

PLC & COTS Workshop

Day 2

Afternoon Session

ESS Controls Infrastructure

Q: What is the reason for developing small IOC with embedded EVR?

A: To have a small embedded system for easy EPICS integrations.

Q: How does NTP server works with MRF system?

A: Moved to offline discussion as it is quite long and technical

Q: What technology does the timing system use?

A: Simple data transfer. Raw data out of GTX.

Q: Precision and jitter of the timing system?

A: Precision around 2 microsec, jitter around 7 microsec.

Q: Why has the microTCA platform been selected?

A: A few prototypes were made and the decision has been taken in 2013/2014. It has it's challenges, like any other platform but ultimately it was just a matter of choice.

Vacuum Control for the LINAC at ESS

Q: What is going to run interlocks? PLC? WinCC?

A: We would like to create a configurable matrix that a PLC will run. EPICS is used as a display.

Q: What type of comms are expected to device controllers (pumps, gauges, etc.)

A: Most will be via direct digital and analog I/O. Additionally there will be some serial interfaces between EPICS and device controllers. PLC will communicate to device controllers via EPICS.

Formal Verification of Industrial Control Systems

Q: How do you deal with badly formalized and ambiguous user requirements?

A: Manually at this stage. We also try to implement requirements patterns to help formulate the correctly. In case of ambiguity, as the client.

Q: Where would one use this if the development process is already quite formalized?

A: To compare results vs requirements.

Q: Is PLCverif the tool that does the whole job.

A: No, external tool actually does the comparison but PLCverif provides all the workflow and GUI. At the moment free, open-source tools are used.

Q: Why not use UML?

A: UML is not a formal language. Also, it doesn't work with PLC's that well.

Q: What level of complexity can this handle? Is it scalable?

A: It is problematic. There are different model checkers available and we are testing them. Work in progress.

Comment from Enrique: Project started 3 years ago, progress is good. The tool is ready. We are aiming to have production version in a year. It also seems that process control industry is starting to go down this path.

Alternative Technologies for Interlocking: HIMA Planar4

Q: Cost?

A: OK for small projects, quick. 15'000 CHF for the example system shown in the presentation.

Q: Decision on future use?

A: Not clear yet.

Q: Reaction time?

A: Tens of milliseconds.

Q: Why this particular system was used?

A: Authorities require technological diversity between trains.

Q: Did you compare this system to other options, e.g. Siemens Sirius relays.

A: Not clear answer. This system was selected to try.

Q: Why is the reaction time so slow?

A: Not entirely sure but possibly due to complex internal logic and long paths of signals through the modules.

ITER Central Interlock System. Fast interlock controller.

Q: How does input and output diagnostics work in those special modules?

A: Diagnostics modules generate some signal. Reaction to failure is configurable.

Q: How often diagnostics run?

A: Once per cycle, 100-200 microseconds.

ESS Beam Interlock System.

Q: Any connection between slow and fast beam interlock systems?

A: No, fully separate, even use different inputs.

Q: Why not make both systems fast?

A: FBIS is still work in progress and long way from ready. SBIS is tried and proven method.

Q: Are you using FPGA or off-the-shelf products?

A: Custom design by ESS based on FPGA.

High Performance Computing Platform for Predictive Interlocks Using PLC at ESS.

Q: Have you evaluated the performance?

A: Not yet. At this stage we only had built the platform to evaluate technical feasibility.

Q: How big is data exchange area?

A: Few bytes at the moment. Can go up to 1 kb per area, multiple areas can be set up. Note, there are some more limitations with i-devices.

Q: Will sensors and actuators be shared with conventional interlock system?

A: Yes.

Q: This would pose a problem for safety certification. Are you going to split them?

A: Haven't decided yet. At the moment we're just testing technical implementation of cluster on PLC's.

Q: Slide 7. Are you planning to control cooling plant from your predictive interlock system and therefore interfere with the cooling plant control system?

A: We'll need some arbitration protocol to define priority of control with two systems. It won't be easy.

Comment from Enrique: Can't see much point of implementing this with PLC's

A: Offline discussion to follow.

Q: Isn't it premature to stop the beam before the interlocks actually happen (Slide 7)?

A: Agree. I am not removing the need for conventional interlock system. Maybe we won't actually activate a beam stop.

Q: You mentioned looking toward neural networks. Did you consider other tools? Bayesian network for example?

A: Thank you for the advice, I am open to other options.