

Task 2.3

Particle simulations studies

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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

Initial list of Partners

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

Work packages - I

- **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 - II

1. General set up of infrastructure

- a. Set up of web site for information exchange
- b. Definition of tools and repositories

2. Review of DA computation protocol

3. Field quality specifications for layout # 1 (120 mm, Nb-Ti – SLHC3.0) (SLAC team)

- a. New triplets
- b. Separation dipoles
- c. Insertion quadrupoles
- d. Specification for non-linear triplets' correctors

4. Field quality specifications for layout # 2 (120 mm, Nb₃Sn – SLHCXX)

- a. New triplets
- b. Separation dipoles
- c. Insertion quadrupoles
- d. Specification for non-linear triplets' correctors

5. Field quality specifications for layout # 3 (140 mm, Nb-Ti – SLHC3.1a)

- a. New triplets
- b. Separation dipoles
- c. Insertion quadrupoles
- d. Specification for non-linear triplets' correctors

Work packages - III

6. Field quality specifications for layout # 4 (140 mm, Nb₃Sn – SLHC3.1b)

- a. New triplets
- b. Separation dipoles
- c. Insertion quadrupoles
- d. Specification for non-linear triplets' correctors

7. Impact of fringe fields of large-aperture magnets

- a. Implementation of tools
- b. Assess impact for four layouts

8. Final assessment of layout # 1 (FNAL: H.-J. Kim, T. Sen)

- a. Tune scan studies
- b. Weak-strong beam-beam studies

9. Final assessment of layout # 2 (FNAL: H.-J. Kim, T. Sen)

- a. Tune scan studies
- b. Weak-strong beam-beam studies

10. Final assessment of layout # 3 (FNAL: H.-J. Kim, T. Sen)

- a. Tune scan studies
- b. Weak-strong beam-beam studies

11. Final assessment of layout # 4 (FNAL: H.-J. Kim, T. Sen)

- a. Tune scan studies
- b. Weak-strong beam-beam studies

Work packages - IV

- 12. Study of impact of crab cavity field quality** (FNAL: R. Appleby, J. Barranco, M. Giovannozzi, H-J. Kim, T. Sen, R. Tomás)
- a. Implementation of tools
 - b. Assess impact for all layouts

Modus operandi

- **General information**
 - A wiki web site will be set up to collect relevant information (e.g., relevant studies from LHC nominal, reports, meetings minutes, actions etc.)
- **Data (input/output)**
 - Via **afs** repositories (as is the case for the LHC nominal).
 - It is proposed to create computer accounts to collaborators to share the same environment and resources (tracking)
- **Discussion**
 - Regular bi-monthly meetings
 - Mailing list (to be set-up)

Interactions with other WP

- Central WP in the study
 - Optics (input for us)
 - Exchange with beam-beam and collective effects
 - Magnets
 - field quality (output for us)
 - corrector packages
 - Collimation, Energy deposition, Machine and Detector Interface
 - general machine configuration: optics (input for us), magnetic imperfections, some tools

Deliverables, milestones and contacted partners

- Magnet field quality specifications -> M36
- Corrector magnets specifications -> M36
 - Setting up of general infrastructure (wiki, some tools, user accounts) -> M3
 - 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)
- Contacted partners
 - **SLAC**: general setting up, preliminary production soon
 - Mail to link persons next week