

Task 2.3

Particle simulations studies

M. Giovannozzi

Objectives

- To study the field quality tolerances for new magnetic elements for the LHC upgrade
- To evaluate the dynamic aperture and tolerances of the correction circuit settings

Partners

BINP, BNL, CERN, CSIC-IFIC, EPFL, FNAL, INFN-Frascati,
KEK, SLAC, STFC, Uni-Liv, Uni-Man

Feedback is more than welcome!

Work packages

- **Preparation of simulation tools**
 - Define and improve tools (e.g., MAD-X, SixTrack, PTC, mask files)
 - Define procedures (e.g. Dynamic aperture protocol)
 - Find and maximise resources (e.g., tracking – LHC@home)
- **Monte Carlo tracking studies**
 - Define field quality of new magnets and characteristics of corrector packages.
- **Specification of required correction circuits**
 - Specify the required non-linear correction systems for the new insertions.
- **Study optimum working points**
 - Evaluation of dangerous resonances.
 - Tune scans.

Work packages details - I

1. General set up of infrastructure
 - Set up of web site for information exchange
 - Definition of tools and repositories -> Contributors: CERN team
2. Review of DA computation protocol -> Contributors: CERN team
3. Field quality specifications for layout # 1 (120 mm, Nb-Ti – SLHC3.01)
 - New triplets, Separation dipoles, Insertion quadrupoles, Specification for non-linear triplets' correctors -> Contributors: SLAC team
4. Field quality specifications for layout # 2 (120 mm, Nb₃Sn – SLHCXX)
 - New triplets, Separation dipoles, Insertion quadrupoles, Specification for non-linear triplets' correctors -> Contributors: Andy's team

Work packages details - II

5. Field quality specifications for layout # 3 (140 mm, Nb-Ti – SLHC3.1a)
 - New triplets, Separation dipoles, Insertion quadrupoles, Specification for non-linear triplets' correctors -> Contributors: E. Levichev et al.?, J. Resta Lopez

6. Field quality specifications for layout # 4 (140 mm, Nb₃Sn – SLHC3.1b)
 - New triplets, Separation dipoles, Insertion quadrupoles, Specification for non-linear triplets' correctors -> Contributors: Andy's team, J. Payet, A. Chancé

Work packages details - III

7. Impact of fringe fields of large-aperture magnets

- Analytical studies
- Implementation of tools
- Assess impact for four layouts -> Contributors: B. Dalena, A. Bogomyagkov

8.-11. Final assessment of layout #1, 2, 3, 4

- Tune scan studies
- Weak-strong beam-beam studies -> Contributors: H.-J. Kim, T. Sen

12. Study of impact of crab cavity field quality

- Analytical studies
- Implementation of tools
- Assess impact for all layouts -> Contributors: R. Appleby, J. Barranco, M. Giovannozzi, H-J. Kim, T. Sen, R. Tomás

Comments

- Tools
 - Most tools are already available
 - Tracking environment documentation: Eric prepared a new draft
 - Maybe missing tools:
 - Filter for setting triplets correctors
 - 6D beam-beam (weak-strong)
- Definition of work packages by layout might be reviewed:
 - Based on recent optics activities, one might reduce the number of layouts
 - Different teams could work on the same layout, but on different magnet classes (e.g., triplets/D1, D2/IR quadrupoles) -> this would impose to work sequentially
- Additional activities (non HiLumi):
 - Improved optics measurements and correction -> R. Tomás and student

Resources - I

- First iteration of resources estimates (orange -> contributes also to other Tasks); FTEs unless otherwise specified:
 - CERN: R. De Maria (0.3), S. Fartoukh (0.3), M. Giovannozzi (0.3), R. Tomas (0.2)
 - FNAL: H.-J. Kim (0.5), T. Sen (0.25)
 - Uniliv: K. Hock (2.4 months) M. Korostelev (16 months), A. Wolski (0)
 - INFN Frascati: M. Zobov (0)
 - CEA: B. Dalena (1), A. Chancé (0.1, after June 0.5), J. Payet (0.5)
 - SLAC: Y. Jao (0.1), Y. Nosochkov (0.2), M. Wang (0.1), Y. Cai (0.1)
 - Proposed 0.5 FTE for improved chromatic correction and map analysis -> details still to be defined (e.g., part of contribution for Task 2.2?).

Resources - II

- BINP: A. Bogomyagkov (0.15), E. Levichev, P. Piminov
- IFIC-CSIC: J. Resta Lopez (0.3)
- Uniman: R. Appleby (0.2), PDRA (Post Doctoral Research assistant) (0.5)

- BNL, DESY, EPFL, KEK, LBNL, STFC: No contribution
- BNL: no resources available; synergies for beam studies on RHIC were proposed.
- EPFL: I will re-contact Lenny
- KEK: no reply by Ohmi-san
- DESY, LBNL: no planned contributions to Task 2.3
- STFC: declined for Task 2.5

Resources - III

- In the case of CEA and IFIC-CSIC the contribution to Task 2.3 will follow that for Task 2.2.
- In the case of BINP, the level of resources is still to be defined, as well as the activity (P. Piminov will use Acceleraticum for simulations).
- Some comments for CERN contributions:
 - They will increase during LS1
 - I(we) will fill the “holes” to complete the proposed work packages
 - B. Holzer is also contributing to WP11 (Non EU) for the 11 T dipole

Deliverables, milestones

- Magnet field quality specifications -> M36
- Corrector magnets specifications -> M36
 - Setting up of general infrastructure (wiki, some tools, user accounts) -> M6
 - Definition of protocols and additional tools -> M6
 - Initial estimates of dynamic aperture and field quality specifications -> M24 (Report)
 - Initial models of correction systems -> M24 (Report)
- Preliminary results for field quality expected for May (IPAC12 paper).