X-FEL Beam Dynamics Meeting
Minutes #1 3.9.03

Topics:

- General
- Discussion on work to do, action items etc.
- Next meeting

General

The X-FEL beam dynamics meeting is meant as a joint meeting of all people who are involved in X-FEL beam dynamics work. In the work-packages notation this covers the injector (WP 14), Bunch Compression and Start-to-End Simulations (WP 15), Lattice Design and Beam Optics (WP 16), FEL Concepts (WP 27). Beam diagnostics is closely related to these topics.
The meeting will be held weekly, Wednesdays at 16:00, Room 459, Bldg. 30b.

To Do List

Winni presents a non-conclusive list of tasks and work to do (see transparencies).

Injector:

Wish to design and optimize the injector for 3 reference bunch charges:
0.3 nC, 1 nC, 3 nC.
Figure of merit should be beam brightness (peak current/slice energy spread/ slice emittance). Mikhail and Evgeny will specify in more detail.
Injector should be optimized for the three cases by Christmas.

Bunch Compressors:

Review present bc layout (3rd stage, S-type chicane, CSR instability). Improve intrinsic stability by maybe better optimized choice of R_{56}.
People: Torsten, Yujong, Martin, Frank

Optics:

Incorporate existing optics solutions (switchyard, collimators, TTF-2) into overall lattice design by end of October. Keep in mind that flexibility of system is needed to incorporate any new FEL ideas, mainly question of undulator section length).

People for lattice design and matching: Winni, Nina, Vladimir, …

Beam stability will most likely be covered by Swiss Light Source!

Start to End Simulations:

Choice of simulation codes:

Optic development: Elegant, TRACKfnm

TRACKfnm has the advantage of in-house availability of the author. It has been agreed that the reference lattice description will be in Elegant format.

Linac tracking: Elegant, ASTRA, CSRtrack

1d CSR model and wake fields to be added to ASTRA. This work is in progress.

FEL codes: GENESIS (steady state model)

For most calculations (jitter, tolerances etc.) the steady state model is sufficient.
Implementation into GENESIS is fast enough to do parameter studies.
An error budget is needed. Holger will start working on this with the help of Mikhail and Evgeny.

Next meeting:

Next meeting will be in 3 weeks (after collaboration meeting).

Tentative program:

- First go at jitter tolerance table (Holger)
- Fundamental parameters (Mikhail)
- Review of optics work (Winni)

Attachments:

- Transparencies

People

Balandin, Vladimir
Brinkmann, Reinhard
Carneiro, Jean-Paul
Decking, Winfried
Dohlus, Martin
Faatz, Bart
Floettmann, Klaus
Golubeva, Nina
Kim, Yujong
Koerfer, Markus
Kozlov, Oleg
Limberg, Torsten
Rossbach, Joerg
Saldin, Evgeny
Schlarb, Holger
Schneidmiller, Evgeny
Stulle, Frank
Yurkov, Mikhail

XFEL optics and bunch compression optimization

- Injector optimization for different charges and bunch lengths
- BC's:
  - Position and energy
  - Optic spec's to avoid slice emittance growth
- Optic development and matching
  - Further study and minimization of space charge dependence
  - Collimation sections
  - Undulator switchyard
  - Undulator optics
  - Beam dump

S2E Calculations

- Tool development and choice
  - CSRtrack
  - Interface routines
  - FAST?
  - Parallel processing GENESIS
  - Linac tracking: elegant, ASTRA, GPT, Merlin, V2, MAD, TRACKfnm
- FEL performance dependence
  - Realistic machine with errors
  - Jitter tolerances (Phase, Orbit, …)
- (Potential) Instabilities
  - Space Charge driven
  - CSR driven
  - …other?

X-FEL “Work packages”

Injector

- Long. internal bunch structure?
- Cavity tilts/coupler kicks?
- Bunch parameter space: low eps w. low charge/higher compression (or vice versa)?
- Rep. rate and duty cycle?

Bunch Compression and Start-to-End Simulation

- Compressors: parameter space: lower charge/higher compression (or vice versa)?
- Sensitivity of bunch shape/structure vs. charge, phase, etc. fluctuations?
- Energy at BC-III variable (at BC-II??)Å impact on energy vs. rep rate issue?
- FODO-type stage desirable (possible)?
- Switch yard
- Collimators
- Incorporation of FEL/SASE processes (undulators)

X-FEL “Work packages”

Lattice Design and Beam Optics/Dynamics

- Main linac and BC matching
- Orbit correction & beam-based methods
- Collimation and diagnostic section
- Beam transport and distribution to user beam lines
- Orbit stability/stabilisation (slow and fast feedback)
- Lattice in undulator systems, phase shifters, correctors, matching sections
- Transfer to dump

FEL Concepts

- Transportation of general theoretical developments in the area of FEL physics into the XFEL project
- Coordination of review of present FEL concepts
- Seeding options (coherent seeding, time slicing,?)