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WP6a Integration meeting #5

Date: 2019/1/22

Project/Activity: WP6a

Attendees:

TE-MS: Amalia Ballarino [AB], Iole Falorio [IF], Jerome Fletier [JF], Yann Leclercq [YL], Patrick William Retz [PR], Jean-Philippe Tock [JT]

TE-MPE: Felix Rodriguez Mateos [FR], Fernando Menendez Camara [FM]

TE-EPC: Michele Martino [MMa], Hugues Thiesen [HT], Samer Yammine [SY]

EN-EL: Davide De Luca [DD], Jean-Claude Guillaume [JG]

EN-ACE: Stephane Maridor [SM]

EN-CV: Michele Battistin [MB]

EN-MME: Robin Betemps [RB]

EN-HE : Jani Hattunen [JH]

ATS-DO : Paolo Fessia [PF], Michele Modena [MMo], Laurent Jean Tavian [LT]

Excused : Alan Gharib [AG], Vittorio Parma [VP], Yifeng Yang [YY]

Agenda: <https://indico.cern.ch/event/791468/>

- WP6a System overview and requirements [AB]

- RT cables terminations and routing to current leads according to baseline [DD]

- Power converts layout and impact of disconnectors [SY]

DISCUSSION

WP6a SYSTEM OVERVIEW AND REQUIREMENTS [AB]

- The input for the space reservation given to WP15 for the DFH (before the design started) was of 3x10 m [AB];
- An intermediate study lead to split the DFH into two units, one for the high and one for the low current, separated by a length of 10 m. The proposal has been presented in TCC in 2018 [AB];
- The power converter group has shown preference of having the 7 kA cables in the first DFH module, whilst in the DFH2 there will be housed the 12x2 kA cables [AB];
- [FR] asks if the new proposal is within budget. The extra link length of 10 m between the two DFH modules is still within the cable length margin initially previewed [AB]. [PF] remarks that a change in design will surely have an impact on other work packages budgets.



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RT CABLES TERMINATIONS AND ROUTING TO CURRENT LEADS ACCORDING TO BASELINE [DD]

- The 600 A are standard air cooled (ACC), while all cable above 600 A are water cooled refrigerated (WCC) [DD];
- The WCC cross section correspondent to the table current rating have been provided:
 - 500 mm² rated at 3.5 kA → 7 A/mm²
 - 1300 mm² rated at 8 kA → 6.2 A/mm²
 - 2000 mm² rated at 13 kA → 6.5 A/mm²
- Three main suppliers in Europe serve CERN: FLOHE, BRAR and GECSA. The relevant information on nominal current, leakage current and DC voltage test level have been shown;
- The current rating and the consequent cables dimension impose constrains on the bending radius of the cable, and this has an impact on the height at which the racks have to be located (see slide 17);
- The cables are supported from the ceiling and therefore it is important to leave some space for installation/intervention;
- The arrangement of the cables has a direct impact on the arrangement of the trays and of the power converters: the distance should be short enough to limit the losses;
- The terminations of the leads have the same configuration of the ones of the power converters [DD];
- The power converters proposed layout and the current lead interface of the WCC for has been presented [DD].
 - The interface between the leads and the disconnection box is missing [AB]. It is in course of integration in the model [SY];
 - The current lead/converters interface for WCC cables could be either vertical or horizontal [DD]. [AB] shows her preference for the horizontal interface, [MMa] highlights that is a topological novelty with respect of LHC;
 - The requirement on the heat load and on the forces have to be clarified [AB];
 - [LT] reminds that in case of transient operation a rapid cool down could take place. A dryer should be integrated in the design to avoid condensation;
- [LT] reminds that the access to UR is allowed even when the 18 kA are powered and this should be take into account when designing safety devices.

POWER CONVERTER LAYOUT AND IMPACT OF DISCONNECTORS [SY]

- Power converter in the UR: the space reservation for the 18 kA is at the moment of 8.2 m x 1.9 m. An additional 8.2x1.4 m are reserved for allowing access/power converter removal;
- General rules for powering include: regrouping the power converters of the same circuit (i.e. having the 7 kA PC too distant from the 18 kA ones is not good for the electromagnetic compatibility), introducing a common copper plate as grounding point for high precision circuit.
- Specific rules for HL-LHC include: optimization of the 18 kA leads length to optimize the energy recuperation, a minimum length of 6.5 m per polarity for the 13 kA cables;
 - The proposal of the two DFH modules reduces the length of the WCC cables so it goes in the length optimization ;

POWER CONVERTER PROPOSAL

- The proposal for the powering system in the UR assume the 13 kA to be in DFH2. The layout can be modified but the access space reserved to handling operations must be respected [SY];



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- The PC boxes are preferred to be not in-line to have similar cables length [AB];
- The bending radius of the cable has to be respected [JF];
- [FR] suggests to start and advance on the integration studies before TCC;

PRESENCE OF DISCONNECTORS BOXES

- The presence of the disconnectors has a minimal impact on the cable length (less than 0.8 m per cable);
 - The length should be verified for the configuration in which the cable comes horizontally [JG];
- In presence of disconnectors the WWC cables will have to be connected to bus-bars termination similar to the one of the PCs;
- The cooling interface between the disconnectors boxes and the current leads should be farther studied. The current leads cooling requirements are needed for the design;
 - It will be circulated [JF]'s document [AB];
 - If the disconnectors box are approved, the design responsibility will be part of the power converter group.
- It is suggested to plan a mock up to be tested in SM18 together with the leads [AB];
 - TCC needs a justification for the disconnectors requirement, security, accessibility and so on [FR];
 - Resources are needed for the mock up, the power converter group is waiting on the decision on the disconnectors before investing more resources on it [MMa];
- In terms of integration the presence of disconnection boxes should not change extremely the topology [FR]. The impact of the disconnection boxes to integration should be checked [AB];
 - From the integration point of view a lot of information are still missing: i.e. cryogenic lines, bending radius with cable tray, interference with smoke system and so on. We will start integrating the first proposal from [SY] and [YL] and from this one will discuss the required modification. Estimated time of the study: 2 months [PF];
 - The calculation of the cooling requirement could have an impact on moving the ventilation units [PF];
 - [AB] invites on studying in parallel the two layouts with and without disconnectors in order to identify the impact they have on the leads. The study should consider the 18 kA, 13 kA and 7 kA circuit in the DFH1.



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ACTIONS

Clarification of the heat load requirements of the leads and on the forces to withstand	??	??
Study of the layout with and without disconnectors and their impact on the leads		
Beginning of integration study on power converter in the UR with and without disconnectors		
Feedback on the power convert location proposal	AB	
Circulation of [JF] document on cooling requirements of the current leads	JF	

Documents:

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Distribution List: All attendees