EXPERIENCE FROM STRING II:

QUENCH PROTECTION SYSTEM

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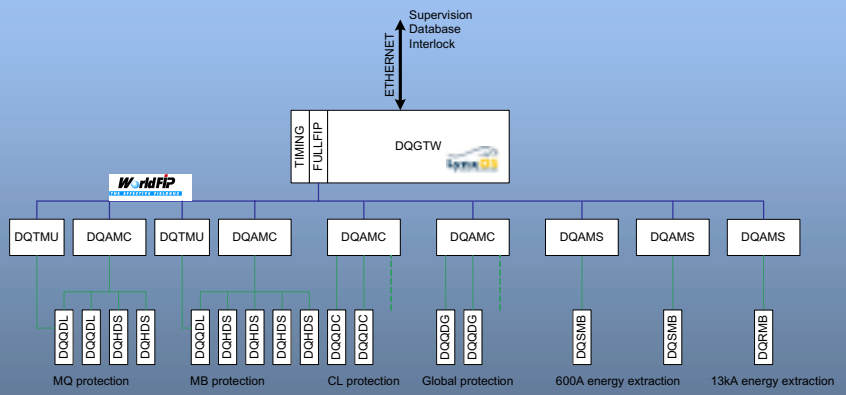
Controlled QPS Equipment in String II

- **QPS-supervision**
  - Quench detectors
  - Quench heater power supplies
  - Test mode units
  - Switch controllers
- **QPS-experiments**
  - Signal conditioners (gain setting directly via STRICT)
  - Test mode units (provoked quenches)

Equipment	Description	Phase I	Phase II
DQQDL	Local quench detector	7	10
DQHDS	Quench heater power supply	20	32
DQTMU	Test mode unit	7	10
DQQDC	Protection system for HTS leads	16	16
DQQDG	Global quench detector	15	15
DQAMC	Acquisition & monitoring controller	17	20
DQAMS	Acquisition & monitoring controller for switch controllers	3	3

QPS String II Communication



Fieldbusses

- **Fieldbus I**
  - 27(33) clients
  - MicroFip in stand-alone (DQTMU) and micro-controlled mode (DQAMC, DQAMS)
  - Master is PowerPC running LynxOs
- **Fieldbus II**
  - 17(20) clients
  - MicroFip in stand-alone mode
  - Master is ordinary PC running some Microsoft
- **Fieldbus general parameters**
  - 1 Mbit/s
  - Only periodic traffic
  - Macro-cycle length of 100ms
  - Timing synchronization via fieldbus

Participation

- **LHC-ICP**
  - QPS hardware
  - Programming DQAMC (acquisition & monitoring controllers)
  - Definition of signals
  - Partial programming of MPGATE application
- **LHC-IAS**
  - STRIDE, STRICT, generic DAQ & interfaces
  - Supervision application
  - Support for fieldbus, local timing and DQAMC
- **SL-CO**
  - Hardware for MP-gateway & servers
  - Programming of MPGATE application including OPC-server for supervision application
  - GPS-timing
  - Interlocks

Commissioning I

- **Access to equipment in the field necessary**
- **Fieldbus**
  - No installation faults
  - Some problems with connectors & daisy-chaining inside of QPS racks
  - Easy to be checked as bus is easy accessible in String II
  - Straps required for commissioning & phase I
  - Short commissioning time also due to full availability of MP-gateway
- **DQAMC & DQAMS**
  - Local serial ports very useful for commissioning
  - Timing synchronization

Commissioning II

- **Test mode units**
  - Access not inhibited in case of powered circuits
- **MPGATE application**
  - Stable version ready and tested in time
  - Smoothly running so far
  - GPS-timing implemented (problems with precision)
- **MPGATE interfaces**
  - Supervision
    - Only minor problems (e.g. missing variables)
  - Historian (STRIDE)
    - Interface not working at begin of String II commissioning
    - Still not fully functional (i.e. alarms, units)
  - Interlock (Power-Permit transferred via supervision)
    - Permit test option had to be added during commissioning

Problems I: "Cohabitation"

- **Equipment**
  - Equipment & people met each other prior to installation
  - But real equipment didn't fit into the foreseen rack
- **Signals**
  - Current lead temperature to be shared with cryogenics
  - Sensor signal conditioned by QPS and routed back to cryogenics
  - QPS speaks [V], cryogenics speaks [4..20mA]
  - Problems with maintenance (i.e. exchange of a quench detector)

Nevertheless:
things are working properly !

Problems II: Physical Units

- Analog values intrinsically coded into “signed integer” format (2 bytes)
- Conversion factors to be shipped to:
  - Supervision
  - STRIDE
  - Generic DAQ (including additional STRICT settings)
- Several lists to be synchronized
- Data in physical units not fully available in phase I – hopefully in phase II

LHC

- WorldFip 1Mbit/s
  - 4 busses per sector for equipment in tunnel (50 clients)
  - 1 dedicated bus per sector for 13kA busbar protection
  - 1 local bus per UA, RR, UJ …
- Revised design for DQAMC / DQAMS
  - Design reduced to required functionality (single chip DAQ)
  - Test mode unit integrated
  - Radiation tolerant
- Reduced number of signals per equipment
  - Optimised number of DQAMC & DQAMS