

# Recent QDS R2E developments

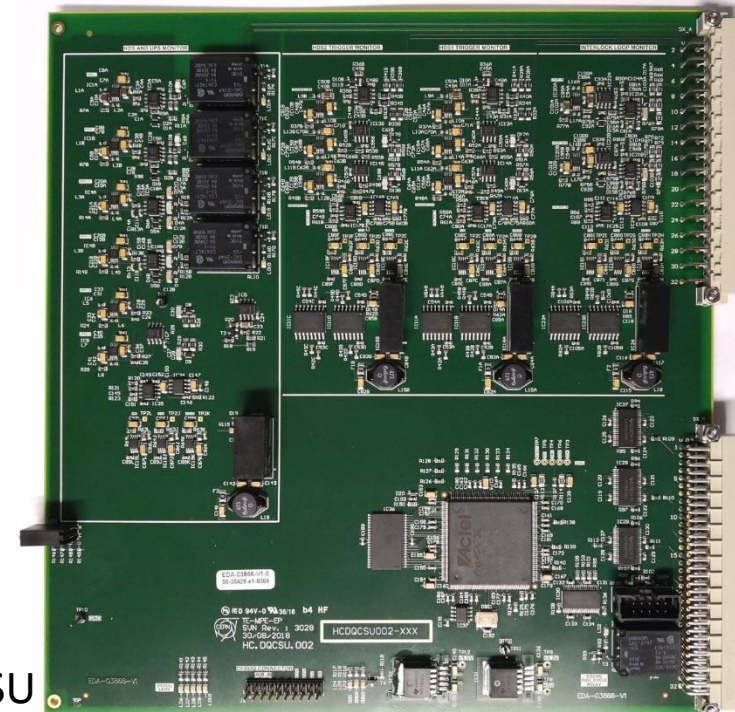
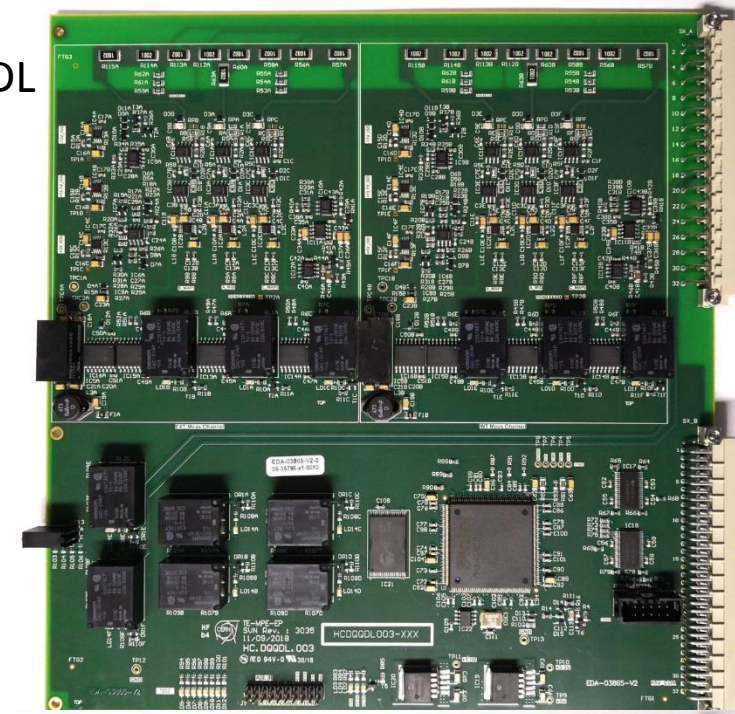
# Upgrade of MQ protection

- Located under “A” or “C” dipoles in LHC tunnel
- Expected annual dose: <1 Gy/y .. 10+ Gy/y
- Target lifetime dose: 200Gy
- Large project, 450 crates to be produced
  - Complex component procurement...
- Components tested in PSI
- System test in CHARM (June & September 2018)
- Installation in LS2

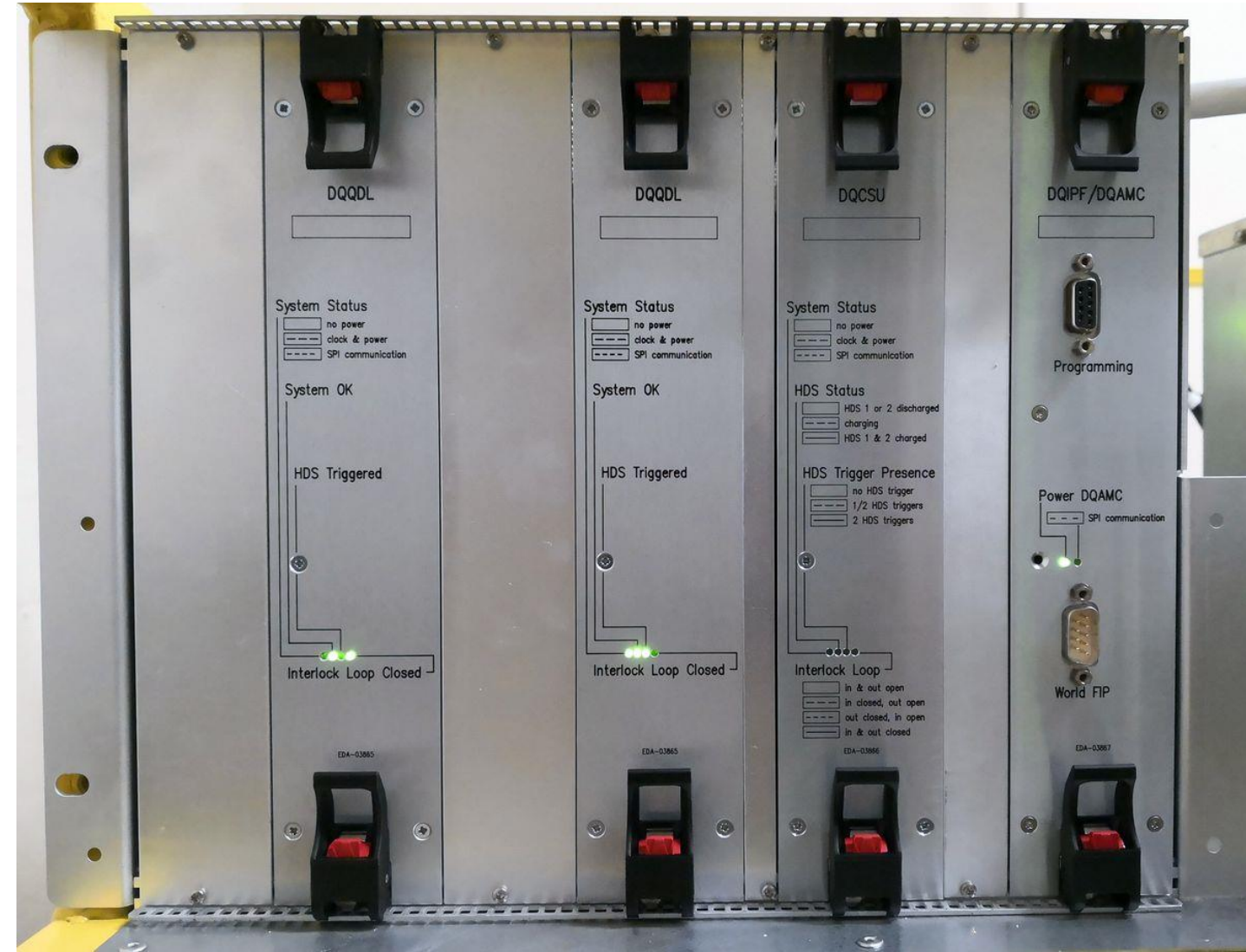
# MQ QDS upgrade, main components

DQLPUBv2 crate

DQQDL



DQCSU



# 11T dipole protection system

- Located in RR73, RR77
- Expected annual dose:  $\ll 1\text{Gy/y}$
- Target lifetime dose  $< 50\text{Gy}$
- Six crates to be installed in LHC
- Components partially tested in PSI
- System test in CHARM (UQDS crate, September 2018)
- Batch qualification of TRACO AC/DC supplies for the tunnel units required





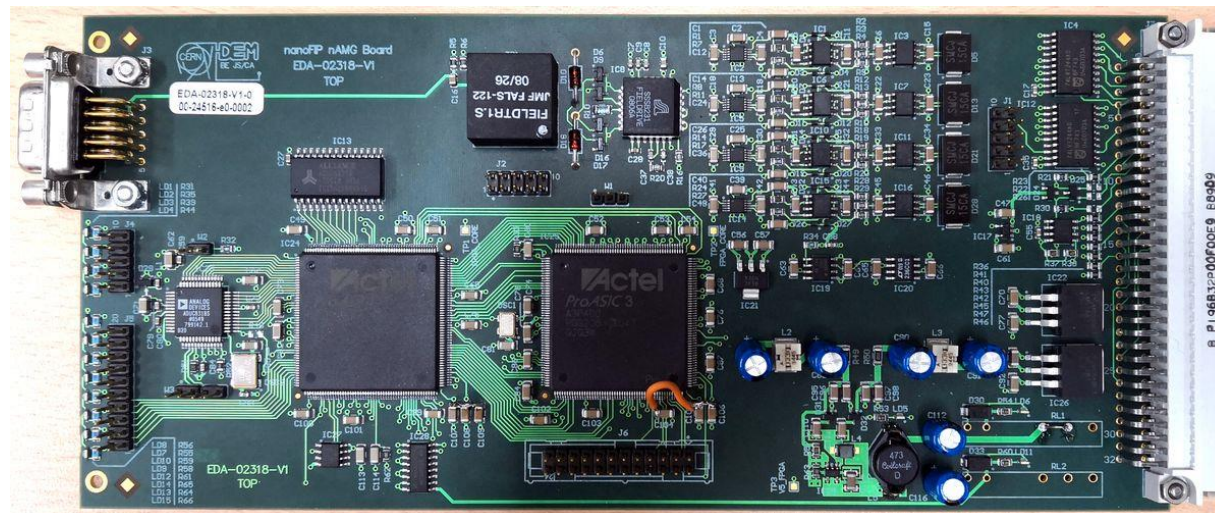
# Flexible individually powered magnets protection board

- Located in RR-Areas of LHC
- Expected annual dose:  $\leq 1$  Gy/y
- Target lifetime dose  $< 100$  Gy
- Used to implement the didt sensor based 600A and IPQ “didt switch” detection
- Numbers not fully clear yet (low in the beginning)
- First installations in LS2
- Not tested yet (built from known and tested components)
- Prototype available next year



# NanoFIP based crate controller prototype

- Hardware developed already in 2011
- First power up last month
- Used as a starting point of NanoFIP based crate controllers
- Prototyping will continue throughout LS2
  - PSI tests etc. once we have a suitable device...



# Summary

- With the upgrade of the quadrupole base layer QDS the “large scale” projects for tunnel equipment will finish for the next years
- 11T protection is based on new technology (IGLOO2, 20-bit ADC) but small in system size and is located in a low-dose area
- Smaller projects to enhance performance in critical spots (Cells 8..12) will continue
  - “Mechanical” DQQBS board deployed during this run to stop tripping nQPS in Cell 8 (Which receives much more dose due to different TCL settings this year)
  - Probably more rad-tol DQQBS board to be developed (based on SAR ADC)
- Preparations for the time “after uFIP” started
- Let’s see what’s coming up (LHC is always good for surprises ;-)