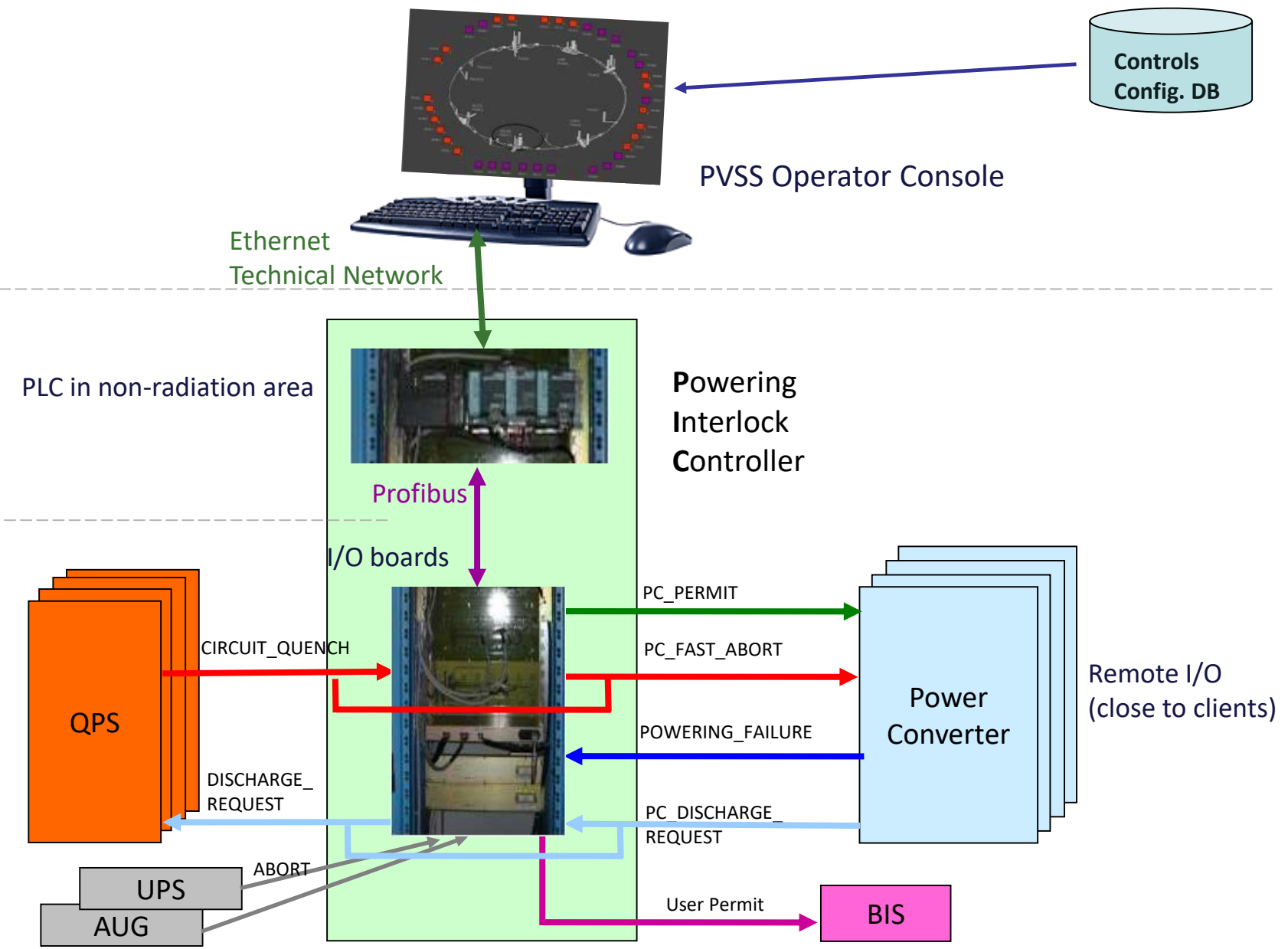


Commissioning Experience and Status of PIC, WIC and FMCM Installations end 2008

Acknowledgments: Pierre & whole MI team



- All 36 systems installed and operational
- After HWC 08, interlocks of 11 circuits (out of >900) not yet fully commissioned (due to nc in magnets, QPS, etc...)
- Few issues found in PIC during HWC, mostly configuration (QPS-PIC), cabling/connector issues, very few interlock HW issues (one redundant PS was exchanged, BIC interface badly soldered)
- Reliability prediction: overall MTBF expected to be ~ 9 months for current loops (exceeded by a factor of 2-3 already, none seen yet)
- Commissioning steps already reduced after 1st sector (PIC2 for all circuits, PIC1 only for mains), probably much less for re-commissioning
- Full automation of tests, reasonable degree of automation for analysis, intended to fully automate also analysis part for start-up 2009 and later on...
 - 1st version of automated PIC-BIC commissioning ready and tested
- Couple of first use-cases where powering system performed emergency dump (1st Emergency beam dump provoked on 11th Sept. after water fault in DC cable)
 - Worked well (redundancy towards BIC, <1ms until completion of beam dump)
- At PVSS level many improvements as requested by OP already implemented by Frederic

- ➔ Revision of functionality of Global Powering Subsector OFF for circuits of type B1 (to avoid quench-back of correctors during FPA)
 - ➔ Requires modification of generic SW package, ECR about to be circulated
- ➔ Connection Access – Powering Interlocks in discussion (active interlock >1kA if zones not closed & patrolled)
- ➔ Full automation of HWC analysis + Internal Post Operational Check of the PIC (will be part of PM project), requires PVSS-PM lib
- ➔ Revision and completion of PIC-BIC test sequence (bookkeeping, etc..)
- ➔ DIAMON: write dedicated PIC agent (FE already done)
- ➔ Software repository and operational procedures tbd
- ➔ Activation of the 'Matrix' (redundant path to PLC for beam dump requests)
 - ➔ No remote programming, requires access to all installations (1 day?)
 - ➔ Connects into Unmaskable BIC input, thus once programmed no beam permit if any of the essential circuits not ready
 - ➔ Need to agree on best approach (staged with intensity/energy of beam, ie start with PLC only, activate Matrix before circulating non safe beam?)

→ 2008 configuration:

- No Powering Subsector OFF functionality
- RB, RQD, RQF, RQX, RD1-4, RQ4-RQ10 essential
- Essential circuits + RCS, RQT%, RSD% and RSF% auxiliary
- RCD, RCO, ROD, ROF, RQS, RSS and all orbit + triplet correctors no impact
- No Matrix programming

→ Phase 1: HWC / injection tests = 2008 run

- No Powering Subsector OFF functionality
- RB, RQD, RQF, RQX, RD1-4, RQ4-RQ10 essential
- Essential circuits + RCS, RQT%, RSD% and RSF% auxiliary
- RCD, RCO, ROD, ROF, RQS, RSS and all orbit + triplet correctors no impact
- No Matrix programming

→ Phase 2: circulating beam, low intensity

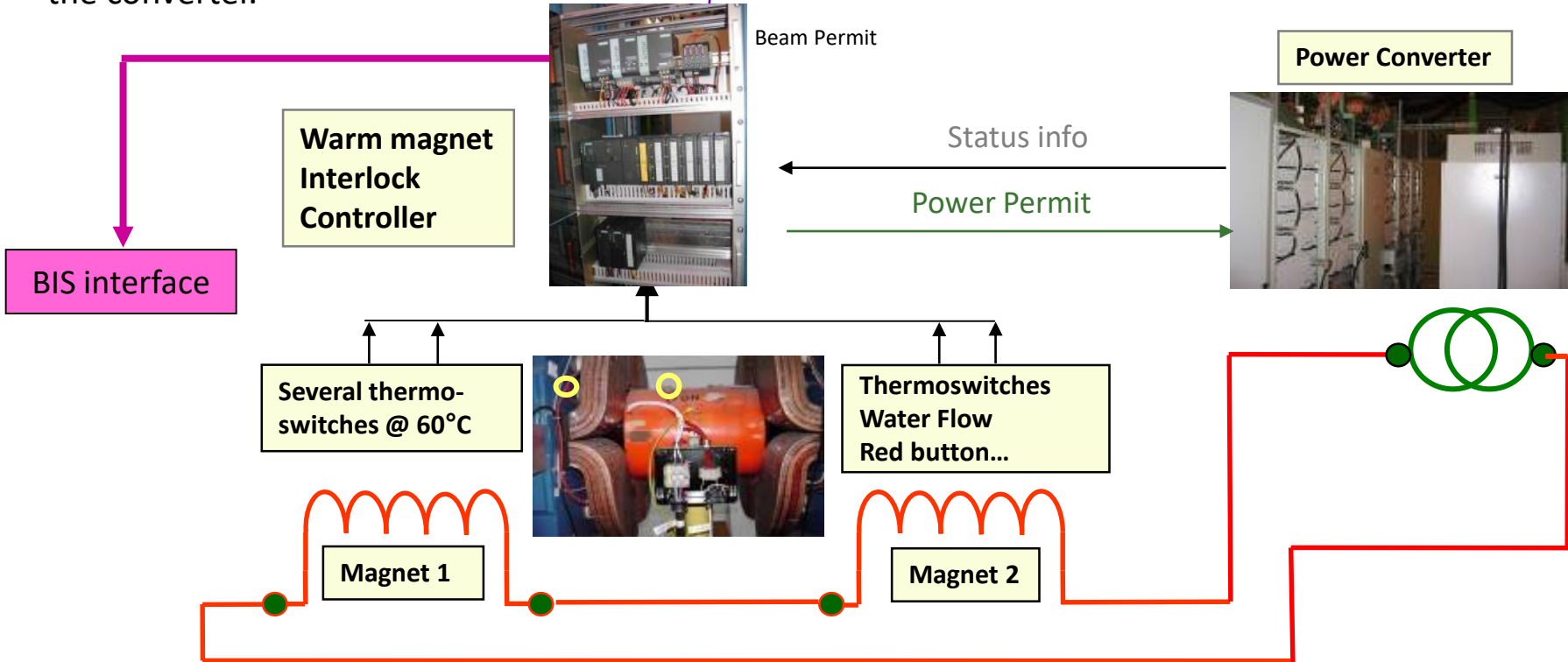
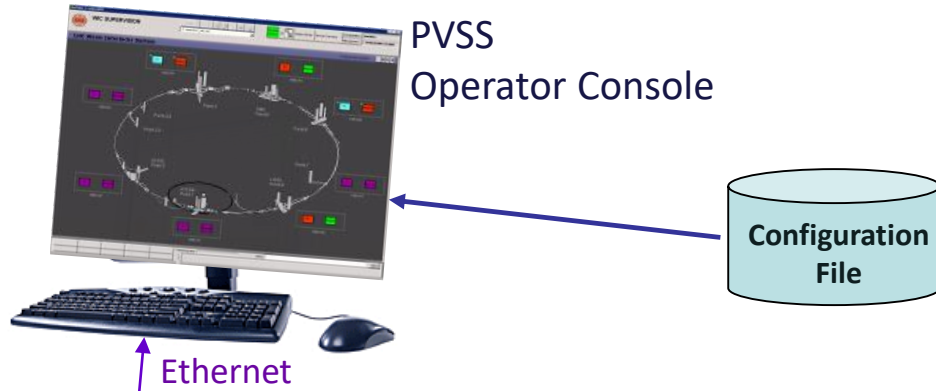
- Powering Subsector OFF for essential circuits
- RB, RQD, RQF, RQX, RD1-4, RQ4-RQ10 essential
- Essential circuits + RCS, RQT%, RSD% and RSF% auxiliary
- RCD, RCO, ROD, ROF, RQS, RSS and all orbit + triplet correctors no impact
- No Matrix programming

→ Phase 3: circulating beam, high intensity

- Powering Subsector OFF for essential circuits
- RB, RQD, RQF, RQX, RD1-4, RQ4-RQ10 essential
- Essential circuits + RCS, RQT%, RSD% and RSF% auxiliary
- RCD, RCO, ROD, ROF, RQS, RSS and all orbit + triplet correctors no impact?
- Matrix programming for essential circuits (redundancy)
 - Needs ~ 1 day of access to program 36 CPLDs

- based on Safety* PLC
- collects inputs from thermo-switches, flow meters, red buttons, ...

and gives the Power Permit for the converter.



(*) the Transfer Lines WIC (the first one that has been deployed) is not based on Safety PLC

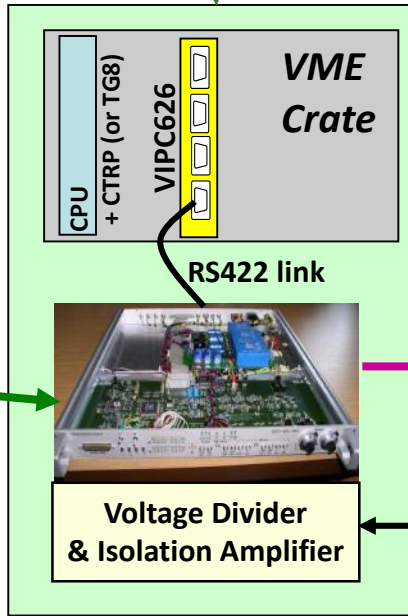
- All 8 systems installed and operational (LHC only...)
- After HWC 08, **everything fully commissioned**, except for the FM352 (=fast module for beam dump, similar concept as PIC Matrix)
- **Few issues found in PIC during HWC**, cabling/connector issues, but NO interlock HW issues
- WIC Commissioning is done manually, only 44 circuits powering 148 magnets in LHC; commissioning takes couple of hours / point, IR3 and IR7 ~ half a day
- At PVSS level many improvements as requested by OP already implemented by Frederic

- Internal Post Operational Check of the WIC (will be part of PM project), requires PVSS-PM lib
- DIAMON: write dedicated PIC agent (FE already done)
- Software repository and operational procedures tbd
- Inclusion and test of FM352 (redundant path to PLC for beam dump requests from power converters)
 - Module already installed in every point
 - Will be connected into logic and tested during HWC phase
- For shut-down 2009: Address automation of HWC and automated WIC-BIC test-sequence (will be very similar to PIC, but CMW configuration and other DB preparation work needs to be done still)

JAVA Application
Operator Console
(CCC)



Technical Network



*ROCS crate (TL)
or
BIC crate (LHC)*

Fast
Magnet
Current
change
Monitor

BIS interface

Voltage Divider
& Isolation Amplifier

resistive
magnet

- ➔ All 26 FMCM units installed, 14 in TL, 12 in LHC, 4 spares in lab
- ➔ Fully commissioned in TL, partially commissioned in LHC (not priority during HWC / startup 09 as maskable inputs to BIC)
- ➔ FESA class & Java GUI up and running

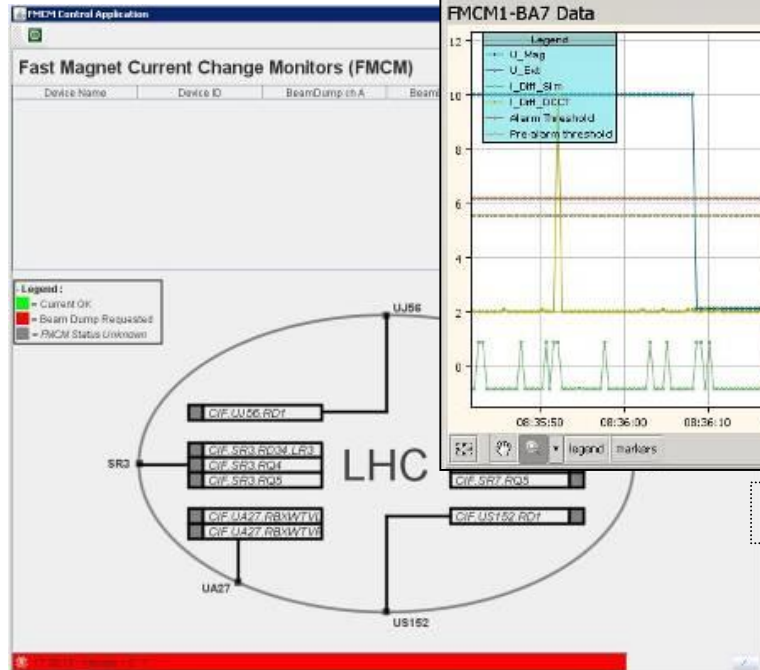
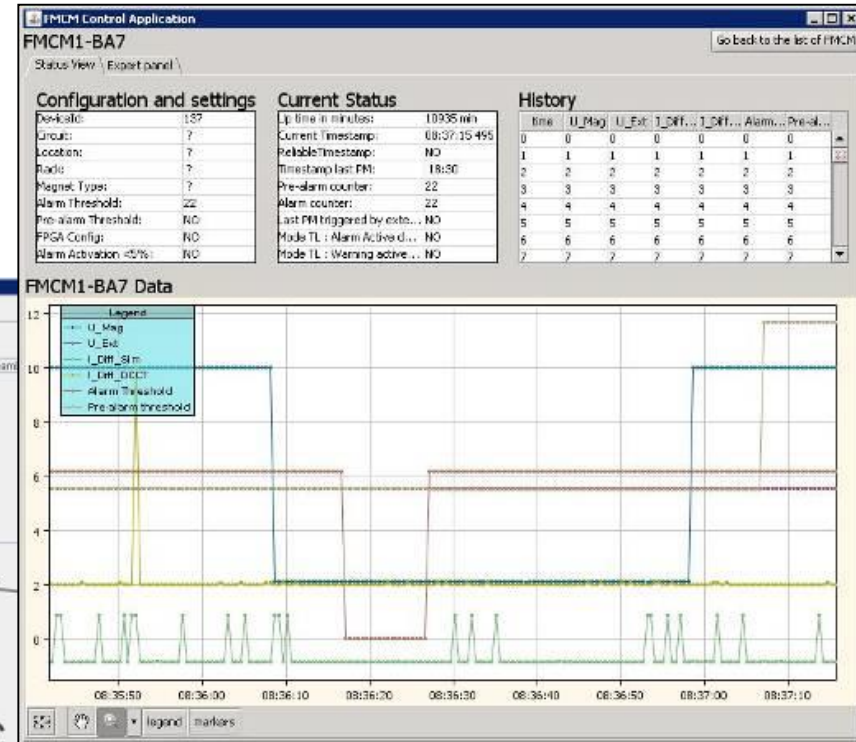
Power Converter







- ➔ On-board firmware from DESY
- ➔ Modified for monitoring in using CO solutions

CONTROLS part:

- ➔ (existing) VIPC device driver
- ➔ FESA Class
- ➔ **JAVA Supervision**
- ➔ Configuration DB
- ➔ PM interface



Courtesy of Nicolas Hoibian (AB/CO/AP)

- TL devices worked rather smooth (with slightly adjusted thresholds wrt to 2007)
 - Adjustment of Voltage Dividers not optimized (not big issue in TL)
 - Controls interface not yet fully operational in BA4/BB4/BA6/BA7 (ROCS co-existence, issue with memory after migration to FESA V2.10 + change of timing config by PO in BA4)
 - Continuous creation of PM buffers due to common extraction event (FMCMs in TL trigger if switched OFF @ Extraction), requires change of timing config to target depending extraction trigger
- Multiple issues in LHC devices (no dedicated time for debugging)
 - RMSD in IR6, cross-talk between monitors 
 - RBXWTV and RD1.LR5 – inversed voltage dividers 
 - 'Feature' in FESA class, forcing PM acquisition on all FMCMs connected to common controls card 
 - Adjustment of Voltage Dividers not optimized (to pass 5% threshold & work @ injection and 5/7TeV), possibly change of FPGA code (DESY)? 
 - Currently manual commissioning (few devices, quickly tbd from CCC), possibilities for automation, but due to < number only for 2010?

- Good experience with HWC 2008, few issues found
- Good degree of automation & result documentation for PIC (as part of HWC)
- No dedicated tests with beam with any of the systems, some few 'emergency dumps' for PIC already
- Few improvements and functional extensions to be added during shut-down (and commissioned in 2009)
- Need to agree on proposal for common staged approach (ie when to transit from flexible state to rigid & full system functionality), time needs to be foreseen for commissioning of last steps
- Documentation of WIC and FMCM (and PIC-BIC) comm progress & results to be agreed (common approach for MP systems?)
- PIC tests & analysis to become almost 100% automated for 2009, for WIC and FMCM not yet foreseen for 2009
- MP commissioning procedures being updated with experience from 2008