

# CERN PROTON IRRADIATION FACILITY (IRRAD) DATA MANAGEMENT, CONTROL AND MONITORING SYSTEM INFRASTRUCTURE FOR POST-LS2 EXPERIMENTS

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# CERN PROTON IRRADIATION FACILITY (IRRAD) DATA \* MANAGEMENT, CONTROL AND MONITORING SYSTEM INFRASTRUCTURE FOR POST-LS2 EXPERIMENTS



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#### **ABSTRACT**

Since upgrades of the CERN Large Hadron Collider are planned and design studies for a post-LHC particle accelerator are ongoing, it is key to ensure that the detectors and electronic components used in the CERN experiments and accelerators can withstand the high amount of radiation produced during particle collisions. To comply with this requirement, scientists perform radiation testing experiments, which consist in exposing these components to high levels of particle radiation to simulate the real operational conditions. The CERN Proton Irradiation Facility (IRRAD) is a well-established reference facility for conducting such experiments. Over the years, the IRRAD facility has developed a dedicated software infrastructure to support the

control and monitoring systems used to manage these experiments, as well as to handle other important aspects such as dosimetry, spectrometry, and material traceability. In this paper, new developments and upgrades to the IRRAD software infrastructure are presented. These advances are crucial to ensure that the facility remains up-to-date and able to cope with the increasing (and always more complex) user needs. These software upgrades (some of them carried out within the EU-funded project AIDAinnova and EURO-LABS) will help to improve the efficiency and accuracy of the experiments performed at IRRAD and enhance the capabilities of this facility.

### PROTON IRRADIATION FACILITY IRRAD

alignment

of  $4\times4$  mm<sup>2</sup>

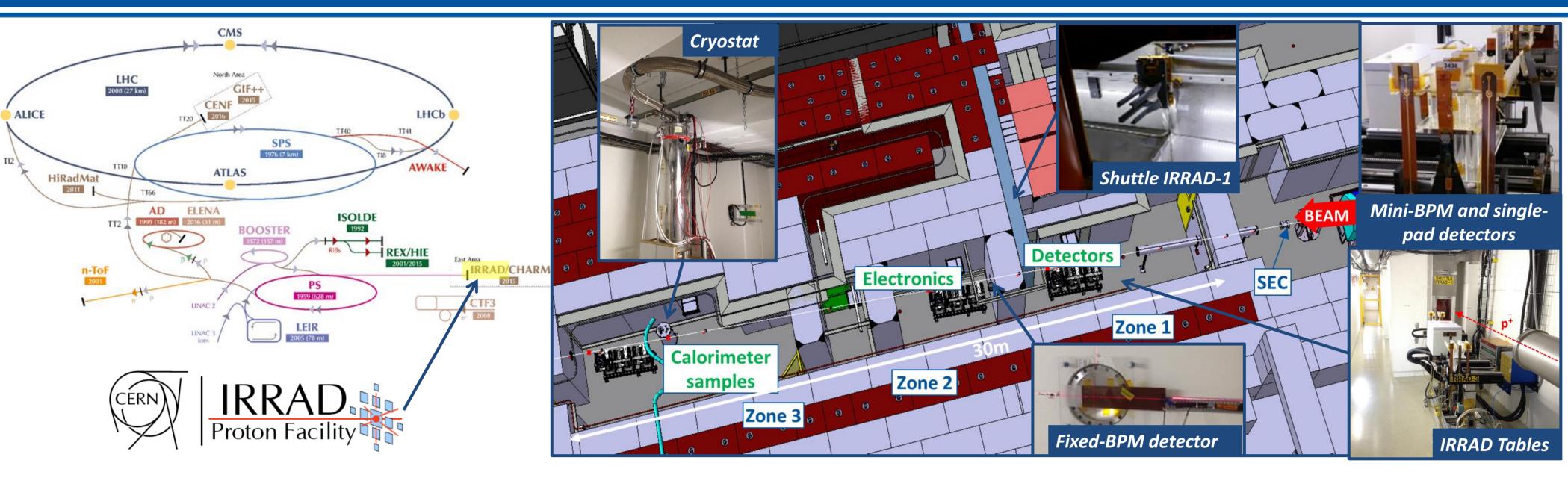
IRRAD facility area

BPM1 device

4mini & 4single-

purpose

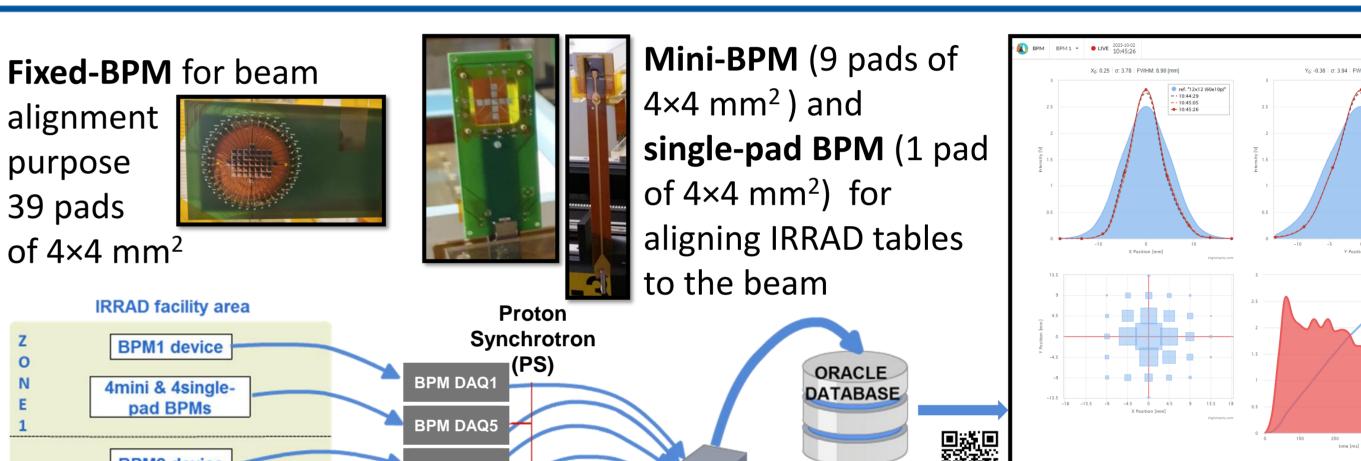
39 pads



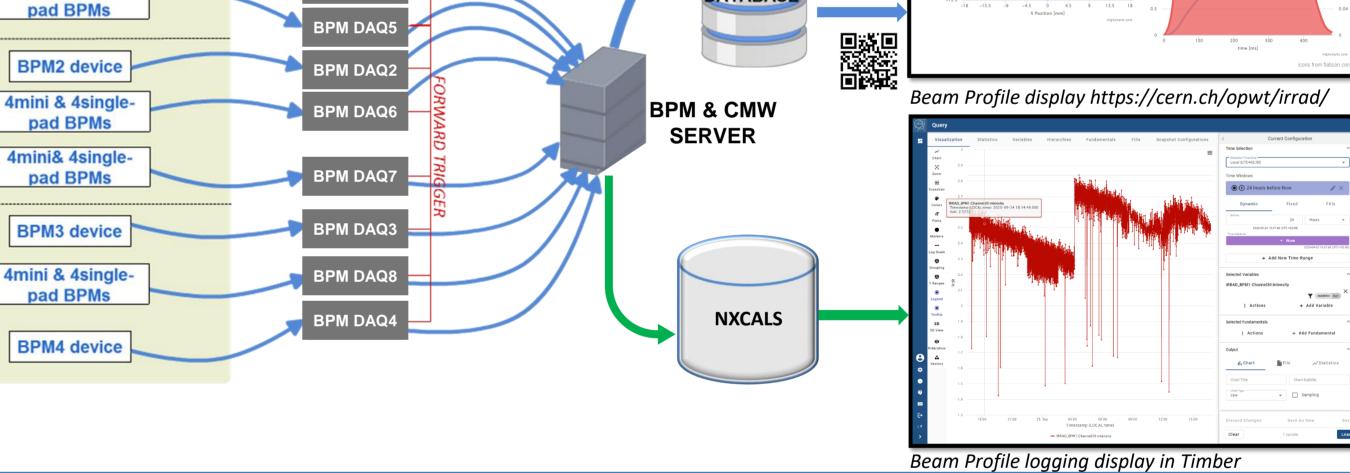
- Qualification of radiation hardness of materials, detectors, and electronic systems for High-Energy Physics experiments
- Proton beam of 24 GeV/c
- Beam of Gaussian shape with typical size of 12×12 mm<sup>2</sup> **FWHM** cern.ch/ps-irrad
- 5×10<sup>11</sup> p/spill, **8×10<sup>11</sup> p/spill from 2024!**
- Spills of 400 ms every ~10 s
- Fluence of  $^{\sim}1.4 \times 10^{16} \text{ p/cm}^2$  in a week
- Scanning also in dimensions of 10×10 cm<sup>2</sup>
- Low-temperature irradiation (-25°C)
- Irradiation down to 4.2 K using Cryostat with LHe
- 8 IRRAD Tables, 1 Shuttle, 2 cold-boxes

# DATA MANAGEMENT IRRAD Data Manager - IDM: A unified data management tool for Irradiation Experiments follow-up: http://cern.ch/idm Beam interaction quantities Dosimeter/sample assignment Logistics/Infrastructure IDM screenshots with the main functionalities RFIDs being tested for sample tagging Label Fluence results calculated and displayed in IDM O CAENSYS Testing CAEN RadHAND

**VIRTUALIZATION** 

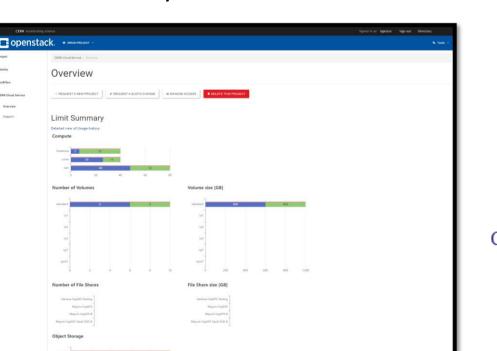


BEAM DATA MONITORING AND LOGGING



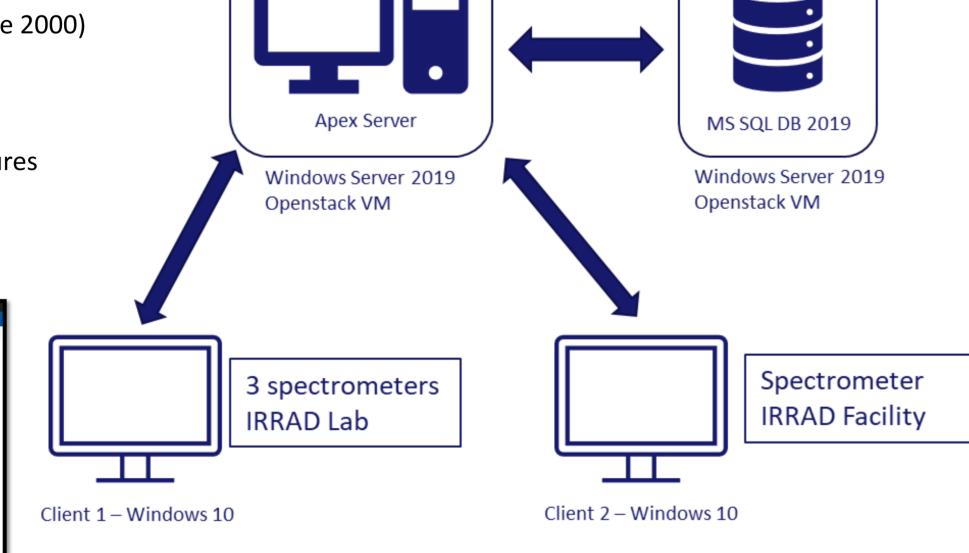
#### Using CERN OpenStack for servers' deployment: BPM & CMW Server (Production and Test) Dose monitoring Apex Gamma Server (Canberra Genie 2000) Apex Gamma MS SQL Server

Advantages Minimizing hardware computer failures Minimising additional costs Improving resilience Redundancy



for ENEA-FNG

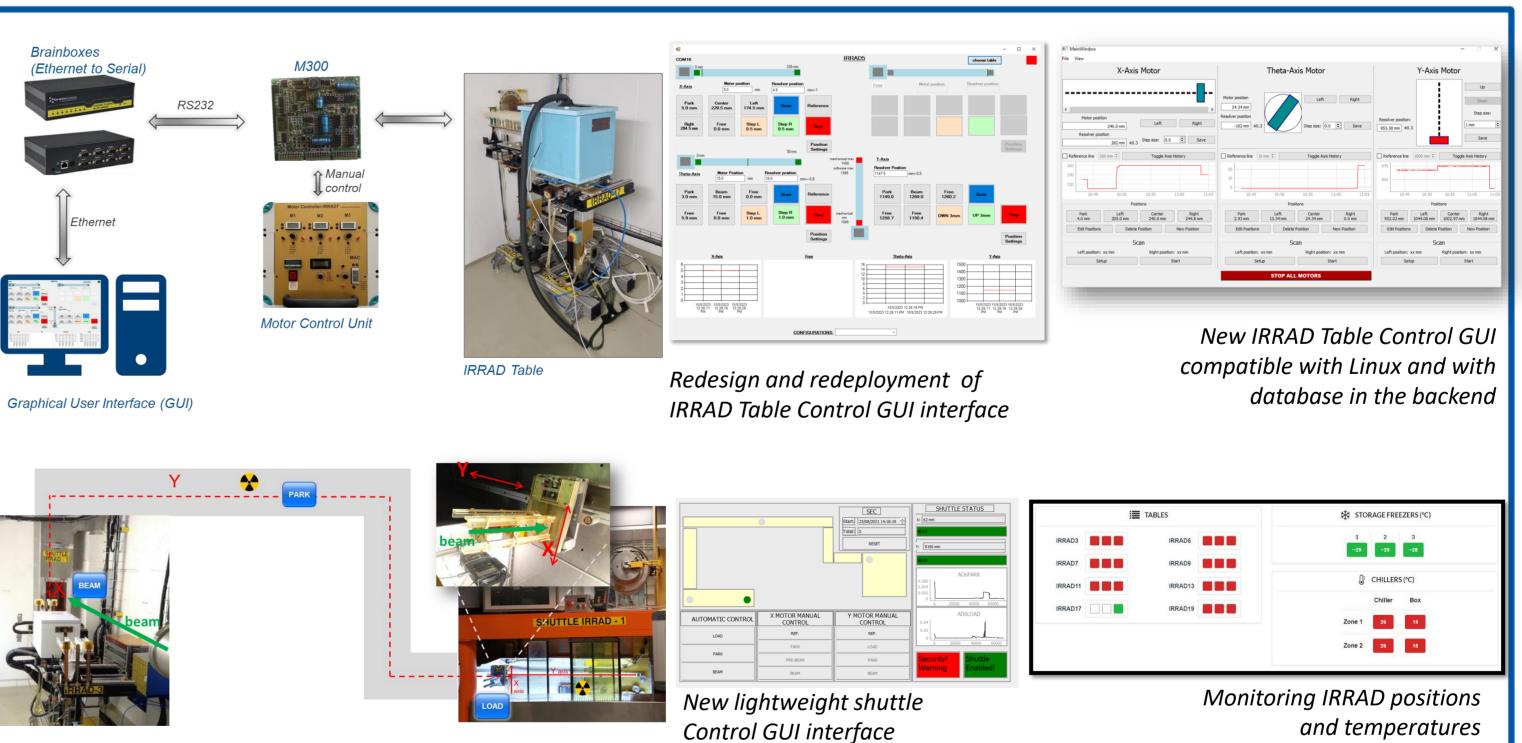
IDM test deployment for GIF++



device and API to be

integrated with IDM

# **CONTROL AND MONITORING SYSTEMS**



compatible with Linux

### **SUMMARY AND FUTURE WORK**

## Summary

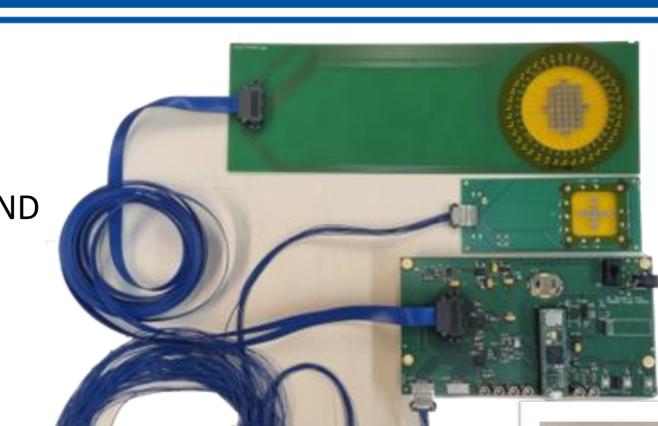
• IRRAD is a refence facility in HEP, handling several experiments and samples

IRRAD Openstack project

- IRRAD Data Manager (IDM) was built and deployed to facilitate the data handling of the irradiation experiments, currently being deployed also in other facilities
- New functionalities were developed in IDM to cover users' requirements and be compliant with the CERN IT infrastructure and security
- New BPM Controls Middleware (CMW) server was put in production to publish data in NXCALS, making data available in Timber
- New BPM sensors were installed in IRRAD
- Virtual Machines were deployed for running IRRAD servers
- New developments for the IRRAD control system GUIs and upgrades of the old ones
- Monitoring of Temperatures, dose rates and humidity

## Future Work

- Aiming to complete the IDM generalization for other facilities
- Testing RFID tags and CAEN RadHAND for possible use in IRRAD
- A new IRRAD-BPM DAQ (scalable system) is developed and will be installed in IRRAD for the run 2024
- A new classifier of beam quality is foreseen



New IRRAD BPM DAQ

Motherboard 160 channels

Union's Horizon Europe Research and Innovation

programme under Grant Agreement No 101057511





O CAENSYS

openstack.





