Minutes of the 94th WP2 Meeting held on 23/05/2017

Participants: A. Alekou, F. Antoniou, G. Arduini, J. Barranco, R. De Maria, D. Gamba, P. Hermes, G. Iadarola, N. Karastathis, S. Kostoglou, Y. Papaphilippou, D. Pellegrini, T. Pieloni, G. Skripka, G. Sterbini, R. Tomas, F. Van Der Veken.

General Information (R. Tomas)

Rogelio summarises the outcomes of the previous meeting. The minutes will soon be circulated.

Extending the previous round table on bad seeds, Riccardo reports that the identification of the corrupted data sometimes triggers on good cases where the initial conditions are not strictly identical. Gianluigi asks if it will be possible to track down the issue to faulty machines, Riccardo replies that it is not straightforward but there is work in progress with Alessio.

Implications of LHCb operation at high luminosity (R. De Maria)

Riccardo reports some target values for LHCb. The experiment plans to increase the luminosity from 4e32 Hz/cm^2 to 2e33 Hz/cm^2 in Run III to be kept also in Run IV and later increased up to a possible ultimate value of 2e34 Hz/cm^2 in run V and VI. The plans are not fully established but the aim is to find ways to accommodate them.

Riccardo shows the requirements in terms of beta* in order to be able to level at the required luminosity for the entire fill. The impact of the polarity is highlighted. The crossing angle for the different beta* is adjusted satisfying aperture constraints. The max corrector strength gives a crossing of 310 urad. All these considerations are for the horizontal crossing. For too high peak luminosity there is no gain in term of integrated luminosity as one cannot sustain the levelling.

A table collects the limits for the horizontal and vertical crossing for the aperture constraints.

The separations of the parasitic encounters are shown as function of the energy along the ramp and squeeze. The studies are repeated for several cases with different values of beta* and H or V crossing. Yannis suggests to add the evolution of the tuneshift parameter for the different cases.

The conclusion is that there is not much to gain with vertical crossing and in case of an upgraded TCDDM the horizontal crossing is much better.

Gianluigi asks if we should consider 250 urad as minimum crossing angle. Riccardo clarifies that smaller crossings are fine for the optics, but pending beam dynamics validation. Gianluigi points out that it would be better to keep 250 urad as a lower limit for the time being. The minimum beta* in this case is 1.4 m.

Riccardo and Dario point out that there might be an advantage to reduce the beta* and run with larger separation even for the nominal scenario (and for Run 3) to reduce the HO beam-beam tune spread.

This should be validated by simulations of the tune footprint. Gianluigi thought (wrongly, as confirmed after the meeting) that the HO tune shift mostly depended on the levelled luminosity value.

DA at the beginning of the fill and impact of LHCb (D. Pellegrini)

The update of the scenario for octupoles (from 0 to -570A) and chroma (from 3 to 15 units) was validated with DA simulations for the end of the levelling process. Dario presents a new set of studies with the full intensity at the beginning of the fill.

With the nominal tunes and large chromaticity the DA drops below 3 sigma for almost every beta* and crossing angle. The octupolar compensation does not work, indicating that the case is head-on dominated. Switching off LHCb, therefore reducing the total tune shift, helps, confirming that the head-on plays a crucial role.

A tune scan reveals a small area of good DA and a new tune of 62.320, 60.325 is selected. This working point is different from the best found for the LHC, Rogelio points out that this could be expected due to the much larger beam-beam tune shift. Dario expresses concerns regarding the stop bands of third order resonances, whose impact needs to be verified with errors. LHCb has a visible impact in the tune space, but it does not change the global picture and the required tune adjustment.

Dario shows DA scans in the Beta* crossing angle plane for the optimised tune and several values of the octupoles. For moderate octupoles the compensation is recovered and good DA are obtained.

Gianluigi notes that the maximum value of the MO in collision has been considered so far as previous simulations with low chromaticity were not indicating strong reduction of the DA. This could be reconsidered taking into account what is required for stabilizing the beam from the point of view of impedance. It was pointed out that this might prevent the operation with non-colliding bunches. This should be discussed in the operational scenario. Gianluigi also notes that the tune would need to be adjusted during the levelling process, Dario agrees.

Dario points out that levelling by separation should be reconsidered to contain the tuneshift and a new simulation campaign is planned. He also expresses the interest of high intensity MDs. **Action: Dario**

AOB: Progress with beam beam in Sixtrack (R. De Maria, G. Iadarola, D. Pellegrini)

Riccardo introduces the beam-beam modelling in Sixtrack, based on the synchro-beam mapping from Hirata. The beam-beam lenses estimated for the strong beam are traditionally built by Sixtrack by using symmetry rules, but an additional option allows importing the lenses from external sources.

The history of the modelling of the 6D beam-beam lens is shown. The updated interfaces are presented. To satisfy its requirements Dario developed new macros in MADX, profiting from its new capability of computing sigma matrices. Dario stresses the fact that simulating beam 2 now looks feasible although more work is required to validate and deploy simulations.

Gianni reviews the physics of the beam-beam in Sixtrack. The maths including all the effects (alpha at the IP, coupling, crossing angle…) is involved and Gianni is looking to derive and implement the entire setup from scratch in order to benchmark with Sixtrack. A testing environment has been implemented. Several steps have been identified.

Gianni explains the fix of the boost-antiboost transformation required in presence of crossing angle, which originally did not return an identity. The impact was checked by Dario with a tune scan, and it turned out to be visible although marginal. The fix is ready and will be used for the next series of studies.

Gianluigi congratulated Dario, Gianni and Riccardo for the progress and the methodical approach which is going to pay off.

Round Table: interest in a 50 ns MD with high intensity bunches (G. Iadarola)

Gianni would like to use the same operational cycle with 50 ns, higher intensity bunches. For heat load studies flat top is sufficient, but going into collision would be a marginal overhead.

The main motivation is to understand the heat load differences between the sectors which appeared after Run I. The test with 50 ns should give similar heat loads as the one in normal operation with 25 ns, but only from well-known sources such as impedance and synchrotron radiation. This will allow testing the presence of other sources in the 25 ns case.

Several synergies with other studies are identified such as: collimation, beam induced heating, beam-beam and luminosity, beam stability. The required systems and possible steps for the intensity ramp up are summarised. The idea is to keep the same operational settings as for the current 25 ns spacing. The availability of the injector has been reported at the LSWG.

Reported by Dario, Gianluigi, Riccardo and Rogelio.