XFEL Beam Collimation and Switchyard Review

Introduction

FEL-Beam-Dynamics Group

3.12.2007
Review Charge

- Review status of various involved work-packages
- Find (and resolve) misunderstandings and misinformation
- Openly discuss unresolved topics, specifications, etc.
- Agree on time line
Collimation and Switchyard

Collimation

Diagnostics and Feedback

Distribution Kickers

Distribution Septa

Undulators

SASE 1
tunable, planar
0.1 nm

e-

SASE 2
tunable, planar
0.1 – 0.4 nm

e-

SASE 3
tunable, helical
0.4 – 1.6 nm

e-

Experiments

electrons
17.5 GeV
Boundary Conditions

- Power and cooling infrastructure located in building/shaft XS1 (Osdorfer Born site)
- Start point of section after linac, 1650 m from gun
- If only 84 modules in main linac, warm section of 200 m before
- Energies:
  - 6 GeV       far future CW option
  - 17.5 GeV    nominal operation
  - 25 GeV      maximum envisioned energy range
- Energy bandwidth:
  - ± 1.5 % top quality acceptance
  - ± 2.5 % transport acceptance
Functionality

• Beam Collimation
  – emergency beam stop
  – halo collimation

• Transverse and energy feedback
  – fix launch conditions within bunch train

• Beam Switchyard
  – distribute bunches within train to beam dump, SASE2, SASE1 and (far future) additional FELs
Basic Parameters for Beam Line Layout

• Energy range 6 – 25 GeV
  Operating range for magnets, diagnostics

• Emittance at end of linac
  – Nominal: $\varepsilon_N = 1.4e-6$ m (projected)
  – Smallest: $\varepsilon_N = 0.8e-6$ m (projected)
  Apertures, machine protection, …

• Energy spread
  – Bunch train: 0% - ± 1.5%
  – Single bunch uncorrelated: 2.5 MeV RMS (= 0.0125% at 20 GeV)
  – Single bunch correlated: 0% - 0.01%
  Apertures, beam sizes, chromatic correction, …

• Bunch charge
  – ?? nC to 1 nC
  Machine protection, diagnostics
Agenda

14:00-15:30
• Section Overview – Winni Decking
• Collimation Section – Nina Golubeva, Vladimir Balandin
• Beam Switchyard – Winni Decking
• Installation, Tunnel Layout – Norbert Meyners
• Beam Distribution Kicker – Frank Obier
• Septum Magnets – Bernie Krause, Sasha Petrov

15:45-16:45
• Vacuum System – Torsten Wohlenberg
• Impedance Budget – Igor Zagorodnov
• Diagnostics, Fast Transverse Feedback – Winni Decking