

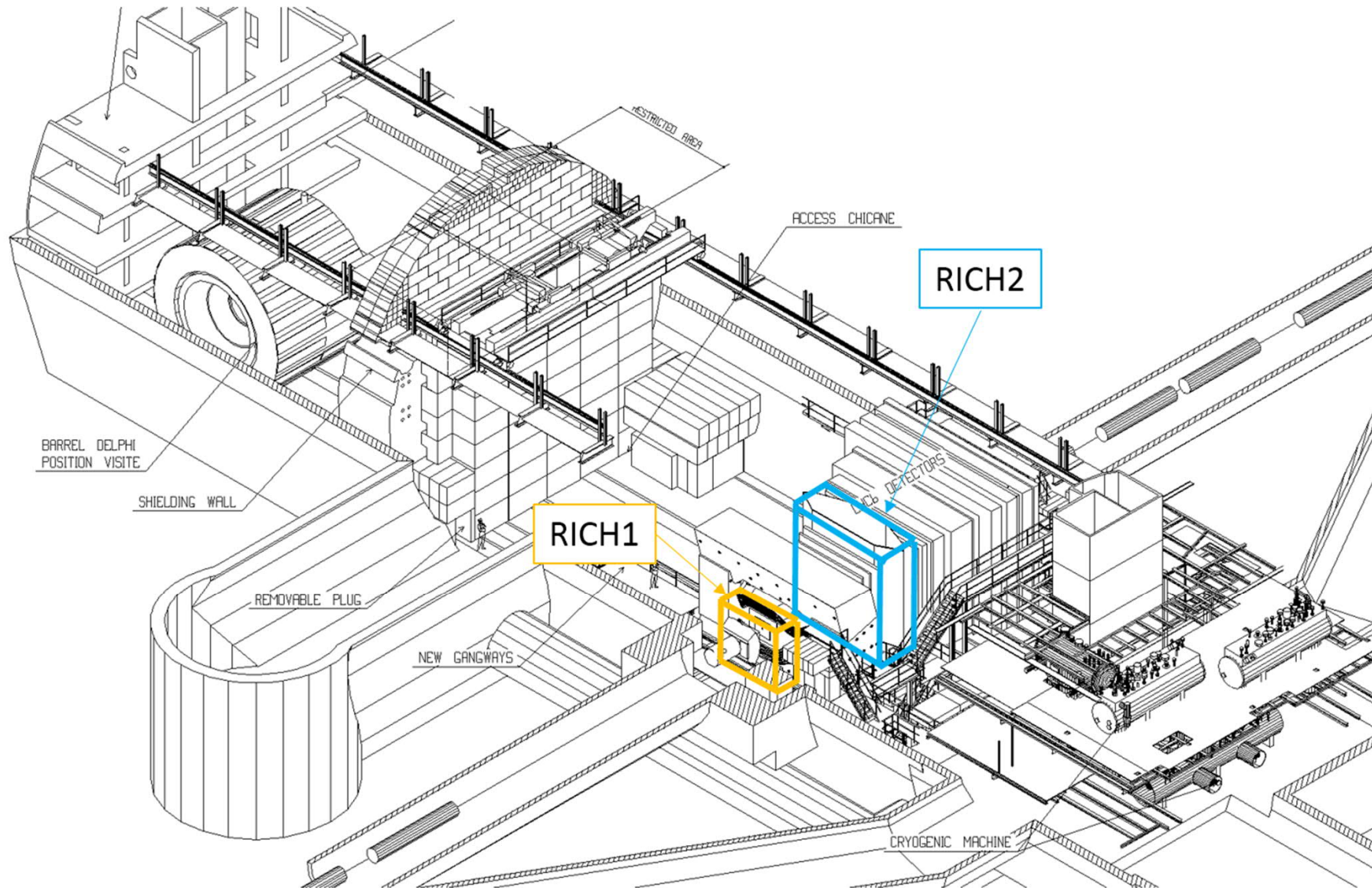


RICH2

Preparation for the Installation of the Upgrade

Christoph Frei
on behalf of the RICH Team
17 May 2018

LHCb Cavern and the RICHes





Outline

- Remind what will be changed
- Dismounting
 - Decommissioning
 - Services
 - Hardware
- Envelope
- New Photodetector System
- Installation
 - Services
 - Hardware
 - Commissioning
 - Cooling
- DAQ - ECS – Traceability
- Installation Procedure

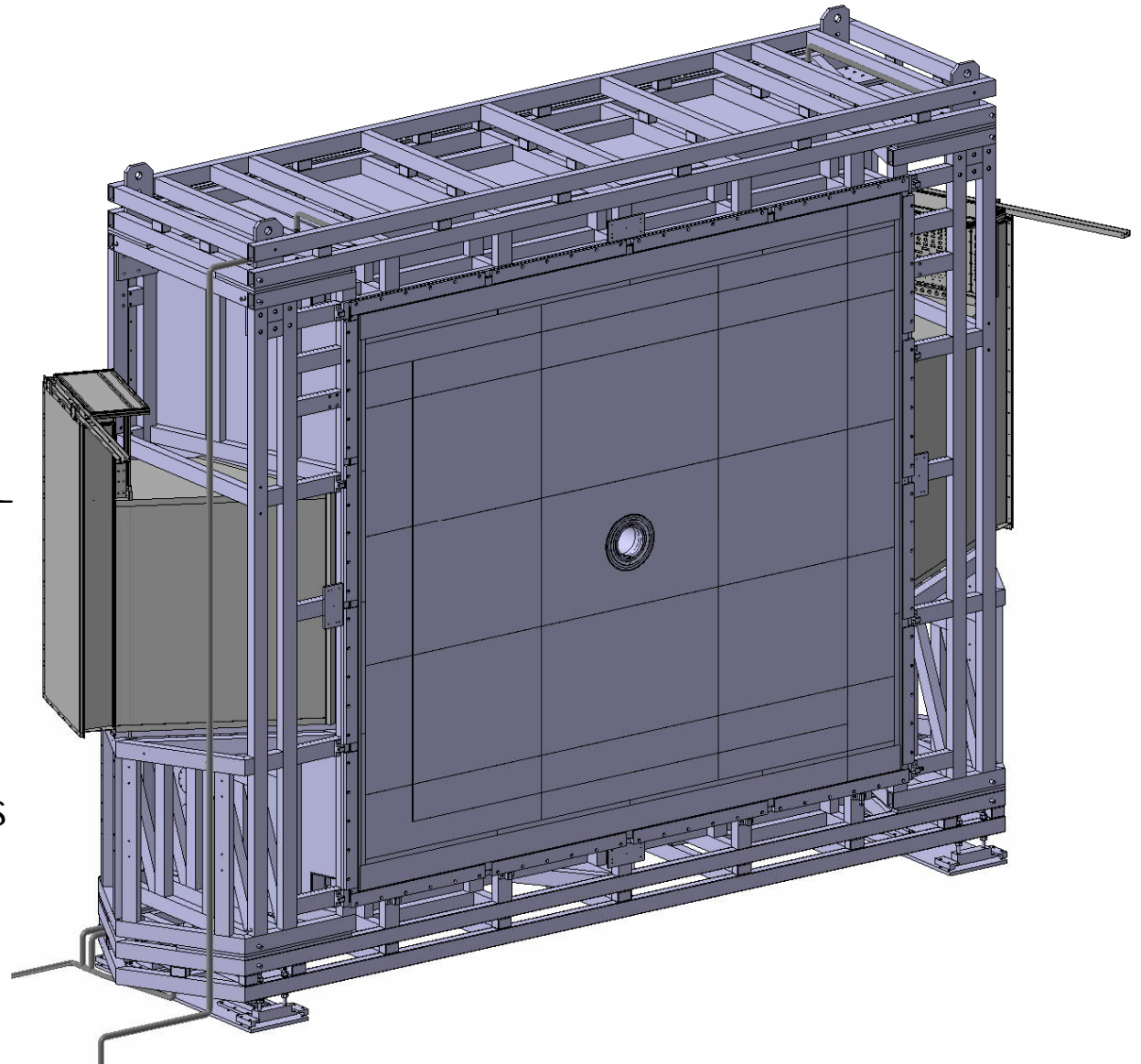
RICH2 – Existing vs Upgrade

Upgrade RICH2 : The photodetectors

- 2× New photodetectors assemblies
 - MaPMTs
 - Readout electronics
 - Column holding
 - Support Structure of the Columns
 - Low voltage power
 - High voltage supplies
 - Cabling + Optical Fibres + Patch Panels Connections
 - Cooling + Transfer Lines

Systems that will stay in place:

- The Superstructure
- The Entry + Exit Windows + Central Tube.
- The Magnetic Shieldings + Extension Frames
- The Quartz Windows
- The Optical System (4× Mirror Walls)
- The Gas System





RICH2 Dismantling

The dismantling of the photodetector assemblies is broken down in the following steps:

- Step 0: Stop of the RICH2 detector (Decommissioning)
- Step 1: Services: Disconnect and Remove
- Step 2: Access Tower: Removing the top floor
- Step 3: HPD Column: Extracting
- Step 4: HPD Support Frame: Removing

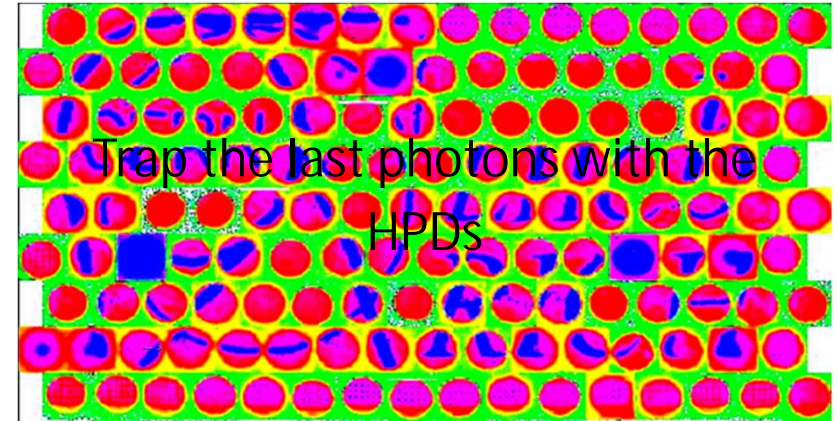
Work Package Procedure (WPP) for the Dismantling of the Photon Detector Systems in the RICH2 detectors [EDMS-1822492]

Defines:

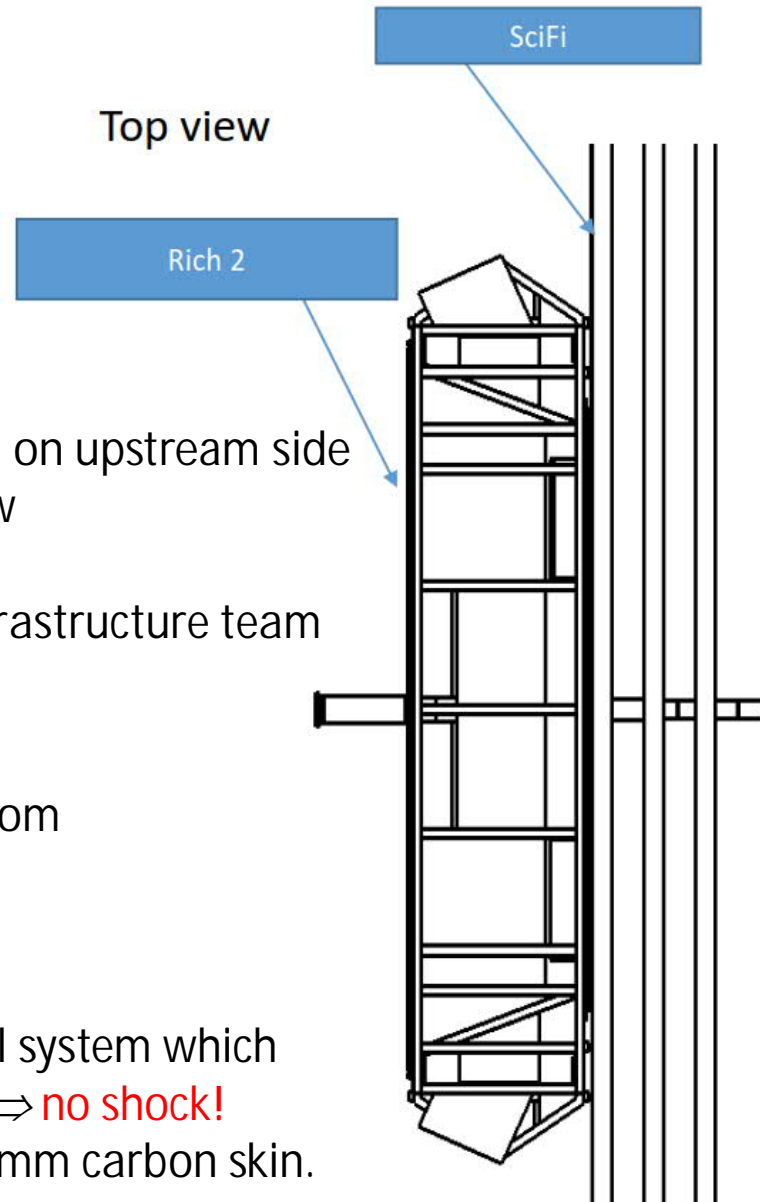
- Preventive Actions
- Preparatory work
- Work
- Number of persons (and support required from the infrastructure team)
- Time Estimate

Dismantling - #0 Stop of the RICH2 detector (Decommissioning)

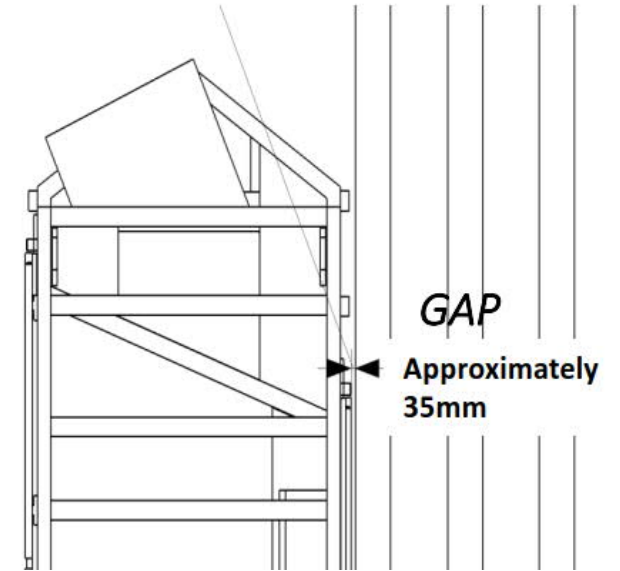
- Turn off all electrical systems: HV, LV.
- Switch off all hardware (power supplies).
- Switch off the cooling valves.
- Turn off the cooling plant + purge the line.
- Inhibit all the alarms from Detector Safety System (DSS) except the gas system.
- Swap the 2x flushing lines of the Photodetector Enclosures from CO₂ to N₂.
- Recover the CF₄ gas and replace it with CO₂ and then N₂.
ECS: All sensors pressures operational. Gas system: fully operational (racks in the cavern)
- Dry air flushing (compressor installation)
- Install accelerometers/seismic and connect them to an online monitoring system.
- Recover the hardware which will be not anymore used: D3 barrack:
 - L1 boards
 - Laser supplies
 - HV supplies
- Pulsed Laser (Hamamatsu) and Continuous Laser Sources



Dismantling - #0+ Entry Window Protection



Window Rich 2
to detector envelopes SciFi



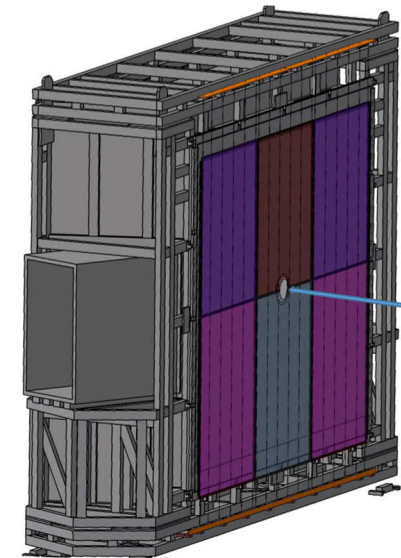
Protection panels mounted on upstream side of the RICH2, Entry Window

Credit to Jacky Rochet + infrastructure team

Main concerns: activities from

- OT+IT \Rightarrow SciFi
- PS/SPD
- M1

Remember this is an optical system which is made, on purpose, light \Rightarrow **no shock!**
Entry window is made of 1 mm carbon skin.



Dismantling - #1 Services: Disconnect and Remove

- Disconnect all the cables and optical fibres at: Patch panels, Bunker, Barrak D2 + D3
- Open the cable trays
- Keep in place all the cables listed here: [EDMS-1707868]
 - TTC optical fibres, few
 - Data optical fibres bundles, few
 - Overheat (DSS) thermos switch cables (Lemo)
 - Signal monitoring cables (BNC)
 - LV cables
(to be check how it will be compatible with the new connectors and position)
 - Sense cables (Lemo)
- Removed (bunker to detector) all the cables listed here: [EDMS-1707868]
(Long distance cables will be removed by the infrastructure team ?)
 - Data optical fibres ribbons (MPO-MPO)
 - TTC optical fibers
 - HV cables
 - (Lemo) Cables
 - Silicon Bias cables (SHV)
 - ECS Monitoring cables (37p), Monitoring cables (15), (SPECS) cables

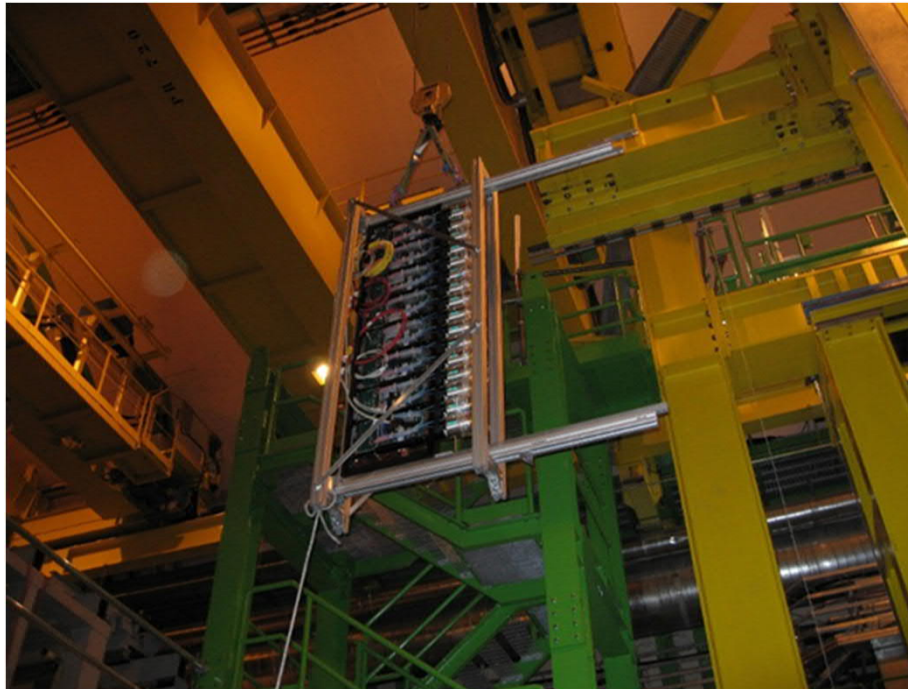
Dismantling - #2 Access Tower: Removing the top floor

- Add the extra balcony on the Muon1 side.
- Secure the top level.
- Dismount the handrails and all the parts not predominant for the structural robustness of the platform.
- Unscrew the top level.
- Lift the top platform.
- If required: transport the platform out of the cavern (RP traceability) for modification.



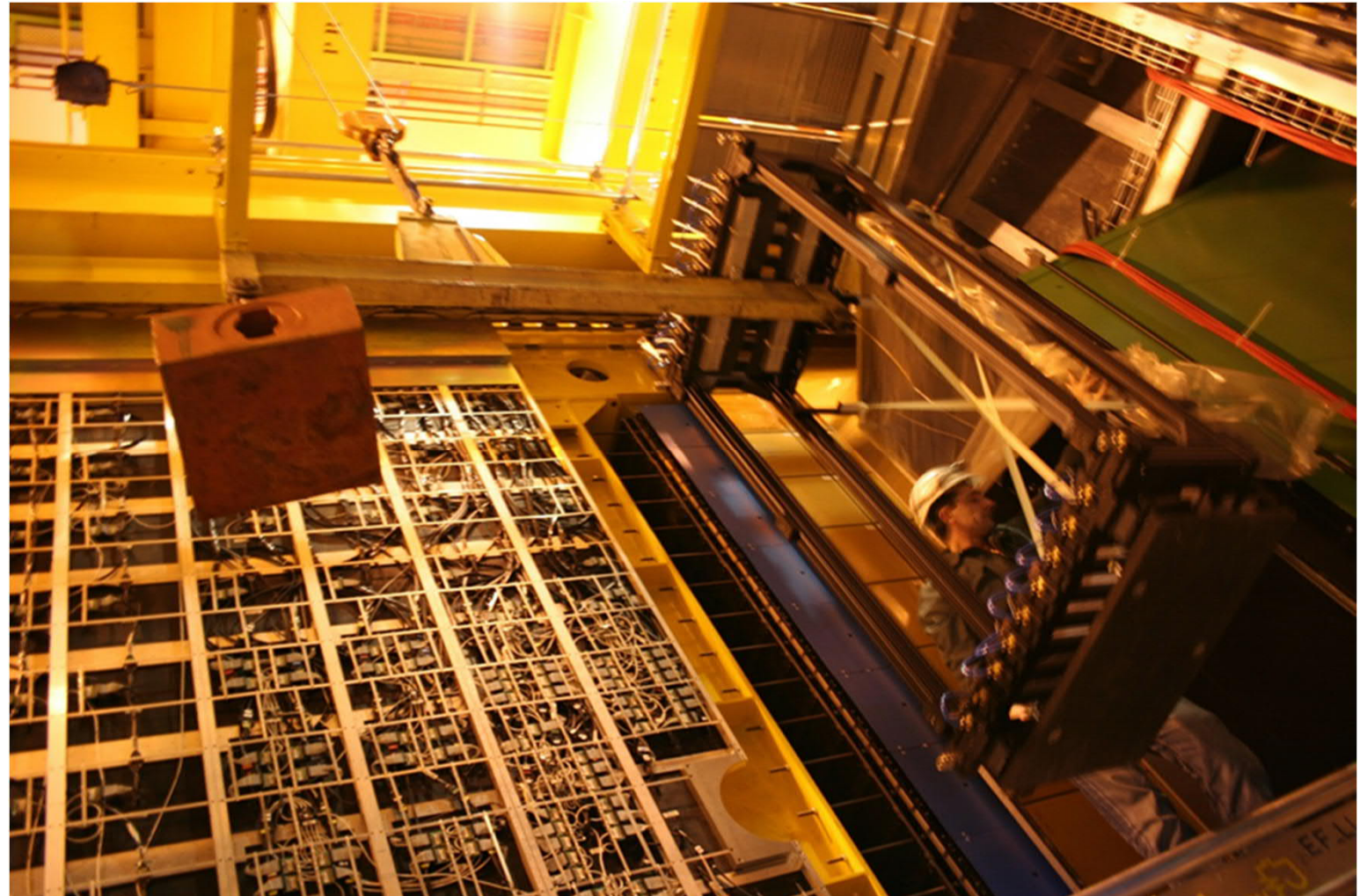
Dismantling - #3 HPD Columns: Extracting

- Open the Photodetector Enclosure
- Survey the radioactivity level (RP team).
- Purge the cooling circuit.
- Disconnect all the services (cabling, optical fibres and cooling) from the patch panel.
- Disconnect the Light Leak Detectors and the Reference PMs.
- Position the Handling Frame in front the HPD Column to extract the HPD Column.
- Transport the Handling Frame with the HPD Column to the cabinet.
- Repeat this operation for each HPD Column.



Dismantling - #4 HPD Support Frame: Removing

- Dismount the Chassis supporting the HPD Columns.
- Protect the quartz.



Dismantling - Work Package Procedure

Organization

Participants (in any order)	Role
Didier Piedigrossi	Supervising the dismantling activities and participating to this job.
Christoph Frei	Dismantling activities on the mechanical systems.
RICH Collaborators (names will be listed in the impact form)	Contributing to the dismantling
Silvia Gambetta (RICH Operation Coordinator)	Turning all electronics systems off
Antonis Papanestis (RICH Project Leader)	In charge for offering the manpower required
Thierry Gys	Supervising the HPD storage and traceability
Collaborators (UK/Oxford)	Supervising the LO Boards storage and traceability
Collaborators (IT/Milano)	Supervising the LV Boards storage and traceability
Collaborators (IT/Milano + Genova)	Supervising the HV Boards storage and traceability
Ken Wyllie	Electronic Coordinator
Laurent Roy	Electric Coordinator
Patrick Vallet	
Transport team	
Cedric Fournier	
Bernard Chadaj	
Gloria Corti + RP	

Final destination

Part name	Description	Qty	Length (m)	Width (m)	Height (m)	Weight (kg)	Final destination
HPD Columns	Containers with 9 HPD Columns	2	2	1	2	1200	Supervised area or sub parts to institutes if all the RP requirements are fulfilled
HPD Support Frame	Frame supporting the HPD Columns	2	1	0.6	1.2	50	Supervised area or Bldg. 153-R-030 ¹
Profiles	Alu profiles used	1	1	0.5	0.5	0.5	Supervised area

Management of waste

Part name	Description	Qty	Length (m)	Width (m)	Height (m)	Weight (kg)
Patch Panels	Plate made of phenolic resin	2	0.8	0.01	0.6	5..?
Pipes	Flexible pipe made of stainless steel	4	1	0.03	0.03	..
Cables	Copper, Plastic (Halogen free)	1	1	1	1	100..?
		2	0.15	0.03	0.03	0.2

Planning



Refer to the WPP [EDMS-1822492] + Meeting of the 16 Oct 2017

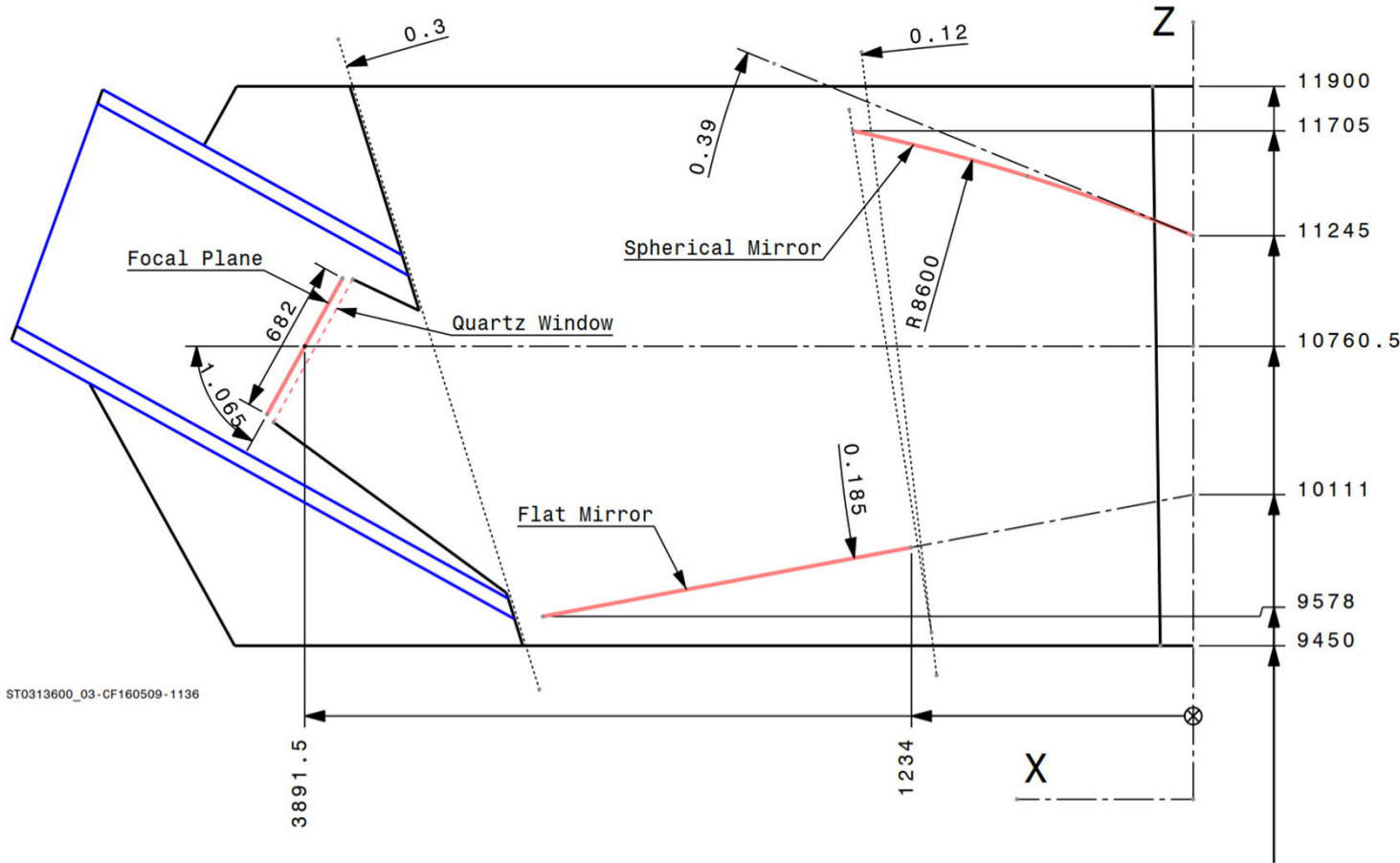
Based on the preliminary RICH Upgrade Planning of the 4 June 2017:
 The removal of the RICH2 photo-detectors will be in: July - August 2019.

- Step 0: Stop of the RICH2 detector (Decommissioning)
 The gas recovering
 This decommissioning can start right after the end of operation.
- Step 1: Services: Disconnect and Remove:
- Step 2: Access Tower: Removing the top floor:
- Step 3: HPD Column: Extracting:
- Step 4: HPD Support Frame: Removing:

1 week
 1 month
 2 weeks
 2 days
 1 week
 2 days

5 weeks, June..July 2019

Envelope



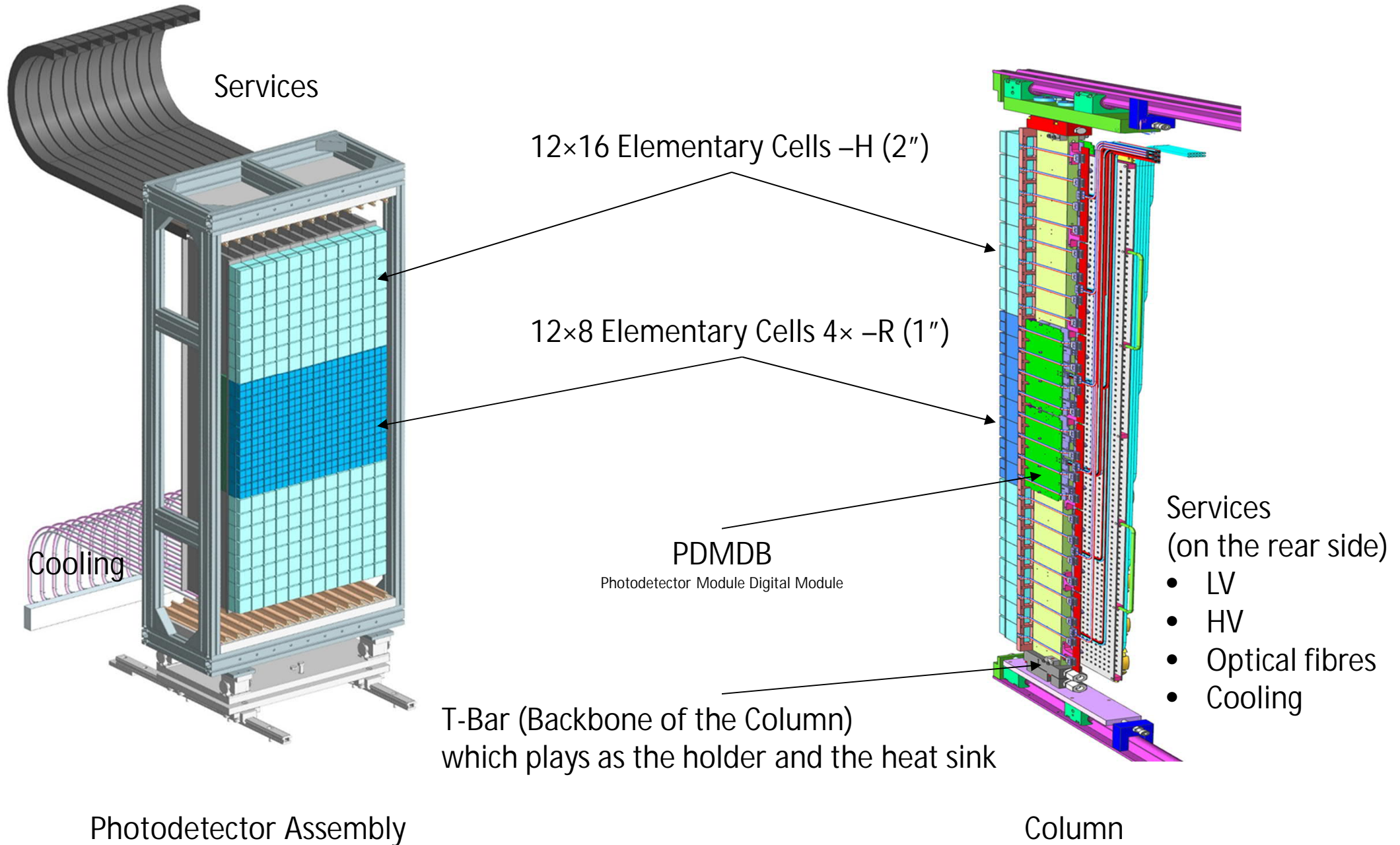
No change compare to the existing

EDMS-1683369

mm [2]	+X	-X	+Y	-Y	Z _{min}	Z _{max}
RICH 2						
Envelope					9400	11900
Windows (Entry - Exit)					9468	11866

To be updated to **9450 mm**
 Changed after the meeting, Christoph 18.05.2018

The New Photodetector Systems





RICH2 Upgraded - Installation

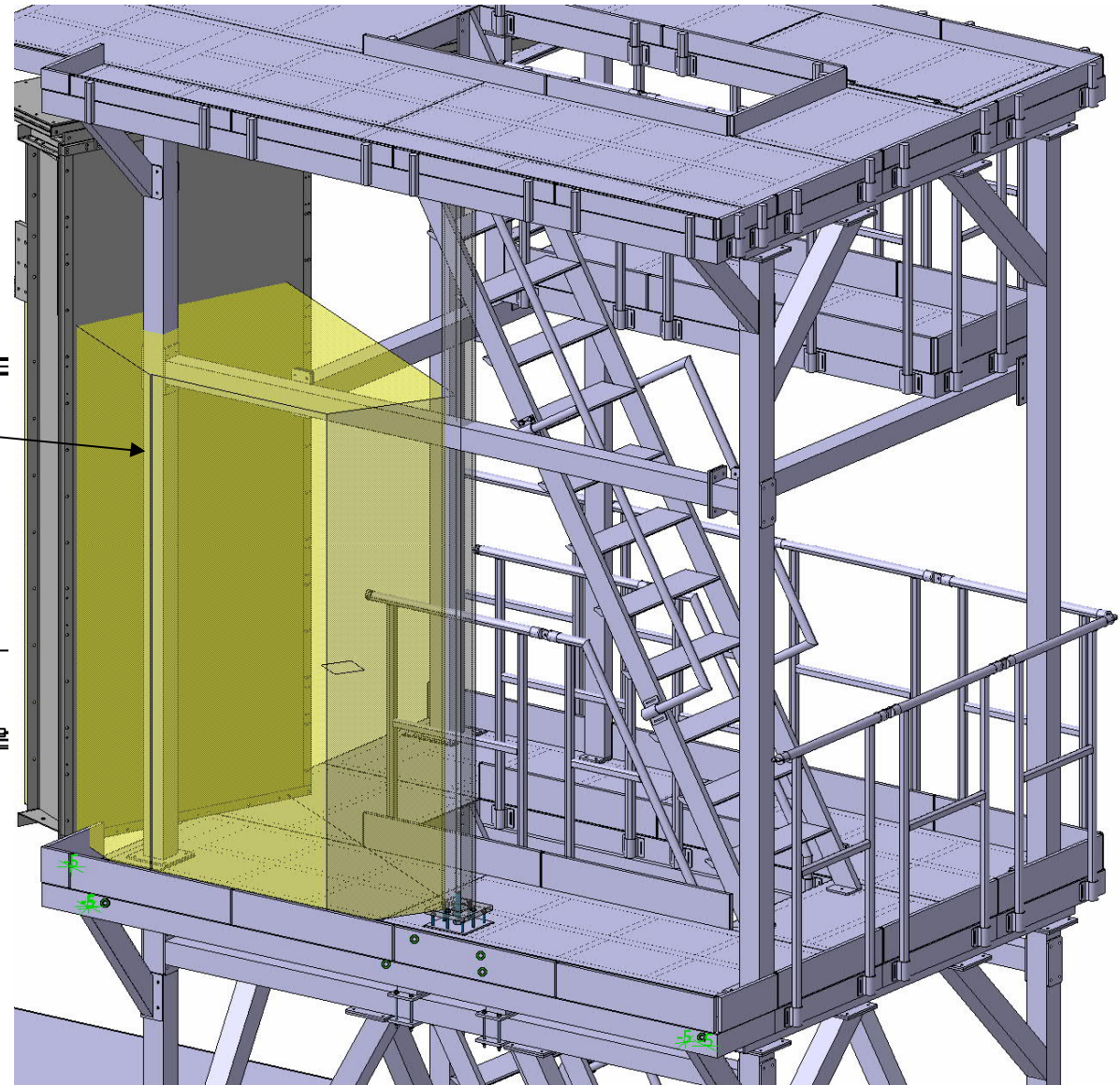
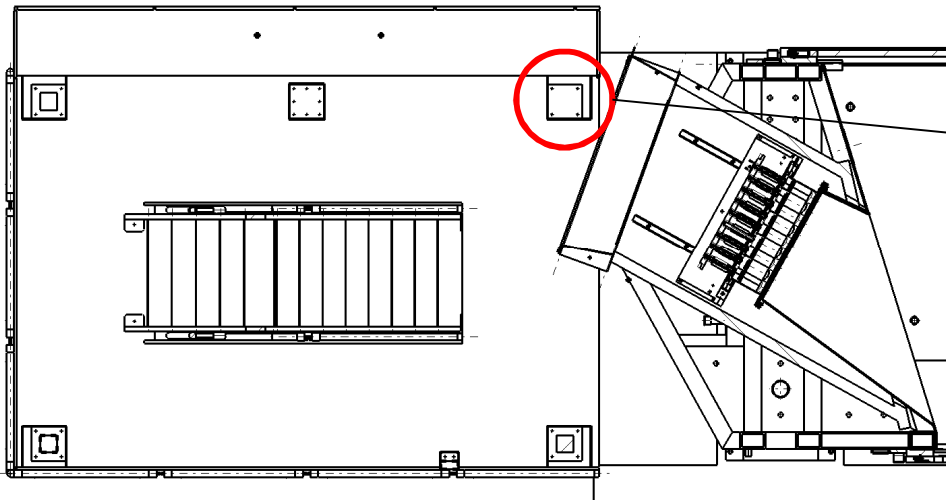
Installation :

- Installation of the services
- Modification of the Photodetector Enclosures
- Gas Enclosure: upgrade the Lighting System
(Time and Exposure Calibration, replace LAMS feedthroughs)
- Install the Chassis for the Columns
- Install the Columns
- Connect all the services
- Commissioning

Installation process similar to the existing system.
Space requirements are similar.

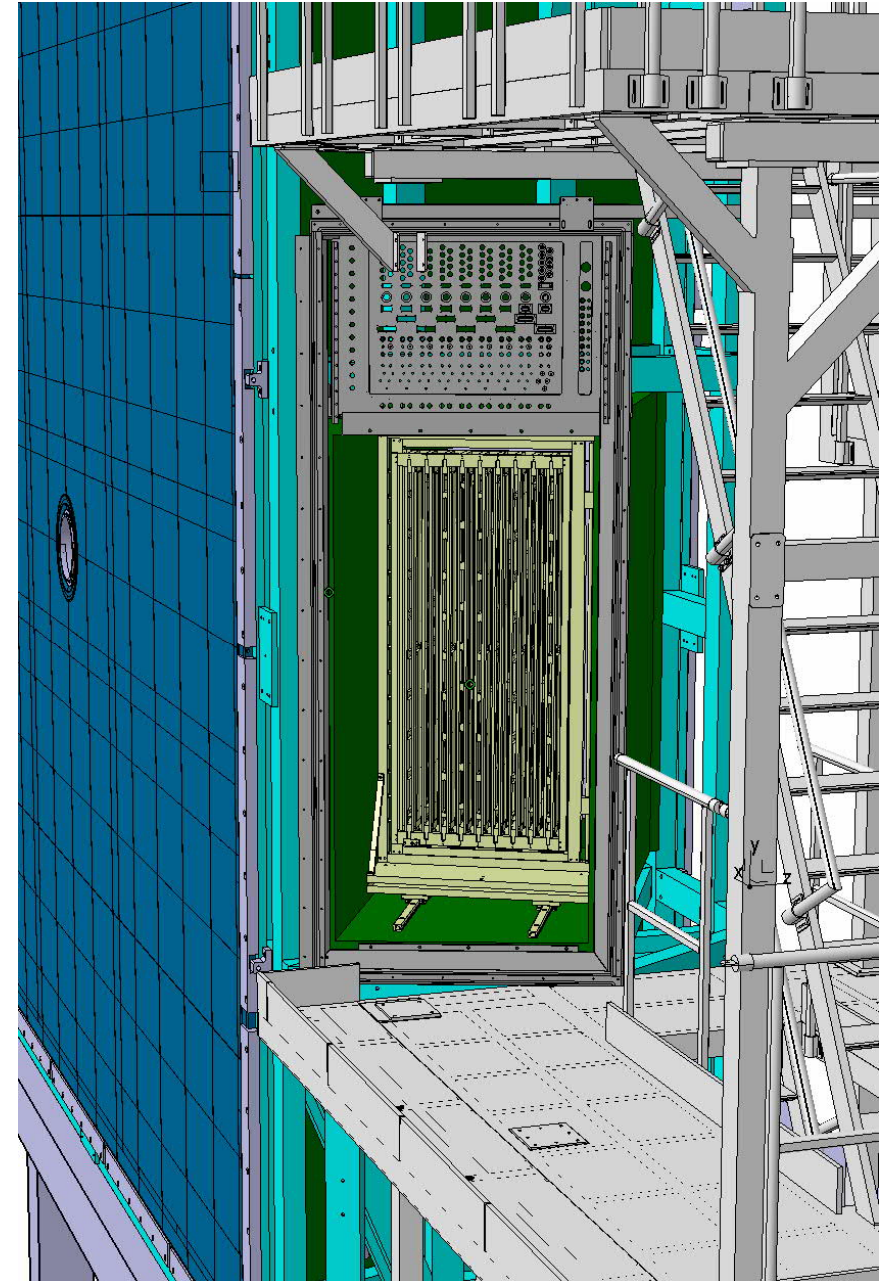
Installation – Access

- Modification (pillars issue..) of the Access Tower on the each side of the RICH2
- Block the access, by default.
⇒ only on request, mount the pillar.
- ..?



Installation – Upgrade the Photodetector Enclosure

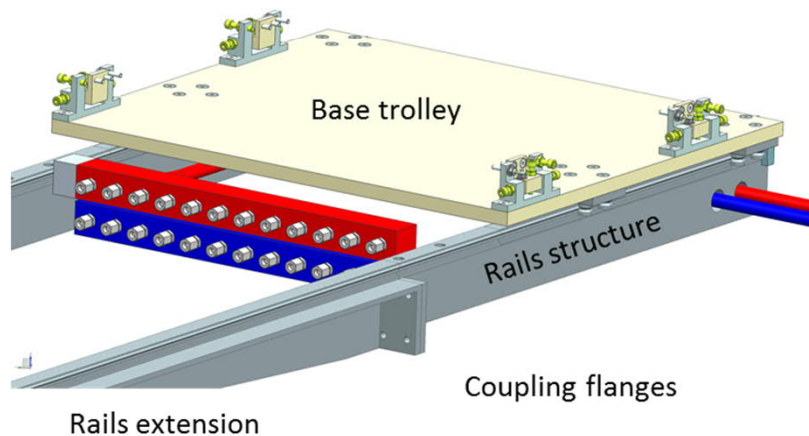
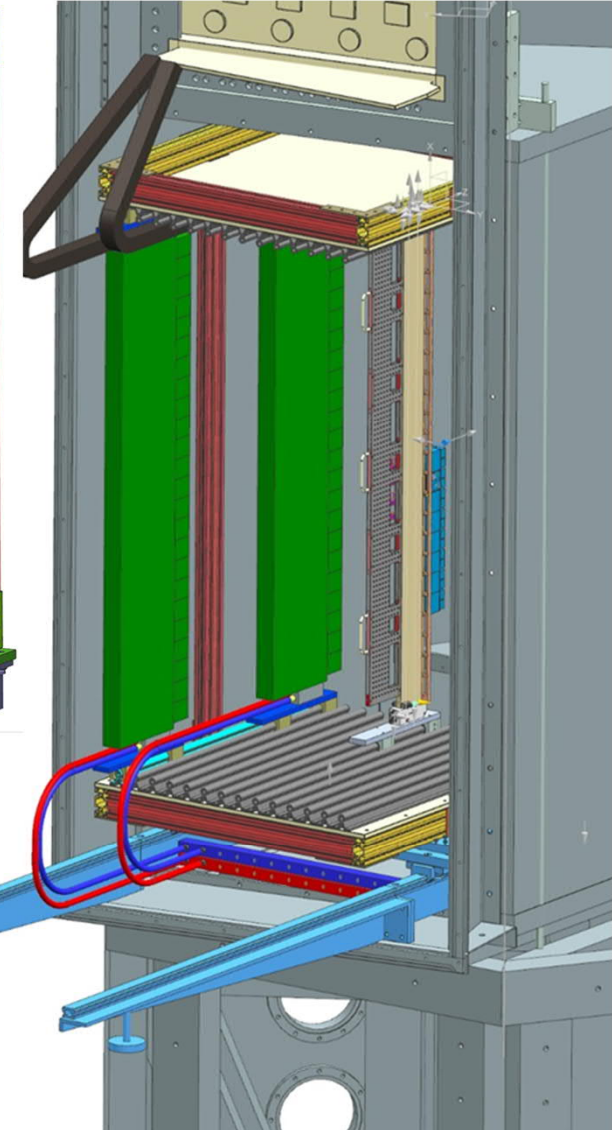
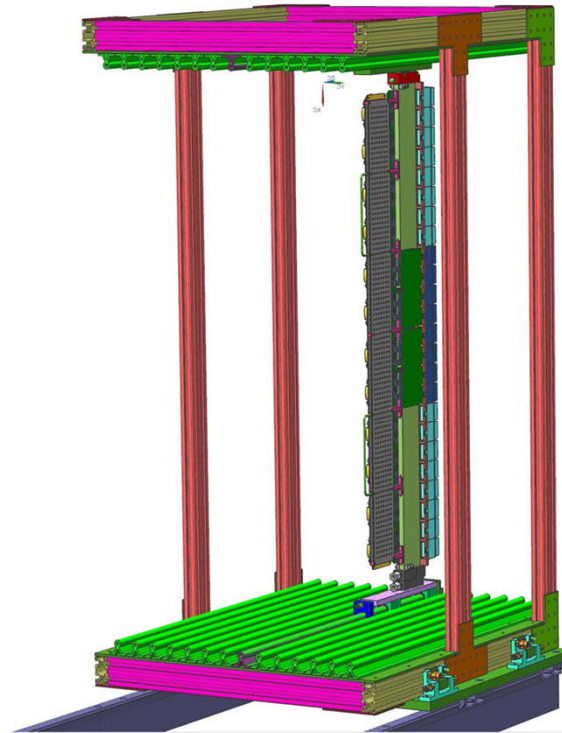
- Assemble support for Cable Chains
(for the routing the services to the column)
- Cooling Feedthroughs
(in the Extension Frame)
- Patch Panel
- Upgrade the sliding system of the door
(rolling + Beam reinforcement)



Installation - Chassis

Installation of the Rack rails and "base trolley"

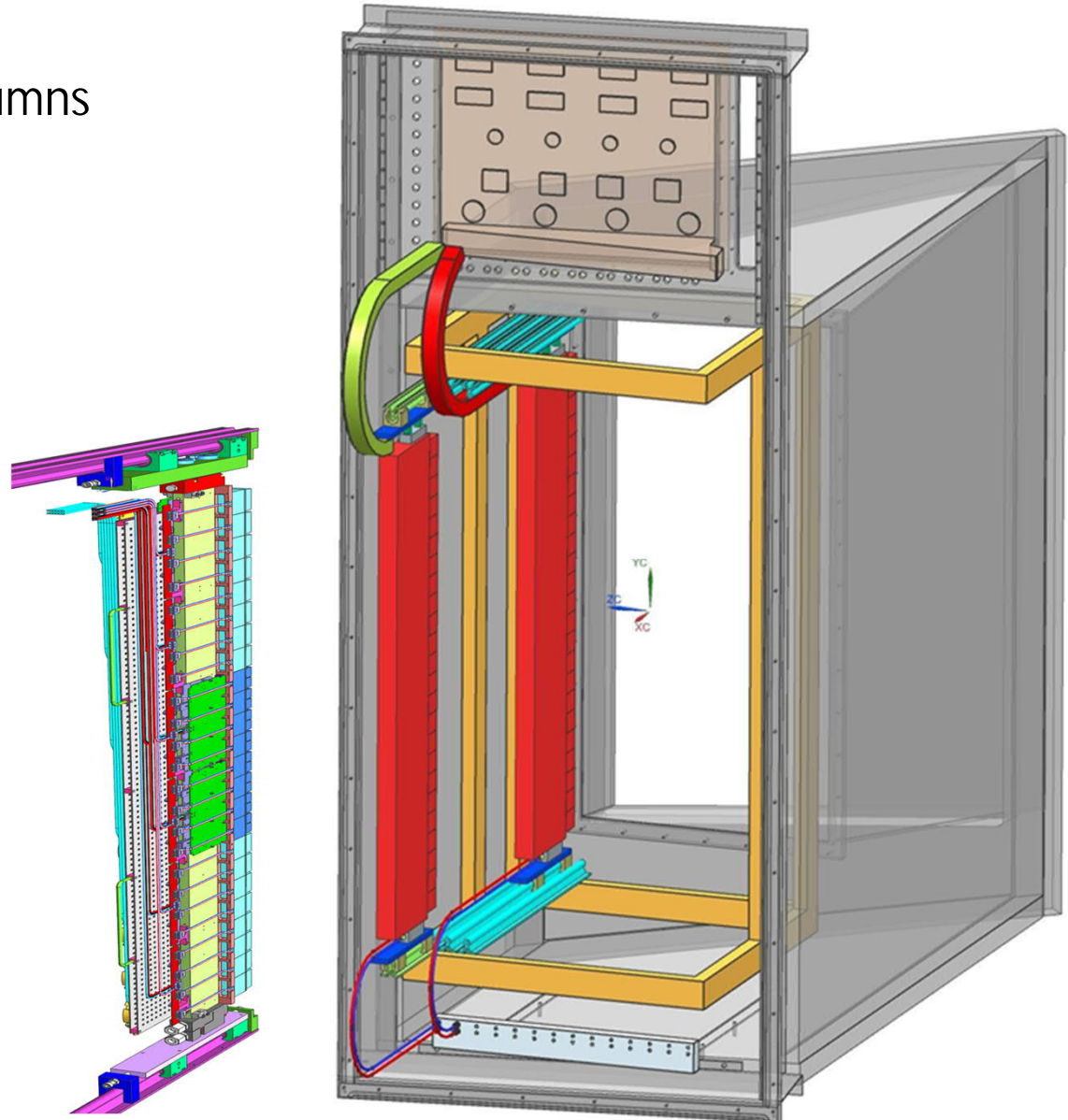
- Rails
- Cooling manifold
- Provisional extension rails to allow rack mounting on base trolley outside enclosure. (Supported by the access tower)
- Using standard eye bolts for lifting the Chassis (~100 kg)
- Locate the crate with the help of the surveyor (similar to EDMS-1033171)



Installation - Columns

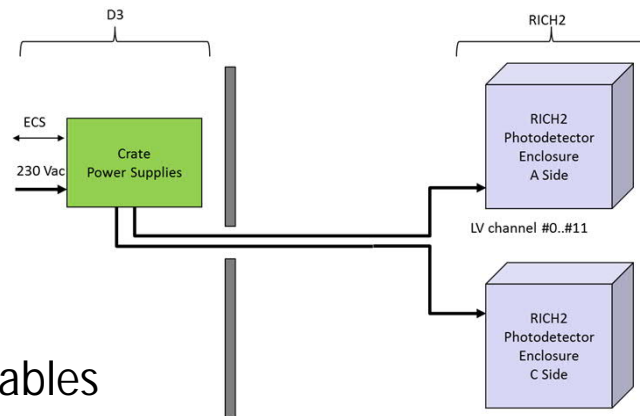
- Use a dedicated cabinet to transport the Columns to the LHCb cavern.
- Installation of the Photodetectors Columns (one by one = 12) inside the Crate
Weight of a Column ~25 kg.
Use a dedicate handling frame.
- Install all services
- Install Light Leak detector
- Sensors:
 - Pressures (cooling)
 - Temperatures (cooling)
 - Temperature (ambient)
 - Humidity (ambient)
- Re-do a survey of the Chassis

- Survey of the RICH2 superstructure (Similar to EDMS-683209)



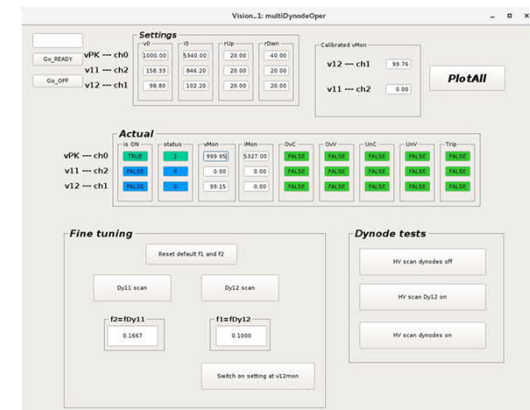
Installation - Services

- Low Voltage (LV) + Grounding [keep the existing]
 - Powers PDMDB and FEBs
- High Voltage (HV) [RICH2 'long distance' cabling for LS2 Upgrade EDMS-1707868]
 - Powers the photodetectors (MaPMTs), JCOP/LHCb guidelines + WinCC Software_β exists
- Data [EDMS-1694337, RICH1 AND RICH2 OPTICAL LINKS CABLING FOR LS2 UPGRADE]
 - Sends data from PDMDBs to TELL40s (Optical fibres)
- Slow + Fast Control (ECS + TFC) [EDMS-1694337]
 - Timing + Configures and monitors. To PDMDBs from SOL40s (Optical fibres)
 - Prototype follow already JCOP/LHCb guidelines + WinCC Software_β exists
- Detector Control System (DCS) [~Keep existing + ...]
 - LVs, Temperatures of MaPMTs, Temperatures, Humidity, coolant Temperature, coolant Pressure, Light-Leak detector (ELMBs + GBT-SCA)



HV: the main new cables

Prototype WinCC:
HV control + monitoring
(JCOP/LHCb)



Installation - Services (2)

- Detector Safety System (DSS) [EDMS-1683369, RICH Infrastructure]
 - Last resort for the safety of the detectors in the case of partial or complete failure
Thermoswitches, Temperatures, Interlocks, leak light.
- Cooling [EDMS-1747707, WP Upgrade of the LHCb RICH Cooling Plant + Transfer Lines]
 - Keep existing + recover Transfer lines
- Dry Atmosphere [Keep existing]
 - Keep existing $\text{CO}_2 \Rightarrow \text{N}_2$
- Gas [Keep existing]
 - Installation + Commissioning a new recovering plant.., on surface

RICH1 + RICH2 – Cooling Plant + Transfer Lines

- Fluid: Novec™ 649
- Cooling Power 11.2 kW (+25%)
- Flows: 1800 I/h RICH1, 1140 I/h RICH2
- Transfer Lines:
Reuse + Recover IT & TT lines : 2× Ø32mm and 2× Ø26mm

[EDMS-1747707, Colling Plant + 1870176, Piping (long distances) and Cooling Plants: WPP]

Cooling Plant, Upgrade:

Plant components	To be replaced	Comments
Pump	Yes	No maintained by the producer
Heat exchanger	Yes	Lack of capacity
Filtration	Yes	To be reviewed for Novec
Tank	No	
Supply manifold	Yes	Pressure drop to high
Return manifold	No	
Piping	No	

RICH1 + RICH2 - DAQ + ECS + Traceability

DAQ

- Automate DAC scans
- Automate threshold scans
- Run control

ECS

- To do: parallelization of the configuration of the CLARO
- Monitoring of the Pt1000 via SCA-ADC
- Monitoring of voltages via SCA-ADC for SEL/SEU in CLARO/Kintex7

MiniDAQ: TOP (MiniDAQ2.06 - MiniDAQ2; #1)

System: MiniDAQ State: READY Thu 26-Oct-2017 17:10:51

Sub-System State: DAQ READY, MEP READY, TFC READY

RICH TEST CONTROL

Load Firmware Configure

	DTM0	DTM1	DTM2
Pnddb0	DA61780A 92418BCE	F9E169F2 C1917C3D	E29162C1 A3319C17
Pnddb1	BF319683 A5F18117	D6916954 BBA183D5	C6617CB0 B5017717
Pnddb2			
Pnddb3			

Fibres to align: [Progress bar]

BXID Offset: 1D59 TELL40 correction MiniDAQ Expert

stop TrgDelayScan: 100% next BX offset scan

per delay/BXID off: DAC scan

Threshold scan: Run Number: 923 ExtComm AutoPilot

Start RUNNING: Triggers Rate: 594496454 23702.306

Counter Reset: Raw Gated: 0 0

Events Accepted at TELL40: 230000

Messages: 25-Oct-2017 15:24:50 - Restarting Devices of TELL40 on System: MiniDAQ2_06

Pdmdb0Control (MiniDAQ2.06 - MiniDAQ2; #1)

Pdmdb0 Initialize

Data Links

GBT 2

FPGA0 Filename: /home/WinCC/ConfigFiles/PDMDB1FPGA0iserdesNoMMCX

FPGA1 Filename: /home/WinCC/ConfigFiles/PDMDB1FPGA1iserdesNoMMCX

FPGA2 Filename: /home/WinCC/ConfigFiles/PDMDB1FPGA2iserdesNoMMCX

DTM0: Program GBT0 Link 6, Program GBT1 Link 7, Enabled

DTM1: Program GBT0 Link 8, Program GBT1 Link 9, Enabled

DTM2: Program GBT0 Link 10, Program GBT1 Link 11, Enabled

Configure FPGA0, Configure FPGA1, Configure FPGA2

Align phases, Align phases 2, Calib Pattern

Program all GBTs, Check GBTs, FPGAs, Load Firmware

CLARO

Claro Config Filename: /home/WinCC/ConfigFiles/claroConfig/claro-optimised-LA

Program Claros, FEBS, All Disabled, Set Claro configuration, Check Claros, Configure All

Messages

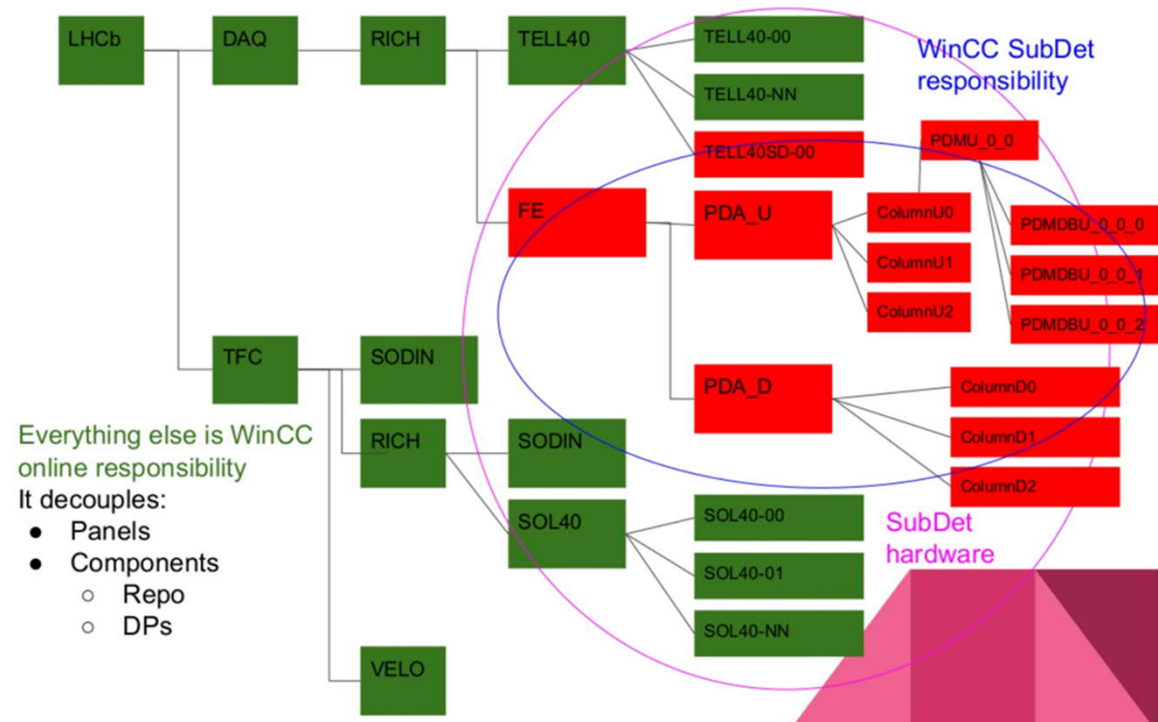
Traceability of components / Inventory Bookkeeping Connectivity already started DataBase

- HW view: all details and history of single HW pieces.
- Logical view: all details and history of the use of a certain "housing slot" of the detector.
- Work in progress: interface with the standard LHCb DB for RP and HW traceability (Gloria and Joel).

RICH1 + RICH2 – Pre-Commissioning of the Columns

- Columns will be fully tested / commissioned in Meyrin, (bldg 153)
- At the Pit, if we would do a last check (to be discussed) :
 - 1 rack for the testing setup
 - Temporary storage space for 12 (TBC) columns
 - 2 kW (for the rack)
 - 1 Cabinet for the hardware
 - 3 (1 SOL40 + 2 TELL40)
 - Few TB range
 - Some stable version (fw and sw) that doesn't change every day ;-)

Towards LHCb FSM



More [details](#)

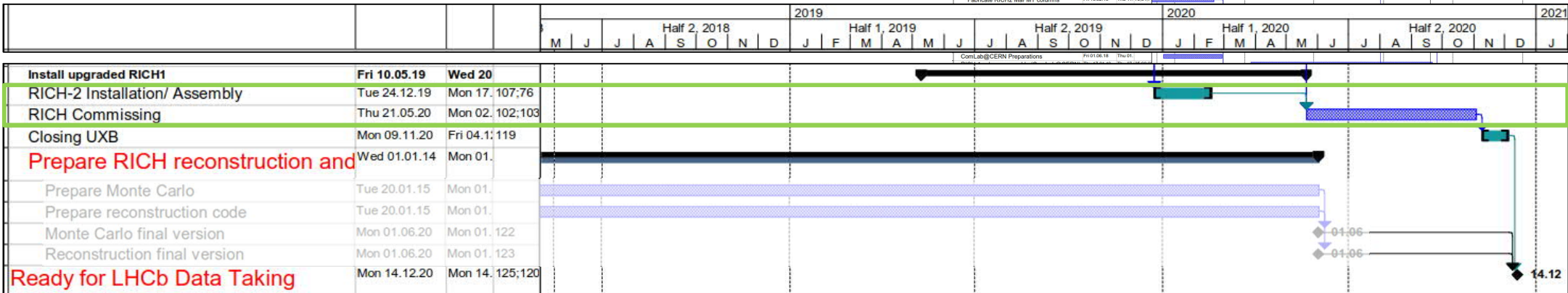
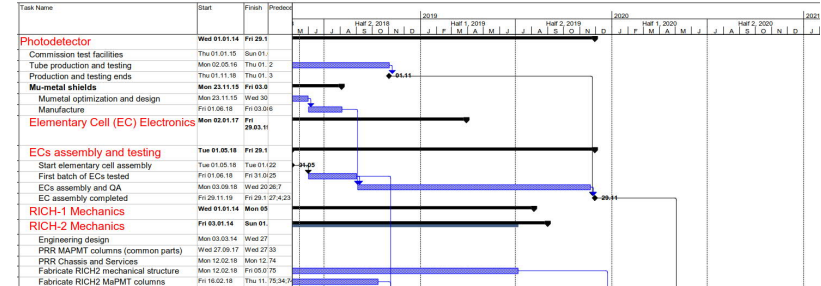
RICH2 - Installation Procedure

Type of risks:

- Radiation Protection Awareness + Controlled/Supervised zones?
- Work at height
- Confined space + Portable ODH Detector
- Electrical habilitation? (or Electrical Safety – Awareness) for cabling installation

Time scale (for full time equivalent = /2. Depending on the resources. TBC..!):

- Services on detector: 1 month
- Installations: 1 month, Q1..Q2 2020
- Commissioning: 5? months (with RICH1), Q3+Q4 2020





RICH2 - Installation Procedure

Expected resources:

- Didier Piedigrossi
- Massimo Benettoni
- Christoph Frei
- Support from UK + IT + CERN DT ?
- Commissioning: RICH Collaboration
- Infrastructure team: handling, tooling, services, supports
- Transport team

To be done..

- Work Package Procedure for the installation
- Work Package Safety Plan for the dismantling + installation
- Generate Dossier Intervention Milieu Radioactive (DIMR)
- Create impacts
- Register (radioactive) equipment
- Trace (storage) equipment + tooling

General RICH Infrastructure document:
EDMS-1683369 to be updated or split in
sub documents

Lot of formalities (administrative load might take more work than the tasks themselves..)



Conclusion

- Dismantling: clear view
- Installation: similar system to the existing
⇒ WPP, etc.
- All (nearly) services stated: New, Keep, Disposal
- Pillar issue..?
- Cooling: in contact with cooling team
- Gas: recovering CF_4 ..
- DAC + ECS: Already testing 1st prototype module in real condition
- Of course, still many things to complete

Thanks for your attention