FLASH Parameters 2017/18

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electron beam energy</td>
<td>2.0 - 1.2 GeV</td>
</tr>
<tr>
<td>Charge</td>
<td>0.02 - 1 nC</td>
</tr>
<tr>
<td>Peak current (µA)</td>
<td>1.5 - 2.5 µA</td>
</tr>
<tr>
<td>Energy spread (%)</td>
<td>0.2 - 0.5</td>
</tr>
<tr>
<td>Brightness (µm)</td>
<td>1 - 35 µm</td>
</tr>
<tr>
<td>Train length (µm)</td>
<td>1.0 - 16.0 µm</td>
</tr>
<tr>
<td>RF gap (mm)</td>
<td>3.5 - 12.0</td>
</tr>
</tbody>
</table>

The FLASH Facility: FLASH1, FLASH2, & FLASH3 in 2018

- 2 st. injector beams (6.5 µs / 13 µs) mas
- 2 st. bunch patterns and charges for FLASH1 & FLASH2 & FLASH3
- 1 special short pulse laser (1.0 - 3.5 µs) mas
- 15% of SK photo cathode
- RF gap: normalised 18 cell 1.5 GHz cavity, 52 µV/m
- RF flat top now 800 µs
- 1 x 3,9 GHz module "chip bending"
- NEW: warm S-band high bandwidth cavity for beam arrival time feedback
- 7 x s.c. 1.3 GHz modules: 8 cav. w/ 8 cells / module
- 2 chicanes at 484 MeV and 490 MeV
- 2 channels of 300 MeV (deceleration) to 1250 MeV
- Switchyard → FLASH1 to FLASH2
- Fast section → Har. Larmor resonance
- NEW: Switchyard → FLASH1 to FLASH2
- Now DC dipole / later: 100 µm half-sinusoidal packed dipole
- 3 RF guns (300 MeV)
- 5.6 MeV / 146 MeV / 450 MeV

Flashing: 6967 operation hours

<table>
<thead>
<tr>
<th>FEL user operation</th>
<th>64.5% / 69% h</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLASH2: 5595 h FEL user operation</td>
<td>1077 h in experiments: 572 h Methods and Instrument Developments</td>
</tr>
</tbody>
</table>

Statistics

- Exotic FEL Operation
  - Harmonic Lasing Self Seeded FEL
  - Post saturation tapering: so far factor of ~2
  - More experiments using the FL2 variable gap undulator / inverse tapering: two color lasing
  - Single spike lasing: short pulse laser w/ x-low charge < 100 pC
  - 21.5 ns separated double pulses for THz / XUV / µm
  - Two lasers on one beamline: pairs w/ variable delay
  - User preparing for EU-XFEL at 4.5 MHz

New Section Upstream of 1st Bunch Compressor Chicanes

- Beam arrival time feedback
- Needs high-bandwidth actuator (warm 5-band cav.)
- "BACCA"
- Redesign/upgrade of section between 3rd harm. Invariant & 1st BC chicanes
- Old all-in-one tripled replaced by 3 separate quads!
- Injector match (SC, dominated beam from gun → well defined optics) improved

FLASH3/FLASHForward

- FLASHForward: electron beam driven plasma wakefield acceleration experiment
- In beamline FLASH / shares tunnel w/ FLASH2
- First beam extracted 2017/08

- Vessel for plasma cell
- Final focus quads
- First beam through vessel in 2018/02

Short Term Upgrades

3rd BC chicanes for FLASH2
- Extra D-chicane in FL2 at end of extraction: compression at low energy reduced
- Peak current in extraction is reduced

Positron TDS for FLASH2/FLASH3
- New X-band Trans. Def. (c) Structure
- CERN/DESY/PSI project: modular/flexible TDS
- 1 x for FLASHForward & 2 x for FLASH2
- See also THP/1048, DUPFM007, TUPM600