Power Converters Integration Layout

Samer Yammine, Hugues Thiesen and Michele Martino

WP6a Meeting / MCF Activity

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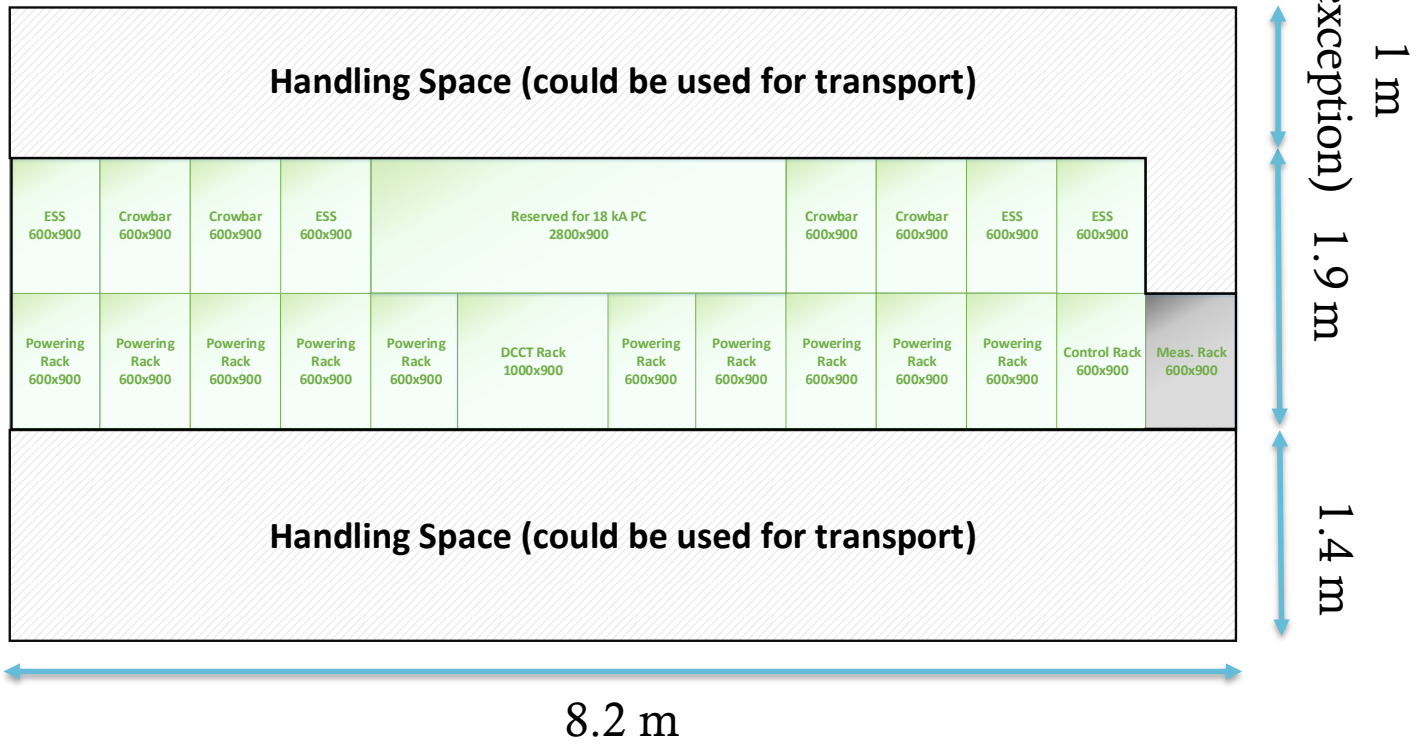
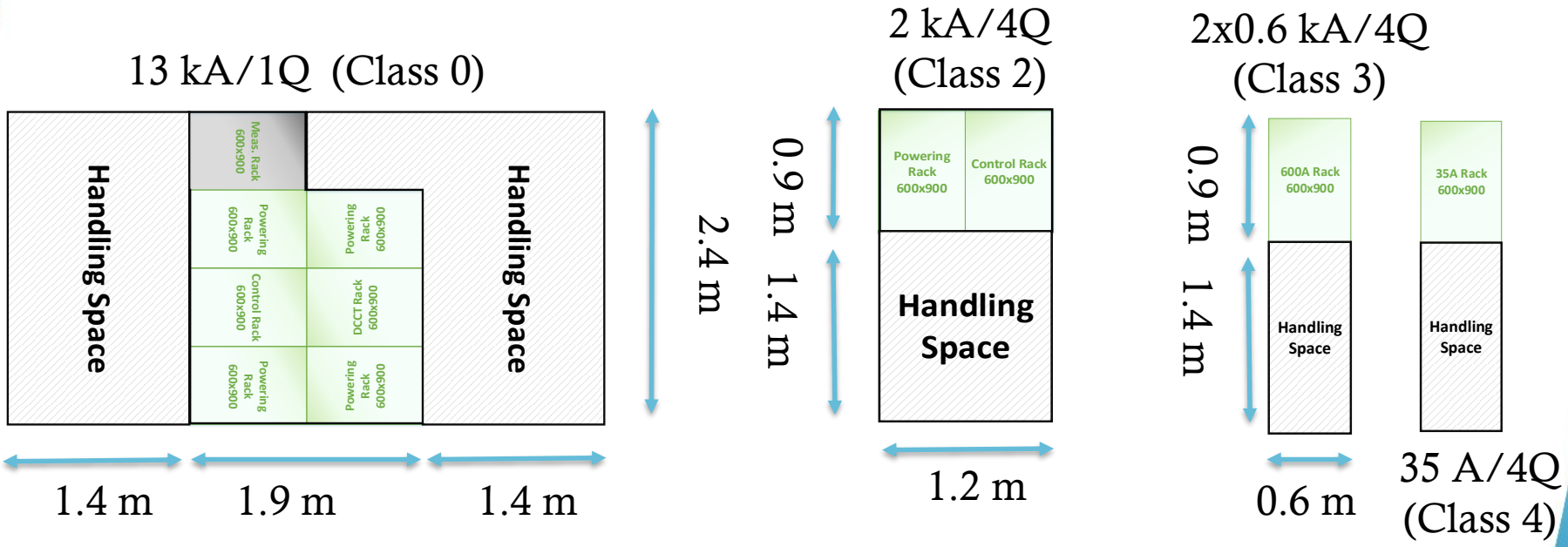
Power Converters in the UR

Power Converters in the UR

18 kA/2Q and Battery System (Class 0)



Power Converters in the UR



General Rules for Powering in LHC/HL-LHC

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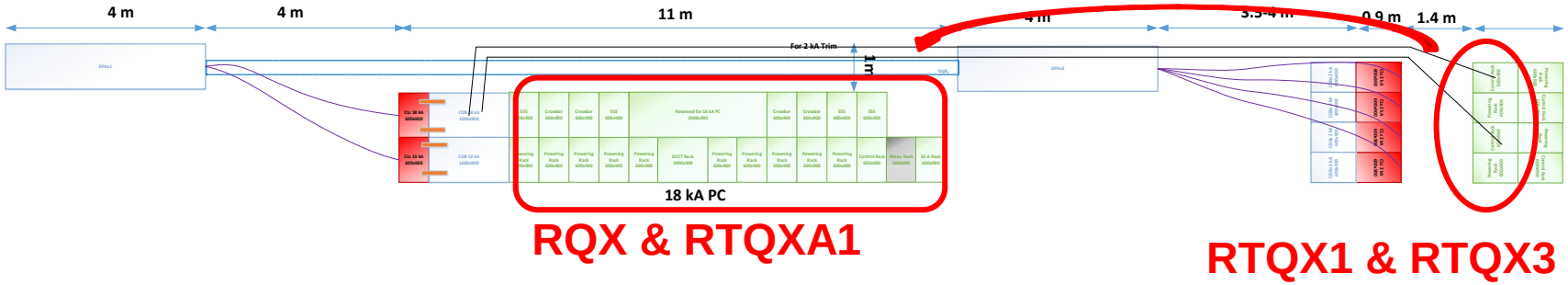
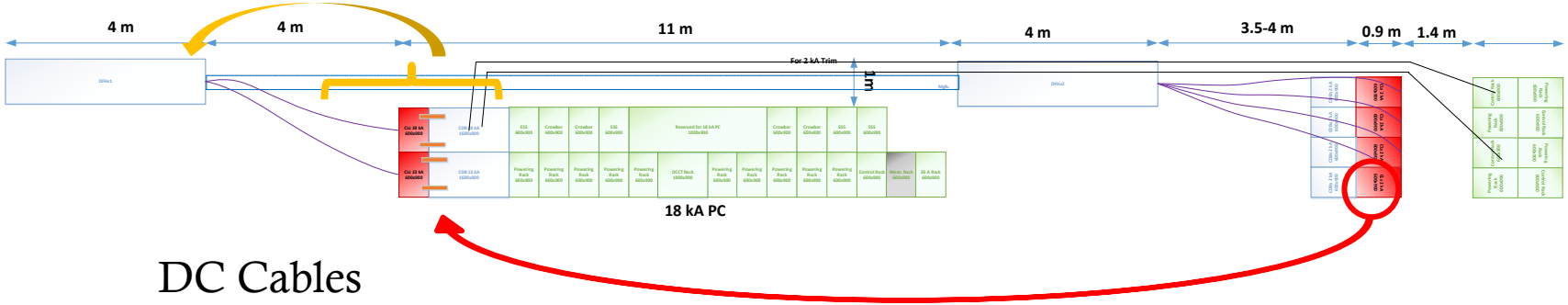
- Regroup the power converters for the same circuit (IT, IPQ, etc.)



General Rules for Powering in LHC/HL-LHC

- Regroup the current leads of the same circuit and connect to same DFH
  - DC cables of two polarity adjacent in the routing
  - Reduction of EMC phenomena
  - Reduction of inductive loops



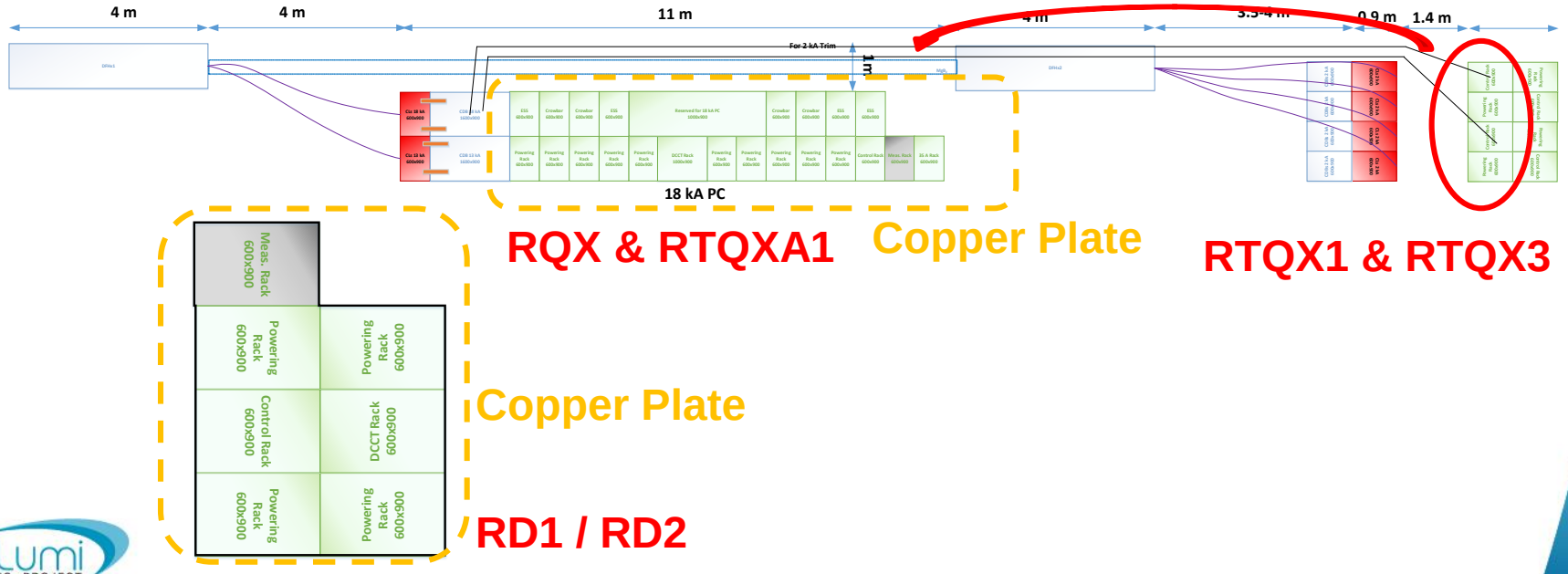
DC Cables

(+) cable close to (-) cable

To be avoided

General Rules for Powering in LHC/HL-LHC

- Introduce Common Copper Plate for High Precision Circuits
  - For class 0 (0.1 ppm) circuits, regroup the power converters and install copper plate to guaranty the same electrical potential

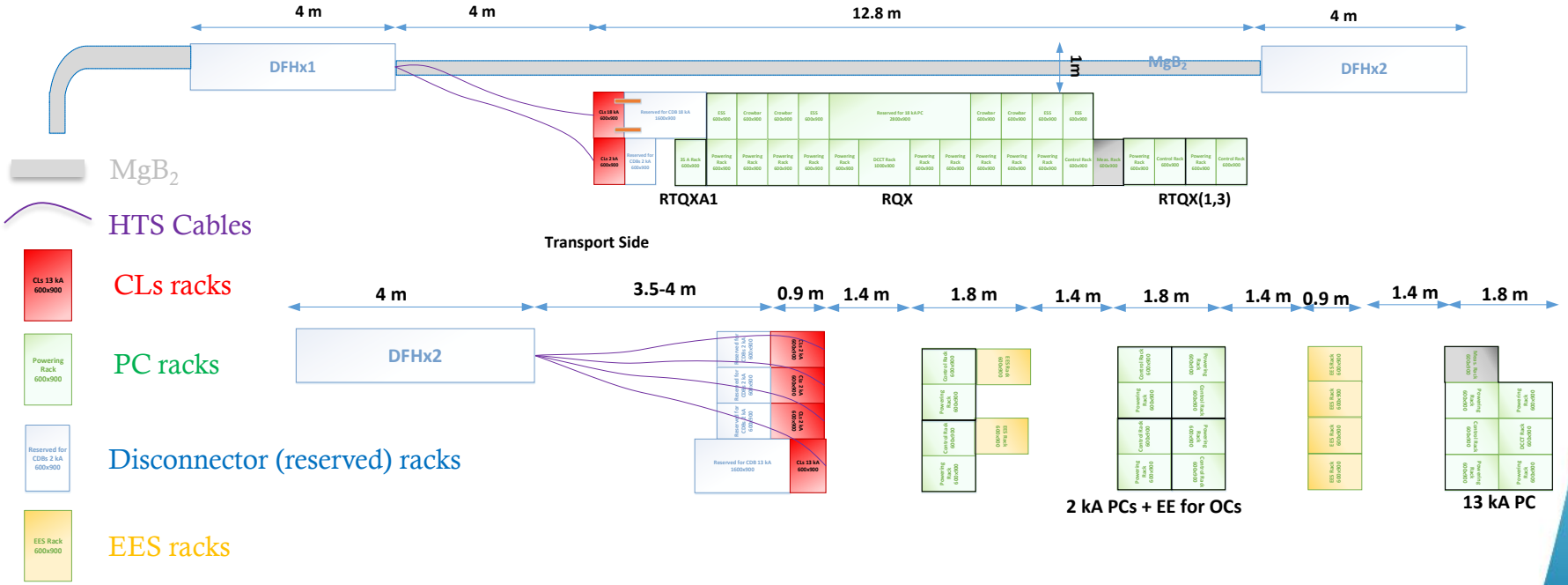


General Rules for Powering in LHC/HL-LHC

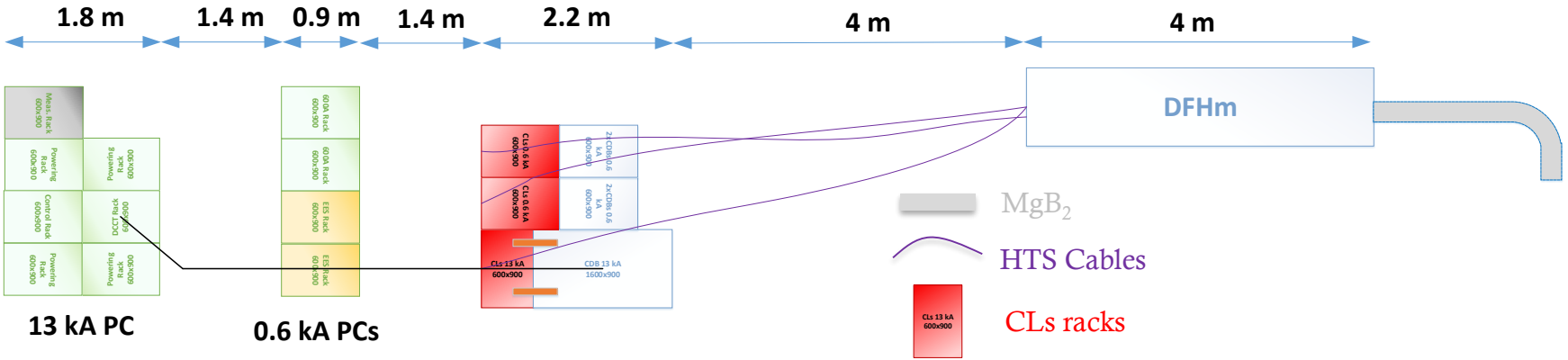
- Specific rules in the case of HL-LHC
  - 18 kA / 2Q power converter includes energy recuperation system
  - Water cooled cables length for the 18 kA should be reduced to optimize energy recuperation
  - 13 kA / 1Q must have a minimum WCC length of 6.5 m per polarity to be in the shadow of the RB circuit discharge

A Viable Proposal for Powering Systems in the UR

A Viable Proposal for Powering Systems in the UR (not only one)



A Viable Proposal for Powering Systems in the UR (not only one)



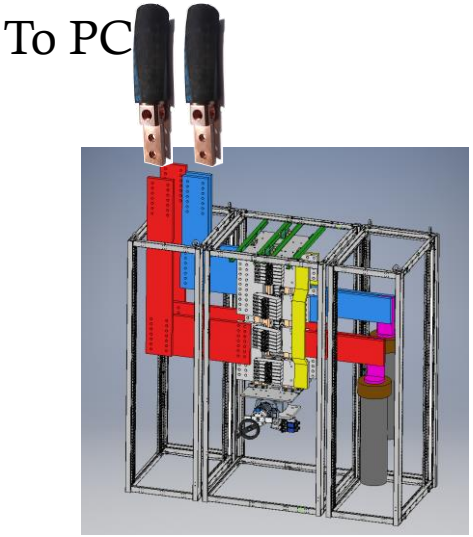
A Viable Proposal for Powering Systems in the UR (not only one)

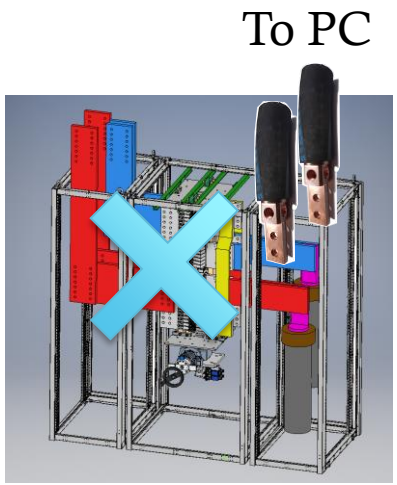
- Proposal with two DFHx and one DFHm reduces significantly the copper cable length (combined copper volume reduction of around 50%)
- Power converters layout could be modified to meet WP6a needs, but handling space and access must be respected (for CDBs if introduced to baseline)

Impact of Disconnectors on WCCs and Interface with CLs

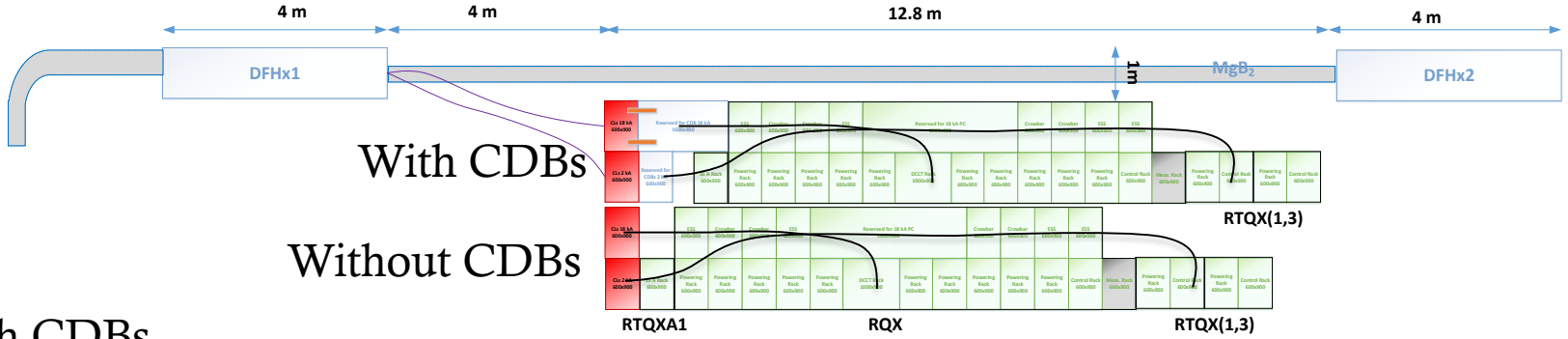
Impact on WCCs and Interface with CLs

- WCCs connect the power converter (DCCT rack) to the disconnetor (if present) or the current leads (e.g. as in LHC)

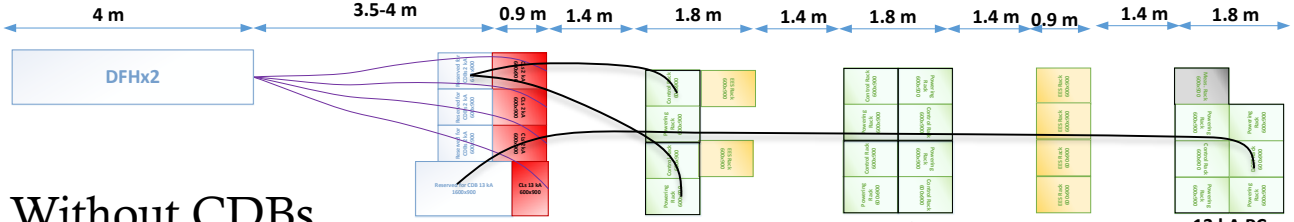




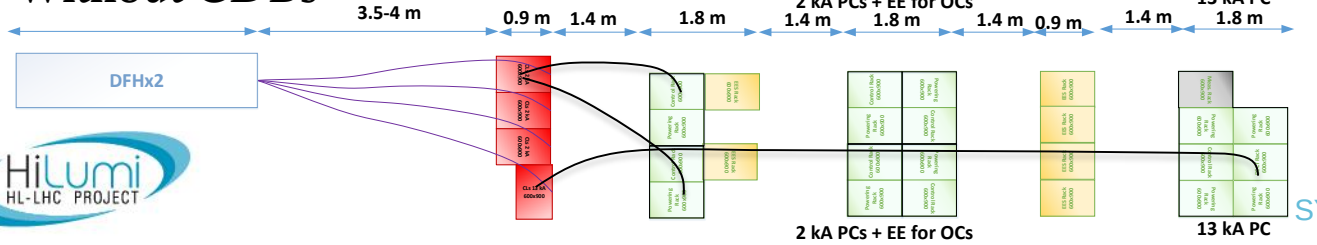
Impact of Disconnectors on WCCs



With CDBs



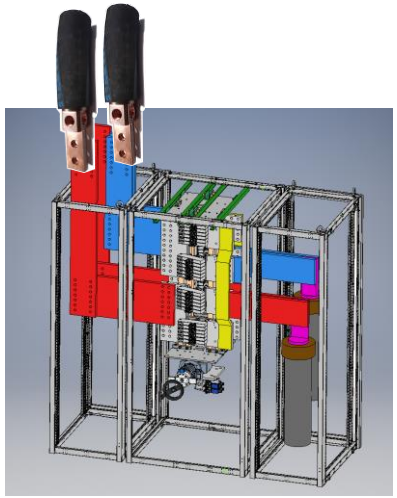
Without CDBs

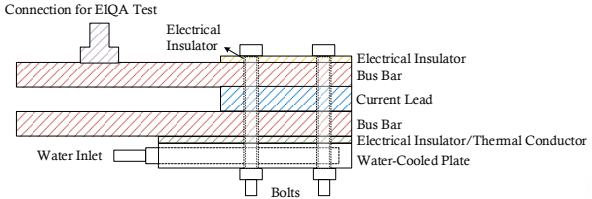


Impact on cable length of less than 0.8 m per cable

Impact on Interface with CLs

- CL design depend on water cooling in cables to control the heat flow
- If CDBs are added, the cooling interface between the CDBs and the CLs should be further studied. Total cooling requirements to be calculated depending on CL needs.
- If CDBs are added, a flexible part in the busbar (i.e. braids, copper sheets, etc.) should be also accounted for in the design (fairly straightforward).





Concept proposal for CL flag cooling (to be further studied)

Conclusion

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- Envelopes for PC integration presented
- General rules for connection of powering systems implies regrouping of powering equipment of same circuit
- Copper plate to be added for high precision circuits (like LHC)
- Disconnectors have marginal impact of WCCs
- WCCs are predominately dependent on position of CLs and PCs
- Introduction of disconnectors affect the cooling scheme of the tips of the CLs. This issue needs to be further studies but solutions exist.
- Flexible parts in the connections between disconnectors and CLs are fairly straightforward

Thank you for your attention