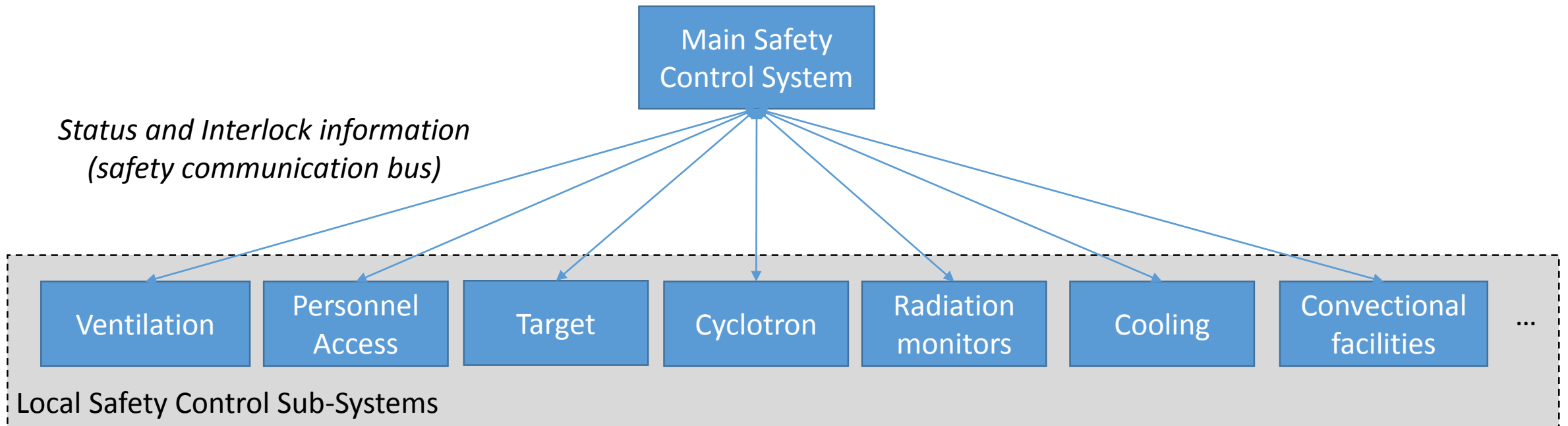


Temporary Safety Control System for the SPES Commissioning and SAT

Jesus Vasquez

Why a Temporary Safety Control System?

The SPES Final Safety Control System (Simplify Layout)



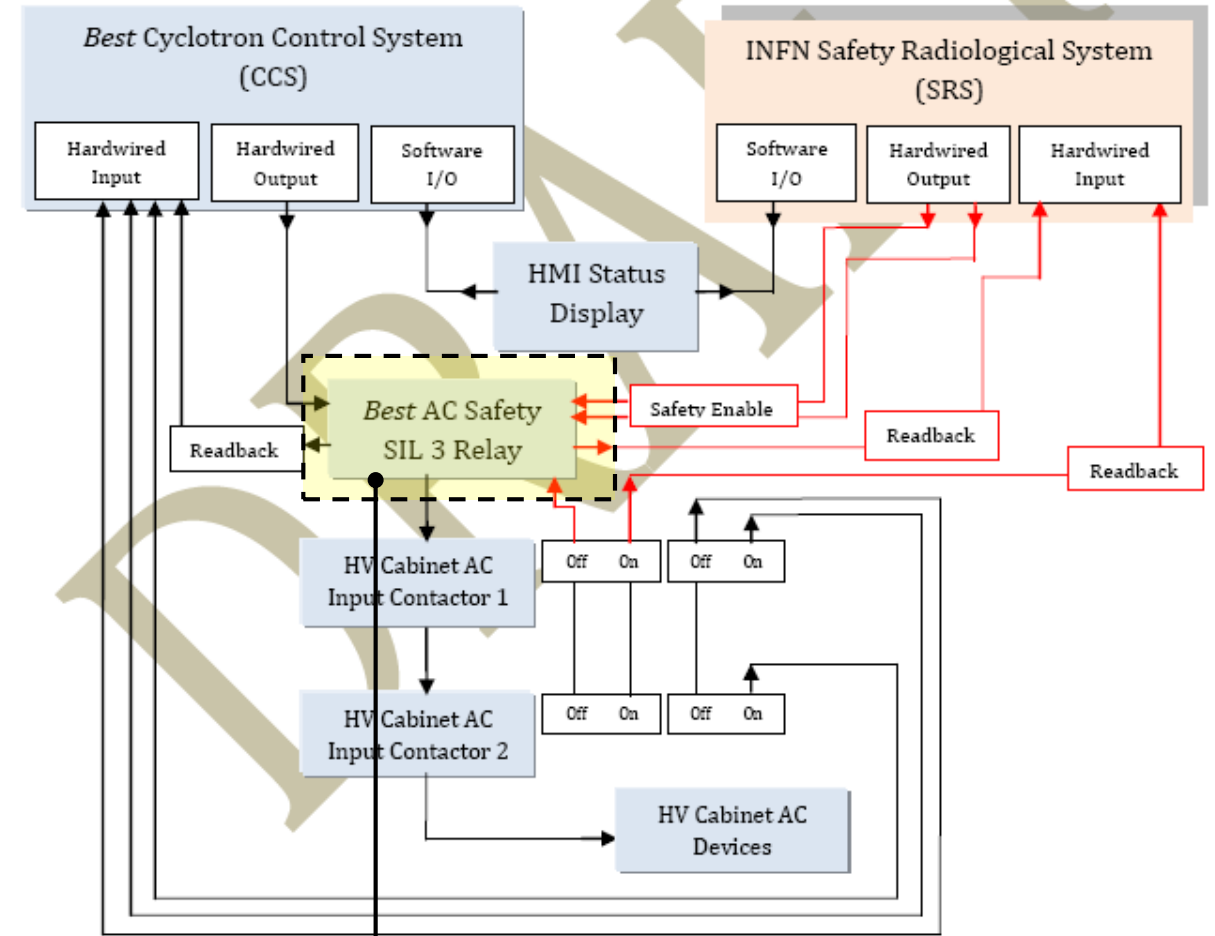
- Require a detailed risk analysis and system designing
- It is still a work in progress
- Will not be ready for the SAT

Temporary Safety Control System

- Temporary safety control system only for allowing the SATs
- Includes only the essential sub-systems necessary for the SAT
- Uses a conventional PLC, with redundant sensors and actuators
- A Graphical User Interface (GUI) will be available for status visualization, operator actions, alarm handling, local data archiving, user authentication,...
- The PLC implements the logic for controlling:
 - Cyclotron Safety Critical Beam Control Devices
 - Personnel Access
 - Emergency stops
 - Cyclotron Maximum Beam Current Limiter
- The PLC reads the status of external safety control systems:
 - Ventilation
 - Beam Dumper
 - Radiation monitors
- The PLC determines the general status of the system and enable/disable the cyclotron accordingly

Cyclotron Safety Critical Beam Control Devices

- Used to Enable/Disable the cyclotron beam
- Based on hardwired SIL3 relays
- Installed by BEST and controlled by INFN
- 5 independent systems (each one stops the beam)
 - HV cabinet AC
 - Bias supply HV grounding
 - Inflector supply HV grounding
 - ISIS Beamstop
 - ISIS gatevalve
- An additional E-STOP system

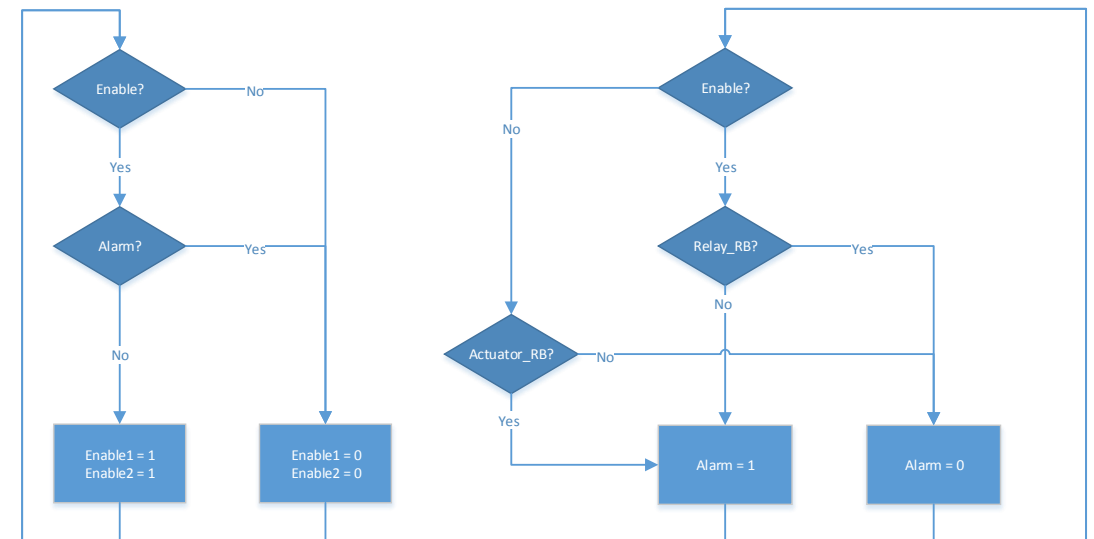
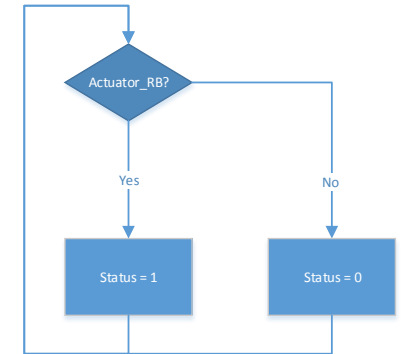
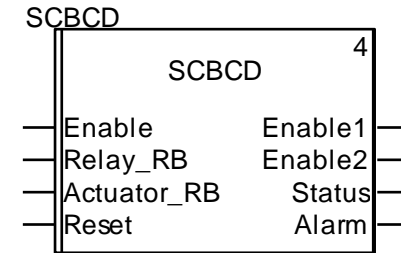


Control signals:

- 2 Enable
- 1 relay readback
- 1 actuator readback

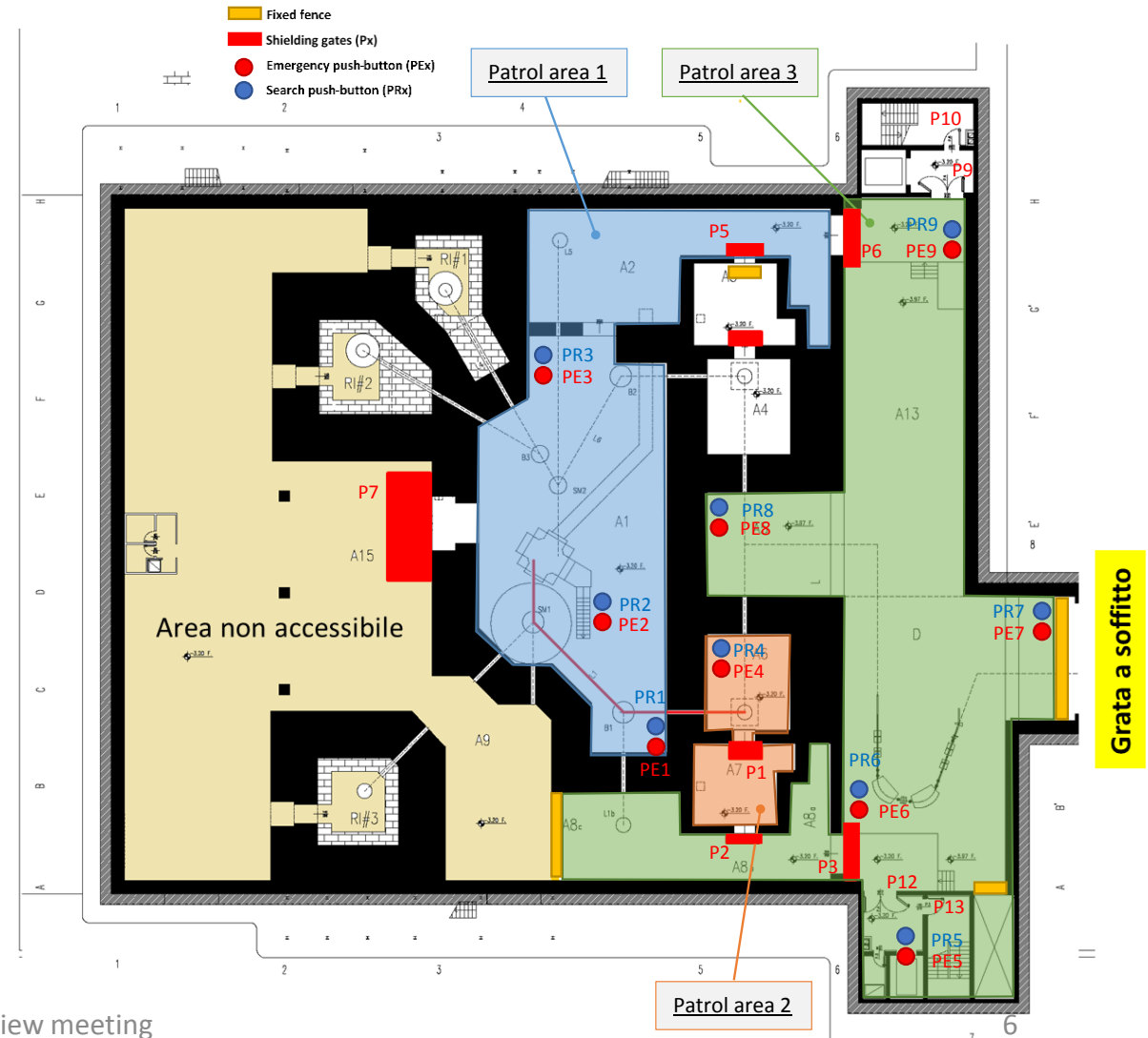
PLC software for the SCBCD

- Generates the enable signal for each SCBCD based on the general status of the system
- Verifies the consistency between the enable and readback signal for each SCBCD, detecting eventual malfunctions
- Allow the operator to reset alarms
- Presents the status on the GUI



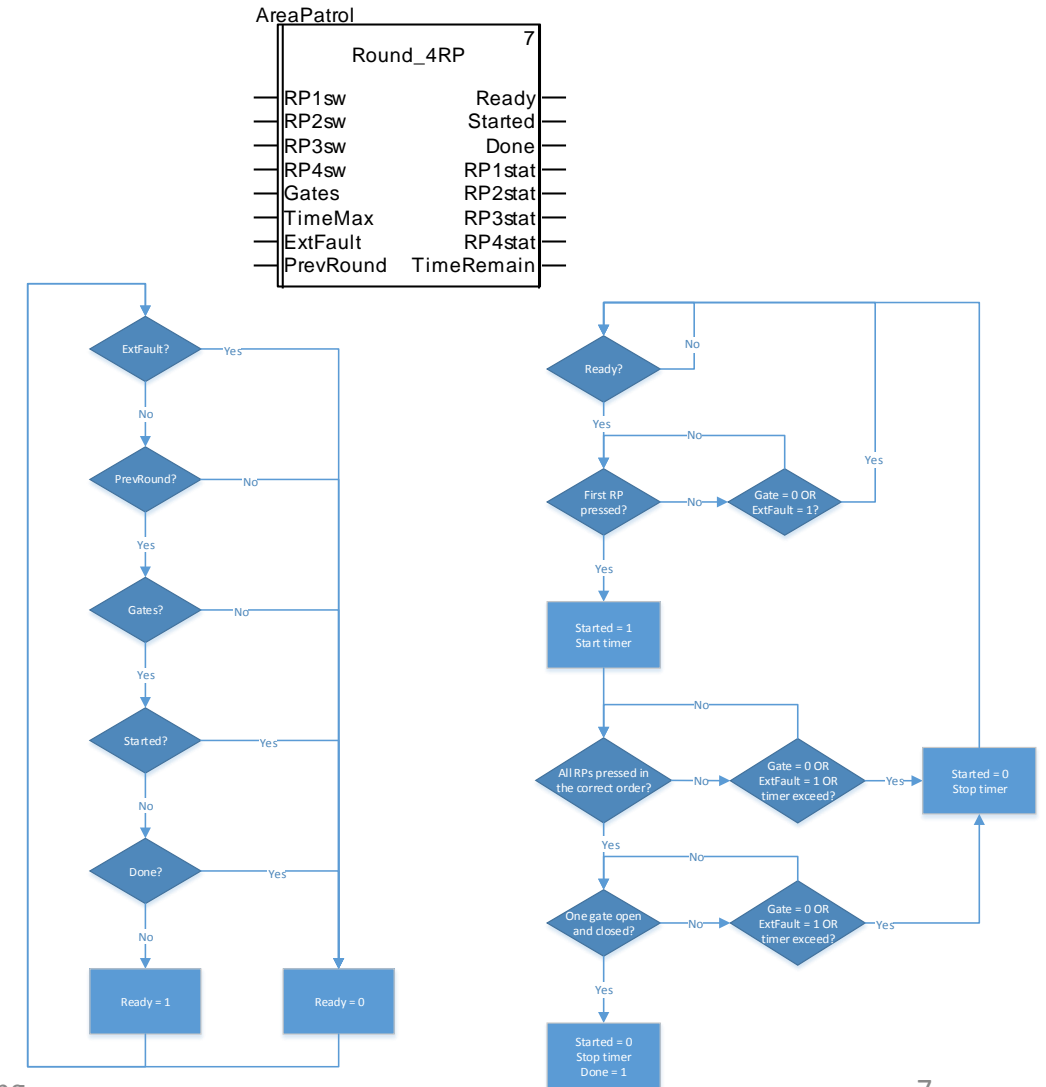
Personnel Access Control System

- Only some areas will be accessible during the SAT
- 3 controlled areas with patrol sequences
 - 10 gates
 - 9 search push-buttons
 - 2 light signaling panels
- All area must be cleared to extract the beam



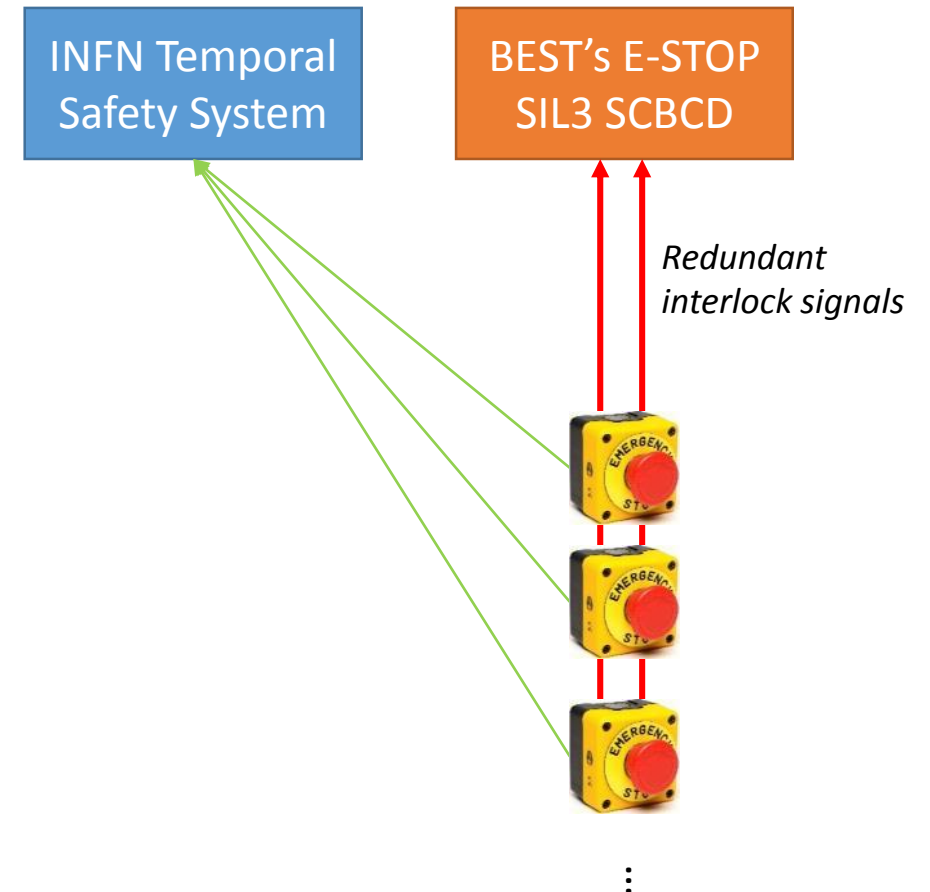
PLC Software for the Personnel Access

- Controls the correct patrol sequence for each area (gate status, order of search button sequence, maximum sequence time, among other)
- Verifies the consistency of the gate limit switches, detecting eventual malfunctions
- Presents the status on the GUI



Emergency Stops

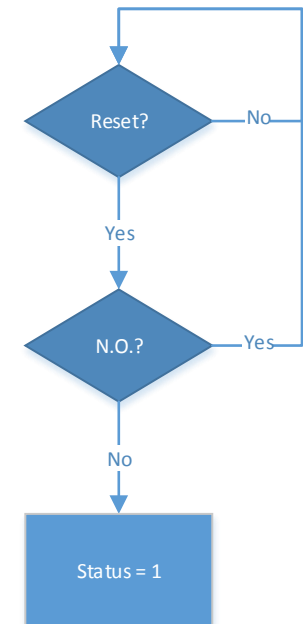
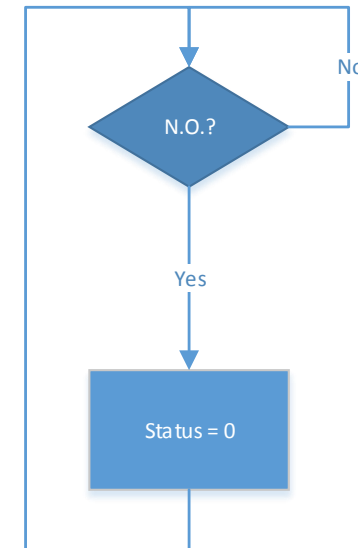
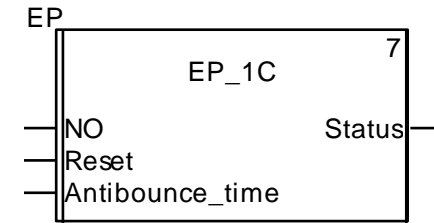
- 10 emergency stop push-button installed on different areas of the facility
- 2 contacts wired in series into the Cyclotron E-STOP SCBCD
- 1 contact individually wired into the temporal safety system
- Pressing any push-button will stop the beam



PLC software for the E.P.

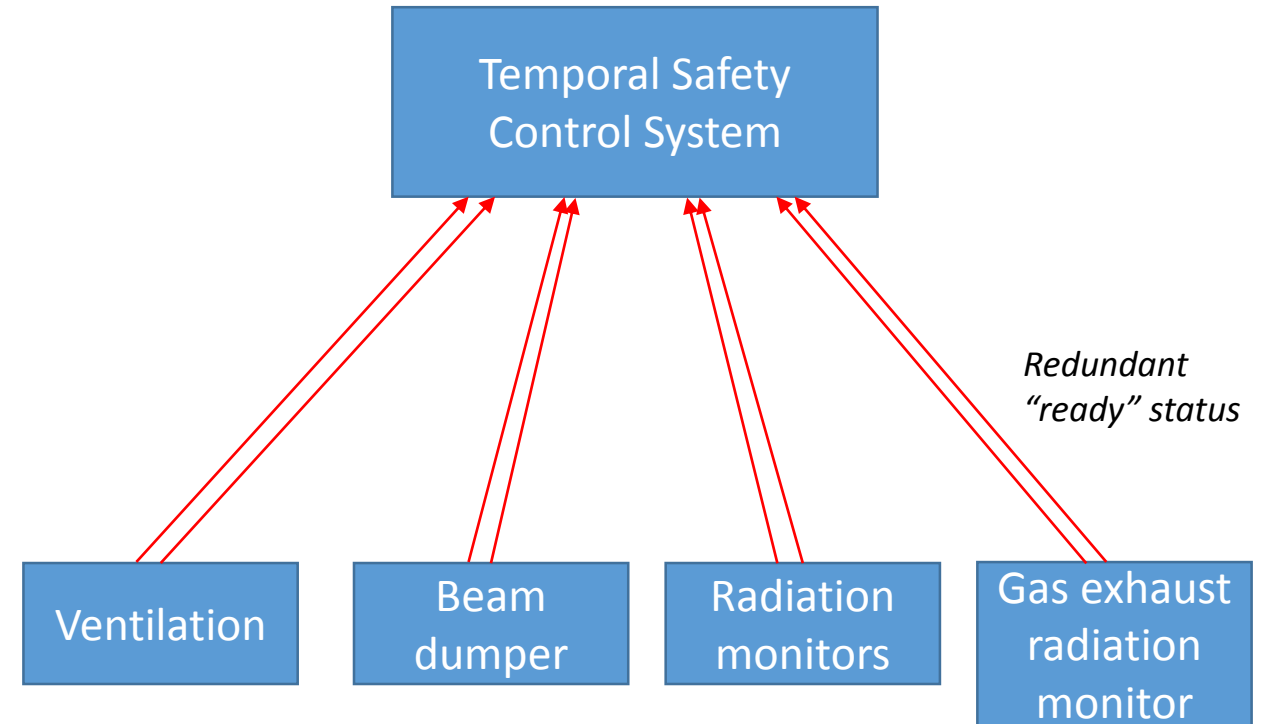
- Identify which push-button was pressed and shows it on the GUI
- Allows the operator to reset the status

(The safety function is performed by the SIL3 relay)



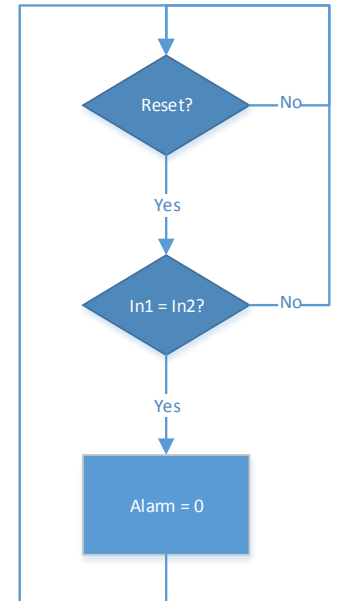
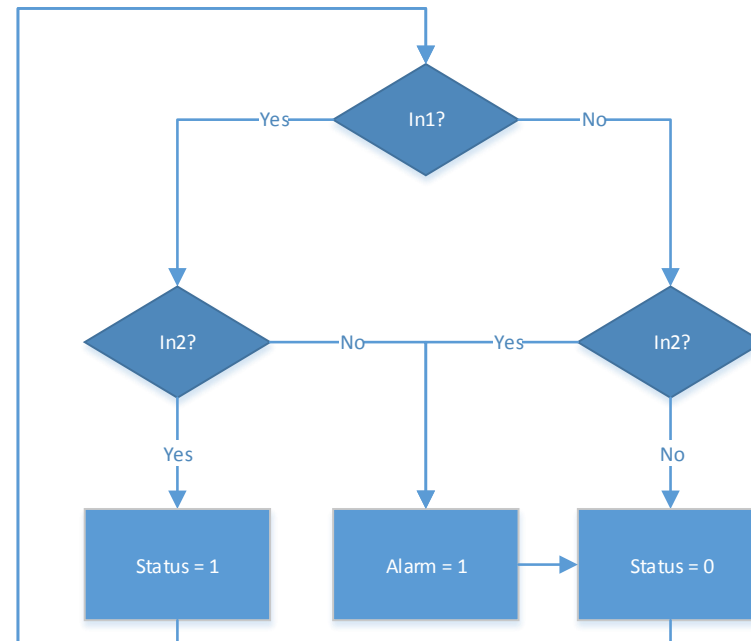
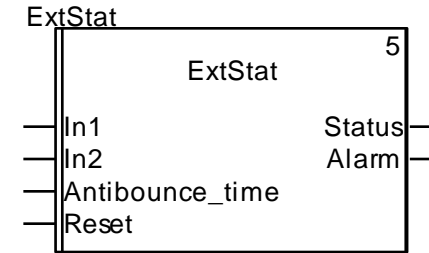
External Safety System Status

- Redundant “ready” signal from other systems
 - Beam dumper
 - Ventilation
 - Radiation monitor
 - Gas exhaust radiation monitor
- All “ready” signals necessary to extract the beam



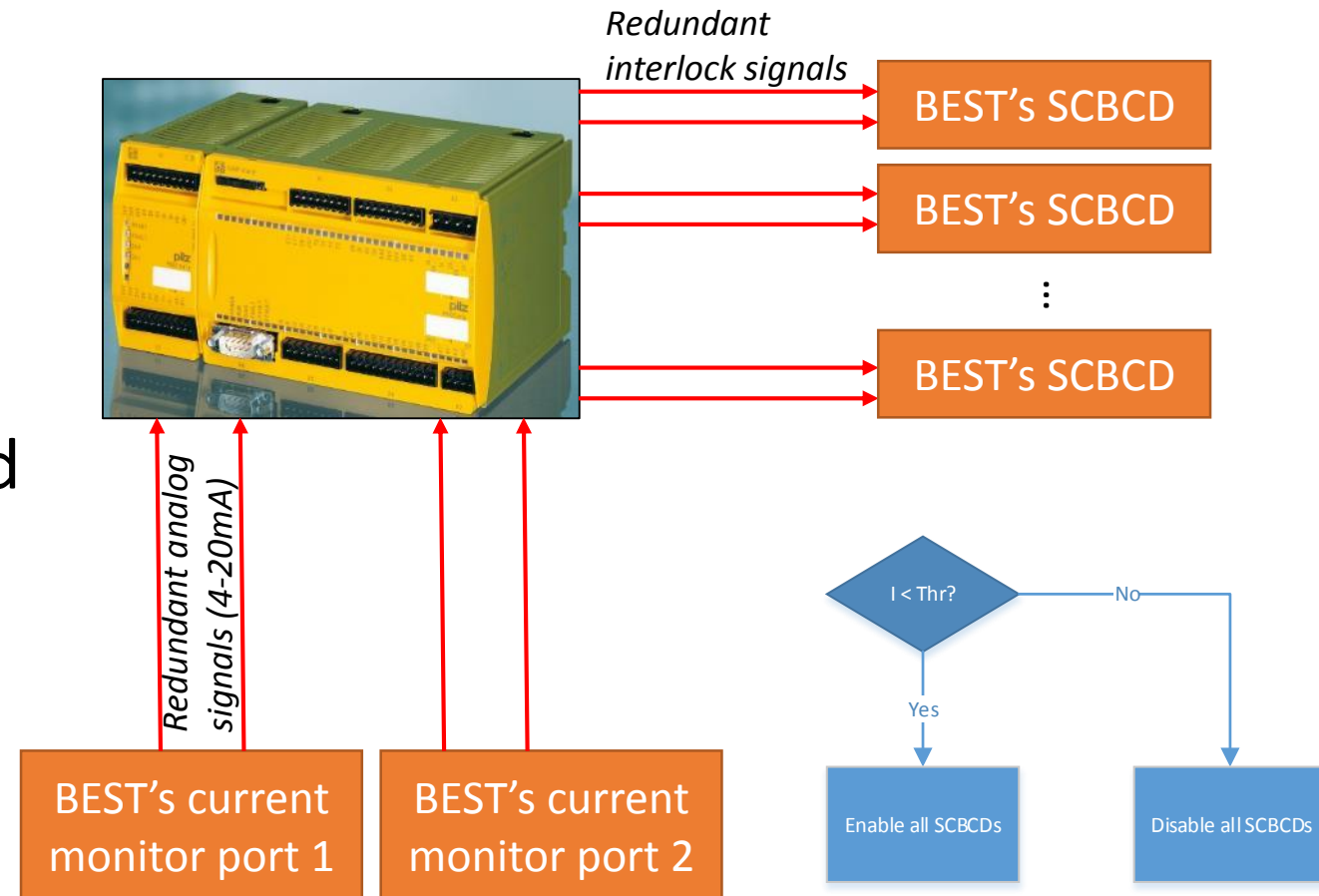
PLC software for the external system status

- Verifies the consistency of the redundant signals
- Allows the operator to reset alarms
- Presents the status on the GUI

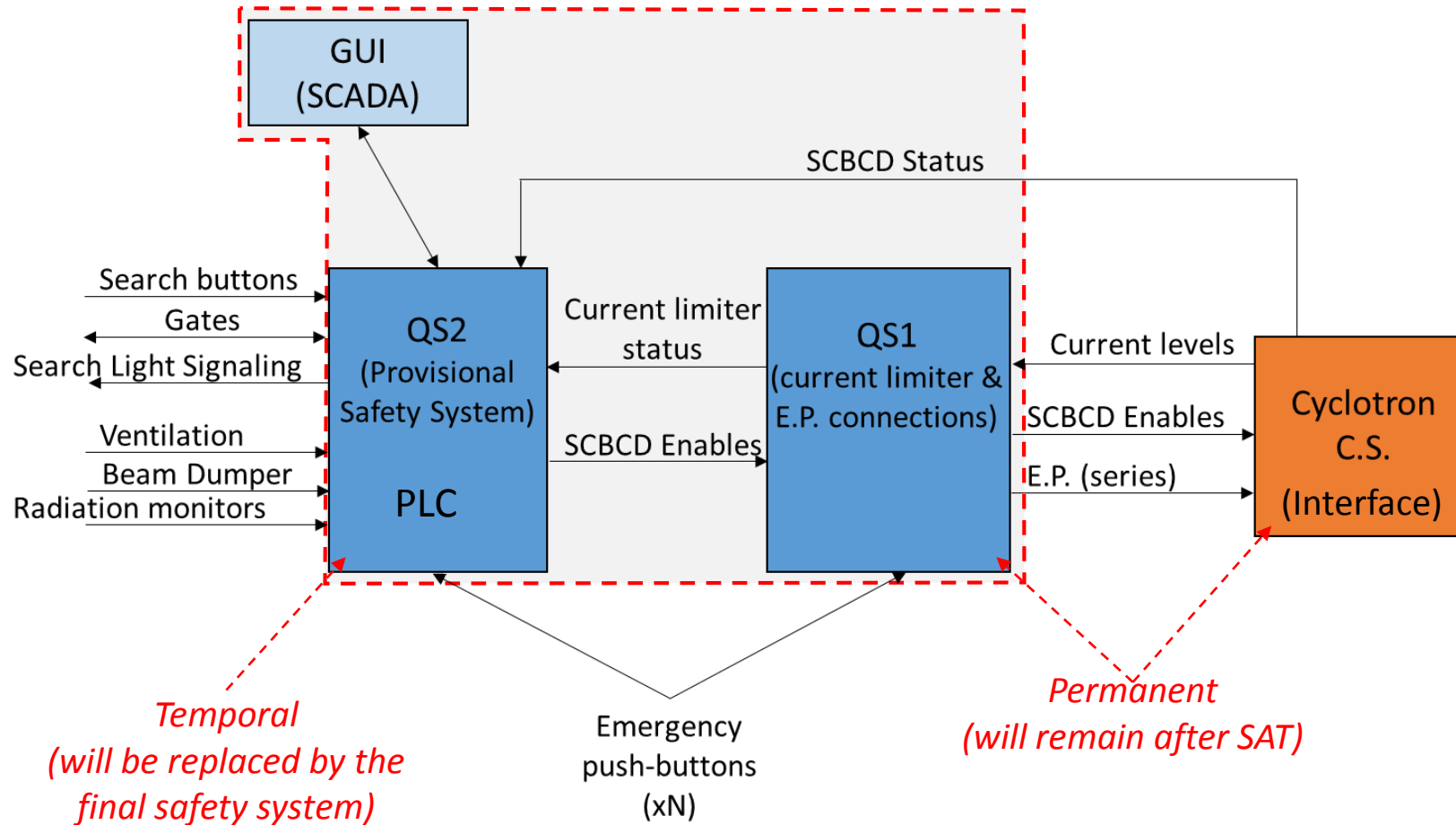


Cyclotron Maximum Beam Current Limiter

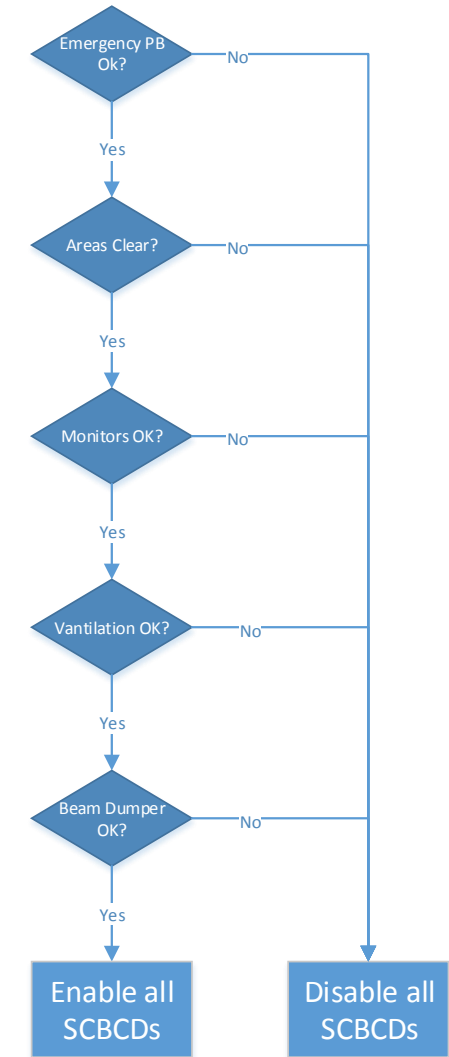
- Independent from the PLC (as requested)
- System based on PILZ's SIL3 certificated configurable safety systems (PNOZmulti)
- Reads analog current level, verify consistency, compare with threshold and generate interlocks
- Interlocks all 5 SCBCD
- The PLC will read the status of this system and presenting on the GUI



Temporary Safety Control System Layout



General PLC logic



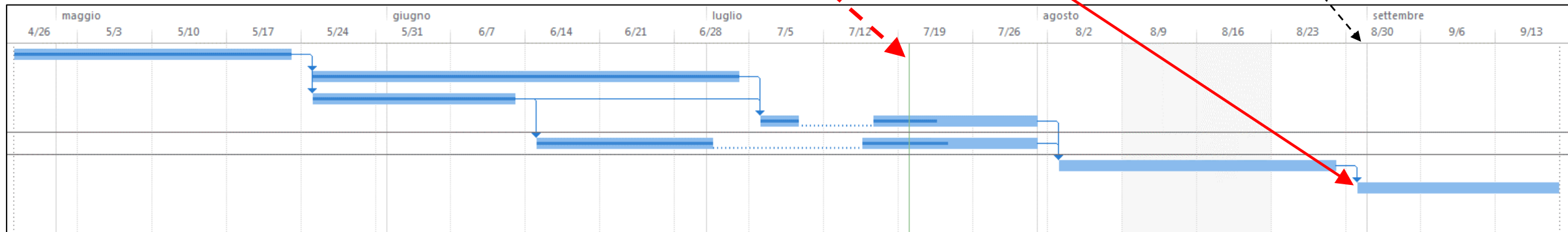
Time schedule

Activity	Weeks
Material purchase placement	4
Material delivery	6
Electrical schematics preparation	3
Cabinet preparation	3
Software preparation	5
Verification and test	2
Installation & test	3

System ready to be
 installed: beginning
 of September

Activities that must be done in parallel,
 necessary for the system installation and test:

- Best's interface cabinet
- External safety systems (ventilation, beam dump, radiation monitors)
- Shielding gates with control systems
- Install and wired the field devices (emergency and search push-buttons, gate sensors and locks, signaling panels, etc.)



Thanks for your attention!

Questions?