Status of DCS for TDAQ racks

Y. Ermoline et al.

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What will be monitored by DCS inside the racks:

- **Air temperature**
  - 3 air temperature sensors (NTC 10k), each sensor requires 1 ADC channel and permit measurements from 5°C to >100°C

- **Relative humidity**
  - 1 humidity sensor (HIH 3610) to monitor the dew point inside the rack, requires 1 ADC channel

- **Inlet water temperature**
  - 1 temperature sensors (NTC 10k) located on the inlet cooling water pipe, requires 1 ADC channel

- **Cooler’s fan operation**
  - 3 fan rotation Hall sensors from CIAT (binary and pulse output version available), each sensor requires either 1 bit of digital input port or 1 ADC

In total - 8 ADC channels per rack

- The ADC channel may be also used to readout a binary signal
- 64 ADC channels per ELMB – 4 connectors of 16 ADC channels
Sensors location and connection to ELMB

- Sensors location on the rear door of TDAQ rack
  - Temperature, Rotation, Humidity
  - All sensor signals and power lines are routed to a connector on the rear door to simplify assembly
- Flat cable connects these signals to 1 of 4 ELMB motherboard connectors
  - 3 connectors receive signals from 3 racks
  - 1 spare connector for upgrades
- 1 ELMB may be used for 3 racks
Test setup and SDX1 installation

- Foreseen SDX1 installation
  - DCS PC running PVSS - rack mounted, 4U, 3 PCI slots (minimum)
    - Kvaser PCIcan-Q (4 ports) card(s) – CANbus branches & PSU ELMB
  - 6U PSU crate ordered for SDX1
    - With 3 power modules for up to 6 CANbus branches
    - Only 1 module for Pre-Series
  - CANbus cable provisionally selected – SCEM 04.21.52.110.0 (3 pairs)
    - Conductor – 0.5 mm² (20 AWG), OD – 10 mm, linear resistance – 37.5 Ω/km
    - Maximum voltage drop: 2.0 V for 20 ELMBs on 50m cable (acceptable)
    - 90 Ω impedance – tested with 100 m cable
    - Still looking for 120 Ω cable:
      - Belden 3108A (3 pairs) – expensive (7.20 CHF/m)
      - Elettronica Conduttori MMCNT/452EC-2 (4 pairs) – used by TileCal
  - 2 ELMBs in 6 Pre-Series racks on DIN rail – SCEM: 06.01.85.260.80
    - On the rear door or rear of the rack
    - Single CANbus connector – need a daisy-chain implementation
ELMB CANbus daisy-chain implementation

- Permanent installation with “thin” CANbus cable
- Modified Phoenix SUBCON-PLUS-CAN connector

![Diagram of ELMB CANbus daisy-chain implementation]

- Cable tray
- CANbus cables
- Socket (38 €)
- To next rack
- To PSU
- Cable fixation
CANbus cables layout in SDX1

- Racks:
  - Level 1: 17 + 18 + 17 racks
  - Level 2: 8 + 17 + 15 racks

- CANbus cables:
  - 1 CANbus branch per row
  - ~200 m of CANbus cable

- 1 ELMB per 3 racks:
  - 32 ELMBs on 6 branches
    - Max cable length ~25 m

- For comparison - 1 ELMB per rack:
  - 92 ELMBs on 6 branches
    - 30% cost increase
## Component and system cost (1 ELMB / 3 racks)

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost (CHF)</th>
<th>N</th>
<th>Total</th>
<th>%</th>
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<tr>
<td>DCS PC</td>
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Further steps

- DCS PC, PSU and ELMB installation in SDX1 Pre-Series racks
  - Temporary solutions until final component delivery
    ⇒ Power supply, daisy-chain connector

- Choice of sensors and wires
  - Temperature
    ⇒ Offer for the NTC with 6m halogen free cable: 29 CHF/pc (100 pieces)
  - Humidity - TBD

- ELMB adapters design for humidity and rotation sensors
  - Humidity sensors need power

- Mechanical arrangement of sensors in the rack
  - Sensor’s fixation, connection to the ELMB