

# LIPAc Control System from Reliability Point of View: Design Concept and Integration

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The development of IFMIF (International Fusion Material Irradiation Facility) to generate a 14 MeV source of neutrons with the spectrum of D-T fusion reactions is indispensable to characterize suitable materials for the first wall of the nuclear vessel in future fusion power plants. As part of IFMIF validation activities, LIPAc (Linear IFMIF Prototype Accelerator) is being constructed at Rokkasho (Japan) to demonstrate the validity of deuteron acceleration up to 9 MeV step by step with a beam current of 125 mA in CW (Continuous Wave). Since July 2017, high power conditioning and the beam commissioning with the world longest and the highest-power RFQ (Radio Frequency Quadrupole) Linac, which accelerates the deuteron beam up to 5 MeV, have been carried out.

The LIPAc Local Control Systems are supplied by CEA, CIEMAT, INFN and F4E as the European Implementing Agency coordinating the European procurement, together with QST as Japanese Implementing Agency for the central control systems (including MPS & PPS). Since the LIPAc is a prototype for the IFMIF, the control systems have been designed for providing as much freedom as possible in operation for an efficient development of this challenging accelerator. At the same time, it should prevent detrimental damage on the accelerator even for most flexible operations. The central control system has been so designed to balance this contradiction by providing minimum but most reliable functions to secure the accelerator operation.

In the presentation, the design concept and concrete measures in the control system that allow such a flexible but secured accelerator operation will be discussed. In addition, realities that we faced and overcame in integrating the local control systems into the central control system will be presented hoping that those could be used as lessons learned in carrying out the commissioning in these innovating international and intercultural projects. Maintenance issues toward long pulse RFQ commissioning will be also discussed.

## Summary

The development of IFMIF (International Fusion Material Irradiation Facility) to generate a 14 MeV source of neutrons to characterize suitable materials for the first wall of the nuclear vessel in future fusion power plants. As part of IFMIF validation activities, LIPAc (Linear IFMIF Prototype Accelerator) is being constructed at Rokkasho (Japan) to demonstrate the validity of deuteron acceleration up to 9 MeV step by step with a beam current of 125 mA in CW (Continuous Wave). Since this project is based on international collaboration and the control systems of subsystems have been designed and implemented by institutions of various countries, we have a variety of problems before the integration. In this presentation, the design concept and realities will be discussed. Future plan for maintenance will be also discussed.

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