FCC-hh General Design Meeting

Notes from the meeting held on 3rd March 2016

Reyes Alemany Fernandez - News and progress of turn-around time studies

R. Fernandez presented studies on the turn-around time for FCChh which is defined as the time between the end and start of the declaration of stable beams. The operational cycle is based on LHC. For the injection phase three options were presented, (i) SPS to LHC to FCC (ii) SPS to HEB (100km) to FCChh (iii) a significantly upgraded SPS to FCChh. Estimates have been presented for the different phases in the operational cycle based on LHC experience. Several problems have been shown that could occur in the injection phase together with a classification into unavoidable issues and issues that can be overcome by improving hardware and software. The total estimate for the turnaround time for FCChh would be 106 min. It was furthermore noted that for LHC only two fills achieved the theoretical minimum time.

- B. Holzer asked what the maximum number of bunches is that can be transferred from the 100km HEB to FCChh. L. Stoel replies that the transfer limit is 5 MJ.
- W. Höfle comments that option (ii) needs a substantially upgraded SPS
- D. Schulte comments that 106 min is about a factor two below the current target which is nice, especially since the theoretical turnaround time was also achieved two times in practice for the LHC. R. Tomás mentions that these two fills might not have been full bunches.
- There was a discussion about how to define the efficiency/availability for FCChh. R. Schmidt comments that there was just a workshop at CERN on availability where they tried to define numbers which can be compared among different accelerators and which one could look into.

Wolfgang Bartmann - Results from the extraction insertion studies

W. Bartmann presented the status of the extraction insertion design. Two options are studied, (i) extraction and collimation in two separate ESS and (ii) extraction followed by collimation. First, the layout and optics design of option (i) were presented. The TCDS has been moved further downstream for a larger beam separation.
For option (ii) a design was presented where the extraction is followed by betatron collimation for one beam. The momentum collimation would be at the other beam. It was noted that showers from the momentum collimation could become a problem for the electronics in this case. The length of the extraction insertion in this case would be 2 km. For the dump line two options were shown of either bending into a separate tunnel or feeding the dump line through the collimation area. Energy deposition studies and the dilution system were briefly shown.

- B. Holzer asked why no quadrupole is used in between the kicker and septum. W. Bartmann replied that the β-function at the kicker is very small so that a pre-firering kicker with a 1σ kick would be less harmful when the oscillating beam, is travelling through the machine. The effect of a quadrupole close to the kicker would then be very weak. R. Tomas adds that the quadrupole should be placed further away from the kicker, the aperture should not be a limit especially if the optics are ramped. R. Schmidt adds that ramping the optics is a promising option which should be studied.
- D. Schulte suggests to consider also the option to increase the β-function at the kicker and decreasing the kicker strength if necessary. R. Schmidt adds that a potential decrease of the kicker strength would also be very beneficial for the kicker design.
- D. Schulte adds that for option (ii) there is 1400m longitudinal space between momentum collimation and the extraction insertion which should be enough to shield from showers.

- D. Schulte comments that the increase of length of the extraction insertion for option (ii) should be re-iterated. How much could it be moved upstream, and could collimation already be matched from the large β-function coming from the extraction to save space.

Antoine Lachaize - Update on collimation optics

A. Lachaize presented the status of the studies of collimation optics. For the betatron collimation followed by momentum collimation, two options were shown. Option (i) is using the dispersion from the arc for momentum collimation which is cancelled before betatron collimation. Option (ii) starts with betatron collimation and creates dispersion through a chicane for the momentum collimation. For (i) without additional dipoles Dx can be matched to 0 at the beginning of the betatron collimation but not D'x, which leads to a large dispersions in the betatron collimation.

- D. Schulte defines two options to be studied. (i) Using a chicane in the collimation design, which will be done by A. Lachaize and (ii) the combination of the extraction insertion with the betatron collimation, which will be done by A. Langner