Minutes of the 59th WP2 Task Leader Meeting held on 13/11/2015

Participants: G. Arduini, J. Barranco, R. De Maria, I. Efthymiopoulos, S. Fartoukh, M. Giovannozzi, E. Métral, Y. Papaphilippou, T. Pieloni, R. Tomás, E. Todesco.

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

The approval of the minutes of the meetings held on 9/10 and 16/10 has been postponed.

Ezio: MQXF is under testing. Large non-allowed multipoles are still present (b3 of 4-5 units) in warm measurements before and after loading. While the origin is not yet known it is important to note that collaring does not change significantly the multipole components. Only two multipoles can be corrected at the same time with shims among a3, b3, a4, b4. Ezio asked which one is better to optimize. **Action: Massimo**.

Ilias: A meeting to discuss about the TAXS and BPMs is organized on Tuesday by WP8 to discuss pro and cons of the various hardware options.

Follow-up of HL-LHC Annual meeting (G. Arduini)

Gianluigi made a summary of the points emerged the annual meeting presentations and discussions. A list of comments and actions identified during the meeting follows:

Field quality
-   Impact of field quality of the beam screen on the triplet, D1 and D2 should be calculated and added to the field quality tables: **Action: Ezio.**
-   Definition and conventions in particular of 2-in-1 magnets should be clarified. **Action: Ezio to write EDMS document on magnetic imperfection conventions by the end of the year.**
-   Dynamic aperture without non-linear correctors should be evaluated. **Action: Massimo**
Impedance
-   Although a significant HOM at 920 MHz in the DQW crab cavity should still be reduced. All the gain in impedance obtained with collimator coating is lost due to crab cavities HOMs.
-   Evaluation of the triplet BPM and Y-chamber impedance should be followed up. **Action: Elias.**
Heat load
-   A table of heat load for each cold element of the IRs 1/2/5/8 should be provided. The same should apply for the arcs for which the heat load per unit length of the main dipoles and main quadrupoles should be provided. A template has been proposed. Stephane noted that synchrotron radiation should be also considered in the triplets. Gianluigi replied that Adriana Rossi is studying these effects for the IRs. **Action: Elias by the end of the year. We should also schedule a presentation of the heat load estimates due to synchrotron radiation**.
-   One should identify the minimum bunch length to avoid upgrading the injector kickers. **Action: Elias.**
E-cloud
-   The position, number and size of the pumping slots in the beam screens (triplets and other magnets) and the position of the baffles should be agreed between the electron cloud and vacuum experts. **Action: Giovanni, Vincent**

Beam-screen and energy deposition
- In order to get constant aperture in D1, one can reduce the W shielding. Stephane commented that reducing copper coating could also be sufficient. **Action: Elias to discuss with Cedric Garion for a possible optimization of the Cu lamination thickness.**
- Operating at constant normalized crossing angle during the levelling process could also be seen as radiation mitigation measure. Stephane commented that it would be difficult with negative LOF. Gianluigi replied that Landau damping should not be an issue as this is proposed during levelling (in collision) furthermore one could enhance the Landau damping with a different order of the telescopic squeeze/pre-squeeze.

Machine Detector interface
- Maximum luminous region was reported to be about 12-13 cm r.m.s. Stephane commented that the present design is 4-5 cm r.m.s., 20 cm total and in a talk from the experiment a loss of efficiency appears to start from 11 cm. Gianluigi agreed that that this must be clarified with the experiments. **Action: Gianluigi, Stephane.**

Beam-Beam
- The tune spread to be used for semi-analytical estimates of the effect of noise while in collision (so far 0.03*0.2 for three high luminosity IPs) should be communicated to P. Baudrenghien. **Action: Sasha, Yannis**.
- The maximum acceptable emittance blow-up due to noise should be specified. According to Gianluigi this should be small as compared to the IBS growth rates. **Action: Yannis.**
- Dynamic beta has been calculated estimated by Tatiana and the impact needs further studied in collaboration with Rogelio. Stephane asked about the strategy to be applied: intensity dependent optics corrections or head-on reduction measures? Gianluigi replied that this must be indeed followed-up. Reduction of the head-on tune spread by crab kissing as proposed by Stephane could be an appealing solution. This should be studied further. **Action: Rogelio, Stephane, Tatiana, Yannis.**

Optics and correction
- Required tune measurement precision without of octupoles should be 10^{-5}. The possibility of attaining such precision should be discussed with the Beam Instrumentation colleagues. Machine stability within this range can be achieved only by the triplet powering scheme with a single main power converter. Rogelio noted that according to the Run I and 2015 experience the above precision can be achieved. Stephane asked to clarify the definition of the quantity due to the multi-particle nature of the observable.
- Uncertainty of measurement of 1 unit is requested in transfer function measurements. At present the error tables for the triplet quadrupoles have a component b_{2U}=0 and b_{2R}=10. According to Ezio the transfer function can be measured with an accuracy of 10 units, while the random component can be improved. The needs and the possibilities should be discussed and compared with those achieved with the present triplets. **Action: Ezio, Massimo, Rogelio**.

LHCb operation at higher luminosity
- Beam-beam simulations should be carried out for a $\beta*$ = 2 m and displaced IP and compared with the nominal scenario. According to Tatiana the DA aperture estimates in the presence of beam-beam have been performed including IP8 with no separation in IP8. **Action: Yannis, Sasha.**
- Study mitigation of HO mitigation strategies (including e.g. crab-kissing) should continue. Stephane mentioned studies of S. White with IP8 separation showing small DA. Gianluigi asked Stephane to send the link to the presentation of S. White. **Action: Stephane.**

Status on beam-beam tools (J. Barranco)

The user interface of SixTrack will be changed to give more flexibility to users. The user will need to specify all the quantities of the strong beam needed by the 4D and 6D beam-beam lens (trajectories and elements of the sigma matrix), that were previously partially inferred from the weak beam optics. The trajectory of the strong beam has to be considered as referenced from the closed orbit (not the reference orbit as in MadX) of the weak beam. For instance the half crossing angle given as input, is the difference between the divergence between weak and strong independently on the closed orbit of the weak. A plot of the position of the strong slices has been produced for several input parameters. Riccardo asked if simplified tests could be produced for the double purpose of having quick regression tests for future developments and further confirm all the underlying input conventions. Single 6D slice can be now be installed and could be part of more general beam-beam interaction then presently allowed by SixTrack by properly adjusting the input parameters, although this possibility needs to be theoretically proven.

The code is now being integrated in SixTrack. First tests show good agreement with previous versions, although small differences, compatible with insignificant numerical inaccuracy should be still understood. The documentation in the developer manual is up to date and the one in the user and physics manual is in a draft state.

The following steps should be carried out:
- Numerical tests and general test suite validation. **Action: Javier, Kyrre, Riccardo**
- Confirm sign conventions and write simple examples and physical observables (e.g. expected one turn orbit effects) that that proves the correctness of the assumptions. This should be part of the tests to be performed anytime a new version of SixTrack is released and update the user and physics manual. **Action: Javier**.
- MADX conversion to be synchronized with SixTrack release. Aim for the production release in spring. **Action: Massimo, Riccardo.**
- Proof-of-principle for 6D external slicing. **Action: Javier**
- Write up of mask files for simulations: **Action: Yannis**

These actions should be completed with the synchronized release of MADX and SIXTRACK versions in spring. **Action: Massimo, Riccardo, Yannis**

Status on wire tools (Y. Papaphilippou)

Yannis presented the status of the wire implementations. The model calculate the deflection of a thin finite wire on a particle with transverse offset integrated on a specified length. The control of orbit effects has been recently introduced and controlled by the same flag used for the same purpose with beam-beam lenses. Initial concerns of sign errors in the slides from Stephane and Rogelio will be discussed off-line. Stephane noted that models taking into account non-round cross section of the wire could be interesting for the studies.

The documentation in the user manual and physics is in draft state. An implementation used for benchmark and simple tests is ready and a version to be included and tested in the SixTrack framework has been provided. Rogelio asked about a wire implementation in MADX, Yannis and Massimo agreed the two codes should contain the same models. Yannis is expected to ship the final version in January. **Action: Yannis.** It is aimed to include the wire model in MADX with the production version in spring. **Action: Yannis.**

Round table:

Elias: Synchrotron radiations is calculated on heat load. Stephane mentioned a possible concern from D1 radiation into Q1 and Gianluigi mentioned Adriana is looking in detail in the synchrotron radiation of the interaction region.

Stephane: Seminar on laser for application on accelerators is being organized at the end of next week. This is particularly interesting since there is a potential for transverse cooling for protons in the LHC.

Reported by Gianluigi and Riccardo