WP2 Meeting #151

Tue 18 June 2019, 10:00 – 11:00

Chair:	G. Arduini
Speakers:	M. Sabate Gilarte, E. Todesco
Participants:	S. Antipov, F.Cerutti, R. De Maria, I. Efthymiopoullos, P. Fessia, L. Fiscarelli, D. Gamba, M. Giovannozzi, G. Iadarodla, N. Karastathis, A. Kurtulus, E. Métal, N. Mounet, K. Paraschou, F. Plassard, B. Salvant, F. Sanchez Galan, D. Schoerling, K. Skoufaris, F. Van Der Veken

AGENDA

The meeting was devoted to updates on energy deposition and magnetic measurements.

MEETING ACTIONS

Riccardo	Follow up with WP13 and WP15 on alternative positions for BGV
Francesco	Optimization of the mask TCLM4 (for the beam incoming to the IP)
Francesco	Evaluation of the dose on the Q4 magnet and MCBY corrector in case the Q4 is rotated
Ezio	Possible reduction of a3/b3 field errors on MCBRD
Massimo	Impact of the a2 and b2 components of the MCBRD on DA

GENERAL INFORMATION (G. ARDUNI)

Gianluigi reviewed the minutes and action items of the last meeting. For the luminosity variation, **Ilias** made a comment emphasizing that the phenomena arises from a combined effect of beam-beam, beam-beam long range and potentially electron cloud. **Gianluigi** proposed reviewing the available data, including on electron cloud build-up and resulting emittance blow-up.

For the IR-4 optics, an issue with the Beam Gas Vertex (BGV) monitor has been identified. **Riccardo** reported there is no location that would provide large enough β-functions, the only solution seems to be to exchange its location with another device (e.g. BGI) in LSS4 or look for another position (LSS8, LSS6). **Paolo** noted there are multiple constraints, including spatial, to be taken into account. **Ilias** stressed that a BGV is a key instrument for emittance measurements. **Gianluigi** emphasized the need to address the issue in the future versions of the optics. Action: **Riccardo** to follow-up with WP13 and WP15 concerning the possibilities for alternative positions

1 ENERGY DEPOSITION AND TAXN APERTURE (M. SABATE)

V1.5 optics has multiple changes with respect to v1.3, including a revision of vacuum layout between TAXS and Q7 (additional modifications expected), D1 beam screen length increase, implementation of crab cavities, and most importantly a change of TAXN beam separation from 148-158 mm to 151-161 mm.

Radiation impact on the triplet is expected to reduce from 26 to 20 MGy/3000 fb^{-1} thanks to a change of shielding in the interconnects. A 11.5 cm long and 1.44 cm thick Tungsten section was added on purpose to reduce the dose, with the aperture remaining the same.

As a result of TAXN movement and increased separation between the two apertures the total power in TAXN increased by around 100 W to 929 W. That reduced the impact on D2, while slightly increasing the impact on Q4. A TCLM4 mask is needed to protect the Q4 magnet. It should also be noted though that the Q4-assembly has changed from v1.3 to v1.5 optics: there are 4 MCBYs in v1.3 while only 3 in v1.5.

Decreasing the TAXN aperture from 85 mm to 80 mm further increases the power on TAXN to 1000 W, removing the power from TCLX jaws. It has no effect on the dose of Q4, while the D2 dose reduces by 10% from 10 to 9 MGy/3000 fb^{-1}. In order to grant a major reduction of the MCBY corrector dose, an internal shielding is needed which would reduce the physical aperture.

- Regarding the TCLM4 mask, **Paolo** inquired if the same quantity of material is foreseen for the other beam, pointing out that the weight might become an issue. **Francesco** replied one needs to start the mechanical design process in order to say definitively. **Gianluigi** summarized it is clear the mask is needed from a functional point of view, now it needs to be optimized (Action: **Francesco**)
- **Gianluigi** pointed out the aperture reduction in TAXN does not lead to a significant change of radiation doses while it reduces potential margin for future modifications. WP2 proposes to maintain the aperture of 85 mm.
- Concerning the possibility of installing a shielding inside the Q4 MCBY correctors, **Riccardo** noted there is little margin in the aperture, around 3 mm, any shielding would therefore pose an

aperture restriction. **Francesco** pointed out there is no possibility to lower the dose below 2 MGy/3000 fb^{-1} except to protect the aperture inside. **Daniel** commented the magnet is unlikely to withstand more than 1.4 MGy, investigation is ongoing. The rotation of the Q4-MCBY assembly proposed by **Massimo** earlier has not been studied yet from the energy deposition point of view but tentatively reduce the radiation to the MCBY corrector from 7-8 MGy/3000 fb^{-1} down to to 5 MGy/3000 fb^{-1}. **Paolo** then inquired about the dose accumulated during Run 4. **Francesco** replied an integrated luminosity of 800 to 1000 fb^{-1} is expected. **Paolo** pointed out that the issue can be postponed and dealt with during consolidation in LS4. **Gianluigi** supported the idea of rotating the corrector and the quadrupole. **Paolo** mentioned this seems doable from the magnet and cryogenics point of view, but there is an impact on the superconducting links. **Daniel** proposed waiting for the definitive test results before going forward with the issue. **Gianluigi** concluded the proposal of rotating the Q4-MCBY assembly would allow reducing the radiation dose and could allow operating until LSS4. The magnet group has now the required information and should make a recommendation based on the feasibility, integration.

- **Gianluigi** inquired about the actual length of the TAXN. **Riccardo** commented there is a small difference in the length between the models ~3350 mm and ~3490 mm which has no impact on the aperture. **Francesco** explained the pessimistic value was used for the study. **Francisco** ensured they have the information they need to proceed with the design; now the team will have to adjust the design of the Y-chamber that depends on the beam separation (the design will then have to verify with the impedance team). **Riccardo** made a comment that the TAXN position is being reconfirmed with the integration. **Gianluigi** emphasized the need to have the TAX design frozen.

2 UPDATE ON FIELD QUALITY MEASUREMENTS (E. TODESCO)

Ezio presented an analysis of field quality in Higher Order (HO), D2, and nested triplet orbit correctors. For the HO correctors the multipoles are within target bounds. The transfer function has an error that increases with the multipole order, with the discrepancy reaching 10% for the decapole correctors. While it may be a mere calibration problem, more studies are needed to find a match of the transfer function to the measurements.

The D2 correctors feature multipoles within specifications for both short models: 1- and 2-aperture. The MCBRDP1 long model has a deviation in a3 (-10 to -15 units), b3 (-6 to -7 units), and a2 (up to -11 units). This deviation seems to be at the tolerance limit. The origin of the deviation for a3 and b3 in understood and seems to be the alignment of the aperture in the yoke. There are alignment notches in the yoke.

For the nested correctors, the inner dipole MCBXFBP1 and MCBXFB have a b3 30 units larger than expected, which is explained by a 0.6 mm shimming of the poles; all other multipoles are within bounds.

- **Gianluigi** raised a question about the feasibility of reducing the a3/b3 values in the MCBRD nested correctors (Action: **Ezio**). **Ezio** replied that, in principle, corrective actions by shaping the iron could be done.
- **Frederik** asked about the MCBXFA results, since those magnets seem to be more critical for the dynamic aperture. **Ezio** replied the measurements have not been completed yet. **Gianluigi**

reminded that the present field quality for the MCBX magnet is not acceptable from the point of view of DA.

- **Gianluigi** proposed checking the impact of the a2 and b2 components of the MCBRD (Action: **Massimo**).
- **Ezio** suggested to give a talk on the triplet, D1, and D2 field quality in July.

Reported by S. Antipov