(r)MPP meeting: Approval of Ion MDs for block#5 in November 2018 27/11/2018

Present: Markus Zerlauth, Jan Uythoven, Christophe Wiesner, Chiara Bracco, Alessio Mereghetti, Rogelio Thomas, Brian Petersen, Christophe Schwick, Anton Lechner, Federico Carra, Jorg Wenninger, Roderik Bruce, Stefano Redaelli (part-time), Andreas Waets

The meeting aimed at a discussion and approval of the MDs foreseen during and at the end of the 2018 ion run. The slides presented are available on the following Indico site: https://indico.cern.ch/event/776386/, whereas the final MD schedule as well as all the detailed procedures can be found here.

MD on Assessing Collimator Coating robustness with beam scraping – A.Mereghetti (Slides), F.Carra (Slides)

Alessio recalled the aim of the test, which is aiming to characterize the endurance of the Mo coating during losses with circulating beam. The assessment of endurance is important for the alignment procedure and during lifetime dips during regular operation. The updated procedure foresees the scraping the full beam at injection (limited to intensities considered safe for the coating), to be repeated at different positions of the fifth axis.

The aim is to scrape 3e8 ions in around 1 second at injection by moving the collimator jaw fully into the beam center. During the test it is expect to reach a peak temperature of 500 degrees C, depending on the conductance assumed between the coating and the bulk material of the collimator jaw. The value of 500 degrees C is hereby a worst-case value for the assumption of a very bad thermal conduction through the junction. Details on the performed FLUKA simulations are given, which uses the tracking simulations as an input. The expected power deposition expected during operation is around 15 kJ/cm3, which sets the useful range of such a test.

The MD proposes a full beam scraping at injection, which has many advantages. The aim of the test is to have a confirmation that the coating will not suffer under such realistic loss-scenarios. The expected scraping time for 3.5 sigma (to the beam center) is in the order of 1.4 seconds. A loss map with the TCSPM as primary collimator (performed with protons earlier this year), losing 2e9 charges, showed no BLMs close to their limit, but instead a margin of a factor 100 with respect to the dump threshold. No BLM thresholds will therefore require to be adjusted for the MD.

It is proposed to inject 4 bunches of 3e8 ions, and only keep 2 (by gently blowing up two of them using the ADT). Full scraping is proposed to be done with the upper jaw, which would allow performing a smear test on the jaw not tested in case the collimator is inspected in-situ after the test. Using the lower jaw would however have advantages wrt to the interpretation of results, in particular if debris are unexpectedly caused by the test. A. Lechner reports that EN/STI hs a strong preference of removing the collimator from the machine for inspection, because of the risk implied when done in-situ. Such an inspection outside would however require the green light from RP and an appropriate location to cut open the collimator tank. Only if it cannot be easily removed and inspected outside out, an endoscope inspection will be done. M. Zerlauth asks what was foreseen as the baseline scenario for this collimator during LS2, i.e. whether to remove it from the machine for Run3 or not. A. Lechner confirms that EN/STI aims at a removal during LS2.

The MD time was initially schedule for 4 + 2 hours (still assuming the scenario of testing at flat-top). With the tests being performed at injection the MD should stop after 5 hours max.

F. Carra presented the details of the thermos-mechanical simulations, assuming 5 microns of Mo coating, while in reality it is 8 microns (but considering as well the Mo/MoGr interface). The MoGr bulk is assumed to be 25 mm, which determines its thermal properties. For the MoGr a conductance of 2000 W/m2/K is assumed. The conductance at the interface is very important as it has a direct impact on the peak temperature achieved in the coating layer. A plot of the number of ions required to reach 500 degrees C in the coating is given as a function of deposition time, considering different conductance's of the interface. A Laser Flash method (LFA) has been used to measure the thermal conductance of the interface. No significant difference was measured between a coated or uncoated MoGr sample. It is concluded that the thermal conductance for this measurement was in the order of 1e4 W/m2/K. To be conservative, one should assume however a worst-case thermal conductive case, as this might have degraded with time and beam exposure in the machine. Stefano asks if the longitudinal transmission is included, which Federico confirms.

A discussion emerged as to which jaw to use during the test. S.Redaelli agreed that it would be beneficial to remove the collimator in case the MD is done. If the MD is not taking place, one could consider however to maintain it as well after LS2. S.Redaelli confirmed that during LS2 an additional 4 devices will be installed per beam, therefore it would be very useful to perform this MD now in order to allow feeding forward the outcome to the series production.
S.Redaelli reports on a discussion with VSC: P.Chiggiato commented that he has not sufficient details to judge whether a degradation might occur and what impact it might have on the vacuum conditions. He however would not object to the test if the responsibility for the MD is assumed by the collimation team, that have not identified specific risks so far in view of the proposed beam conditions. Care should however be taken when venting the area after the test (to avoid the displacement of debris should they be created during the MD) and if necessary cleaning should be done.

Decision:

- rMPP agrees to perform the test at injection with total beam intensities up to 1E9 ions, which is an intensity not expected to induce any damage to the coating of the collimator. As at least 2 attempts are planned for a given position on the jaw, the first attempt should be done with lower intensity.
- In order to thoroughly assess the potential damage on the coating, rMPP supports the plan to remove the collimator after the MD, or have a confirmation by EN/STI that a proper and safe inspection can also be done in situ, guaranteeing that no damage has occurred when in case the collimator is left in the machine.
- Details of the venting after the MD should be defined with the vacuum group. The choice of upper or lower is to be determined by the MD team and all the above details added to the final version of the procedures in asm.cern.ch.

Reported by J.Uythoven and M.Zerlauth