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IRFU COLLABORATION IN SPIRAL2 & LIPAC CONTROL SYSTEMS

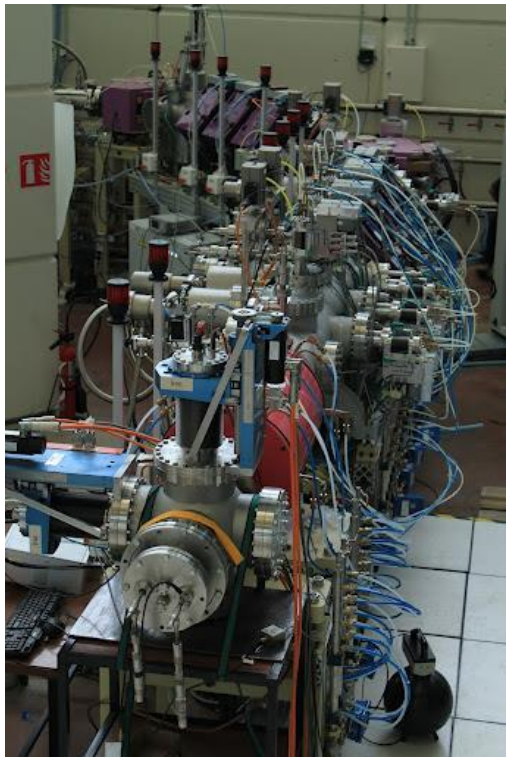
Françoise Gougnaud

On behalf of D. Bogard,

J-F. Denis, A. Gomes,

J-F. Gournay (now retired),

Y. Lussignol and P. Mattei



EPICS Meeting October 21st 2014

Irfu

OUTLINE

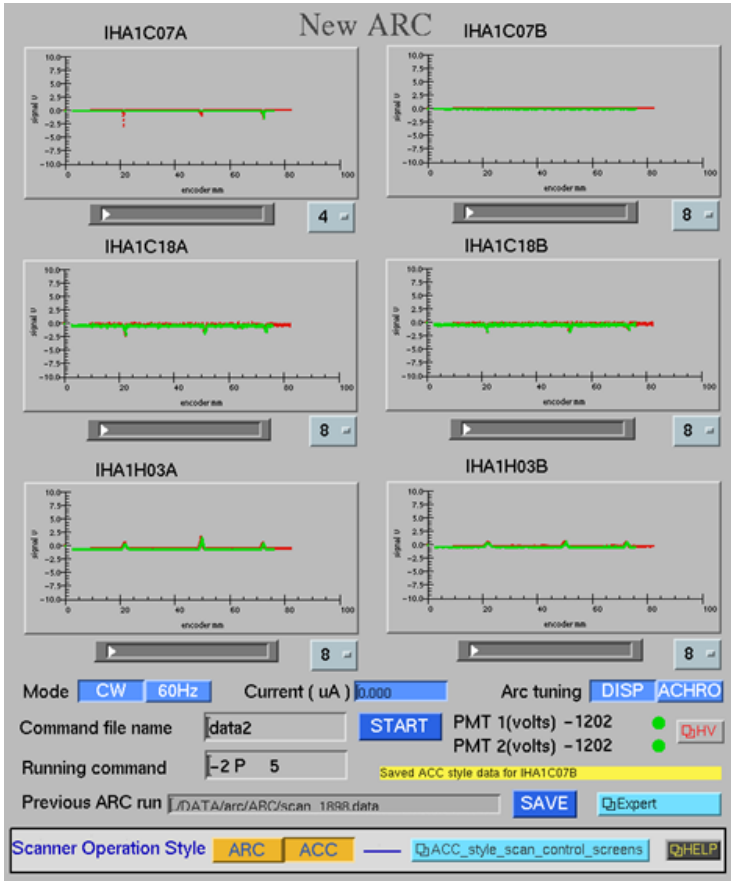
Brief legacy with some EPICS projects

Our collaboration in Spiral2

Our collaboration in LIPAc

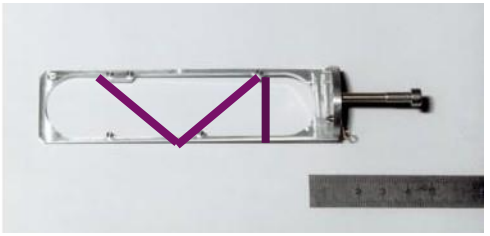
BRIEF LEGACY OF EPICS IN OUR INSTITUTE

Started with EPICS in 1993 on TTF at Desy
TTF Injector, LLRF and some diagnostics



1996-1999 ARC energy measurement at Jlab, Hall A

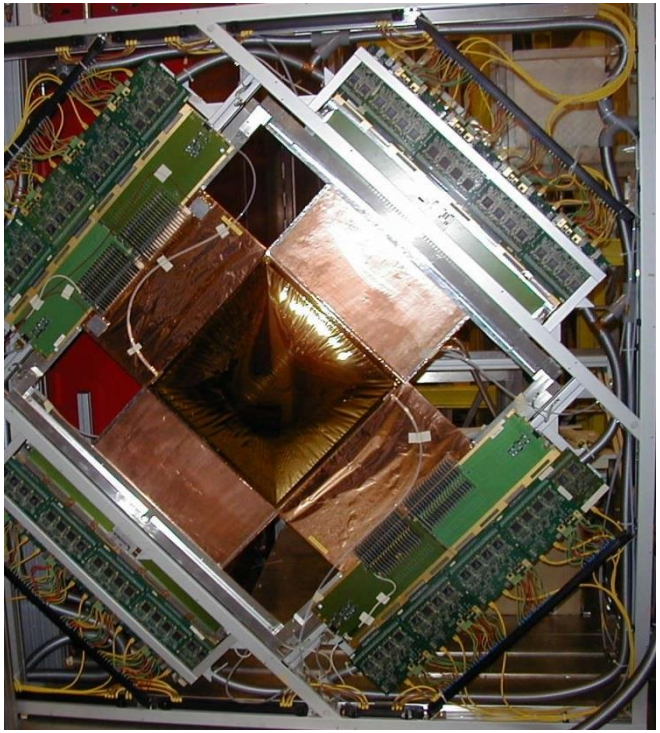
- Controls of wire scanners for the bend angle measurement
- Field integral measurement of the ARC



EPICS BETWEEN 2000-2005

4 EPICS VMEs on COMPASS at CERN

- Micromegas and drift chambers
- Quench data acquisition and slow control for the superconducting magnet

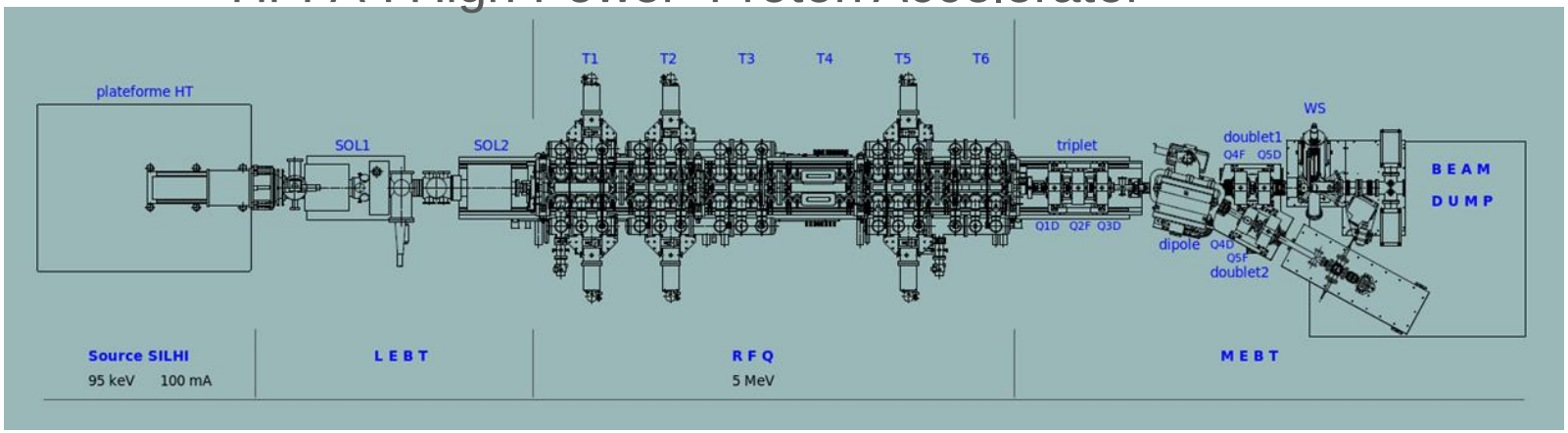


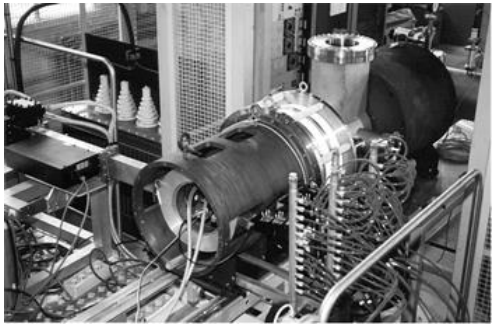
Ground Support equipment of MIRI imager (JWST)

- ESO software for IR detector
- EPICS for slow control

IPHI : AN HPPA PROTOTYPE INSTALLED AT SACLAY

IPHI (High Intensity Proton Injector) started in the 90's
HPPA : High Power Proton Accelerator





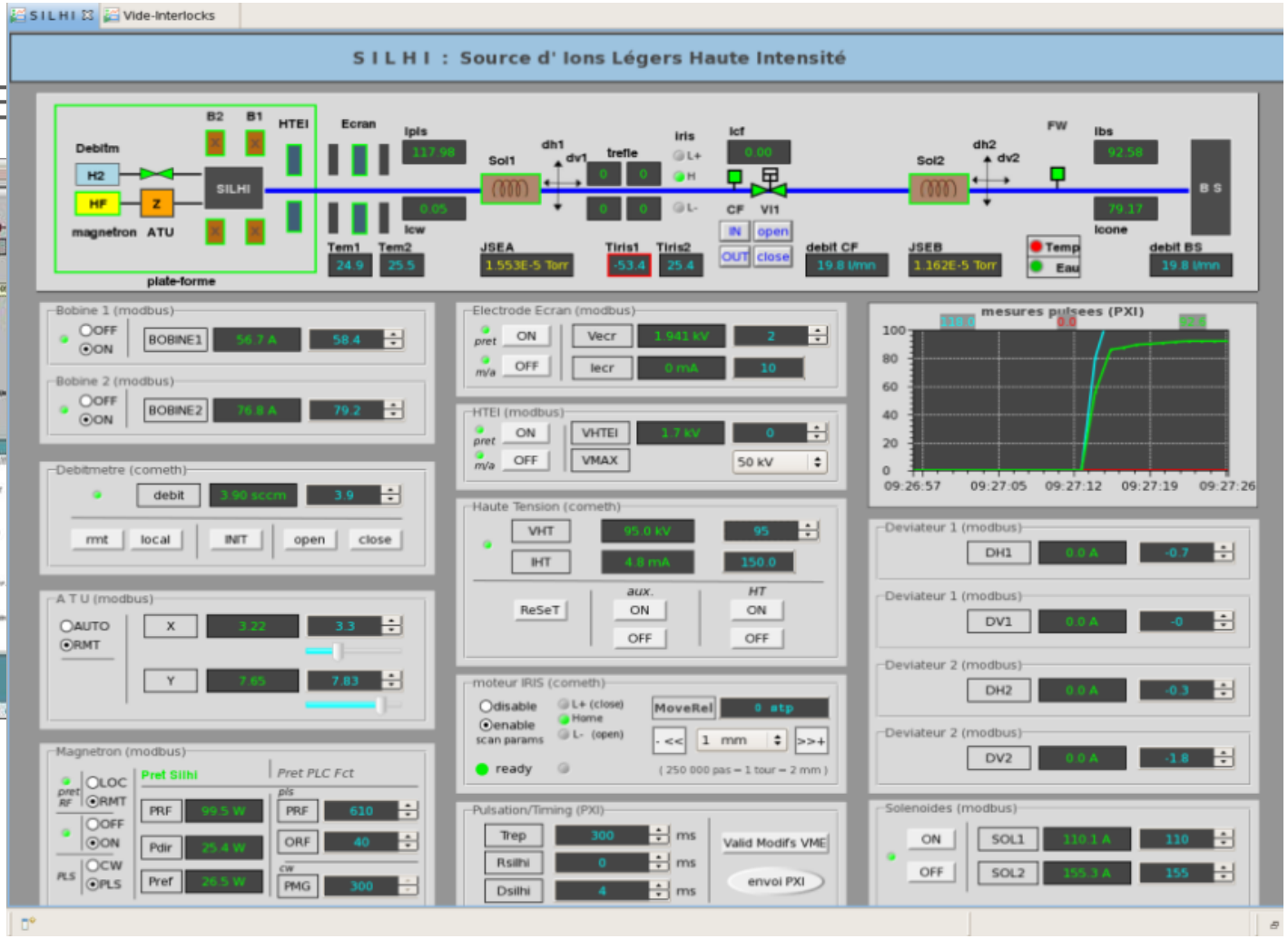
CW Source SILHI

5 MeV RFQ cavity

MEBT: with diags

RENOVATION OF THE CONTROL

A first E



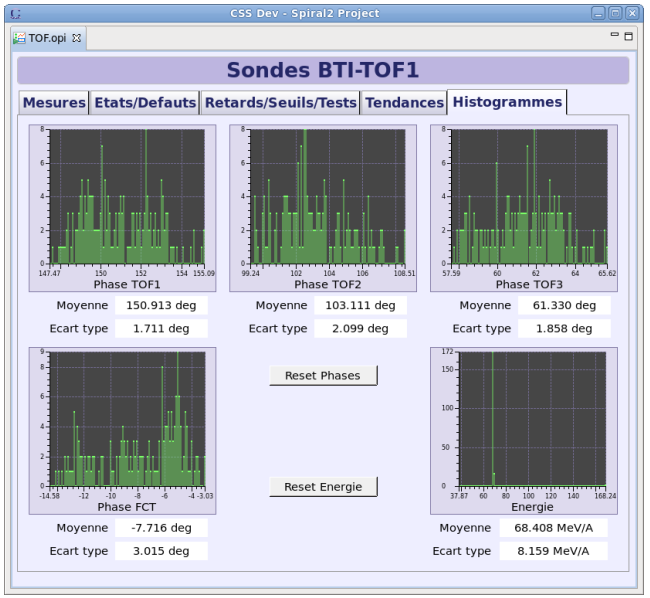
Hardware and Software Renewal in 2012

SPIRAL2 CONTEXT

- The Spiral2 facility will be a new Rare Ion Beam facility for nuclear physics and astrophysics at Ganil in Normandy
- Spiral2 control system is under the responsibility of Ganil with E. Lécorché (following presentation)
- 3 French Labs, Ganil (Caen), IPHC (Strasbourg) and Irfu cooperate for the Spiral2 control system

IRFU CONTROL WORK-PACKAGES IN SPIRAL2

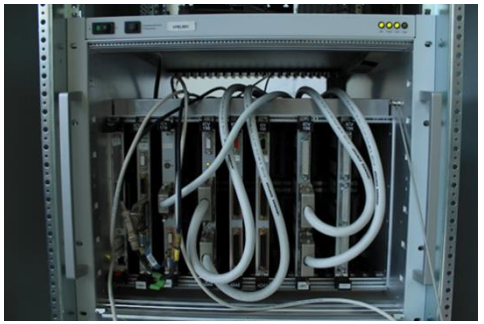
- the EPICS platform for the whole project
  - based on VME/VxWorks and Linux PCs
- injector (2 sources, 2 LEBTs, RFQ) with CS
- some diagnostics controls
  - FC, ACCT/DCCT
  - Fast Current Transformers
  - Time of Flight
  - Agilent oscilloscope EPICS interface for the Fast Faraday Cup
  - Chopper
- LLRF



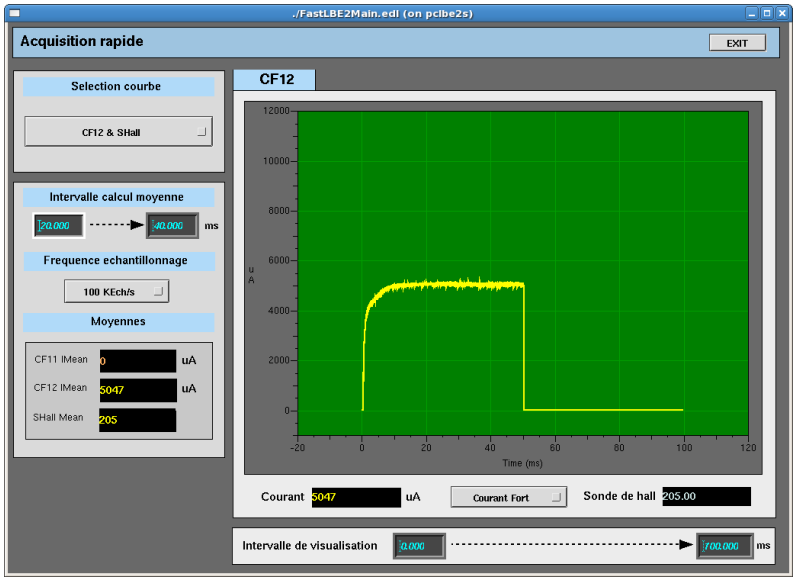
COMMON SPIRAL2 HARDWARE PLATFORM

- Emerson MVME 5500

- VME NEXEYA ADAS boards/EPICS drivers
  - ICV150: 32 ADCs, 16-bit resolution, 30 K samples/s
  - ICV714: 16 DACs, 12-bit resolution
  - ICV196: 96 binary I/O channels
  - ICV108: a controller board with RAM 4 Mbytes, external trigger
  - ICV178: 8 ADCs, 16-bit resolution, 50 K Samples/s up to 1.2 M Samples/s

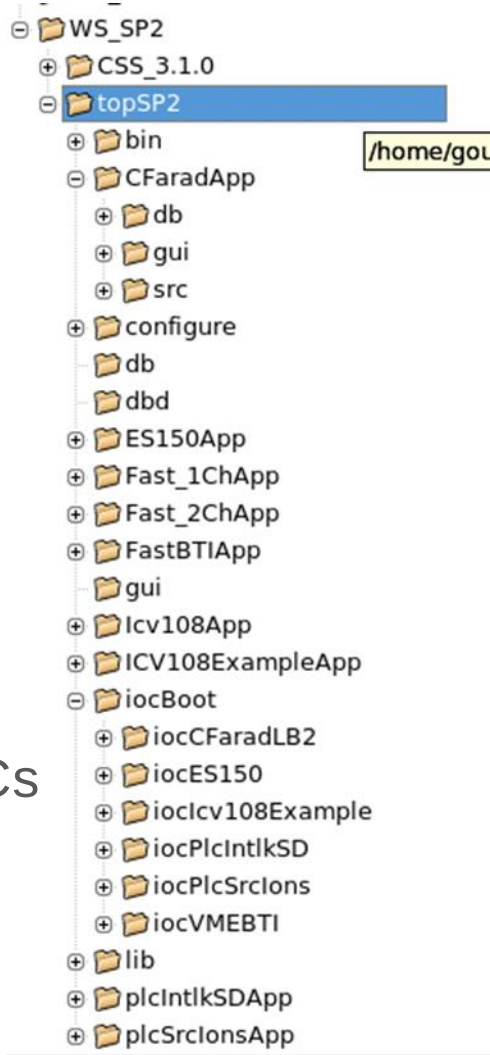


EPICS driver developed for the synchronised intensity measurement (FC, ACCT, EMU) on Spiral2 and then used on other projects



COMMON EPICS SOFTWARE PLATFORM (1)

- Homogeneous development was needed between the 3 labs to ease integration :
  - Rules :
    - for naming files and global functions
    - for naming PVs
  - Development model :
    - Top directory topSP2
    - makeBaseApp templates for Apps and IOCs



THE COMMON EPICS PLATFORM (2)

- EPICS 3.14.12.4
- VxWorks 6.9 for MVME5500
- CentOs or Scientific Linux CERN on PCs
- Available from SVN server at Ganil

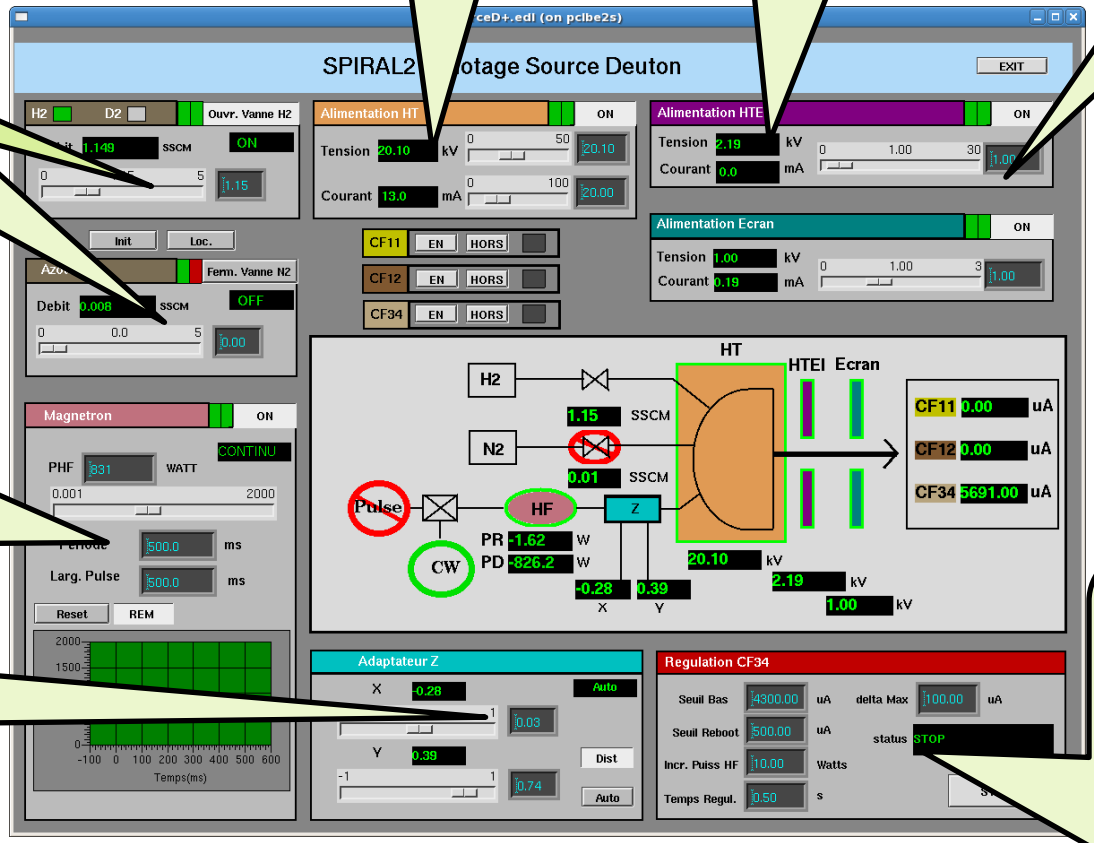
SPIRAL2 DEUTERON SOURCE EQUIPMENT

50 KV PS polarizes pt

30 KV PS, intermediate electrode

-3 KV PS repelling electrode

2 Flow controllers: Deuterium/Hydrogen & Nitrogen

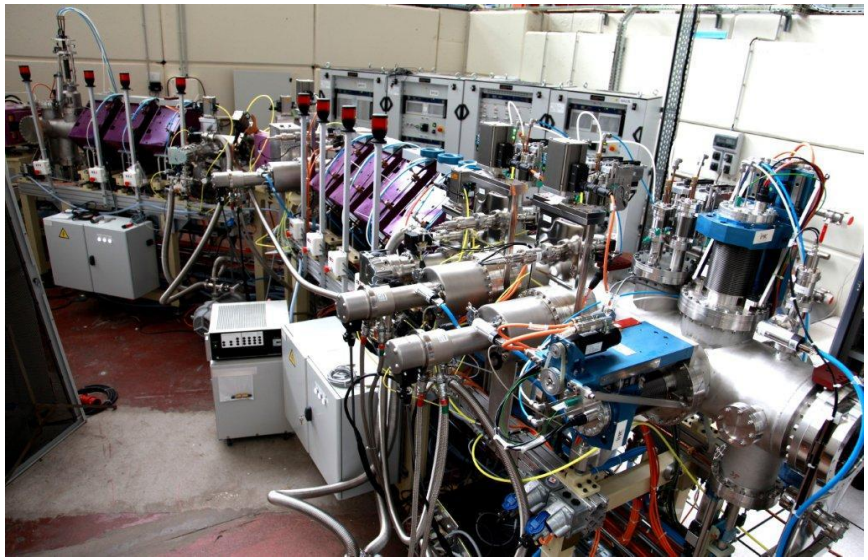


Agilent pulse generator RF generator= magnetron

Automatic Tuning Unit= impedance adapter

SNL program for regulation based on the beam current reading

SPIRAL2 LEBT TESTED AT SACLAY



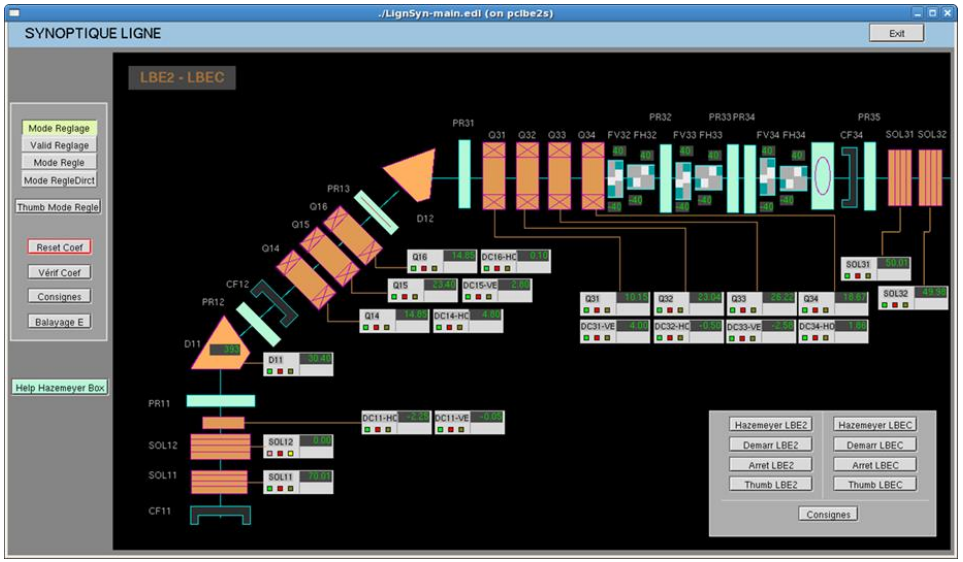
20 Hazemeyer Power Supplies :

- 2 dipoles
- 2 solenoids
- 7 quadrupoles
- 9 steerers
- Connected to Ethernet fieldbus & accessed via Modbus/TCP
- A common software interface (Ganil)

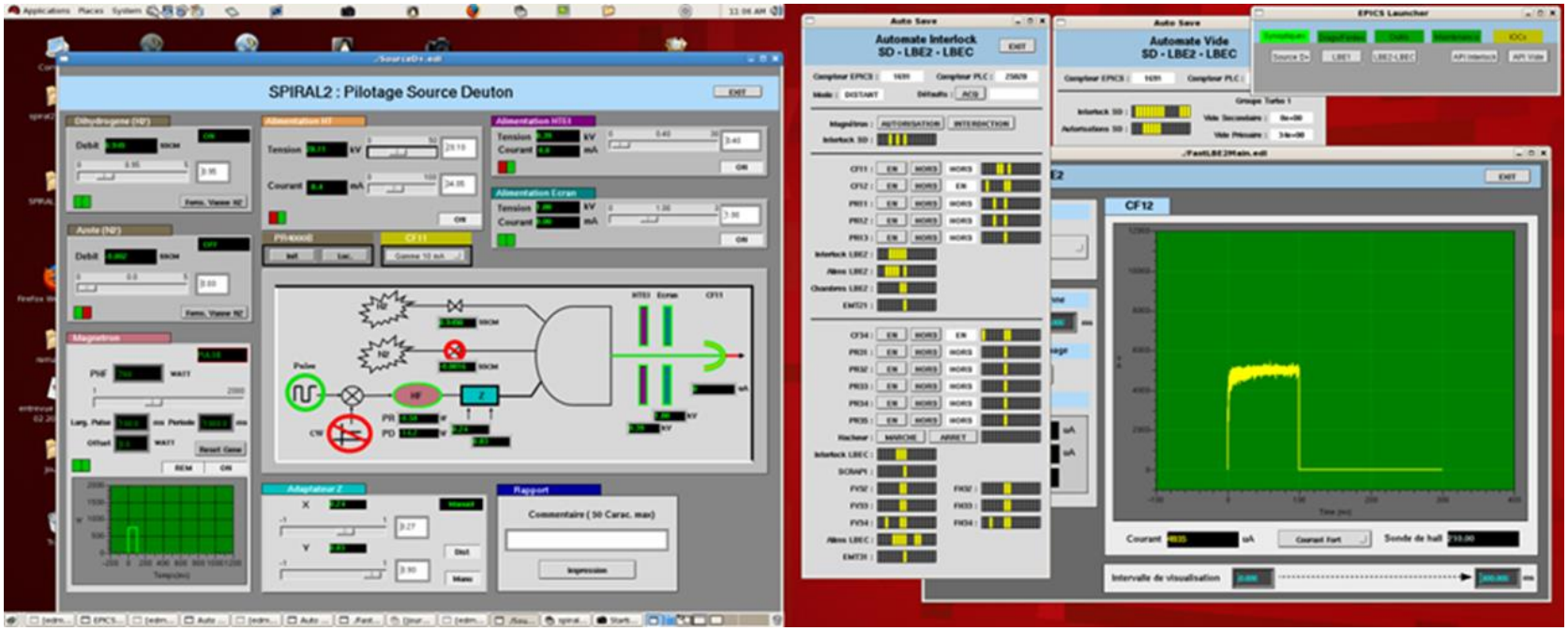
Controls of diagnostics & 20 Power Supplies

Diagnostics:

FC, ACCT & DCCT, SEM-grid harps (Ganil), Allison emittance-meters (IPHC), Slits => VME or Modbus/Tcp used

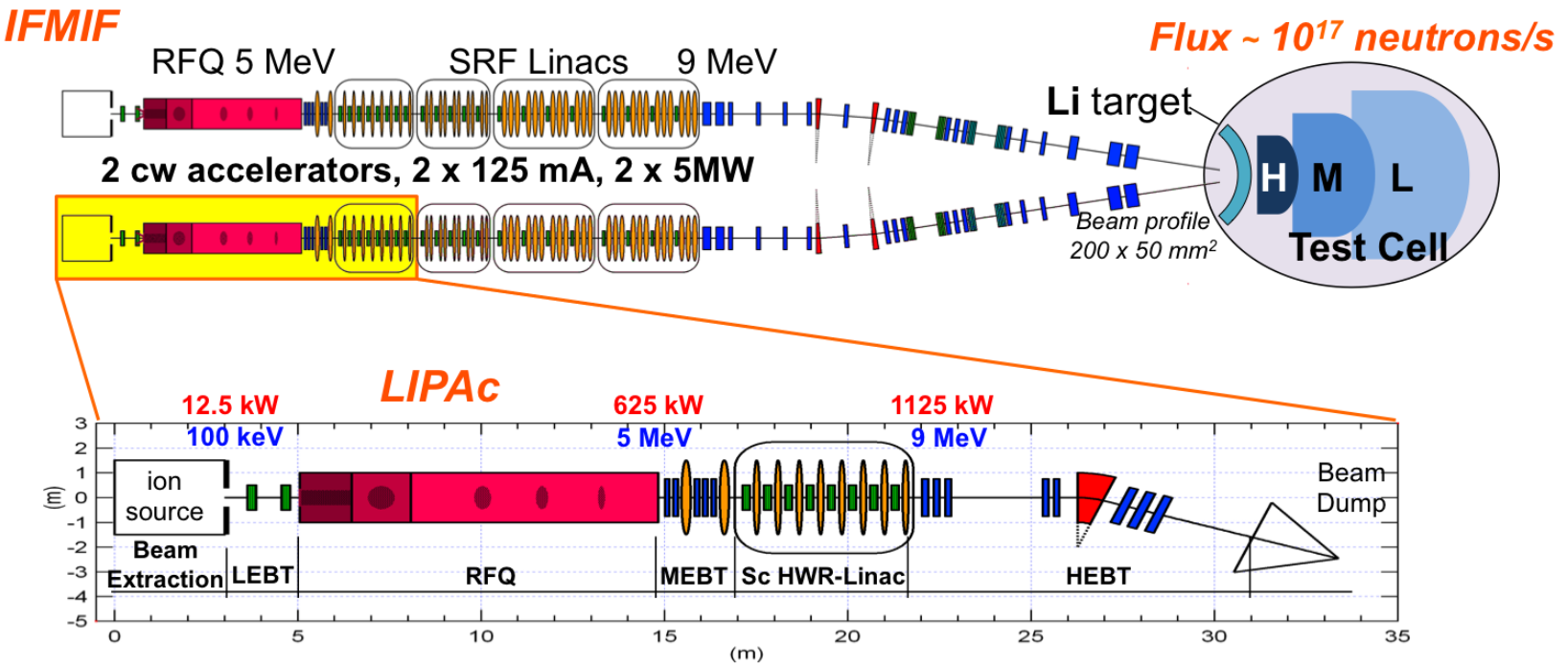


SPIRAL2 INJECTOR CONTROL STATUS



- The 2 beamlines Saclay and Grenoble tested with only EDM displays
- Migration to CSS BOY started late 2011
- Tests at Saclay and Grenoble stopped in May 2012
- We are waiting for the starting signal from Ganil for the CS installation

CEA COLLABORATION IN LIPAC (IFMIF)

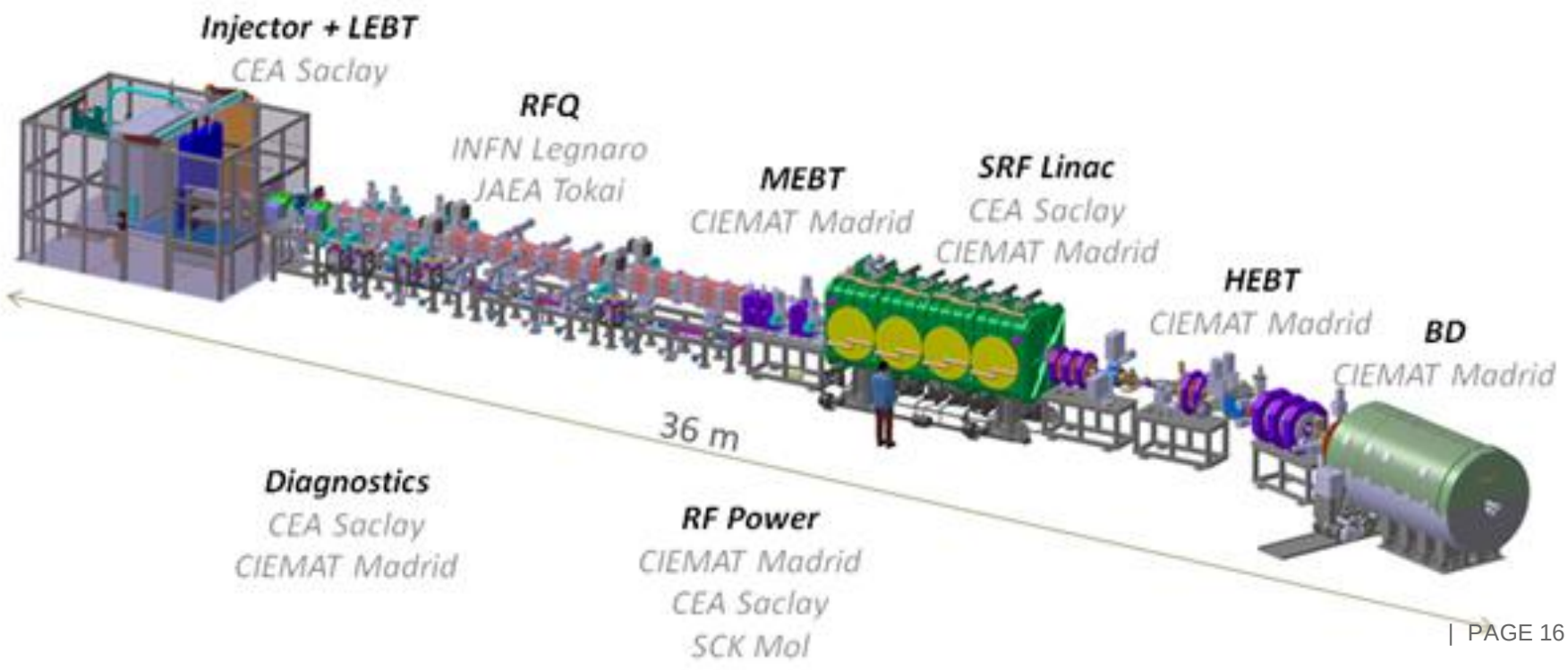


- IFMIF (International Fusion Materials Irradiation Facility) purpose: provide an accelerator based on a neutron source to produce high-energy neutrons (deuterons) at sufficient intensity and irradiation volume to qualify materials for fusion reactors

- 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

LCSS SHARED BETWEEN 3 INSTITUTES

- LIPAc is developed under the Broader Approach for Fusion agreement between Europe and Japan. 3 European countries are involved: France, Italy and Spain and share the sub-systems
- The control system is split into different LCSs between Ciemat Madrid, INFN Legnaro and CEA Saclay



IRFU LCSS

LCS	Institutes
Source & LEBT	CEA Irfu
RFQ	INFN Legnaro
MEBT	Ciemat Madrid
SRF Linac	Ciemat & CEA
Diagnostics	CEA & Ciemat
HEBT	Ciemat Madrid
Beam Dump	Ciemat Madrid
Coordination	CEA Irfu

- in charge of a transverse coordination, standardisation of the development and acceptance tests through European LCSs

LIPAC TRANSVERSE COORDINATION

- EPICS software platform
  - Identical to Spiral2 platforms (hardware & software)
  - With the same templates to use for development
- Guidelines for installation
- Guidelines for development
- Guidelines for naming
- Template LCS Acceptance Test
  - To be filled up and followed step by step during the acceptance

LCS ACCEPTANCE TESTS

- Checking of the manuals
  - User manual
  - Maintenance manuals (one per device)
    - Design of software development
    - Hardware configuration
    - Scenarios to test controls

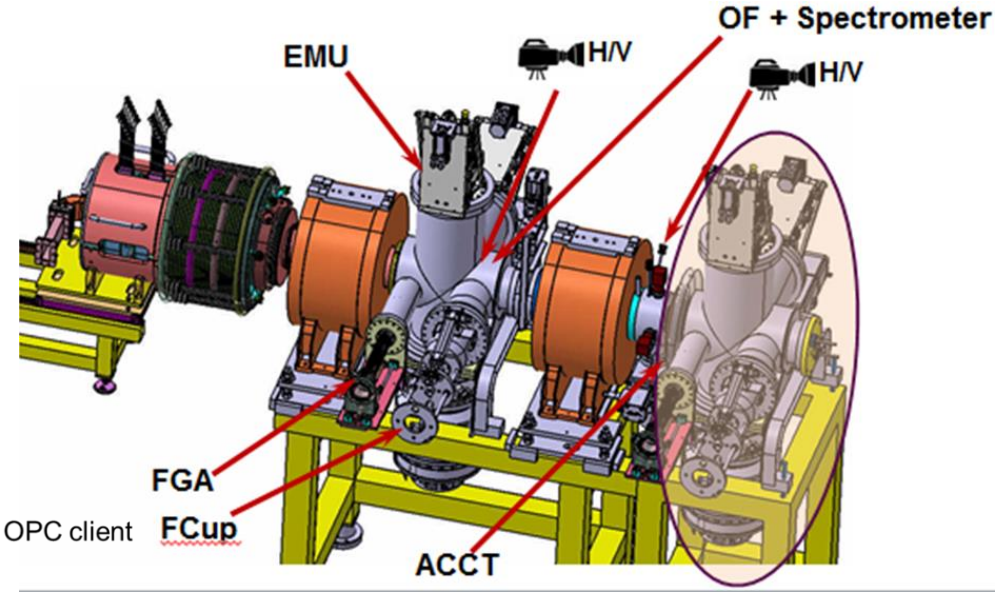
- Checking software installation
  - Start from scratch
  - The complete LCS software has to be reinstalled automatically if possible
  - Checking of the topIFMIF tree
  - Checking of the database records naming

} Scripts in collaboration with INFN/Legnaro

LCS ACCEPTANCE TESTS (2)

- Application module acceptance test
  - Checking scenarios adapted by the person/developers in charge of the LCS
- Release acceptance test
  - This phase concerns the test of the full system from the LCS user interface to the I/Os.
- Global acceptance test
  - All LCSs connected to the Rokkasho network and Central Control system
- CEA diagnostics European LCS Acceptance tests took place May 2014

Injector disassembly at Saclay November 2012



Linux PC / EPICS supervision:BOY displays and archiving

Siemens microbox/ OPC server&EPICS OPC client

Ethernet

MVME5500/VxWorks 6.8

Profibus

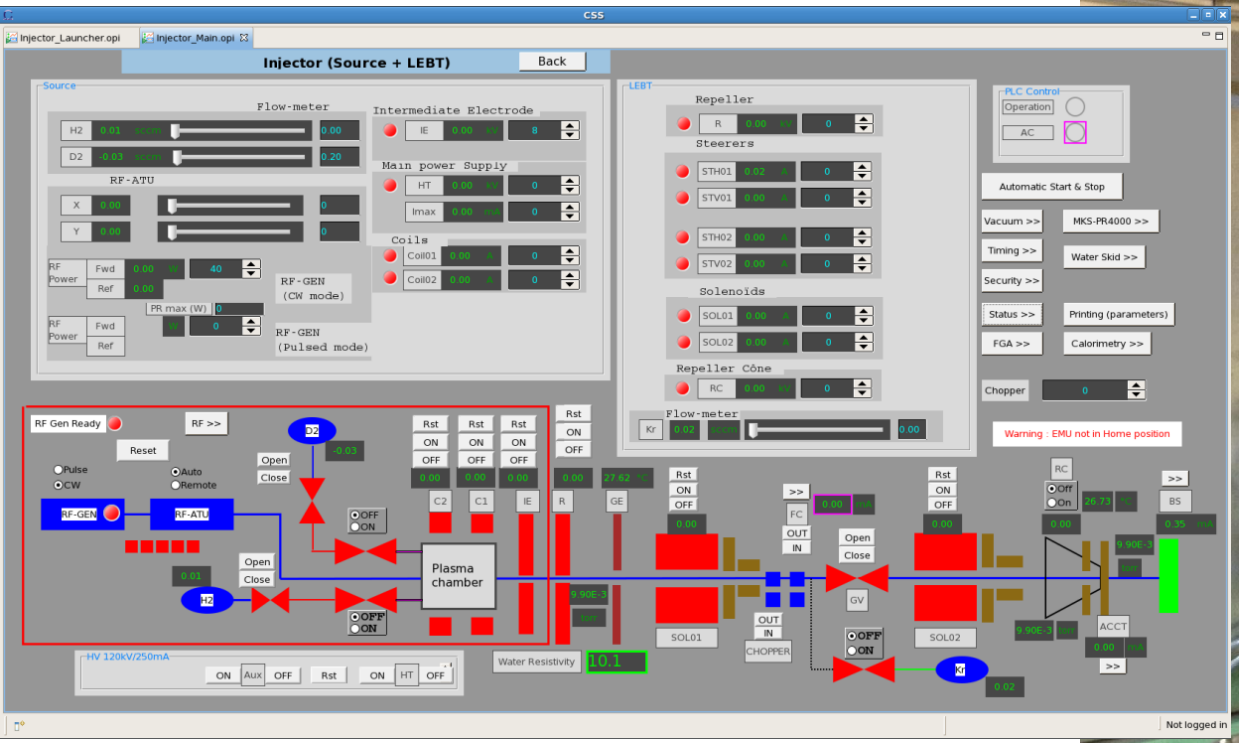
EMU,ACCT, FC, FGA

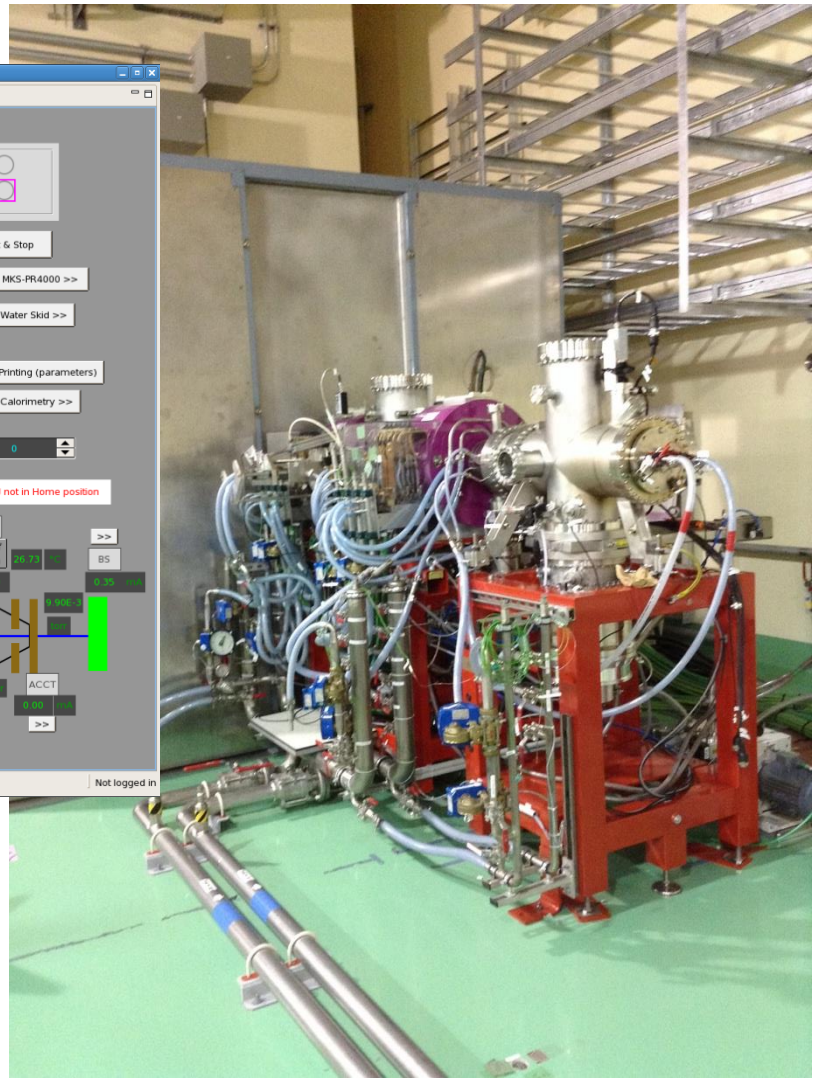
ECR source(HV PS, RF generator, ATU, coils, electrode) LEBT(coils, solenoids)

Vacuum

Water cooling

INJECTOR AT ROKKASHO





Control system tested October 1-9th

3 OTHER PRESENTATIONS ON LIPAC ON WEDNESDAY

- CEA Diagnostic controls of IFMIF-Eveda prototype accelerator:LIPAc

Jean-François Denis (CEA)

- LIPAc LLRF control system development based on EPICS

Julio Calvo (Ciemat)

- LIPAc status: EPICS integration and commissioning

Alvaro Marqueta (Project Team at Rokkasho)

CONCLUSION

- Our collaboration in Spiral2 and then LIPAc :was, and still is, very rewarding
  - Fruitful exchanges
  - 2 different projects enabled us to study different technologies
  - Improvement of our methods of work between the 2 projects
- Many thanks to the EPICS community for all their help since 1993.

IRFU EPICS TEAM

EPICS platform & tools : Y. Lussignol & P. Mattei

Spiral2 EPICS team

sources: J-F. Denis

LEBTs: J-F. Denis, F. Gougnaud, Y. Lussignol

LLRF: Y. Lussignol

LIPAc EPICS team:

Injector: D. Bogard, P. Mattei & A. Gomes

Diagnostics: J-F. Denis

Transverse Coordination: F. Gougnaud, J-F. Gournay (now retired)

2 EPICS beginners: T. Joannem & N. Senaud