Upgrades of FLASH in 2007

Siegfried Schreiber, DESY

- Shutdown 2007
- further upgrades → Rossbach

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Schedule and Milestones

- 1 GeV beam energy
- Shutdown: installation 6th module etc
- Lasing with long bunch trains (>30)
- Variation of wavelength on shift-to-shift basis
- First lasing at 13 nm
- FEL experiments start
- Saturation at 32 nm achieved

2006
- First lasing at 32 nm
- First beam to dump
- Commissioning injector started

2005
- Commission RF gun at PITZ finished

2004
- FLASH is a user facility
- Three weeks preparation before each user block

User Experiments
FEL and SASE Studies
FEL Studies

• User Experiments
• FEL and SASE Studies
• FEL Studies

Siegfried Schreiber, DESY | FLASH Seminar 6-Feb-2007
### FLASH Schedule 2006/2007

#### Last modification 21-Nov-2006

<table>
<thead>
<tr>
<th>January 2007</th>
<th>1</th>
<th>1-Jan - 7-Jan</th>
<th>Accelerator Studies</th>
<th>Schoolholidays HH/SH</th>
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<tr>
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<td>FEL Studies</td>
<td>with SASE towards end of week</td>
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<td>February</td>
<td>5</td>
<td>29-Jan - 4-Feb</td>
<td>User Run</td>
<td>800 pulses, 13.5 nm</td>
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<td>FEL Studies</td>
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<td>9</td>
<td>26-Feb - 4-Mar</td>
<td>User Run</td>
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<td>13</td>
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<td>2-Apr - 8-Apr</td>
<td>Installation of ACC6</td>
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<td>9-Apr - 15-Apr</td>
<td>Repair ACC5, new ACC3</td>
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<td>25-Jun - 1-Jul</td>
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<tr>
<td>Sep</td>
<td>1</td>
<td>1-Sep</td>
<td>1 GeV beam energy reached</td>
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<tr>
<td>Dec</td>
<td>1</td>
<td>1-Dec</td>
<td>Lasing at 6.4 nm</td>
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Modules

Module 6 to be installed
Module 5 tuners to be repaired
Module 7 being assembled to replace ACC3
3rd harmonic cavity not in 2007
→ energy reach goal: 1 GeV to lase with 6.4 nm

Couplers and cavities to be conditioned after shutdown
Infrared Undulator

- **Infrared undulator project**
  - install undulator in beam line between last undulator module and dump dipole
  - Motivation: pump and probe experiments
  - FLASH seminar: 13.02.2007 (O. Grimm)

- **Double pulse scheme**
  - double pulse generator installed in laser to generate a second pulse for each pulse in the train with a delay of some rf buckets
  - Motivation: delay scan of IR vs VUV/EUV radiation is easier if IR arrives first at experiment

- **Infrared beam line**
  - Motivation: infrared radiation to experimental hall
  - FLASH seminar: 20.02.2007 (M. Gensch)
UV diagnostics/doubler

- variable attenuator
- \(\lambda/2\) wave plate
- polarizing splitter
- telescope x2
- Pulse shaping iris
- joulemeter
- LBO/BBO
- prism
- Double Pulse Generator
- Streak Camera
- Photodiode (phase)
- to rf gun
- UV Photodiode
- Double Pulse Generator
- Streak Camera
- Photodiode (phase)
Optical Replica

- **Optical replica**
  - MATCH/SUND section (after collimator)
  - Motivation: measurement of longitudinal bunch profile with fs resolution
  - Consists of seed laser (outside tunnel), laser beam line, two undulators (+PS), chicane (+PS), Grenouille/FROG, diagnostics
  - Dogleg vacuum chamber modification to insert seed laser
  - Seed laser in new laser hut being constructed west of tunnel
  - Undulators and chicane to be installed on optical tables in seeding section
  - E-bunch shape translated into optical pulse to be analyzed in a classical FROG set-up (optical gating)
  - FLASH seminar: 27.02.2007 (H. Schlarb)
Optical Replica

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• New design of the Gun section
  ▪ GUN section between rf gun and ACC1 overcrowded and difficult to align
  ▪ new diagnostic cross design with reduced wakefield
  ▪ easier alignment of elements in the section
  ▪ rf gun – similar to cathode system – on rails
  ▪ rf gun to be moved upstream by 30 cm to increase efficiency of darkcurrent collimator (→ Han)
  ▪ use the additional place for a darkcurrent kicker
  ▪ rework laser beamline
  ▪ commission required: solenoid alignment, new optimization (small emittance)
→ FLASH seminar 06.03.2007 (K.Floettmann)
Orbit feedback

• Orbit feedback test set-up for XFEL
  ▪ with PSI
  ▪ special BPMs from PSI
Dispersive Section Diagnostics

• New BPM in BC3 dispersive section (similar to new BC2 BPM)

• Rearrange BPMs in BC2 section to measure orbit in a well defined manner
  ▪ swap quadrupole ds BC2 (move BPM to upstream quad)
  ▪ dark current kicker to be removed to make place for the BPM
    → three BPMs in a drift section

• Coherent synchrotron radiation diagnostics
  ▪ Synchrotron radiation port BC3
  ▪ Beam line to TOSYLAB

• Synchrotron radiation port dogleg
Synchronization

• synchronization in fs scale
  ▪ set-up with stable fiber laser
  ▪ distribution of laser pulses with optical fibers along the machine
  ▪ test for XFEL but also useful for FLASH, especially pump probe experiments

• New phase monitors (BC2, BC3, collimator, ACC7 section)
Backup Laser

• second photoinjector laser system is being installed now
  ▪ the upgrade has been tested at PITZ
  ▪ pumped fully with laser diodes
  ▪ improve overall stability

• we intend to use the new laser as a working horse
  ▪ present laser as backup
Miscellaneous Work

- New MCP detectors
- New magnet power supplies: choppers to be replaced by Heidbrooks (noise reduction)
- Change of EO crystal
- Possible: change of screen in ODR set-up (by-pass)
- New laser building (28 g, close to FLASH tunnel) in construction
  - Coherent radiation diagnostics, Electro-optical measurements, Optical replica, Optical clocks and synchronization, …
  - FLASH seminar: 31.10.2006 (S. Khan)
• Installation of 3rd harmonic cavity
• .... → Rossbach