HL-LHC DFHx-DFM meeting #3

Date: 2018/11/21	***Project/Activity:*** WP6a

Attendees:

TE-MSC: Amalia Ballarino [AB], Iole Falorio [IF], , Yann Leclercq [YL], Vittorio Parma [VP], Yifeng Yang [YY]

TE-CRG: Serge Claudet [SC], Antonio Perin [AP]

EN-MME: Robin Betemps [RB], Julien Pascal Dequaire [JPD], Diego Perini [DP]

Excused: Jerome Fleiter [JF]

Agenda: https://indico.cern.ch/event/771912/

- Strategy For Dealing With Thermal Contractions For The WP6a System [AB]
- DFH key function: splices cooling [YL]

DISCUSSION

THERMAL CONTRACTION WP6a SYSTEM [AB]

- The compensation of the thermal contractions of the SC-link (including in the short length between the two DFH units) will be carried out via continuous snaking of the cable along its length (supported every 4 m, lateral offset of 20 cm). The snaking is being validated for two 18 kA sub-cables during Demo 1;
- The thermal contractions of the SC-Link have been quantified and the results will be presented in a dedicated meeting;
- The heat load of the "snaked" cryostat has been quantified to be 1.5 W/m and proving that the performances are not affected by the wavy geometry;
- The fix point (fixing the SC-Link to the helium vessel) is desired in two points :
    - @ the MgB2-HTS splices in the DFH. At the moment two-units DFH are foreseen therefore a fix points should be placed in each box for the dedicated cables;
    - @ the NbTi-NbTi splices in the DFX;
- The MgB_2-NbTi splices are supported against the protective termination sleeve but not fixed to the helium vessel. No waves are possible in the vertical shaft therefore the compensation will be done at the top of the shaft;
    - If the frame moves because of the contraction, the splices will also move. A margin when deciding at which height controlling the level should be taken [SC];
    - At the moment 125 mm of liquid helium are foreseen above the nominal splice location [YY];
- In the up-to-date conceptual design there are two sets of NbTi-NbTi splices. It is not clear on which one of the two the fix point should be. It should also be kept in mind that the plug should not see forces [VP];
    - The two sets of splices are yet to be confirmed. If should be first discussed if it is possible to reduce the two sets to one. The 7 m length between the shaft and D1 were decided when no many information were available, it should be studied the feasibility of getting the lambda plate closer to the shaft reducing this distance [AB];
    - The superfluid volumes are usually dedicated to active components like superconducting magnets [SC];
- The DFX shares the helium environment with the link but not the vacuum [YL];

  - The insulation vacuum proposal document (EDMS 2048016) should be clarified accordingly because it shows vacuum barrier [SC];
- AB is invited to produce a sketch of the fix points location and in particular of the MgB_2-NbTi protective sleeve fixation to the helium vessel for everyone clarity [VP];

HEAT EXTRACTION FROM SPLICES [YL]

- In order to maintain the splices at a temperature below 20 K it is required to have a local reduction of the flowing area around the splices, ensuring always operation in full turbulent flow;
- It has been proposed to insert filling material with multiple functions:
  - Fix point;
  - Flow obstruction;
  - Electrical insulation.
- A preliminary approach (splices located in individual tubes) shows that current leads mass flow requirements would cover the required mass flow for cooling the splices. The power dissipated by the 7 kA leads shall be corrected to nominal values [AB];
  - Post meeting comment: Done and updated on the Indico page by YL;
- The filling material will not be the only electrical insulation, use of ~ 50 µm Kapton foreseen [AB], but it has small heat transfer coefficient which will increase the temperature on the splice [YL]. The contribution of the Kapton needs to be quantified [AB];
- The configuration suggested considers the 18 kA splices located in individual flowing tubes in series with the current leads and proposes two options for the 2 kA and 7 kA splices:
  - Splices in a central common environment;
  - Splices in separate pipes in series with the current leads;
- The two cases were either one current lead or a splice requires more flow are discussed. SC underlines the difficulty to control mass flows in parallel circuits with one common outlet valve.
  - YL and JD are invited to come with a proposal on the geometry before finalising the concept and moving to drawings [AB];
  - The option of having the 18 kA splices in a common environemt should also be investigated [AB];
- YL and JF have to work on mock up to study the geometry routing of the splices in the DFX [AB].

ACTIONS

Correction on the nominal power dissipated by the 7 kA leads	YL	DONE
Feasibility study of locating the λ-plate closer to the shaft	YL	ASAP
Evaluate the effect on heat transfer of a layer of Kapton around the splices	YL	ASAP
Detailed study and comparison of splices in common environment vs splices in separate pipes	YL, JD	Next meeting
Preparation of splices mock ups	YL,JF	ASAP

Documents:

Prepared by: Iole Falorio, Yann Leclerq	***Date:*** 2018-11-17

Distribution List: All attendees