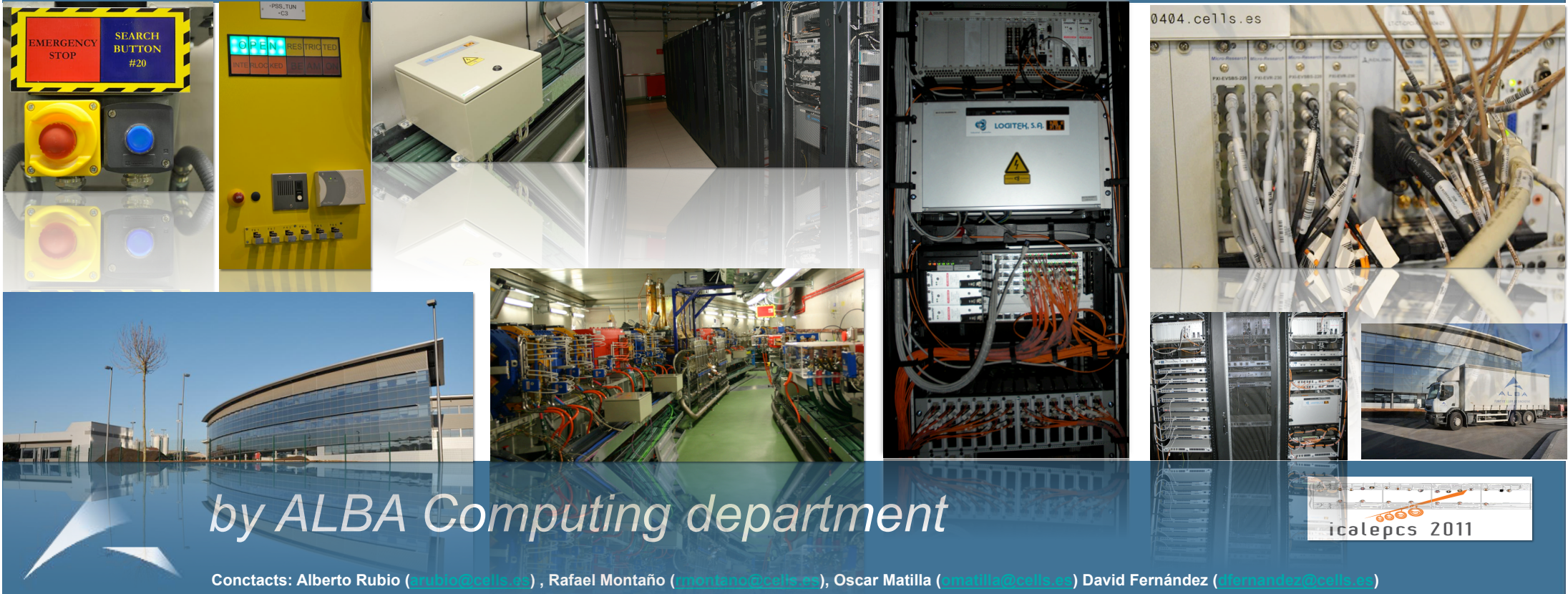


PERSONNEL PROTECTION, EQUIPMENT PROTECTION AND FAST INTERLOCK SYSTEMS AT ALBA



Contacts: Alberto Rubio (arubio@cells.es), Rafael Montaña (rmontana@cells.es), Oscar Matilla (omatilla@cells.es), David Fernández (dfernandez@cells.es)

PSS: Personnel Safety System

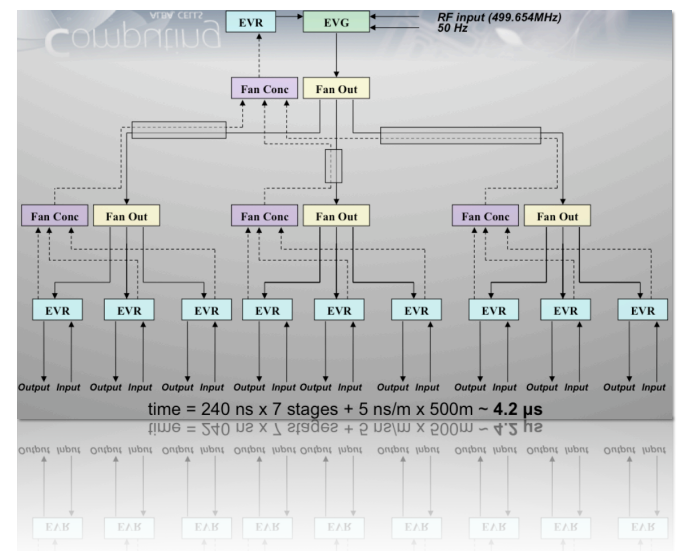
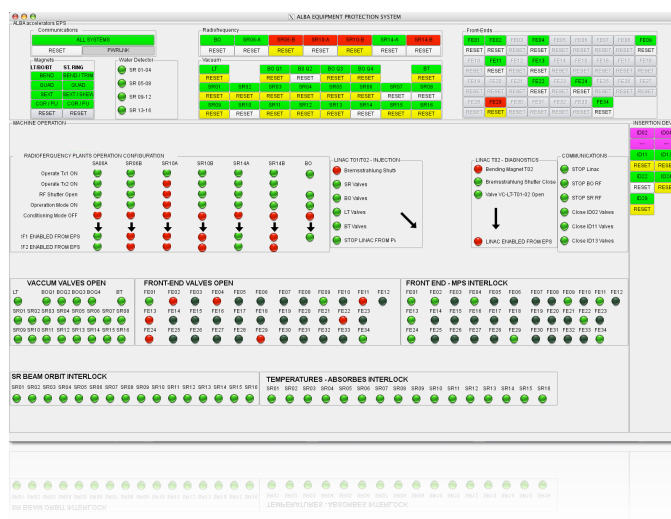
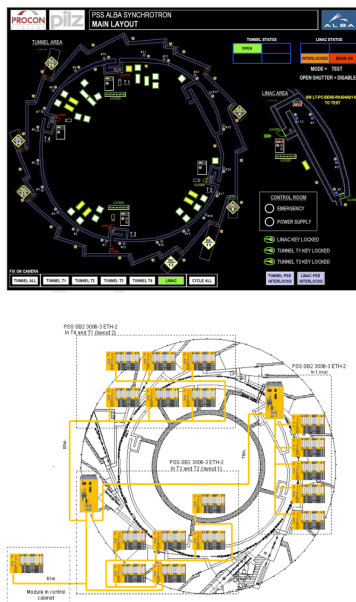
- The PSS is an independent system based on Pilz Safety PLCs.
- It prevents people from getting a radiation dose higher than the limits given by the law. It is subjected to Ionizing Radiation Regulations.
- It manages access to restricted areas, such as Linac, Tunnel and Beamline lead hutches, and surveys radiation levels.
- It is independent from any other system in Alba.
- It has been approved by the Nuclear Safety Council.

EPS: Equipment Protection System

- The Equipment Protection System (EPS) manages permits and interlocks avoiding damaging the hardware.
- It is responsible for all interlocks in the machine and the Beamlines.
- Cycle times are below 20 ms.
- It is built on B&R PLCs with CPUs installed in cabinets in the service area and distributed I/O modules installed in shielded boxes inside the tunnel and in the beamline hutches.
- CPUs and remote periphery are interconnected by the X2X fieldbus.
- A deterministic network, Ethernet-PowerLink, interconnects all CPUs to each other.

Fast Interlock System

- When an interlock signal is produced in the Beam Position Monitors (BPM), Radio Frequency plants (RF), and Front Ends (FE), it is transmitted back to an event-receiver adjacent to the event generator which redistributes the events to the whole tree.
 - The fiber optic links have all a fixed length, 200 meters, required for ensuring the precision in the synchronization events.
 - The time between the generation of one interlock event in one node, and the reception is in the order of 4.2 microseconds.
 - The fast interlock system provides accurate timestamps of each event (interlock), allowing a 8 nanosecond resolution in the discrimination of interlock-events for postmortem analysis.
- Ref: WEPM023. "The Alba Timing System". O. Matilla et al.
MOPMU023. "The MRF Timing System. The complete Control software integration in Tango". J. Moldes et al.



Conclusions

Nowadays, the PLC technology is used in a wider range of applications that traditionally were linked to other technology. Safety PLCs are today a common choice in the industry for high risk environments where a failure might have many people killed, like trains, etc. Also, standard PLCs are cheaper, smaller and more powerful and we found a large variety in the market today. A distributed system combining Ethernet (used as a fieldbus) and a proprietary X2X fieldbus is proven to be cost-effective solution. Periphery can be closer to the devices, making cabling easier and cheaper. Where the required response times are several microseconds, a solution with PLCs is not viable anymore. Those cases are often a reduced subset and can be accomplished with "ad-hoc" solutions. For this particular case, the upgrade of the Timing system, to support bidirectional links for implementing fast Interlocks, took place. It was proposed by Alba and Implemented and made available in the market by MRF.

Contributions

Many people have worked in these projects, in particular we would like to thank X. Queralt, the Safety Officer, A. Camps, S. Marchal, B. Saló, J. Jamroz (electronics group) and the whole controls group. Also, special thanks to P. Berkvens, the safety officer of the ESRF, for his help and his advises with the PSS logic. The EPS is one of the most important customers of the cabling database, developed and maintained by CELLS Management Information System group, especially I. Costa and O. Sánchez.

D. Fernández-Carreiras, D. Beltrán [on leave], J. Klor, J. Moldes, O. Matilla, R. Montaña, M. Niegowski, R. Ranz [on leave], A. Rubio, S. Rubio-Manrique, CELLS, Cerdanyola, Barcelona, Spain

