

DESY Machine Protection and PLCs

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ESS, Lund

Overview

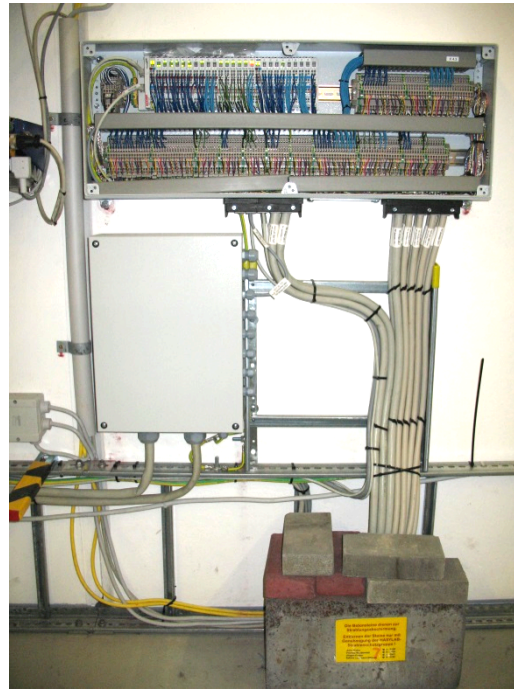
- PLC based Vacuum Interlock for PETRA experiments
- PLC and FPGA based FLASH MPS
- FPGA based PETRA MPS
- „Fast magnet current change monitor“ for LHC and Hera
- Old „Toroid Protection System“ (TPS) for FLASH

Vacuum Interlock for PETRA experiments

Fanless CPU:
Soft SPS
(Beckhoff)



I/O-Box



Properties:

- Volume: 14 beamlines with 80 modules per beamline
- Cycle time: 40 ms
- Archive resolution: 40 ms
- Field bus: ETHERCAT

Tasks:

- Check temperatures, water flow, pressure
- Close valves
- Log events

Courtesy: Markus Degenhardt, DESY

MPS for FLASH linear accelerator

- Protect collimators, undulators, beamline.
- Combination of
 - Fast and simple interlock (FPGA + Hardware)
 - Slow and complex interlock (PLC)
- The PLC controls the masking of the Fast Interlock and reads back the status via PROFIBUS

FLASH MPS: PLC + „BIC“

„BIS“ (Beam Interlock System):

PLC based interlock part:

Siemens S7 and optocouplers

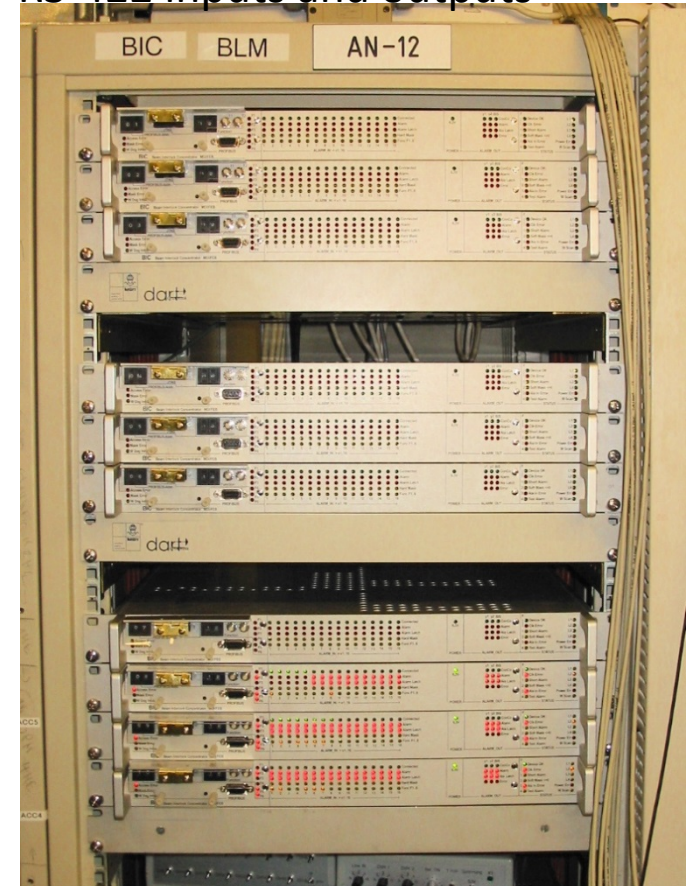
Cycle time: 1.5 .. 5 ms



„BIC“ (Beam Interlock

Concentrator):

- Fast OR of 16 inputs (maskable)
- Latency < 100 ns
- Redundant logic: FPGA + TTL chips
- RS-422 inputs and outputs



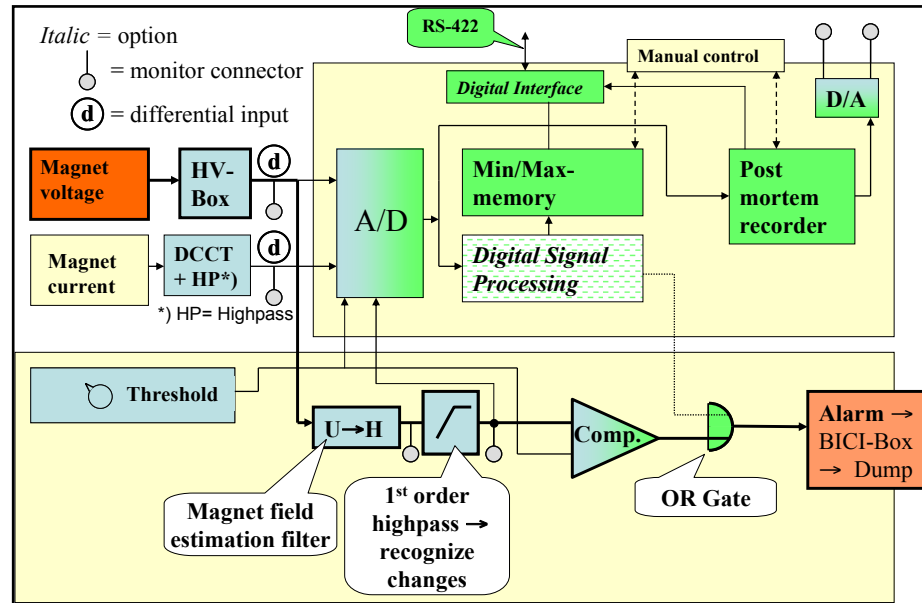
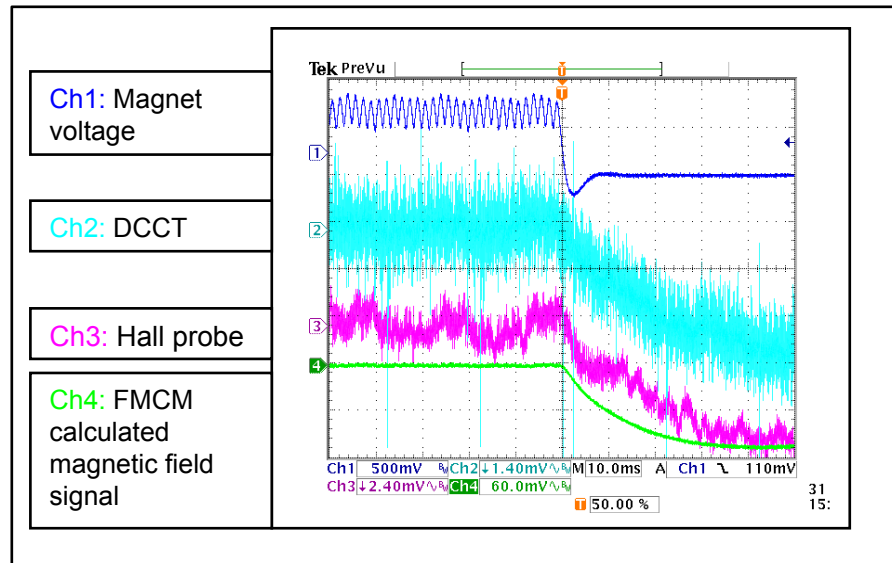
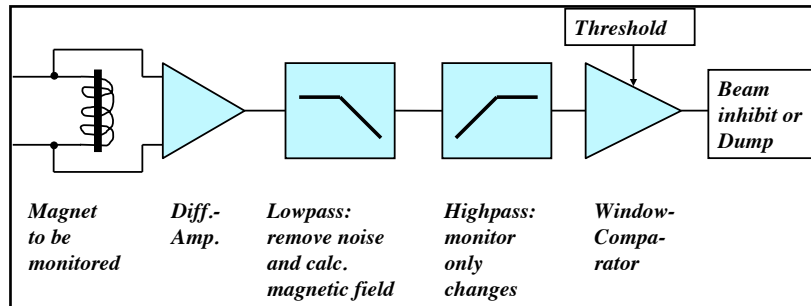
Courtesy: Martin Staack, DESY

Fast Interlock for circular accelerator PETRA

- Protect beamlines and undulators
- worst case damage: 3 days no beam, repair costs
- Latency specification: Switch off within 100us including cable delays.
- **See presentation of Timmy Lensch**

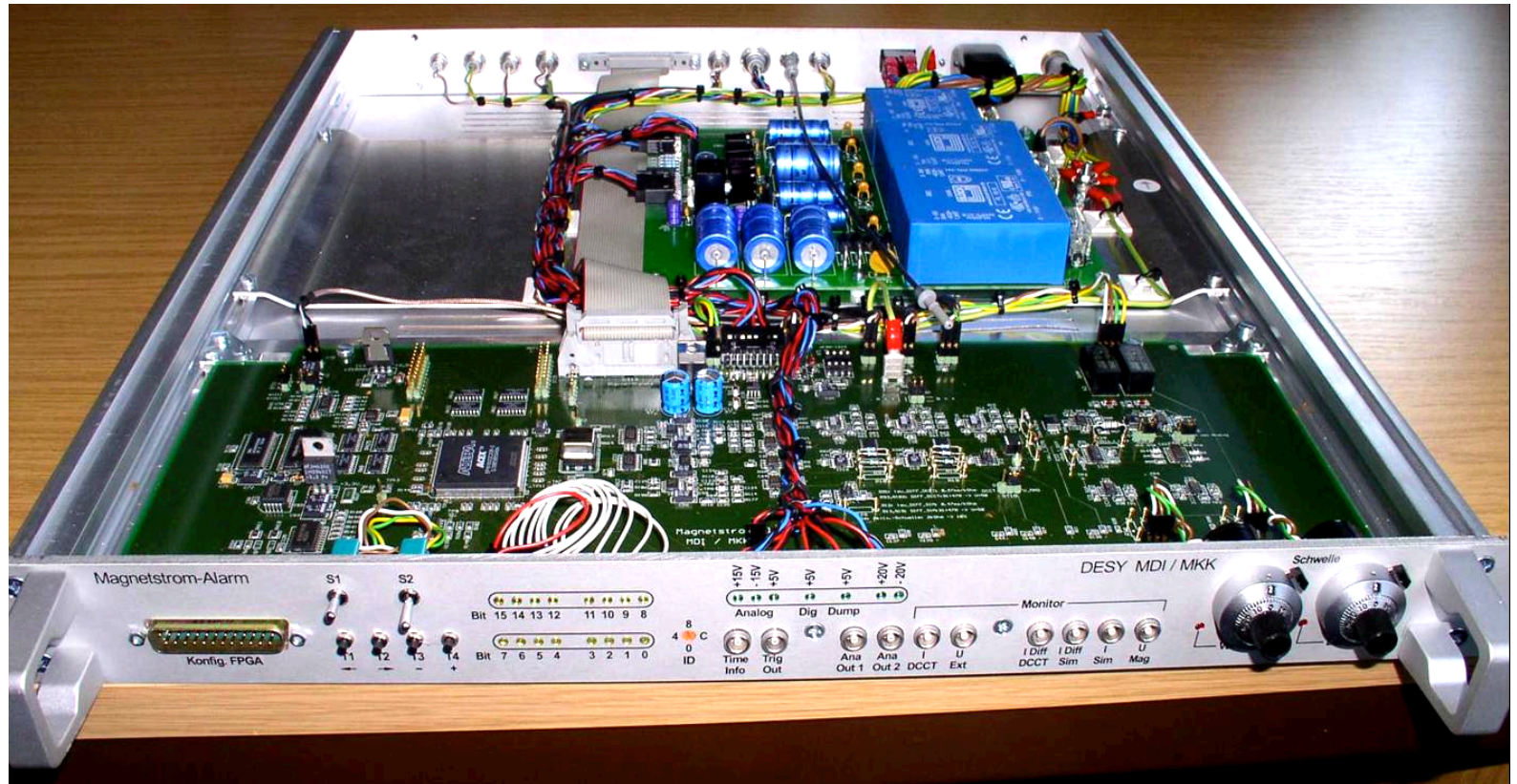


LHC / Hera magnet current alarm



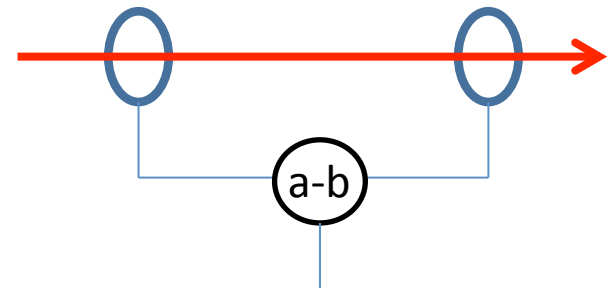
Analogue preprocessing
Redundant logic (FPGA + TTL)
FPGA for monitoring

LHC / Hera magnet current alarm



Old TPS for FLASH

- TPS = „Toroid Protection System“
- Compare the bunch charge measured at two toroid sensors, taking into account the cable delay and the beam travelling time.
- If difference is above threshold: stop beam because loss is assumed
- Concentrated system: one hardware module processes two toroid inputs
- → for EXFEL we will use a distributed system (see presentation), this will be also installed in FLASH



Thanks to:

- Markus Degenhardt
- Martin Staack
- Kay Wittenburg (Group leader diagnostics)
- And many others ...

Thank you!

Questions?