DIAGNOSTIC CONTROLS OF IFMIF-EVEDA PROTOTYPE ACCELERATOR

Irfu
Institut de recherche sur les lois fondamentales de l'Univers

J-F.Denis *, P.Mattei *, P.Abbon, D.Bogard, J-F.Gournay, Y.Lussignol (CEA-Irfu/Saclay, France)

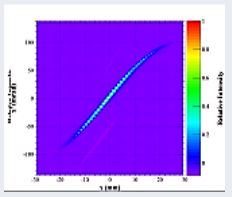
THPPC026

The Linear IFMIF prototype accelerator (LIPac) will accelerate a 9 MeV, 125 mA, CW deuteron beam in order to validate the technology that will be used for the future IFMIF accelerator (International Fusion Materials Irradiation Facility). This facility will be installed in Rokkasho (Japan) and Irfu-Saclay has developed the control system for several work packages like the injector and a set of the diagnostic subsystem. At Irfu-Saclay, beam tests were carried out on the injector with its diagnostics. Diagnostic devices have been developed to characterize the high beam power (more than 1MW) along the accelerator: an Emittance Meter Unit (EMU), Ionization Profile Monitors (IPM), Secondary Electron Emission Grids (SEM-grids), Beam Loss Monitors (BLoM and µLoss), and Current Transformers (CT). This control system relies on COTS and the Irfu EPICS software platform. A specific isolated fast acquisition subsystem running at high sampling rate (about 1 MS/s), triggered by the Machine Protection System (MPS), is dedicated to the analysis of post-mortem data produced by the BLoMs and current transformer signals.

* contact : jfdenis@cea.fr , pmattei@cea.fr

EXPERIMENTAL ROOM

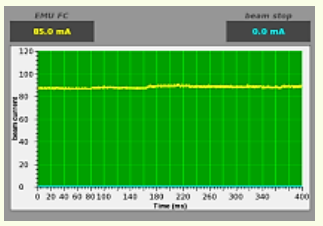
Emittance Meter Unit



An Allison scanner is implemented to measure the transverse emittance in the LEBT. A servo motor drives the head to scan the distribution of the beam.

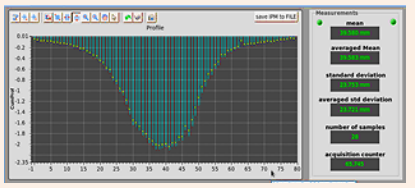
The movements of the head are achieved through an OMS MAXv motion controller. Amplifiers and a power supply are used to provide the needed high voltages. Input/Output ADAS VME boards are in charge of the other controls and acquisition for this equipment.

Current Transformers

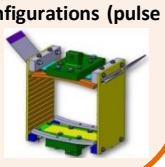


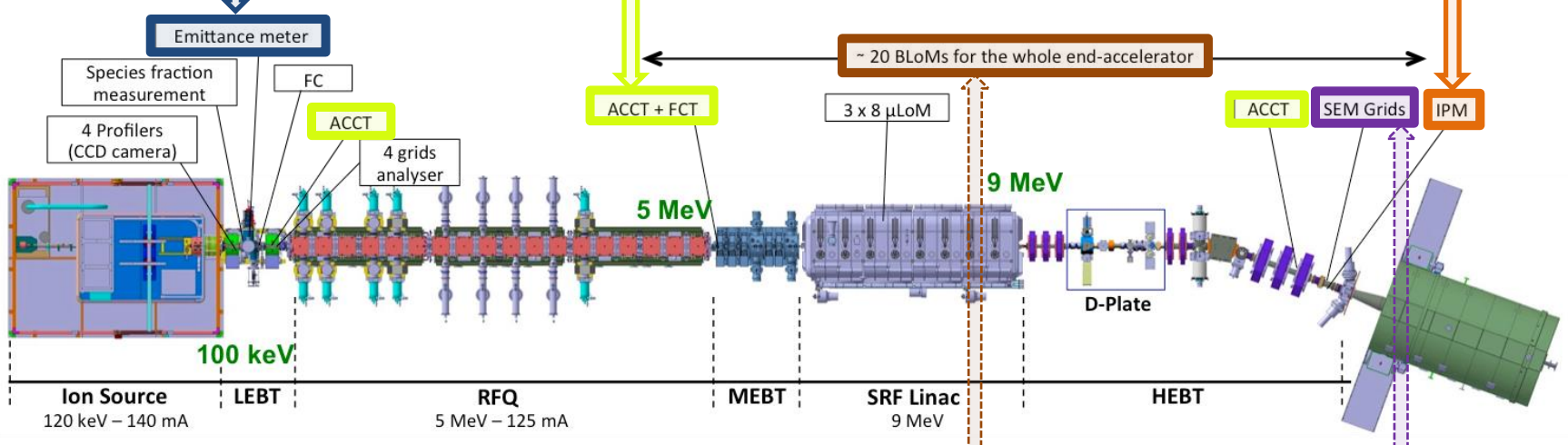
CT is a kind of monitor which allows measuring the beam current with a precision of 0.15 mA.
The acquisition is based on both VME boards, ADAS ICV108 and ADAS ICV178. The ICV108 is a controller board with an external trigger and includes a 4 MB RAM dedicated to measurements with possibility of DMA transfer. The ICV178 is an 8 channels board with 16-bit resolution for each ADC. The sampling frequency goes from 50kS/s up to 1.2MS/s and can also be modified online.

Ionization Profile Monitors



The goal of an IPM is to measure the transverse beam profile. The Front End Electronic (FEE) integrates the input current from the IPM over longer time, typically 0.1 to 1 second. and was specially designed to manage the sampling and the holding functions for all beam configurations (pulse or cw).
Several ADAS VME Boards are used to control the hardware.





Post Mortem

In order to understand what happened when beam shuts down, a dedicated fast acquisition will be designed. Signals will be sampled every µs by the same ADAS VME boards used for the sampling of CT. When a trigger from the MPS occurs, acquisition is stopped and the circular buffer gets frozen for analysis.

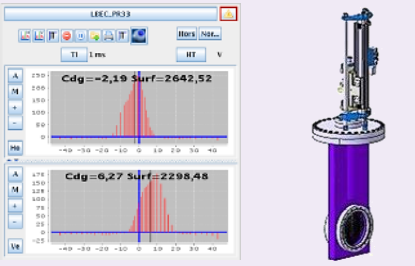
IFMIF Epics Platform

The Standard VME is composed of an Emerson Motorola MVME5500 and ADAS VME boards:
- ICV 150 (32 ADCs, 16 bits, and 30 K Samples/s)
- ICV714 (16 DACs, 12bits)
- ICV196 (96 binary I/O channels)
- ICV108 (Controller board with 4 M bytes of RAM)
- ICV178 (8 ∑Δ ADCs, 16 bits, 1.2 M Samples/s)

Beam Loss Monitors

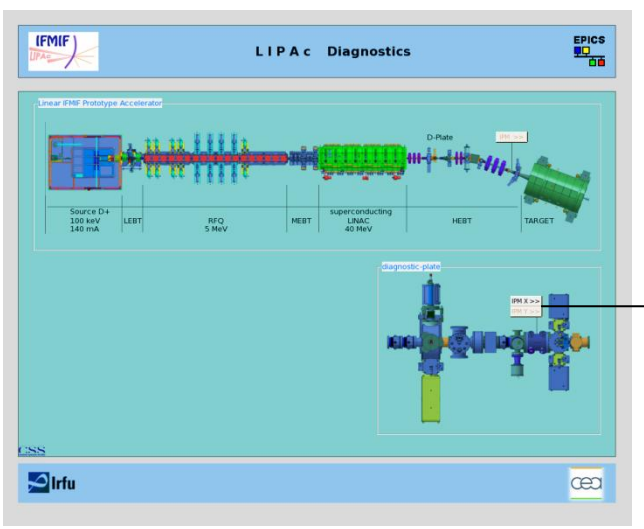
The main goal of the BLoM system is to measure the particle loss to insure the machine safety. It must provide a fast interlock signal to the Machine Protection System (MPS). This system is based on LHC-type Ion Chambers (IC).
The electronics will provide 2 signals for the MPS triggered by 2 thresholds. The integrators are similar to those developed for IPMs.

SEM-Grid

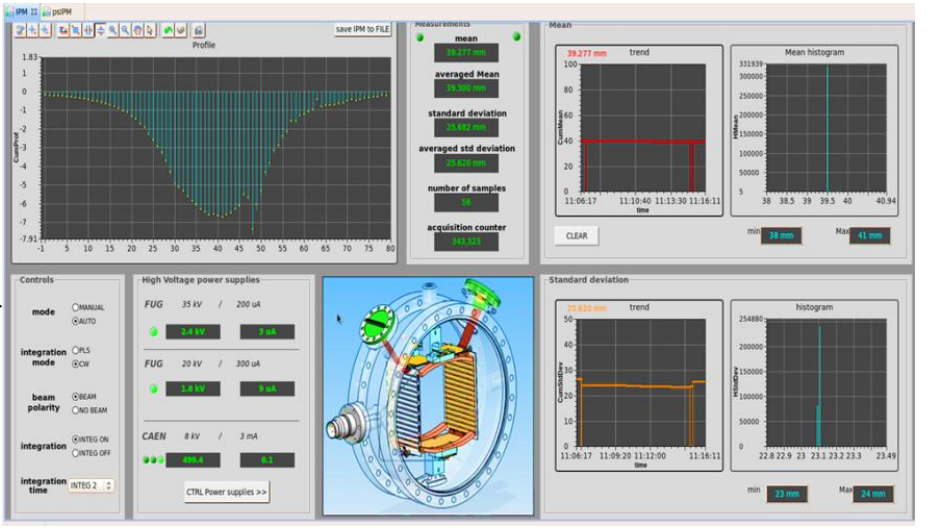


The goal of a SEM-Grid is to have a beam profile measurement at low duty cycle in case of IPM measurement is not sensitive enough. A complete integrated solution (COTS and EPICS software), provided by Ganil laboratory, will be used to manage the measurement and acquire the data.

CONTROL ROOM



Main Boy OPI Panel for diagnostics



GUI for IPM control