

FLASH – Free Electron Laser in Hamburg

- Overview of the accelerator
- EUV/soft X-ray lasing down to 6.5 nm
- Outlook







Total length of linac:

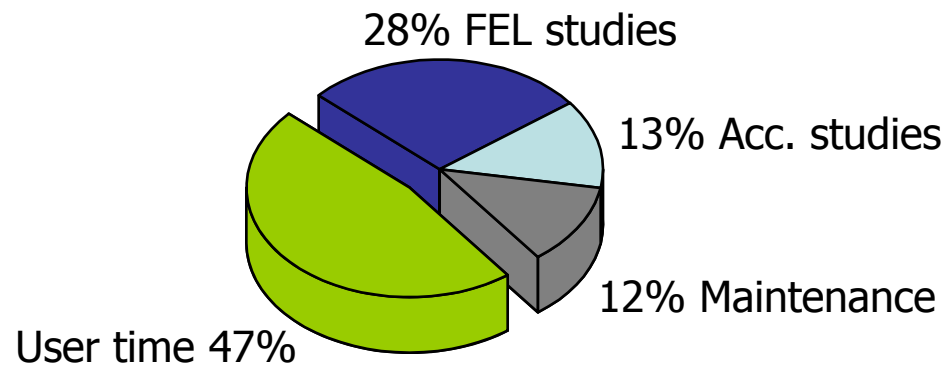
~260 m

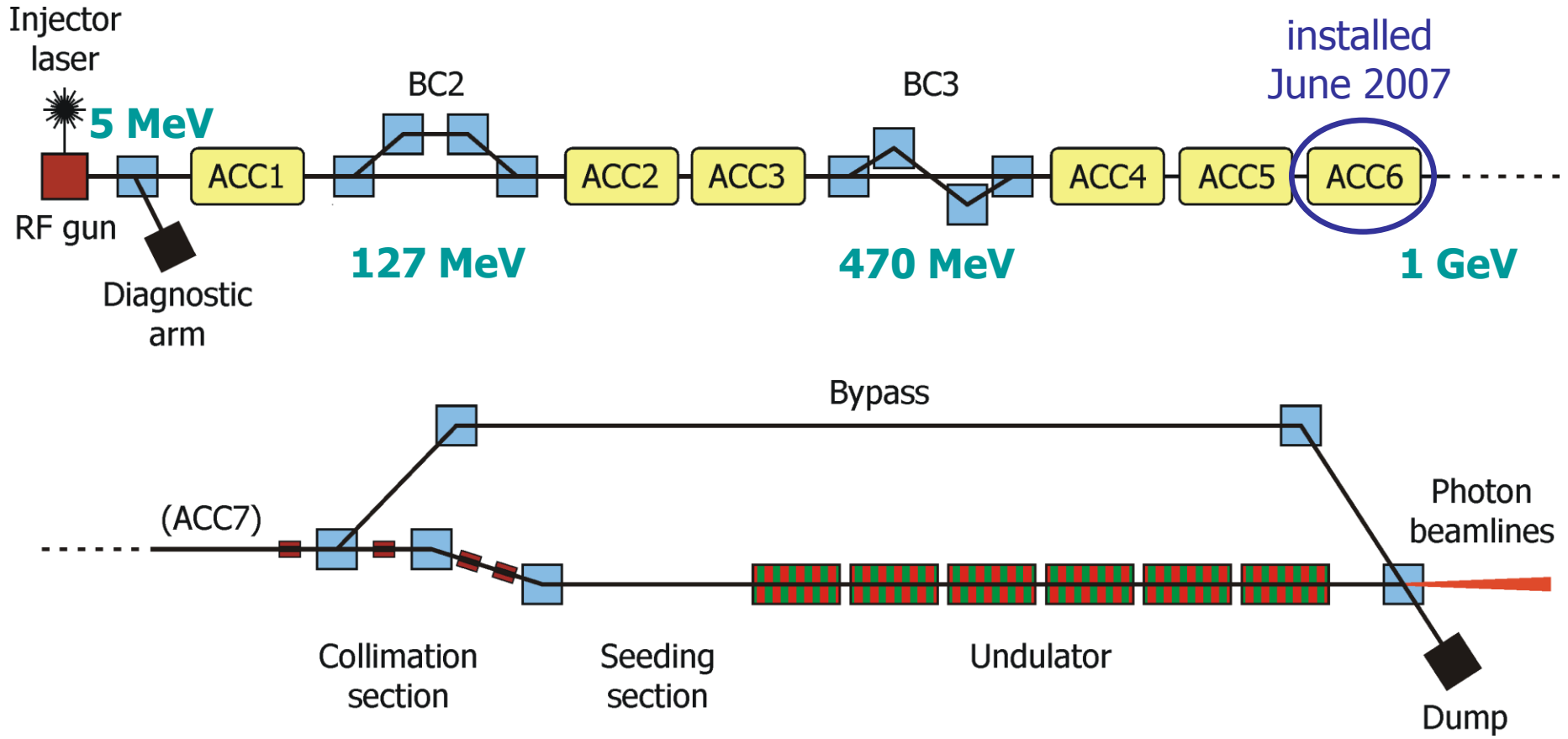
Undulator length:

~30 m

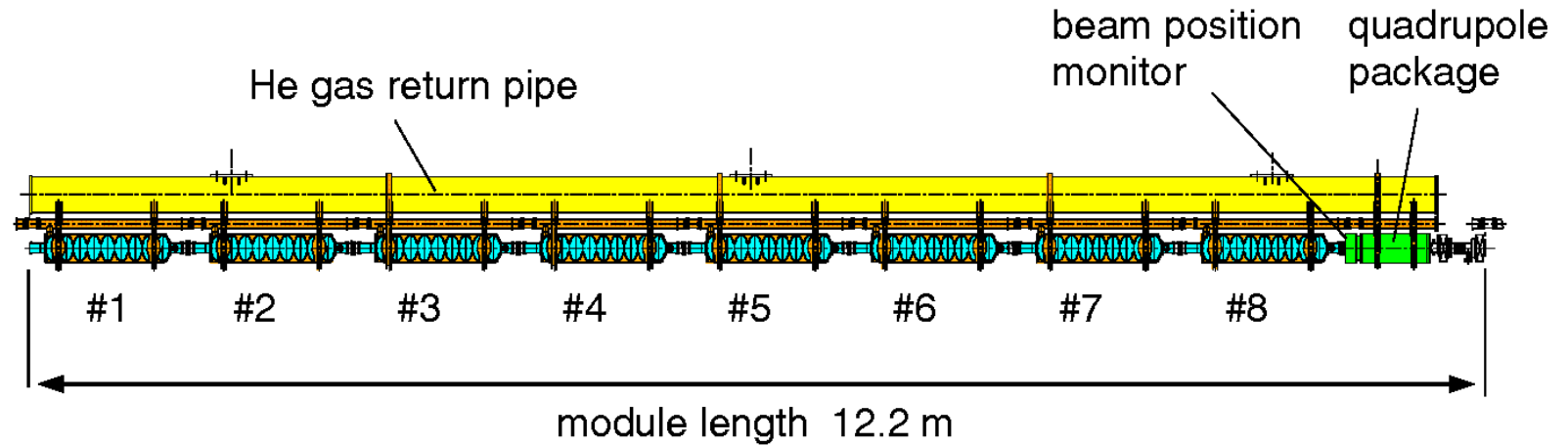
Beam time allocation:

- **User time**
- **FEL studies** to improve machine performance
- **Accelerator studies** to advance technology, mainly for XFEL and ILC



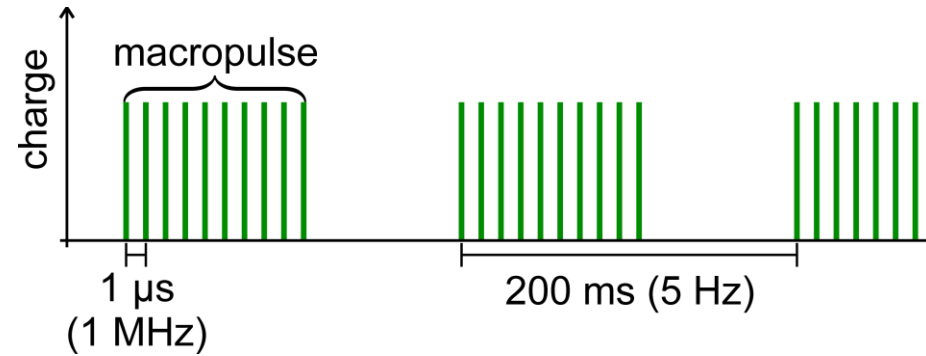


TESLA Acceleration Module



Electron Beam

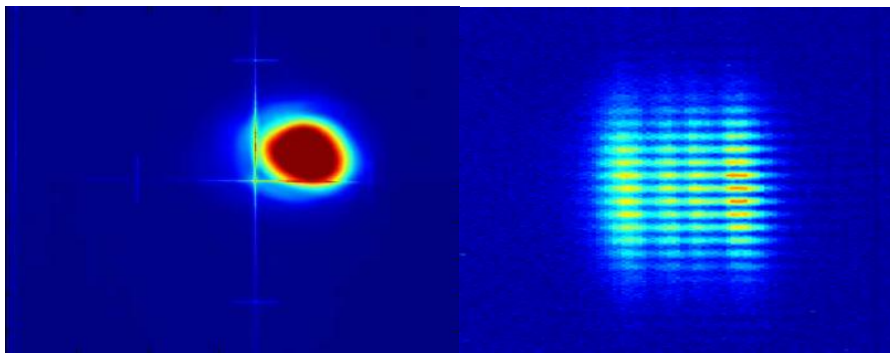
| | |
|--|------------|
| Beam energy (MeV) | 370 – 1000 |
| Bunch charge (nC) | 0.5 – 1.0 |
| Bunch peak current (kA) | 1 – 2 |
| Norm. emittance (mm mrad) | 2 |
| Repetition rate (Hz) | 5 |
| RF pulse flat top length (μs) | 100 – 800 |
| Bunch spacing (μs) | 1 – 25 |
| Beam power (W) | 1 – 4000 |

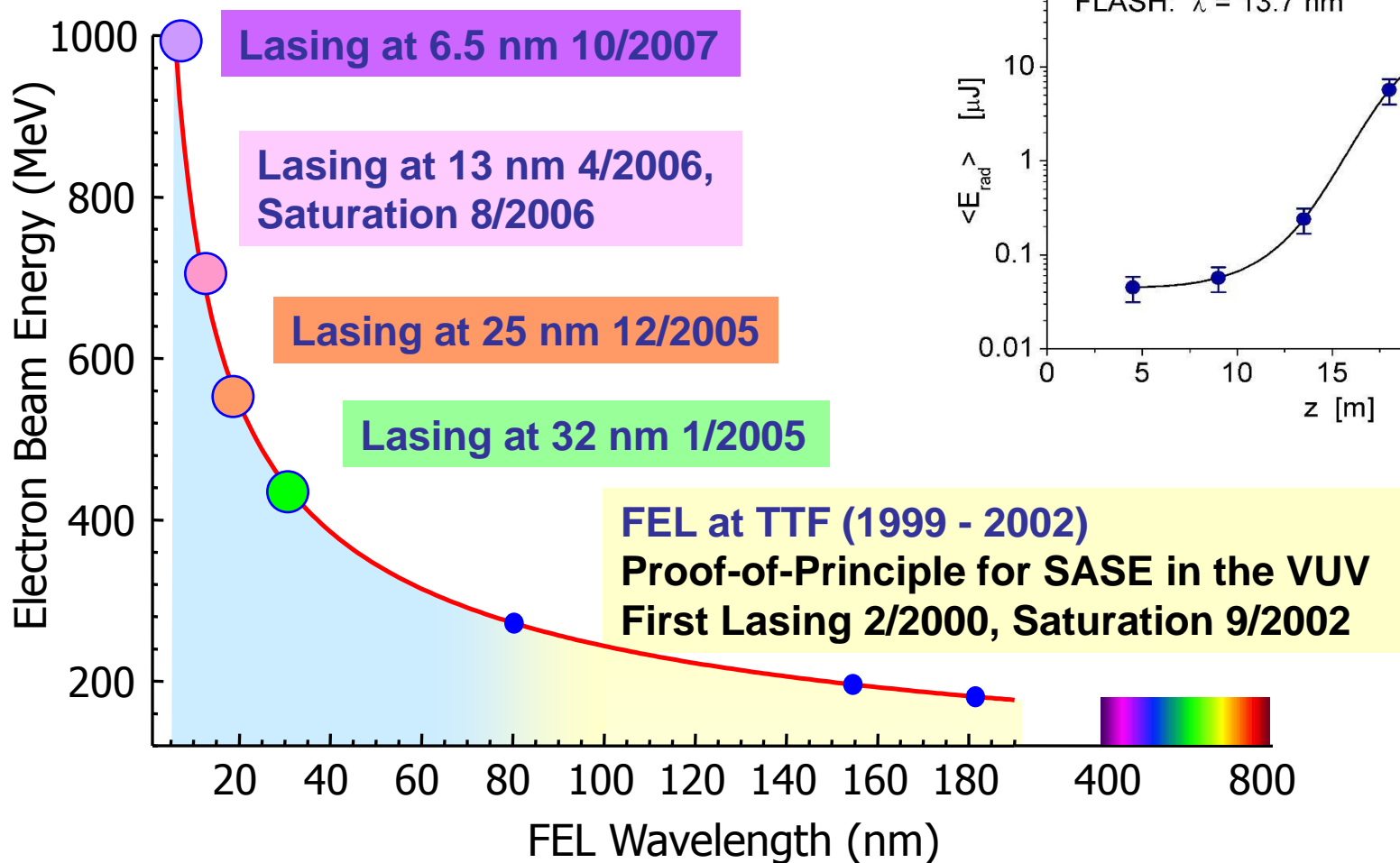


Photon Beam

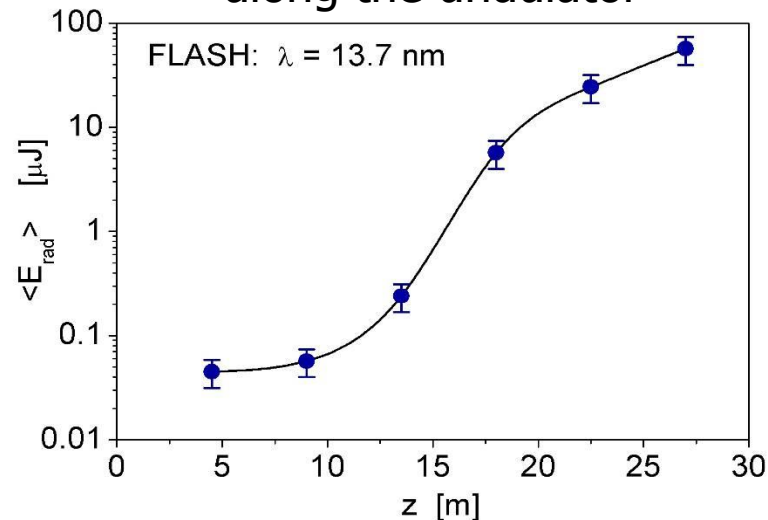
| | |
|--|----------------|
| Wavelength (nm) | 6.5 – 46 |
| Average pulse energy (μJ) | 20 – 70 |
| Pulse duration, fwhm (fs) | 10 – 50 |
| Peak power (GW) | 1 – 7 |
| Average power (mW) | 1 – 55 |
| Divergence (μrad) | 90 |
| Spectral width, fwhm (%) | 0.7 – 1.0 |
| Brilliance B | $\sim 10^{29}$ |

[B] = phot./s/mrad²/mm²/0.1% BW

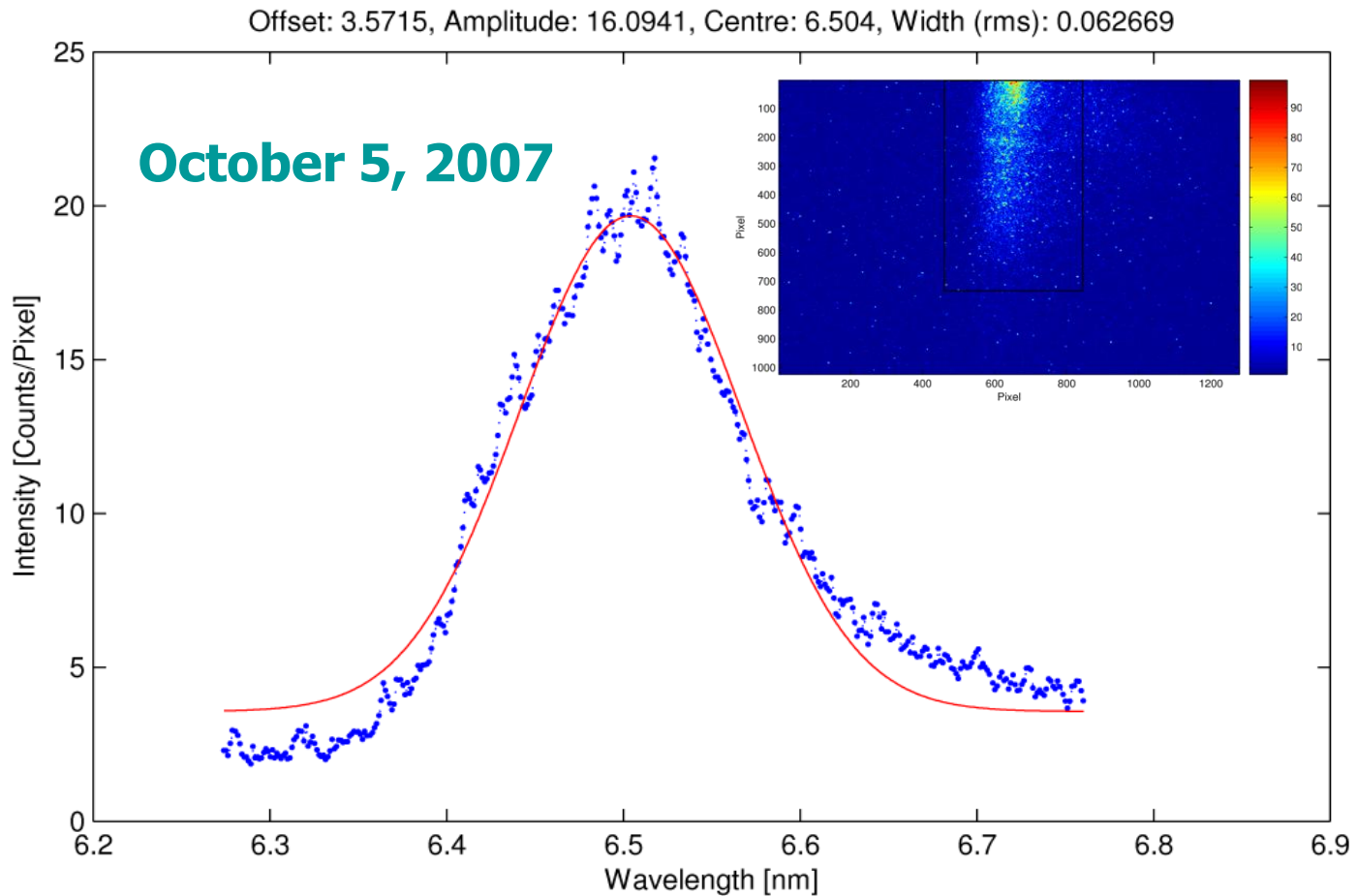




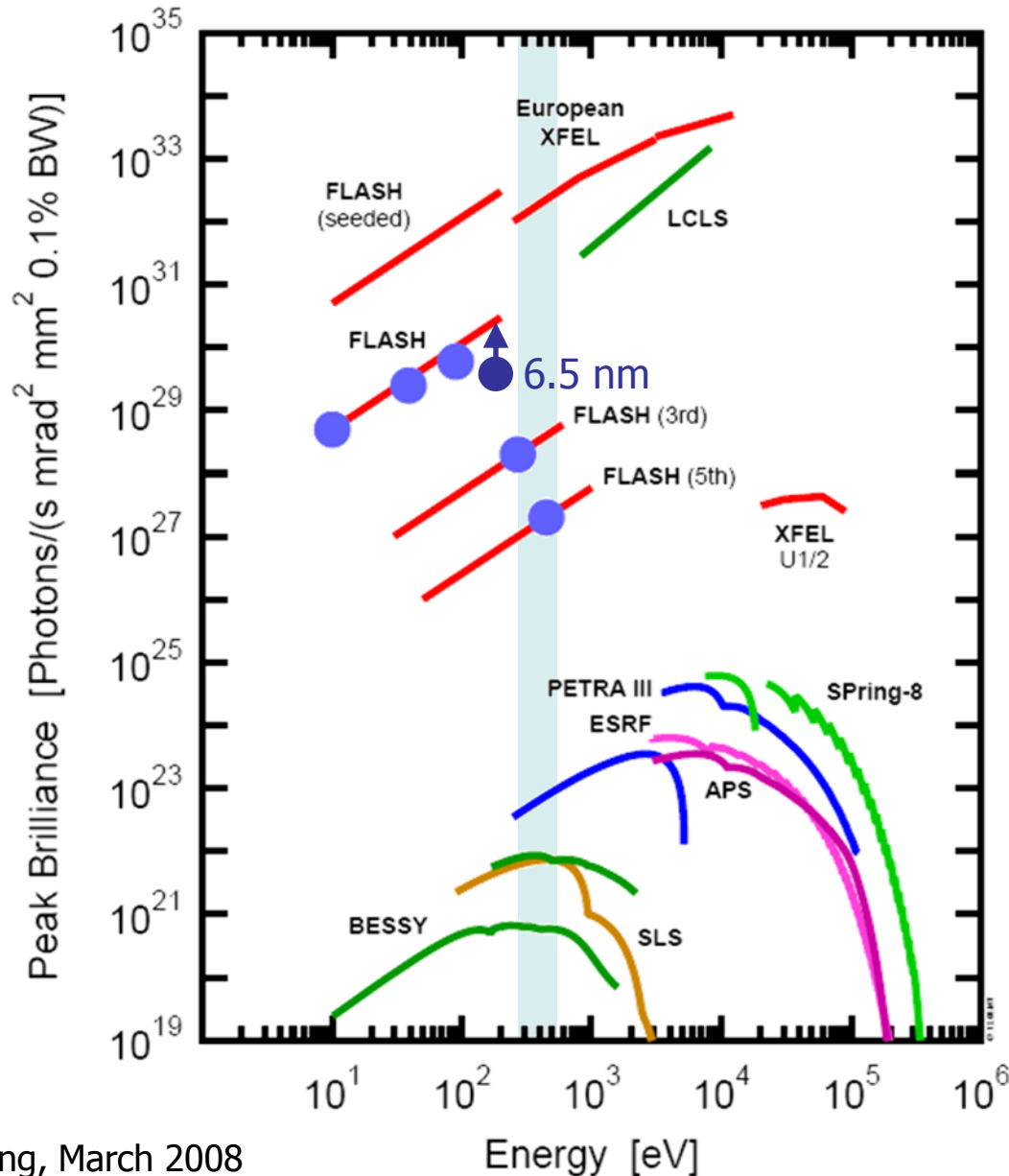
photon pulse energy along the undulator

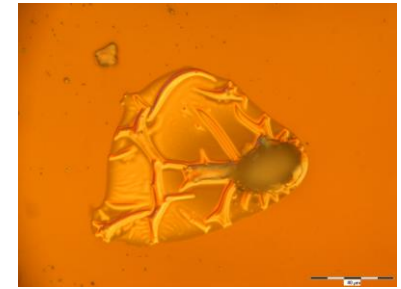
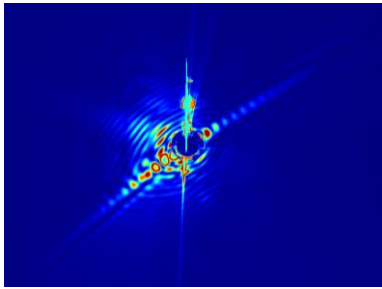
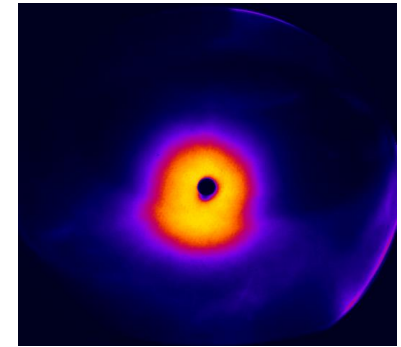
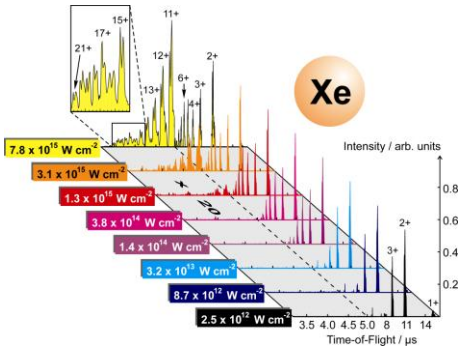


- Lasing at 6.5 nm and 6.9 nm demonstrated, 7 nm delivered to users
- Estimated pulse energy: 2 μ J (50%)



Peak Brilliance

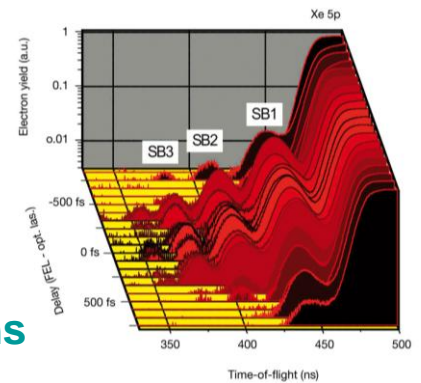
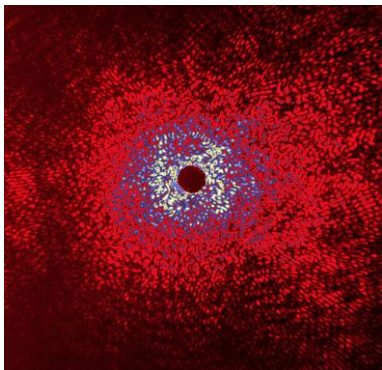




About 25 publications already,
many more to come:

- 4 Physical Review Letters
- 6 Applied Physics Letters
- 1 Nature
- 1 Nature Physics
- 1 Nature Photonics
- ...

See, e.g.,
<http://hasylab.desy.de/facilities/flash/publications>

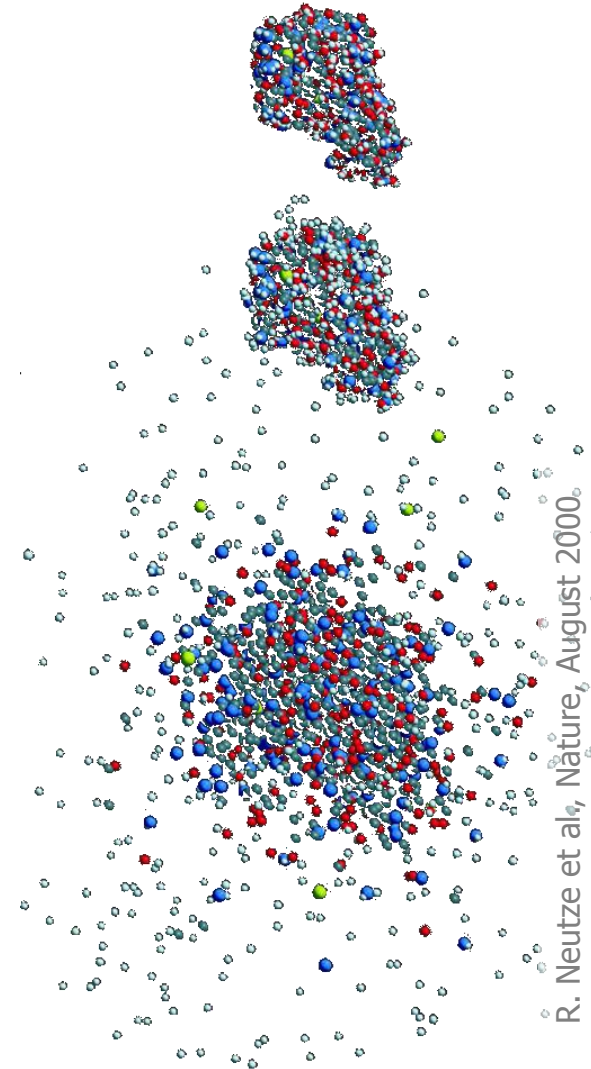


Present

- FLASH is a unique user facility
- ... and a testbed for superconducting technology: cavity gradients for XFEL proven in daily use
- ... with time for accelerator studies and development
- FLASH offers brilliant, short photon pulses in the wavelength range of 6.5 – 46 nm
- 3rd harmonic of FEL radiation reaches the water window

Future

- Full characterization of 6.5 nm radiation: next week
- 7th module: increase energy to 1.2 GeV (4.4 nm)
- sFLASH – Seeding with HHG scheme



Many thanks to the FLASH team and all co-workers
for their enthusiastic effort.



Upcoming FLASH talks – Thursday

St. Wesch

Spektroskopie kurzwelliger kohärenter Übergangsstrahlung

A. Willner

Bunch diagnostics with coherent infrared undulator radiation

J. Bödewadt

First measurements at the optical replica synthesizer experiment

Ch. Behrens

Messung kohärenter Synchrotronstrahlung

B. Beutner

Measurement and Analysis of CSR Effects

E. Prat

Spurious Dispersion Effects

N. Pchalek

Statistische Analyse der Betriebs- und Stillstandsdauern

