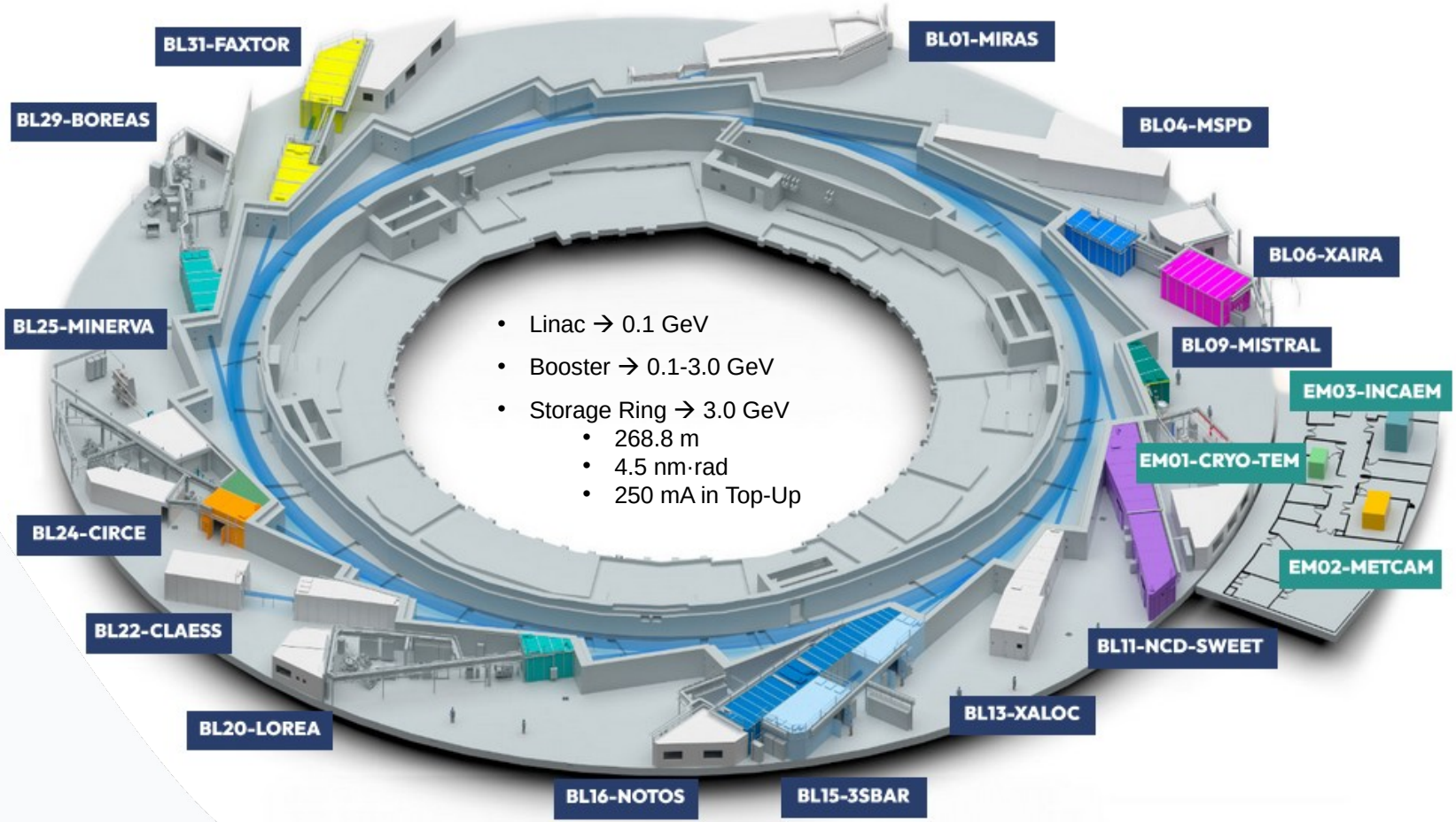
ALBA Status and Upgrade

33rd ESLS workshop – 30th October 2025, Soleil

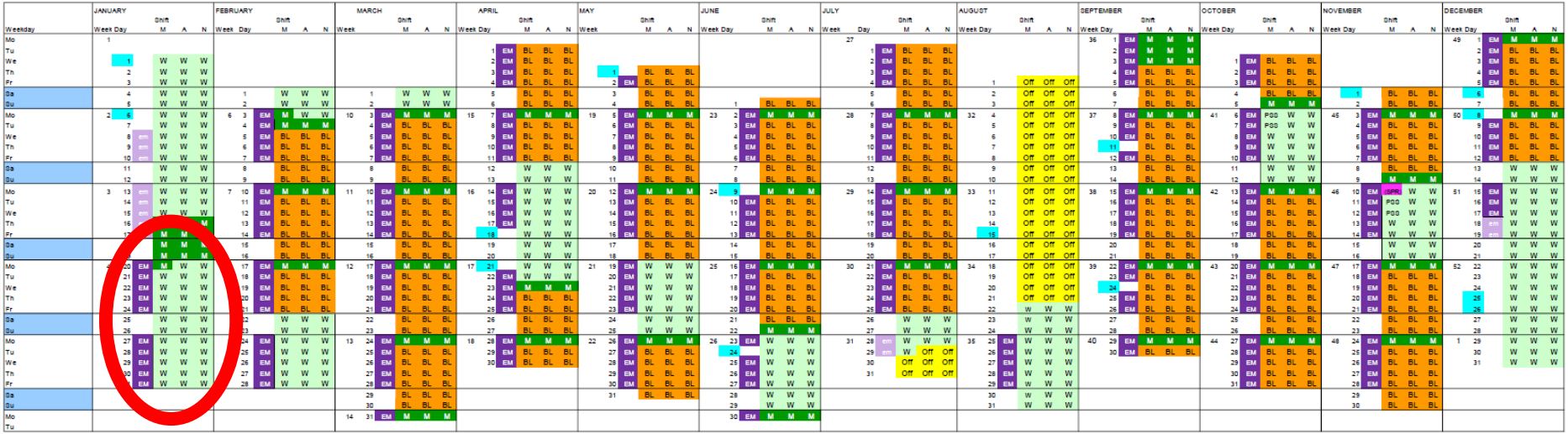
Ferran Fernandez, on behalf of the Accelerators team

2025 Operation

ALBA Synchrotron Light Source



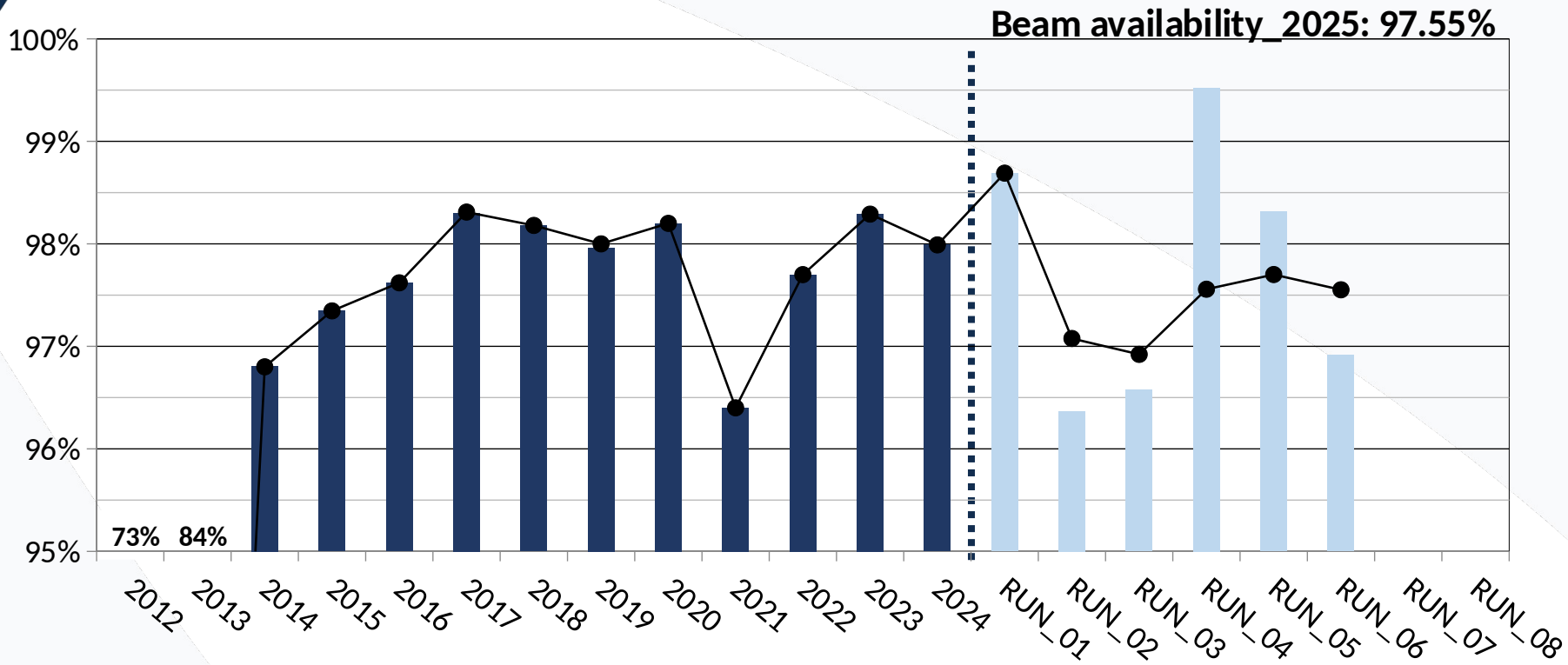
Operation Calendar 2025



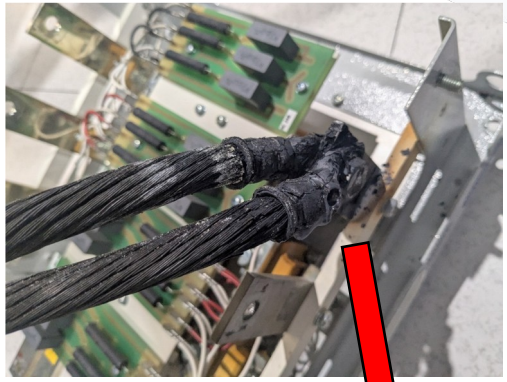
SR Bending magnets PS incident

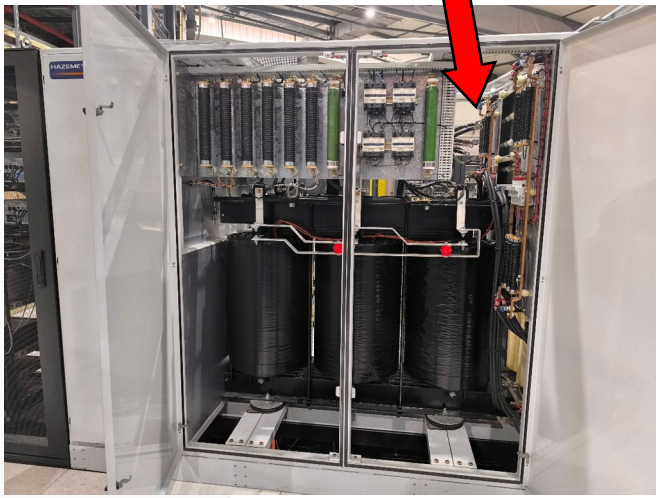
	Hours
M	1.152
BL	4.512
Total	5.664

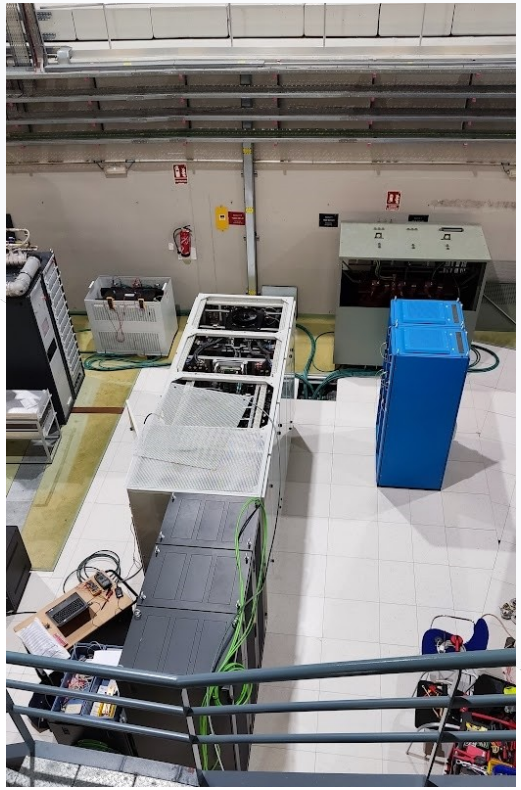
Statistics


Beam availability_2025: 97.55%
100%
99%
98%
97%
96%
95%
73%
84%
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
RUN_01
RUN_02
RUN_03
RUN_04
RUN_05
RUN_06
RUN_07
RUN_08

SR-Bending Magnets Power Converter incident

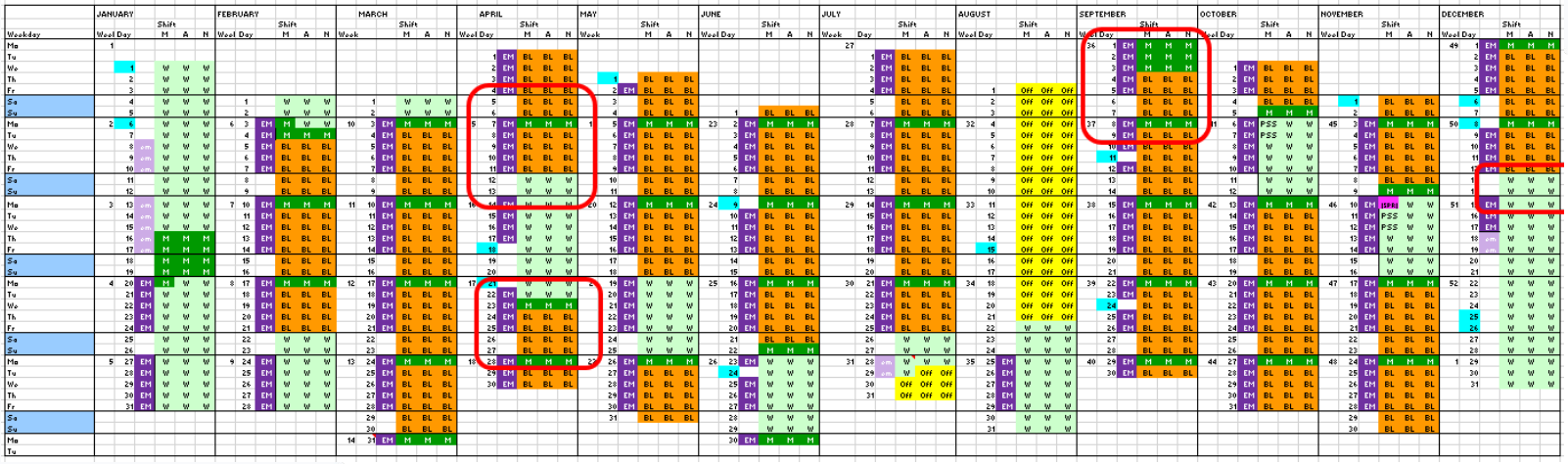






SR-Bending Magnets Power Converter incident

- SR PS tested after Winter Shutdown (1 week before start operation)
- SR PS worked during first 4 M days
- Failure the day before start with Beamlines
- Temporary solution: rent two transformers from a Belgium company (not same voltage)
- New transformers bought and installed following shutdown
- Operations calendar 2025 modified to recover the 13 BL days lost



Peninsula blackout

•28th April 12h30 a general blackout affected the whole country (ALBA machine day)

Primera Edición

EL PAÍS

EL PERIÓDICO GLOBAL

Fundado en 1976 · Año L · Número 17.439

Edición Nacional · 2,00 euros · Martes · 29 de abril de 2025

UNA CAÍDA ELÉCTRICA MASIVA AFECTA A TODA LA PENÍNSULA IBÉRICA

El gran apagón

● El Gobierno no descarta ninguna hipótesis sobre la causa de un colapso energético sin precedentes

● El fenómeno interrumpe el teléfono, internet y el tráfico ferroviario, y crea enormes atascos en las ciudades

● A las 12.32 desaparecieron del sistema 15 gigawatios de potencia, equivalentes al 60% del consumo

•ALBA UPS and diesel generators worked as expected
  - Critical equipment kept running: data servers, internet, vacuum system, SCW cryocoolers, …
  - Some equipment status secured for a safe restart

•Afternoon and night shifts cancelled. All the staff required for the recovery to meet early next morning

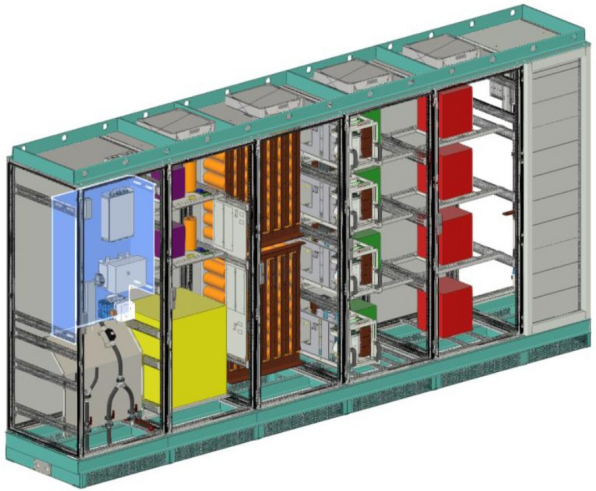
•The following day (beam for users) it took 8h to recover
  - Turn on transformers, power up SA racks, turn on water cooling…

•Some lessons learnt → CRISIS COMMITTEE working in procedures/checklists

ALBA Accelerator Developments

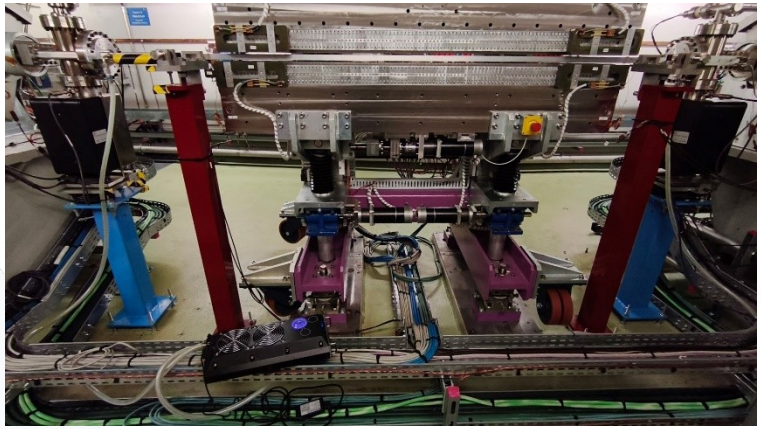
New Booster Power Supplies

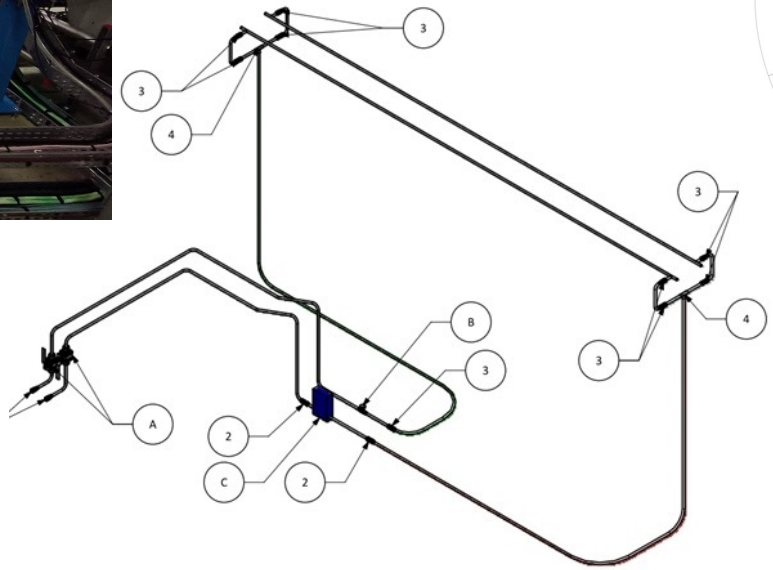
- Install Easter 2026 → SAT Summer 2026
- Both present and new PS operative → switch rack

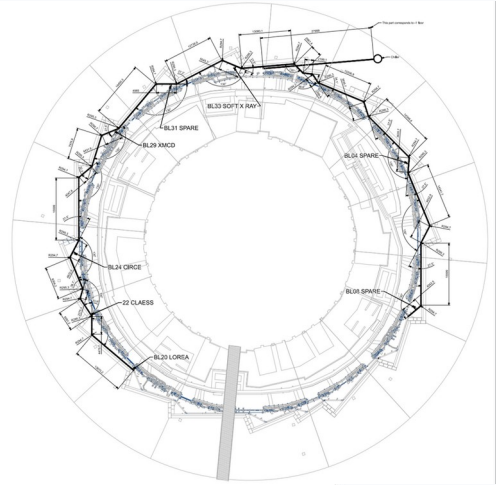


Aluminum cooling water circuit

- Dedicated water cooling circuit for aluminum chambers cooling

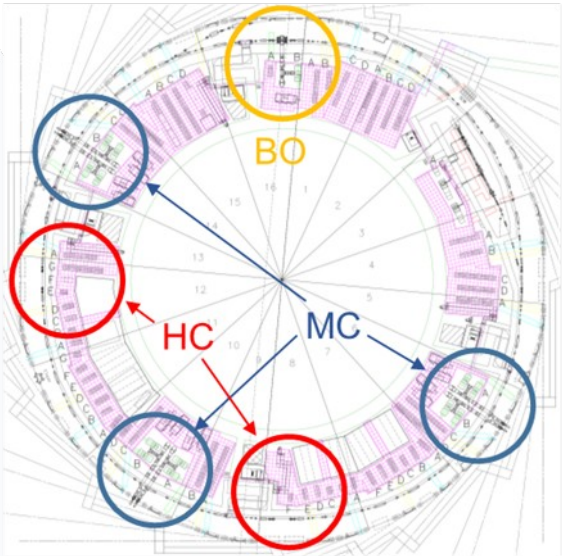


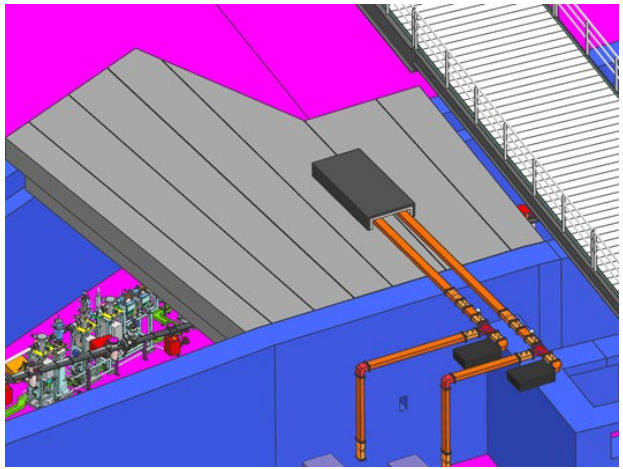


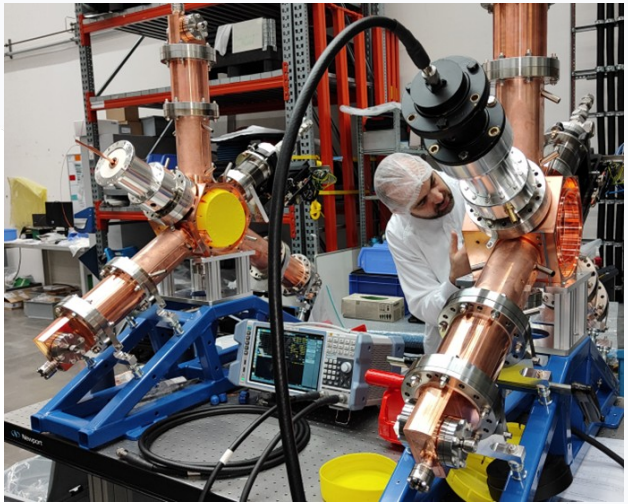


3rd Order Harmonic Cavities

- Installation of 4 harmonic RF systems in ALBA SR
- Planned to be in operation by the end 2026
- 2 cavities in long straight sections: S08 & S12

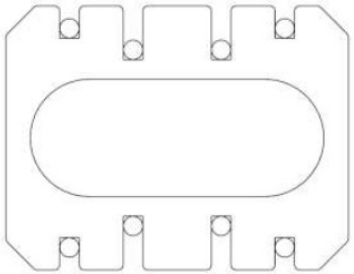


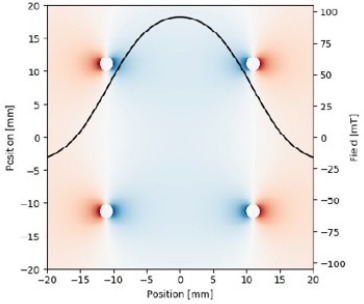




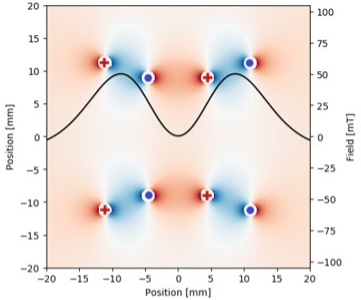
Double Dipole Kicker

- Installation of DDK in ALBA SR this winter shutdown

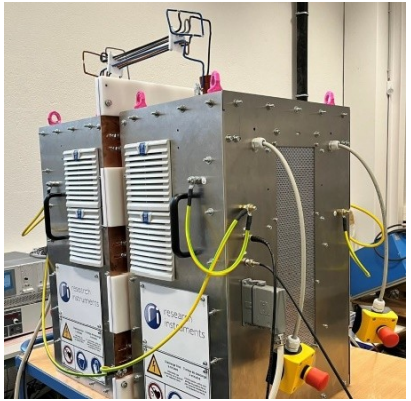


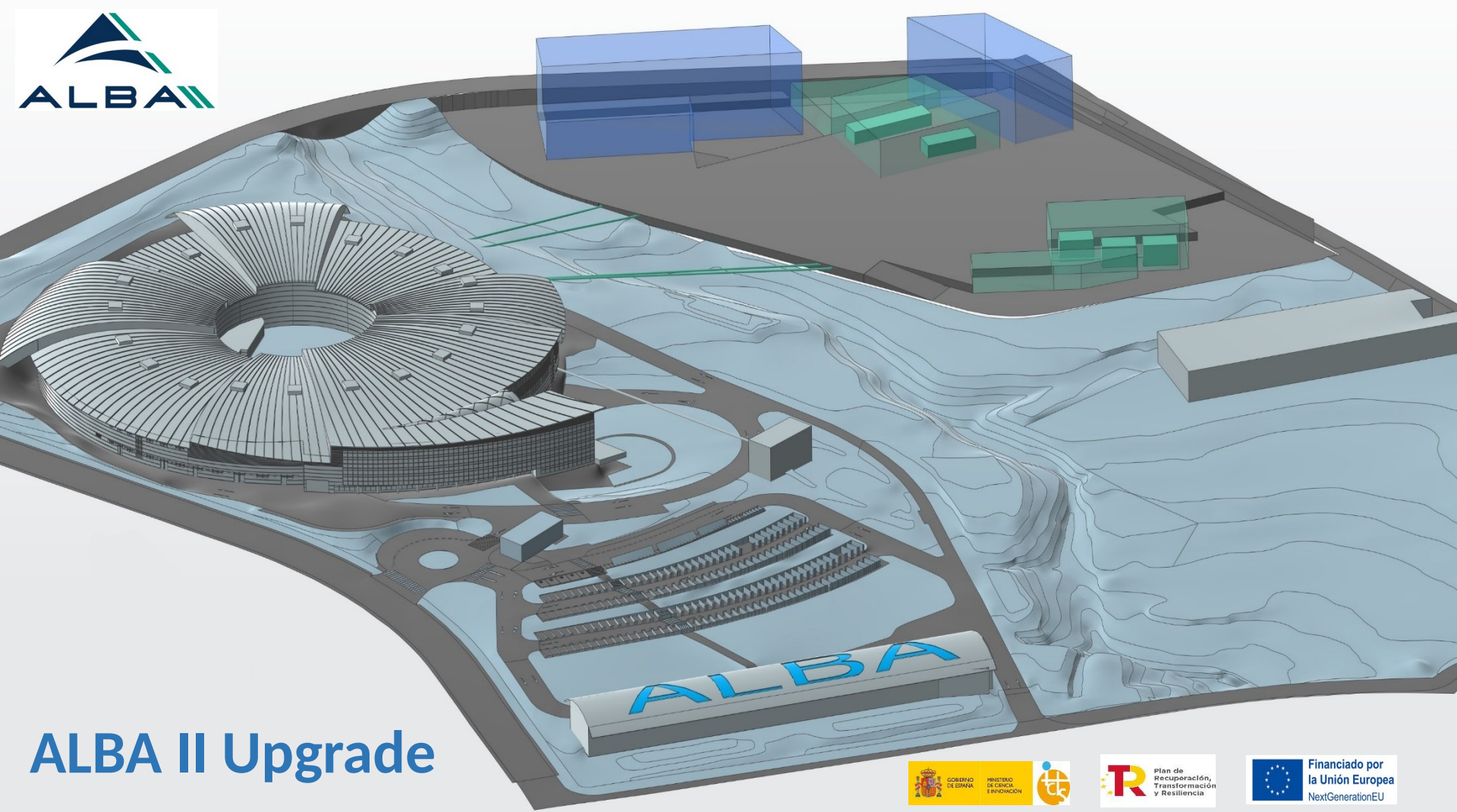


1 Power Supply
Outer coils powered
Dipole field for on-axis injection
Useful during commissioning



2 Power Supplies
Outer + Inner coils powered
Zero field at the stored beam
Field peak at the injected beam



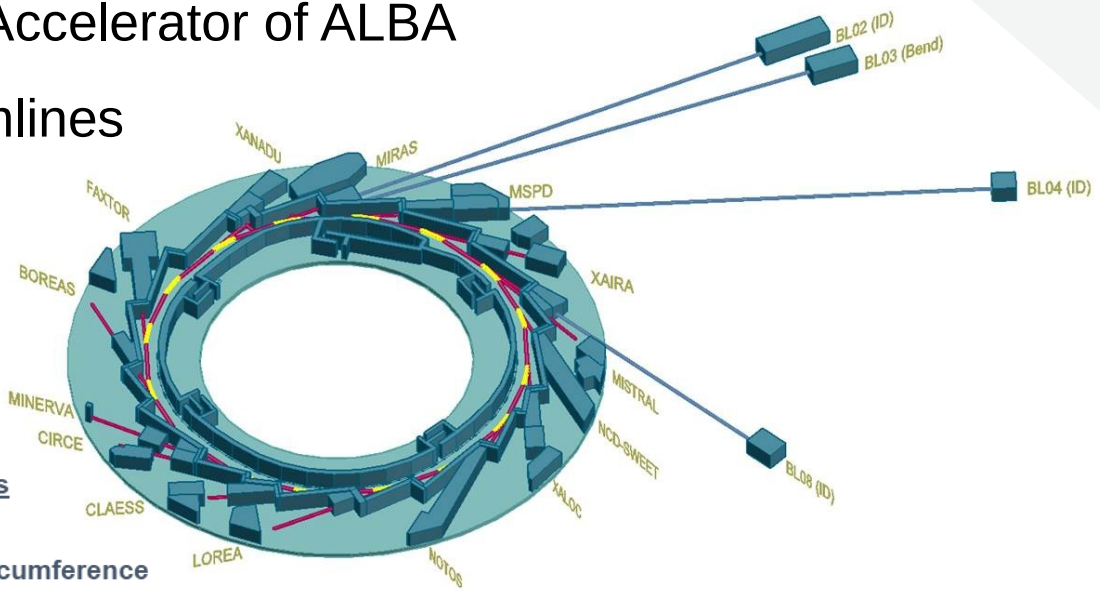


ALBA II Upgrade

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN
Plan de Recuperación, Transformación y Resiliencia
Financiado por la Unión Europea NextGenerationEU

ALBA II Objectives

- Replace the Storage ring Accelerator of ALBA
- Upgrade the existing beamlines
- Build new long beamlines



ALBA II Design Constrains

- 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 Main Dates

Starting the design

Presenting to funding agencies the 'pre-White Paper'

ALBA II included in 2021-2024 ALBA Strategy Plan

First funding for prototyping (ALBA01) – 7.5 M€

Funding for 1st ALBA II BL (ALBA05) – 10 M€

New plots assigned for Long BLs extension - 16 M€

White Paper published

Decision on long BLs

Government approval long-term budget (2024-2038)

Define project work packages

September 2025

2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Prototyping

Design

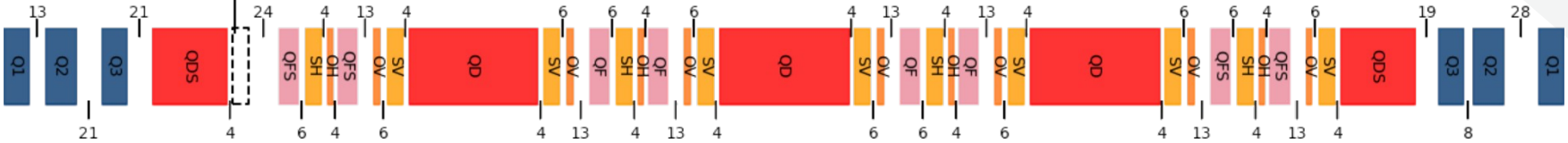
Production + Assembly

Dark period

Operation

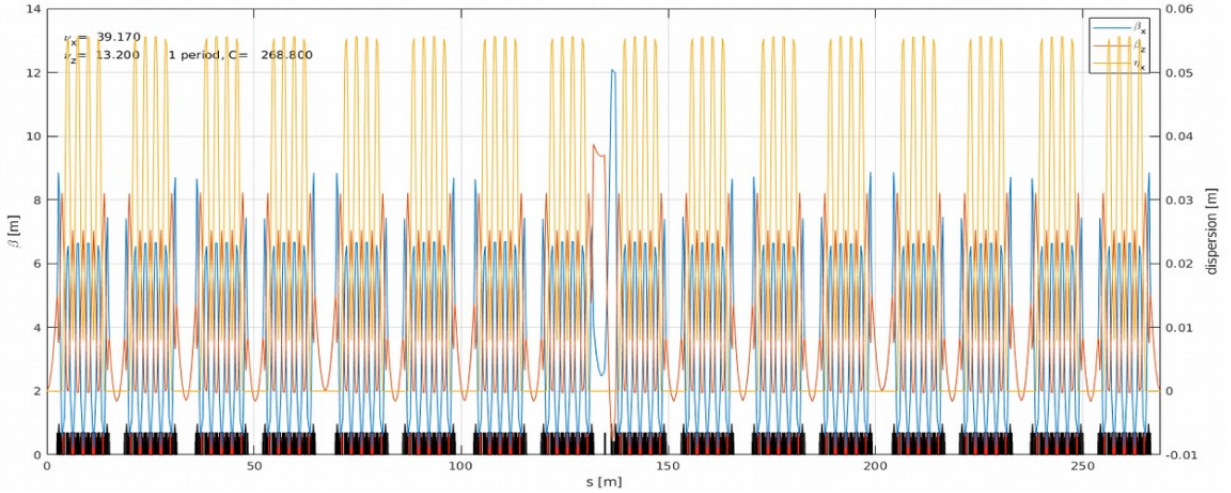
ALBA II Lattice Design

- October 2024 5BA with octupoles (ESLS'24)

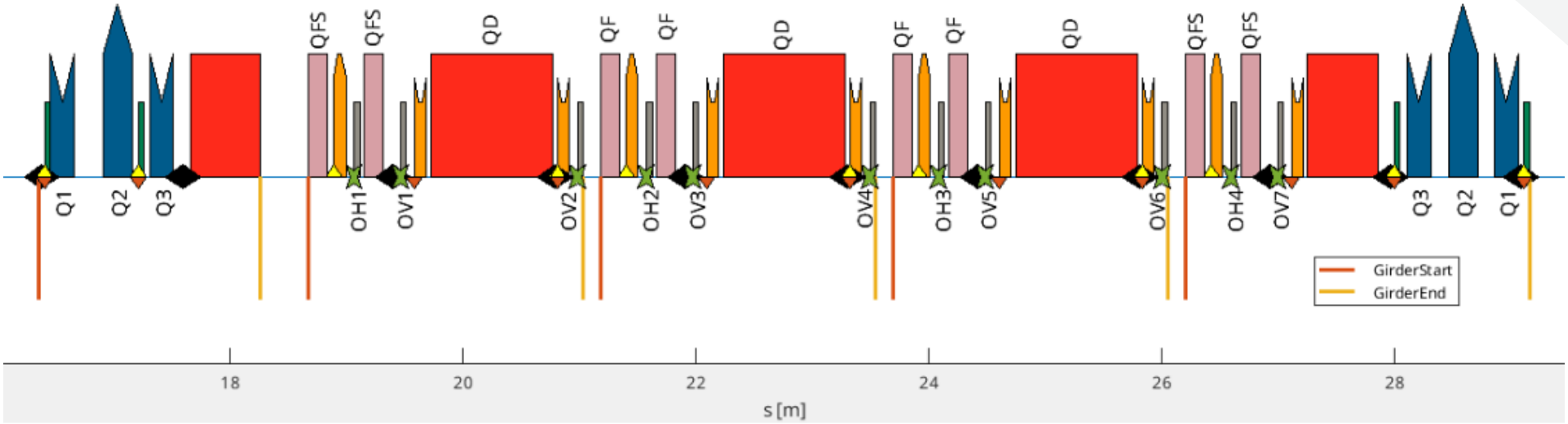


- September 2025 Alpha lattice

In this modification (inspired by M.Abo-Bakr, P.Goslawski, HZB), **all the straight sections, including the long ones, have low betas, but the injection section would be asymmetric** to produce low β_x at the thin septum while high β_x at the DDK kicker



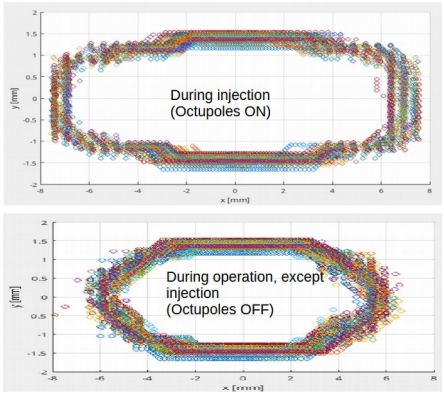
ALBA II Correction Scheme

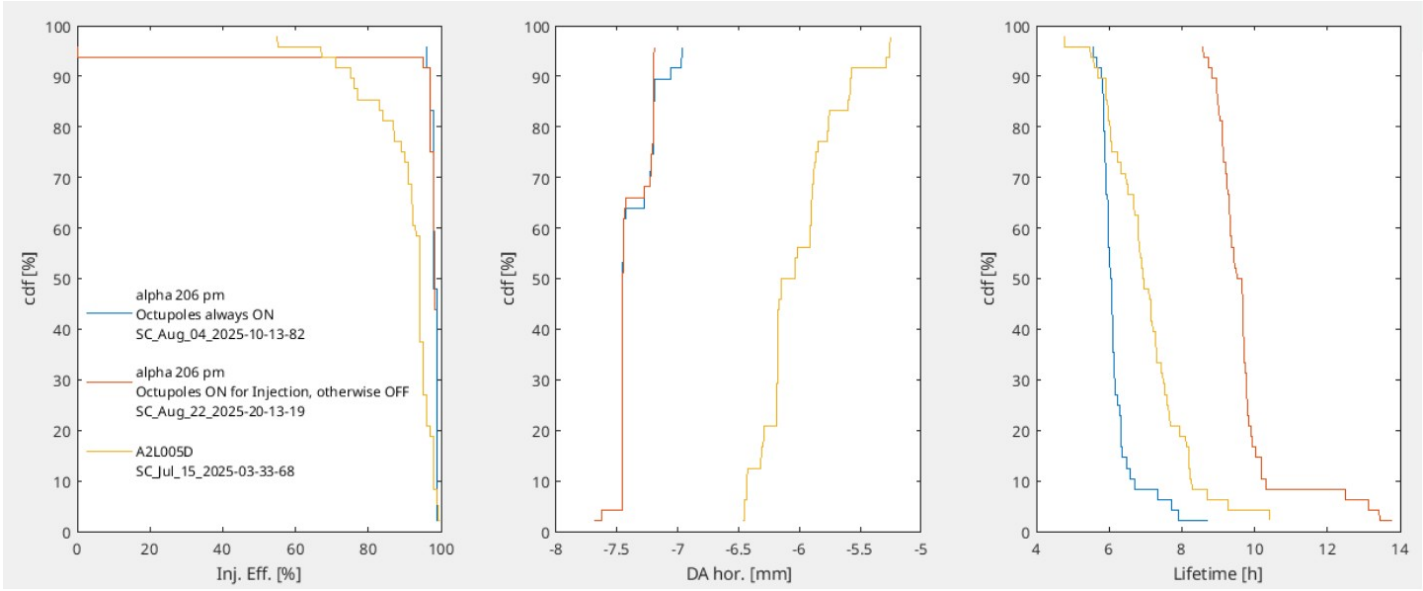


- 11 BPM
- 11 HCM (7 in Sext, 4 in SS)
- 11 VCM (7 in Sext, 4 in SS)
- 16 quadrupole gradients
- 11 SKCOR in octupoles

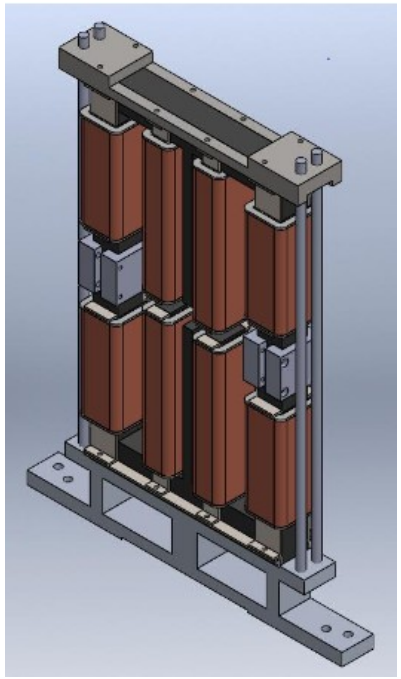
ALBA II Lattice Design

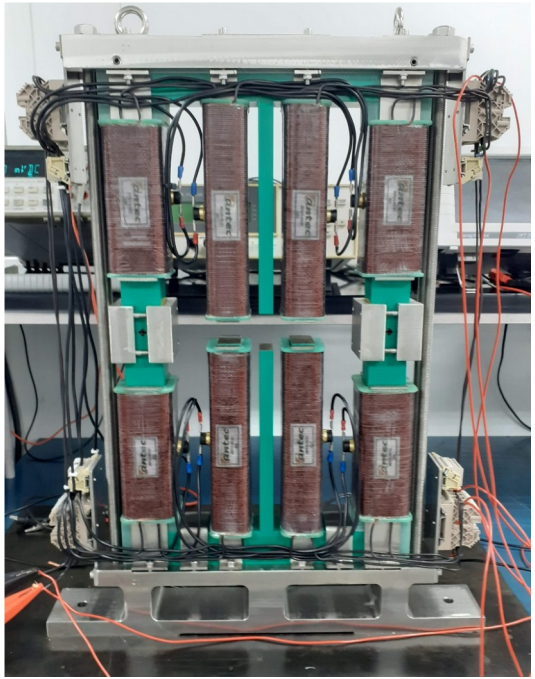
- Octupoles ON only during injection? → improve lifetime



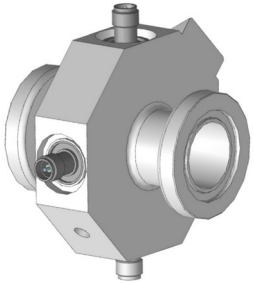


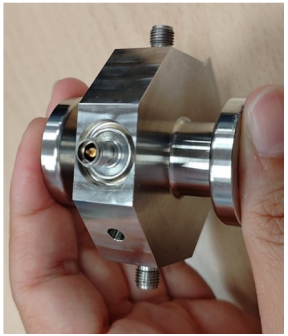
ALBA II Prototyping





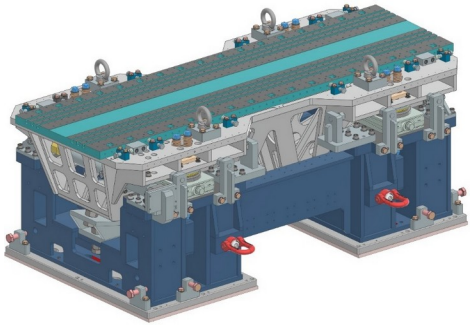
Straight Section SR corrector

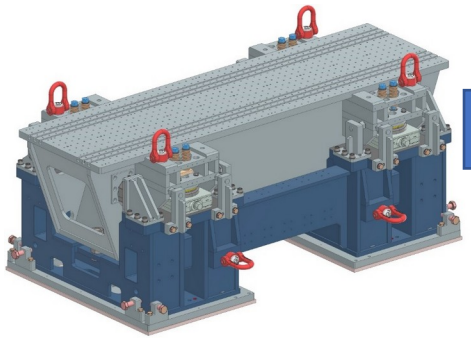




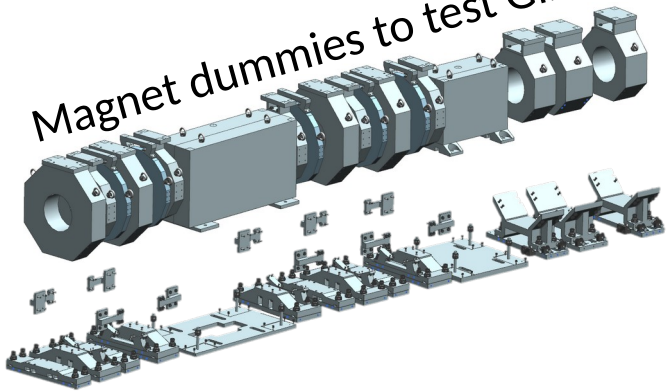
BPM test chamber and buttons

ALBA II Prototyping

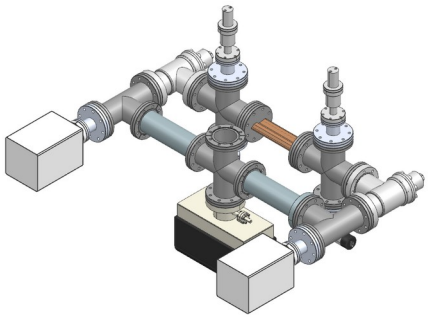


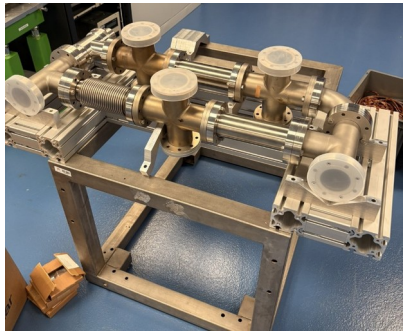


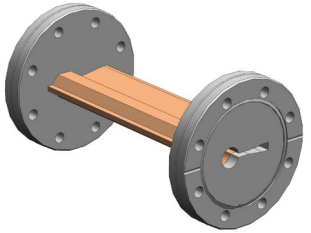
Magnet dummies to test Girder



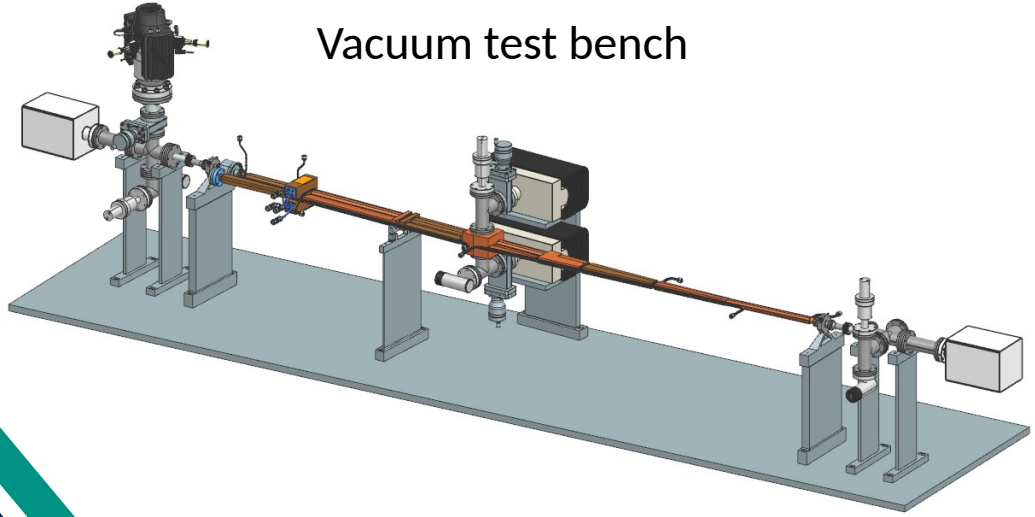
ALBA II Prototyping





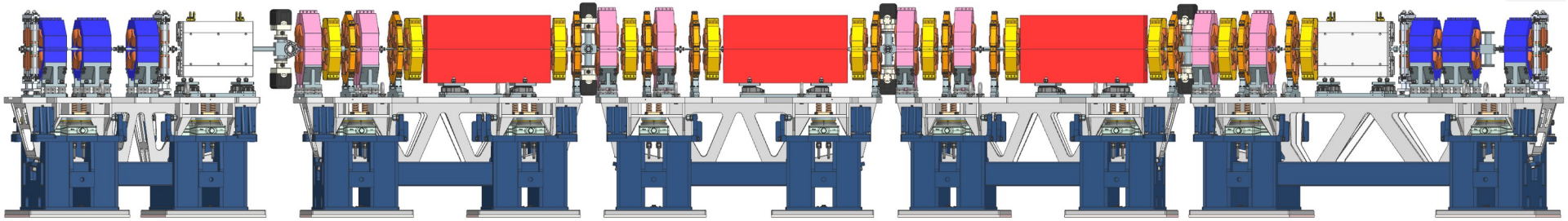


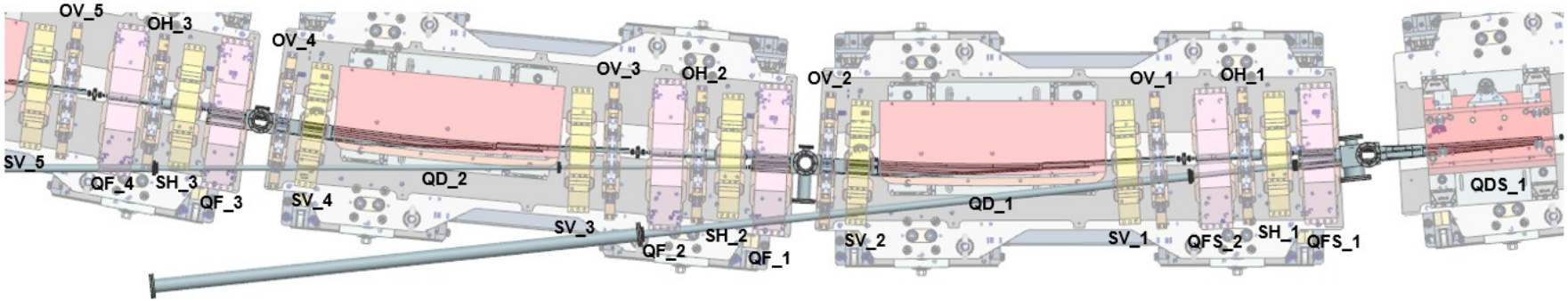
Vacuum test bench



CuCrZr chamber

ALBA II Eng. design

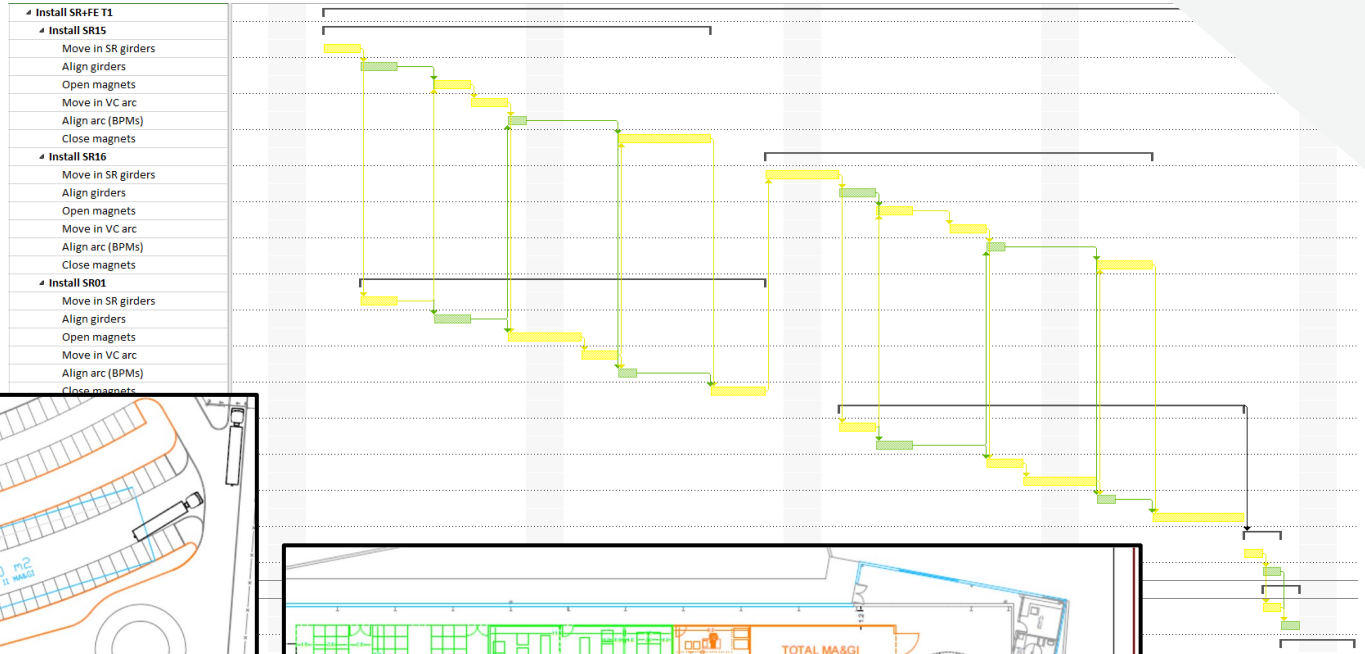


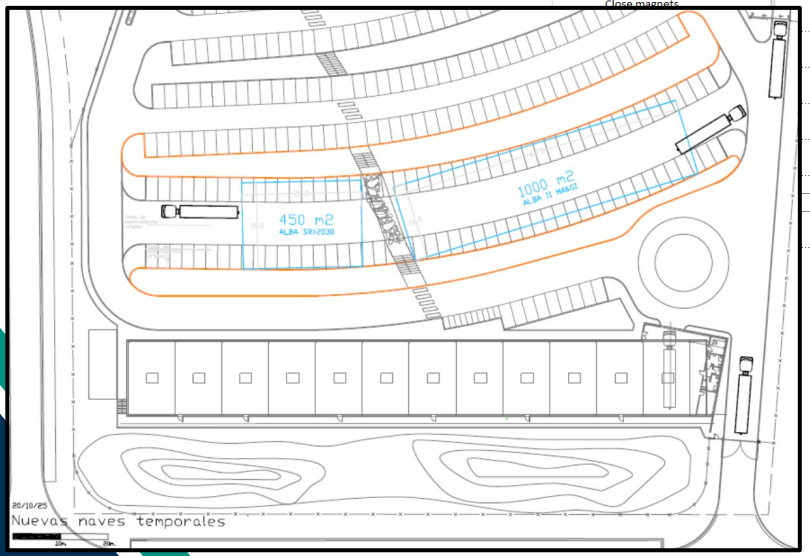


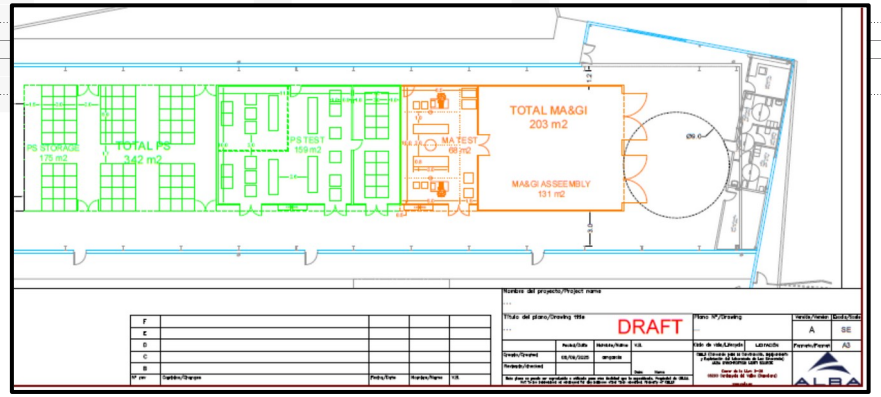
Light extraction → magnets modifications

ALBA II Implementation program

- Tunnel Removal and Installation plan
- Required spaces for storage and assembly







On behalf of the Accelerator Division and the ALBA II team,

Thanks for your attention