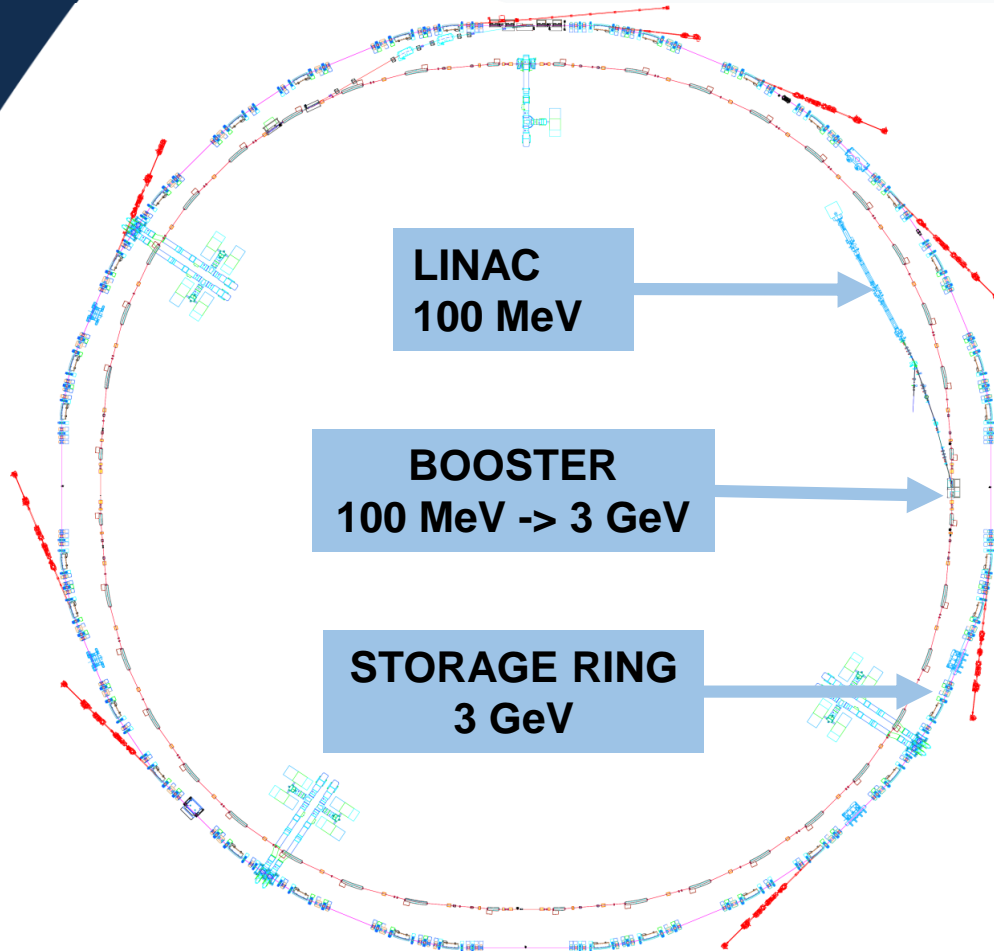J.Bañuelos, **F.Fernandez**, J.C.Giraldo, P.Lengua, J.Rio, M.Rodriguez, O.Serres, M.Sos and D.Yépez

# Control tools developed by the ALBA Synchrotron Operators

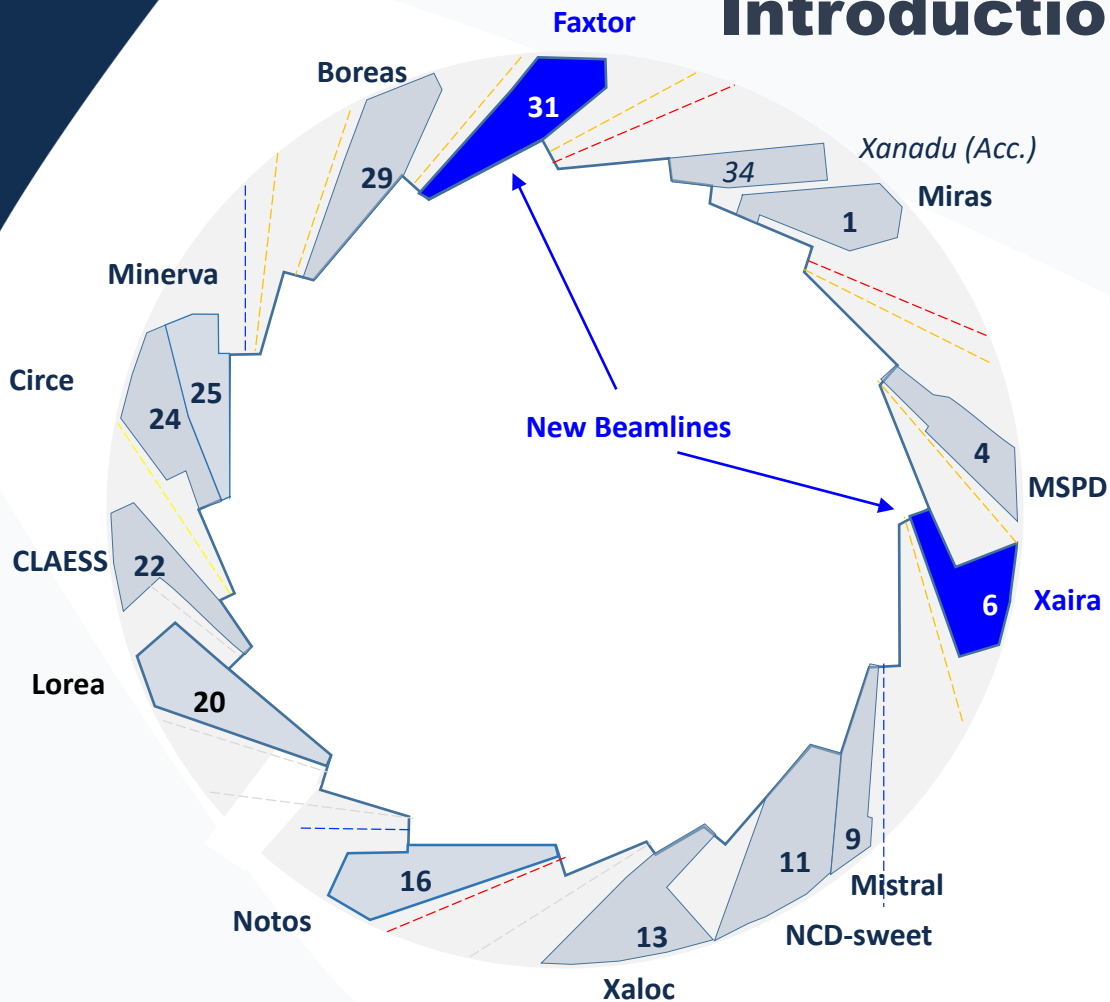WAO2023

# Introduction



**LINAC**
**100 MeV**

**BOOSTER**
**100 MeV -> 3 GeV**

**STORAGE RING**
**3 GeV**

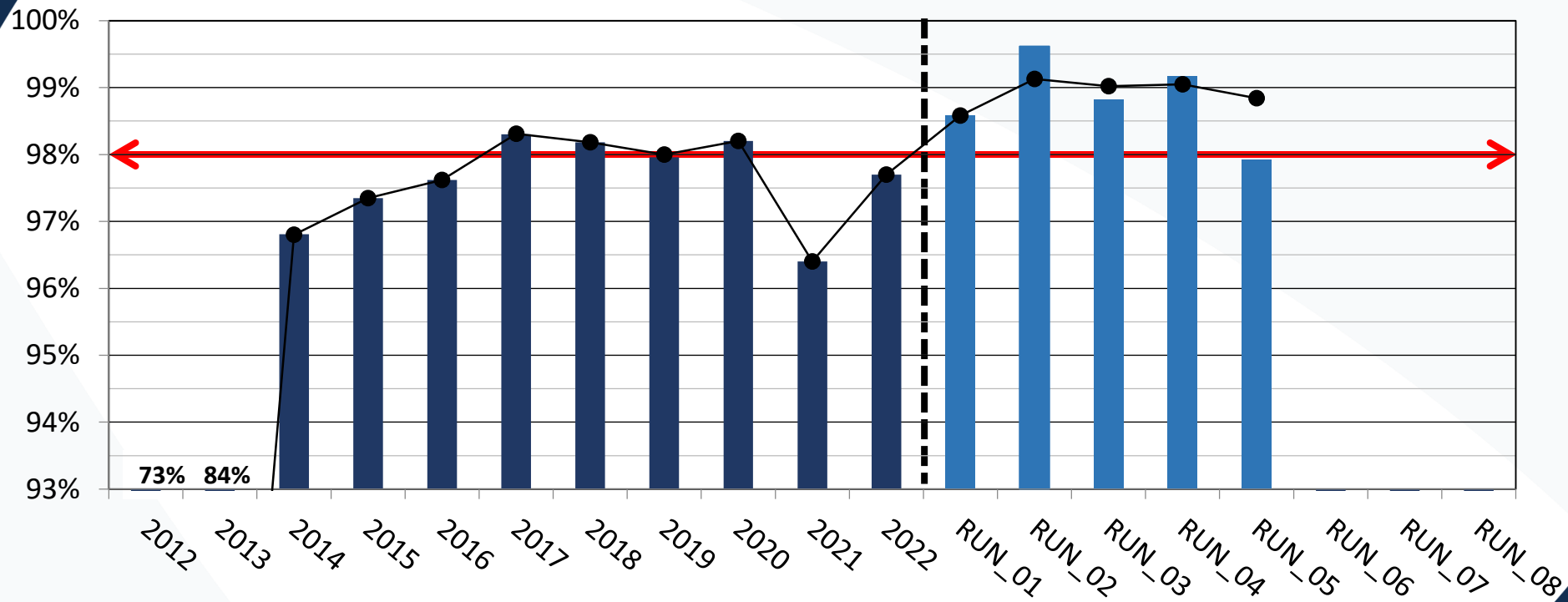| Parameter | Value |
|---|---|
| Energy | 3 GeV |
| Circumference | 268.8 m |
| Emittance | 4.5 nm·rad |
| Current | 250 mA |
| Rf frequency | 500 MHz |
| # cavities | 6 |
| Long straights | 4   (8 m) |
| Medium straights | 12 (4 m) |

# Introduction



- Operating for users since 2012

- 5650h/year
  - 4500h for users
  - 1150h for machine

- Operating 11 beamlines

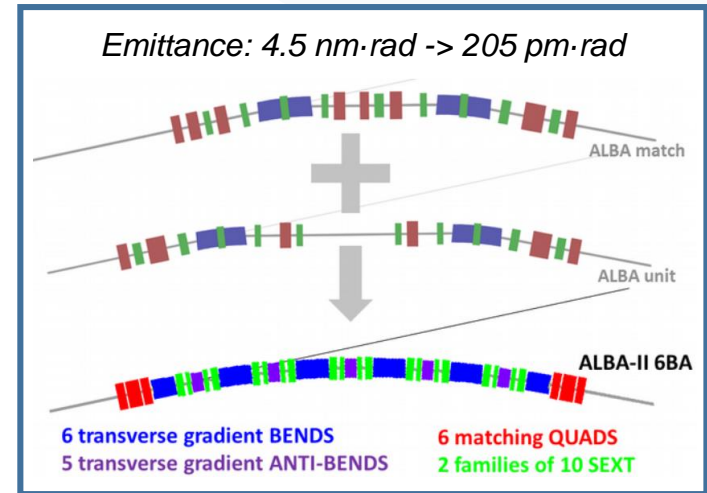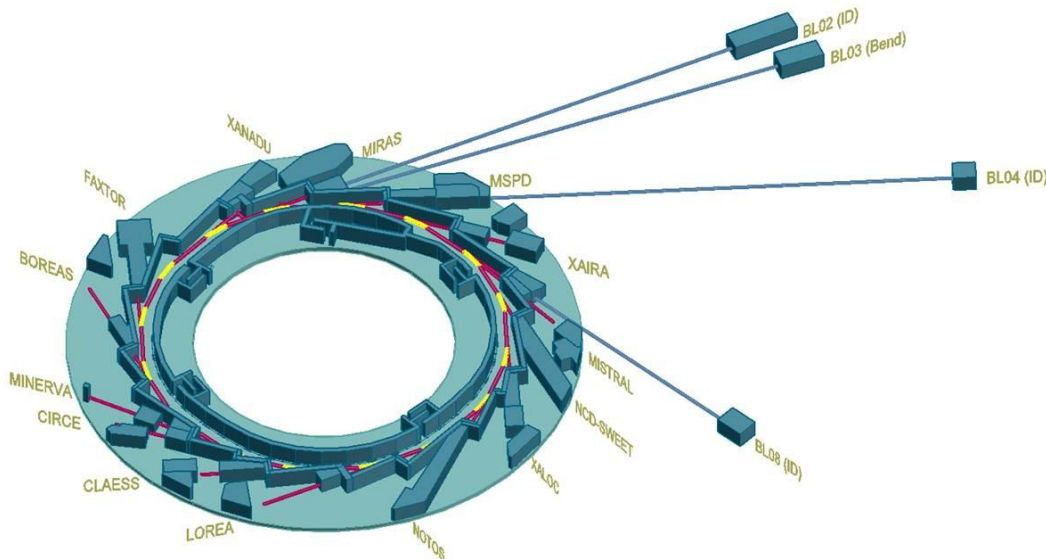- Building/commissioning 2 new ones

# Introduction



Beam availability_2023 : 98.84%

# Introduction

- **ALBA II project**: Storage Ring upgrade + Long Beamlines + Data acq. + …
  - Same injector and present Beamlines position
- Authorities commitment (New land plot + 7.5M€ for prototypes)
- Installation 2030 -> Commissioning 2031



*Emittance: 4.5 nm·rad -> 205 pm·rad*

ALBA match

ALBA unit

**ALBA-II 6BA**

**6 transverse gradient BENDS**
**5 transverse gradient ANTI-BENDS**

**6 matching QUADS**
**2 families of 10 SEXT**

# Introduction

- The ALBA Accelerator Operators

  - 8 operators (1 operator/shift)

  - 50% On Shift // 50% "office"

  - 20% Machine days // 80% Beamlines days

Time for other duties

- Projects related with Operation

- Each operator is assigned to a subsystem:

  1. Linac
  2. Pulsed elements
  3. Radiofrequency
  4. Diagnostics
  5. Controls
  6. PLCs
  7. Front Ends, Magnets & Insertion Devices
  8. Mechanical Designs

# Operators Control Tools

- ALBA is operating with users since 2012 (Commissioning in 2011)

- Controls group provided Control System (based on Tango) and Guided User Interfaces (GUIs) to operate the different subsystems, as well as the protection systems: Equipment Protection System (EPS) and Personal Safety System (PSS)
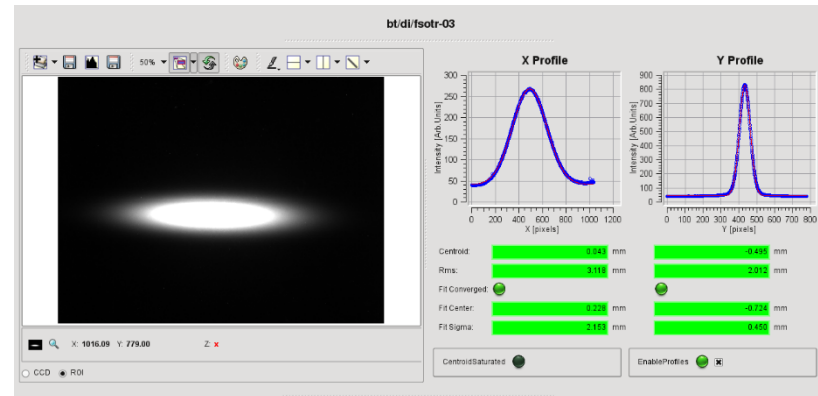


- Beam Dynamics took care of the Matlab Middle Layer; for commissioning tools and machine setup (LOCO, chromaticity, orbit correction,…)

# Operators Control Tools

- As soon as the operation stabilized, Operators started asking for:

  1. "Simple" scripts for repetitive tasks/checks

  2. GUIs designed from our point of view

- But:

  1. Low priority requests

  2. Controls already at 100% workload

  3. Operators started to have time for projects

IT'S A

MATCH!
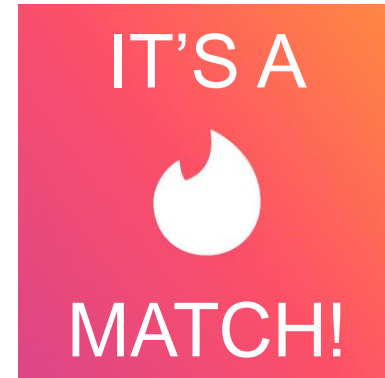
# Operators Control Tools

- Start writting scritps & creating GUIs with TaurusGui
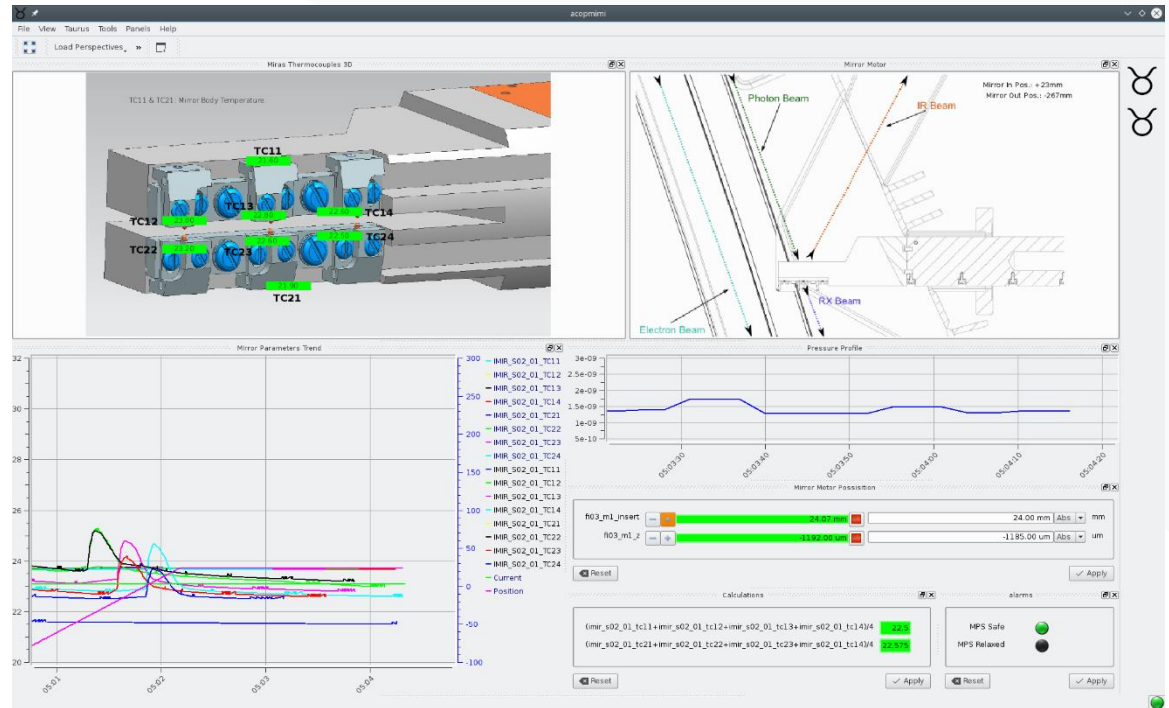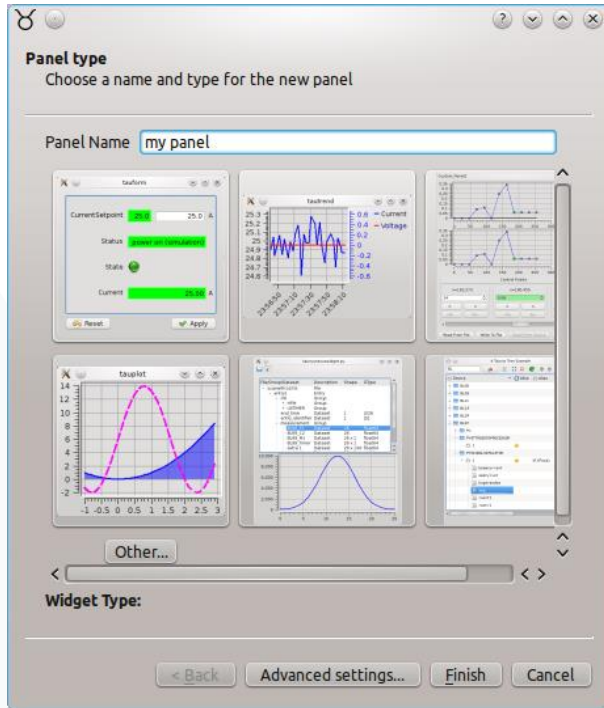
# GUIs for Operation

- Startup/Shutdown procedures checks & automatization

  - CheckFSS.py → Moves IN/OUT all Screens and Scrapers

  - RFcheck.py → Checks all LLRF parameters and suggests working pase

  - IDopen & IDclose

  - RingImageCapturer.py

- Shutdown GUI



*It even kills the beam reading the DCCT and action on the scraper*
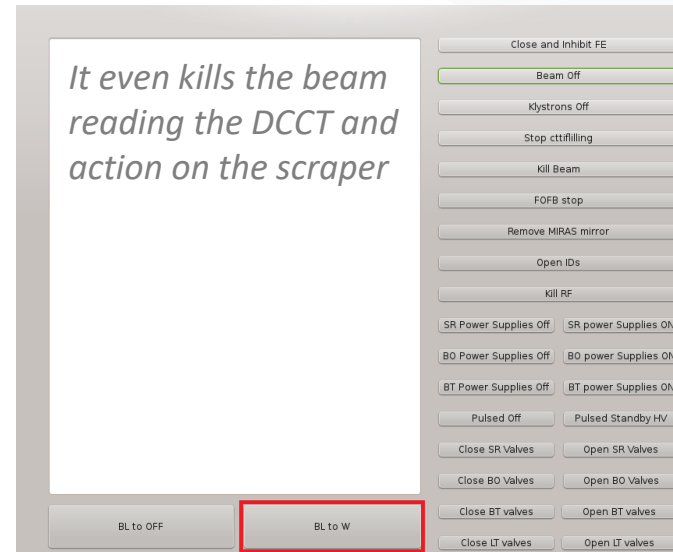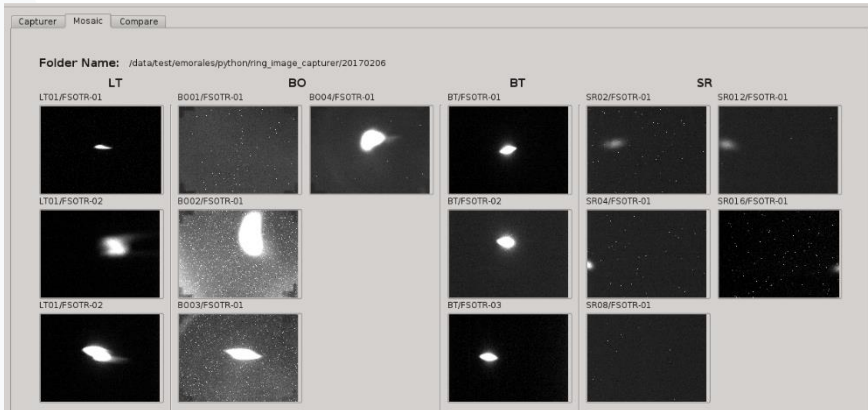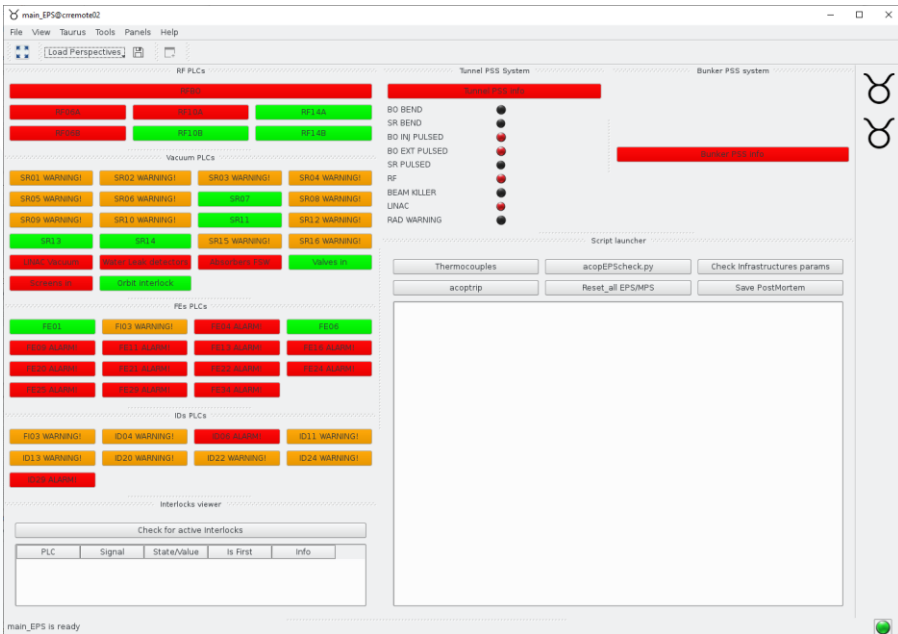
# GUIs for Operation

- TopUp stability related GUIs

✓ SR BPMs, temperatures, pressure,…

✓ Injection: efficiency, pulsed amplitude meas., transfer line BPMs,
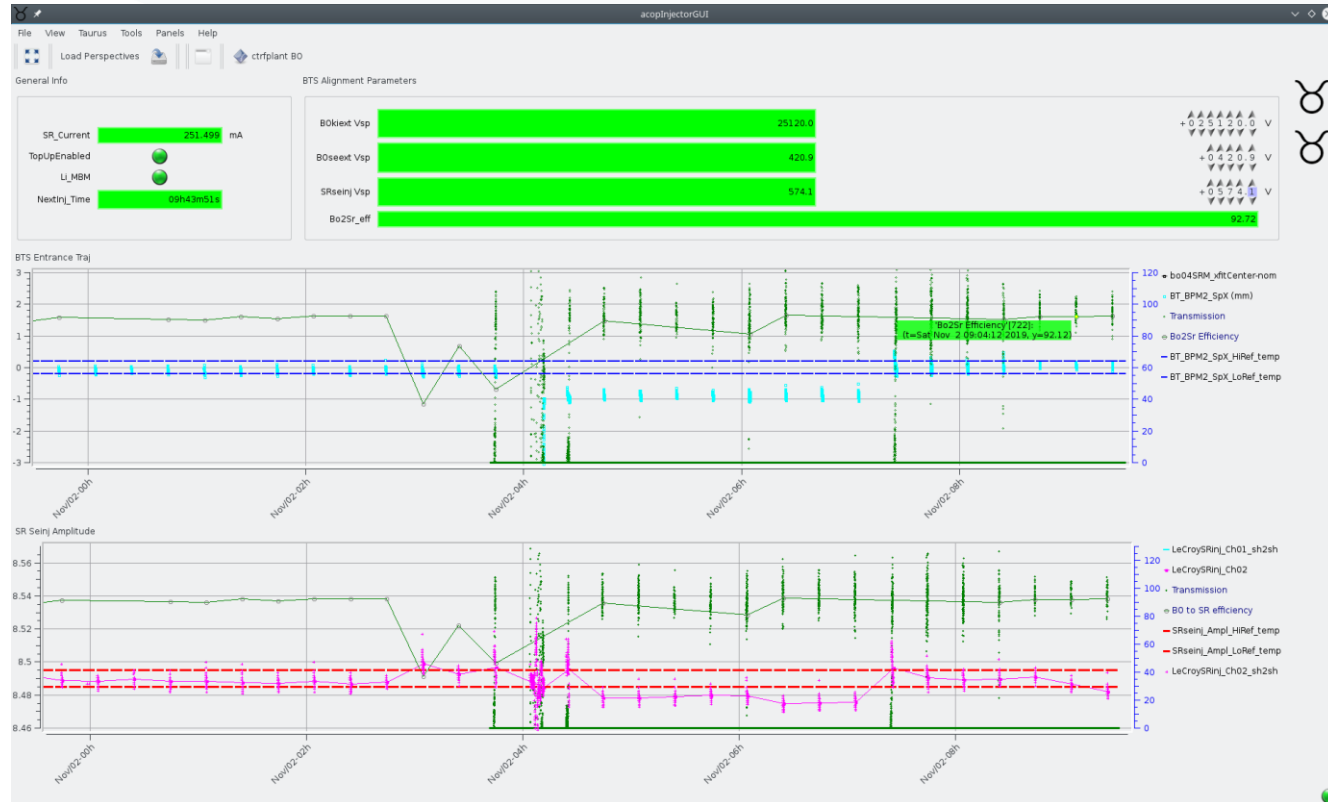
# GUIs for Operation - Subsystems

- Equipment Protection System (EPS)

EPS user GUI

EPS PLCs configuration check GUI

# GUIs for Operation - Subsystems

- Power Converters

PC checker

PC cycler

# GUIs for Operation - Subsystems

- Power Converters – Measure and compare Booster PC
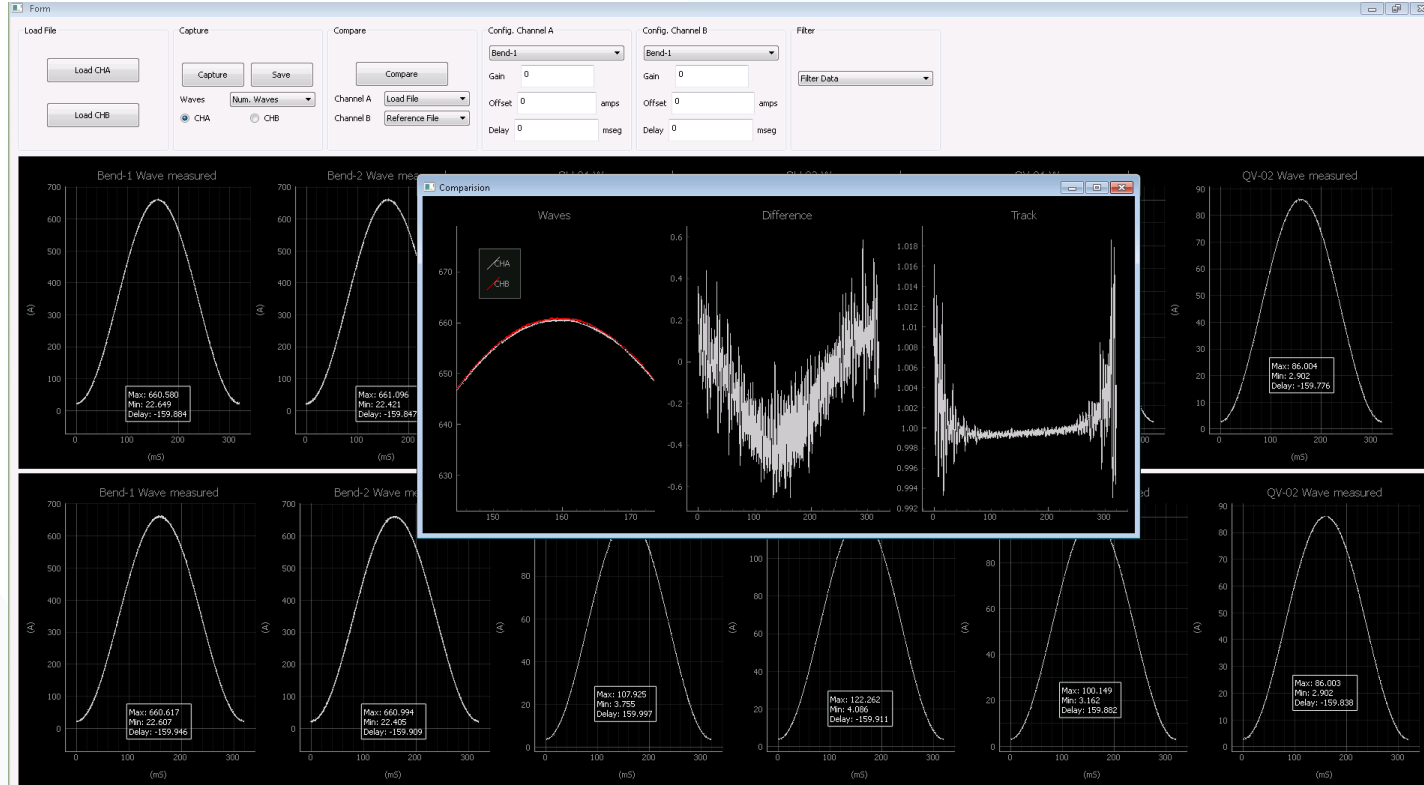
# GUIs for Operation - Subsystems

- Beam Position Monitors (BPMs)

### Check and synchronize BPMs
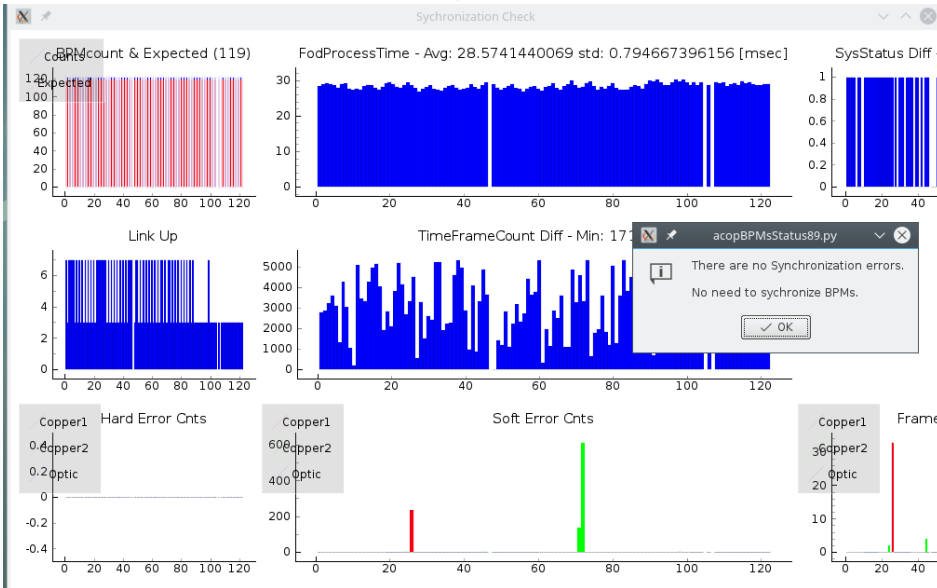
### Fast Polarization Switch (orbit bump)
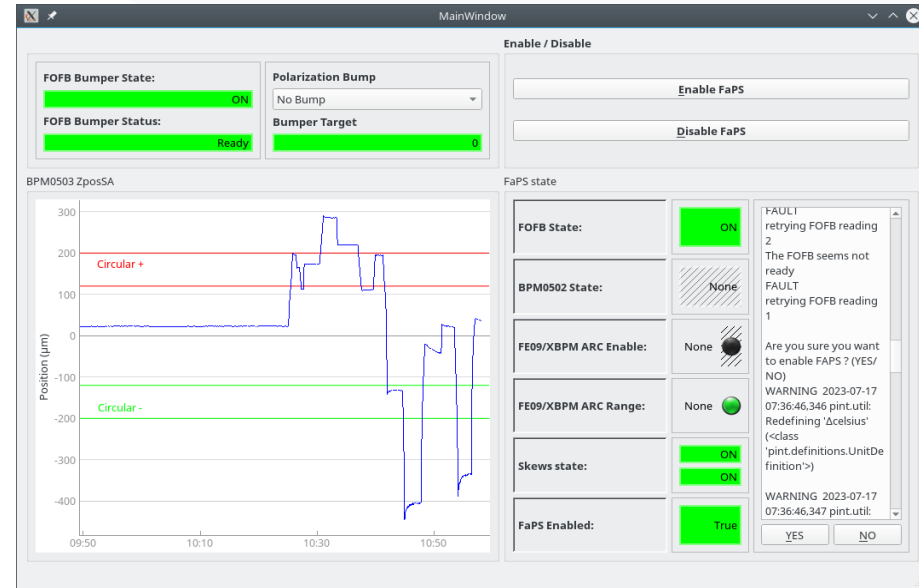
# GUIs for Operation

- And many other GUIs…

    - **Check FE** → check XBPM positioin at FE + neighboring SR corr. & compares to other dates

    - **Trip Info** → collects data from timing, RF status as first response after beam trip

    - **Frequency hunter** → takes data from BPMs Fast Archiver, FFTs, follow peaks,…

    - **Save Post Mortem** → Connects and downloads all postmortem data from BPMs

    - **Bump & Tune** → Monitors at every injection the beam distortion (bump closure) and tune

    - **Plot Data** → Access to archived data for plotting with advanced featrues like filtering

    - **Statistics** → Chron script that computes statistics from DCCT data

# Other contributions

- We do with limited functioning devices (tango composers and processors)

    - Create our own atributes calculated from other attributes

- We write communication functions with oscilloscopes

- We work with "Sardana macros"; mainly cron scripts that collects data at every injection.

- Support to Accelerators scientists regarding data acquisition and devices control

- Two operators are giving support to Controls and PLCs groups

    - Difficult to get involved due to the shiftwork

# Coordination with Controls

- They teach

  - How to create Taurus GUIs

  - How to create/edit PANIC alarms

  - Python course for beginners

- Hotline for doubts on programming or interacting with devices


- Programming skilled operator contributing to Control tools

- Keep track and report failures of the Control System

- *The more we know, the less we call them*
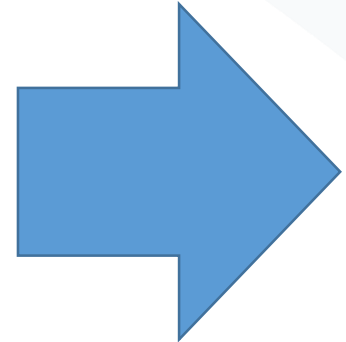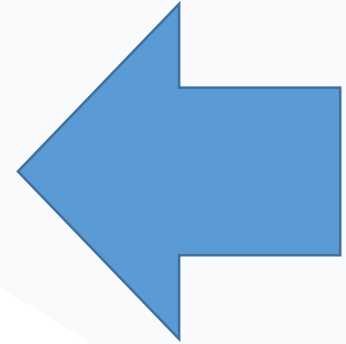
# Thanks on behalf of the

# Accelerator Operations team