Minutes HL-LHC WP14 Technical Meeting #7 - 07/06/2016

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Excused: B. Goddard

https://indico.cern.ch/event/538778/

Energy deposition in TCDS and MSD during an asynchronous beam dump with HL beams – M. Frankl

- Asynchronous beam dump at top energy due to a "type 2" erratic, particle distribution at TCDS provided by M. Fraser: about 45 out of 200 bunches hitting the front face of the TCDS.
- BCMS beams: 2.3e11 protons and 1.37 um emittance. These parameters are very conservative (minimum emittance for 2.3e11 protons should be 1.7 um) but:
    - FLUKA studies showed no dependence on emittance but only on intensity
    - An official statement from HL-LHC committee on beam parameters is still missing (only LIU confirmed) ➔ **to be reported at the TCM on June 30th (Anton).**
- Maximum energy deposition of 2.6 kJ/cm^3 on high density CFC and 1.2 kJ/cm^3 on Ti at the right jaw (the one protecting the septum plate)➔ need for ANSIS simulations but already clear that either a **different material than Ti (Al?) or a third block** are needed. The left jaws sees only the showers from the right one and attenuates the energy deposition on the downstream MSD. **It has to be evaluated if also this jaw needs to be upgraded or not (evaluate risk of direct beam impact due to over-kick, is this possible?). Check if a local mask at the MSD entrance would be sufficient to absorb the secondary showers.**
- Temperature increase at the MSD yoke: 87 K ➔ ~110 °C absolute temperature. This temperature is not critical for what concerns a possible change in the magnetic properties of the ferrite (up to 150 deg is considered as acceptable). Moreover the peak occurs in the plate and does not reach the first lamination ➔ no issue for the coil insulation. Moreover this is an instantaneous (us) heating/cooling process while problems in the coils are expected in the eventuality of continuous operation at >60 °C . For normal operation a ΔT of 12 °C is measured.
- Temperature increase at the vacuum chamber can go up to 83 K for the stored beam, it might be critical for Mu-metal layer ➔ **check likelihood and effect of vacuum chamber deformation.**
- Need to gather more information on the vacuum chamber layout and alignment at the MDS. **Chiara will contact Eric Page to provide the needed information and organize a meeting.**
- Further FLUKA calculations have to be performed to quantify the energy deposition and temperature increase of the water in the MDS cooling pipes. This will allow to evaluate the risk of a pressure rise and possible consequent shockwave (STI calculations). **Invite Yacine Kadi at the next meeting to profit of his expertise.** Philippe reminds that magnet coils were tested for 1 hour at 60 bars and operational pressure is 12 bars.

- Philippe requested to calculate the activation of the yoke after one year of operation ➔ possible to scale down the present FLUKA calculations wrt a typical intensity in the abort gap (1e10 protons). **Chiara will ask RP to periodically perform a survey at the MSD (done!).**

Magnetic aging of steels – M. G. Atanasov

- Ageing of steels manifests as a continuous decrease of magnetic properties associated with microstructural changes caused by carbon inclusions ➔ use of low carbon content (0.15%) steels for the LHC MSI and MSD.
- This effect is more evident at high temperatures: any degradation after bake out?
- Morishita et al.: drastic change of magnetic field and permeability for temperatures of the order of 600- 700 °C ➔ no expected nor observed degradation due to periodical bake out at 200 °C for 24 hours.