

Status of DCS for TDAQ racks

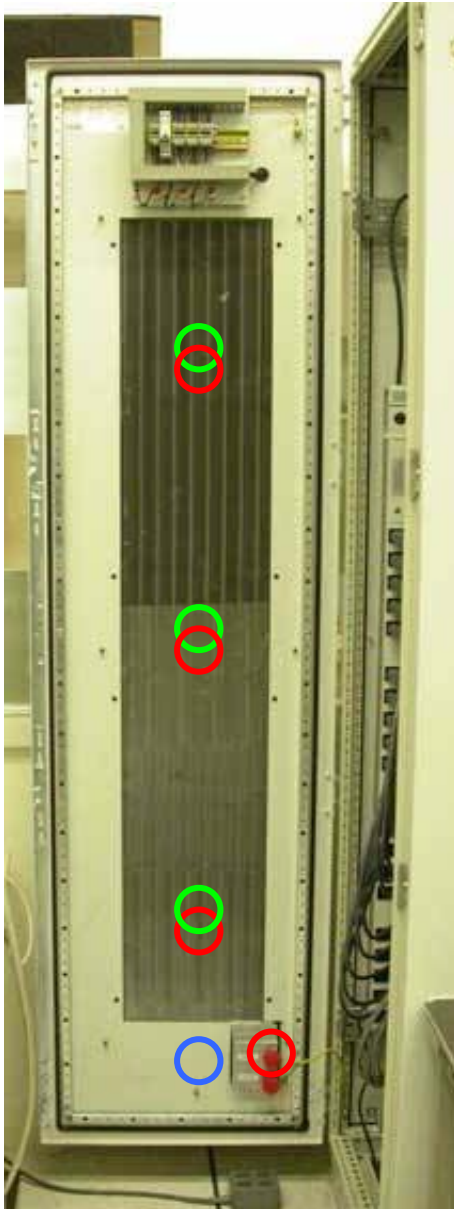
Y. Ermoline et al.

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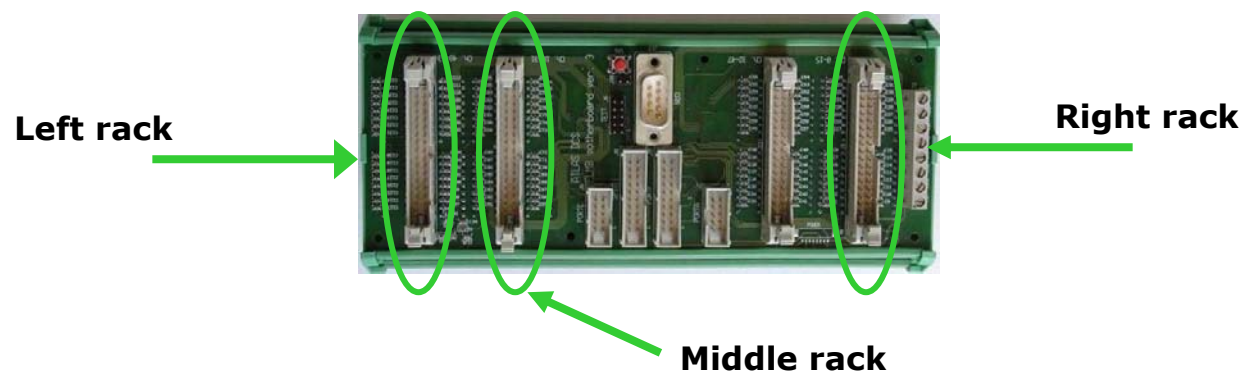
TDAQ racks monitoring by DCS

- 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



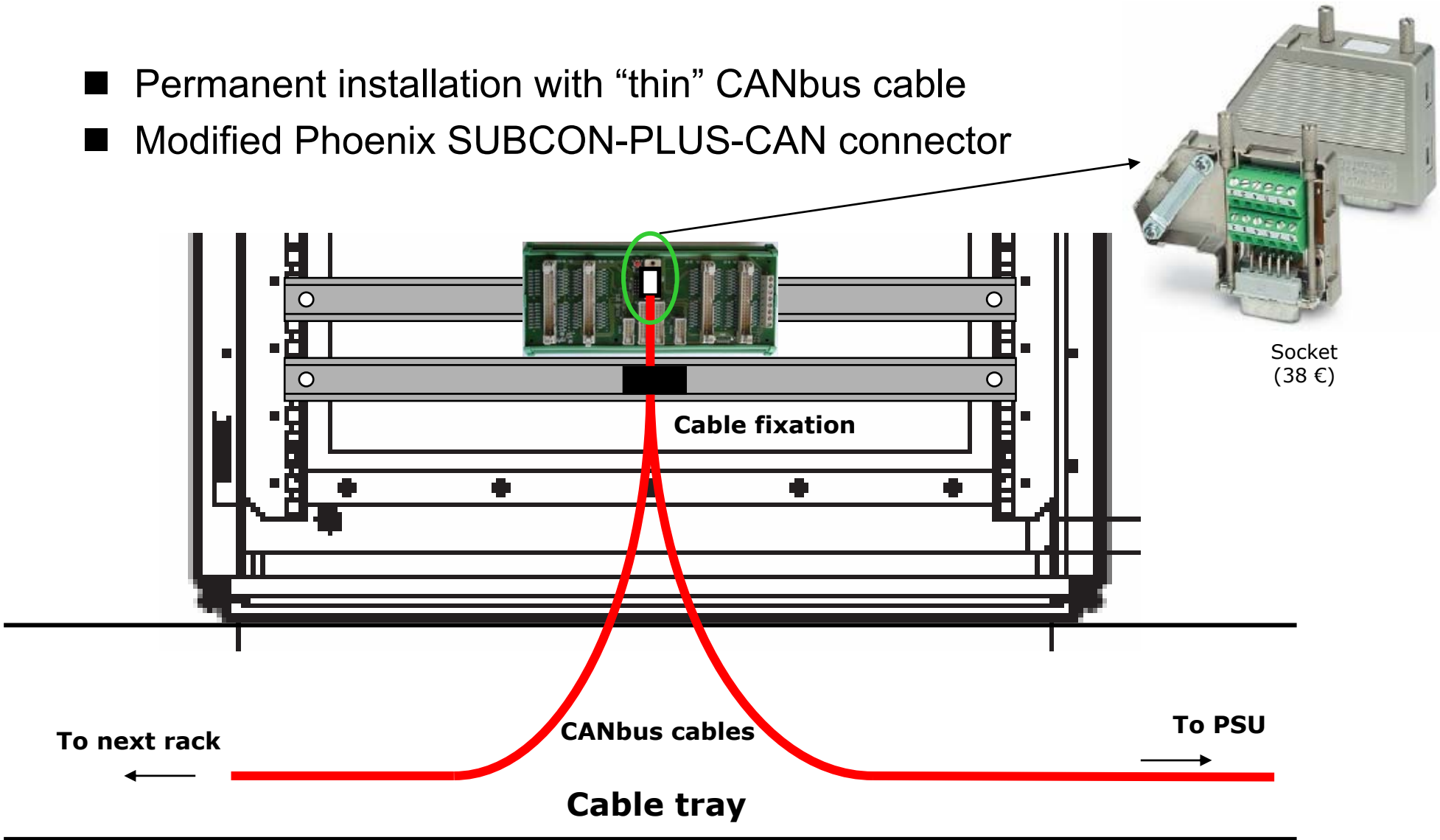
Test setup and SDX1 installation

■ 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 MMCNTH/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

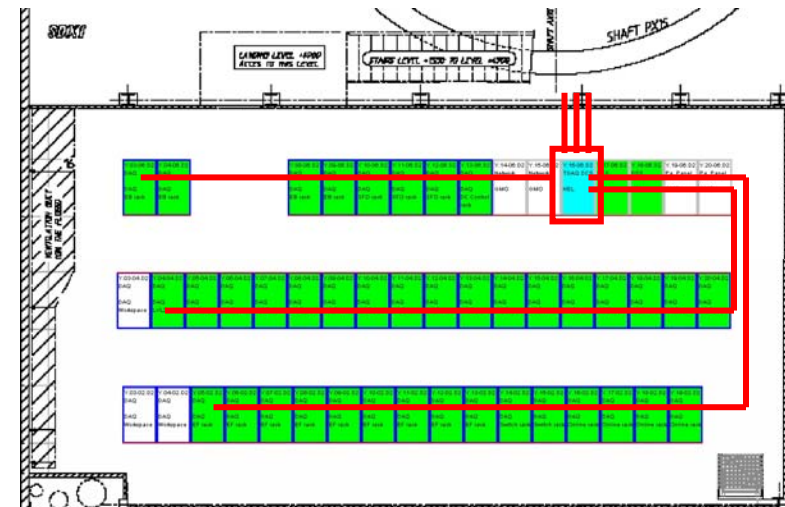
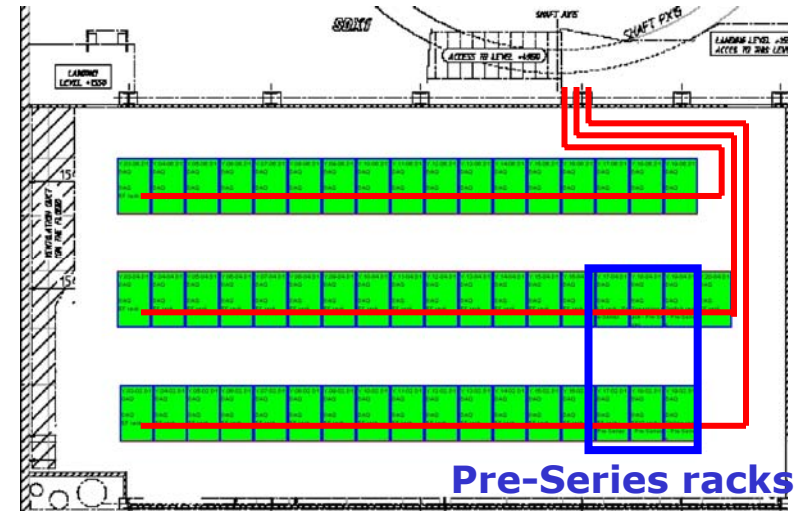
ELMB CANbus daisy-chain implementation

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



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)

Component	Cost (CHF)	N	Total	
DCS PC	2000.00	1	2000.00	7.58%
Kvaser PC/Can-Q CARD	558.00	2	1116.00	4.23%
PSU crate	1500.00	1	1500.00	5.68%
Power module	700.00	3	2100.00	7.96%
CANbus cable	1.64	200	328.00	1.24%
Daisy-chain connector	50.00	32	1600.00	6.06%
ELMB+motherboard	165.00	32	5280.00	20.01%
DIN rail (m)	2.70	16	43.20	0.16%
Temperature sensor	25.00	368	9200.00	34.87%
Humidity sensor	25.00	92	2300.00	8.72%
Sensor cable	10.00	92	920.00	3.49%
Total			26387.20	

Component and system cost (1 ELMB / rack)

Component	Cost (CHF)	N	Total	
DCS PC	2000.00	1	2000.00	5.08%
Kvaser PC/can-Q CARD	558.00	2	1116.00	2.83%
PSU crate	1500.00	1	1500.00	3.81%
Power module	700.00	3	2100.00	5.33%
CANbus cable	1.64	200	328.00	0.83%
Daisy-chain connector	50.00	92	4600.00	11.68%
ELMB+motherboard	165.00	92	15180.00	38.56%
DIN rail (m)	2.70	46	124.20	0.32%
Temperature sensor	25.00	368	9200.00	23.37%
Humidity sensor	25.00	92	2300.00	5.84%
Sensor cable	10.00	92	920.00	2.34%
Total			39368.20	

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