Minutes of the 54th WP2 Task Leader Meeting held on 31/07/2015

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Minutes, Follow-up of Actions, General Information (Gianluigi)

Minutes of the last meeting still have to be approved.

A technical committee was held on the 30.07.2015:

- Massimo presented the layout with some additional information on the Q4 aperture and the current non-conformities in the LHC including the ones to be resolved for the HL-LHC.

Concerning the new layout V1.2 the most important points are:

- The standard parameters will stay unchanged in respect of the layout V1.1, explicitly the nominal parameters are beta* =0.15/0.15 m for round optics and beta* =0.075/0.3 m for flat optics.
- The tolerances of the various components affecting the aperture (beam screen, tungsten shielding, cold bore, etc.) should be reviewed, the possibility of reducing the crossing angle should be considered to make sure that the design beta* is achievable. Within WP2 it should be investigated if the crossing angle could be reduced in order to gain some aperture margin. Sasha commented that reducing the crossing angle might then exclude ultimate luminosities. Gianluigi replies, that the more the crossing angle is reduced, the more one relies on beta* levelling and it should be studied carefully which crossing angle is needed assuming a constant crossing angle throughout the levelling. **Action: Sasha and Yannis**.
- The option of powering D1 and D2 in series is considered with a trim on the D1 or D2 magnet to compensate for any possible transfer function differences.
- The MCBRD and MCBYY4 will be operated at 2.8 T and it is foreseen to increase the length to 1.8 m.

Gianluigi circulated some slides concerning the optimization of the beta function at the crab cavities takng into account that the impedance effect depends linearly on the beta function while the kick of the crab cavities goes with the square root of the beta function.

For a given maximum RF voltage some optimization can be done on the number of crab cavities and beta function. For the nominal scenario the parameters are not far from optimum.

The next WP2 TL meeting will take place in September.

Update on strong-strong beam-beam effects (A. Valishev)

Until now coherent beam-beam effects have not been a limiting factor, which might change for the LHC. Therefore the main focus lay on incoherent beam-beam effects, noise and as a third point unexpected coherent effects.

Sasha presents a summary of the effect of noise and references on the topic, where low frequency noise and high frequency noise should be distinguished. Low frequency noise in combination with beam-beam might enhance the effect of resonances, whereas high frequency noise could result in fast emittance growth.

At the 4th HiLumi workshop K. Ohmi presented weak-strong simulations including crab cavity noise, which are documented in http://arxiv.org/pdf/1410.4092.pdf. He obtained that the tolerance on crab cavity noise lies around few 10^{-5} rad for the phase error and few 10^{-5} for the relative voltage amplitude error under the assumption of white noise. Ji Qiang showed simulations at the 24th LARP/HiLumi meeting using a strong-strong model, which yielded the similar limits for white noise. Ji also studied the dependence of the luminosity degradation on the beta*. During his visit, Ji also cross-checked his results with Phillipe Baudrenghien and they concluded, after a careful comparison, that their results in general agree. Javier Barranco is currently comparing simulation results obtained with COMBI with operational data and will, after this benchmarking, apply the code to the HL-LHC case.

Sasha summarizes some general facts about coherent instabilities including a list of references. Coherent modes are in general stable in a conservative system, whereas an interaction with non-conservative forces like e.g. impedance can lead to instabilities. The instabilities can in general be stabilized with Landau damping, the non-linear beam-beam force, octupoles or a breaking of the symmetry like e.g. a tune split. For HL-LHC Simon White studied coherent instabilities and found that a high chromaticity is advantageous but cannot cure all modes. Tatiana looked at stability diagrams including the beam-beam force before collision and the dependence on different octupole polarities and amplitude with the outcome that negative polarity is preferred.

Sasha shows a summary and list of open topics to be addressed. This list has been send around earlier per mail to the people concerned. The main points were additional benchmarking and the dependency on the frequency spectrum compared to simple white noise.

Gianluigi asks Sasha concerning the dependence of the luminosity degradation on beta*. The simulations assume full crabbing at maximum intensity and minimum emittance. It is suggested to repeat the simulations with realistic parameters during beta* levelling. Gianluigi furthermore asks if an ideal damper model is assumed without any bandwidth. For multibunch cases the bandwidth should be taken into account. **Action: Sasha and Yannis.**
Concerning the simulation results of Simon White on coherent instabilities, Gianluigi asks if a tune split would help to damp the instabilities. Sasha replies that the emittance growth increased with a tune split. At the end of the squeeze a tune split does not mitigate the instabilities with the explanation that Simon's simulation results are valid for strong head-on interaction, which is not the case for the end of the squeeze.

Reported by Gianluigi and Miriam