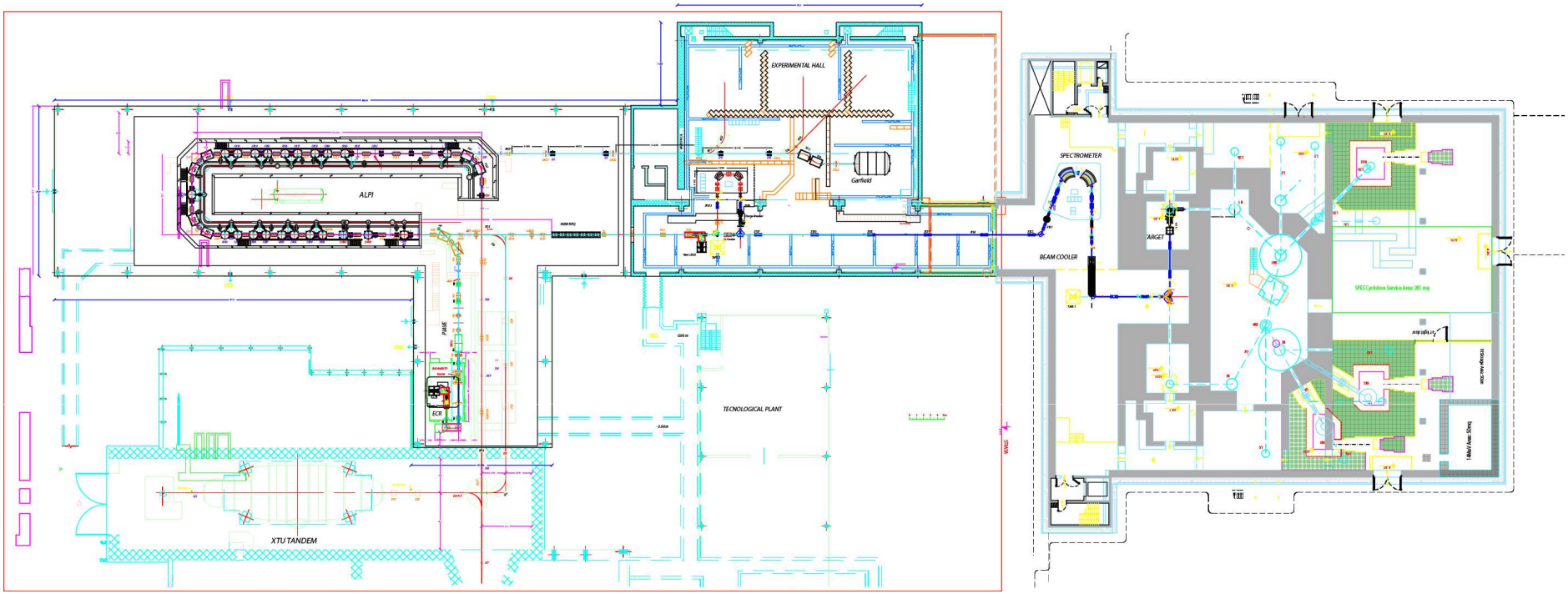
SPES Control System



L. Antoniazzi, G. Bassato, A. Battistella, M. Bellato, J. Bermudez, M. Biasotto, D. Bortolato, S. Canella, O. Carletto, M. Contran, S. Fantinel, M. Giacchini, M. Gulmini, R. Isocrate, M. Montis, R. Ponchia, J. Vasquez

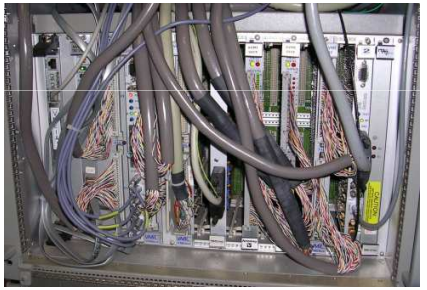
SPES - TAC meeting 22-23 Jan 2014

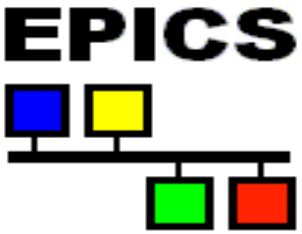
Topics

- Architecture
- Infrastructure for controls
- Hardware developments
- Subsytems layout
- Software developments

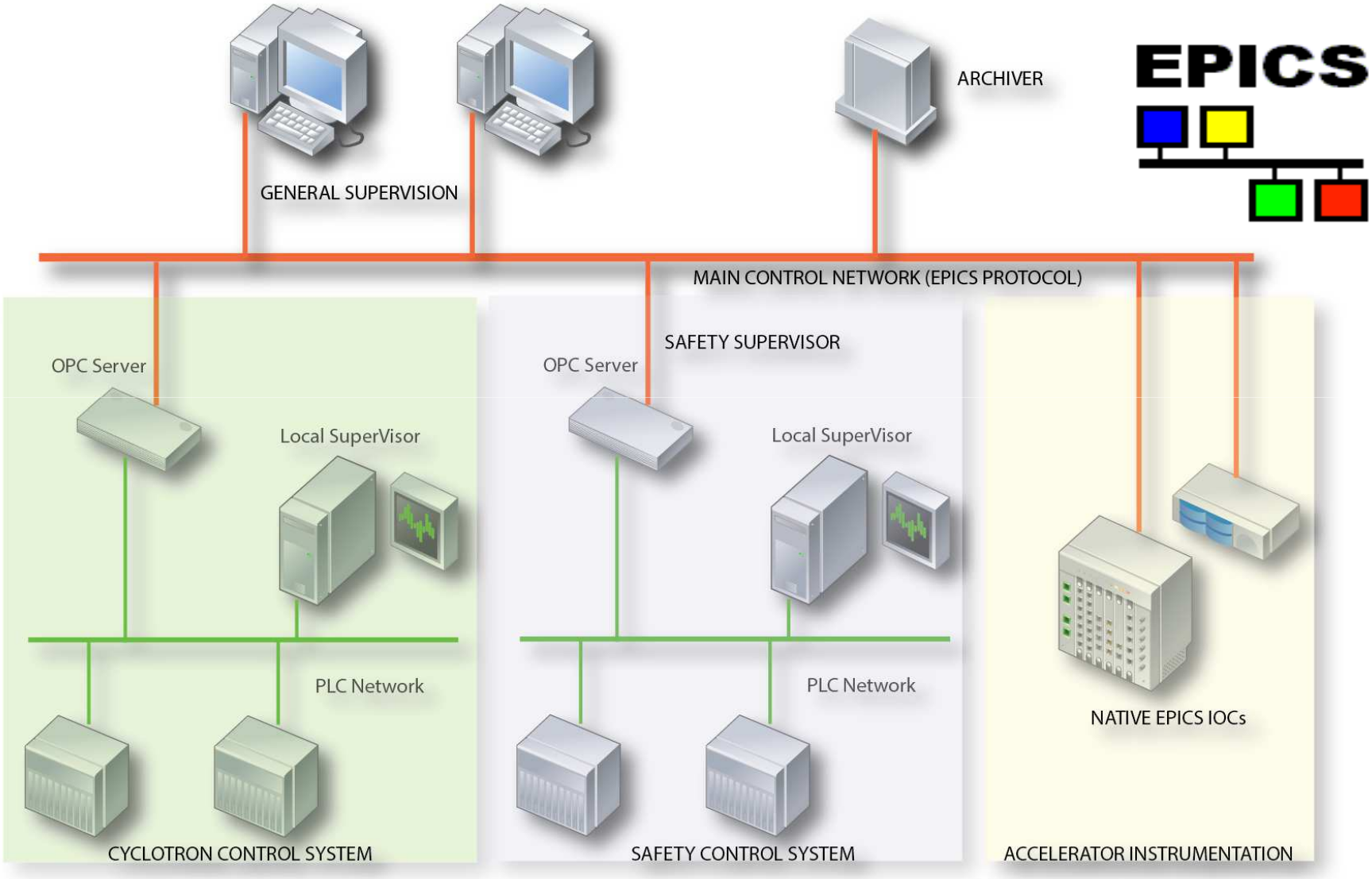
Driving Concept : Standardization

- Mandatory for SPES integration
  - Has forced a revision of existing systems
  - Extended to all accelerating machines and services
- Hardware
  - Field bus, PLC , custom
- Software
  - EPICS on Linux O.S
- Services
  - Archiving, networking, backup

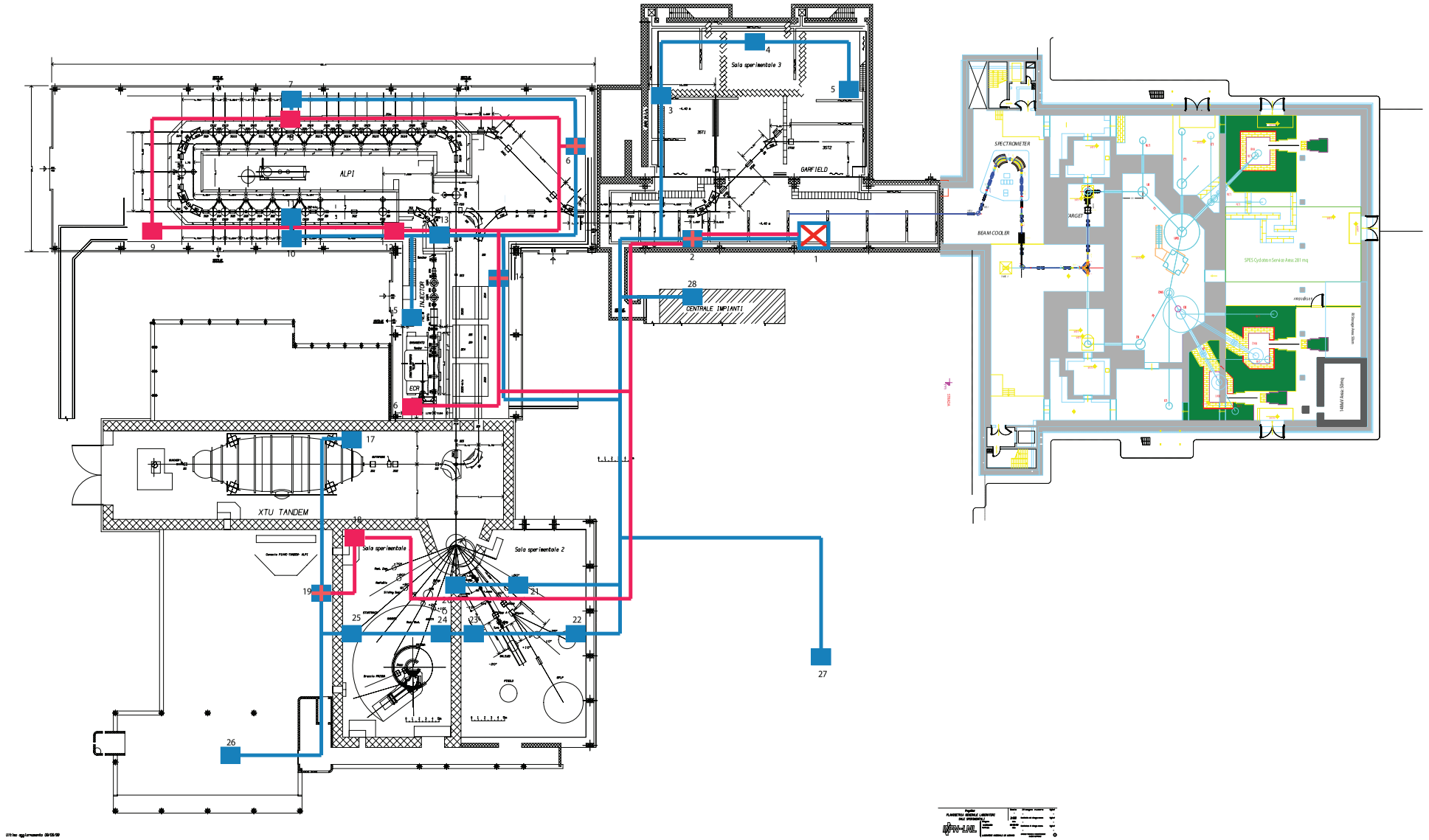




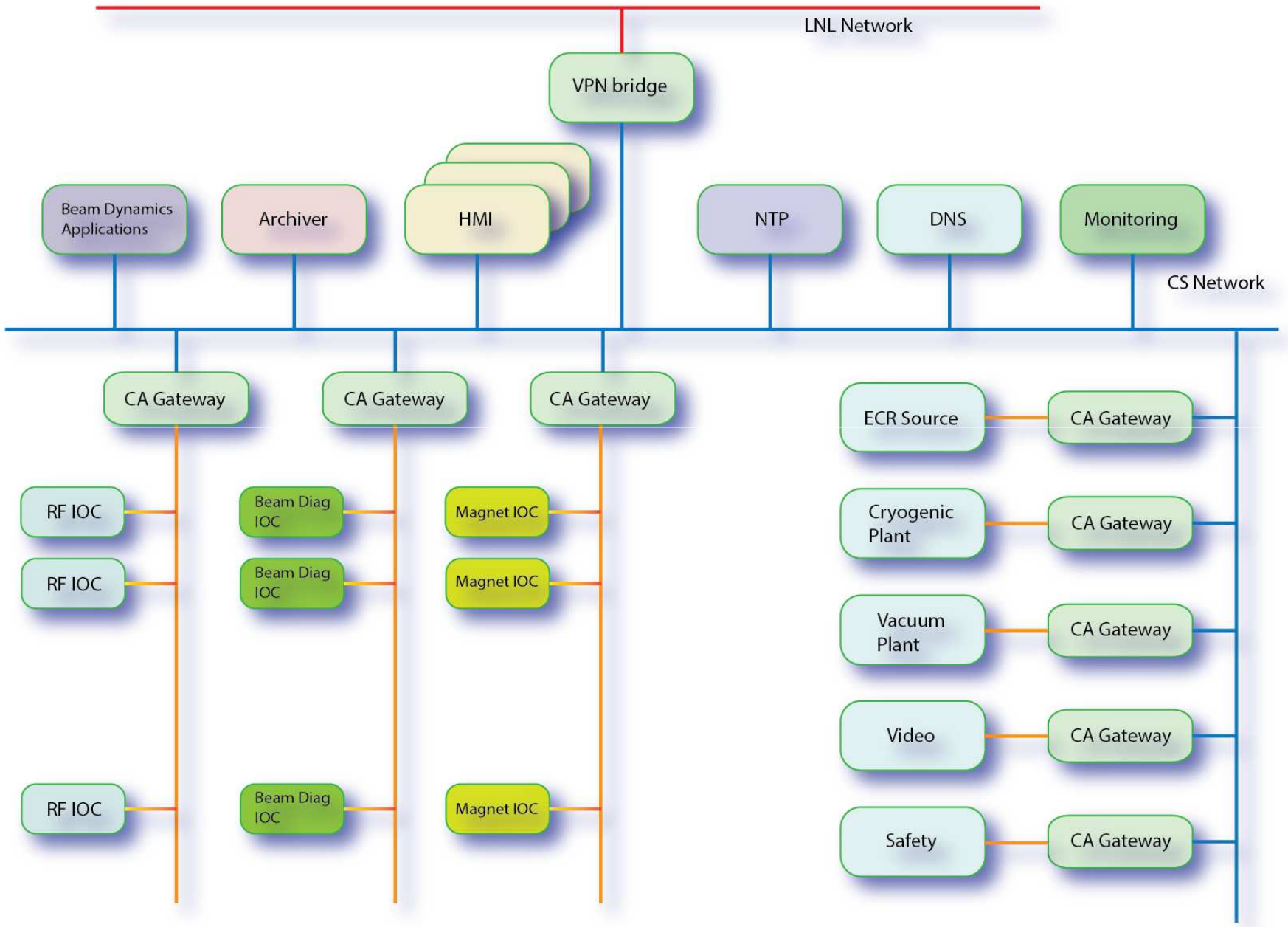
General Architecture



Control network layout

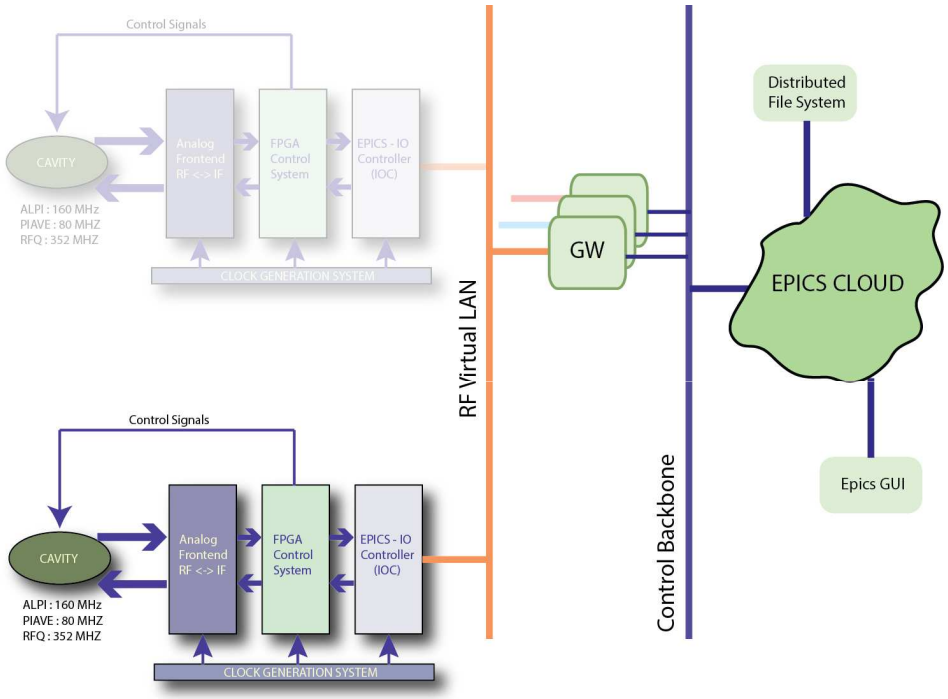


Network Architecture



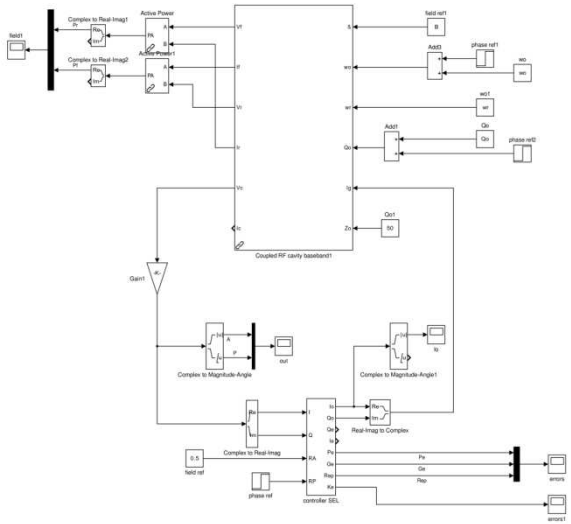
LLRF Developments

- LLRF for RFQ/LINAC cavities control
- Existing analog controllers have maintainability problems
- Need for higher resolution phase control
- New controller based on HF sampling/ digital control
  - More versatile, adapts easily to 40 MHz, 80 MHz, 160 MHz and 352 MHz cavities
  - An EPICS IOC is embedded in each LLRF controller



Digital LLRF controller status

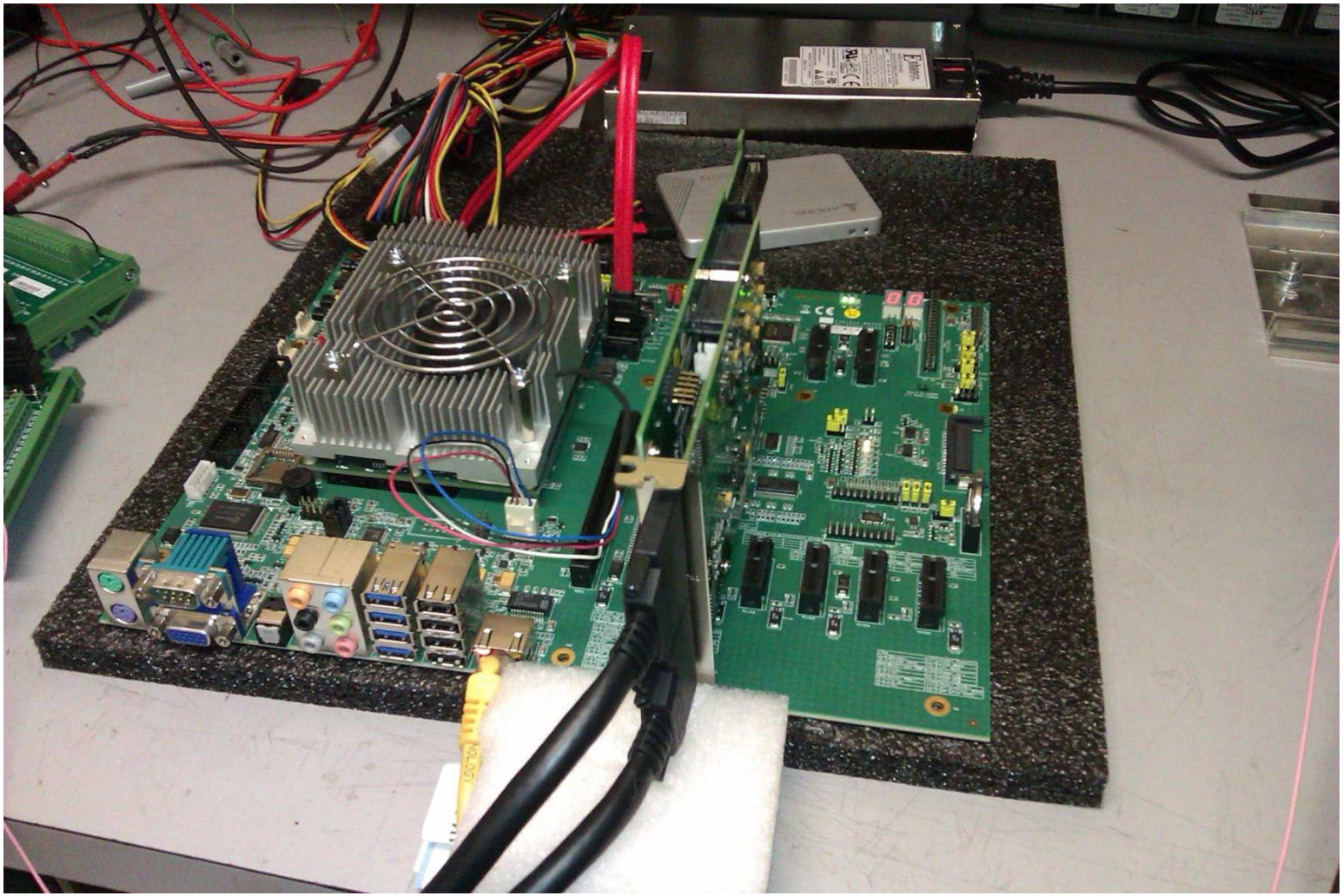
- R&D started in October 2012
- Mockup working with warm 160MHz cavity on March 2013
- Start of EPICS software on May 2013
- Test on cold 80MHz and 160 MHz cavities – June 2013
- Schematics completed on Nov. 2013
- PCB layout of RF part started on Dec. 2013
- Test on RFQ at low power on Jan. 2014
- Pre-production prototype expected on Q2 2014
- Collaboration with LLRF group @ ISOLDE



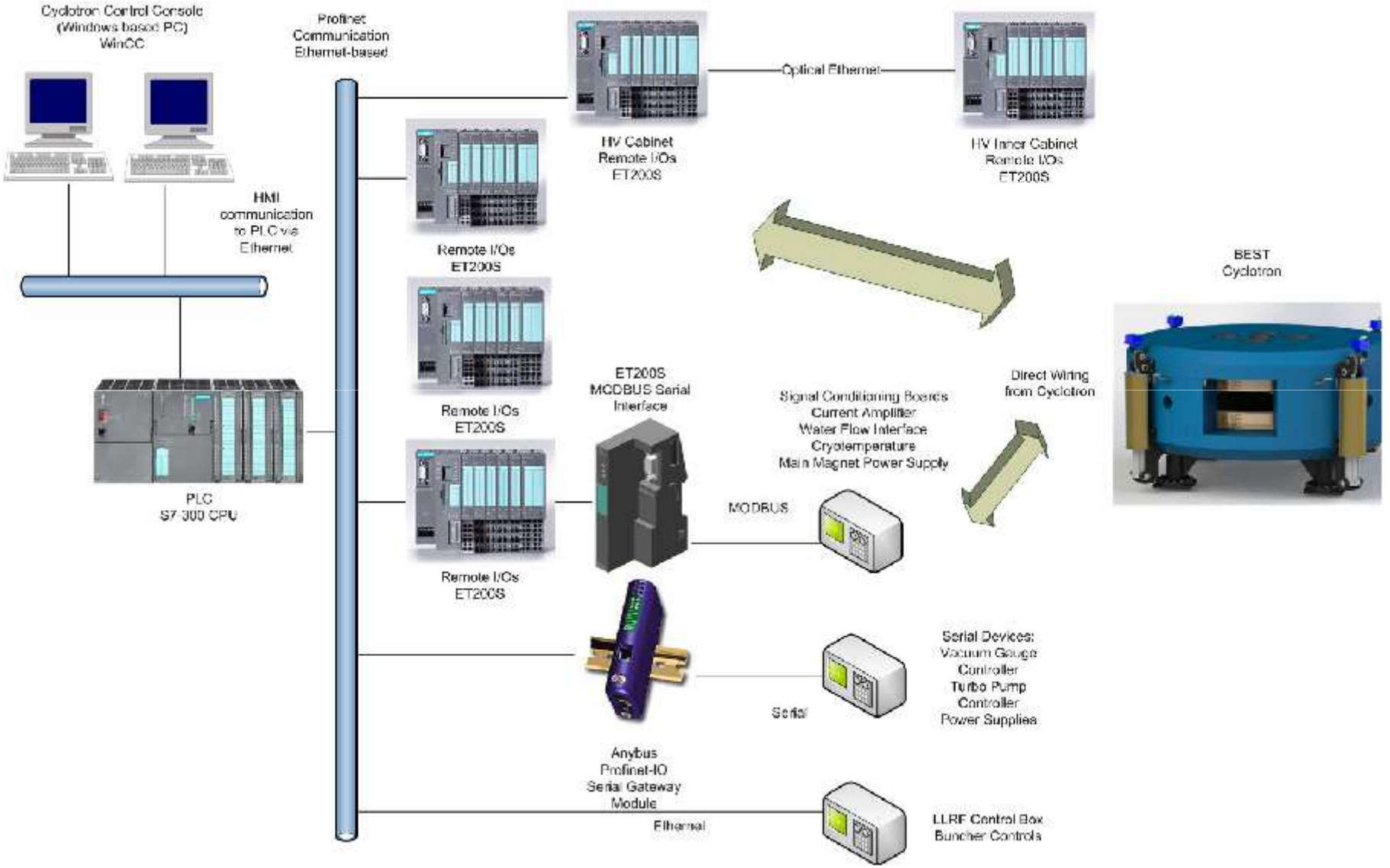
LNL IOC development

- Rationale:
  - Build once, use it everywhere
  - Reliable and easy to maintain
  - Affordable(< 400E target), low power
  - Runs standard X86 code
    - Core CPU is a COM-EXPRESS industry standard
  - Fits the needs of : Magnets & Lenses PS, BPM, Tape Sys, EM, FC, etc
- Design is starting on Q1 2014

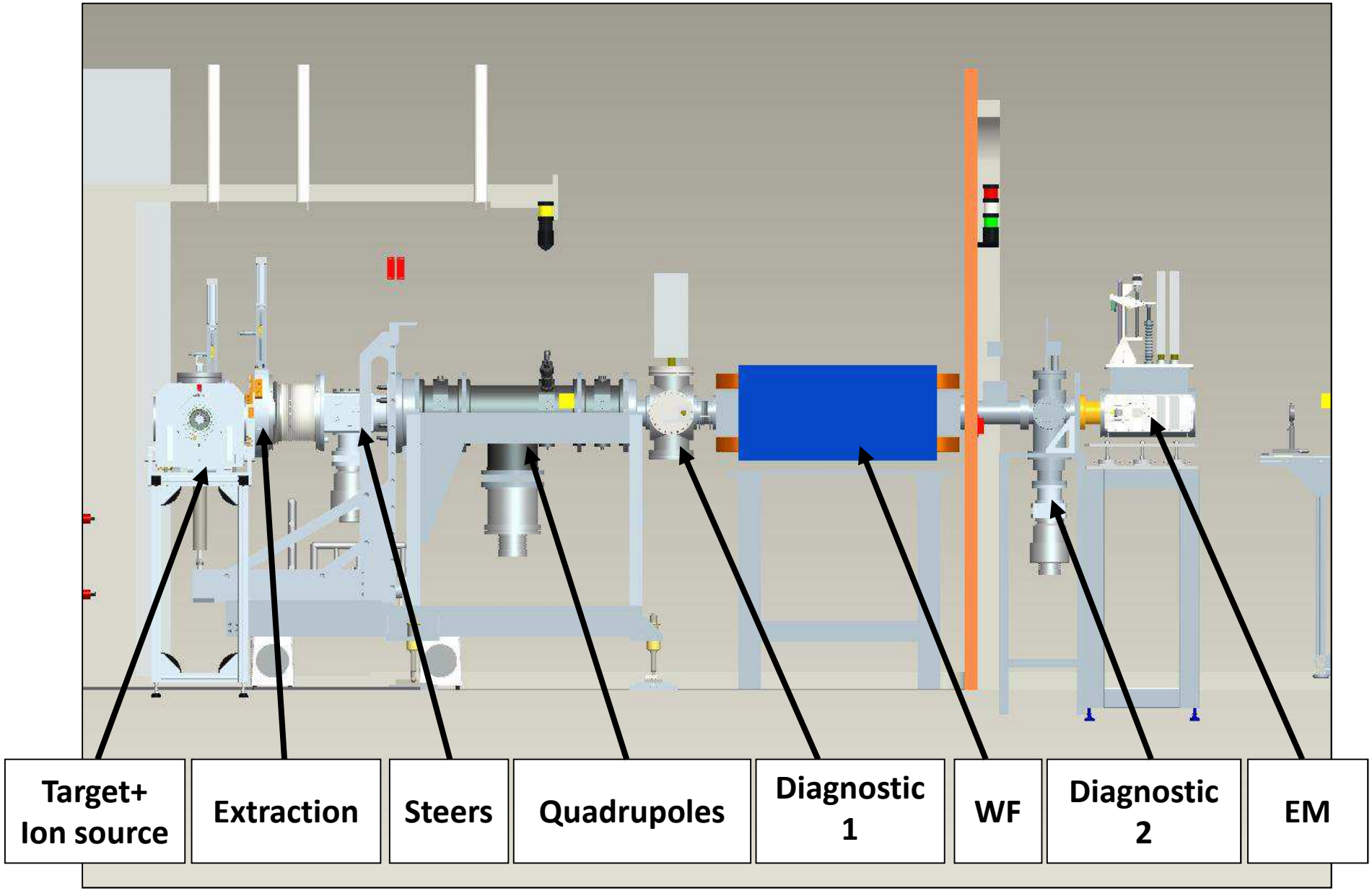
LNL IOC development



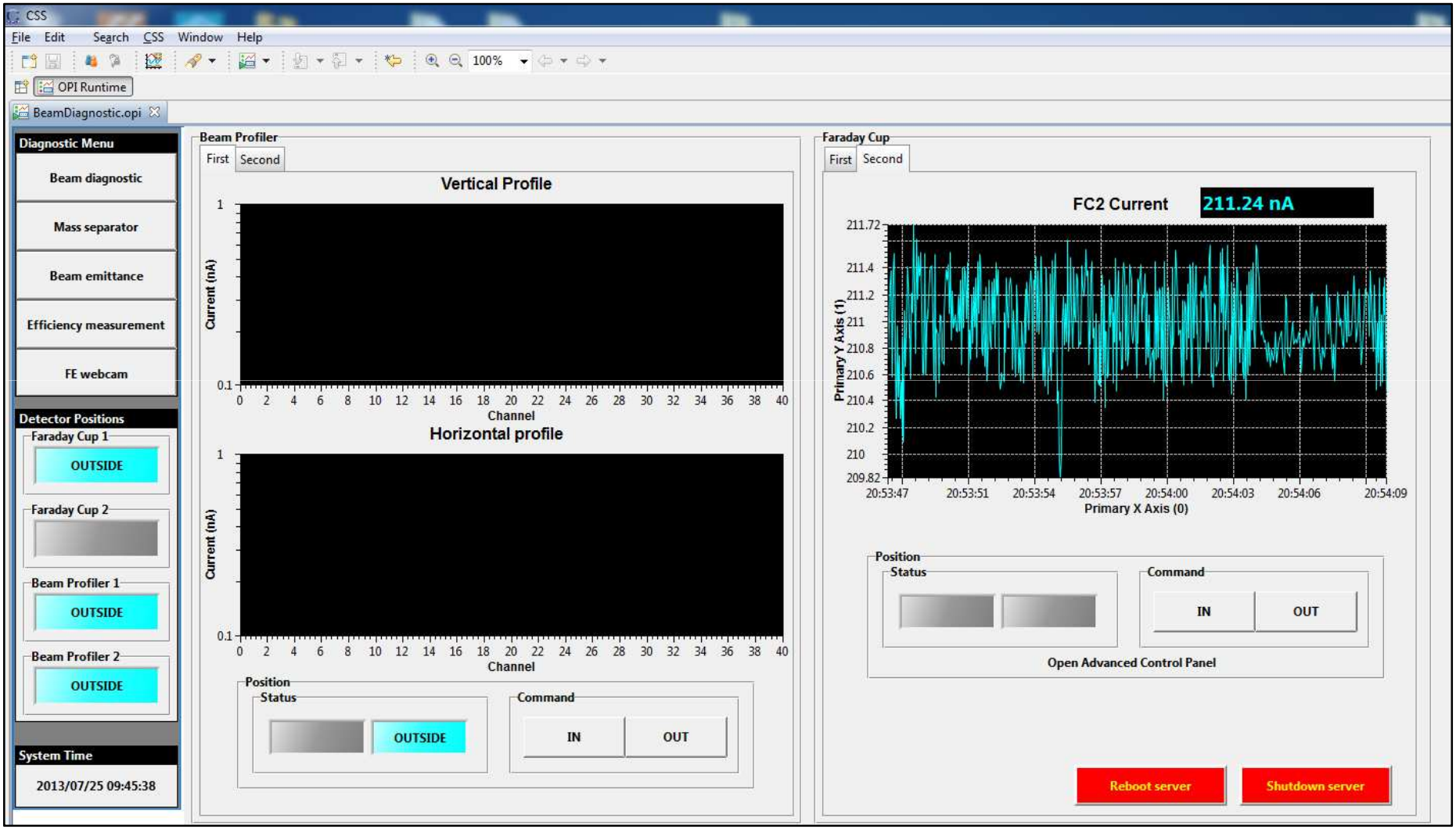
Cyclotron Control



Target & Ion Beam Source Control

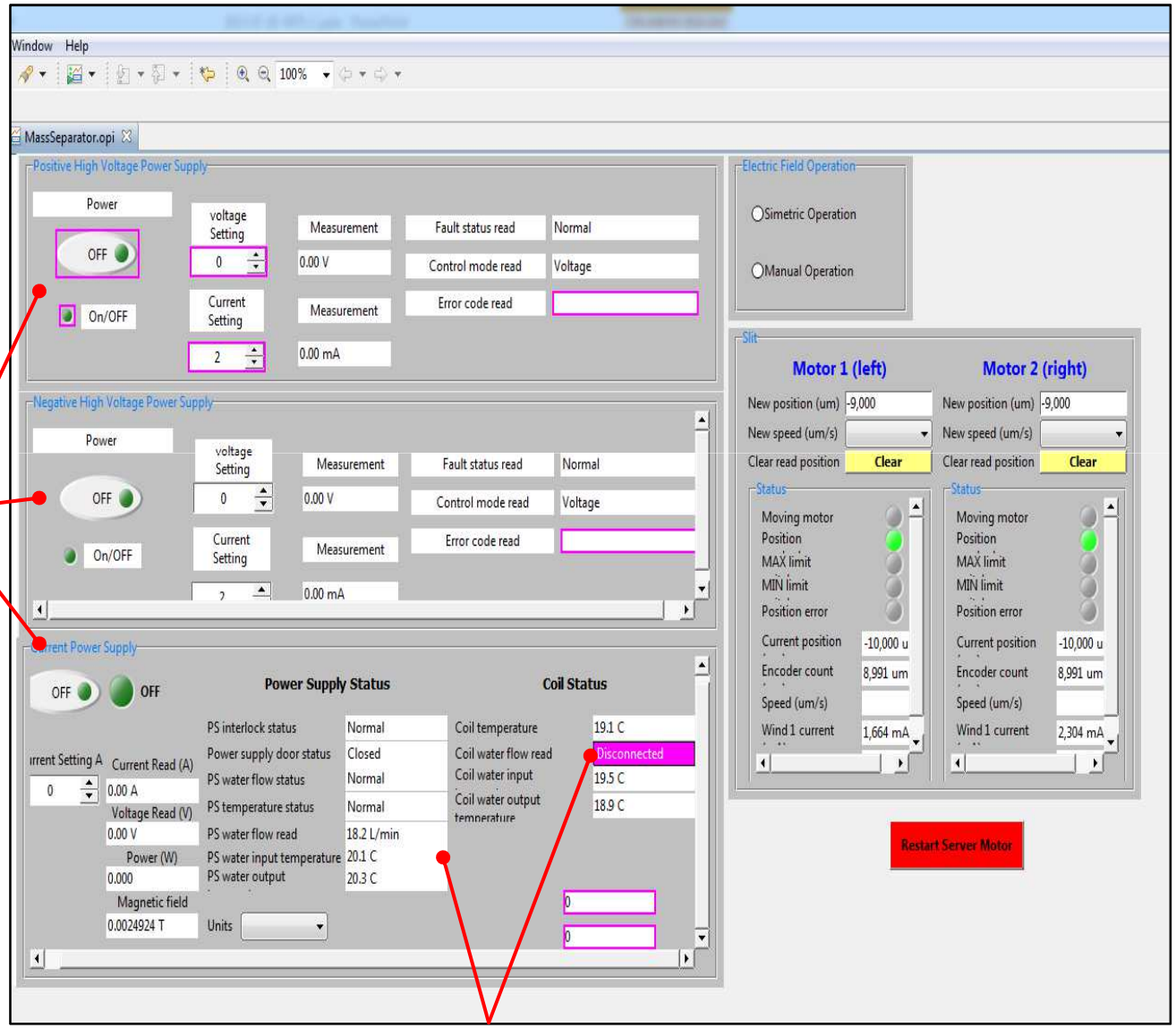


Target & Ion Beam Source Control



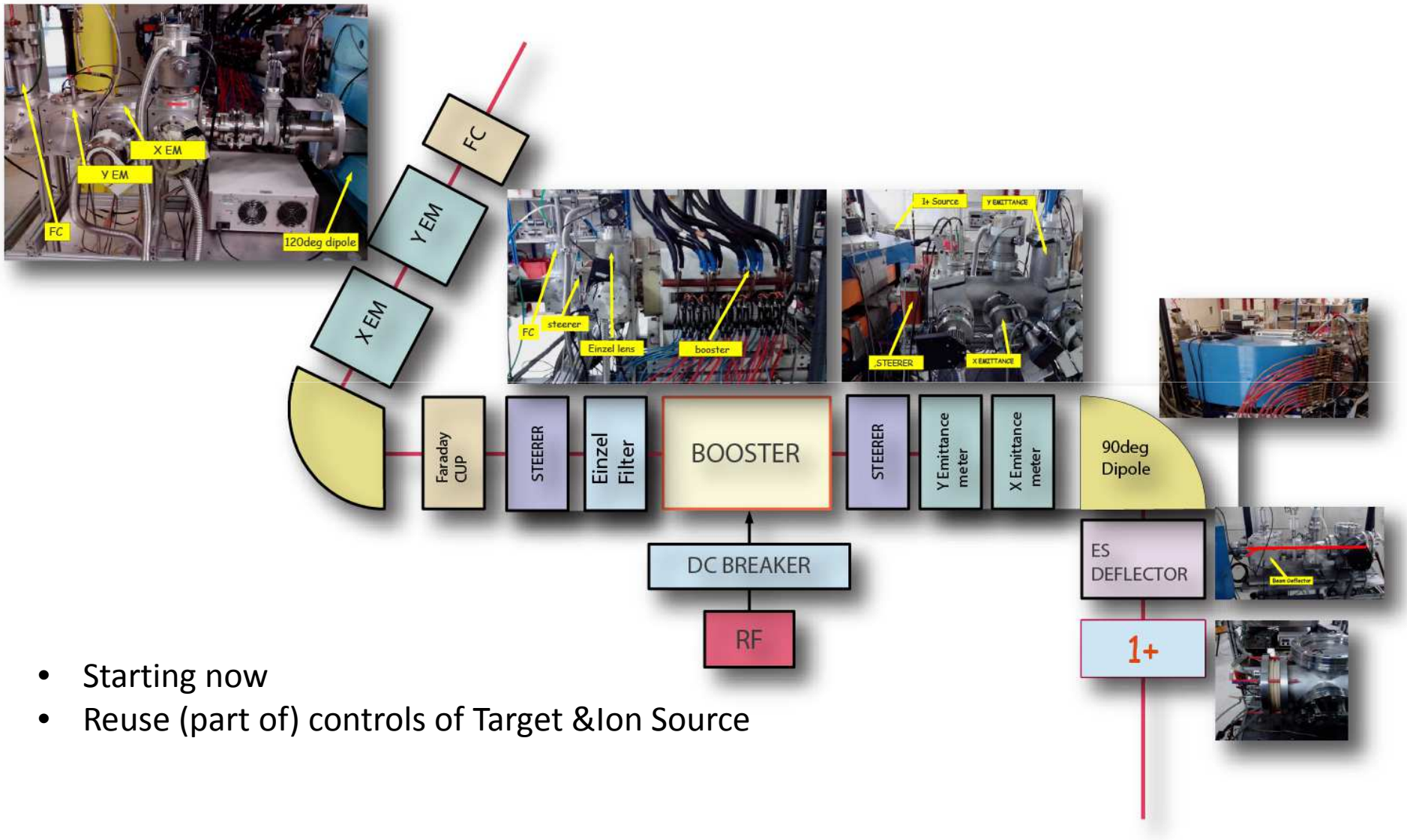
Target & Ion Beam Source Control

Power Supply Settings



Temperature readings

Charge Breeder Control



- Starting now
- Reuse (part of) controls of Target &Ion Source

Tape System Control

- Prototype built with Labview
- Now migrating to EPICS
- New HW based on LNL IOC

DAQ for Ge Detectors under physicist control

New Network Architecture

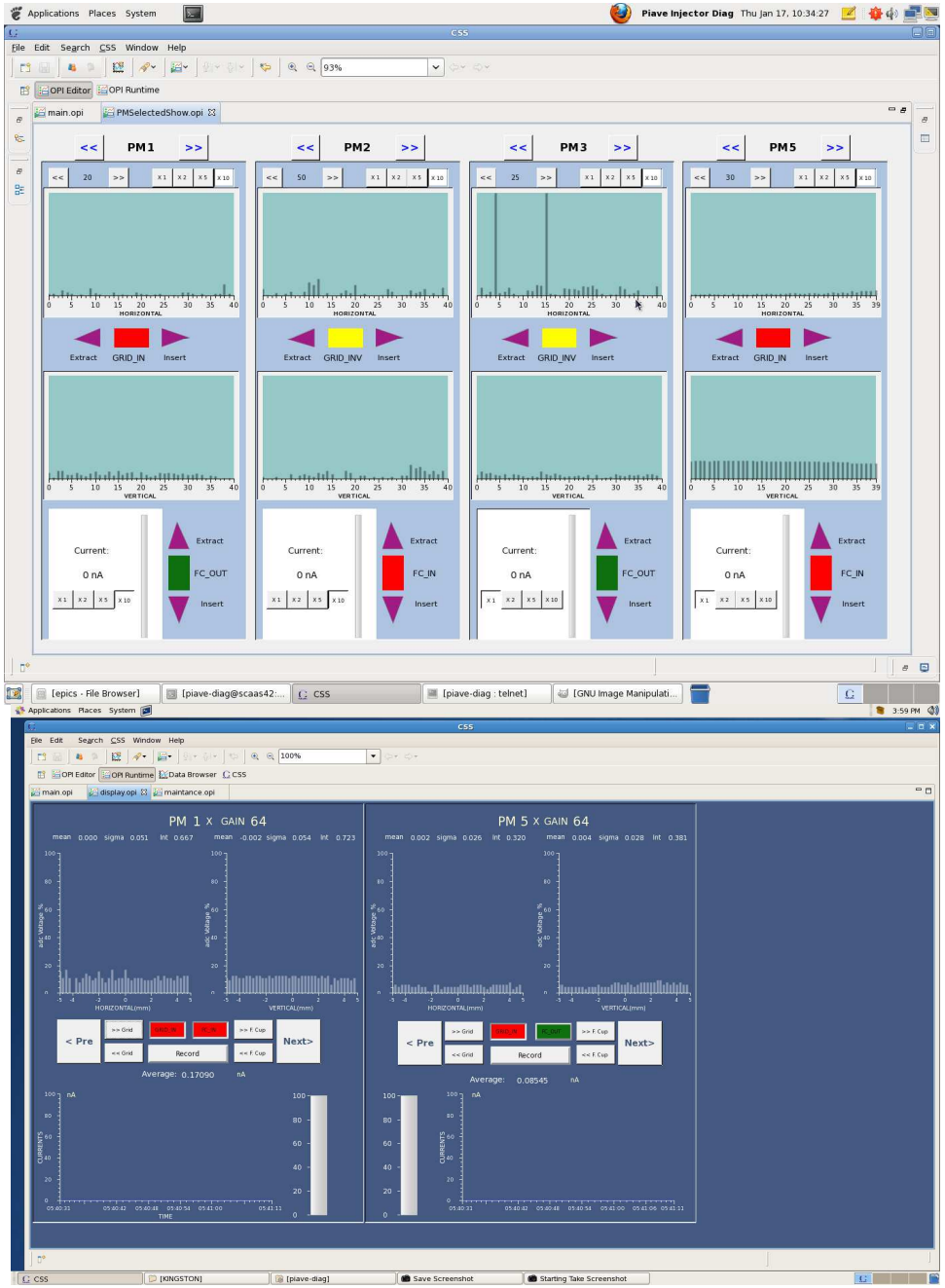
- Homogeneous layout for all accelerating machines
- Private network integrated with Lab network
- Vital services(timing, domain name server , …) centrally managed
- Laboratory-wide IT service key for implementation and maintenance
- Executive project completed
- Cabling starts in Feb./March 2014
- Extension to SPES building due for Q1 2015 (depending on building availability)

Archiving

- Common Archive for every subsystem (RF, vacuum, diagnostics, magnets P.S, etc…)
  - Accessible from every EPICS endpoint
  - Centrally managed
- Pilot implementation based on Postgres DB
  - Tested at a max rate of 1.000 process variables/sec
  - Up-time of 3 months at full rate
- Prototype Archiver scheduled to be online on Q2 2014

Beam Diagnostics

- New Control SW
  - EPICS based
- Prototype actually working on PIAVE injector
  - In commissioning since April 2013
- Installation on ALPI Linac started on Oct 2013
  - Ready for deployment in Feb. 2014
- New HW IOC integrating EPICS controls under investigation



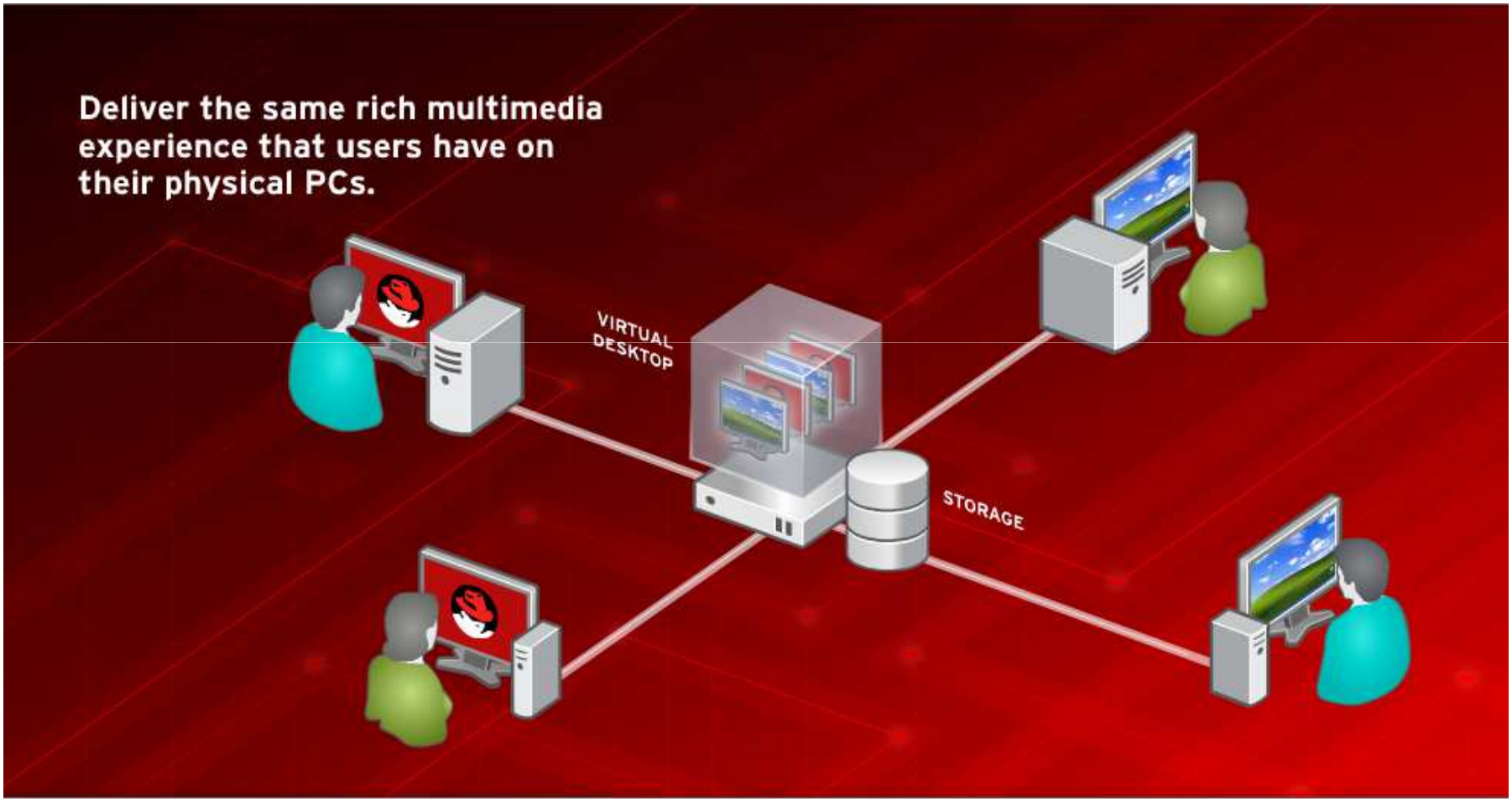
Magnets & Lenses PS Control

- SW control for PS of magnets, quadrupoles, steerers, etc
- EPICS based
- Prototype in commissioning since Nov. 2013
  - Daisy chain of six Danfysik PS + one steerer
- Deployment foreseen on June 2014
- New HW
  - Micro-IOC w/ EPICS in each PS

Beam Transport Automation

- Leverage EPICS and XAL to model RF cavities and beam optics (by experts)
- Interact with accelerator field controls
  - BPMs, LLRF controllers, lenses, etc
- Deliver a procedure to (at least partially) automate beam transport
- Investigation has started (post-doc position dedicated to the task)

Operator Interface



Summary

- No conclusions : *work in progress* !
  - Many tasks started in parallel
- Progress is constrained by “normal” maintenance & operation of existing accelerators
- Skilled manpower is crucial because training time on controls is remarkable (*obvious but true*)