



SOLEIL UI experience, ... and future plans

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Towards SOLEIL II

UI status around control system

UI organization

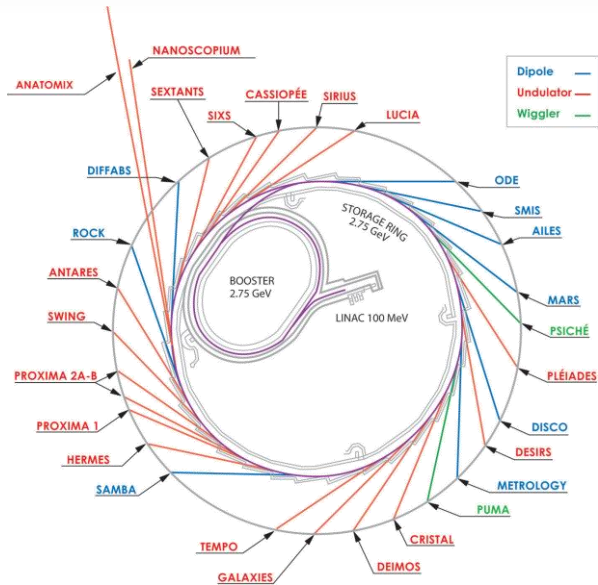
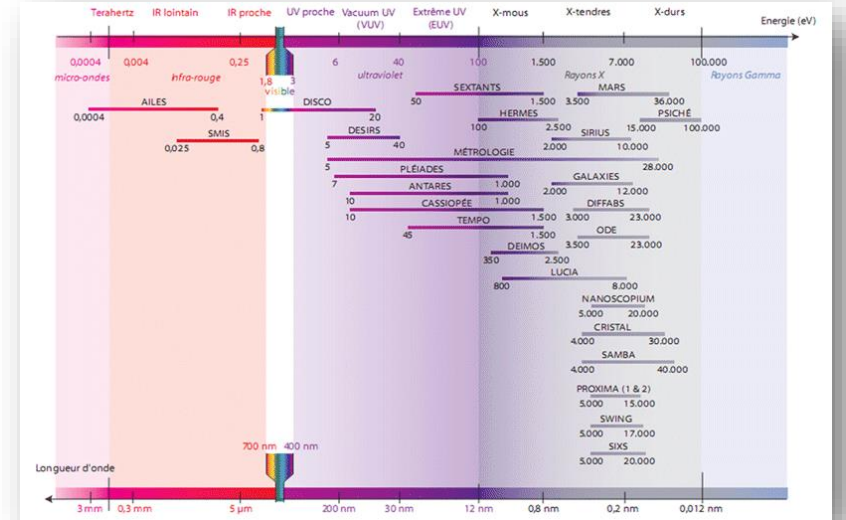
Future plans

Towards SOLEIL II





- Storage ring 354m, 2.75GeV
- 29 beamlines
- From far IR to hard X-rays
- Open to external users in 2008
- ~ 450 staff members



in 2022
~ **2746**
single users
(~150 remote access)

More than
12 000
users since
2008

- Beam delivery **24 hours, 7 days a week**
- **5019 h (x 29!) ~ 145000 hours of beamtime in 2022**
- Beam availability **98,95%** in 2022
- Mean time between failures (MTBF) **139 hours** in 2022

| | |
|----|---|
| U | Uniforme Top-Up - 500 mA |
| H | Hybride Top-Up - 450 mA |
| 8 | 8 paquets Top-Up - 100 mA |
| S | 1 paquet Top-Up - 16 mA |
| L | Low-Alpha Top-Up |
| B | Beamlines |
| Cp | Contrôles RP périodiques, 3 mardis de 7h à 23h |
| Tv | Tests RP de validation, faisceau Lignes redonné à 10h |
| A | Temps Accélérateurs |
| . | Arrêt Machine |

| janv 2022 | févr 2022 | mars 2022 | avr 2022 | mai 2022 | juin 2022 | juil 2022 | août 2022 | sept 2022 | oct 2022 | nov 2022 | déc 2022 | janv 2023 | févr 2023 | | | | | | | | | | | |
|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|-------|
| sam 01 | mar 01 | B B B | mar 01 | ven 01 | dim 01 | H H H | mer 01 | U U U | ven 01 | U U U | lun 01 | jeu 01 | A A A | sam 01 | U U U | mar 01 | S S S | jeu 01 | H H H | dim 01 | mer 01 | U U U | | |
| dim 02 | mer 02 | U U U | mer 02 | sam 02 | U U U | lun 02 | jeu 02 | U U U | sam 02 | U U U | mar 02 | ven 02 | A A A | dim 02 | U U U | mer 02 | S S S | ven 02 | H H H | lun 02 | jeu 02 | U U U | | |
| lun 03 | jeu 03 | U U U | jeu 03 | dim 03 | 13 | mar 03 | ven 03 | 22 | dim 03 | 26 | mer 03 | sam 03 | A A A | lun 03 | A A Tv | jeu 03 | S S S | sam 03 | H H H | mar 03 | ven 03 | U U U | | |
| mar 04 | ven 04 | U U U | ven 04 | lun 04 | A A Tv | mer 04 | sam 04 | U U U | lun 04 | A A A | jeu 04 | dim 04 | A A A | mar 04 | B B B | ven 04 | S S S | dim 04 | H H H | mer 04 | sam 04 | U U U | | |
| mer 05 | sam 05 | 05 | sam 05 | mar 05 | B B B | jeu 05 | dim 05 | U U U | mar 05 | Cp Cp B | ven 05 | lun 05 | A A A | mer 05 | U U U | sam 05 | S S S | lun 05 | A A A | jeu 05 | dim 05 | U U U | | |
| jeu 06 | dim 06 | U U U | dim 06 | mer 06 | H H H | ven 06 | lun 06 | A A Tv | mer 06 | U U U | sam 06 | mar 06 | B B B | jeu 06 | U U U | dim 06 | S S S | mar 06 | A A Tv | ven 06 | lun 06 | A A Tv | | |
| ven 07 | lun 07 | A A Tv | lun 07 | jeu 07 | H H H | sam 07 | mer 07 | B B B | jeu 07 | U U U | dim 07 | mer 07 | U U U | ven 07 | U 40 | lun 07 | A A Tv | mer 07 | U U U | sam 07 | mar 07 | B B B | | |
| sam 08 | mar 08 | B B B | mar 08 | ven 08 | H H H | dim 08 | jeu 08 | H H H | ven 08 | U 27 | lun 08 | jeu 08 | U U U | sam 08 | U U U | mar 08 | B B B | jeu 08 | U U U | dim 08 | mer 08 | H H H | | |
| dim 09 | mer 09 | H H H | mer 09 | sam 09 | H H H | lun 09 | jeu 09 | H H H | sam 09 | U U U | mar 09 | ven 09 | U U U | dim 09 | U U U | mer 09 | H H H | ven 09 | U 49 | lun 09 | jeu 09 | H H H | | |
| lun 10 | jeu 10 | H H H | jeu 10 | dim 10 | H H H | mar 10 | ven 10 | H H H | dim 10 | U U U | mer 10 | sam 10 | U U U | lun 10 | A A A | jeu 10 | H H H | sam 10 | U U U | mar 10 | ven 10 | H H H | | |
| mar 11 | ven 11 | H H H | ven 11 | lun 11 | A A Tv | mer 11 | sam 11 | H H H | lun 11 | A A Tv | jeu 11 | dim 11 | U U U | mar 11 | L L L | ven 11 | H 45 | dim 11 | U U U | mer 11 | sam 11 | H H H | | |
| mer 12 | sam 12 | H H H | sam 12 | mar 12 | B B B | jeu 12 | dim 12 | H H H | mar 12 | B B B | ven 12 | lun 12 | A A Tv | mer 12 | L L L | sam 12 | H H H | lun 12 | A A Tv | jeu 12 | dim 12 | H H H | | |
| jeu 13 | dim 13 | H H H | dim 13 | mer 13 | U U U | ven 13 | lun 13 | A A Tv | mer 13 | H H H | sam 13 | mar 13 | 8 8 8 | jeu 13 | L 41 | dim 13 | H H H | mar 13 | B B B | ven 13 | lun 13 | A A Tv | | |
| ven 14 | lun 14 | A A Tv | lun 14 | jeu 14 | U U U | sam 14 | mar 14 | B B B | jeu 14 | H H H | dim 14 | mer 14 | 8 8 8 | ven 14 | L L L | lun 14 | A A A | mer 14 | U U U | sam 14 | mar 14 | B B B | | |
| sam 15 | mar 15 | B B B | mar 15 | ven 15 | U 15 | dim 15 | mer 15 | U U U | ven 15 | H 23 | lun 15 | jeu 15 | 8 8 8 | sam 15 | L L L | mar 15 | Cp Cp B | jeu 15 | U U U | dim 15 | mer 15 | U U U | | |
| dim 16 | jeu 16 | H H H | jeu 16 | sam 16 | U U U | lun 16 | ven 16 | U U U | sam 16 | H H H | mar 16 | mer 16 | U U U | dim 16 | L L L | lun 16 | U U U | ven 16 | U U U | jeu 16 | U U U | U U U | | |
| lun 17 | jeu 17 | H H H | jeu 17 | dim 17 | U U U | mar 17 | ven 17 | U 24 | dim 17 | H H H | mer 17 | sam 17 | 8 8 8 | lun 17 | U U U | mer 17 | U U U | sam 17 | U U U | mar 17 | ven 17 | U U U | | |
| mar 18 | ven 18 | H H H | ven 18 | lun 18 | A A Tv | mer 18 | sam 18 | U U U | lun 18 | A A Tv | jeu 18 | dim 18 | 8 8 8 | mar 18 | U U U | ven 18 | U 42 | dim 18 | U U U | mer 18 | sam 18 | U U U | | |
| mer 19 | sam 19 | 03 | sam 19 | mar 19 | B B B | jeu 19 | dim 19 | U U U | mar 19 | B B B | ven 19 | lun 19 | A A Tv | mer 19 | U U U | ven 19 | U 46 | lun 19 | U U U | jeu 19 | mar 19 | A A A | | |
| jeu 20 | A A A | dim 20 | H H H | dim 20 | U U U | ven 20 | lun 20 | A A A | mer 20 | U U U | sam 20 | mar 20 | B B B | jeu 20 | U U U | dim 20 | U U U | mar 20 | U U U | ven 20 | lun 20 | A A Tv | | |
| ven 21 | A A A | lun 21 | A A Tv | lun 21 | U U U | jeu 21 | mer 21 | L L L | jeu 21 | U U U | dim 21 | mer 21 | H H H | ven 21 | U U U | lun 21 | A A Tv | mer 21 | U U U | sam 21 | mar 21 | B B B | | |
| sam 22 | A A A | mar 22 | B B B | mar 22 | B B B | ven 22 | dim 22 | L L L | ven 22 | U 29 | lun 22 | jeu 22 | H H H | sam 22 | U U U | mar 22 | B B B | jeu 22 | U 51 | dim 22 | mer 22 | H H H | | |
| dim 23 | A A A | mer 23 | U U U | mer 23 | U U U | lun 23 | jeu 23 | L L L | sam 23 | U U U | mar 23 | ven 23 | H H H | dim 23 | U U U | mer 23 | H H H | ven 23 | U U U | lun 23 | jeu 23 | H H H | | |
| lun 24 | A A A | jeu 24 | U U U | dim 24 | U U U | mar 24 | ven 24 | L L L | mer 24 | U 25 | lun 24 | jeu 24 | H H H | lun 24 | U U U | jeu 24 | H H H | sam 24 | U U U | mar 24 | B B B | ven 24 | H H H | |
| mar 25 | B B B | ven 25 | U U U | ven 25 | U 12 | lun 25 | mer 25 | S S S | sam 25 | L L L | lun 25 | jeu 25 | H H H | mar 25 | U U U | ven 25 | H H H | dim 25 | U U U | mer 25 | U U U | sam 25 | H H H | |
| mer 26 | U U U | sam 26 | U U U | sam 26 | U U U | mar 26 | lun 26 | L L L | lun 26 | U U U | mer 26 | jeu 26 | U U U | lun 26 | U U U | sam 26 | H H H | lun 26 | U U U | jeu 26 | U U U | dim 26 | H H H | |
| jeu 27 | U U U | dim 27 | U U U | dim 27 | U U U | mer 27 | ven 27 | S S S | lun 27 | A A Tv | mer 27 | U U U | U 30 | sam 27 | U U U | mar 27 | B B B | jeu 27 | U U U | dim 27 | mer 27 | U U U | lun 27 | U U U |
| ven 28 | U 04 | lun 28 | U U U | lun 28 | A A A | jeu 28 | U U U | U U U | mer 28 | B B B | jeu 28 | U U U | U U U | dim 28 | U U U | mar 28 | U U U | ven 28 | A A A | lun 28 | A A Tv | mer 28 | U U U | U U U |
| sam 29 | U U U | U U U | U U U | mar 29 | Cp Cp B | ven 29 | mer 29 | U U U | mer 29 | U U U | jeu 29 | U U U | U 39 | U U U | U U U | mar 29 | B B B | jeu 29 | U U U | dim 29 | U U U | U U U | U U U | U U U |
| dim 30 | U U U | U U U | U U U | mer 30 | U U U | sam 30 | lun 30 | U U U | jeu 30 | U U U | sam 30 | mar 30 | U U U | U U U | U U U | mer 30 | H H H | ven 30 | U U U | lun 30 | A A Tv | mer 30 | U U U | U U U |
| lun 31 | A A Tv | U U U | jeu 31 | U U U | mar 31 | B B B | mer 31 | U U U | dim 31 | U U U | mer 31 | U U U | U U U | U U U | U U U | lun 31 | A A A | sam 31 | U U U | mar 31 | B B B | U U U | U U U | U U U |

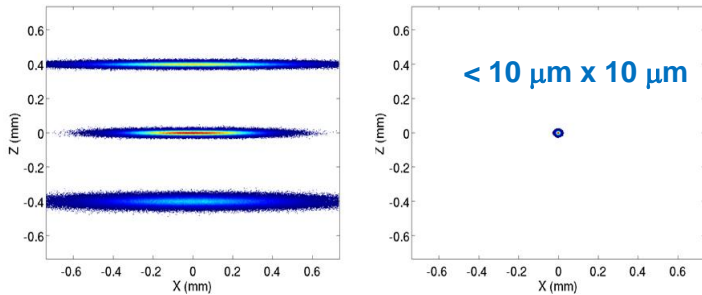


UPGRADE

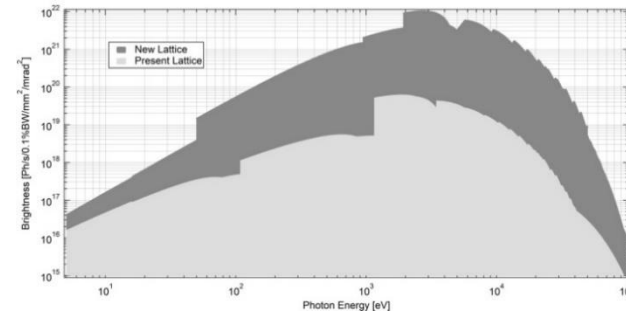
- Better performances for Accelerator and photon sources
 - Reaching an emittance **< 100 pm.rad.**
 - Keeping the same electron beam energy : **2.75 GeV**
 - Preserving a maximum current of **500 mA** in the multibunch mode.
- New access mode with **more efficient use** of the SOLEIL Beamline



Beam SIZES



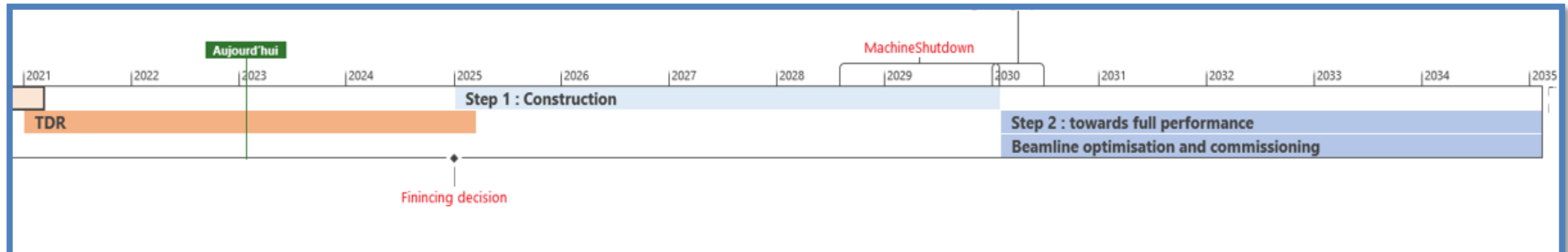
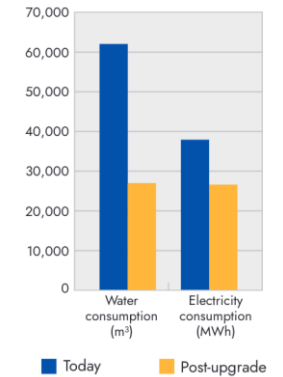
Brightness



- Upgrade Timeline (1 year delay from initial planning)

- Green infrastructure

- Reduction in the facility environmental footprint
- Lower power and water consumption
- Reduce operational cost



Acquisition and Control System Engineering (ISAC) team,

in charge of

- Accelerators and beamlines control systems
- ~12000 Electronics devices (motion, cPCI, PLC, Robotics, ...)
- ~24000 Tango devices and ~12000 device servers
- Involved in daily operation with 3 on-call duty 24/7:
 - Software
 - DaQ and motion control
 - PLC, Robotic

Involve in TDR around 50 WBS for

- Accelerators program
- Infrastructure Program
- BeamLine and Laboratory (BL2) program
- IT and Data management (transverse to support the others program)

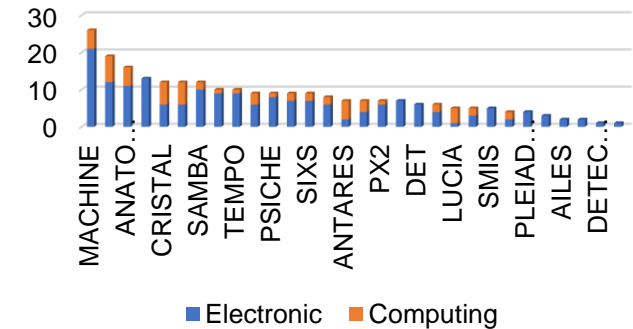
Works with other computing teams for SOLEIL IT systems integration

- ISI: Infrastructure & networks
- ISG: Management Information System
- GRADES: Data analysis

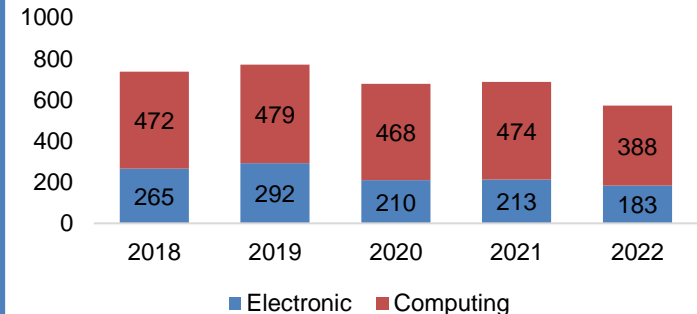
Software in operation

- **459** c++ Devices
- **32** Java Devices
- **44** GUI / API
- **300** Embedded codes for motion, DAQ, Robotic, PLC

services requests



Incidents profile



UI status around control system



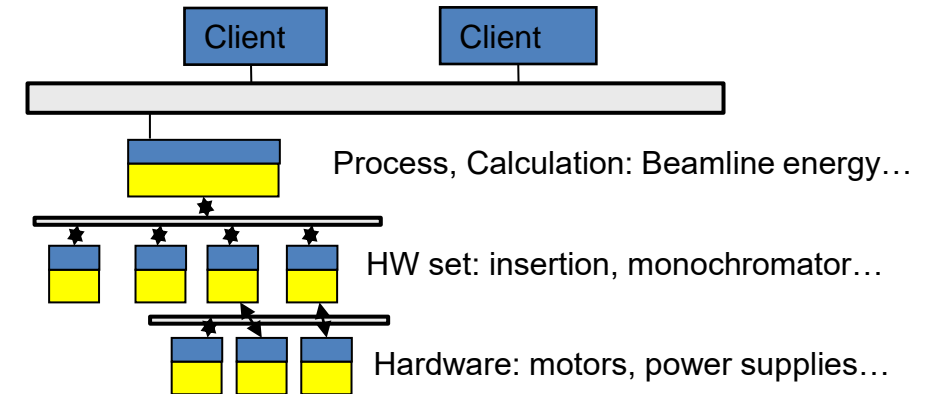
What is your control system made of?

Tango has become a SOLEIL standard de-facto

- Tango is used on all control systems (Accelerators, Beamlines and Labs)

Strategy to integrate everything in Tango devices
(*ancestor of SOA/ μ Service architecture?*):

- Hardware (motors, vacuum, power supplies, ...)
- Hardware sets (insertions devices, monochromators,...)
- External systems (Building Management in OPC, LINAC in LabVIEW....)
- Calculations, orchestration, workflows (beamline energy, beamline acquisitions processes, experimental data management, archiving...)



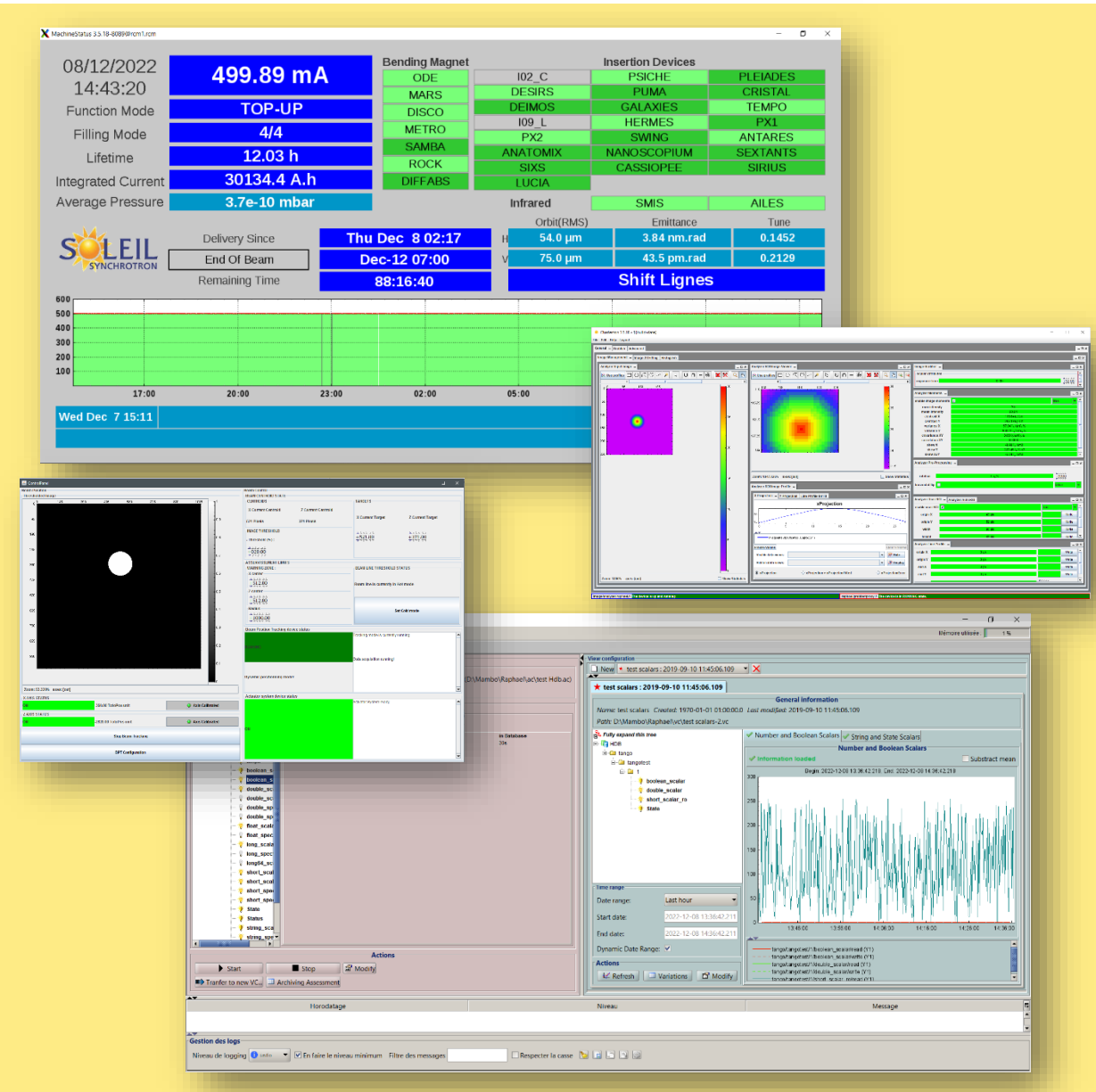
Outcomes:

- A seamless integration in all Tango clients (GUIs), in archiving...
- Built-in data correlation
- Autonomy to our users with Tango client API (Python, Matlab, Labview, Igor Pro)

For its common GUIs, SOLEIL use Java SWING language and has developed the Comete framework.

Library of widgets and data sources, with intermediates that manage the connection in between.

This framework enables to quickly develop new GUI.



The image displays several screenshots of the Comete framework GUIs. The largest screenshot at the top shows the 'MachineStatus' window, which includes a table of insertion devices and various machine parameters. Below it are several smaller windows, including one with a circular beam profile, one with a 2D heatmap, and one with a 1D histogram. The bottom screenshot shows a 'View configuration' window for 'test scalars' with a tree view of components and a time-series plot.

No-code tool to create GUIs with drag & drop.

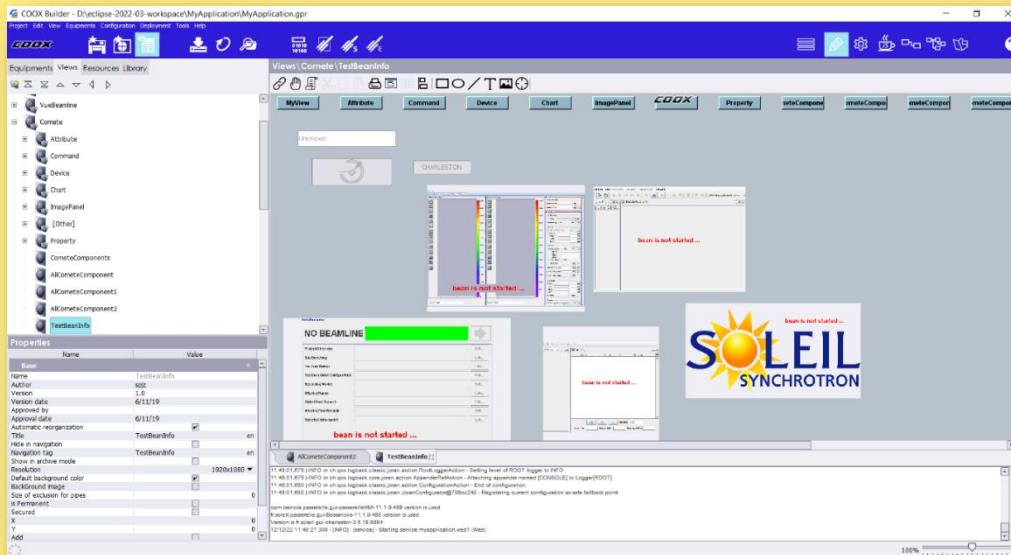
Developed in Java 8 by ORDINAL company

Based on Comete widgets

Used by almost all beamlines which are autonomous in creating their views

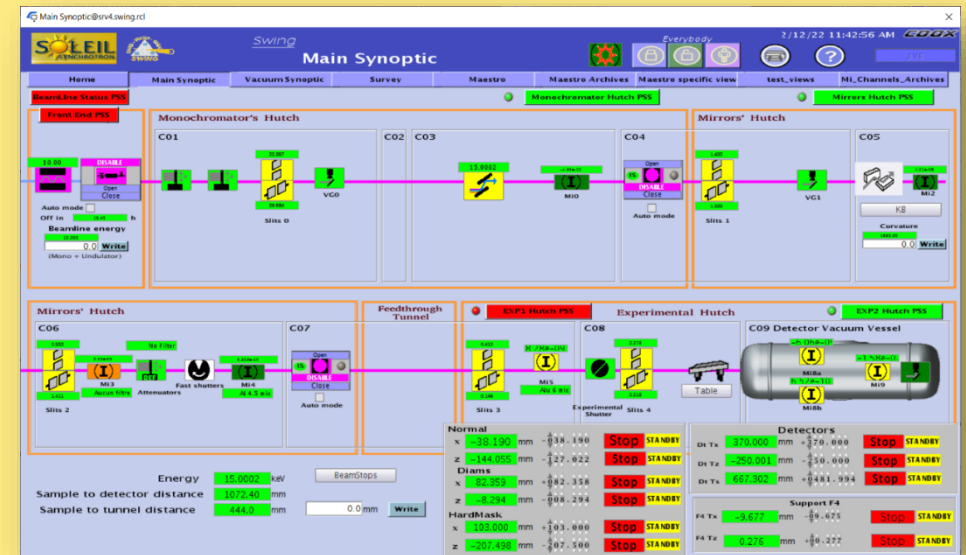
Builder

Creation of views by drag'n'drop
(uses SOLEIL's components with Comete)



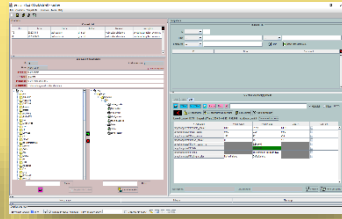
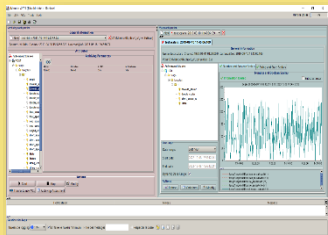
Viewer

Runs the views previously created with
Builder

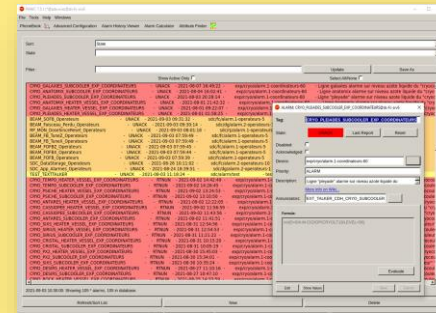


Tango Archiving

Configure & plot
HDB & TDB & Snap



Alarms - PANIC



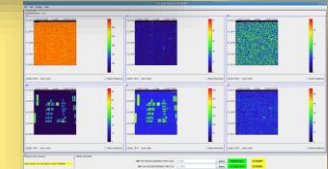
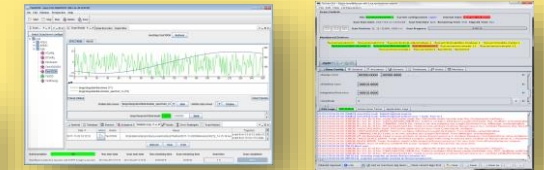
Acquisition

Spyc: SOLEIL Python CLI

```

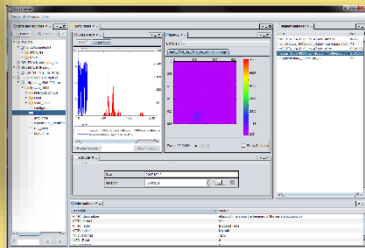
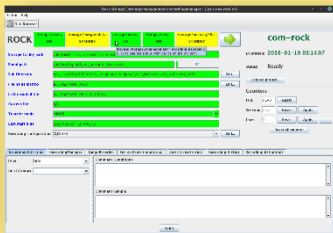
    Usage: spyc [options]
    -h, --help            show this help message and exit
    -i, --integration_time INTEGRATION_TIME
                        integration time in seconds
    -p, --position POSITION
                        the detector position in mm
    -r, --range RANGE     the detector range in mm
    -s, --steps STEPS     the number of steps
    -t, --time TIME       the integration time in seconds
    -v, --verbose          show the acquisition progress
    -w, --width WIDTH     the detector width in mm
  
```

Fronts for scan devices
(FlyScan & ScanServer)



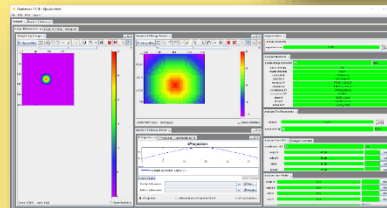
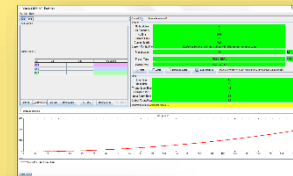
Experimental data recording

Configure & plot



Detectors

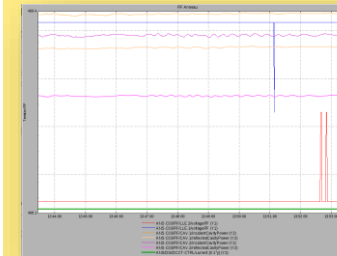
Multi Channel Analyzer



Beam image calculations

Tango tools

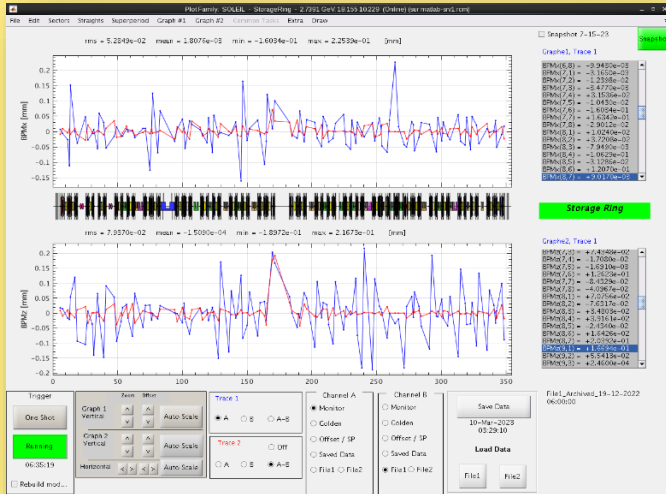
Large usage of ATKPanel, ATKTuning, Jive, Astor, ATKTrend



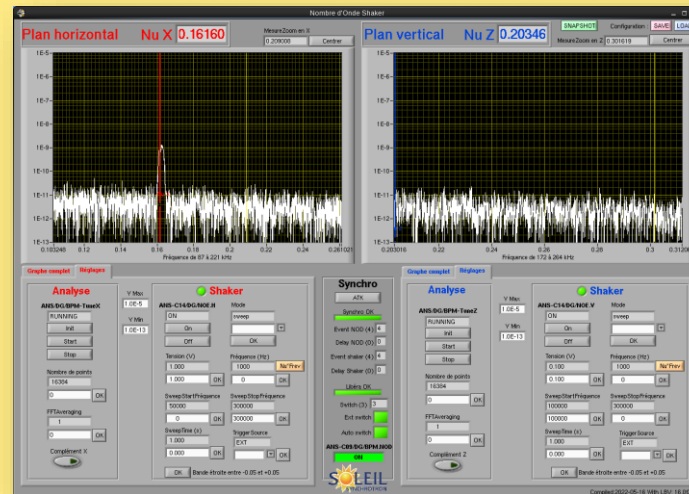
| M1 | | M2 | |
|------|--------------|------|--------------|
| Tx.1 | -12.200 mm | Tx.2 | 0.501 mm |
| Rx.1 | 0.00000 mrad | Rx.2 | 0.00000 mrad |
| Tz.1 | -2.0315 mm | Tz.2 | 2.6470 mm |
| Cl | 850 step | Rs.2 | 2.4978 mrad |

All the Java GUI based on Comete are also beans that can be integrated into COOX screens

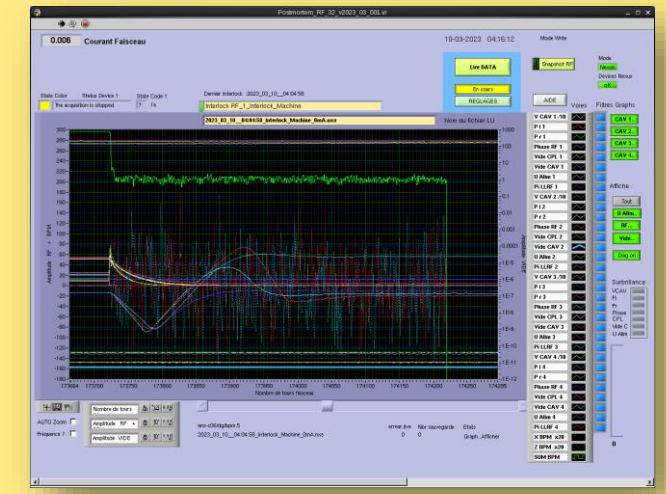
Beam positions - Matlab



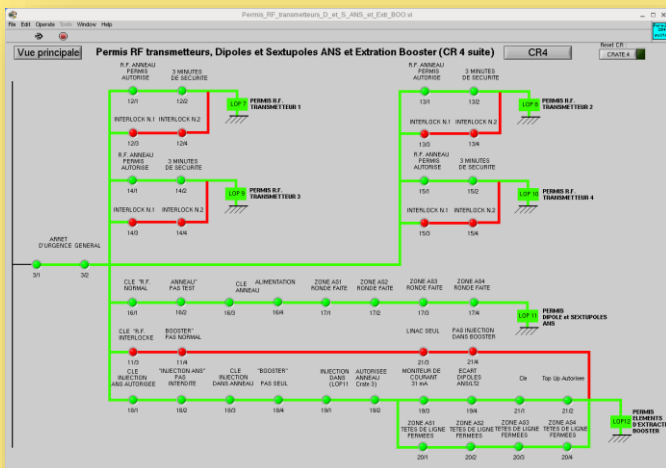
Beam Nu/WaveNumber measure - Labview



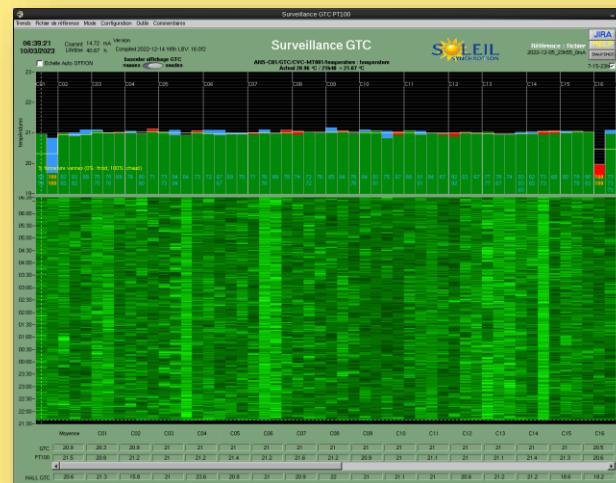
Postmortem analysis - Labview



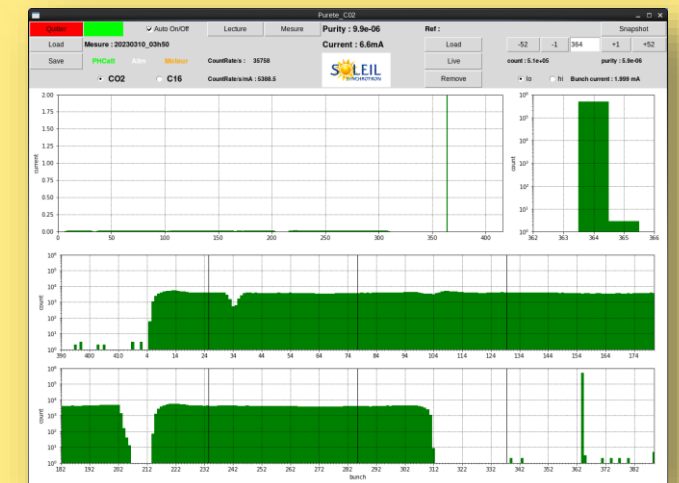
PSS permits (Personal Safety System)- Labview



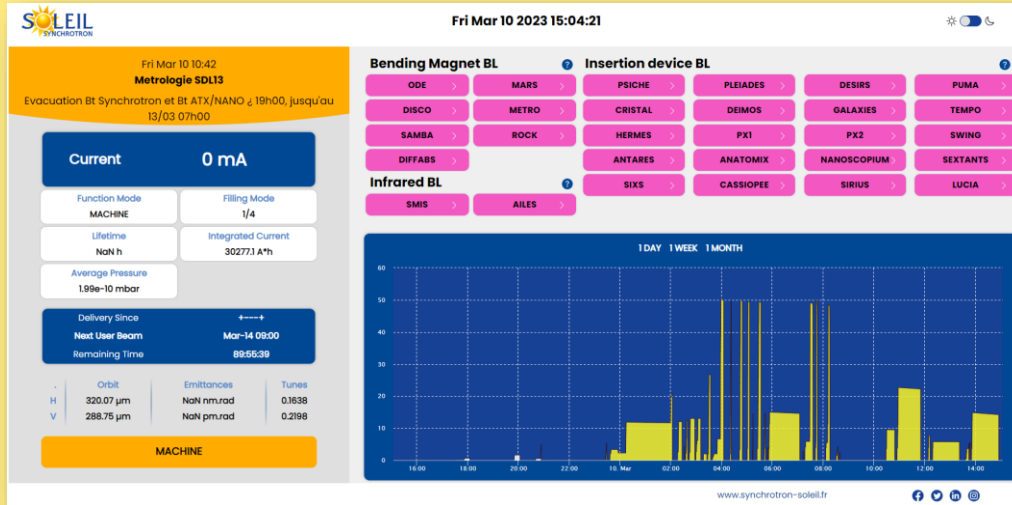
Utilities monitoring (AC & Fluids) - Labview



Beam purity measure - Python



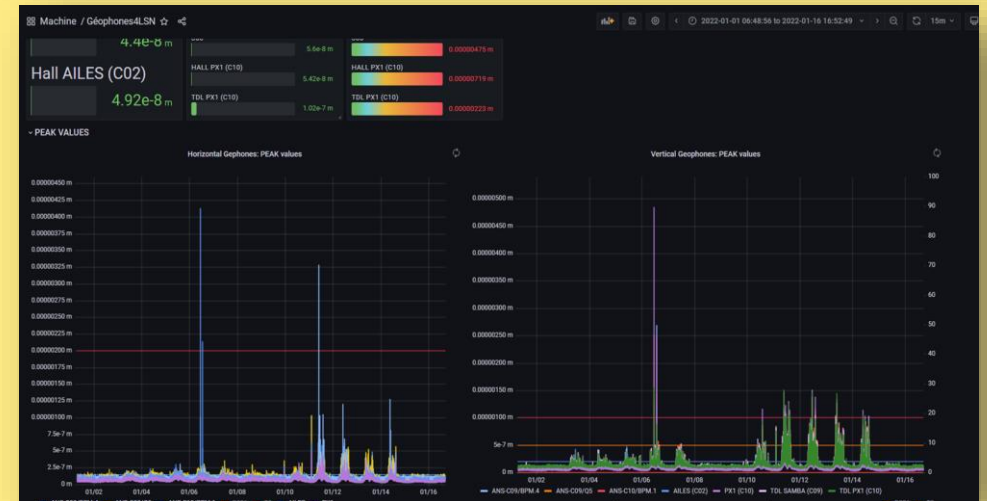
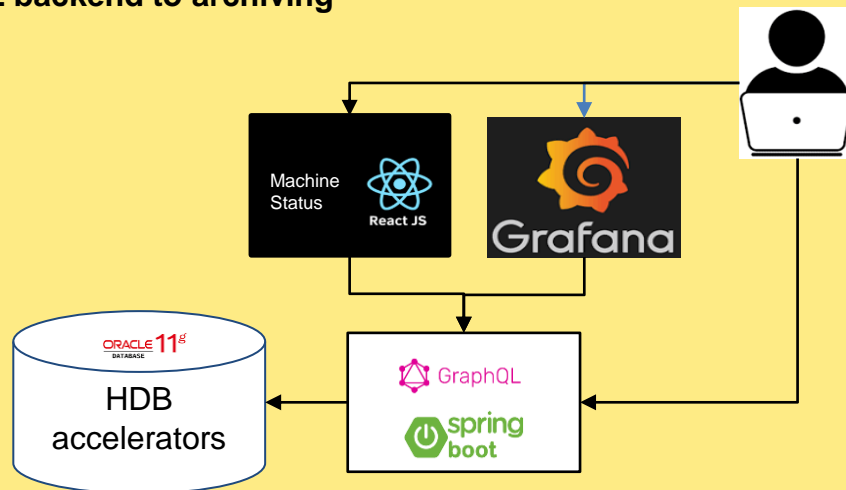
Machine status



Grafana



GraphQL backend to archiving



UI Organization



Accelerators as owner of

Labview apps
Python apps
Matlab apps

Accelerators as user of

Tango GUI (Jive, ATK...)
PANIC
Databrowser
Mambo / Bensikin
MachineStatus
Grafana (under evaluation)

152 LabVIEW apps
56 Python apps
114 Matlab apps
60 Grafana dashboards

Accelerators staff develop their own scripts/devices/GUI

- LabView, maintained by operators, acc. groups
- Matlab, maintained by physicists
- Python (TkInter, scripts, Tango devices), maintained by operators, physicists and acc. groups

GUI apps that embed the process are critical

- Top-up Injection process (Labview)
- Some feedbacks (Slow orbit feedback, ...) (Matlab) ...

Lots of accelerators' GUI are only for experts, and not for operations

Beamlines as owner of

Python apps
Igor Pro apps
Labview apps

Beamlines as user of

Tango GUI (Jive, ATK...)
PANIC
COOX
Salsa / FlyScan GUIs
Datastorage/Databrowser
Mambo/Bensikin
MachineStatus

Beamline staff develops their own scripts/devices/GUI

- Python (TkInter, scripts, Tango devices)
- On a few beamlines and laboratories
 - Igor Pro,
 - LabVIEW
 - Matlab

Beamline staff creates and maintains views of COOX synoptics

Computing teams as owner of

Tango generic GUI (Jive...)
 Comete framework
 GUI based on Comete
 PANIC
 COOX
 Spyc
 Tango Bindings
 Grafana (under evaluation)

*Support on deployment of products
 (Matlab, Labview, Python...)*

Tango

Nexus

Computing teams provide common GUI solutions (Comete, COOX, Tango binding)

- Development, delivery, deployment, training and support

Computing teams provide a very limited support for Matlab, Labview, Python and Igor Pro

- Provides help for deployment of these products, their licenses and their tango bindings

Resources for GUI (not fulltime)

- ISAC :
 - 1 expert for Java Swing GUI development
 - 1 expert for back-end in Java
 - 1 expert for front in React.JS
- ISI:
 - 1 sys. admin for products and licenses installation, OS upgrades

Accelerators

Accelerators as owner of

Labview apps
Python apps
Matlab apps

Accelerators as user of

Tango GUI (Jive, ATK...)
PANIC
Databrowser
Mambo / Bensikin
MachineStatus
Grafana (under evaluation)

Computing teams

Computing teams as owner of

Tango generic GUI (Jive...)
Comete framework
GUI based on Comete
PANIC
COOX
Spyc
Tango Bindings
Grafana (under evaluation)

*Support on deployment of products
(Matlab, Labview, Python...)*

Tango

Nexus

Beamlines

Beamlines as owner of

Python apps
Igor Pro apps
Labview apps

Beamlines as user of

Tango GUI (Jive, ATK...)
PANIC
COOX
Salsa / FlyScan GUIs
Datastorage/Databrowser
Mambo/Bensikin
MachineStatus

Feedbacks on user autonomy

- Positive feedbacks from users of COOX and apps w/ Tango bindings
- First feedbacks w/ Grafana are also positive

Sharing concerns between computing teams and business teams difficult to balance :

- Computing teams: focus on stability and reliability
- Business teams: focus on flexibility and changes
- Long term maintainability to be build :
 - *Migration from Python 2 to Python 3 is in progress with a support of ISAC on Beamlines and Accelerators*
- At some point, IT expertise is mandatory to operate GUI applications as they interact with a lot of IT components (Tango devices, the OS, network....)



Future plans



Transversal TDR program has a project dedicated to UI just started

- Strategy definition is under construction in the IT & Data management program
- Accelerators, beamlines and computing teams working together on the project

UI requirements

- Shared development between business & computing teams
- Well-known technologies are important -> Possibility to sub-contract
- Existing framework with a strong community to be able to share experience /dev
- Control layer between Tango device servers & GUI:
 - Add security/authentication: to allow only approved clients
 - Add requests tracking: to track clients requests and abnormal usage

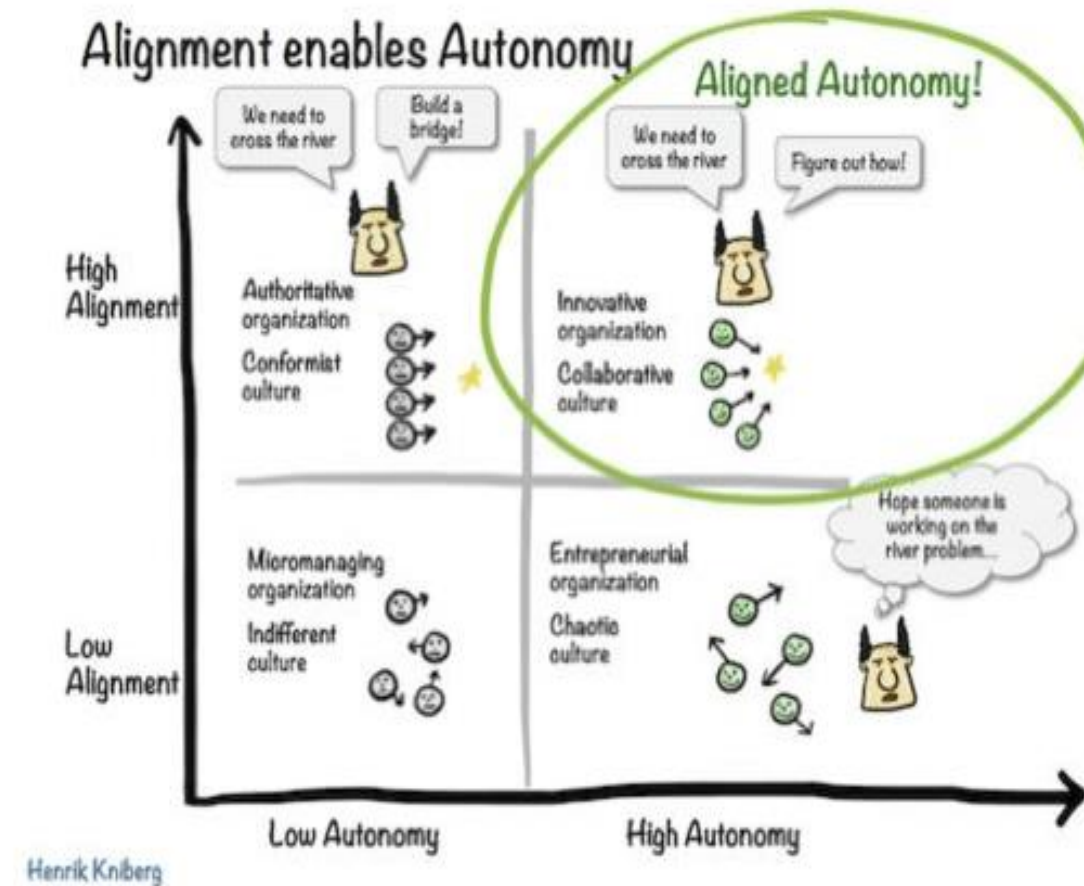
UI short/mid term perspectives:

- Maintain existing Java Swing
- Organize transition to new GUI technologies
- Deploy Grafana for monitoring on the control systems
- Provide Python ecosystem

Accelerators & Beamlines requests:

- Python/PyQt and other Python packages
- Web solutions

Computing teams & business teams work together to share the strategy



Understanding organization in the other institutes

- Who do what? How?
- Experience of migrating to new GUI technologies: skills, complexity
- What about long-term maintenance of the GUI? Which policy did you choose?
- UX Expertise?

Understanding operational architecture up to the desktop

- Cloud technology approach
- What about security for these upcoming solutions?
- What about library packaging?
- How to transition smoothly?

Feedbacks about Taurus

- Users' feedbacks from other institutes
- Which skills required to provide and deliver Taurus?
- Technical feedbacks: complexity, maintainability

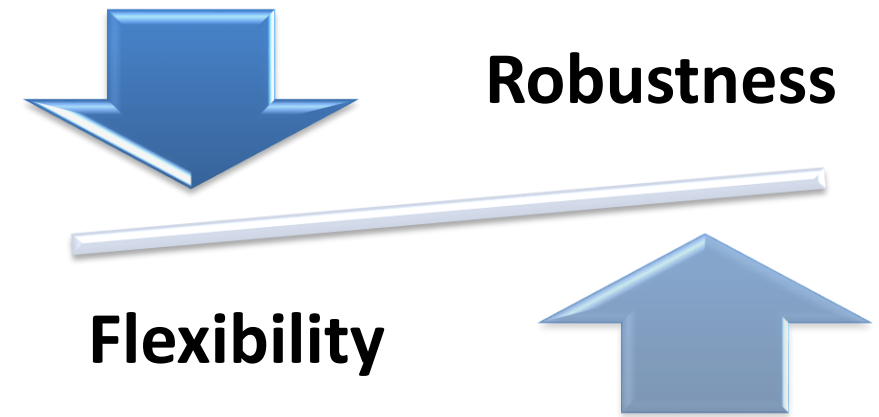


GUI strategy under construction in the context of SOLEIL II TDR

Current challenge is to manage the transition

Balance between desktop and web to be defined

Looking for partners to share UI frameworks and experiences



Architecture and technology Transformation

complexity/reliability/maintenability

Collaboration
Strong community



THANK
YOU