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Software development to support LIPAc beam operation and RFQ conditioning

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The Linear IFMIF prototype accelerator, LIPAc, aims at producing a powerful (9MeV, 1.1MW) deuteron beam at 125mA in CW, to validate the concept of the future IFMIF accelerator (40MeV, 125mA CW). The beam is accelerated through two main accelerating stages (RF Quadrupole (RFQ) and SRF Linac), plus two bunching cavities as part of the Medium Energy Beam Transport (MEBT). In order the beam to be accelerated continuous wave RF power at 175 MHz for the 18 RF power sources feeding the eight RFQ couplers (200kW), the two buncher cavities (16kW) and the eight superconducting half wave resonators of the SRF Linac (105kW) are needed in the final stage.

Presently LIPAc consists of the Injector, RFQ, MEBT, Diagnostics-plate and Low Power Beam Dump components as the second phase of the project. This phase aims to demonstrate the acceleration of a deuteron beam through RFQ up to 5 MeV in pulsed mode at a low duty cycle of 0.1%. For the successful commissioning including the beam operation, RFQ conditioning and other activities, the greatest care was necessary for integrating the local control systems (LCS) from Europe coordinated by Fusion for Energy to the central control system (CCS) that is designed and managed by QST.

For example, to optimise the RFQ conditioning process the control of the RF power system for the RFQ consisting of four LLRF units with two RF chains each was enhanced with a python based automatic rearming tool to resume the RF power automatically in case of safety interlocks. The rearming tool is communicating with EPICS channel access using pyEPICS module in Python language, running on the CCS and is interfacing the RF power system LCS through EPICS. Additionally, the effective ways to share the large amount of data collected during the commissioning with the participating laboratories in Europe are currently under preparation.

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