SAFETY REQUIREMENTS IN SPES CONTROL SYSTEM: PRELIMINARY DESIGN

G. Bassato, A. Andrighetto, L. Costa, M. Giacchini, Minglong Li#, G. Prete, J. Vásquez*
INFN, Laboratori Nazionali di Legnaro, Viale dell' Universita' 2, 35020 Legnaro PD, ITALY
#on leave from China Institute of Atomic Energy, Beijing 102413, PRC
*on leave from Universidad Simón Bolívar, Caracas, Venezuela

The SPES project at LNL

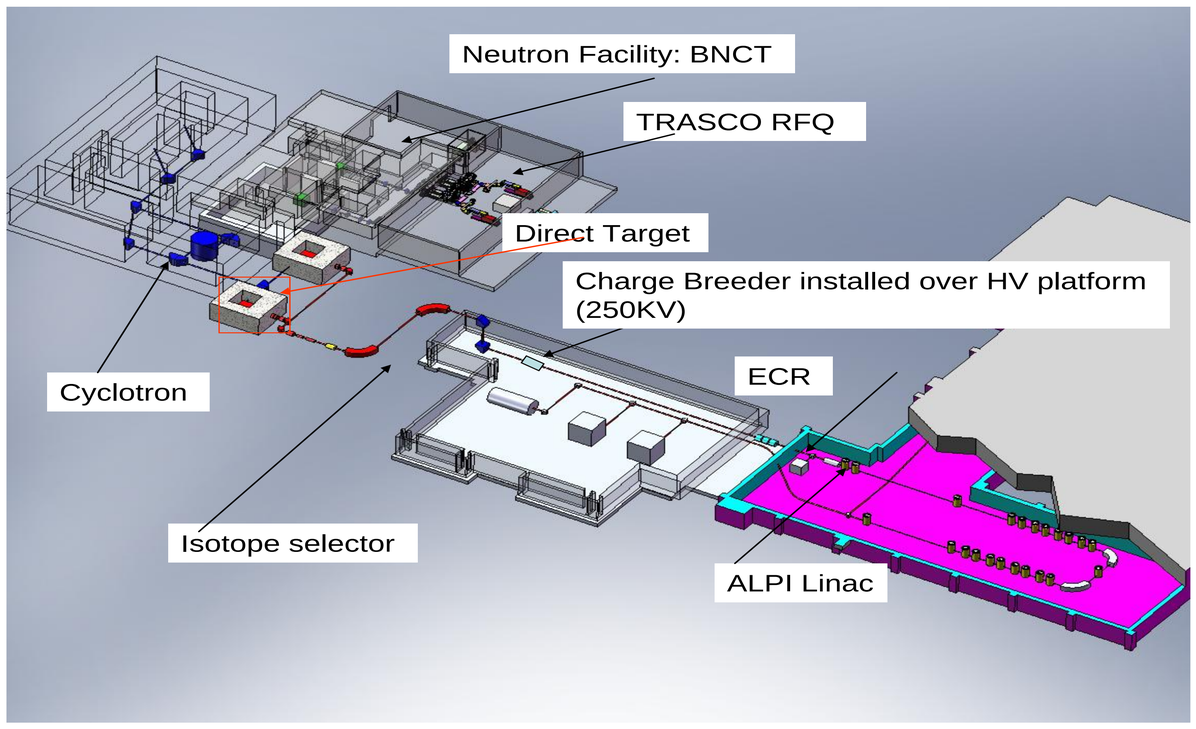

Fig. 1: SPES layout

Selecting technology for safety

PLCs used for safety applications.
Fault tolerance required in most cases.
High reliability PLCs (i.e. Siemens series F) are considered for vacuum control, cooling systems, personnel access control.
Redundant configurations are mandatory for radiation monitors, cooling and venting systems in the target area, fire detectors, machine protection systems.
No brand chosen at this moment, Siemens and Schneider are both candidate.

Which architecture for fault tolerance?

"Software redundancy backup" tested for slow controls: good solution if a latency of a few seconds can be tolerated (Fig.2).

Full Hardware Redundancy (i.e. Siemens series S7-400-H) required for fast controls.
Pro: highest availability Contro: high cost

SPES Control System

Based on EPICS: different PLC technologies will be integrated under the Channel Access protocol.
Supported PLC families will be interfaced using Windows based IOCs[2].
PLCs not supported by a direct driver will be integrated trough an OPC server[3].

EPICS IOCs based on either Linux PCs or embedded devices will be widely used for control of accelerator's instrumentation and replace VME crates in many applications.
VME + Vxworks still used for beam diagnostics and where there is demand for deterministic response.

No decision taken about the general supervisor:
EDM in use for fast prototyping, LabView used in some applications [4].
CSS [5] evaluation will start soon.
PLC based systems delivered as turn-key or legacy installations will maintain their native supervisor for local operation (Fig. 3).

EPICS Channel Archiver used as archiving tool of the overall facility.

Phase 1: Radioactive Ion Beam facility [1]

Proton driver: cyclotron (40 to 70 MeV, 250 μA)
Target: Ucx, direct type, thin, multidisk
Power on target: 8 KW
Isotope separator + charge breeder
The Linac ALPI used as re-accelerator
Status: funded, construction scheduled from 2010

Phase 2: Neutron Physics facility

Medical applications: BNCT
(Boron Neutron Capture Therapy centre)
LENOS (material irradiation and interdisciplinary Physics)
Accelerator used: high current RFQ (5Mev, 30mA)
Status: waiting for fundings

Safety Concerns

Activity level expected in the target area: 10^{13} Bq
High Availability demand for control devices used in the radioprotection and machine protection systems.

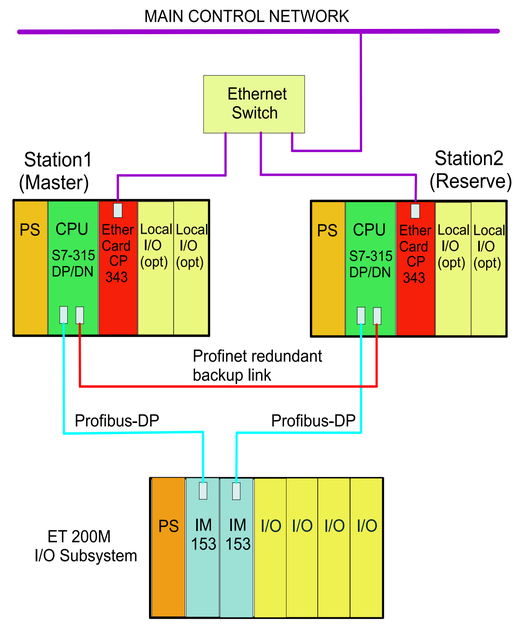

Fig. 2: Test of a redundant configuration based on "software backup. Master to Reserve switching takes 2 secs (Processors: Siemens S7-315DP)

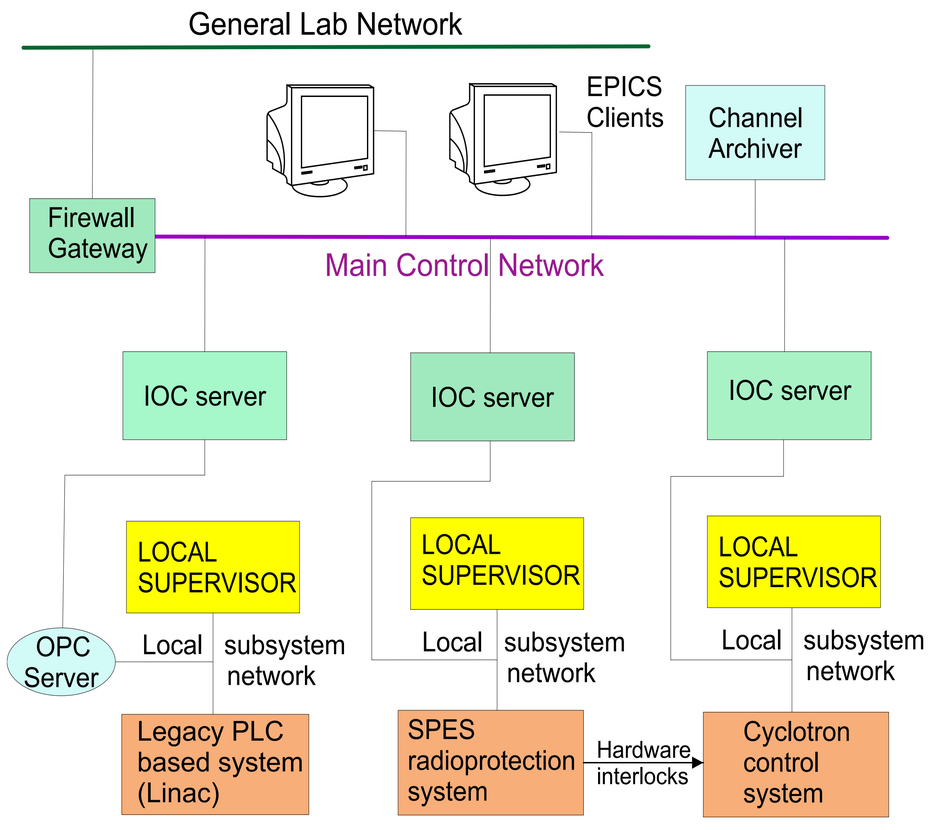

Fig.3: Integration of PLC based systems in the EPICS network

References

[1] http://www.lnl.infn.it/~spes/tech_design_2007
[2] http://epics.web.psi.ch/software/s7plc/
[3] http://www-csr.bessy.de/control/SoftDist/OPCsupport/
[4] M. Giacchini et al., The Control System of SPES Target: Current Status and Perspectives [this Conference]
[5] http://css.desy.de/content/index_eng.html