IFMIF EVEDA RFQ Local Control System Integration into Main Control System

M. Montis[1], L. Antoniazzi[1], A. Baldo[1], M. Giacchini[1], A. Jokinen[2], A. Marqueta[3]

1. INFN-LNL, Legnaro, Italy   2. F4E, Barcelona, Spain   3. IFMIF-EVEDA, Rokkasho, Japan

The RFQ apparatus Local Control System built for IFMIF-EVEDA Project has been designed and realized for being both a standalone architecture and part of a more complex control system composed by different sub-systems. This approach lets RFQ's engineers and scientists have a degree of freedom during power tests in Legnaro and during the RFQ integration in IFMIF-EVEDA facility in Rokkasho. In this paper we will describe the different aspects observed when the LCS was converted from the standalone configuration to the final integrated one.

RFQ LCS – Power Test at LNL

Intent related to the Power Test

The final three modules had been tested at high power to verify and validate the most critical RF components of RFQ cavity and to test performances of the main ancillaries that will be used for the IFMIF-EVEDA project. These modules had been chosen due to the fact that they will operate in the most demanding conditions in terms of power density (100 kW/m) and surface electric field (1.8*Ekp).
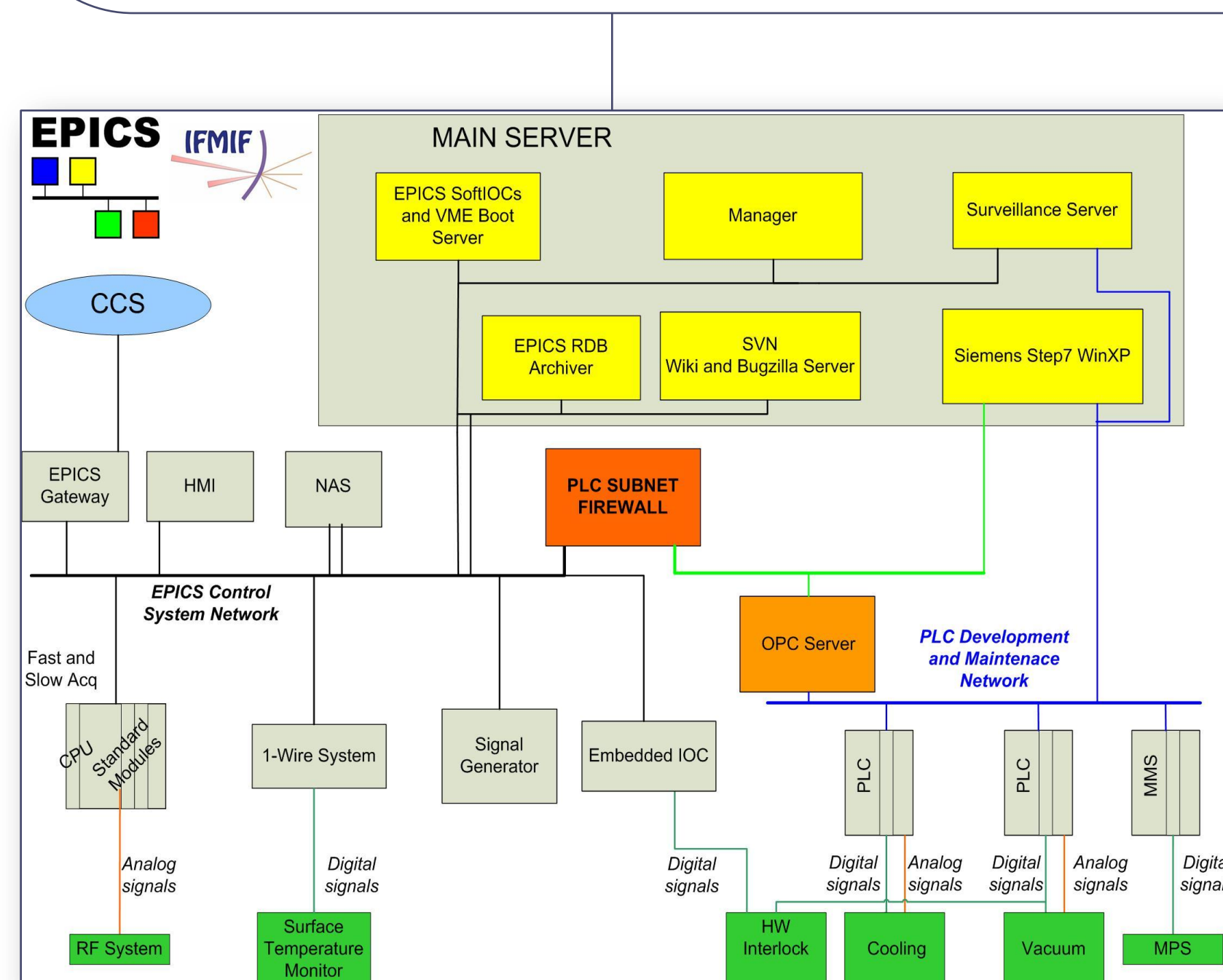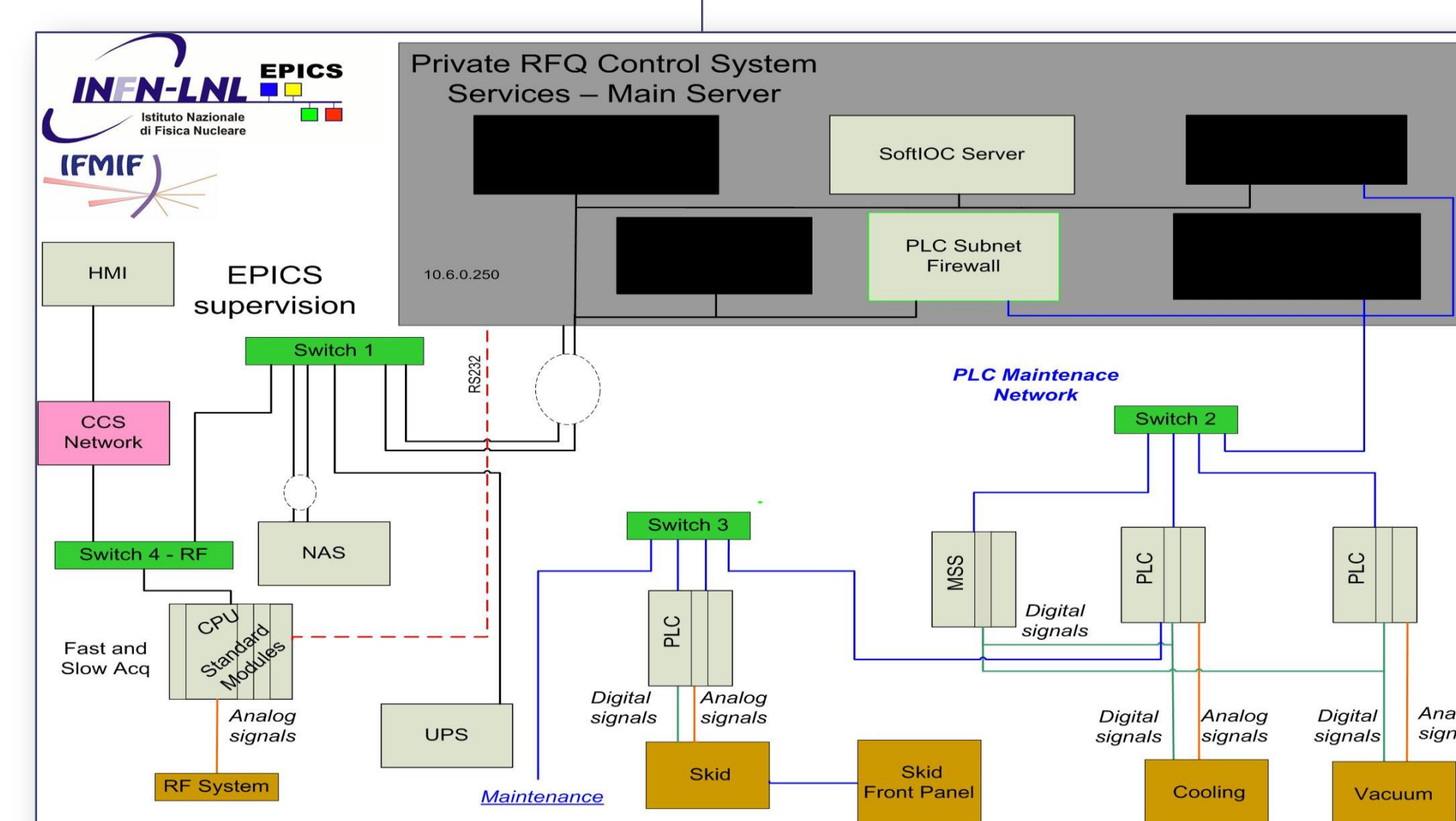

LCS Architecture:
- 3-layer architecture
- based on EPICS framework
- Design criteria:
  - PLC in sub-system where security is the most critical feature
  - VME where the acquisition speed rate is crucial
  - Common hardware or virtual host chosen when only integration is required
- PLC sub-system integrated in EPICS through OPC Server Technology
- KVM Virtualization

LCS and Power Test Preparation

Power Test Cubicles

Preliminary Measurements for the RFQ test bench

Control System Configuration

Power Test Execution
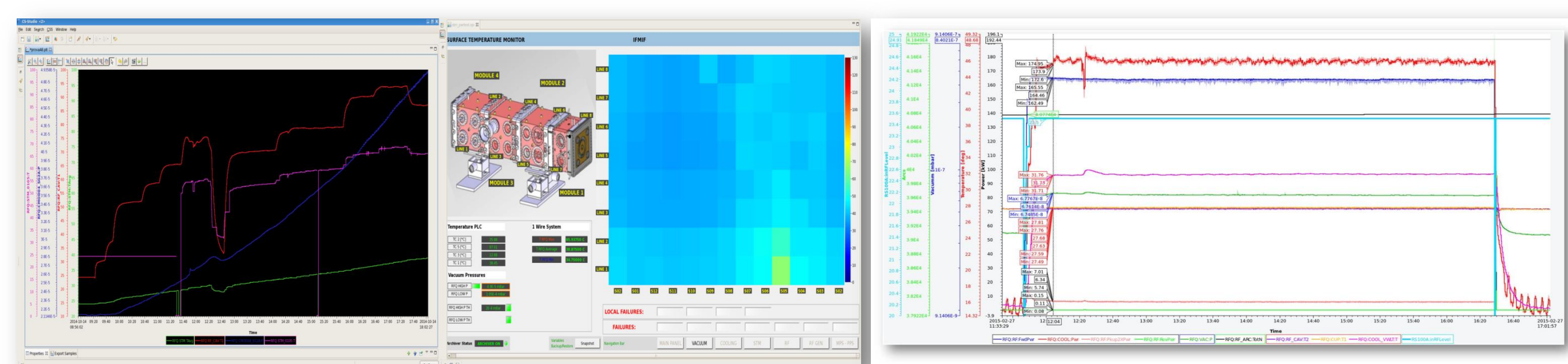
Control panel for surface temperature monitoring composing the HMI for the Power Test

Power Test successful completed after continuous operation at nominal voltage for more than 4 hours.

Power Test - Lesson Learned

- Freezing behaviour with OPC Server
  - → New solution based on s7PLC EPICS driver and dedicated sync method.
- RFQ LCS works properly as standalone architecture
  - → degree of freedom during commissioning in Rokkasho

RFQ LCS – Final Integration in LIPAc at Rokkasho

LCS Integration Stage

the RFQ LCS installation and integration has been made in different stages and following different configurations:
- A hybrid solution during the RFQ baking operation, where the LCS works as a standalone architecture, for the baking operation.
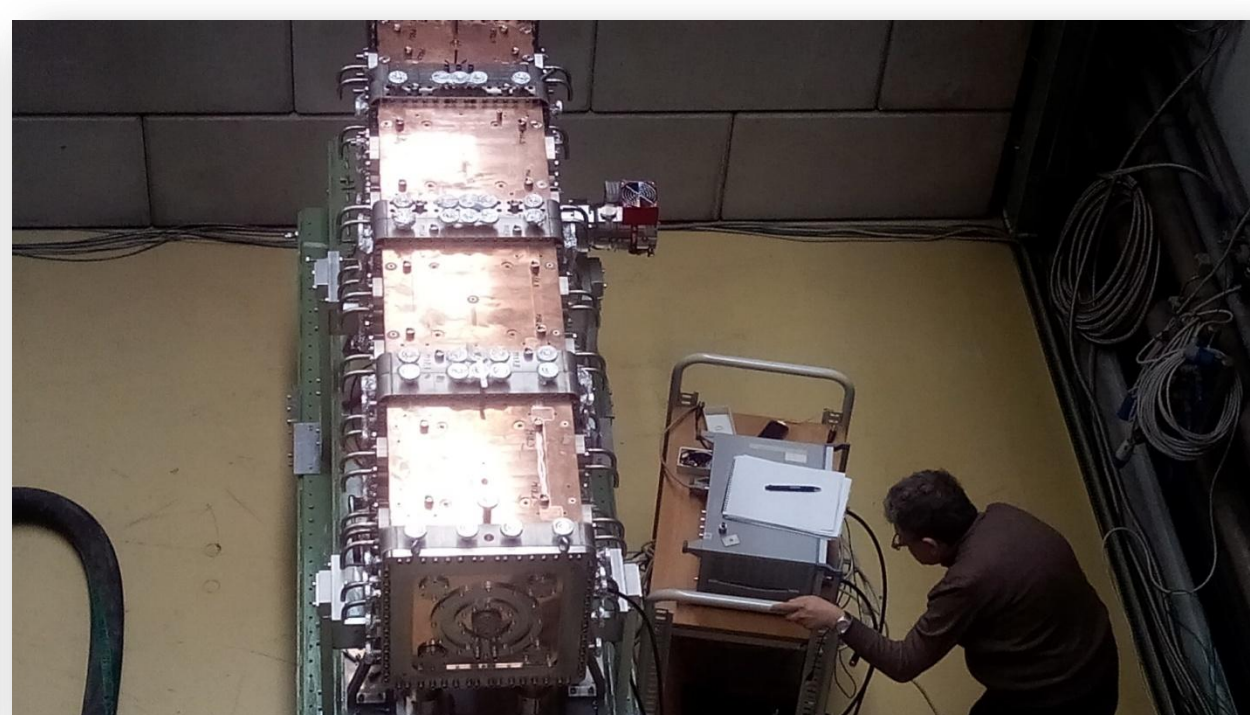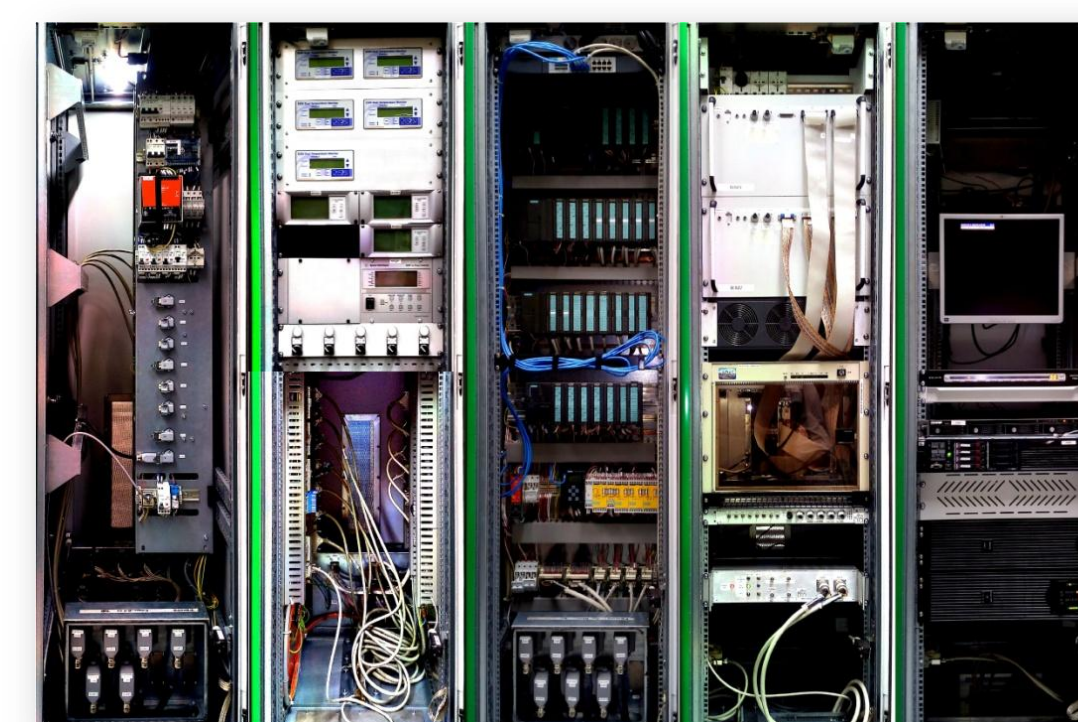- A fully integrated solution has been used for the RFQ conditioning and the final operational setup.

LCS Architecture- updates:
- PLC sub-system integrated in EPICS through s7plc EPICS driver
- PLC Firewall virtualized
- Cubicles and hardware interface to the apparatus redesigned
  - → optimize time for installation
- Network services available for preliminary operations (baking, etc.)
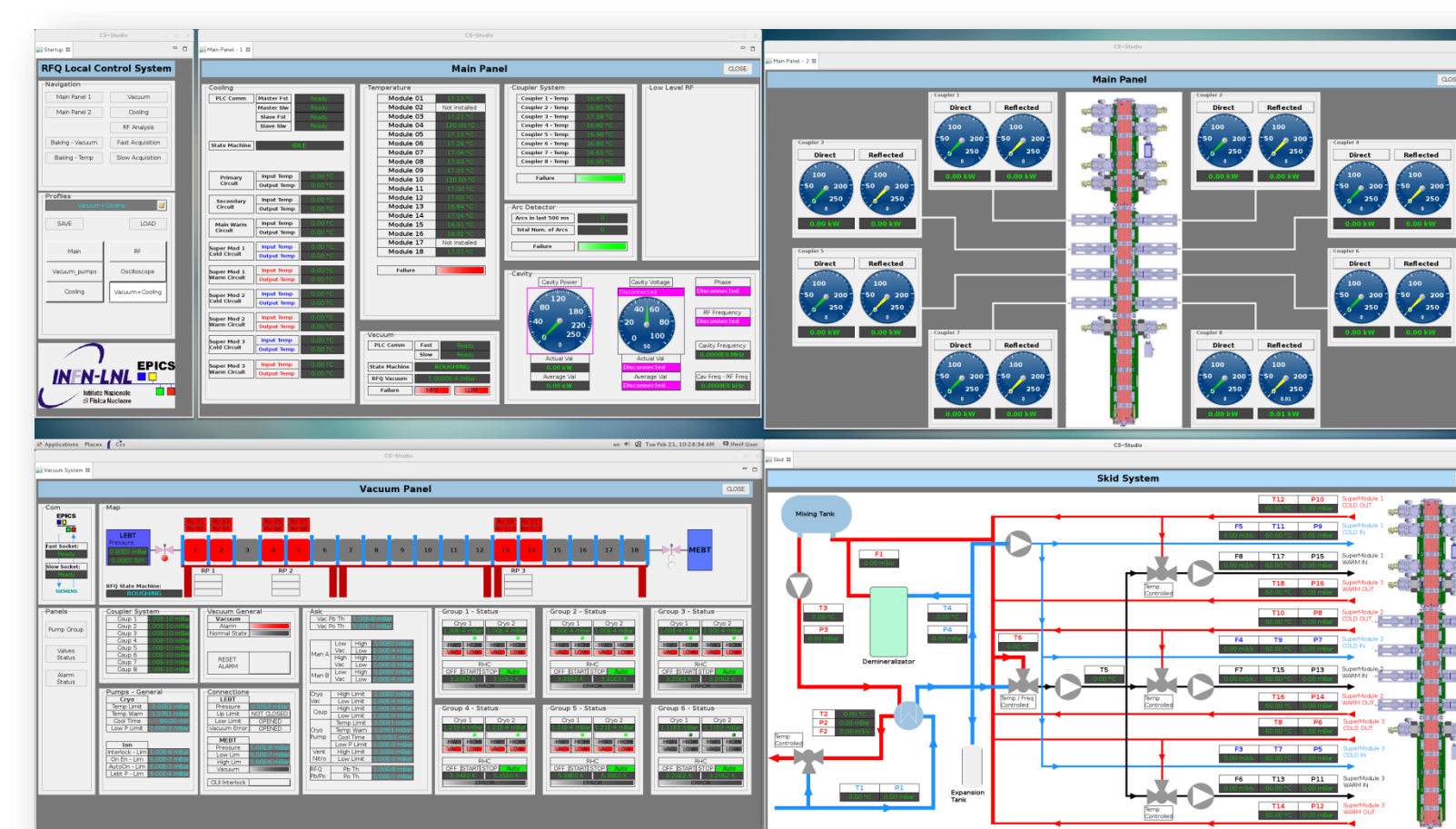
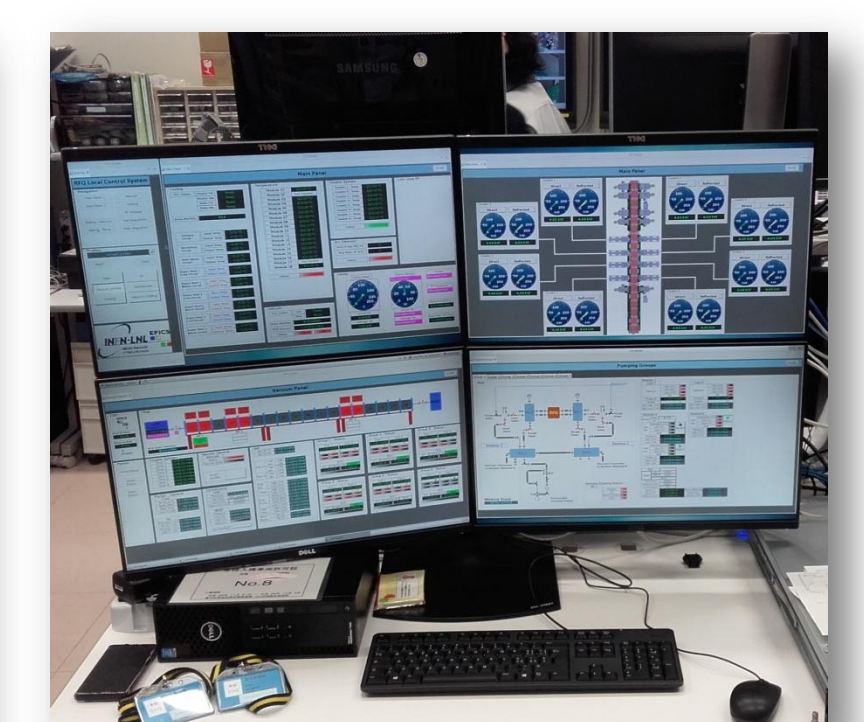### LCS Installation and Integration

Cubicles – final configuration

RFQ during RF cables calibration

Control panel developed in Control System Studio

4-monitor HMI installed for RFQ system

Comparison

Object:	Power Test:	Final System:
IOCs	6	4
Databases	17	25
EPICS Process Variables	1153	8852
Process Variables Archived	970	450
Control Panels	17	21

Conclusion

Technical solutions adopted during the design stage let us reduce time and effort during the installation and give us the degree of freedom of working as standalone system and as part of the entire IFMIF control system when required. Actually the system is fully integrated into the CCS and it is performing the first stage of the RFQ conditioning, and the results obtained by the formal acceptance tests and baking stage let us be confident in the good prosecution of the operations until the end of the RFQ commissioning.
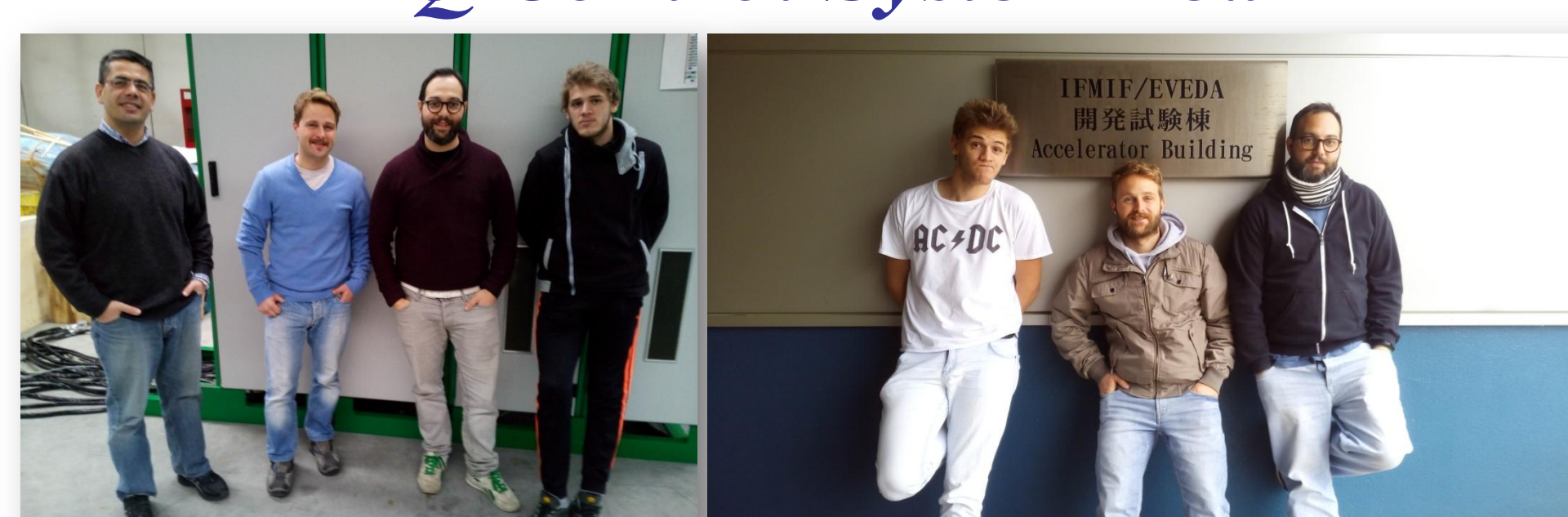
RFQ Control System Team

"The science of today is the technology of tomorrow" (Edward Teller)