AGENDA

The meeting was devoted to corrections implemented in the routines used to compute the dynamic aperture, in particular related to the sign of the errors, and to the resulting DA obtained for the v1.4 optics.

MEETING ACTIONS

Frederik Document the changes in the routines

GENERAL INFORMATION (G. ARDUINI)

Gianluigi reviewed the minutes of the 154th meeting, in particular the actions to be performed to provide limits for the impact of b2 on D2 (Massimo Giovannozzi), provide D2 measurements (Ezio Todesco), and to finalize the v1.5 optics, update the D2-BPM length and the aperture values in D1 and TAXN-D2, and optimize the strength in the non-conform MQTLs to increase the beam size at the dump window (Riccardo de Maria).

Gianluigi mentioned that the program of the HiLumi Collaboration Meeting (to be held at Fermilab from October 13th) is not yet finalized (except for plenary talks). There will be parallel sessions between the Work Packages 2, 4, 5 and 13. The program will be circulated when finalized.
Gianluigi also mentioned the Review of HL-LHC Alignment and Internal Metrology, from 26th to 28th August, where anyone from WP2 is welcome to attend, and the International Review of HL-LHC Magnet Circuits from 9th to 10th Sept.

ERROR ROUTINES FOR HL-LHC v1.4 OPTICS (F. VAN DER VEKEN)

The aim is to check and correct the signs of the magnet errors in the routines used for DA computation, as there are lots of possibilities of mistakes due to the sign conventions, in particular when considering the errors for Beam 2 (the so-called Beam 4 configuration in MAD-X). Also, optics v1.4 required some adaptation of the routines.

The main point is that magnet errors are specified from the connection side and in a left-handed coordinate system; these need in turn to be propagated to the real situation, taking into account the orientation of each magnet (this is the main point), the change to the right-handed system, the differences between beams, and the relation between apertures and beams. Whenever a x-flip has to be taken into account, some multipoles have to change sign. Some additional complexity arises from the absence of reference strength for several magnets (correctors), hence the need to use absolute errors (case of MCBRD, MCBXF and fringes), or the dependency of the sign of the reference field on the optics, for D1 and D2 correctors.

As a result, the routines were changed essentially to

- set correctly magnetic_sign (it was previously set to zero),
- correct the missing factor in errorgenerate_abs() (this had no impact on the resulting DA),
- avoid the ambiguity between bv_aux and bvaux, which was a source of mistake in e.g. the MCBXF routines (now bv_aux is always chosen).

The connection side of the magnet matters, as it defines its orientation, and this has to be checked for each magnet. The previous implementation for Q2 / D1 / D2 / MBH were hence found to be wrong and subsequently fixed. The detailed layout, sign errors, and their fixes, were shown for the MQXF, MCBXF, MBXF, MBRD, MCBRD, MQY and MBH. For the MBH in IP7 (11T magnets), the naming was wrong (the changes have been propagated to other IPs in case they are chosen in the future).

The resulting dynamic aperture, obtained with both the new routines and the v1.4 optics, are now much more consistent between the different beams (note that b2 in the talk actually means b4): now the MCBRD increases the DA for all seeds and all beams (this was previously the case mainly for b4). Similarly, the MCBXF always decreases the DA but now consistently and more or less homogeneously for all beams.

The average DA is not significantly changed, but the spread between seeds is, and is now similar between the two beams (while it was much smaller for b1 previously). The changes observed between v1.3 (with the old routines) and v1.4 (with corrected routines) can be both due to the new settings and the update of the routines; still, an overestimation of the DA with the old routines is suspected.

In conclusions, the error routines were cleaned up and several mistakes corrected. The updated results with v1.4 optics were presented, showing a significant improvement in their overall consistency, in particular reducing the difference between the two beams.
The remaining tasks are to use the non-linear corrector package to correct together the D2 and MCBRD errors; implement the fringes of D1/D2; perform a Monte Carlo study over the signs of the MCBXF; and implement the routines for v1.5 optics.

- Gianluigi asked if the changes in the routines are all commented and explained (for the future). Frederik did a template mask file with explanations. Gianluigi insisted on the need to write a small documentation on the implementation (action: Frederik).
- Gianluigi asked if the mask can be used for beam-beam studies, Frederik answered that it can (it will soon be in the repository).
- Gianluigi asked if the new measurements of the field quality in Q4 are taken into account, Frederik said that they are.
- Gianluigi insisted on the need to improve the field quality of the MCBXF magnets (strong decrease in DA).
- Concerning the 11T magnets in IP7, Gianluigi mentioned that an ECR is out, so the baseline is fixed now.

AGENDA OF NEXT MEETING (G. ARDUINI)

The next meeting will be on 20th August at 10am (agenda still to be sent by Sergey).

There will then be a meeting on 3rd Sept, and a long meeting on 10th Sept in the afternoon (to allow people from cryogenics to be present).

Reported by N. Mounet