MEBT and D-Plate Control System Status of the Linear IFMIF Prototype Accelerator (LIPAc)

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Introduction

On the way to nuclear fusion there are several milestones, the IFMIF project, a linear accelerator-based neutron source, is a crucial one. The objective of IFMIF is to gain the knowledge in radiation effects materials for the design of a demonstration fusion power plant. For the validation of the IFMIF accelerator facility, LIPAc (Linear IFMIF Prototype Accelerator) is being built, see Fig 1. LIPAc is capable of generating, accelerating and transporting an intense deuteron beam in continuous wave to an energy of 9 MeV with a current of 125 mA, developing intense a power of 1.125 MW for that given energy. Therefore, due to the spatial charge issues associated with these beam properties, the operational requirements of such magnitudes make a complex control system but fundamental to proper operation of the prototype accelerator.

LIPAc Control System

LIPAc control system consists of the remote control, monitoring and data acquisition of all devices, systems, subsystems and operations carried out in the accelerator vault. It uses EPICS as the main set of control software tools. General distributed process control can be seen in Fig. 2.

Main functional requirements of the LIPAc control system are the following:
- Able to remotely monitor and control operations of all the facility.
- Acquisition and archiving of all the data, including control and diagnostic during the operation.
- Protection of the machine components from possible damages.
- Providing the control and monitoring of each subsystem.

Medium Energy Beam Transport (MEBT)

The MEBT subsystem is responsible of the transport and matching of the RFQ beam into the SRF Linac. In order to minimize the beam losses caused by the strong space charge forces affecting the beam in this area, while keeping the sufficient freedom in beam optics optimization, a very compact scheme based in two sets of quadrupole magnets with steerers and two re-buncher cavities has been built, see Fig. 2.

A detailed control system architecture of the MEBT is shown in Fig. 4.

A solution based on a Vertilon data acquisition system has been developed. Fig 5. High voltage control for the PMT is required, the acquisition system delivers 64 data points for both FPMs of the D-plate.

Control of the power supplies in MEBT

Elytt Energy is manufacturing the five power supplies (0-180 A, 0-20 V) for the quadrupoles.

Signamph Electronics is manufacturing the eight power supplies (+/- 25 A, +/- 5 V) for the steerers.

Control software is based on a client-server architecture, Fig 6. Verilab device is accessed from an EPICS IOC (client) using TCP/IP protocol, connecting with a LabVIEW application (server), which is the one that gets direct access to the device.

Fluorescence Position Monitors in DP

A solution based on a Vertilon data acquisition system has been developed. Fig 5. High voltage control for the PMT is required, the acquisition system delivers 64 data points for both FPMs of the D-plate.

Disclaimers:
This work has been partially funded by the Spanish Ministry of Economy and Competitiveness, under project FIS2013-4890-R and the Agreement, as published in BOE 16/01/2013, page 1988.