LLRF Reliability/Availability LHC

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Most informations from J. Molendijk

Before each fill

- Reboot all VME CPUs
- Reload all FPGAs from Flash ROM (radiation resistant)
- Reload all active settings
- Launch checking application
  - Voltage supplies
  - Presence of all clocks
  - Temperature of VME cards (many sensors)

During beam on

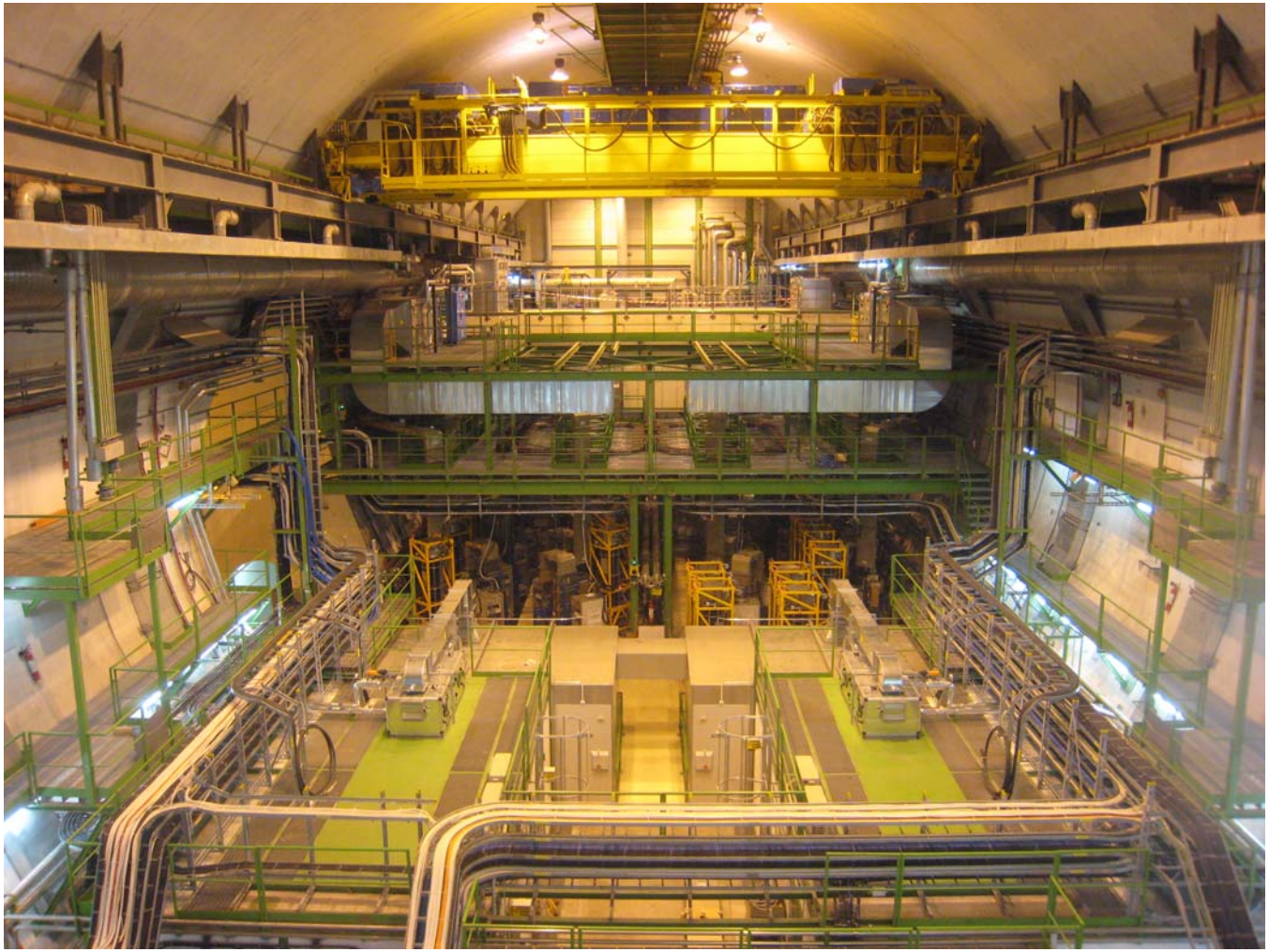
- Surveyance of serial links (1 Gbps)
  - Count errors
  - On errors two strategies: insert zero or keep previous (VCXO, Set Point, RF fdbk, Long damper,..)
  - Sanity check (VCXO: bounds on values and increment)
- Surveyance of VME crates fans
- Cycle Redundancy Check (CRC) on distribution of functions

- Monitoring of signals: ~ 40 channels per cavity controller (input/output of each module plus other critical points)
  - 30 turns @ 40 MHz
  - 6 s @ slow (frev) rate Monitoring of signals: ~ 40 channels per cavity controller
- Machine-wide Post-Mortem memories
- If frev disappears it is re-generated on-board

Global

- Measurement of each supply crate current. (Believed to increase with radiation damage)
- All LLRF on Uninterrupted Power Supplies (UPS)
- Klystron never over-driven (Switch&Protect module)

- If radiation becomes a concern there is room for movable concrete blocks in front of FC



However…

- No triple voting
- Klystron trip -> cavity impedance jumps from 45 kOhm to 2.7 Mohm… Unstable at 1/5 th nominal. Excessive beam loss on transient well below that…