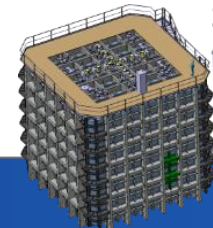


Slow control system: production, QA, installation

Y. RIGAUT on behalf of ETHZ group

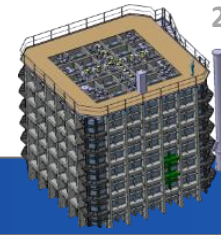
ProtoDUNE-DP Design Review



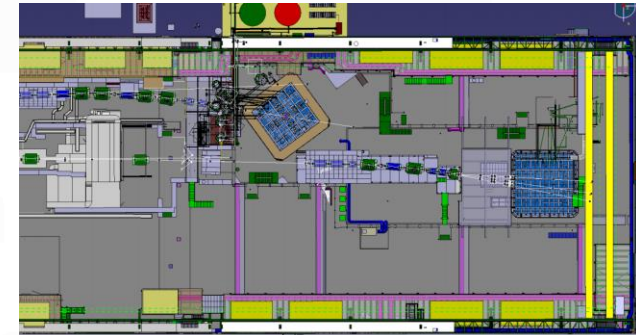
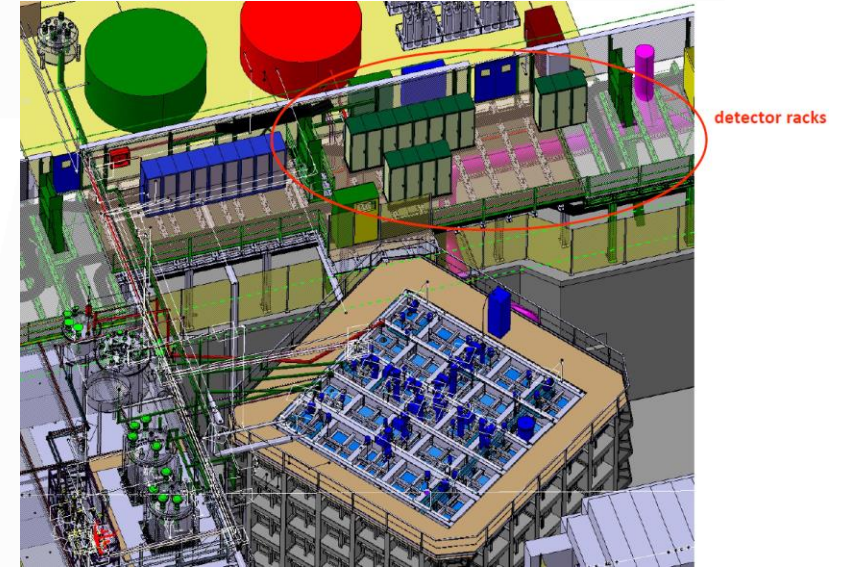
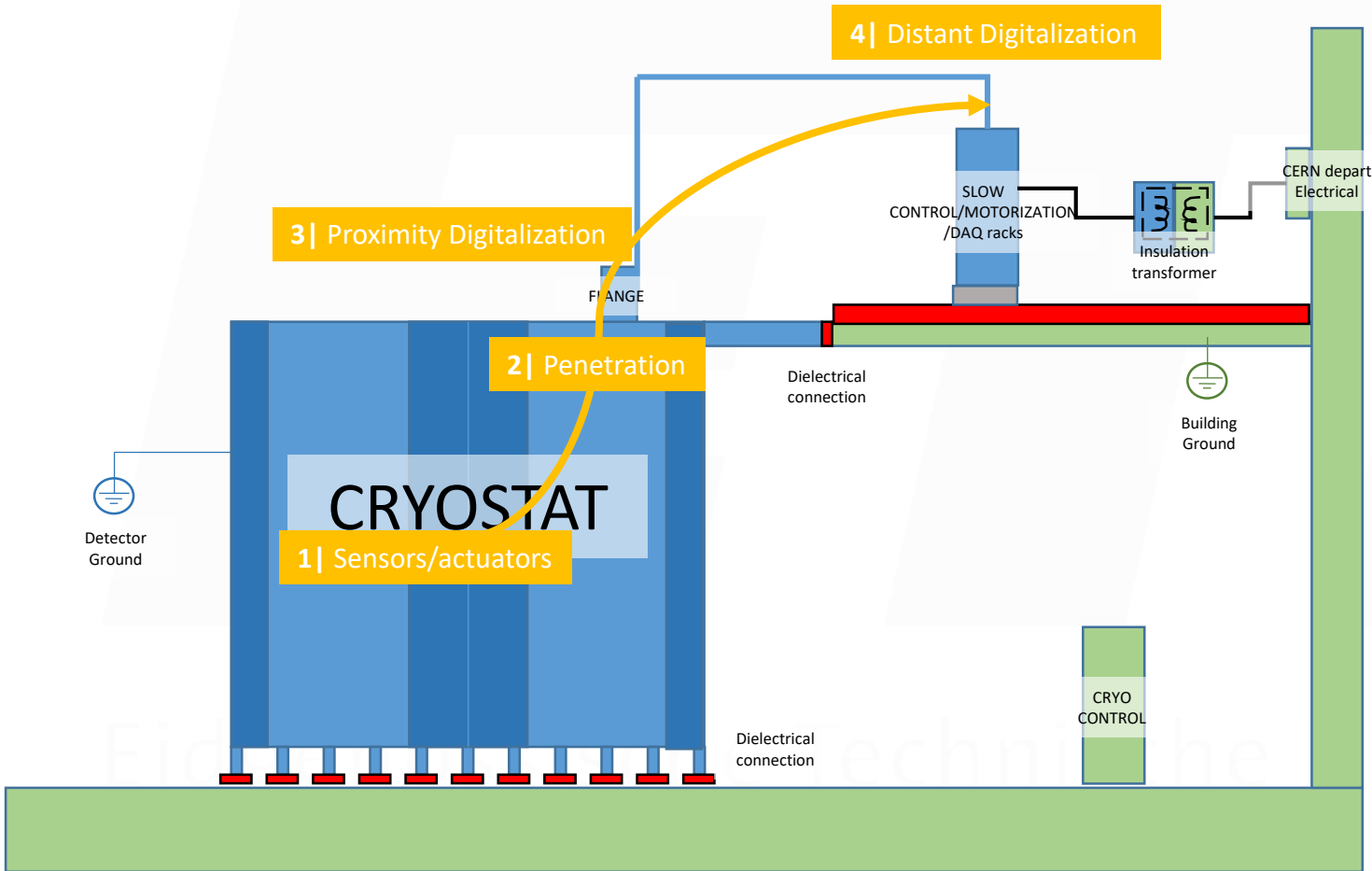
OUTLINE

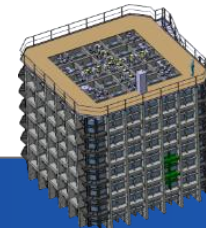


- General view of ProtoDUNE DP
- 1 | Sensors\Actuators
- 2 | Penetrations
- 3 & 4 | Digitalization
- Roof integration
- Racks configuration
- Monitoring



GENERAL VIEW OF PROTODUNE DP

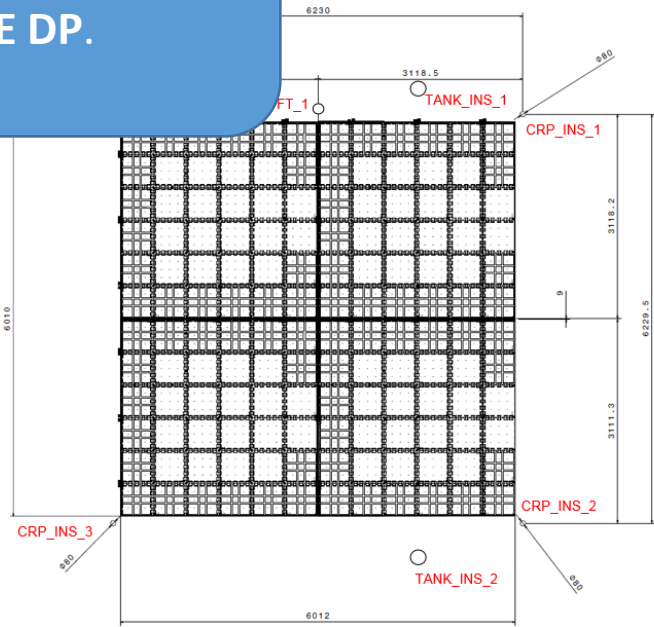


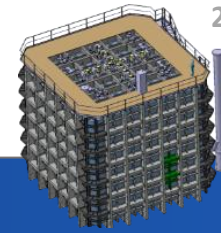


1 | SENSORS/ACTUATORS

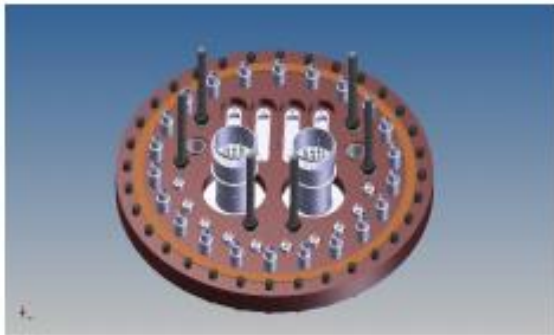
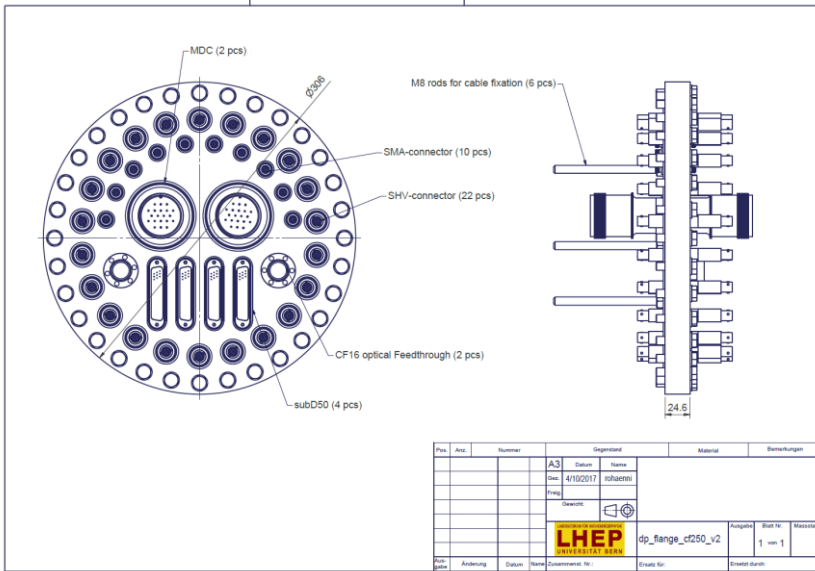
Measurement location	Picture	Sensors			Cables										Patch Panel	Connectors on PP and									
		Qty	Price (unit)	Total Price	Category	SKU	Picture	Number of cables	Length	Price (unit)	Total Price	Standard	Connector on PP	Category		SKU	Picture	Number of cables	Length	Price (unit)	Total Price	Standard	Range	Picture	Comment
x4 TOP, MIDDLE, BOTTOM, CRP	Temperature (8 PCBs composed by 8 Pins 12 on the CRP)	6	200	1200	CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.462.A		3	7	21	63.5mm	SUBD 50 pins	Patch Panel 1	SUBD 50 pins	CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.462.A		3	7	0	63.5mm	SUBD 50 pins			
	Temperature for heaters (Pin 12 for regulator loop with heaters)	4	20	80	CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.438.D		1	7	7	21mm	SUBD 50 pins		SUBD 50 pins	CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.438.D		1	7	0	21mm	SUBD 50 pins			
	Capacitive level meters	4	0	0	CABLE COAXIAL SO CHM - PAIRLE PIRET - TYPE C-50-13-E	DA.81.11.368.A		8	5	40	4.2mm	SMA		SMA	CABLE COAXIAL SO CHM - PAIRLE PIRET - TYPE C-50-13-E	DA.81.11.368.A		8	5	0	4.2mm	SMA			
	Distance meters	3	0	0	CABLE COAXIAL SO CHM - PAIRLE PIRET - TYPE C-50-13-E										CABLE COAXIAL SO					0	4.2mm	SMA			
	Heaters (cable will allow also to avoid liquid on CRP) - 6Pin	4	350	1400	PL DE CABLES ELECTRONIQUE L'EMBALLAGE PAREE INCOMPLEMENT	DA.01.81.800.1						1.5mm		AMPHEMCOL MDC 10 pins	Number of heaters on bottom need to be define										
	HV LHM	72	0	0	HEATRES TORADERE POUR DC - PAE L27 mm	DA.21.22.438.D									SUBD 50 pins	Depends on heaters number									
Extraction 0.5m/1m	4	0	0	HEATRES TORADERE POUR DC - PAE L27 mm	DA.21.22.438.D								SUBD 50 pins	Number and position need to be define											
x2 TANK_INS_1, TANK_INS_2	Class of Pa (2 composed by 12 Pins)	24	800	800	CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.462.A																			
	Party Monitor	1																							
	PMUs	18			Capton Instru KAPW5000																				
	Heaters on the bottom		400		PL DE CABLES ELECTRONIQUE L'EMBALLAGE PAREE INCOMPLEMENT	DA.01.81.800.1				4		1.5mm	AMPHEMCOL MDC 10 pins	Number of heaters on bottom need to be define											
	Temperature for heaters (Pin 12 for regulator loop with heaters)		20		CABLE PLATS PAREE TORADERE POUR DC - PAE L27 mm	DA.21.22.438.D				7			SUBD 50 pins	Depends on heaters number											
	SDs - 12/15 Volt according ambient temperature	3	40		PL DE CABLES ELECTRONIQUE L'EMBALLAGE PAREE INCOMPLEMENT	DA.01.81.800.1		6	4		1.5		AMPHEMCOL MDC 10 pins	Maybe some additional on the bottom											
	Cameras				Capton Instru KAPW5000	NO							SUBD 50 pins	Number and position need to be define											
Cloud Level meters	1						1				??														
Pressure	1																								
HV_L1	HV cathode	1											Dedicated	Delivered											

With 3m x 1m x 1m, we have a better understanding of which sensors we need and where to place them. So with this informations we have built the instrumentation list for ProtoDUNE DP. See Cosimo talk

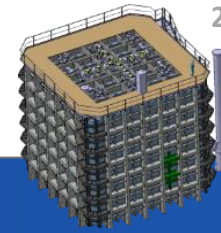




2 | PENETRATIONS

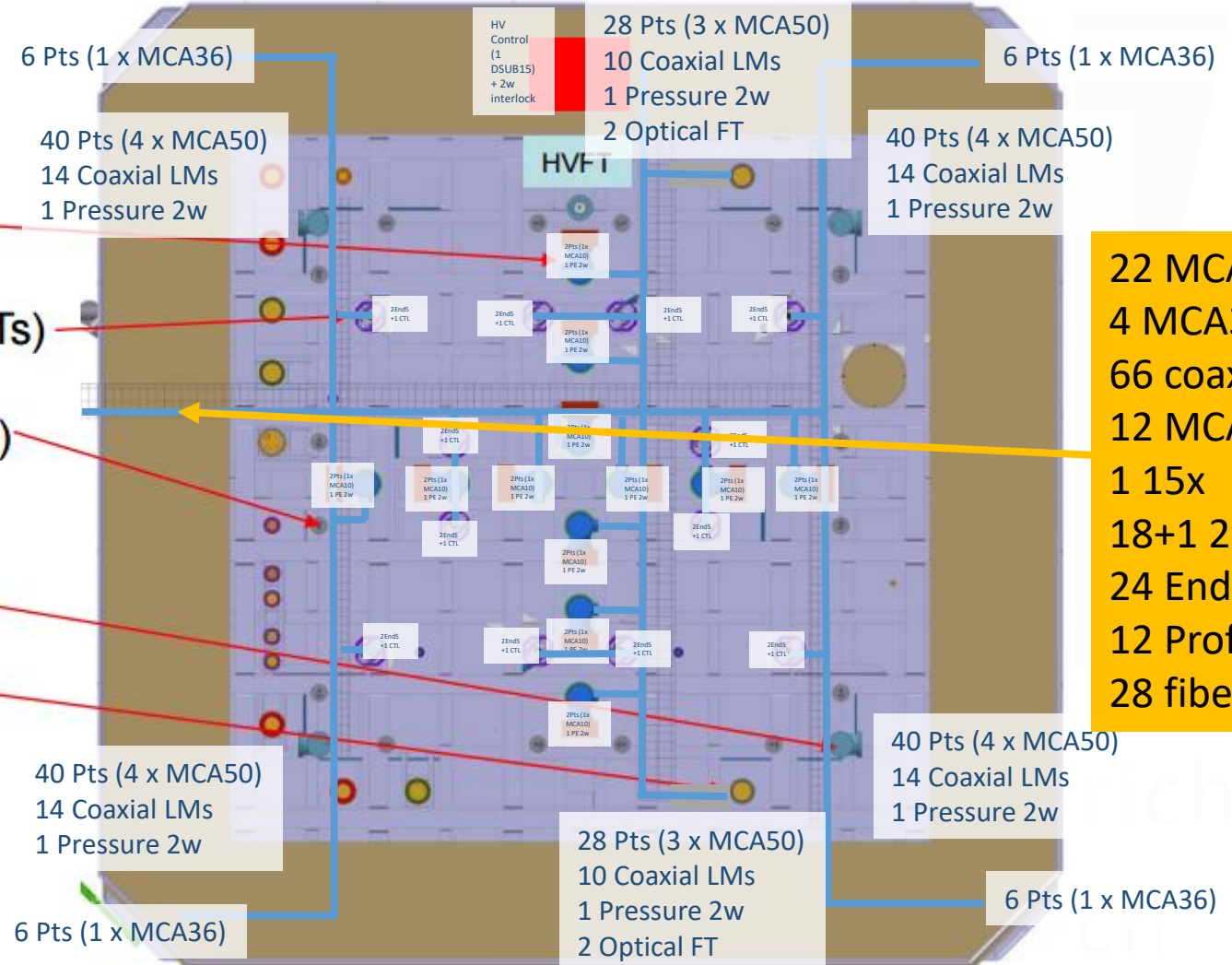


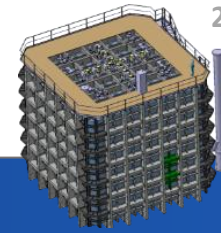
Flange	Item	Which institute ?	OUT	Cable Tray	Link on the roof ?	Rack/Box interface
x4	Temperature (6 PCB composed by 6 Pts 1K on the CRP)	ETH Zurich	3x DSUB50	Signal	no	NP02_R09, NP02_R10
CRP_INS	Temperature for heaters (Pts 1K for regulation loop with heaters)	ETH Zurich	1x DSUB50	Signal	no	NP02_R11
	Capacitive level meters	ETH Zurich	6x SMA	Signal	no	NP02_R06
	Distance meters	LAPP	8x SMA	Signal	yes	Distance Meter Box
	Heaters (resistor with sheet size to avoid liquid on CRP) - 48Vac	ETH Zurich	1x AMP 10 pins	Power	no	NP02_R12
	HV LEM	ETH Zurich	72x SHV	Power	no	NP02_R08
	Extraction Grid/FFS	ETH Zurich	4x BNC	Power	no	NP02_R09
x2	Pulsar	IPNL	??	Direct link with box	yes	Pulsar Box
	Pressure	ETH Zurich	2x Prop.	Signal	no	NP02_R11
	Chain of Pts (2 composed by 12 Pts)	ETH Zurich	2x DSUB50	Signal	no	NP02_R09, NP02_R10
	Purity Monitor	UCL			yes	Purity Monitor Box
	PMTs	CIEMAT/LAPP	18x SHV	Power	no	NP02_R14
	Optical for PMTs	IFAE			yes	Calibration Light Box
TANK_INS	Heaters on the bottom	ETH Zurich	1x AMP 10 pins	Power	no	NP02_R12
	Temperature for heaters (Pts for regulation loop with heaters)	ETH Zurich	1x DSUB50	Signal	no	NP02_R11
	LEDs - 12/15 Vdc according ambient temperature	ETH Zurich	1x AMP 10 pins	Power	no	NP02_R12
	Cameras	ETH Zurich	1x SUBD50	Direct link with box	yes	Raspberry Box
	Capacitive level meters	ETH Zurich	8x SMA	Signal	no	NP02_R06
	Coaxial Level meters	ETH Zurich	2x SMA	Signal	no	NP02_R06
x12	Pressure	ETH Zurich	2x Prop.	Signal	no	NP02_R11
	Pts	ETH Zurich		Signal	no	NP02_R09, NP02_R10
	Signal	IPNL	10x KEL	Direct link with box	yes	uTCA
SGFT	Low Voltage	IPNL	1x SUBD	???	yes	LV Distribution box
	Pressure	ETH Zurich	1x Prop.	Signal	no	NP02_R11
HVFT	Cathode	ETH Zurich	Dedicated	Direct link with rack	yes	Heinzinger
x4 IS_INS	6 Pts by flange	GTT	1x DSUB25	Signal	no	NP02_R09, NP02_R10
x12	End Switch	LAPP	2x Prop.	Signal	no	NP02_R03, NP02_R04
	Power	LAPP	1x Prop.	Power	no	NP02_R03, NP02_R04
SPFT_CRP	Control	LAPP	1x Prop.	Signal	no	NP02_R03, NP02_R04



3 & 4 | SIGNAL DISTRIBUTION ON ROOF

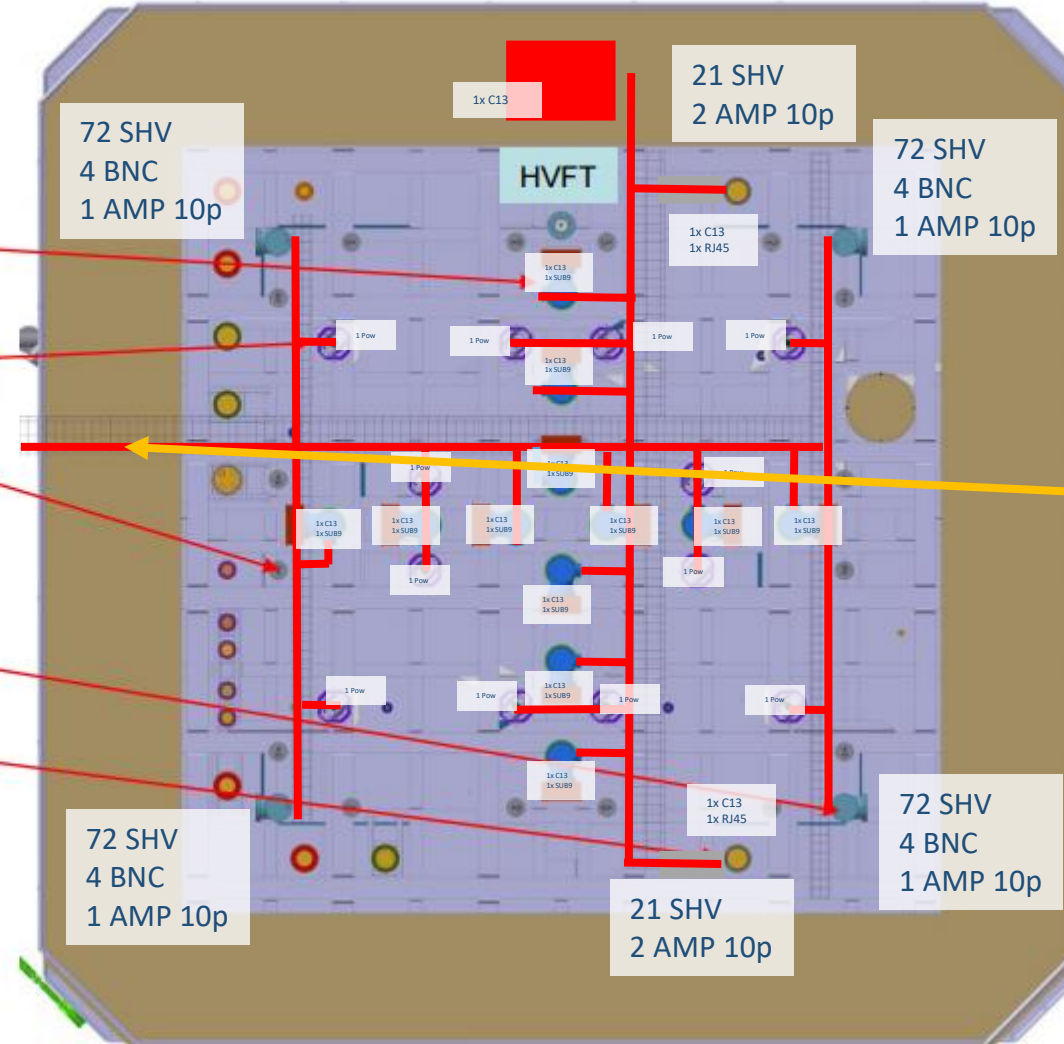
- 12 x SGFT (Signal FTs)
- 12 x SPFT CRP (suspension FTs)
- 16 x FC SPFT (suspension FTs)
- 4 x CRP-INS
- 2 x TANK-INS
- 1 x HVFT



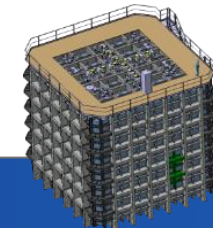


3 & 4 | POWER DISTRIBUTION ON ROOF

- 12 x SGFT (Signal FTs)
- 12 x SPFT CRP (suspension FTs)
- 16 x FC SPFT (suspension FTs)
- 4 x CRP-INS
- 2 x TANK-INS
- 1 x HVFT

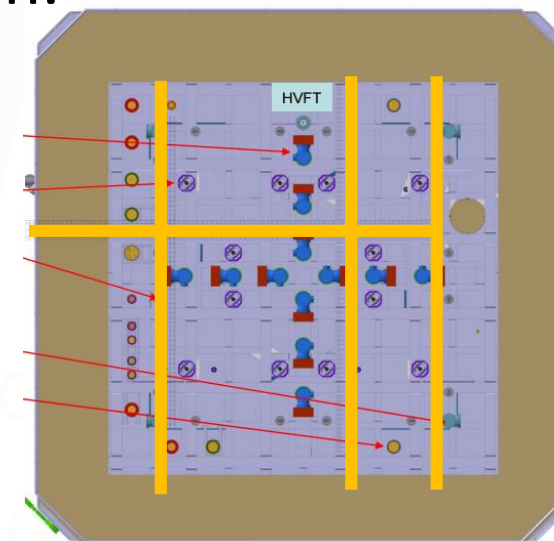
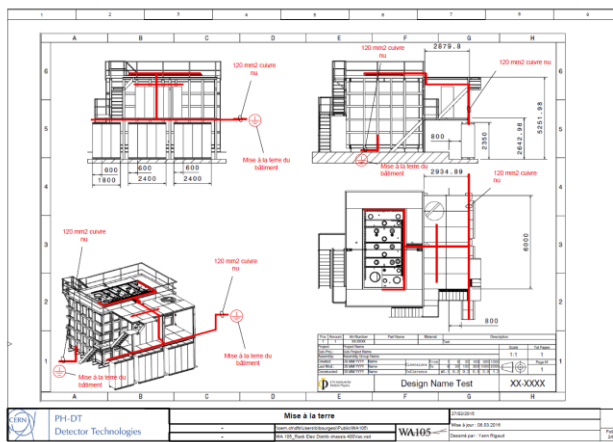


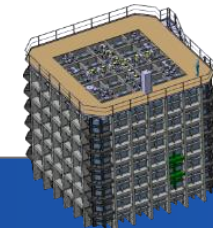
230 SHV
16 BNC
8 AMP
12 Pow M
12 Sub9
2 RJ45
15 C13



3 & 4 | LESSONS LEARNT FROM 3m x 1m x 1m

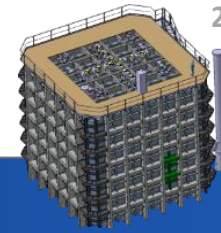
We learnt also more about noise requirement, for example to minimize the noise we had installed copper plates for GND and use some shielded cables to improve the system.



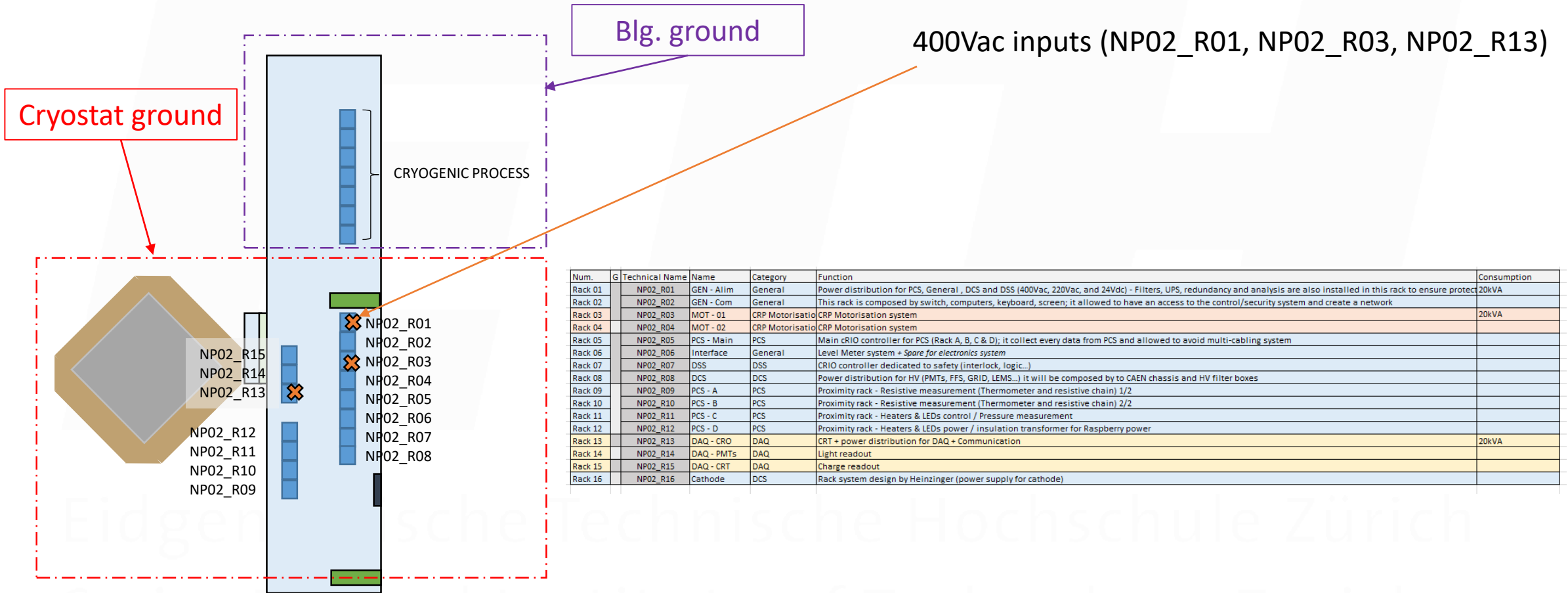


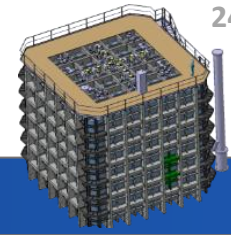
3 & 4 | ROOF MATERIALS (except traying)

Rack/Box interface	Item	Which institute ?	OUT	Cable Tray	Other link on roof ?	Rack/Box interface
Distance Meter Box	to be define	LAPP			no	NP02_R03, NP02_R04
Pulser Box	GND	IPNL	1x Screw	GND	no	no
	220Vac Power Sup	IPNL	1x C13	Power	no	NP02_R15
Purity Monitor Box	to be define	UCL			no	
Calibration light box	to be define	IFAE			no	NP02_R14
Camera (x2)	GND	ETH Zurich	1x Screw	GND	no	no
	220Vac PS	ETH Zurich	1x C13	Power	no	NP02_R01
	Ethernet	ETH Zurich	1x RJ45	Power	no	NP02_R02
uTCA (x12)	GND	IPNL	1x Screw	GND	no	no
	220Vac Power Sup	IPNL	1x C13	Power	no	NP02_R15
	Fiber Time, trigger	IPNL	2x fiber		no	NP02_R15
	Fiber Digitized sugnals	IPNL	1x fiber		no	NP02_R15
LV Distribution box	GND	IPNL	1x Screw	GND	no	no
	220 Vac PS	IPNL	4x C13	Power	no	NP02_R15
Heinzinger	GND	ETH Zurich	1x Screw	GND	no	no
	220Vac Power Sup	ETH Zurich	1x C13	Power	no	NP02_R01
	Interlock	ETH Zurich	1x 2w	Signal	no	NP02_R07
	Front program plug	ETH Zurich	1x DSUB15	Signal	no	NP02_R07
	Ethernet	ETH Zurich	1x RJ45	Power	no	NP02_R02
Display on roof	220Vac	ETH Zurich	1x C13	Power	no	NP02_R01
	Ethernet	ETH Zurich	1x RJ45	Power	no	NP02_R01
Power plug	220Vac	ETH Zurich	1x C13	Power	no	NP02_R01



4 | DISTANT DIGITALIZATION



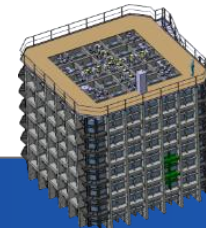


4 | EXISTING RACKS



A large part of these rack are already built and functional. They are currently used for the **3m x 1m x 1m** since September 2016 and they will be moved when they will be available.

Only some minor modification to add more sensors and to improve the system are needed.



4 | EXISTING RACKS

We had conceived these racks to be standard and like these they are easy to reproduce, to transport and to adapt.

RACK 1 – Alimentation + Réparation
RACK 2 – Computer + Communication
RACK 3 – Process Control System
RACK 4 – Detector Safety System 1
RACK 5 – Detector Safety System 2
RACK 6 – Detector Control System

PH-DT Detector Technologies		Distant Rack		Designé le : 20.01.2015	
		Team: chris/leann/yongul/Desap		Visé à jour : 07.12.2015	Page 2/5
		Imprimé : WA105		Designé par : N. BOURGEOIS / Y. RIGAUT	

Distant Racks

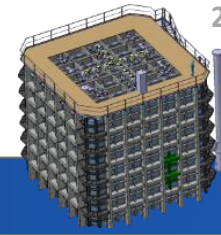
RACK A - Pt
RACK B - Pt
RACK C - Others sensors
RACK D - DI/DO

2041 mm
600 mm

PH-DT Detector Technologies		Remote Rack		Designé le : 20.01.2015	
		Team: chris/leann/yongul/Desap		Visé à jour : 07.12.2015	Page 4/5
		Imprimé : WA105		Designé par : N. BOURGEOIS / Y. RIGAUT	

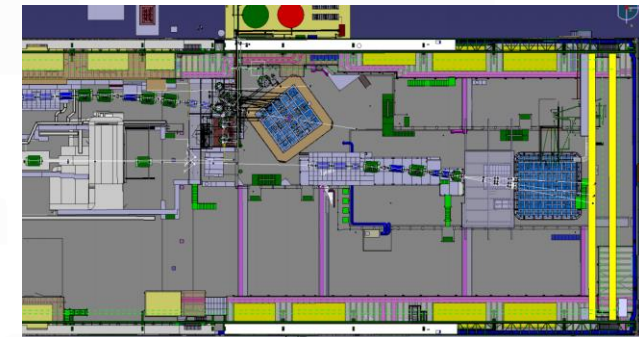
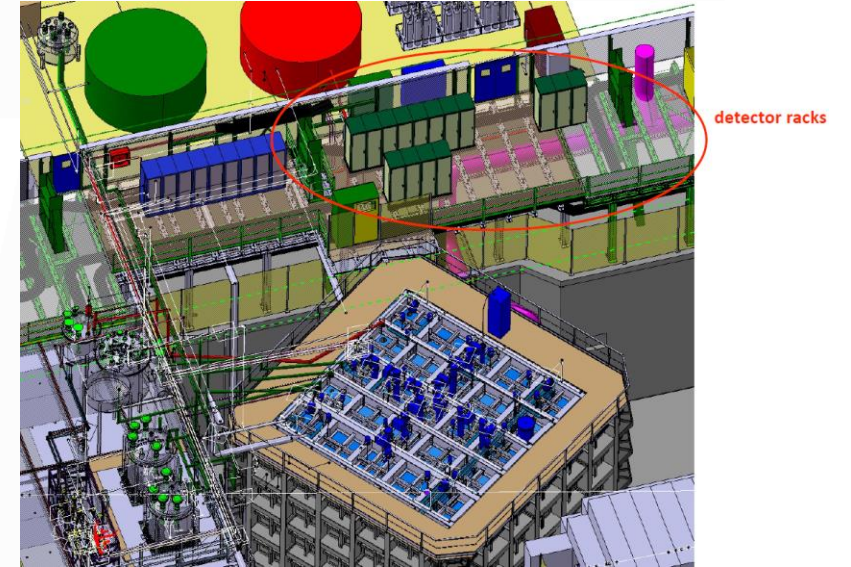
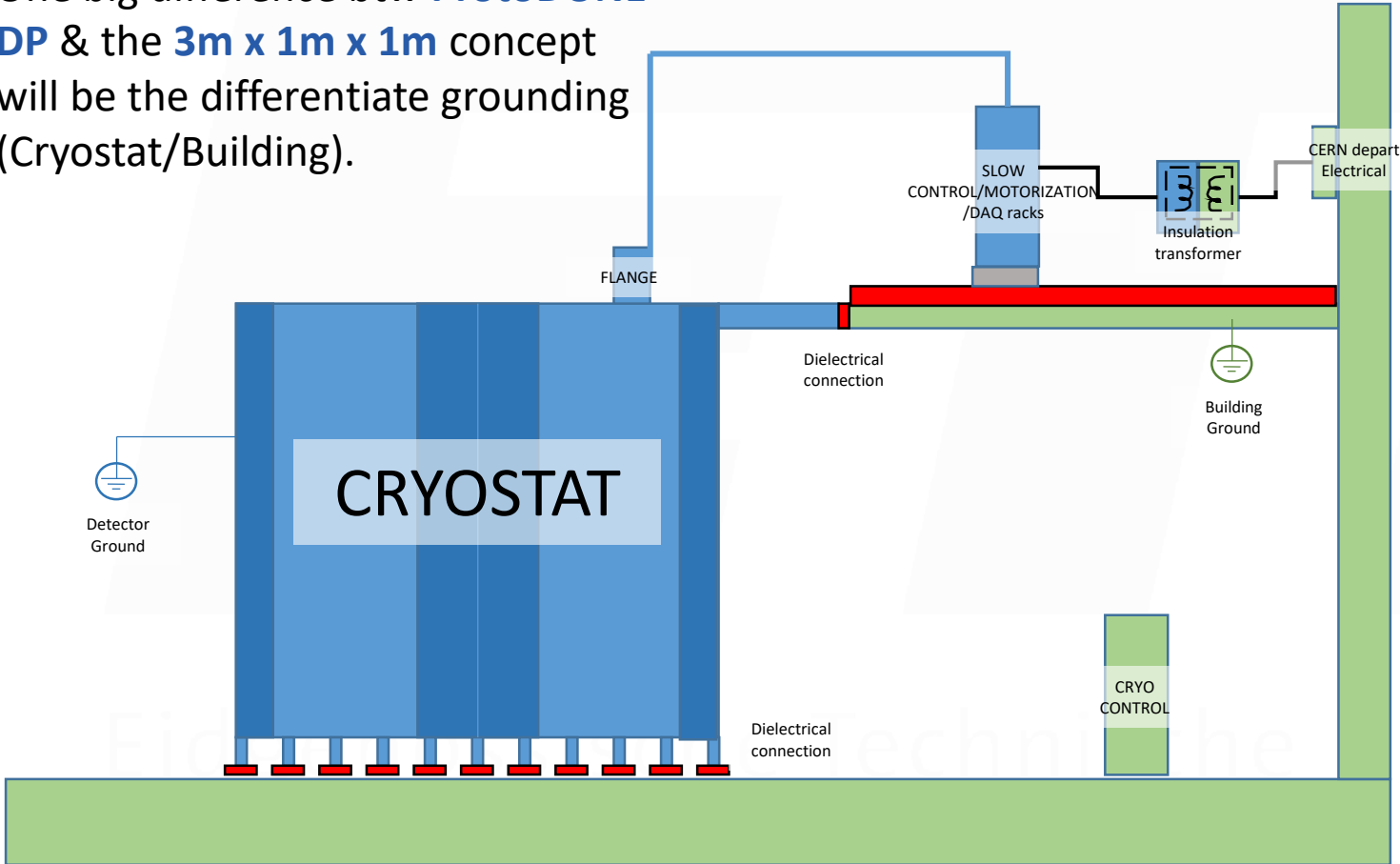
Remote Racks

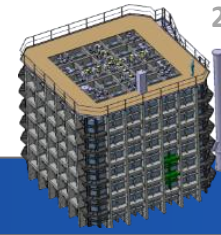
Swiss Federal Institute of Technology Zurich



4 | INSULATION PRINCIPLE / RACK LOCATION

One big difference btw **ProtoDUNE DP** & the **3m x 1m x 1m** concept will be the differentiate grounding (Cryostat/Building).

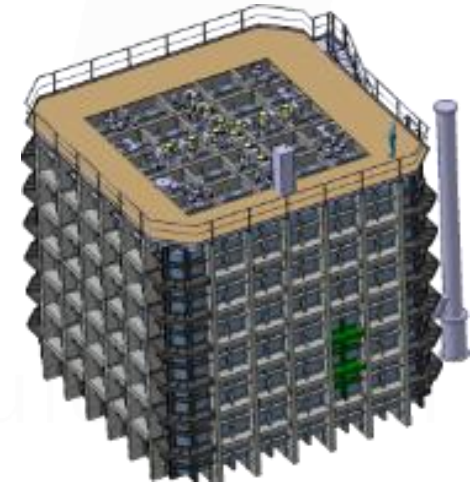
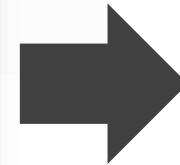
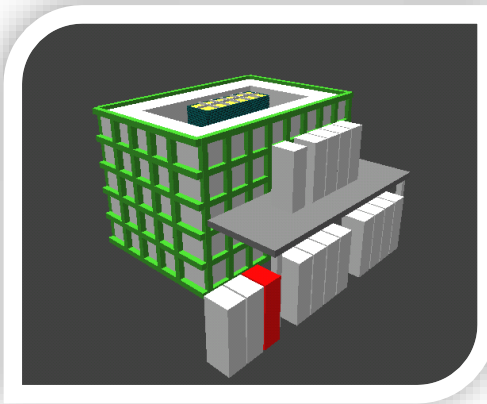
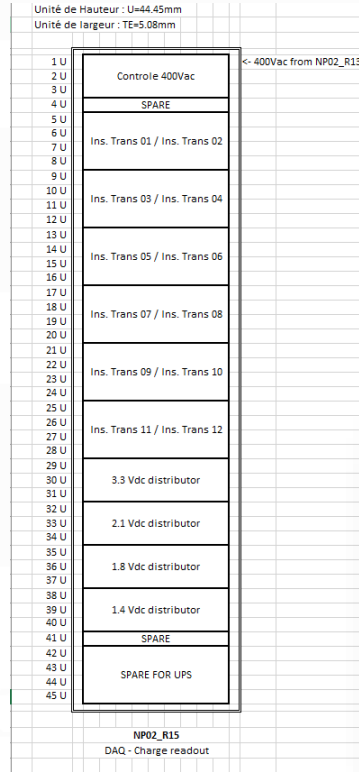
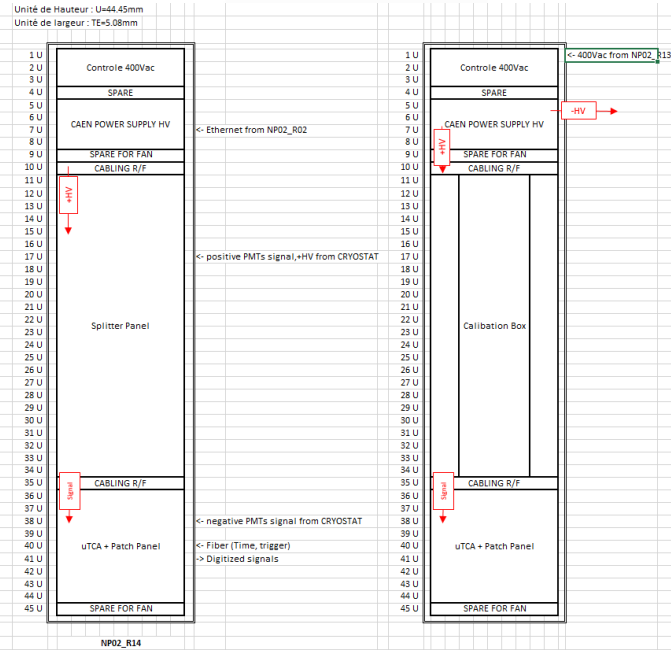


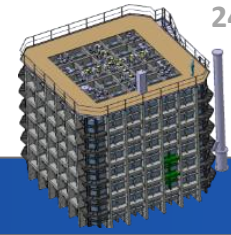


4 | DAQ RACK STANDARDIZED

Work in progress for the design of the 3 DAQ racks.

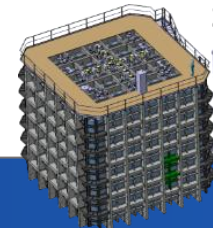
When final design will be established it will be possible to start construction of the structure to be ready when we will move racks to blg. 887 (EHN1).



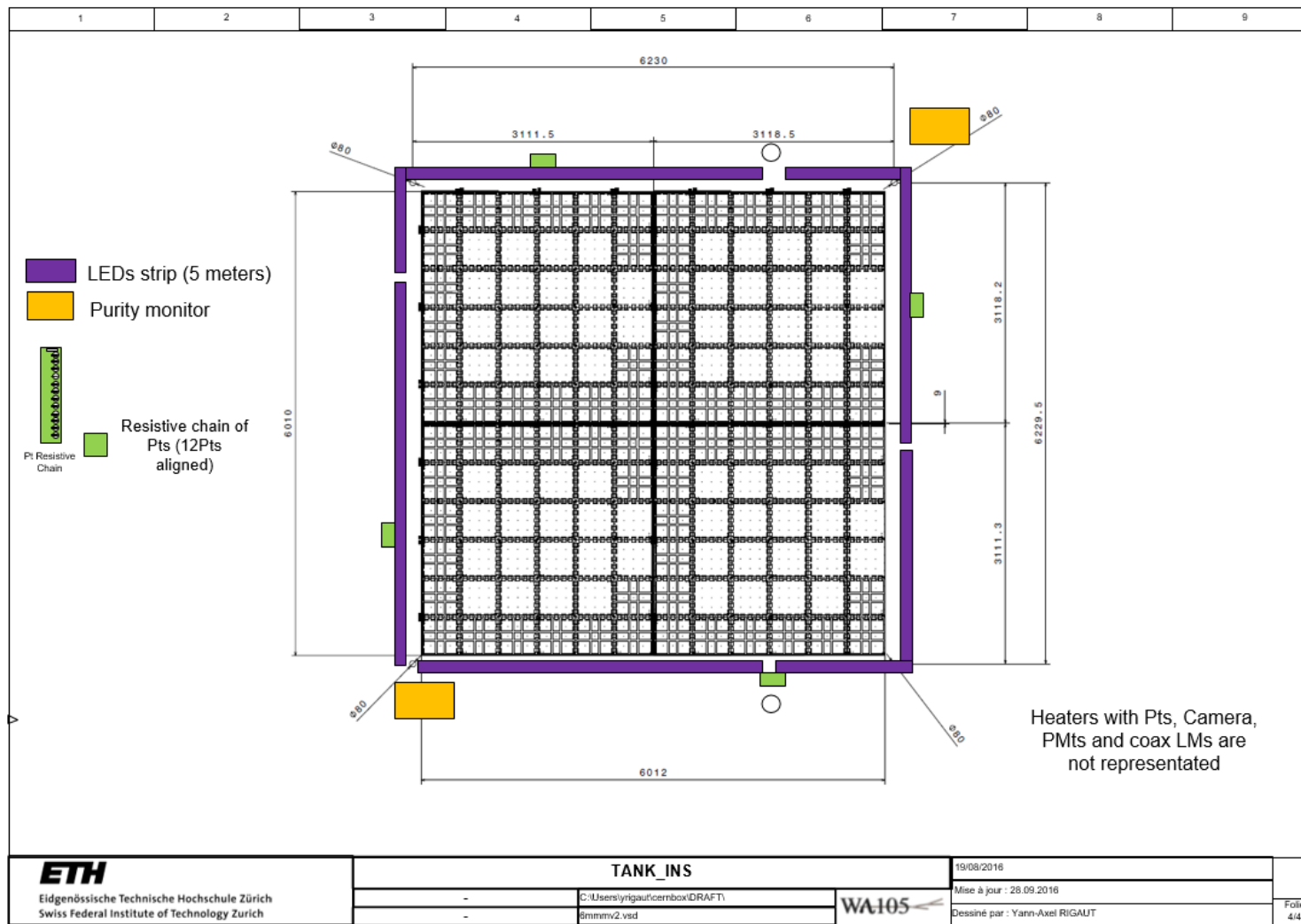


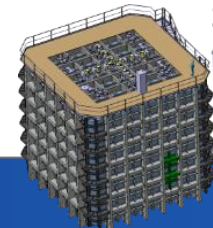
Back up slides...

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

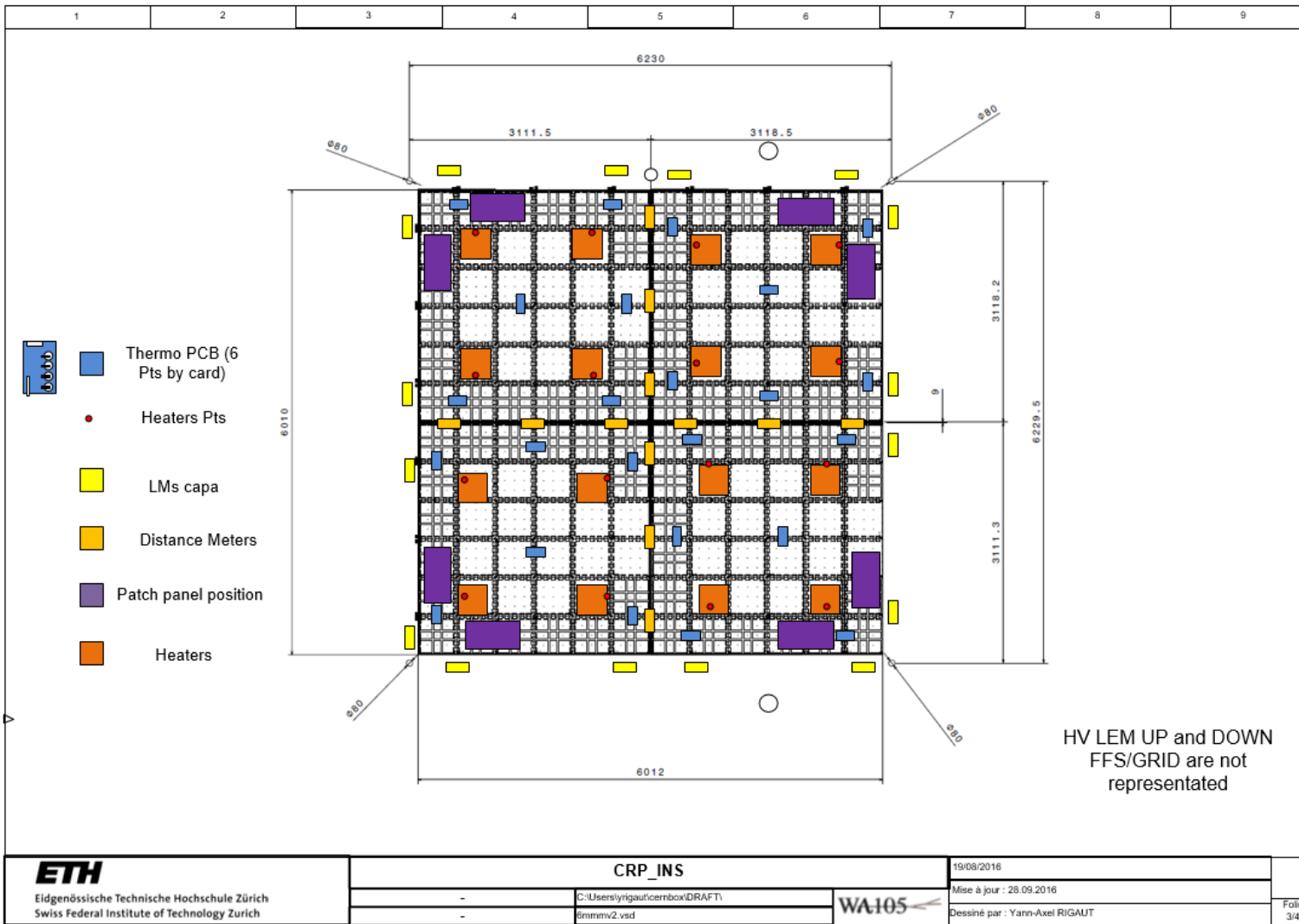


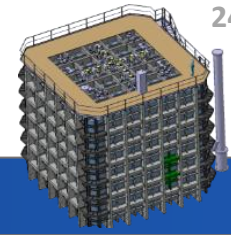
TANK_INS



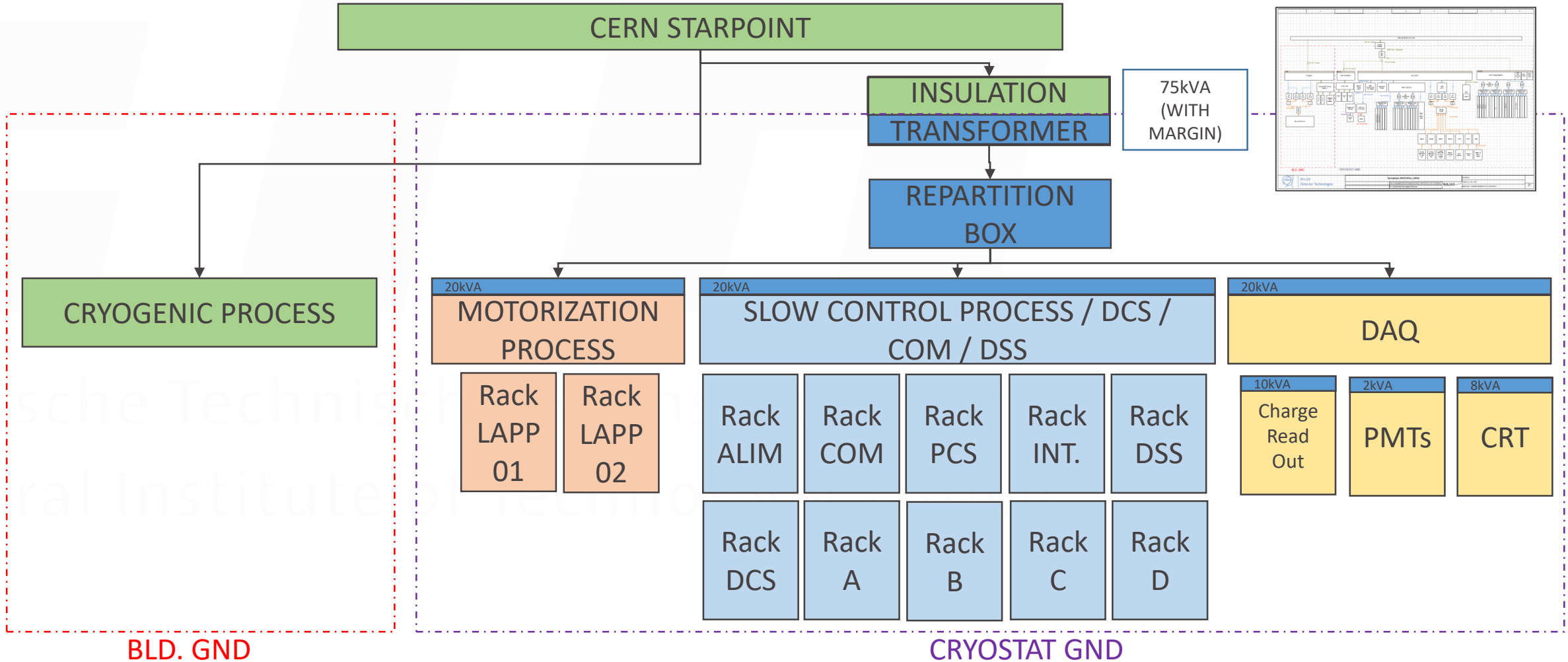


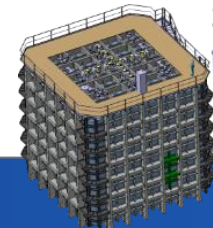
CRP_INS





POWER DISTRIBUTION (SIMPLE VERSION)





3m x 1m x 1m network

