FROM RESEARCH TO INDUSTRY

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DIAGNOSTIC CONTROLS OF LIPAc

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EPICS MEETING

OUTLINE

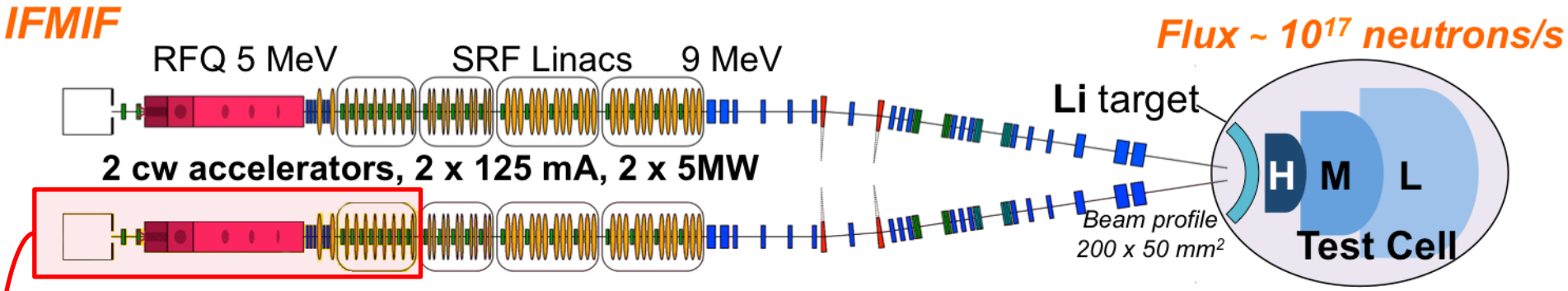
Context

Description of each diagnostic

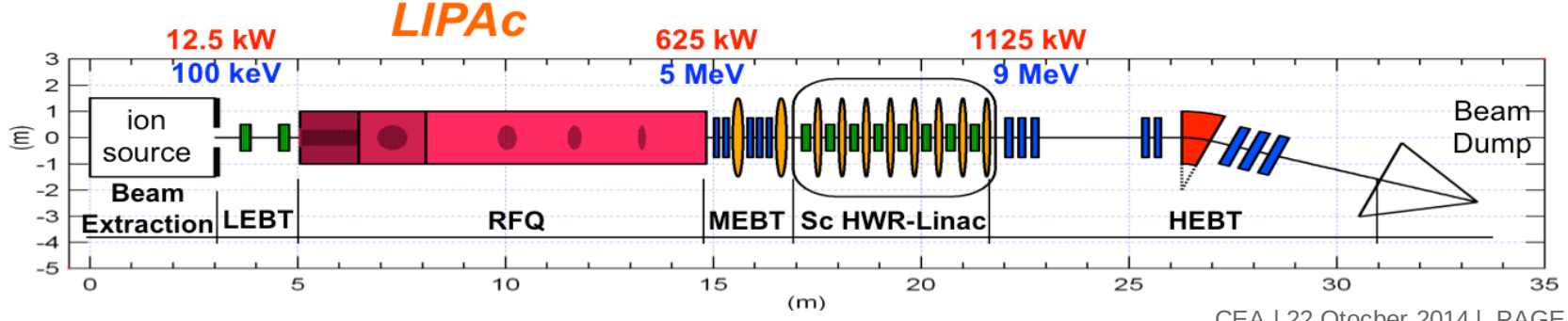
Conclusion

CONTEXT

- IFMIF (International Fusion Materials Irradiation Facility) will be built to provide an accelerator based on a neutron source to produce high-energy neutrons (deuterons) at sufficient intensity and irradiation volume to qualify materials for fusion reactors of the future

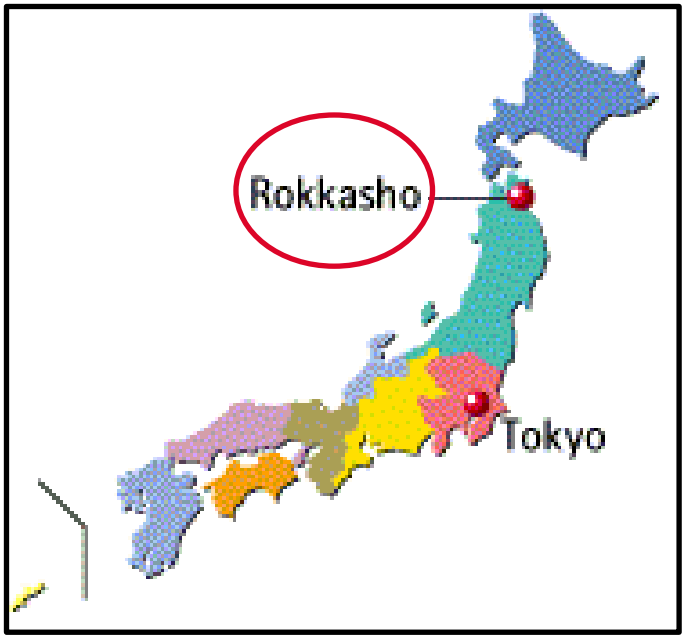


- A prototype LIPAc(Linear Ifmif Particle Accelerator) identical to the low energy section of IFMIF is being built to check the validity of the design before launching the IFMIF construction



CONTEXT

- This facility will be installed at Rokkasho JAEA (Japan Atomic Energy Agency) site



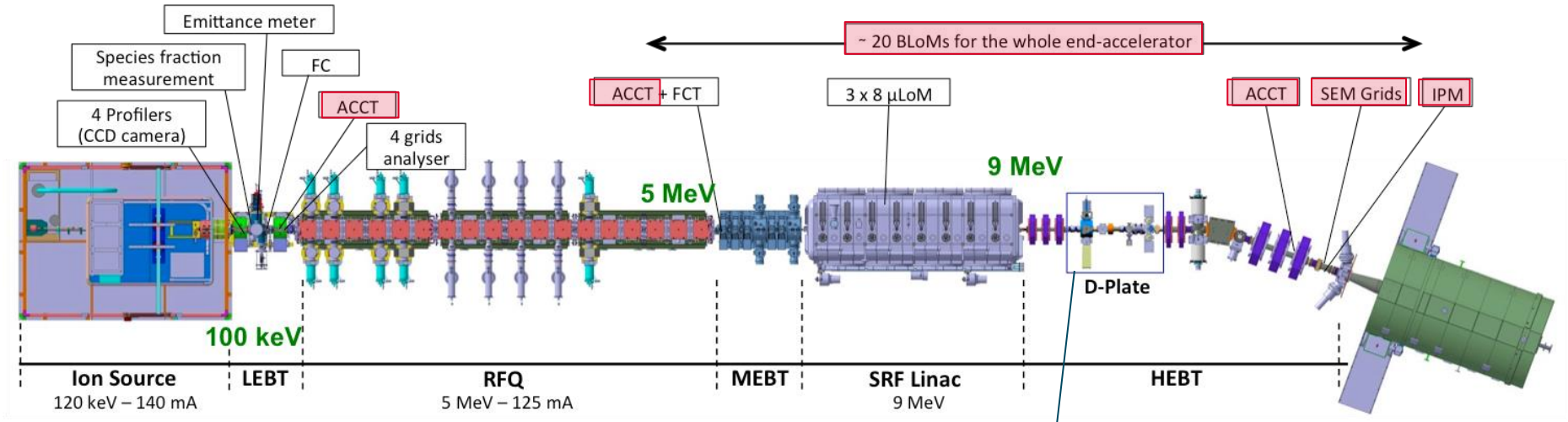
- Irfu-Saclay has developed the control system for several work packages like the injector and a set of the diagnostic subsystem

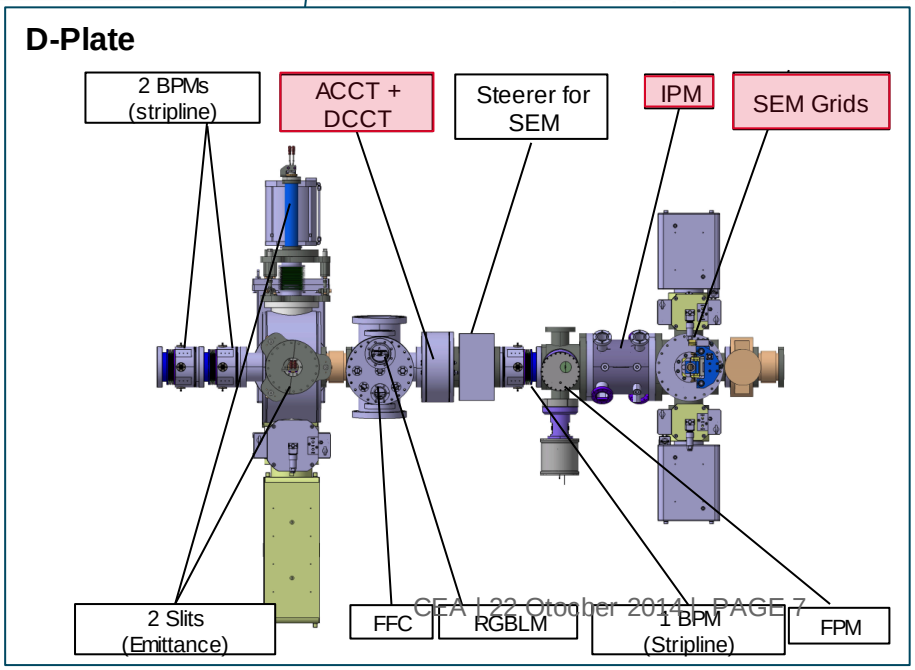
Context

Description of each diagnostic

Conclusion

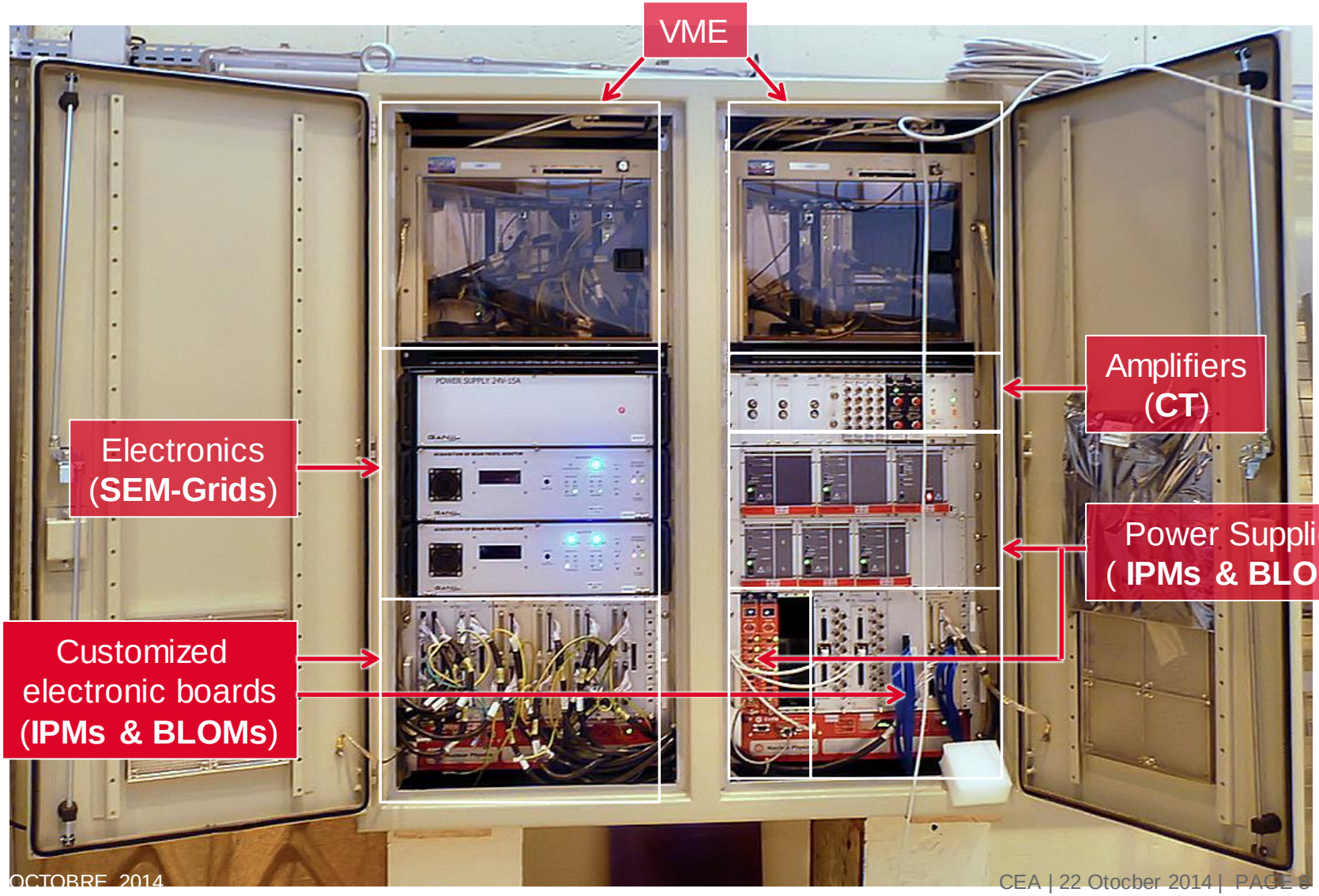
DIAGNOSTICS INVOLVED…



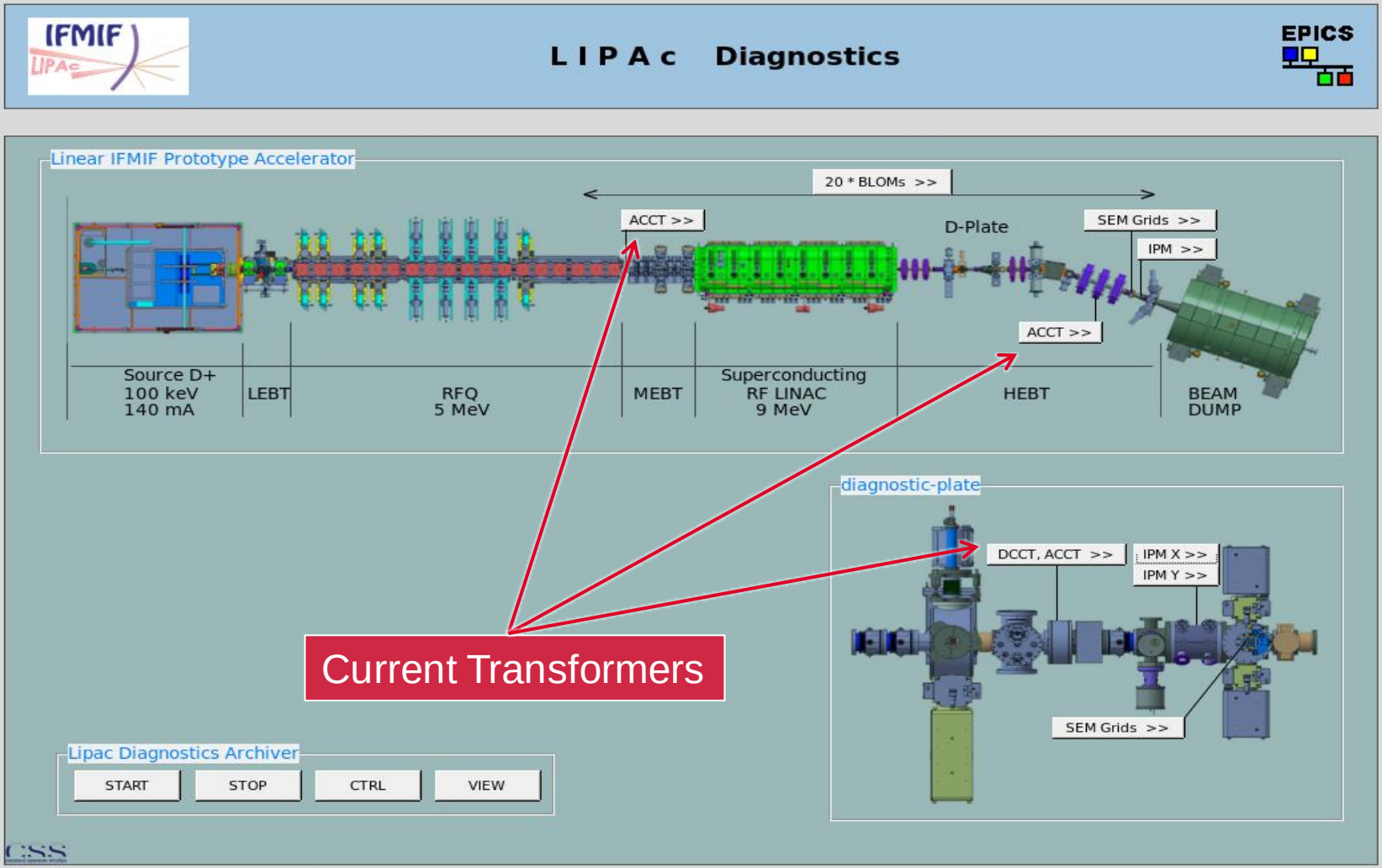


- Current transformers (CT)
- Beam loss monitor (BLoM)
- Electron Emission Grids (SEM-Grid)
- Ionization Profile Monitors (IPM)

LET'S START WITH THE CABINET…

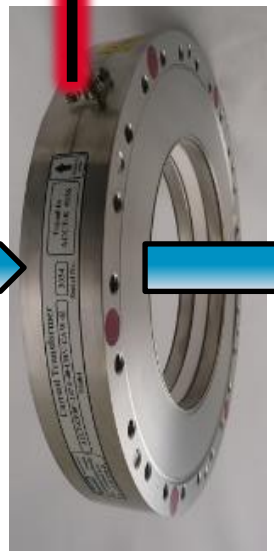


LET'S CONTINUE WITH THE MAIN LAUNCHER…



CURRENT TRANSFORMERS

- The fast acquisition is based on two 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 1.2MSamples/s

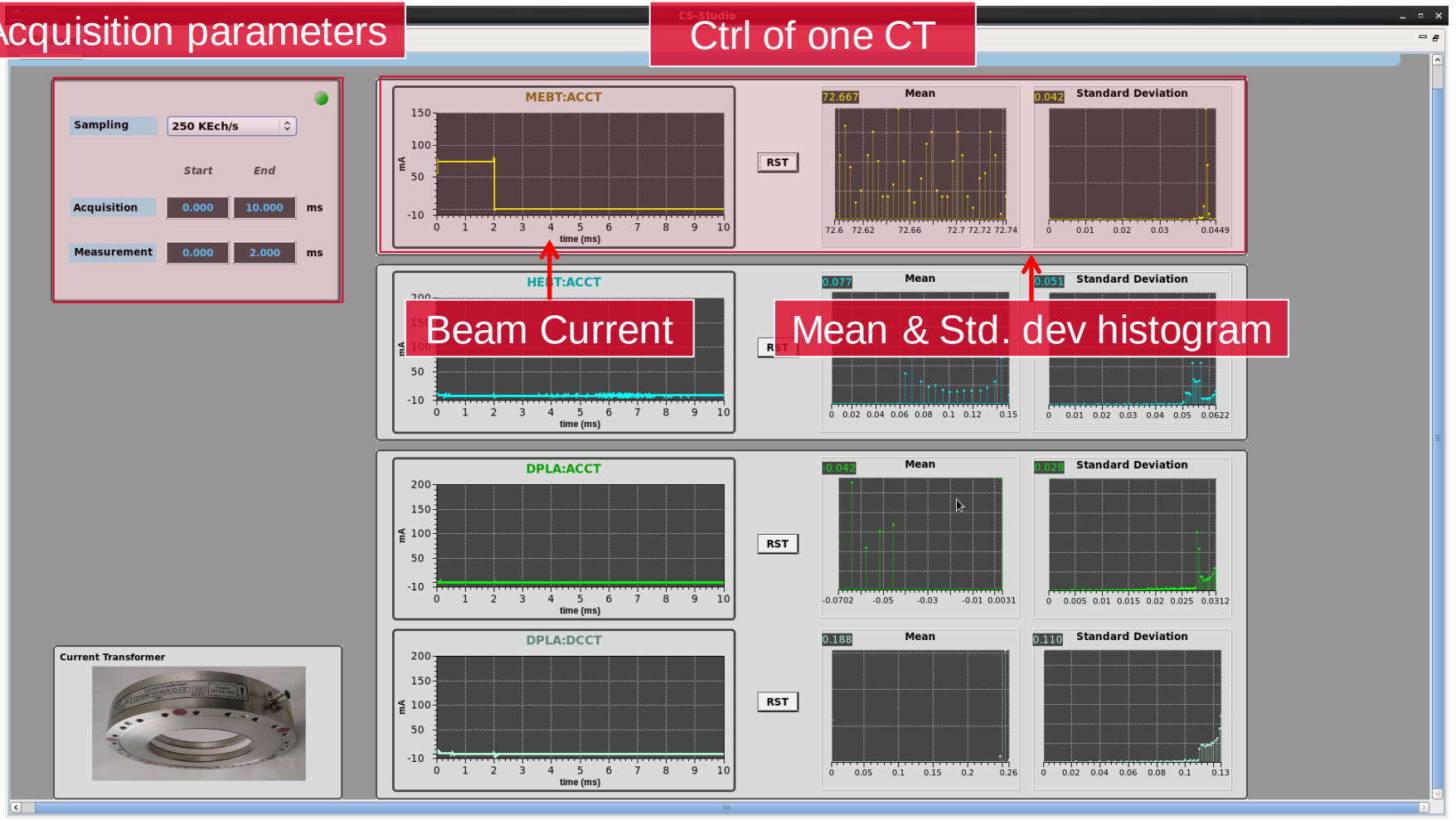


GOAL

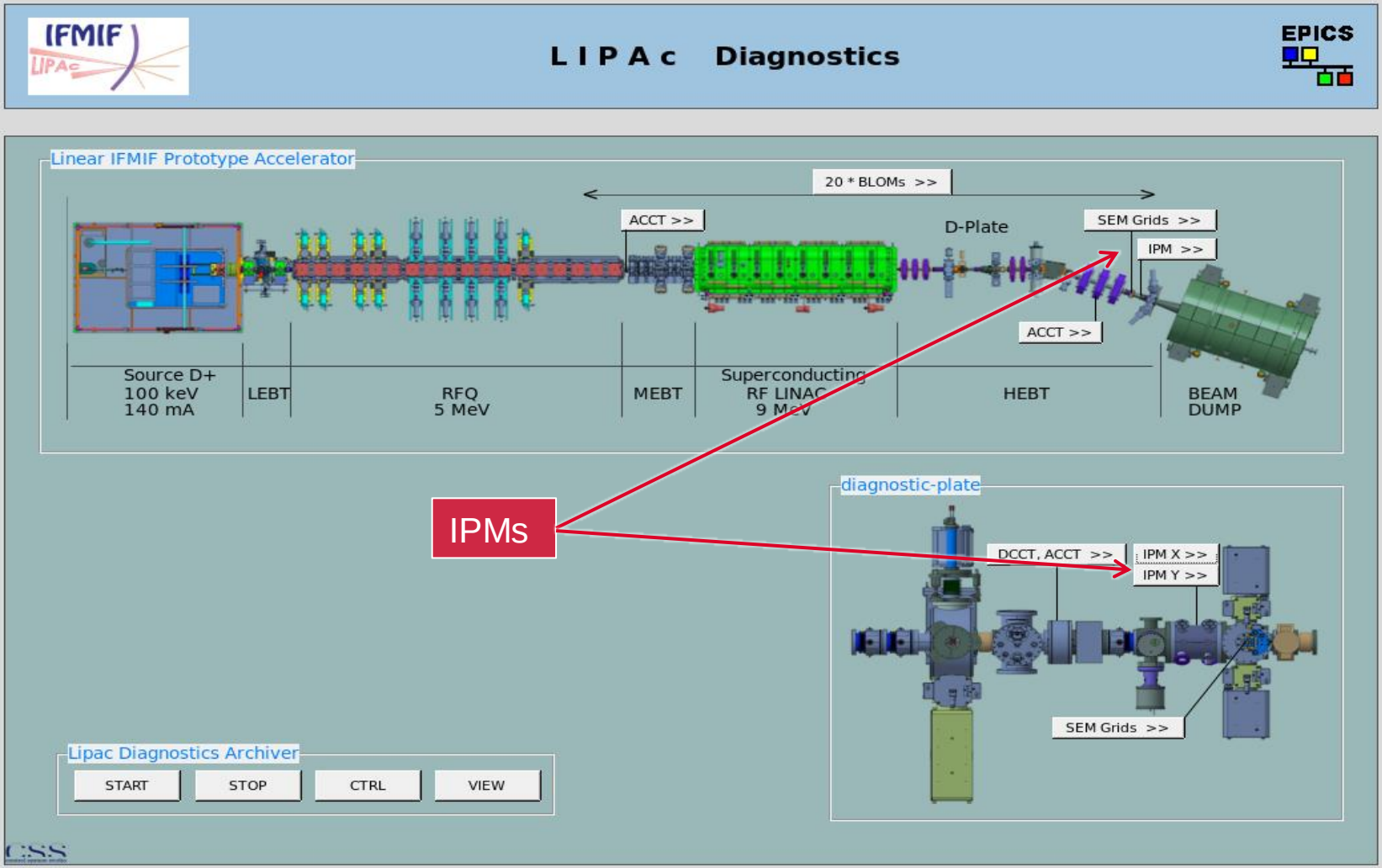
CT is a kind of monitor which allows measuring the beam current with a precision of 0.15 mA

Particule beam

CURRENT TRANSFORMERS

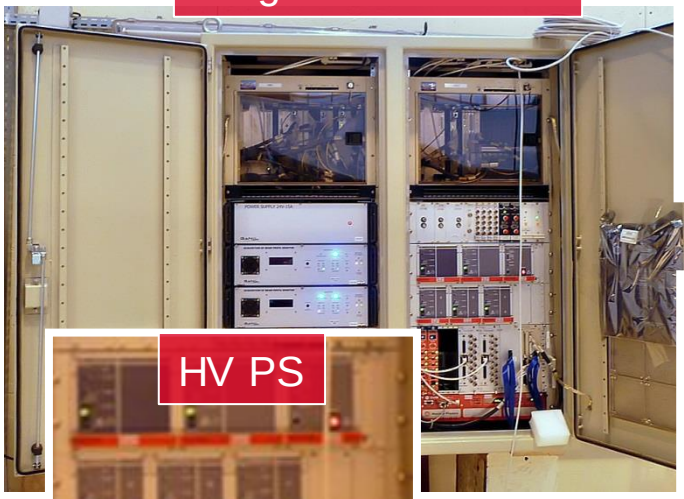


FROM THE MAIN LAUNCHER…



IONIZATION PROFILE MONITORS

Diagnostics cabinet



HV PS

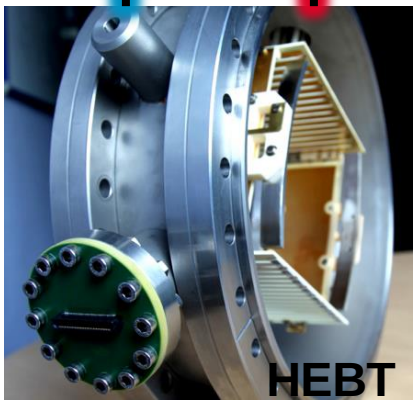
- Power supplies (FUG)

VME

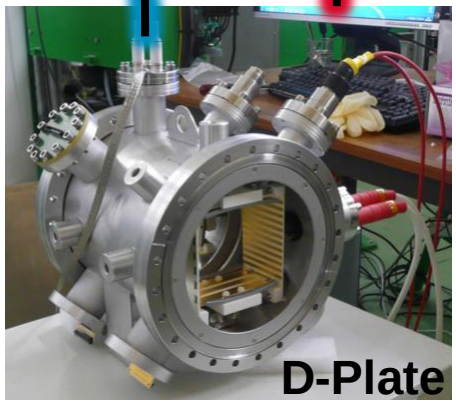
- ADAS VME Board to control Front End Electronic (FEE) and make slow acquisition

FEE

- FEE integrates the output current from the IPM over longer time, typically 0.1 to 1 second and was specially designed to manage the sample and hold functions for all beam configurations (pulse or cw)



HEBT

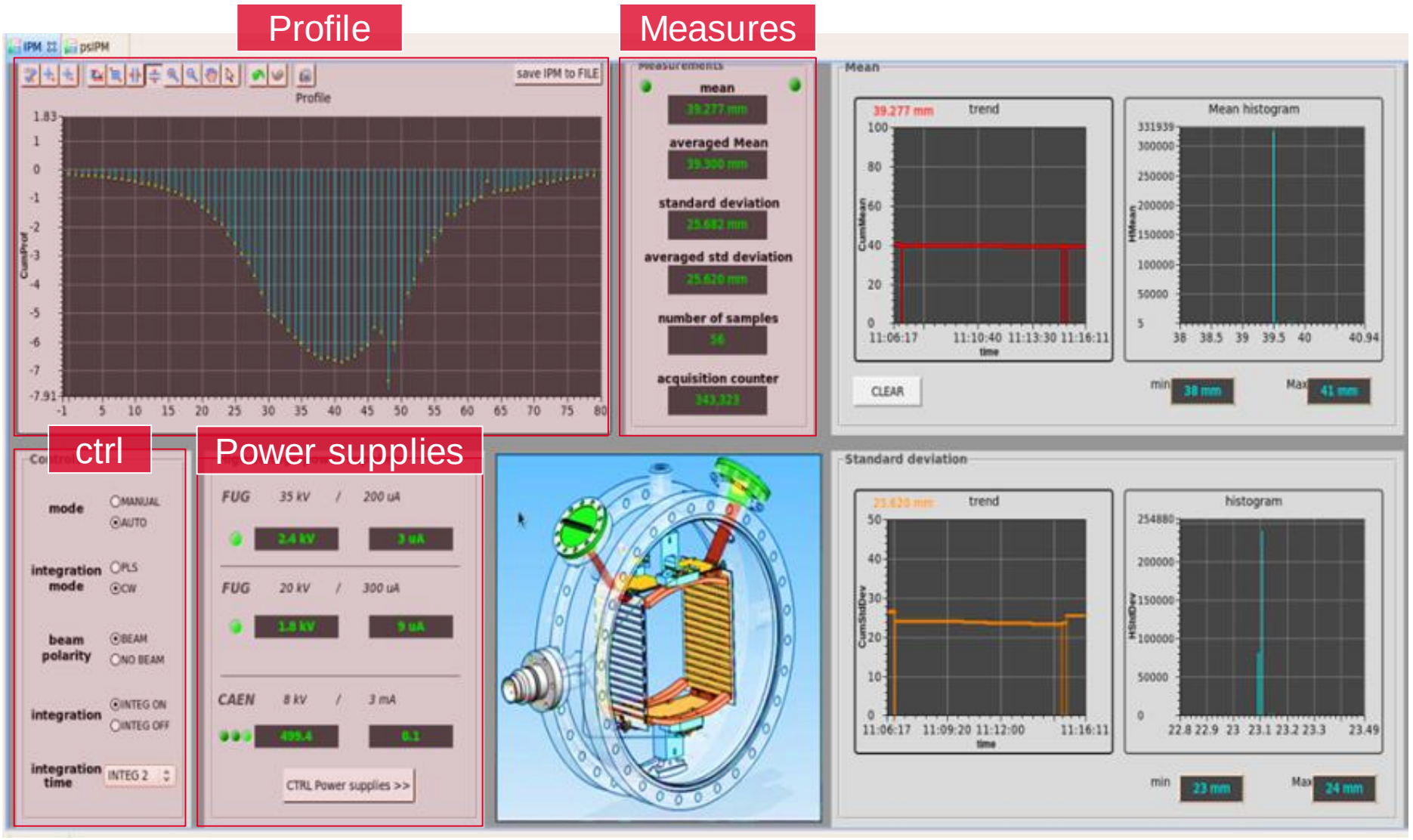


D-Plate

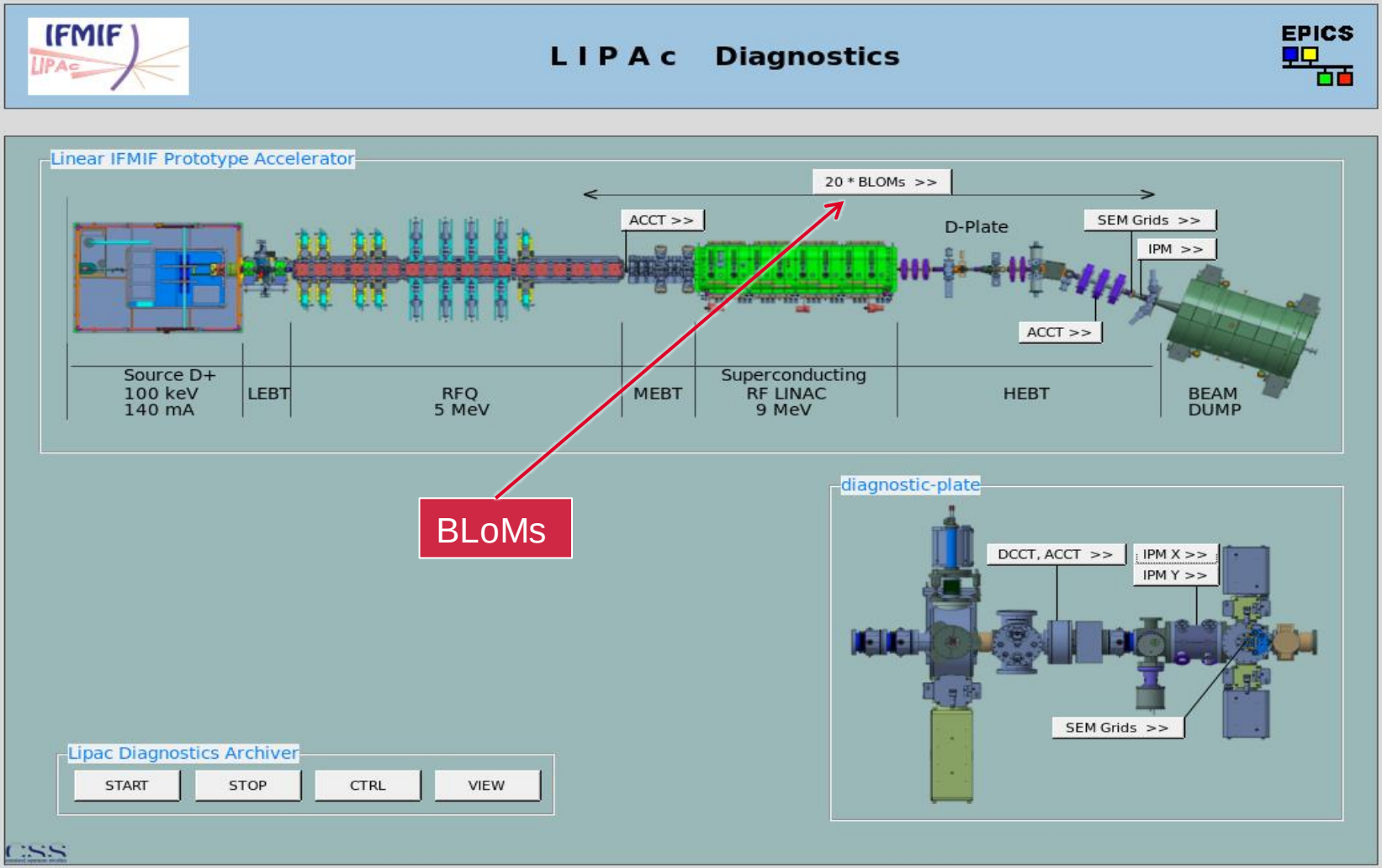
GOAL

- The goal of an IPM is to measure the transverse beam profile

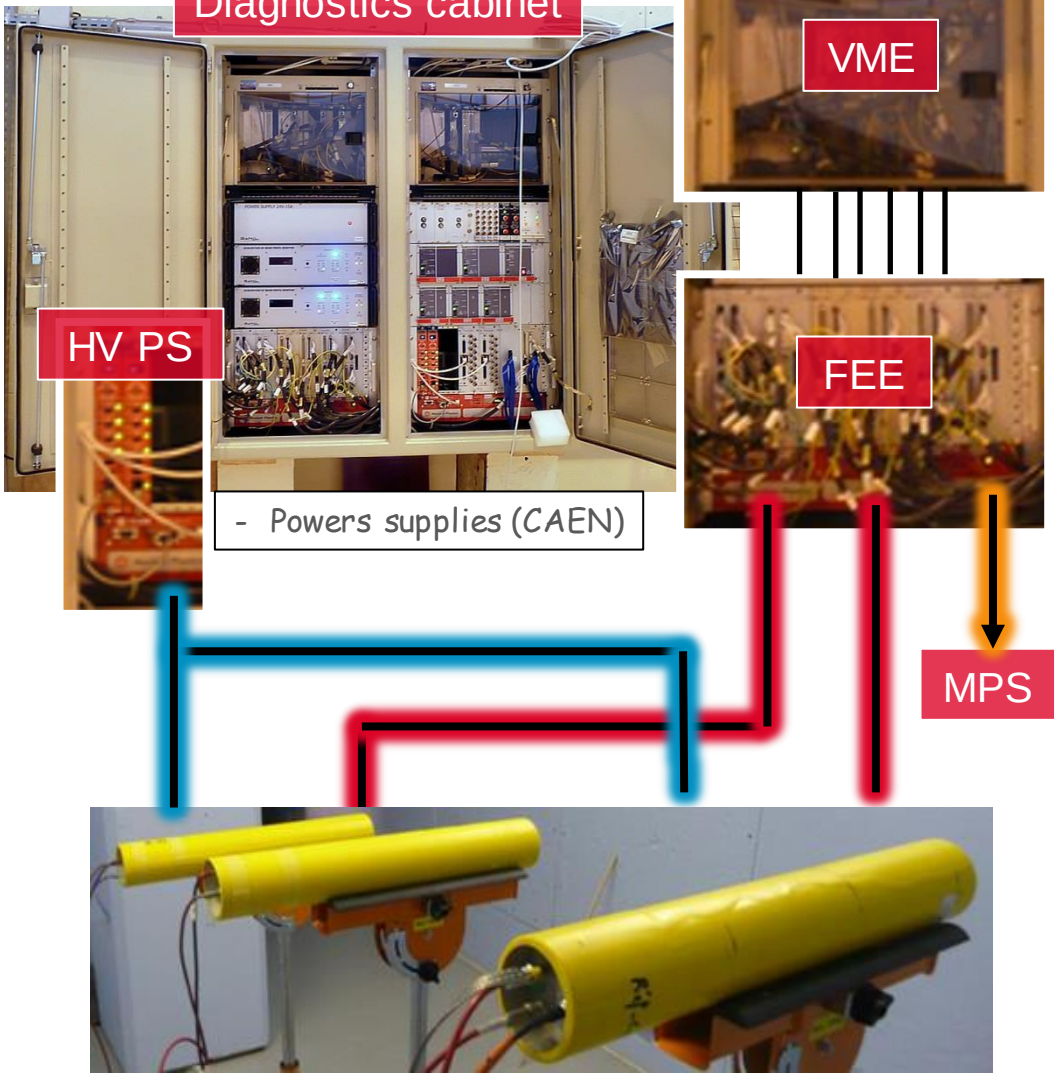
IONIZATION PROFILE MONITORS



FROM THE MAIN LAUNCHER…



BEAM LOSS MONITOR



- **ADAS VME Board to control Front End Electronic and make slow acquisition**

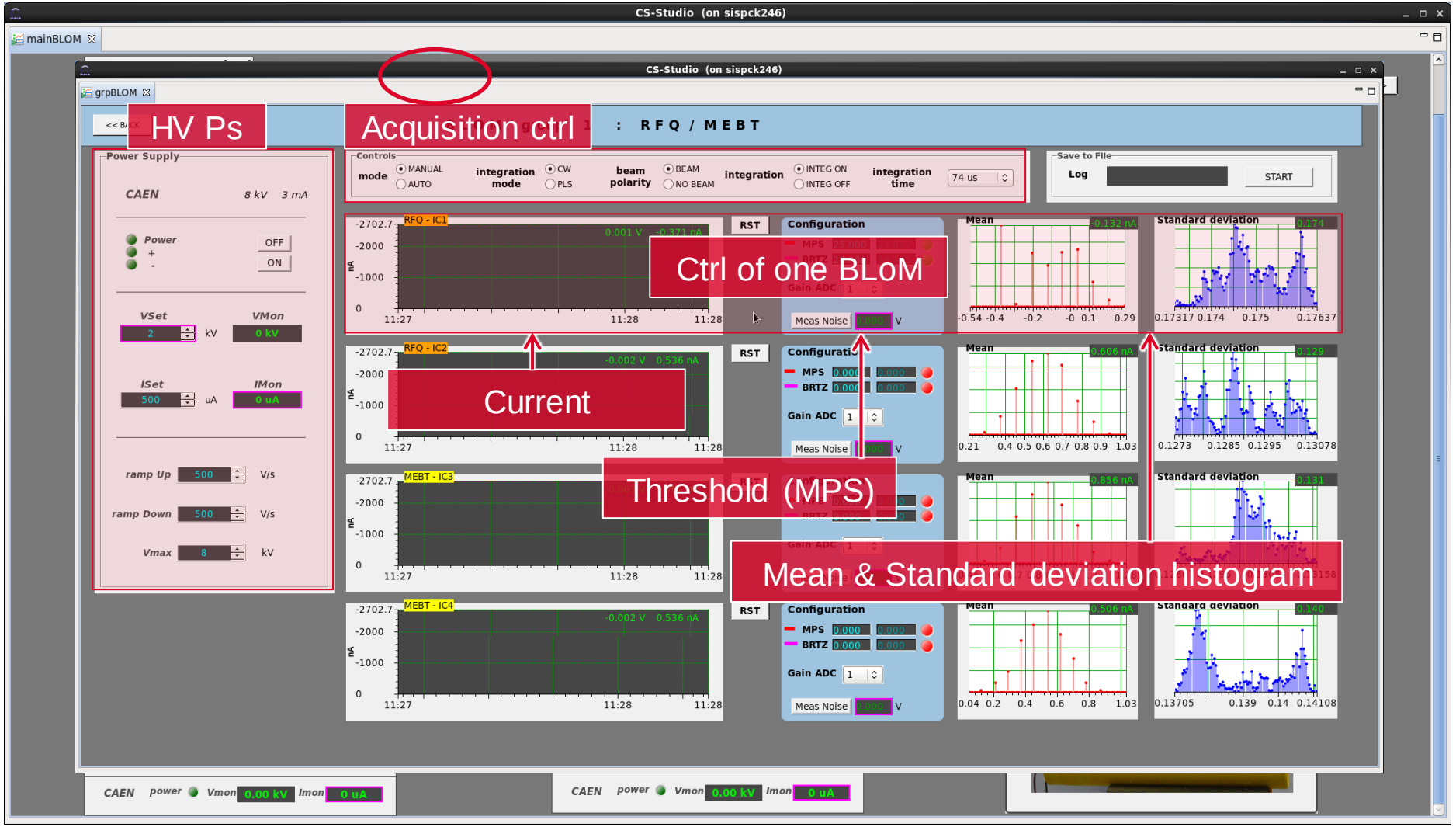
FFE integrates

- **<u>Monitoring</u> : the output current from the BLOM over longer time, typically 0.1 to 1 second and was specially designed to manage the sample and hold functions for all beam configurations (pulse or cw)**
- **<u>Safety</u>: It provides also a fast interlock signal to the Machine Protection System (MPS).**

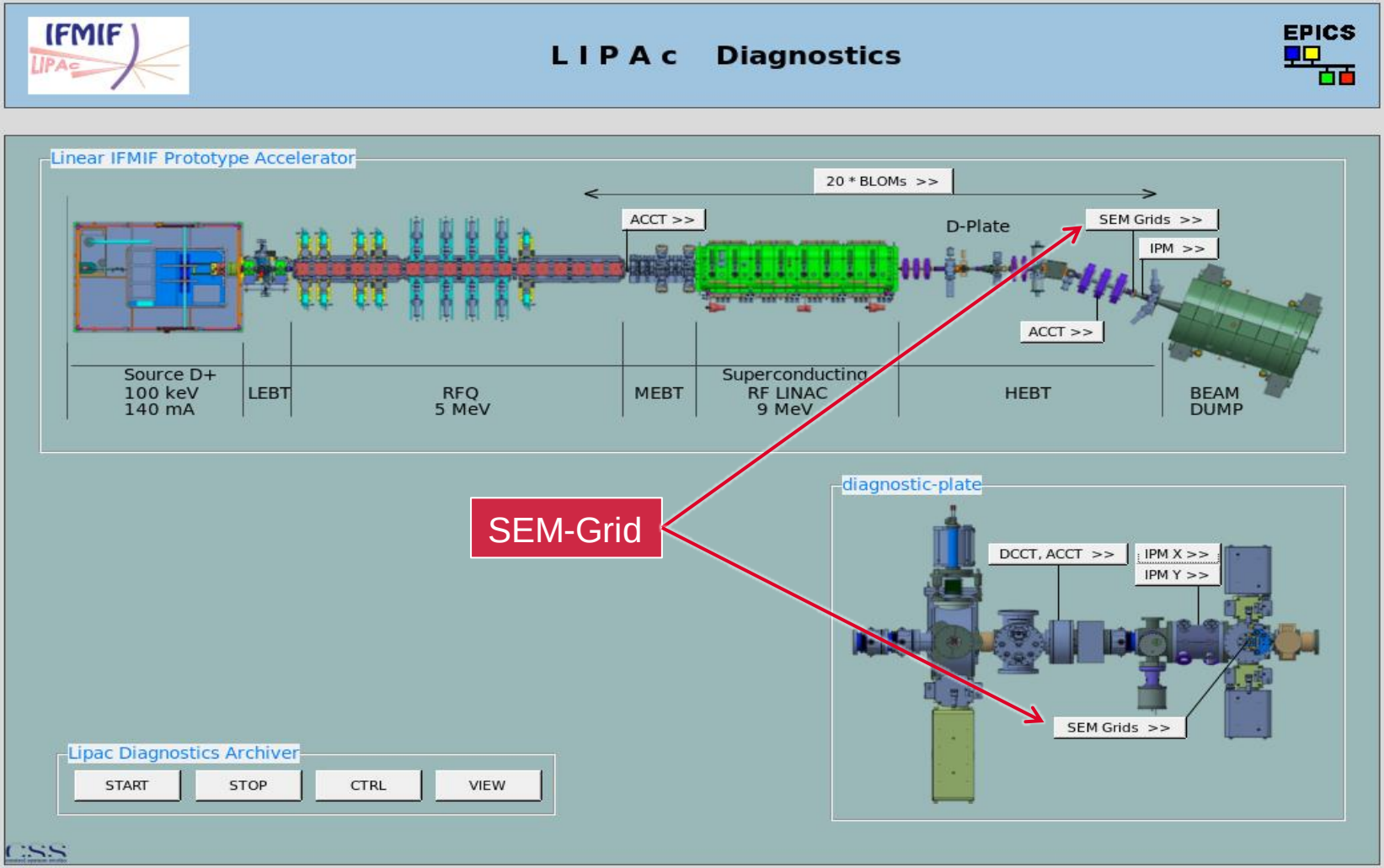
GOAL

- **The main goal of the BLoM system is to measure the particle loss to insure the machine safety**

BEAM LOSS MONITOR



FROM THE MAIN LAUNCHER…



SEM-GRID

VME

Diagnostics cabinet

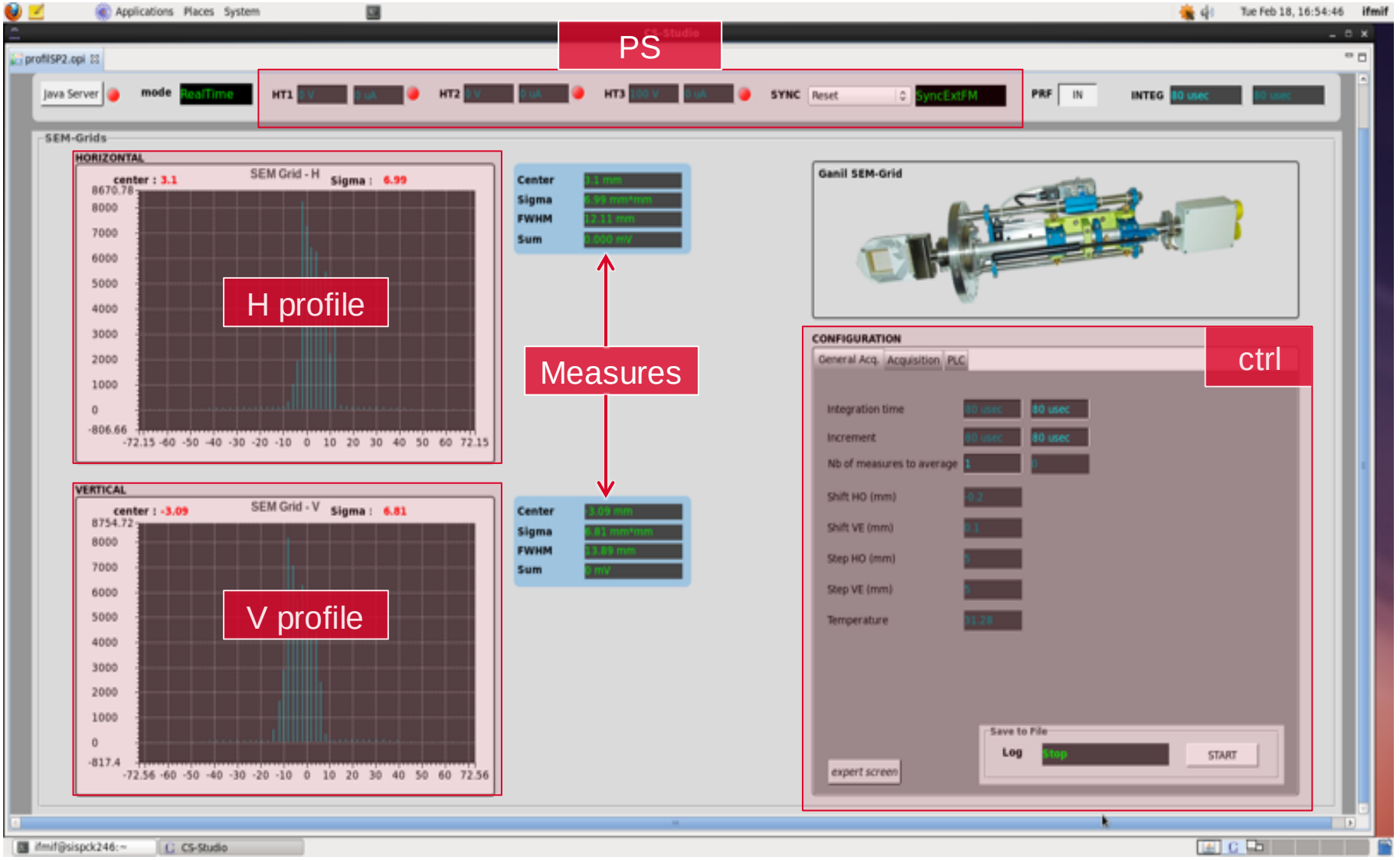
Modbus

- **A complete integrated solution with the EPICS driver, provided by Ganil laboratory, will be used to manage the measurement and acquire the data**

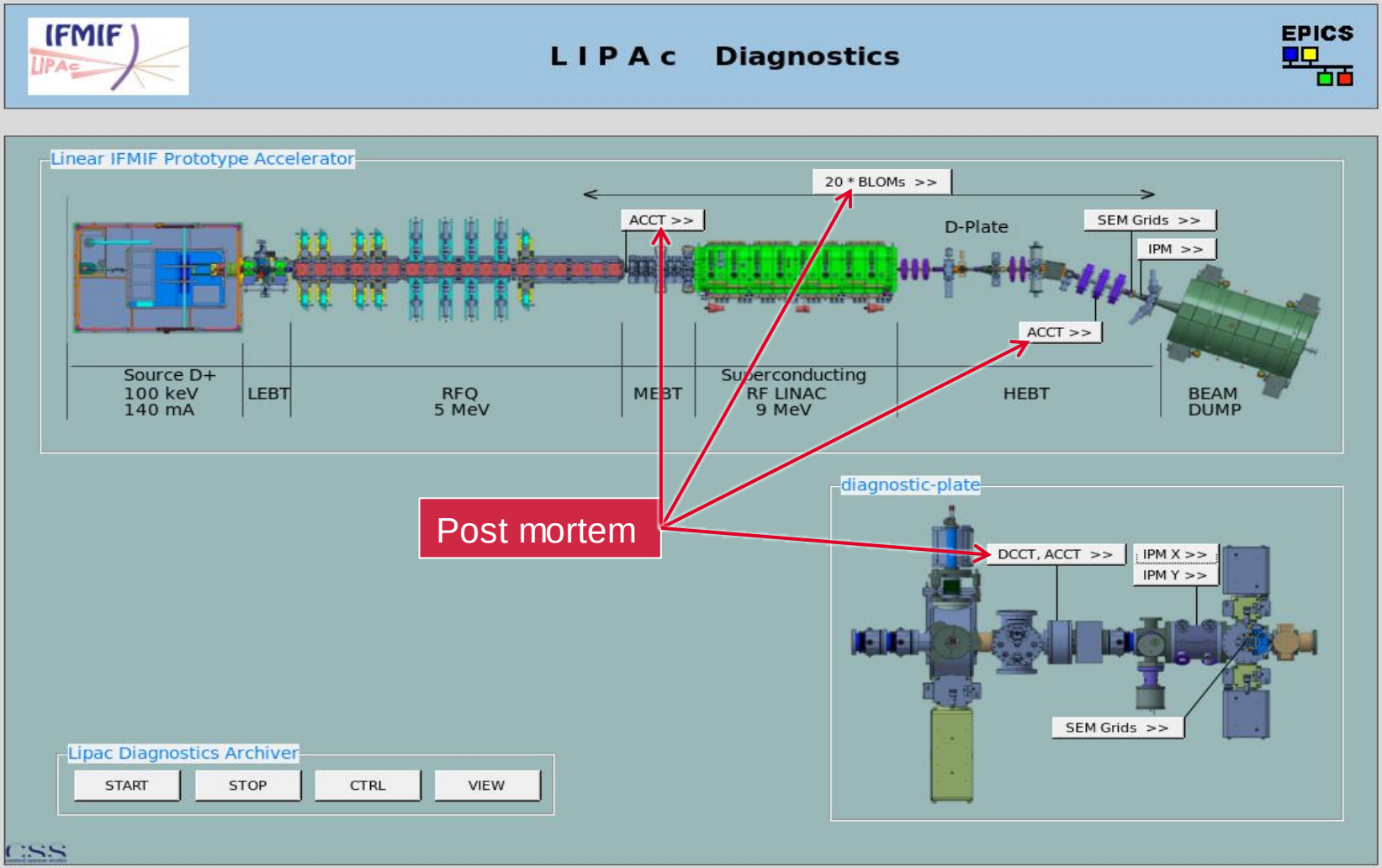
GOAL

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.

SEM-GRID


PS
H profile
Measures
V profile
ctrl
Ganil SEM-Grid
HORIZONTAL
VERTICAL
CONFIGURATION
SEM-Grids
Java Server
mode
RealTime
SYNC
SyncExtFM
Center
Sigma
FWHM
Sum
Integration time
Increment
Nb of measures to average
Shift HO (mm)
Shift VE (mm)
Step HO (mm)
Step VE (mm)
Temperature
Save to File
Log
START
expert screen

FROM THE MAIN LAUNCHER…

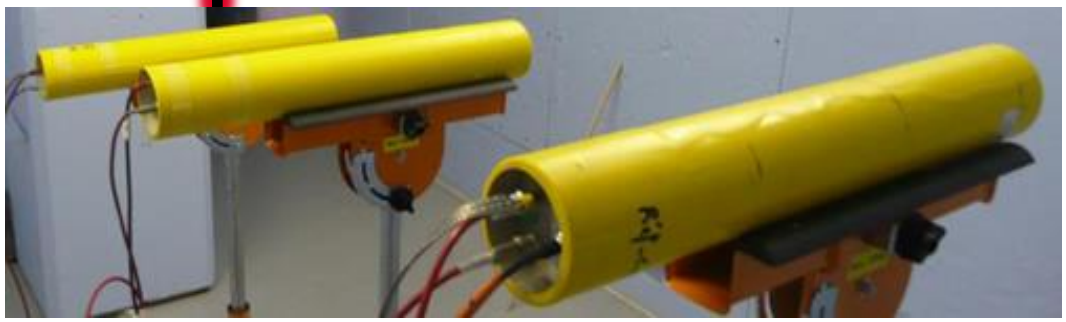


POST MORTEM…

MPS

- Signals from all BLoM & CT will be sampled at 1 M
  and recorded on the circular buffer of
- When a trigger from th… …quisition is
  stopped and … gets frozen for analysis.
  …ion is based on two VME boards, ADAS
  …08 and ADAS ICV178

In progess



BLoMs

CT

GOAL

In order to understand what has just happened when the beam shuts down

Context

Description of each diagnostic

Conclusion

CONCLUSION

- European Acceptance tests were successfully done at Saclay for every kind of diagnostics

- The cabinet left Saclay in September, and arrived last week at Rokkasho! ☺

- The commissioning will be done in 2 phases :

  - Injector + RFQ + Dplate : in 2016
  - The whole accelerator : in 2017

THANKS FOR YOUR ATTENTION !

Commissariat à l'énergie atomique et aux énergies alternatives IRFU
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