

# **Tools for Continuous Improvement of** the Reliability of the SOLEIL Accelerators

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The SOLEIL synchrotron is the French third generation synchrotron light source (2.75 GeV, 354 m of circumference, 4 nm.rad natural emittance). In operation since 2008, it provides photon beams simultaneously to a total of 29 beamlines. The electron beam intensity can reach up to 500 mA depending on the filling pattern (all 5 of them are available, all in Top-Up injection) with sub micrometer stability.

After the first ten years spent improving the reliability of our equipment to reach or approach the goals of 99% beam availability and 100 hours mean time between failure. We continue our efforts to maintain these good results in spite of the important work necessary in parallel to prepare the forthcoming upgrade of our facility.

We will present examples of tools and actions that we have developed or implemented to anticipate incidents or reduce their impact, whether they be monitoring programs, incident follow-up, equipment modifications or changes in machine optics settings.



## PANIC: an ALARM TOOL for the TANGO Control System



This tool, developed at ALBA is for generating audible alarms on various conditions of equipment like out of tolerance or frozen values. It includes acknowledgement of the alarms. It also provides access to our Confluence knowledge database, with a direct link to a guide (reflex continue)



Grafana : An Open-Source software used for data monitoring. A plugin has been written in Typescript providing access to all long term-archived accelerator and utilities parameters (HDB). Users can create and share dashboards with multiple display options. Time-series, pie charts, bar gauges, alerts based on a readback value or an equipment status. Annotations can be added and seen by anyone. This type of tools is very useful for remote monitoring and is used by experts on call.

# MATRIX APPLICATION

r and storage ri



application developed with LabVIEW allows to v nt in the power supplies of the storage ring. In thes noise on the current regulation of quadrupoles ical visualization is also available for storage nng-ion of quadrupoles were ble for a more precise observation. I on this matrix layout, surveying both is conditioning units and

# **OTHER IMPROVEMENTS**

- entification of equipment that is critical for beam railability and building of a spare one (e.g., The LINAC
- g a delay on the non-critical signals in the interlock to avoid untimely faults.
- chain, to avoid untimely faults. Reporting every incident in JIRA incident database, highlighting frequent issues and leading to interventions during Machine days or shutdown periods.
- Modification of the management of superconducting RF cavities during a failure of the cryogenic system or the utilities, allowing improved a better cold maintenance and a better beam recovery time.



## **RADIATION AND BEAM LOSS MONITORING**



installation of a R&D injection kicker (MIK) and of a 3T-superbend in summer 2021 resulted in a modification of the age ring optics. Two new gamma monitors had been installed close to the MIK; we observed large steps in cumulated es during beam losses. As a result, we could lose the authorization to inject in the storage ring until the CIGs interlock automatically reset every 4 hours.

lodifications were made to ensure a normal recovery time after a beam loss: Modification of the triggering (on the Kicker Killer) during a Beam Loss. Use of two injection kickers instead of a single one : This allowed to relocate the beam losses in the over shielded injection area with much smaller dose levels. Modification of the machine optics using Multi Objective Genetic Algorithm for retuning the sextupoles allowing ar operation with higher injection efficiency and a lower horizontal chromaticity.

