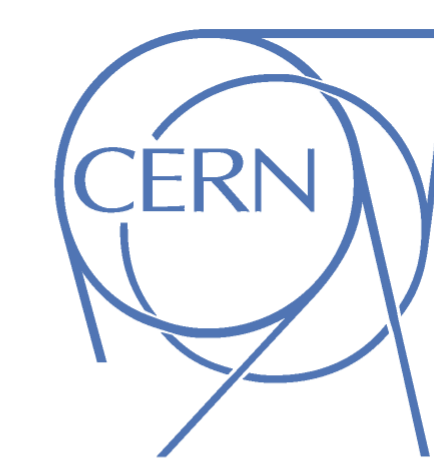


LHC MAGNET TEST BENCHES CONTROLS RENOVATION

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ABSTRACT

The LHC magnet test benches controls were designed in 1996. They were based on VME data acquisition systems, Siemens PLCs control and interlocks systems. After a review of renovation of superconducting laboratories at CERN in 2009, it was decided to replace the VME systems with a PXI based systems and the obsolete Sun/Solaris workstations with Linux PC's. This paper covers the requirements for the new system and shares the experience of the upgrade of the magnet test benches to these new platforms.

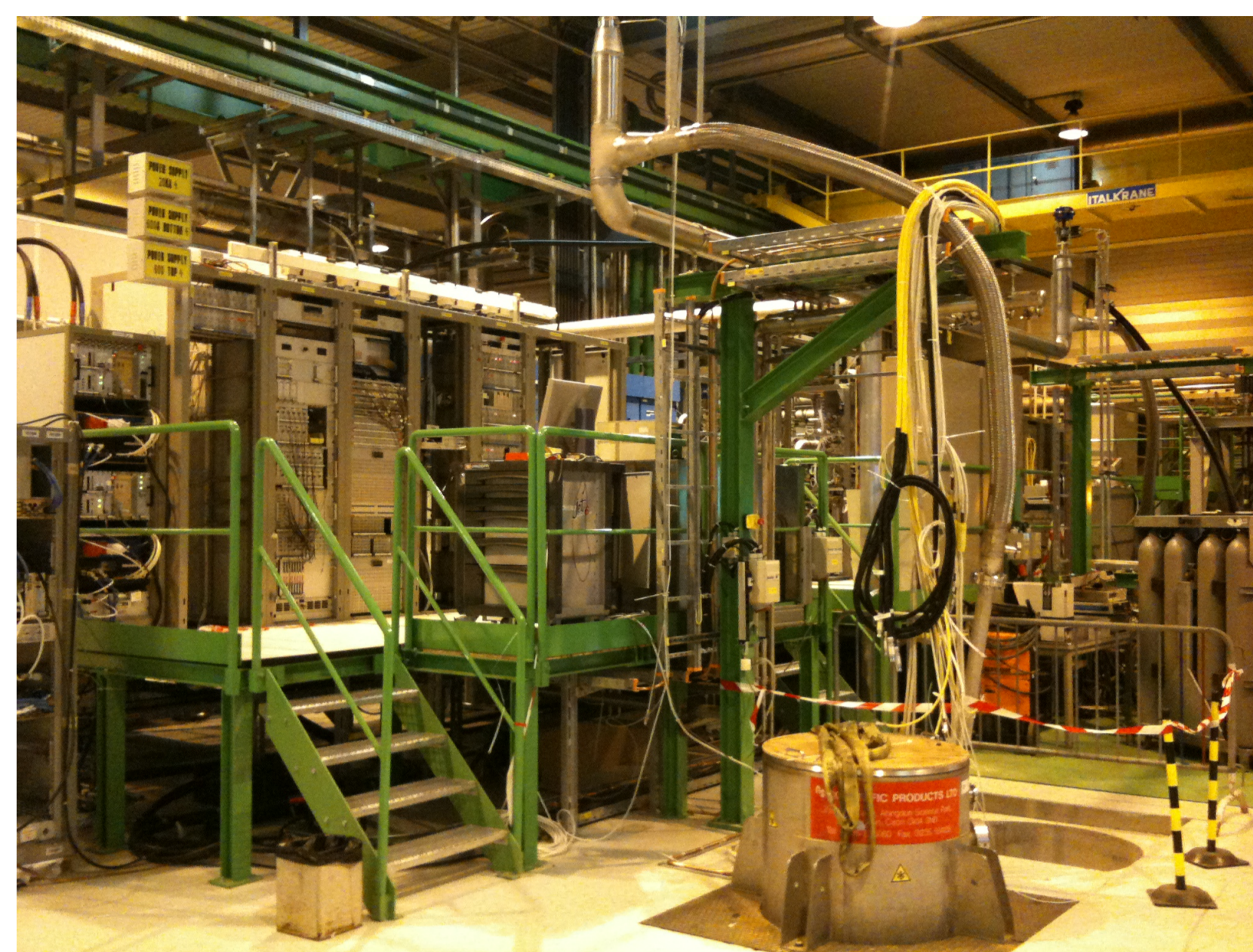
THE MERGED FACILITY

The new MTB facility was created in three main steps. First of all, the removal of the vertical test station from Block4 on the Préveessin site to the final site; then the modification of one horizontal test bench in order to allow testing the spares of the present inner triplets; finally the modification of one horizontal test bench to allow the testing of the new inner triplet magnets.

The old Block 4 facility



The vertical test benches



The vertical test station is now equipped with 4 cryostats of different dimensions for different purposes: 3 of them were used in the previous facility and a 4th, the biggest, is procured within the High Field Magnet (HFM) project for the FRESCA2 magnet.

The former protection and detection systems and the data acquisition system were obsolete and cannot be integrated into the new system. Therefore a new one has to be developed and installed in the same time with the new station.

The horizontal benches to test the LHC main magnets, such as dipoles and corrector magnets, will now share optimally the resources with the vertical benches.

The horizontal test benches



THE MEASUREMENT AND CONTROL SYSTEMS UPGRADE

Every power converter is controlled by a Function Generator Controller (FGC) that hosts the control software. Normally a set of FGCs is connected to the Control Middleware (CMW) via a gateway PC through a WorldFIP bus.

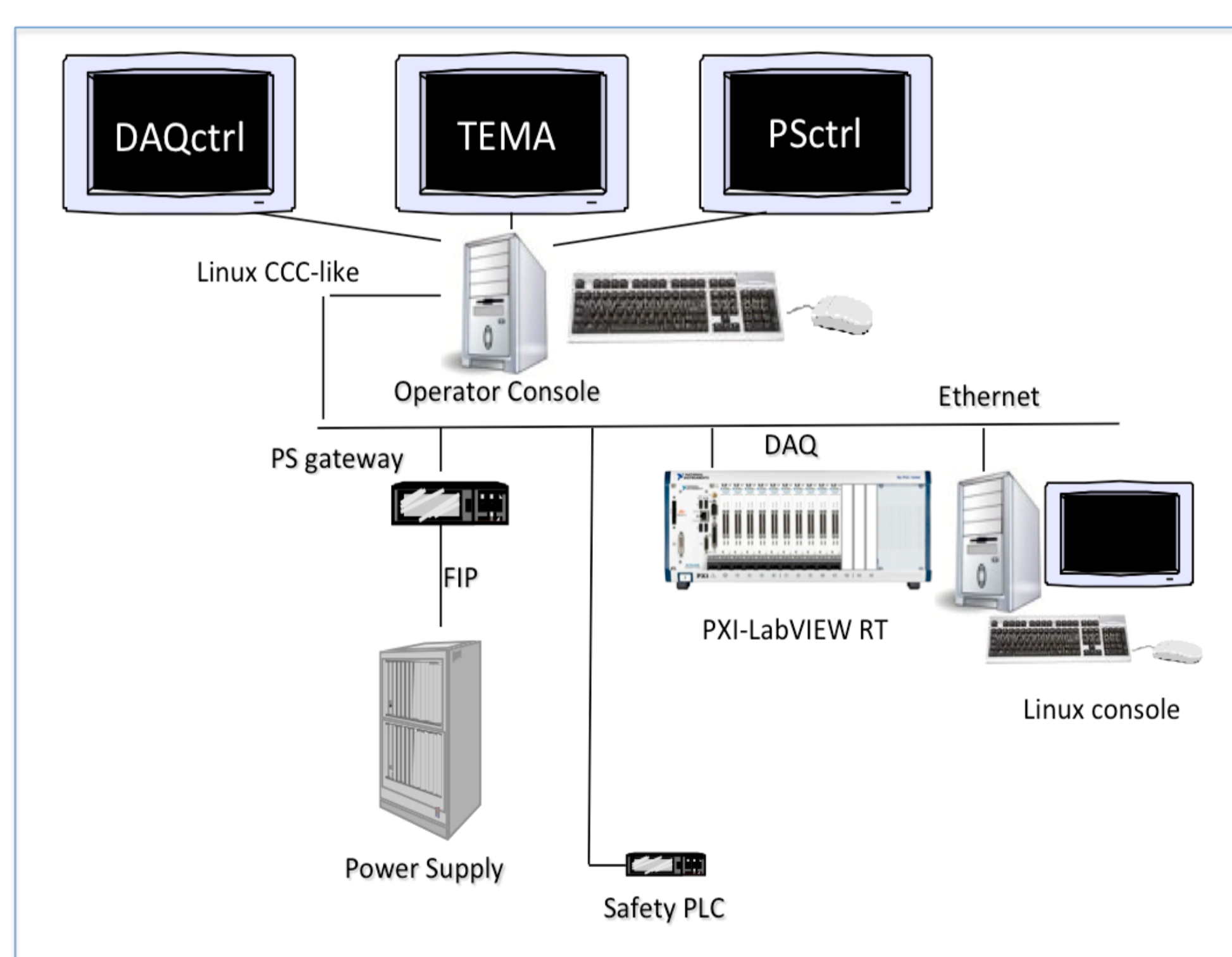
The upgrade of the building gateways was needed for the LHC software architecture (LSA) to directly control the power converters. This additional flexibility will probably be needed in the future.

The FGC upgrade was requested in order to have the "post mortem" data with the detailed executed current cycle or to investigate eventual problems offline in detail. Last but not least, it is worth to have the last electronic version (i.e. FGC2 interface) to control all converters for maintenance reasons and for the ongoing magnet control developments.

The Power Converter Control electronics



The Architecture



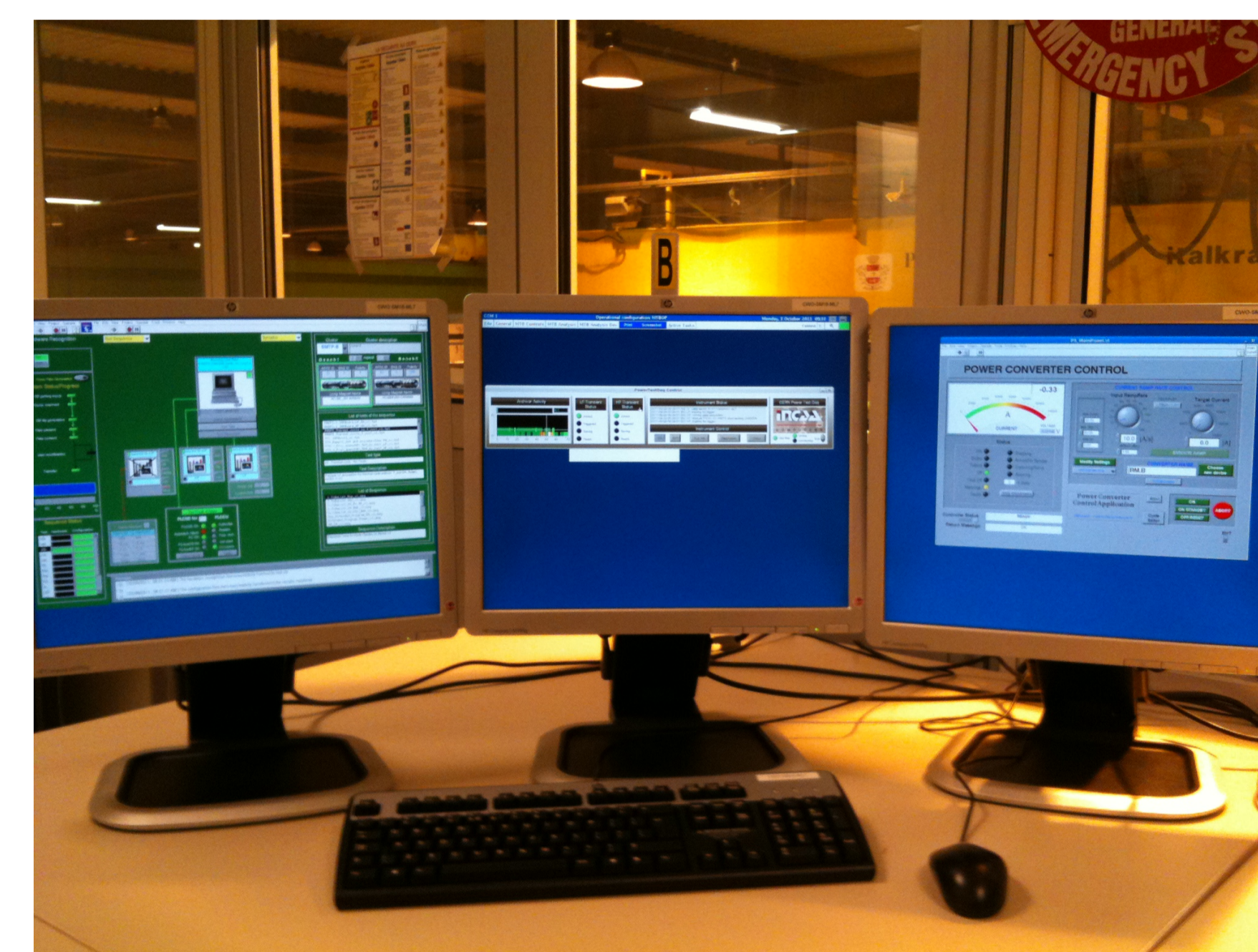
The first step of the upgrade of the Measurement Systems was to replace the existing VME based Data Acquisition (DAQ) system with a new one based on PXI hardware and LabVIEW RT.

A new architecture has been defined in our group and a prototype based on PXI has been built with the goal to test it on present LHC magnets and to qualify the solution to be applied on each horizontal bench and the vertical test station. The second step was to port the actual Test Master, the application that drives the sequence of tests, and Hardware Recognition, the application that allows to configure the electronics, on Linux with the addition of a DAQ control application.

The next step was to port the actual Power application on Linux to access all the Power Converters via the LHC Control Middleware using RADE from the control room. The new control room has become similar to the CERN Control Room.

On the three screen consoles; the middle one shows the Test Master window, which is equivalent to the sequencer for the LHC Hardware Commissioning, and on the left and right screens there are the DAQ and the Power Converter control applications.

The Three Screen console



CONCLUSIONS

The review of superconductors and magnet laboratories concluded the removal of the facilities of Block4 to SM18 site. Merging the two facilities allowed the creation of an integrated magnet test facility, adding to the existing horizontal test benches a vertical tests station for prototype magnets.

Thanks to the merging we started a renovation program to replace the obsolete VME DAQ and Solaris consoles with modern PXI RT and Linux consoles. In addition the update of the FGCs has made the MTB look like the "ninth" LHC sector from the control system point of view.

The renovation of the control architecture started end of 2009 and involved 3 FTE up to now. The upgrade went in parallel with the standard magnet test benches operations to keep the compatibility between the new and the old systems as they needed to run in parallel.

The upgrade has now been completed and all the test benches are now commissioned. Further improvements are ongoing until the end of this year.

