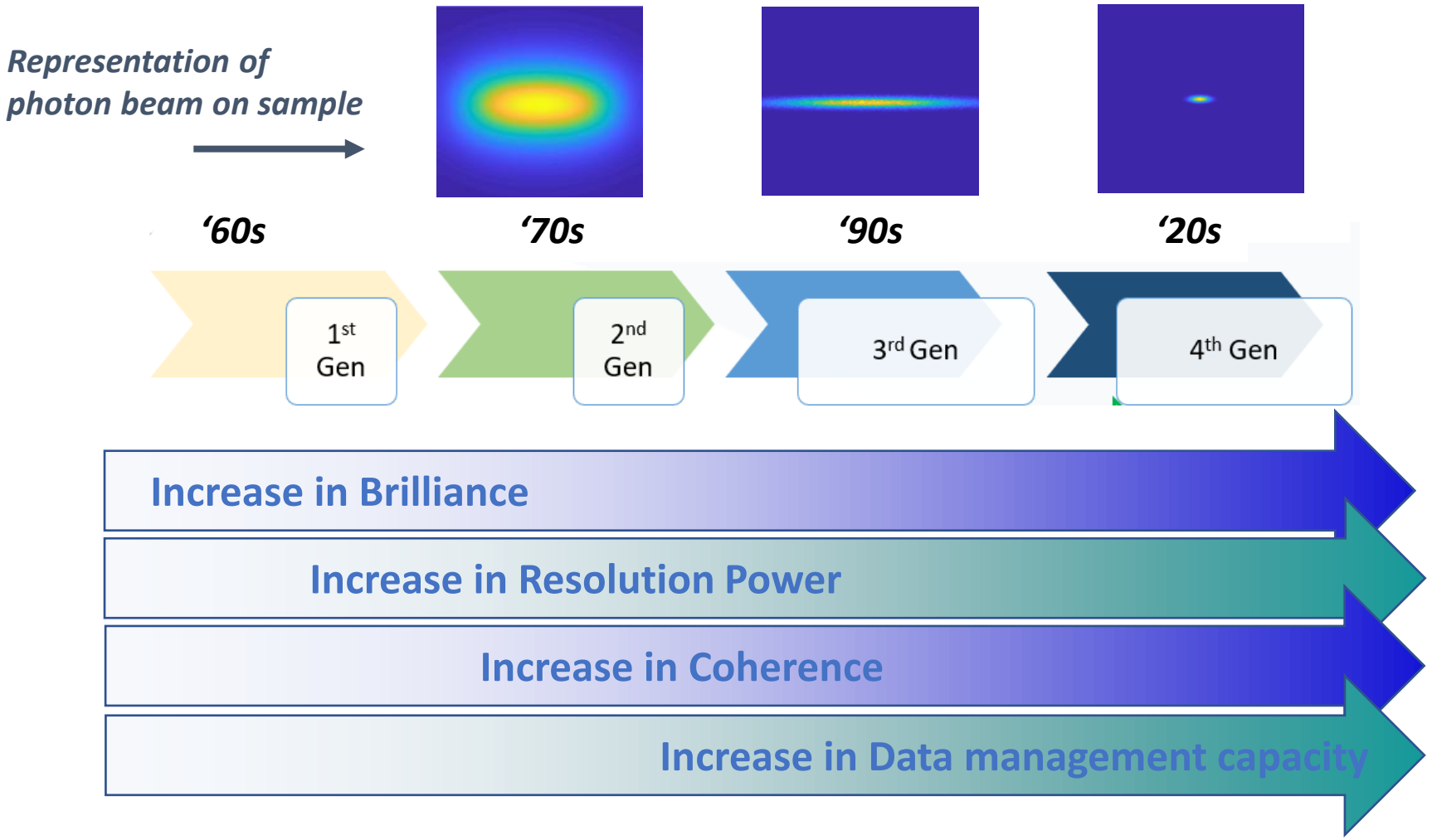
Evolution of ALBA to the 4th Generation ALBA II



To produce new science beyond the '50s

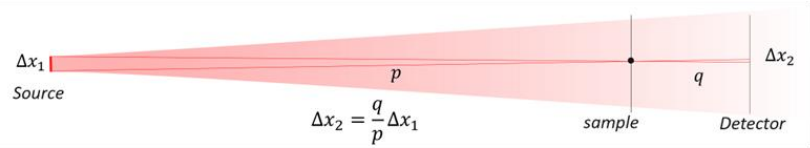
Why the upgrade?

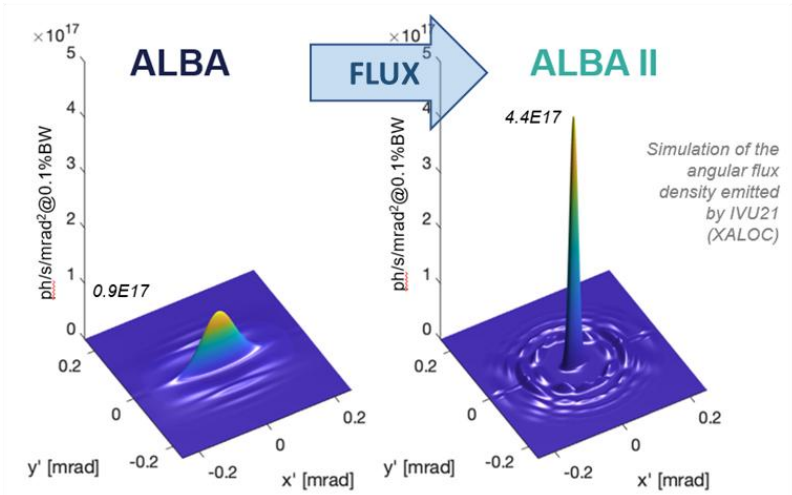
Evolution of Synchrotron Radiation Sources

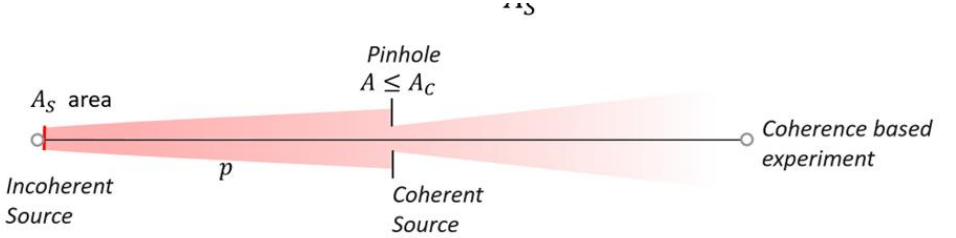


Evolution from 3rd to 4th generation synchrotrons

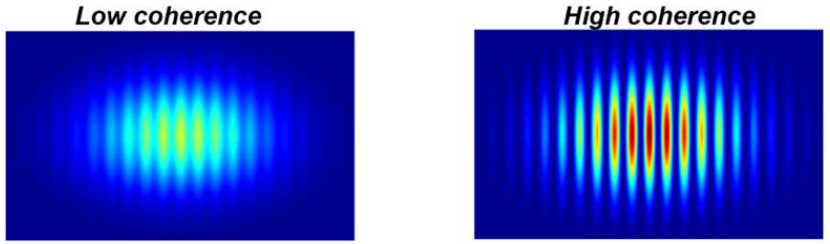
increase in Brilliance, flux, coherence of synchrotron light by orders of magnitude – boosted by long photon paths







Most basic example: Young's Double slit interference

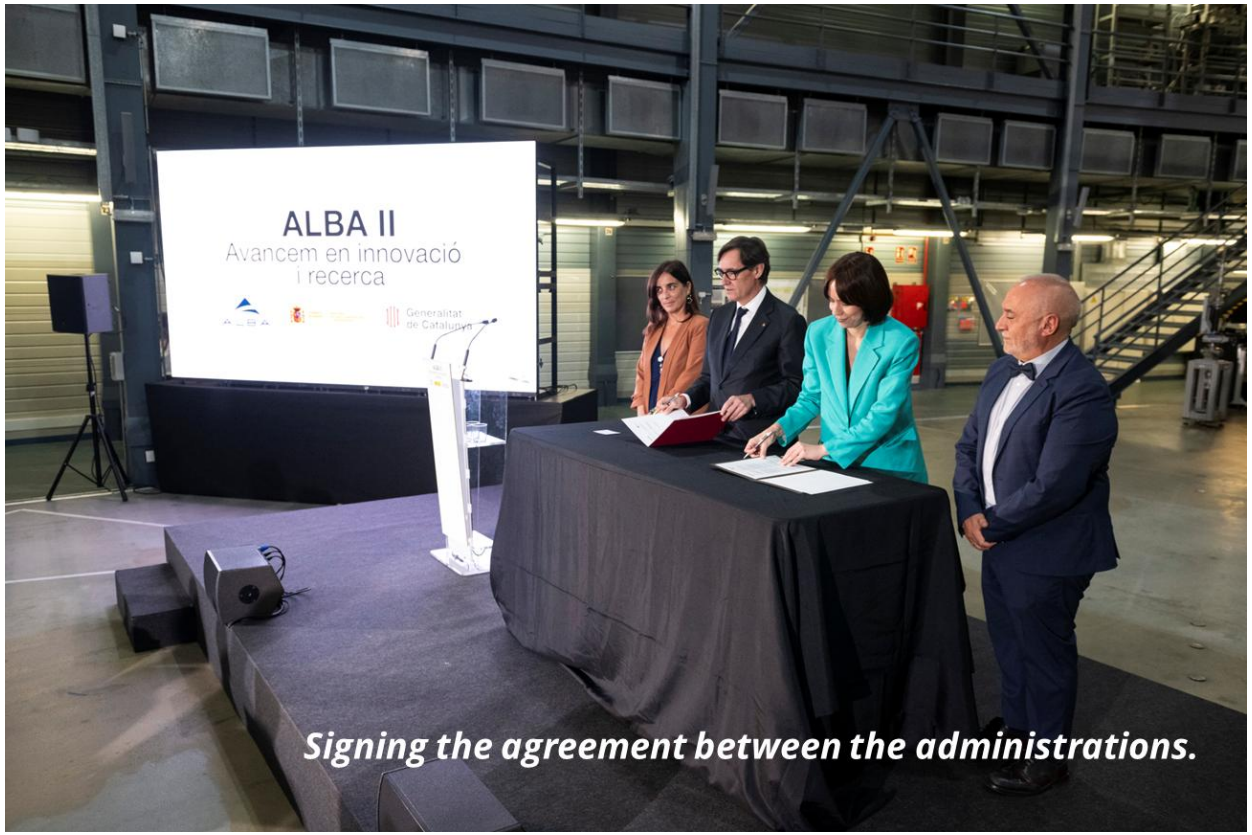


$$A_C(p) = \frac{(\lambda p)^2}{A_S}$$

Faster experiments

Higher resolution (either spatial, in time or in energy)

ALBA II project was approved in Sept 2025
Published in BOE 1/1/2026



Signing the agreement between the administrations.

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

Generalitat de Catalunya
Departament de Recerca i Universitats

BOLETÍN OFICIAL DEL ESTADO
Núm. 1 Jueves 1 de enero de 2026 Sec. III. Pág. 281

III. OTRAS DISPOSICIONES

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

63 *Resolución de 19 de diciembre de 2025, de la Secretaría General de Investigación, por la que se publica la novena Adenda del Convenio con la Generalitat de Cataluña, para la constitución del consorcio para la Construcción, Equipamiento y Explotación del Laboratorio de Luz de Sincrotrón.*

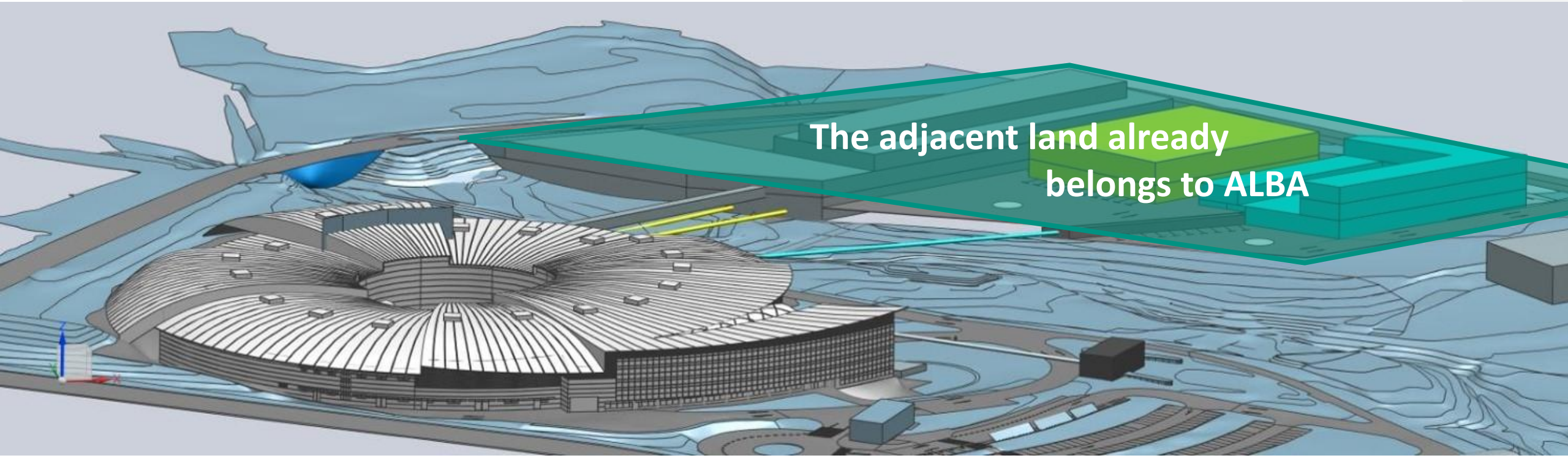
Habiendo sido suscrita el 18 de diciembre de 2025 la «Novena Adenda al Convenio firmado el 14 de marzo de 2003, entre el Ministerio de Ciencia y Tecnología (actualmente Ministerio de Ciencia, Innovación y Universidades) y la Generalitat de Cataluña para la constitución del consorcio para la Construcción, Equipamiento y Explotación del Laboratorio de Luz de Sincrotrón» y en cumplimiento de lo dispuesto en el artículo 123.2.c) de la Ley 40/2015, de 1 de octubre, de Régimen Jurídico del Sector Público, procede la publicación en el «Boletín Oficial del Estado» de dicha adenda, que figura como anexo a esta resolución.

Madrid, 19 de diciembre de 2025.–La Secretaria General de Investigación, Eva Ortega Paíno.

ANEXO

Novena Adenda al Convenio firmado el 14 de marzo de 2003, entre el Ministerio de Ciencia y Tecnología (actualmente Ministerio de Ciencia, Innovación y Universidades) y la Generalitat de Cataluña para la constitución del consorcio para la Construcción, Equipamiento y Explotación del Laboratorio de Luz de Sincrotrón

Upgrade Project



The upgrade ALBA II includes:

- **upgrade** of the storage ring.
- **upgrade** of the existing beamlines to keep up with the new ring.
- **expansion** of the infrastructure.
- **construction** of two new long beamlines.
- **synergy** to create a scientific and technological pole in the area.

ALBA II Schedule

JAN 2026

ALBA II APPROVED

JUN 2030

CLOSED ALBA

SEPT 2030

START OF SR INST.

SEPT 2031

START OF SR COMM.

FEB 2032

START OF BL COMM

2 years gap in User's operation

JUN 2032

ALBA II

USERS OPERATION

ALBA II Storage ring design

Being optimized while defining all technical details: 5BA lattice

- **Keep** beam energy **3 GeV**
- **Keep** the **tunnel** → SR with similar compact circumference

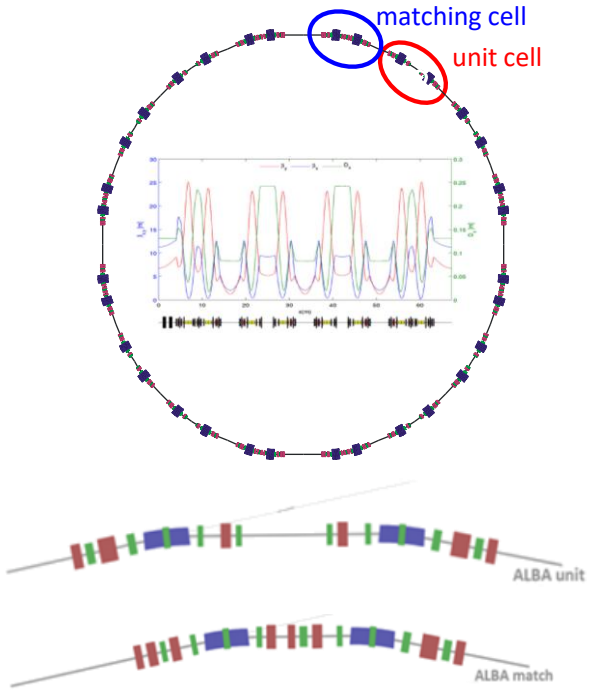
- **Keep** existing **ID beamlines** → preserve 16 cells and source points
- Bending beamlines can be relocated

- **Keep injector** (present $\varepsilon_x^{booster}$ = 10 nm·rad)
- **Keep infrastructures**, as much as possible

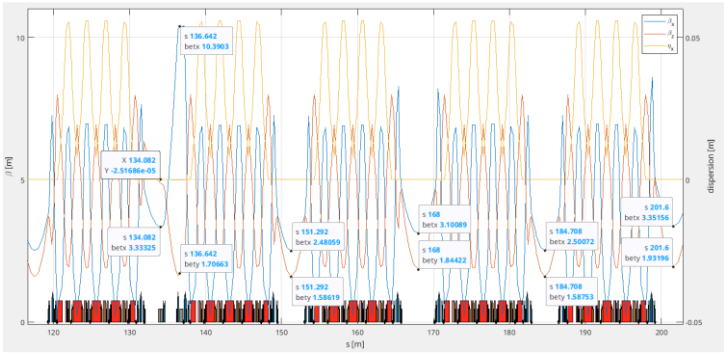
- **Straight sections** ~4 m, with $\beta_x \sim \beta_y \sim$ 2 m
- Reduce **emittance** by more than a factor 10 **(<400pmrad)**

ALBA II Storage ring design

Being optimized while defining all technical details: 5BA lattice

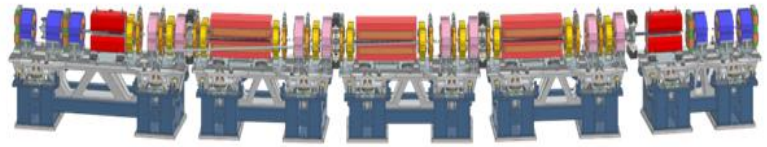


	ALBA		ALBA II
Energy	**3 GeV**		**3 GeV**
Circumference	268.8 m		268.8 m
Symmetry	4-fold		4-fold
Lattice	8×2-DBA cells		16×5BA cells
Emittance	**4.5 nm·rad**	**÷22.5**	**200 pm·rad**
Nº of cells	8+8		16
# of straights	4 / 12 /8		16
Straight length	7.8 / 4.0 / 2.3m		3.5 / 4.0 / 4.5 m



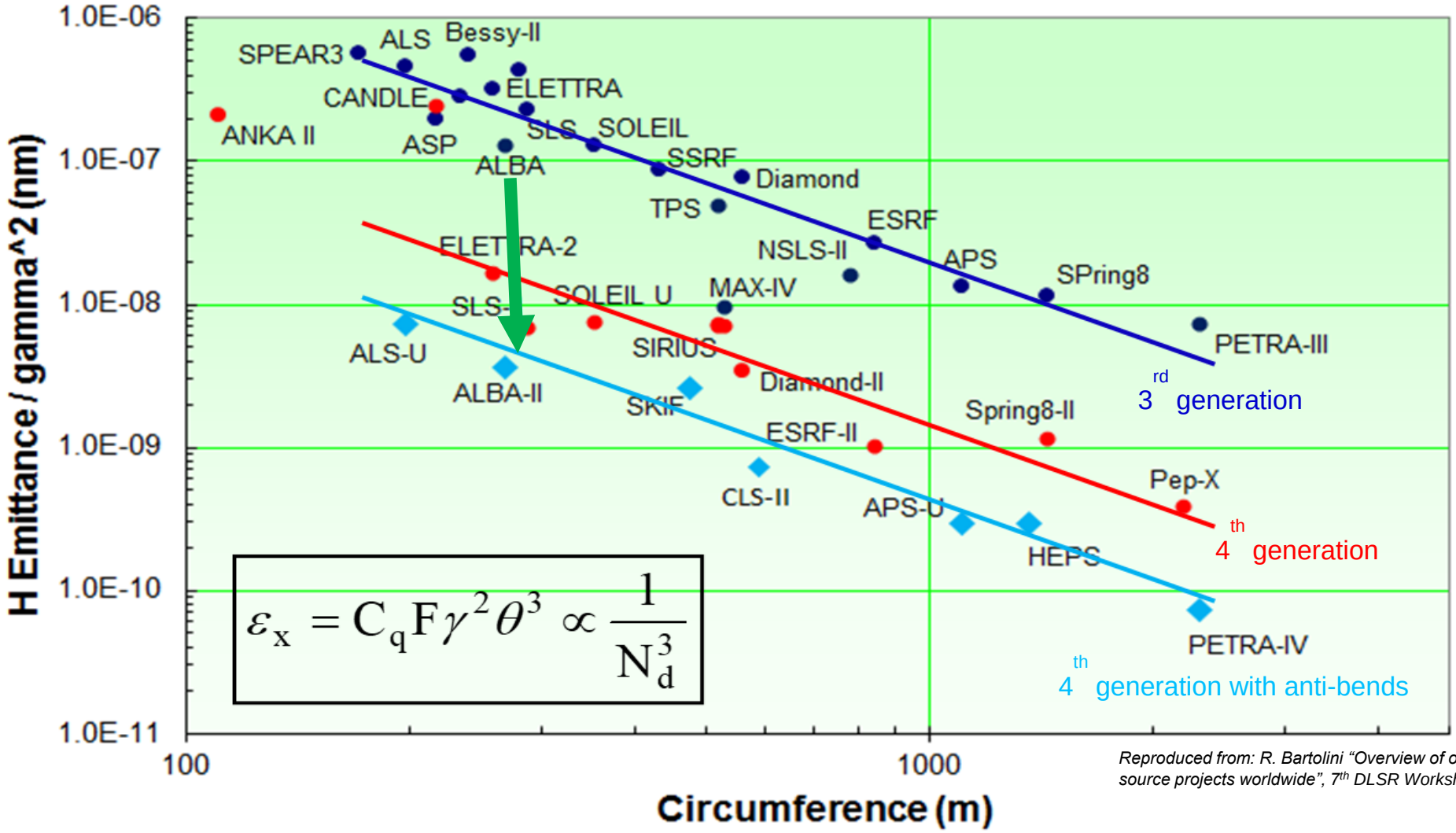
Much compact!





The emittance from ALBA to ALBA-II

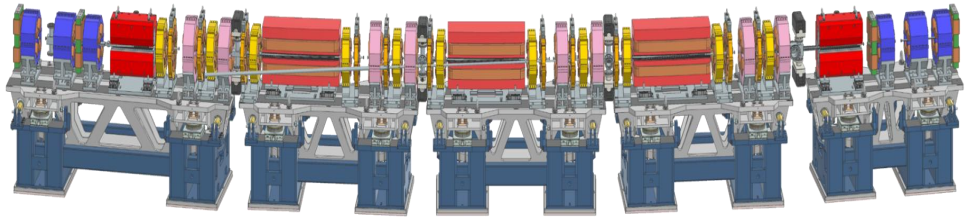
ALBA II will reduce the **emittance** by a factor ≈22: **from 4.5 nm·rad to 200 pm·rad**

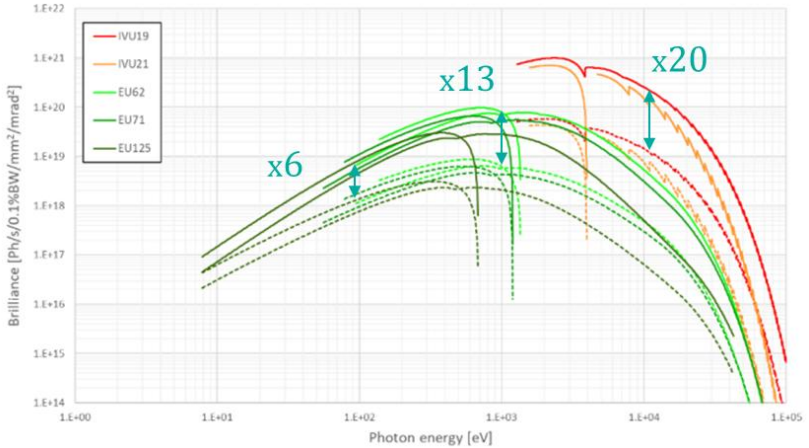


Reproduced from: R. Bartolini "Overview of ongoing 4th generation light source projects worldwide", 7th DLSR Workshop (2021)

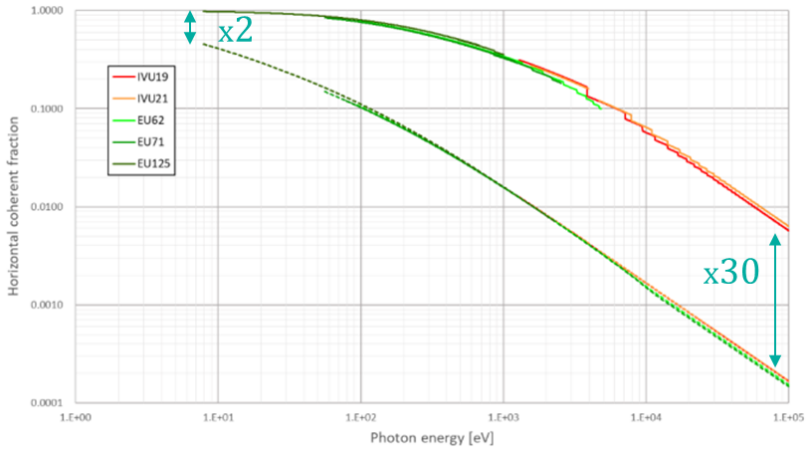
ALBA II design in progress

- 4th generation light source
- Emittance 200 pm (20+ times smaller than ALBA)
- Current 300 mA (+ 20% with respect to ALBA)
- Increase of brilliance by order of magnitude
- Increase of coherence
- **Advanced properties for imaging, spectroscopy, diffraction**





*Undulator's **spectral brilliance** in the present ALBA (dashed lines), and in the upgraded ALBA II (solid lines).*

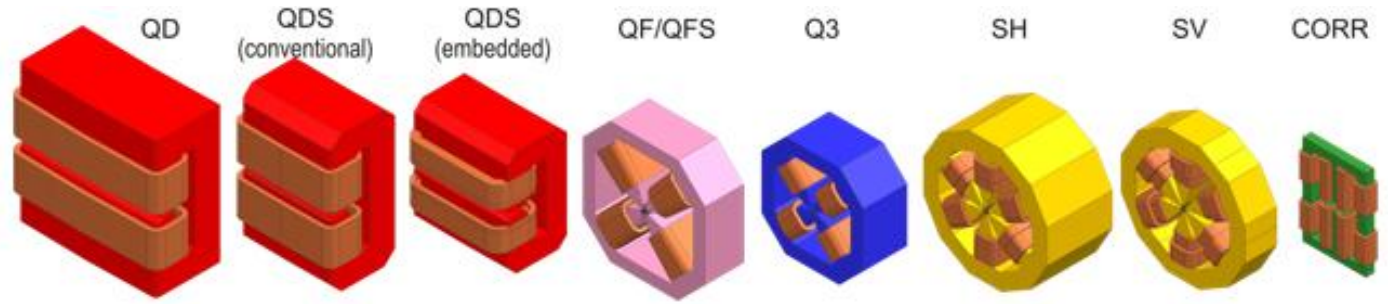


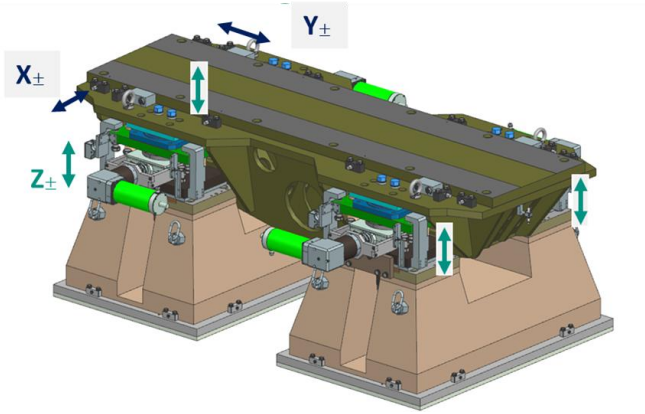
Horizontal coherent fraction, for the present storage ring (dashed lines) and for the upgraded ALBA II (solid lines).

Design and prototyping main systems of the storage ring (2023 – 2026)

Funded by the European Union NextGenerationEU
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
Generalitat de Catalunya Departament de Recerca i Universitats

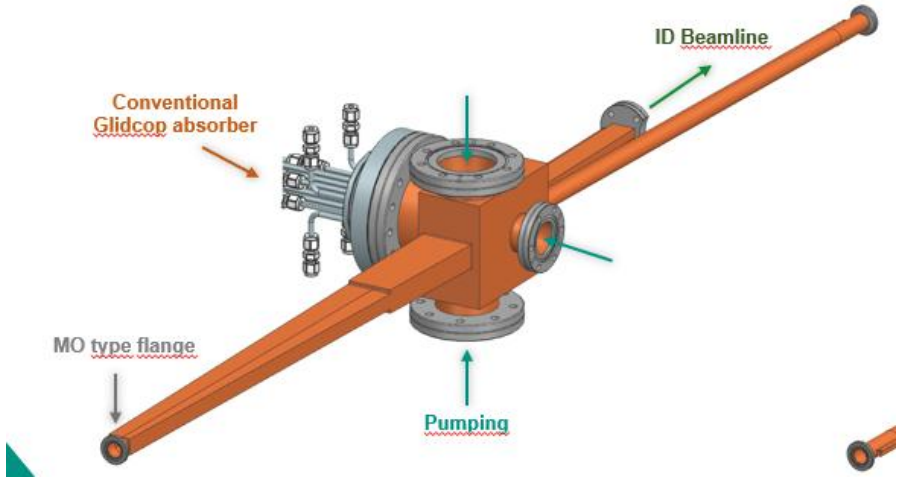
Magnets





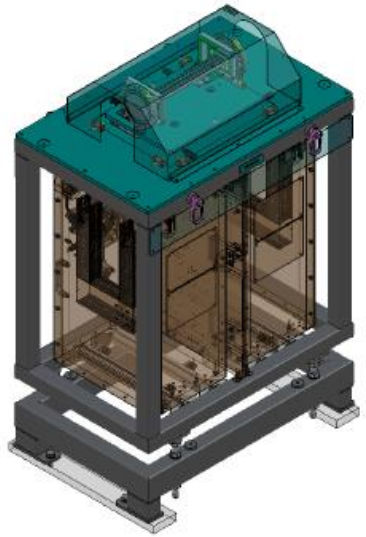
Girders

Vacuum



Injection elements

Double Dipole Kicker



Design and prototyping main systems of the storage ring (2023 – 2026)

Funded by the European Union NextGenerationEU
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
Generalitat de Catalunya Departament de Recerca i Universitats

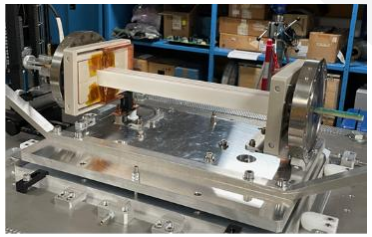
- Electromagnets
- Permanent magnets
- Vacuum chambers
- Pulsed magnets
- 3rd Harmonic Cavity
- Digital LLRF

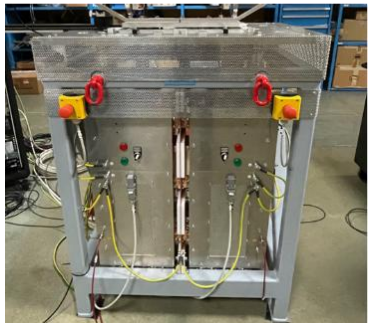


3rd Harmonic Cavity



Corrector





Pulsed magnet and power supply

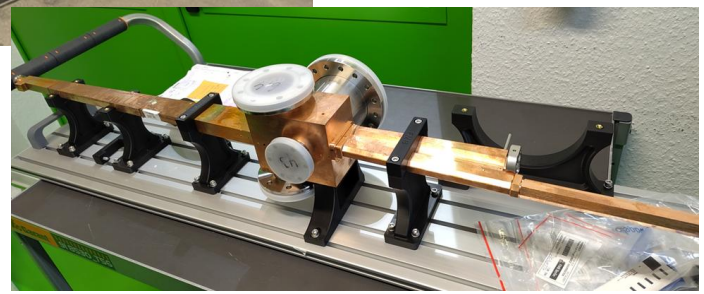
Permanent Magnet



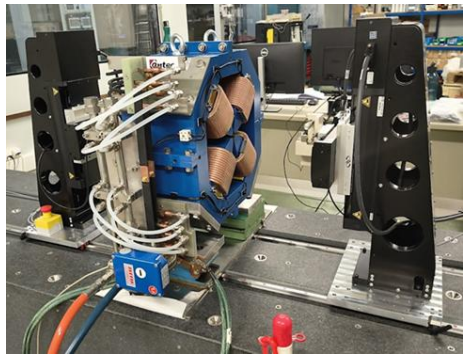


Girders

Vacuum chamber



Electro-Magnet

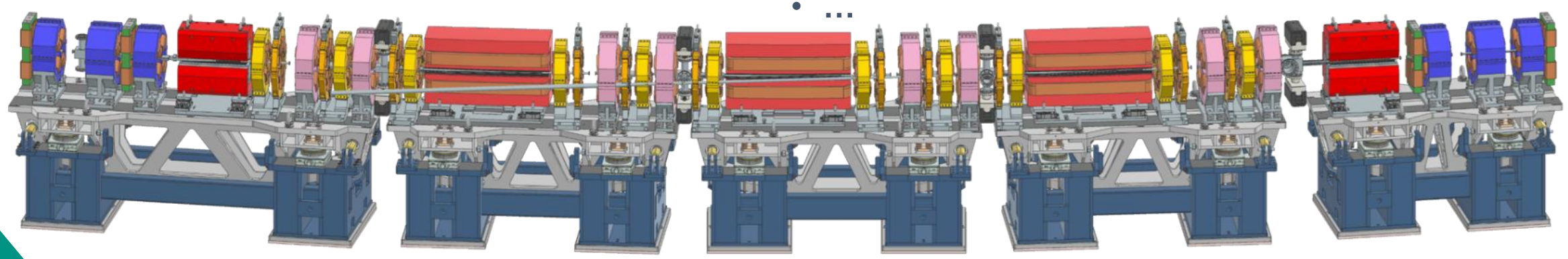




BPM block

Accelerator Implementation (2027 – 2030)

- New magnets
  - ~ 720 magnets
  - ~ 1100 power supplies
  - Permanent magnets
- New vacuum chambers
  - ~ 270 m vacuum chambers
  - SS, Cu, NEG coated
- New Girders
  - High vibration modes
  - High precision remote movement
- Many others:
  - Upgrade RF system with SSA and 3rd Harmonic Cavity
  - New Diagnostics equipment
  - New Insertion Devices
  - Upgrade electronics
  - …



ALBA II, day one



BL02-CoDI

BL04-CORUS

ALBA II BLs portfolio in 2032

- *13 ID beamlines (full)*
- *4 BM beamlines*
- *1 IR beamline*
- *1 Visible diagnostics*
- *2 XR pinhole diagnostics*

Joint Electron Microscope Center

3 x TEMs (1 x Glacios, 2 x Spectra)

Scanning Probe Microscope Platform

What ALBA II will provide

Full infrastructure to tackle the grand challenges of our time for the Spanish and European users

ALBA II combines the excellence and availability of the user program of ALBA with the development of full characterization suites for characterizing multi-lengthscale problems

- Enhanced **microscopy** capabilities
- **Multimodal methodologies** to address complex development tasks
- **High throughput capabilities** and big-data connectivity for fast innovation
- And **optimized operando environments** to optimize functional materials and devices

ALBA II Upgrade Project summary

The upgrade ALBA II includes:

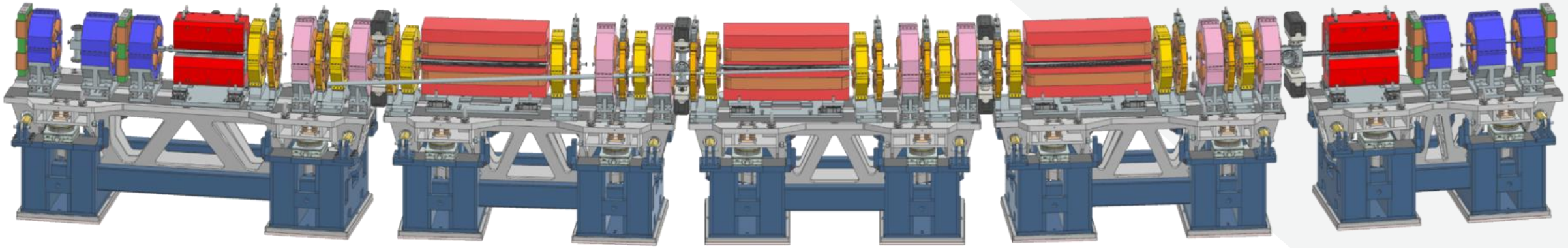
- **Upgrade of the storage ring.**
- **Renovation** of the existing beamlines.
- **Expansion** of the infrastructure.
- **Construction** of up to three new long beamlines.
- **Synergy** to create a scientific and technological pole in the area.

923 M€
for the period
2025 – 2038
Includes ALBAII, manpower & operation.





Thanks for your attention,
and the to the whole ALBA team



Questions welcome

Generalitat de Catalunya
Departament de Recerca
i Universitats

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MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES