



ALBA Status and Upgrade

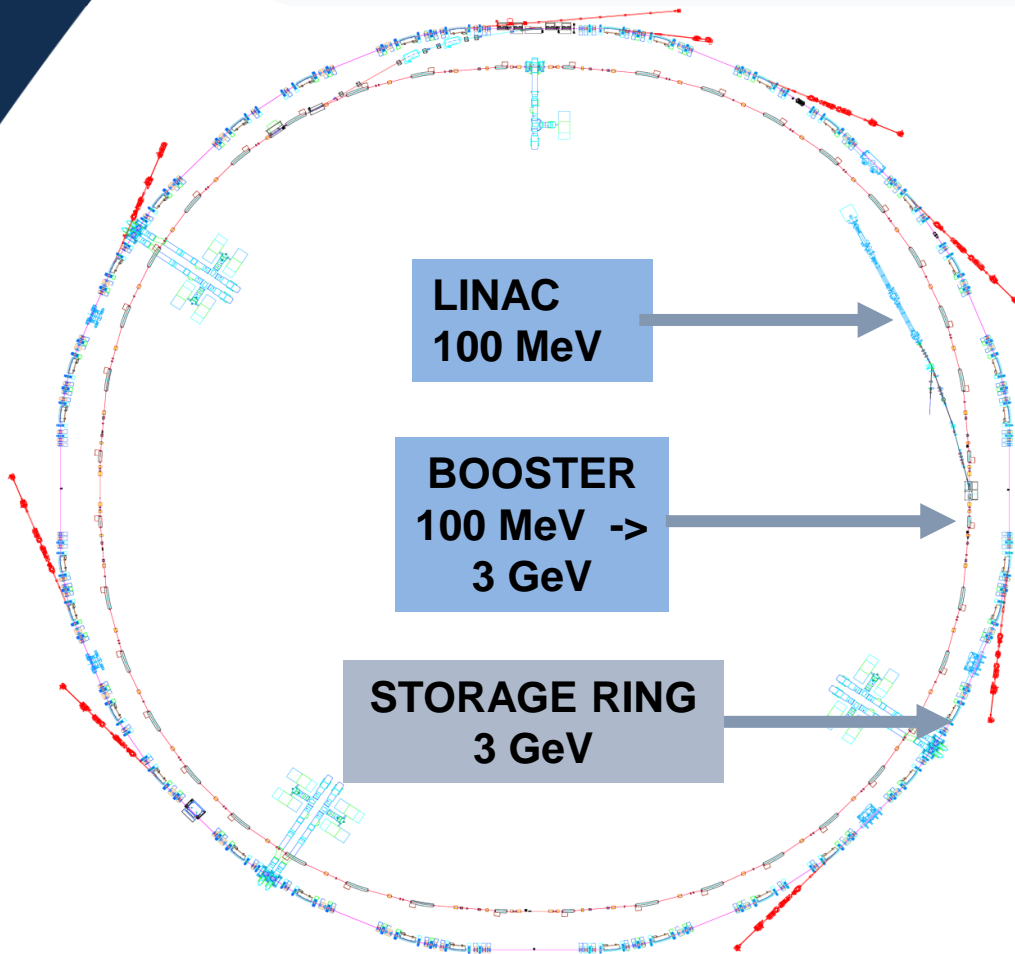
16th December 2020, 28th ESLS workshop

Ferran Fernandez,

on behalf of the Accelerators team

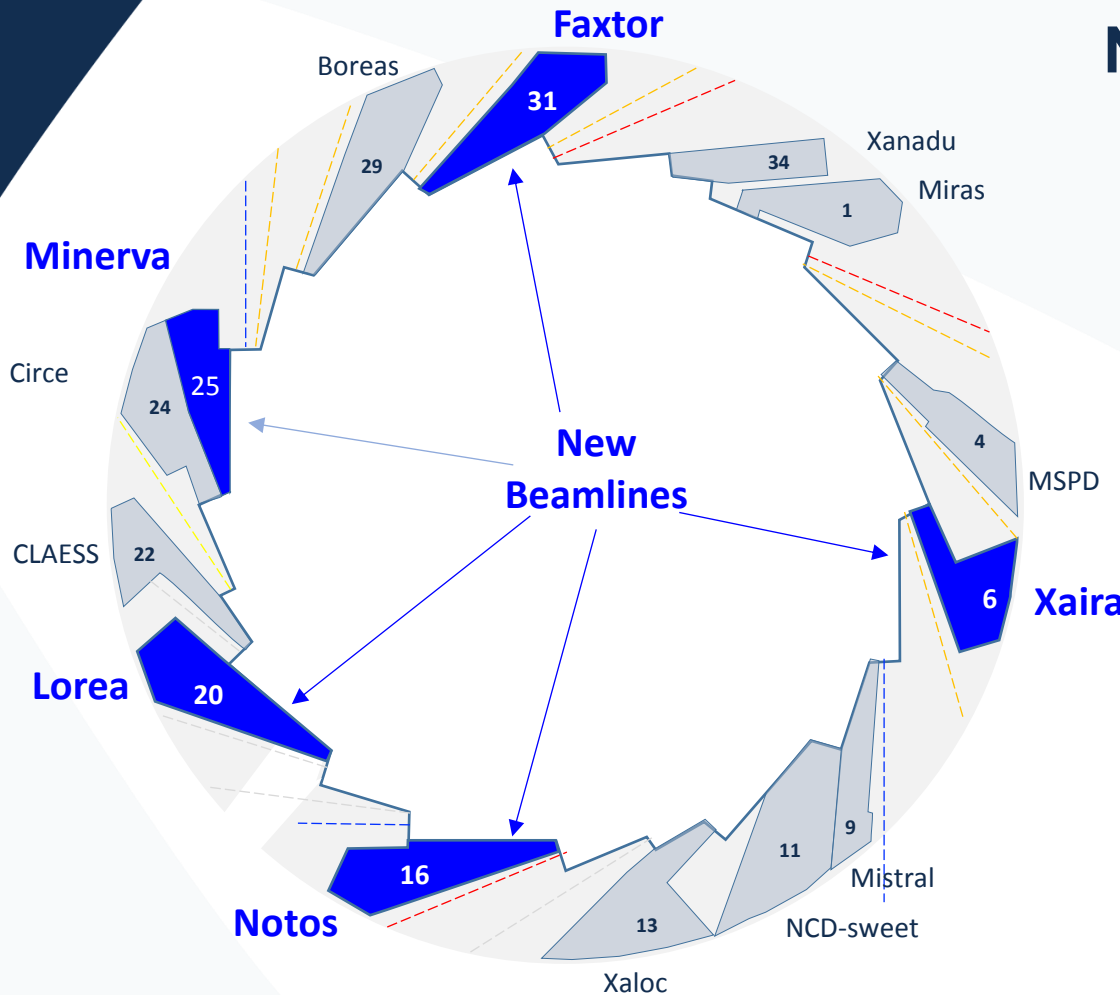
- ALBA Status
- 2020 Operation
 - Covid impact on Operation
 - Statistics
 - Issues 🙅
 - Developments 👍
- ALBA II

ALBA Layout



Parameter	Value
Energy	3 GeV
Circumference	268.8 m
Emittance	4.5 nm·rad
Current	250 mA
Rf frequency	500 MHz
# cavities	6
Long straights	4 (8 m)
Medium straights	12 (4 m)

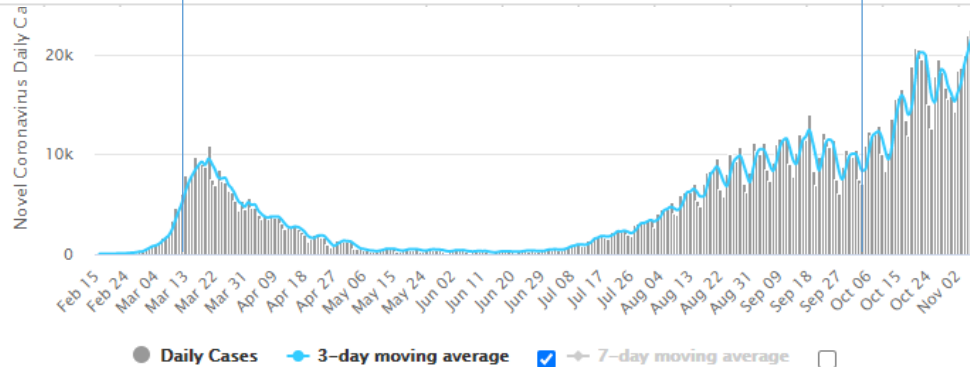
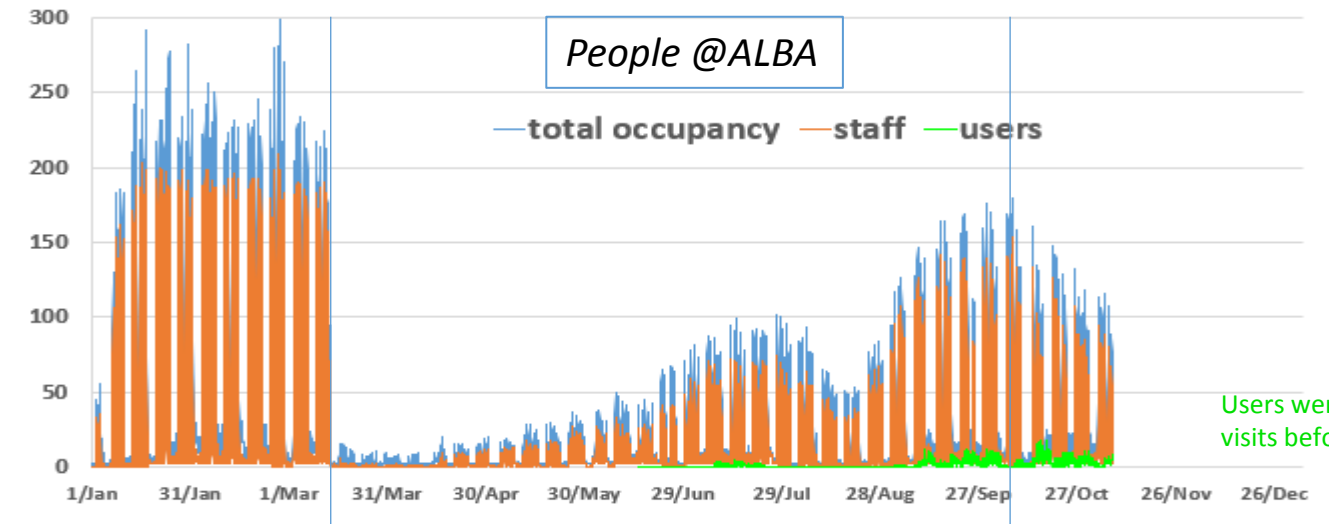
New Beamlines



ALBA is currently building/commissioning 5 new beamlines.

BL20-Lorea	ARPES
BL16-Notos	XAS-PD / metro
BL06-Xaira	microfocus MX
BL31-Fautor	HXR tomography
BL25-Minerva	Metrology

Covid19 impact on Operation

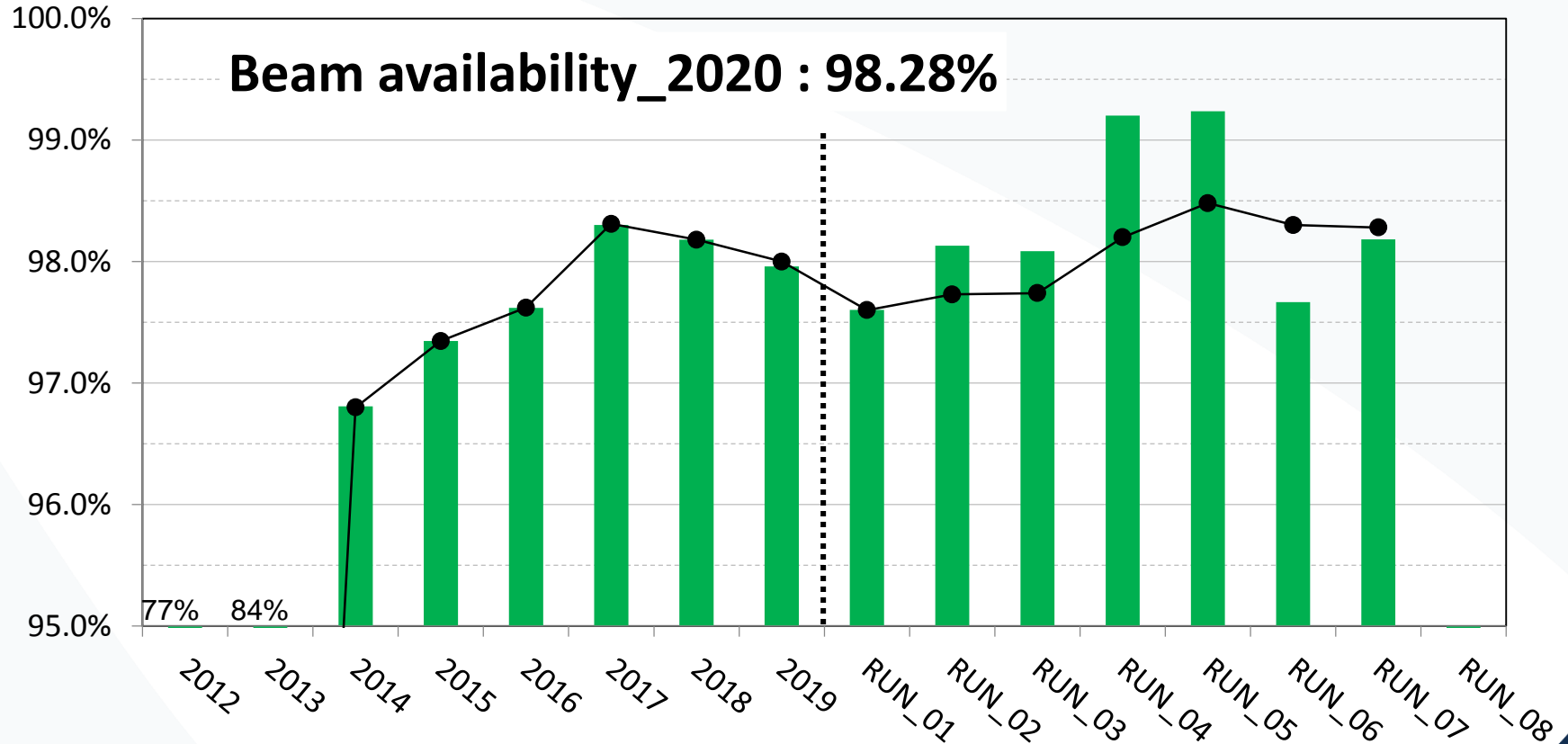


<https://www.worldometers.info/coronavirus/country/spain/>

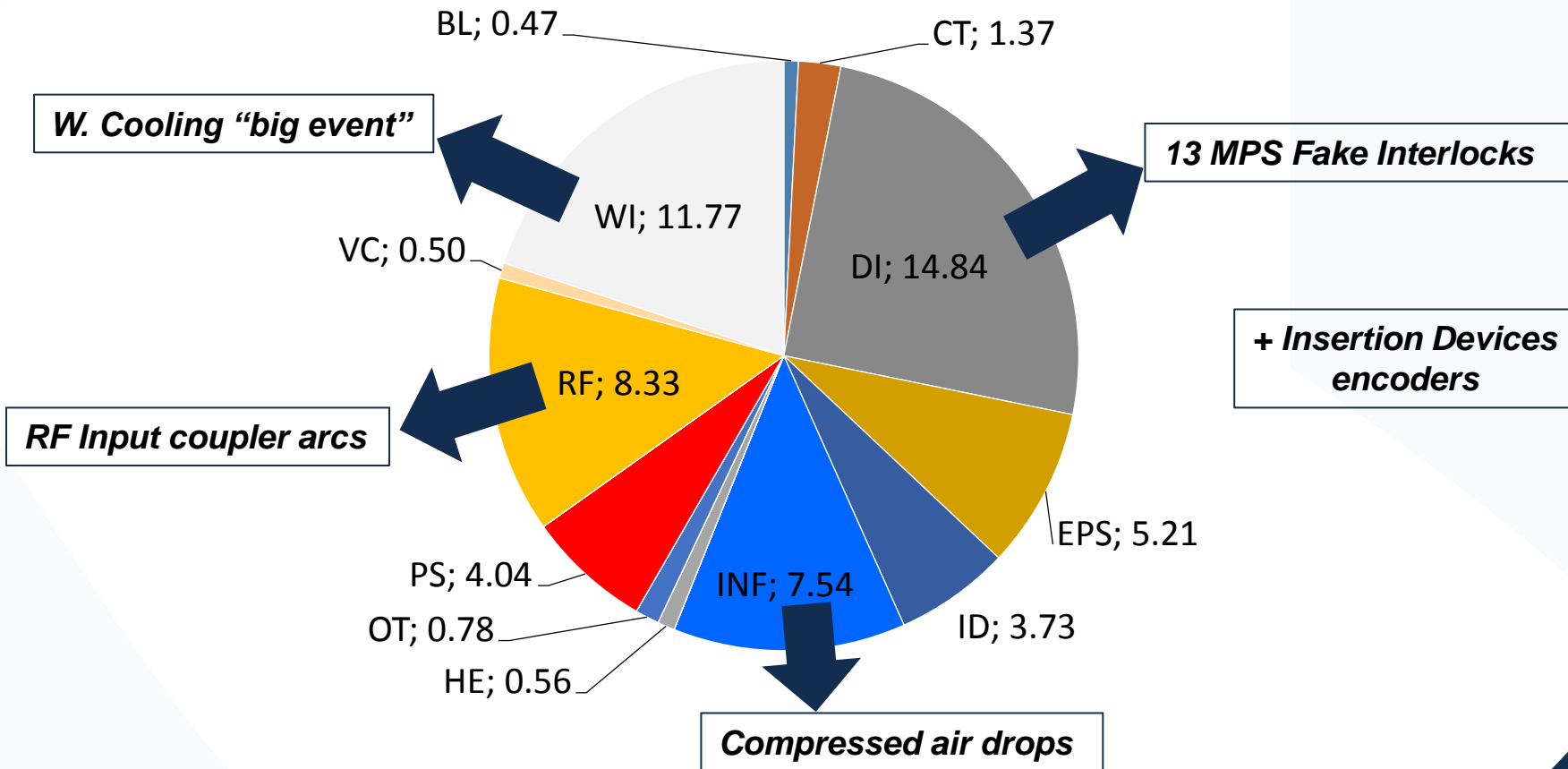
Covid19 impact on Operation

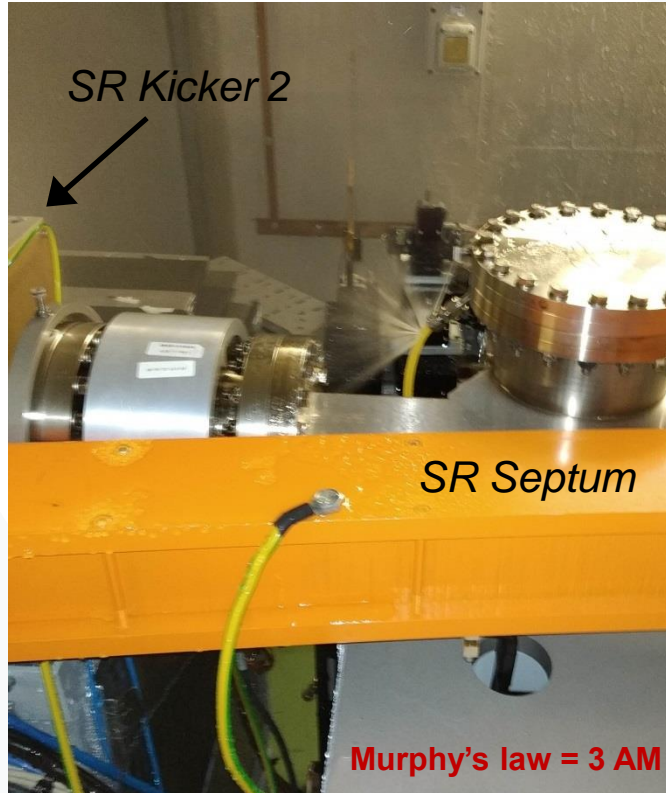


- **Emergency Committee** from the beginning
 - FAQs and Safety Guidelines are kept updated
- **Safety means**
 - Masks, cleaning, reduced occupancy at canteen,...
 - **No face-to-face** meetings
 - **Business trips** have to be authorized by the Director
 - Outreach **visits are not allowed**
 - **Remote users** whenever possible
- Working conditions
 - **More flexibility** on working time
 - **Teleworking** encouraged whenever possible
 - Easier to have **a working time reduction**
 - Special treatment of **vulnerable workers**



2020 Downtime hours per subsystem

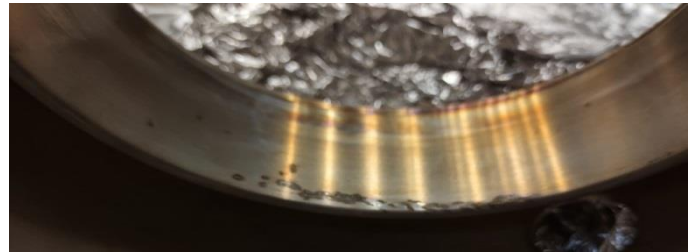
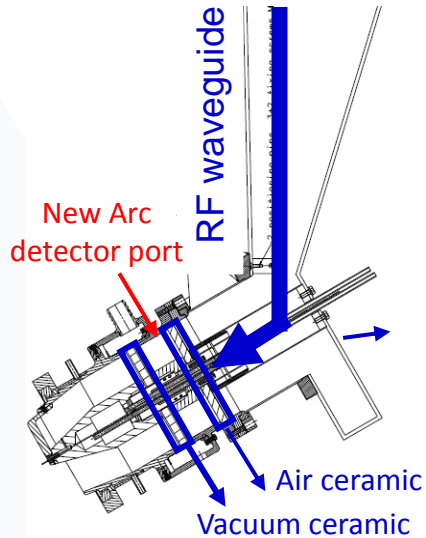
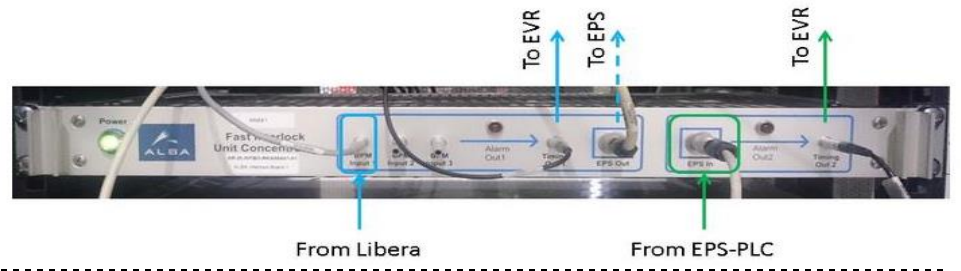




- **Cooling water hose (9h lost)**
 - Injection elements had to be repaired
 - “Predictive” maintenance: exchange the rest of yellow hoses in the tunnel

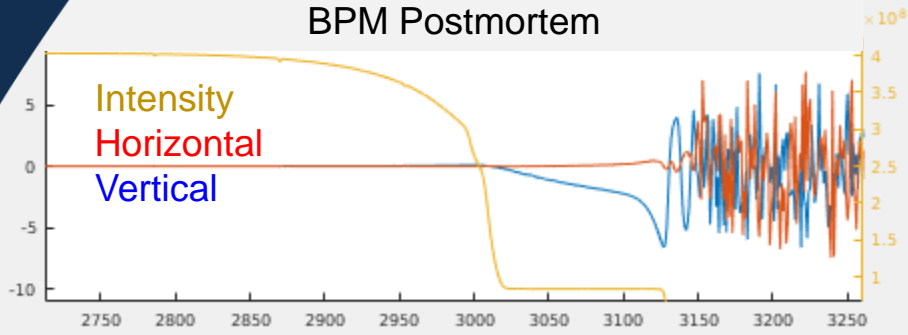


- **Interlock boards** fake ITLKs
 - Install ferrites + improve grounding
 - Looking for a definitive solution



- **RF input coupler arcs**
 - Exchanged. Slow vacuum recovery
 - Added new arc detector in a blind spot

BPM Postmortem



- **Compressed air drops**

- Beam lost without any apparent reason
- Fluorescent screens “hold up” with compressed air
- “Solved” -> Mechanically blocked

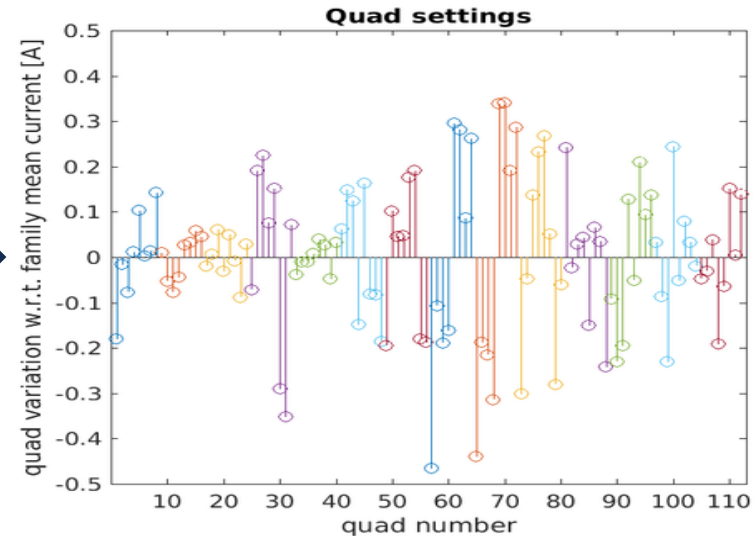
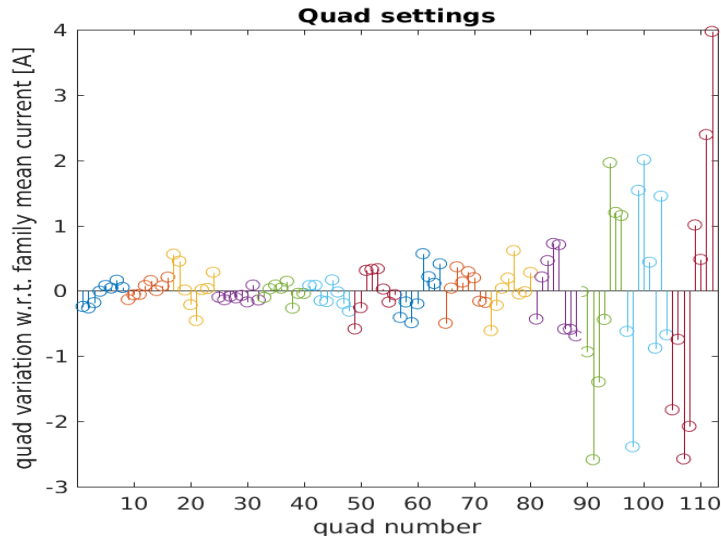
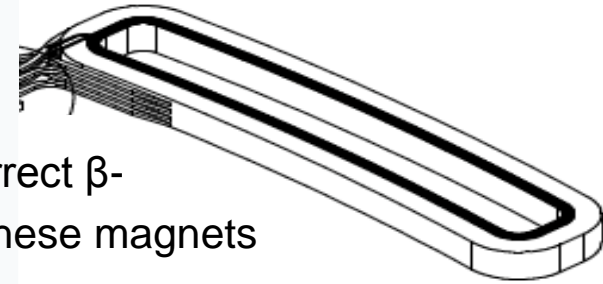
- **IDs encoders aging**

- After 10 years of operation, more than 50% of the encoders broke in 6 months
- The rest has been replaced



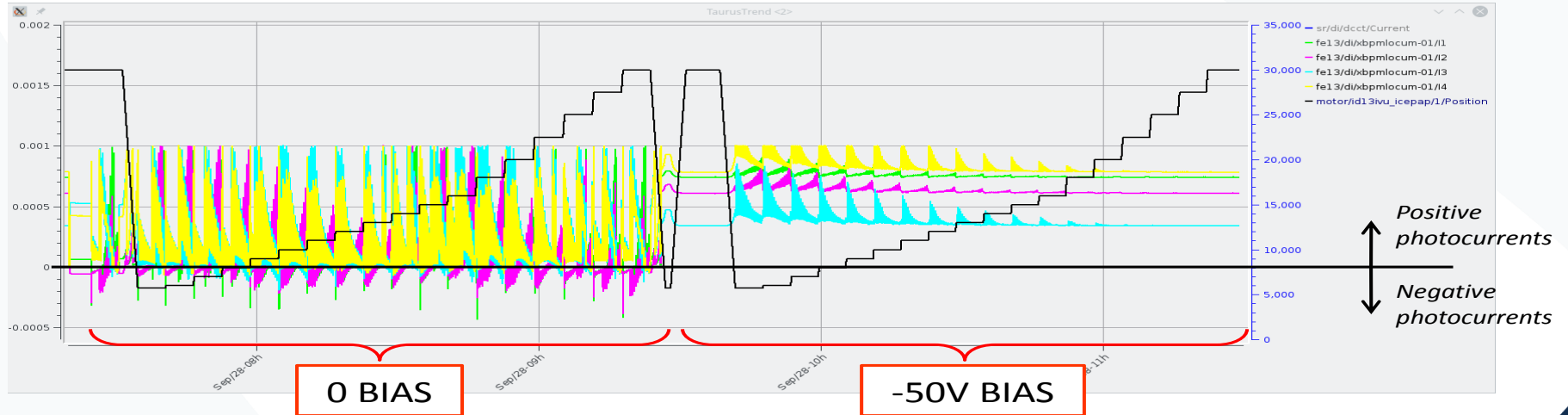
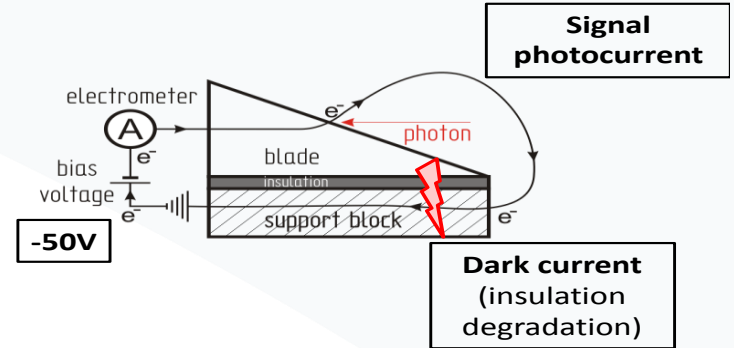
Trim coils correction

- One power supply for all dipole+quad magnets
- With LOCO we were **over-using quad corrections** to correct β -beating produced by the quadrupolar systematic error at these magnets
- 32 Trim coils are installed allowing local correction



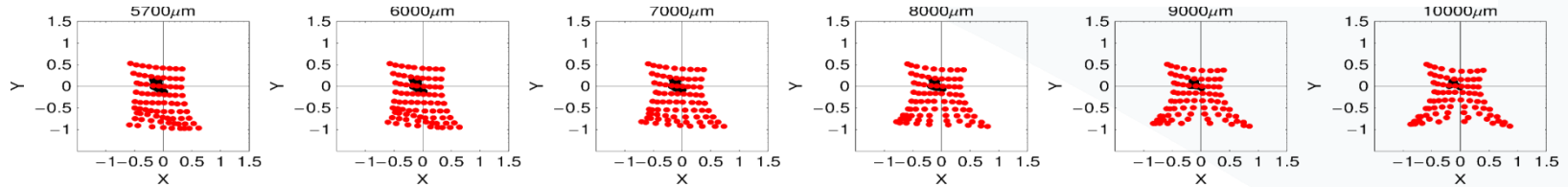
XBPM without bias voltage

- XBPMs blades isolation is deteriorating
- The bias voltage, used for decoupling the blades, produce a large background signal that reduces the xBPM sensitivity.

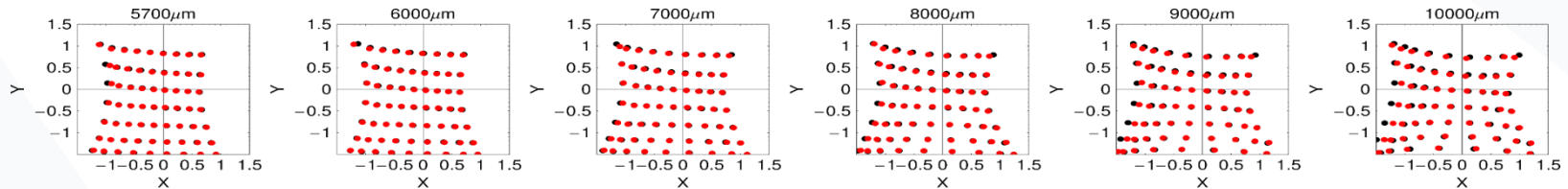


XBPM without bias voltage

Nominal BIAS, Raw data (black) and **Background corrected data (red)**



Zero BIAS, Raw data (black) and **Background corrected data (red)**



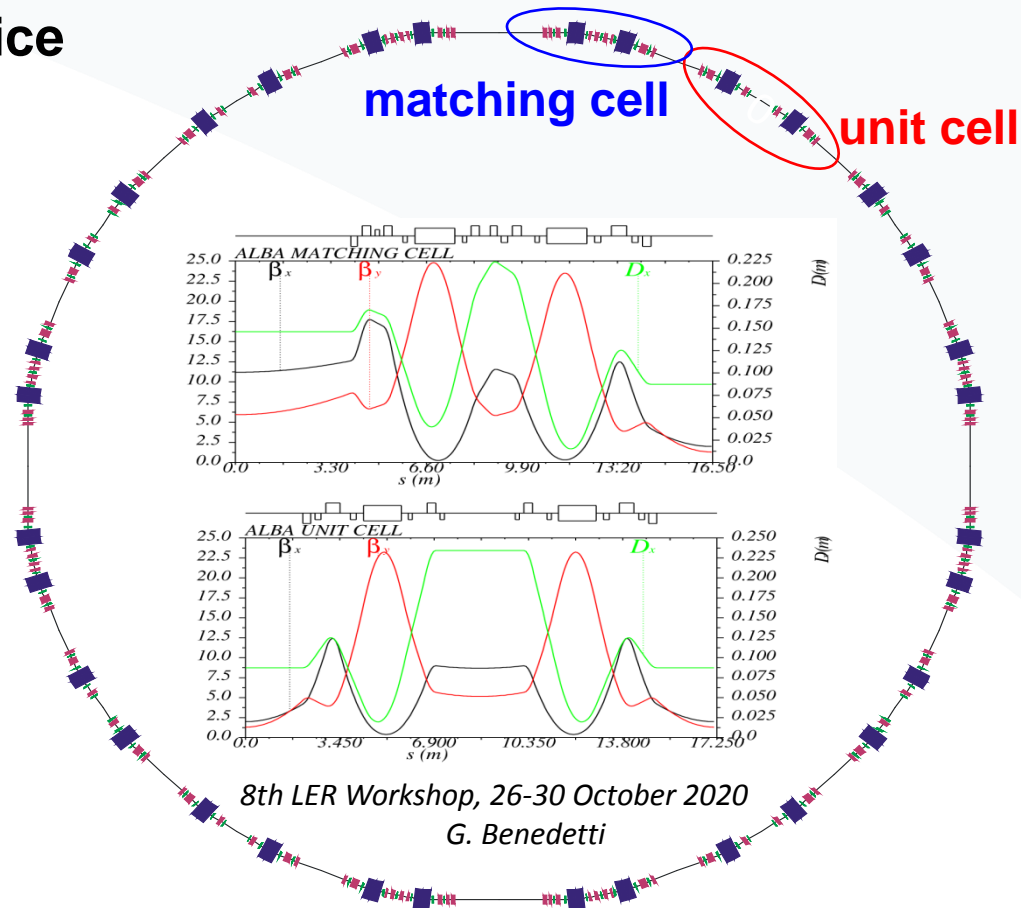
When comparing to nominal BIAS data, at **zero BIAS** the XBPM displays a **higher sensitivity**, a **higher linearity** and a smaller **gap dependence**. In addition, it **does not suffer from changes in the leakage currents** and is **less sensitive to bending background**

Present ALBA SR lattice

- Energy = 3 GeV
- Circumference = 268 m
- Symmetry = 4 fold
- Emittance = 4.5 nm·rad
- **8+8 DBA-like cells**
- **17 m long**

Straight sections:

- 12 medium straights (4.0 m)
- 4 long straights (7.8 m)
- 8 short straights (2.3 m)



8th LER Workshop, 26-30 October 2020

G. Benedetti

• Requirements

- Reduce emittance below 250 pm·rad
- Straight sections longer than 4 m
- Betas at straight section center: $\beta_x = \beta_y = 1.0-2.0$ m
- One type of cell (instead of the present two)

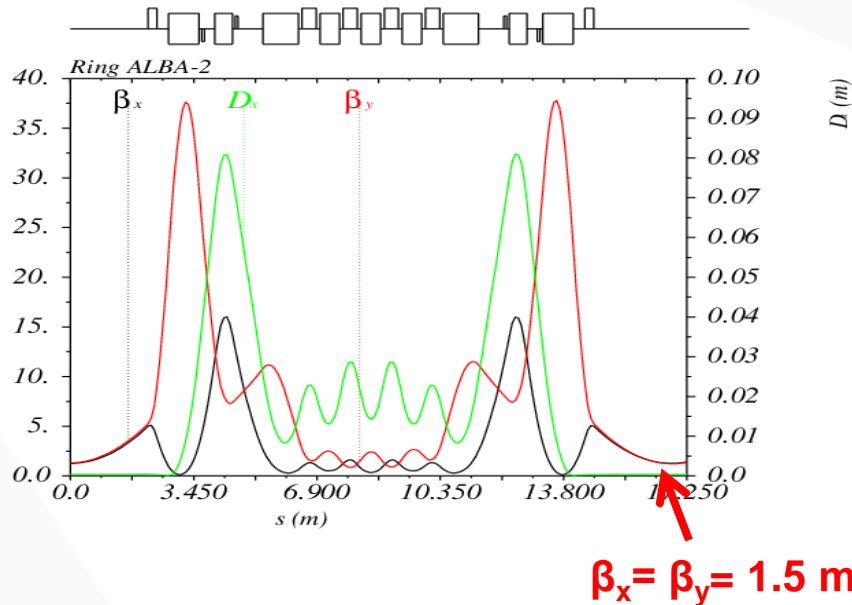
• Constrains

- Keep beam energy 3 GeV
- Keep tunnel (SR with similar compact circumference)
- Keep existing ID beamlines (preserve 16 cells and source points)
- Keep injector (present $\epsilon_x^{\text{booster}} = 10$ nm·rad)
- Keep infrastructures, as much as possible

G.Benedetti

8th LER Workshop, 26-30 October 2020

“First study for an upgrade of the ALBA lattice”, IPAC 2019

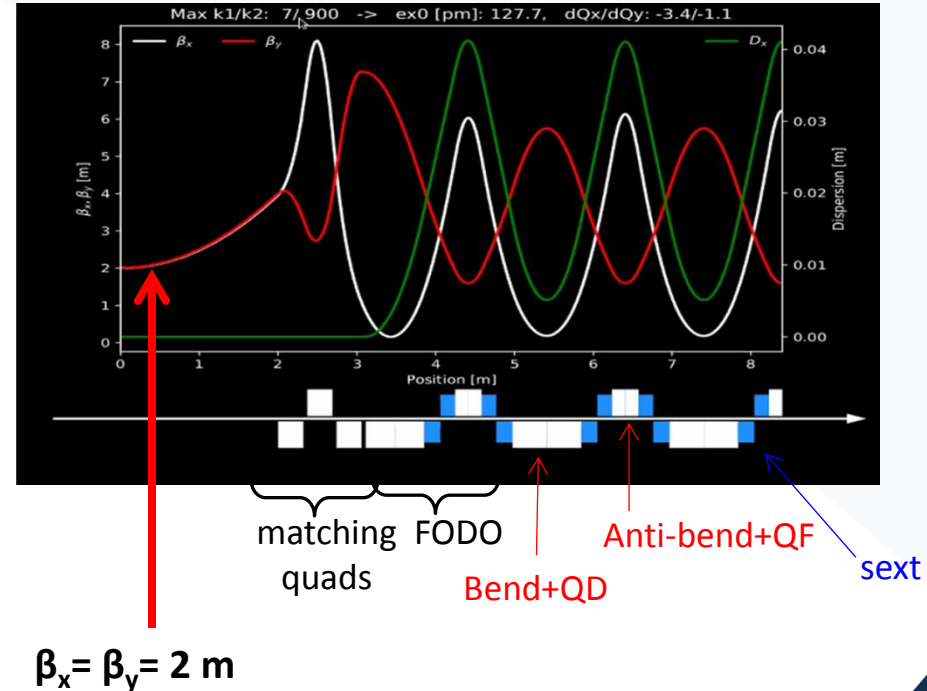


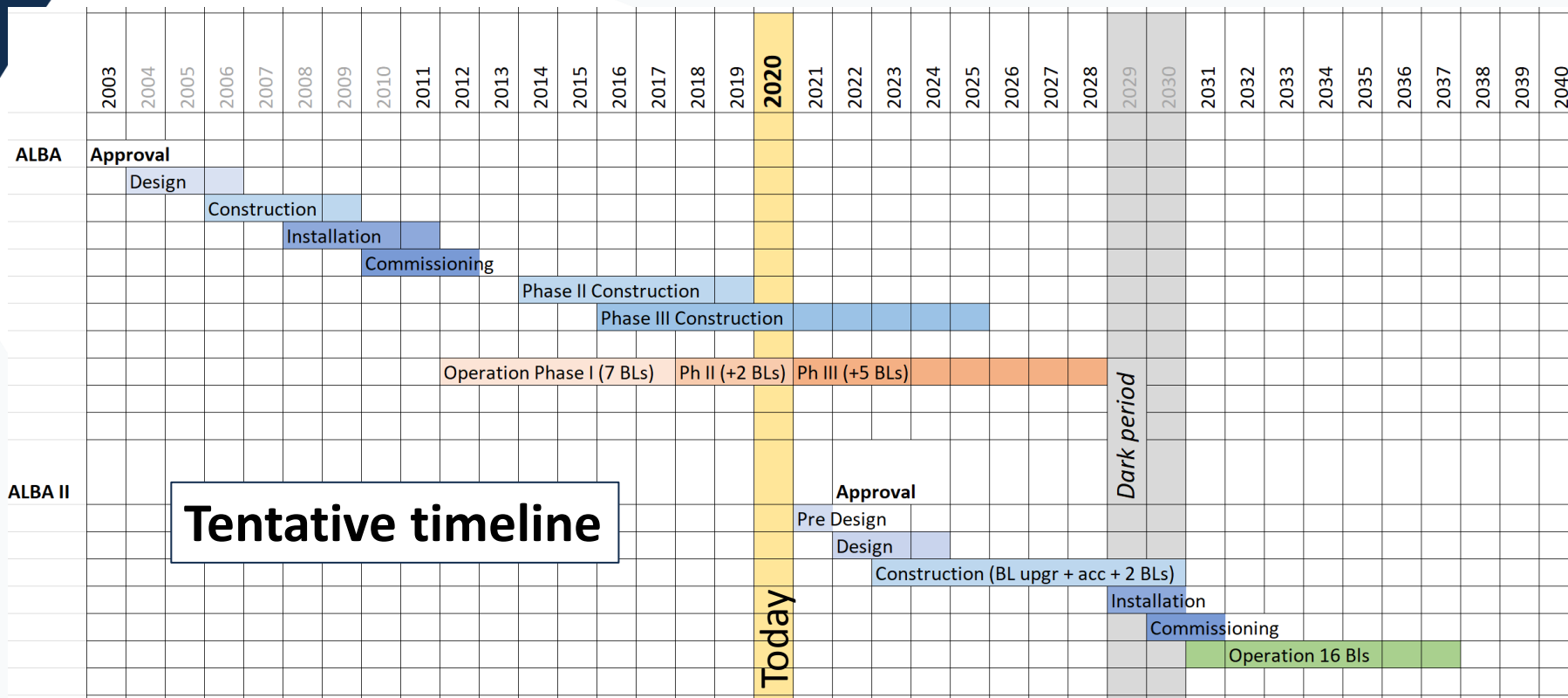
$\epsilon_x = 160$ pm·rad without longitudinal gradient in bending magnets

- Following SOLEIL’s IPAC2018 example, in 2019 we started testing a H7BA cell
- **16 hybrid 7BA with anti-bend identical cells** → 16 straights 4.35 m
 - **7 combined gradient BENDS**
 - **6 focusing QUADS** (< 90 T/m)
 - **2 ANTI-BENDS**: knob to minimize dispersion in BEND 2 and 6
 - **3 families of paired SEXT** with “ π trick” (<2000 T/m²)

Second Study: Distributed sextupole cell

- Example of half 6BA cell: $\epsilon_x = 128 \text{ pm}\cdot\text{rad}$
- FODO made of transversal gradient BENDS and anti-BENDS
- **Maximum gradient ($< 70 \text{ T/m}$)**
- **Distributed Sextupoles ($< 9000 \text{ T/m}^2$)**





Tentative timeline

Today

Dark period

On behalf of the Accelerator Division...



Thanks for your attention