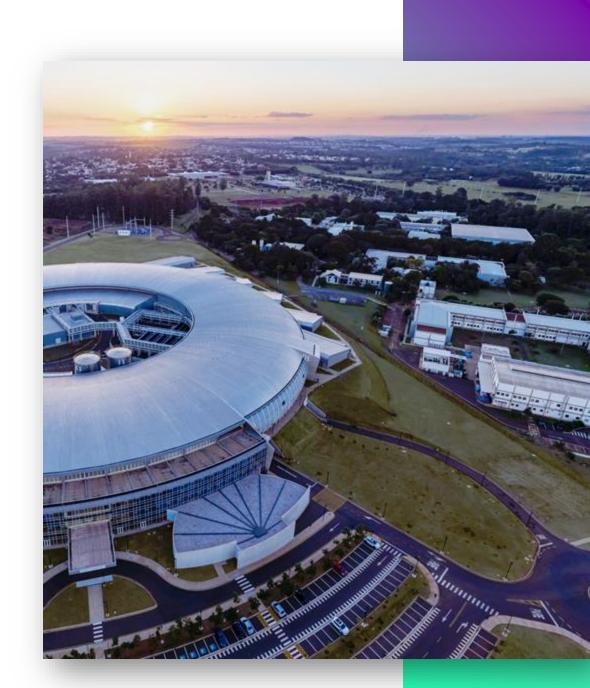
# LNLS Status for Controls and Acquisition GUI Strategies

Ana Clara de Souza Oliveira Control Software Group (SwC) Data Acquisition and Processing Division (DAP) Brazilian Synchrotron Light National Laboratory (LNLS) Brazilian Center for Research in Energy and Materials (CNPEM)







### **Overview of SIRIUS**

- 4GSR synchrotron light source
- 10 beam lines in operation, 4 in construction or commissioning •
- Now in maintenance shutdown (July 25th to November 11th)
- EPICS framework based control system







### Technologies in use

#### Development

- Equipment control and monitoring:
  - Mostly python, PyQt5, pyqtgraph, PyDM
    - Zero code (pure QtDesigner), low code (QtDesigner + some python logic), pure code (PyQt5 + PyDM components)
  - Some use of web solutions
    - Typescript, React, Next.js, epics2web
    - Mostly only monitoring
  - Minor use of EDM, MEDM, CaQtDM, CSStudio
    - No developments, only community ready to use GUIs





# Technologies in use

#### Development

- Acquisition
  - Mostly Jupyter Notebook and/or python PyEpics + PyQt5
  - Some use of web solutions
    - MxCube
    - Some adhoc solutions in some beamlines
    - Preliminary implementations for integrating with bluesky solutions
      - Turborepo + Next.js (managing the monorepo and building the apps) tRPC + @tanstack/react-query (API routes)

      - shadcn/ui (UI components)
      - Server-Sent Events (SSE) (stream data from sources like Kafka and Bluesky HTTP-server)
- Visualization during experiments
  - Adhoc solutions with silx, pyqtgraph and/or matplotlib







### Technologies in use

#### Deployment

- Desktop python solutions
  - packaging
  - micromamba environments with dependencies from pypi, conda-forge and local pip repository packages
- Web solutions
  - Containerization with docker and podman
  - Orchestration with docker compose and podman compose





# Challenges and strategies

#### Development

- Provide generic, shareable solutions while enabling tailored developments suited to each beamline's experimental environment.
  - Strategy:
    - Propose standardized solutions for equipment control and monitoring GUIs.
    - Create shareable libraries as a foundation for customized solutions where applicable.
    - Implement ad hoc solutions for acquisition GUIs.
- Provide generic tools for visualizing and interacting with (partially) processed data to support decision-making during experiments.
  - Strategy:
    - Exploring customized solutions using silx or pyqtgraph.







# Challenges and strategies

#### Deployment

- Migration to Python packaging:
  - Currently in progress, focusing on defining standards and migrating existing solutions.
  - Strategy: Define and utilize template tools, such as cookiecutter or copier.
- Definition and implementation of automated deployment tools:
  - Strategy: Use Ansible to track package versions and manage computer configurations.
- Tracking Package Usage:
  - Difficulties to track which packages are in use and which can be discontinued
  - Strategy: ?





### **High level questions**

- What tools do you use for data visualization (e.g., interaction, comparison) with data structured in Nexus format?
- For users of experiment orchestration libraries (e.g., Bluesky):
  What GUI solutions do you implement for acquisition and experiment control?
  - What feedback have you received from beamline users regarding your solution?
- For those exploring web-based control/acquisition GUI solutions:
  - Is anyone investigating the technologies we discussed?
  - Are you encountering challenges with streaming real-time data from similar sources? If so, how do you address these challenges?



### Thank you

#### Ana Clara de Souza Oliveira ana.clara@lnls.br

Igor Ferreira Torquato igor.torquato@lnls.br





Brazilian Center for Research in Energy and Materials

MINISTRY OF SCIENCE TECHNOLOGY AND INNOVATION

