Powering Interlock Controller

Summary of changes & Commissioning after EYETS

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Summary of changes
Introduction

- 3 changes during EYETS
  - At the process level:
    - Introduction of the "Global Protection Masking" concept
  - At the supervision level:
    - Upgrade of WinCC OA V3.15
    - Upgrade of PIC Application
  - At the AccTesting level:
    - B2 circuits validation tests with automated endorsement

Summary of changes
Global Protection (1)

- Purpose:
  - Prevents quench propagation on a powering subsector level during normal operation.

- Operation:
  - Prevents powering individual circuits if any of the main circuits (i.e. main dipoles, main quadrupoles, IPQs or IPDs) are not fully operational.
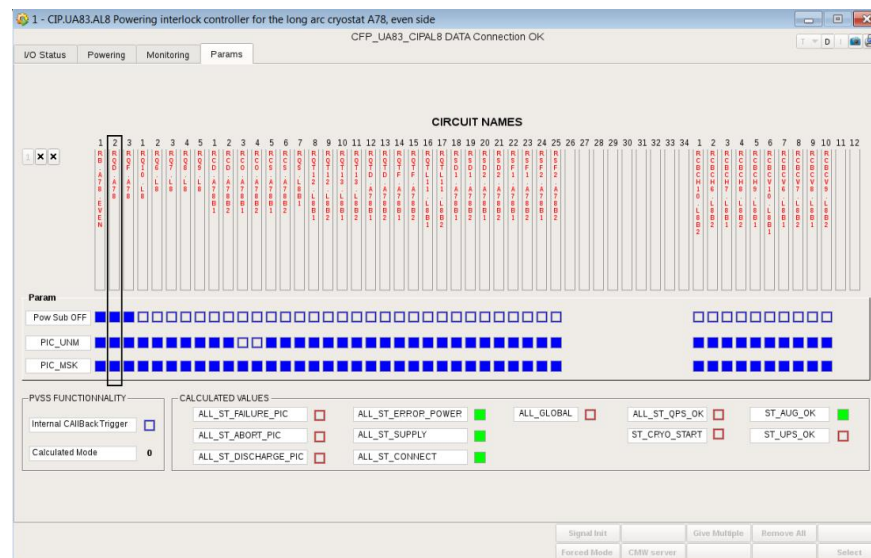
Example of a PIC device configuration

Summary of changes
Global Protection (2)

- Hardware Commissioning:
  - Need to validate the circuits independently of each other.
  - The Global Protection feature prevents the validation of any circuits in a whole subsector in case of at least one main circuits is not operational.

- Introduction of the Global Protection Masking Concept:
  - Masking the Global Protection mechanism will allow to individually power the circuits (as long as their respective powering conditions are met) within the same subsector, disregarding the state of the main circuits in the same powering subsector.

Approved ECR ➡ https://edms.cern.ch/document/1758307/1.0

Summary of changes
Global Protection (3)

| Situation in 2016	After EYETS 2016/2017
The masking of the GP is done manually by a PIC expert and required some PLC Software manipulation.	New integrated function in the PLC software: no modification of the low level software required.
No visibility on configuration changes at the supervision level	Control of the Global Protection Masking by a PIC expert from the SCADA application.
No log of the expert intervention.	Masking traceability (logging).
The CRC verification doesn't detect the changes (PLC software not recompiled).	Protection against masking activation during LHC operation: time limited function and BEAM_INFO status check.

Summary of changes
Supervision (WinCC OA)

- Migration to WinCC OA V3.15.

- General maintenance of the PIC project

  - Widgets improvement

  - Panels improvement

  - Resolve QPS_OK status not evaluated.

- Add Global Protection Masking control panels.

- Remove LASER alarms.

- Remove parallel archive and remove local archive from PIC application.

- All modifications can be found under PICSW and ENS Jira projects: https://its.cern.ch/jira/issues/

Summary of changes
AccTesting

- B2 circuits (IPQs/IPDs) are now fully supported in AccTesting
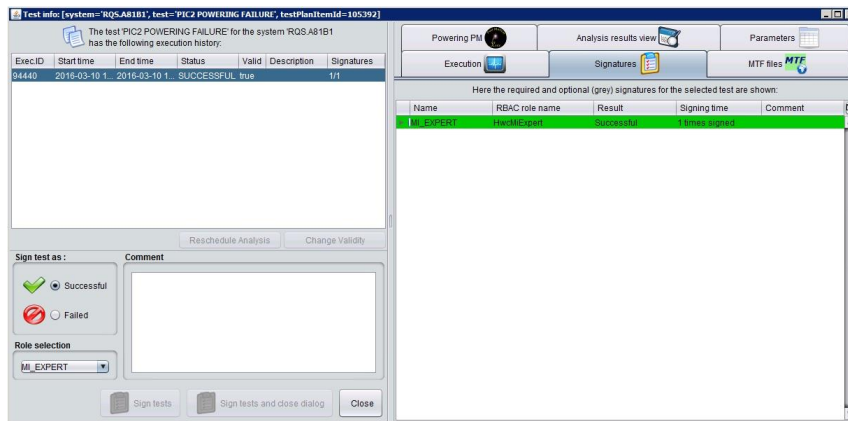
Automated test endorsement

Commissioning after EYETS

- Apply to all 36 PIC devices
- Commissioning without beam
  - Individual System tests for all PIC devices, including the new "Global Protection Masking"
  - PIC – BIS Interface test
  - WinCC OA stop test in operational conditions (at least for one subsector)
- Commissioning during Machine Checkout
  - Beam Dump triggered by:
    - AUG
    - UPS
    - CRYO
    - POWERING_FAILURE
- Commissioning with beam
  - No need to perform any tests.
- Reference:
  - EDMS 896390 - LHC-OP-MPS-0005[*] (MPS Aspects of the Powering Interlock System Commissioning)

[*] The document has to be updated to include the new Global Protection Masking function

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Power Interlock Controller (PIC)

- The Powering Interlock System is designed to ensure the permission for safe powering of the different electrical circuits comprising superconducting magnets installed around the accelerator

- 28 powering subsectors
- 36 interlock controllers (2 for long arcs)
- 5-43 circuits / controller