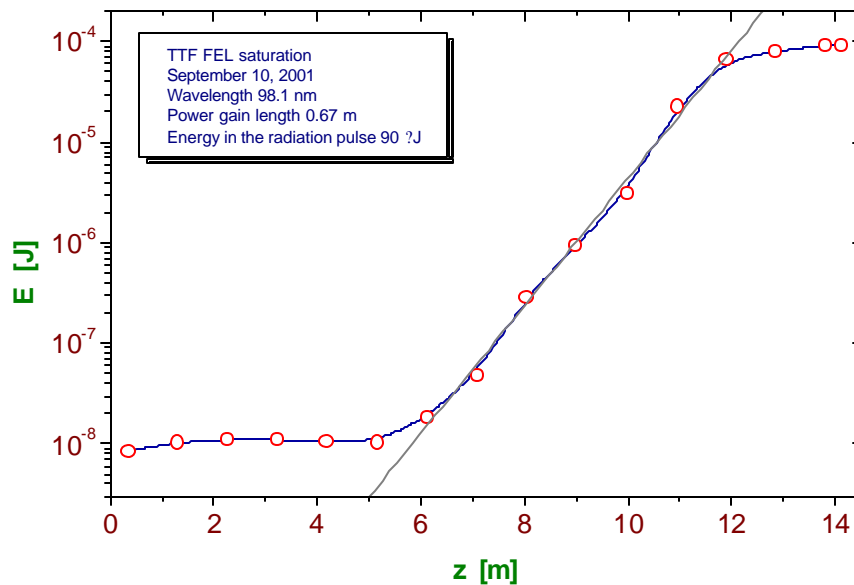
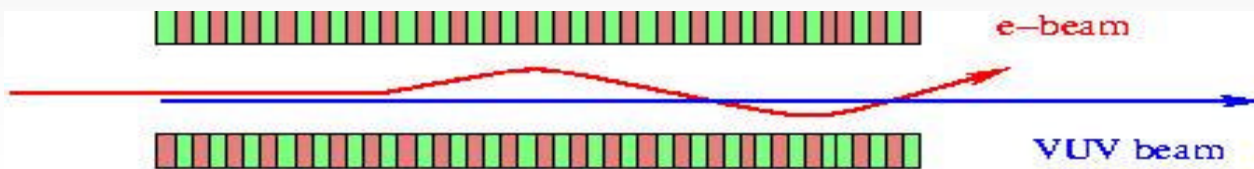


Results from the TTF Free-Electron Laser since Last Meeting

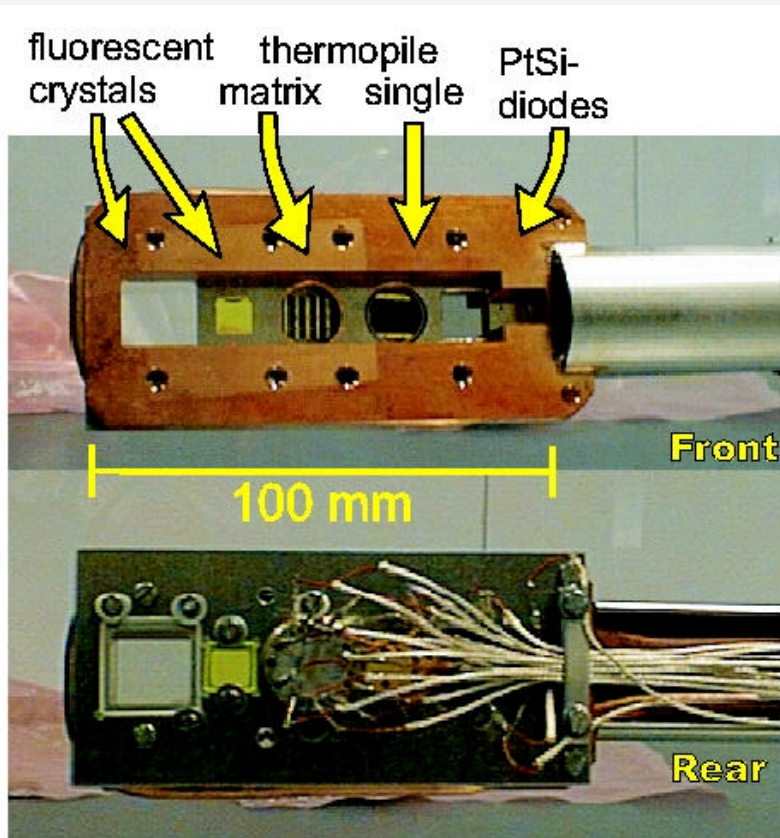
Jörg Rossbach, DESY



Photon pulse energy with step by step orbit distortion

Laser saturation @ 98 nm

Measurement of photon pulse energy



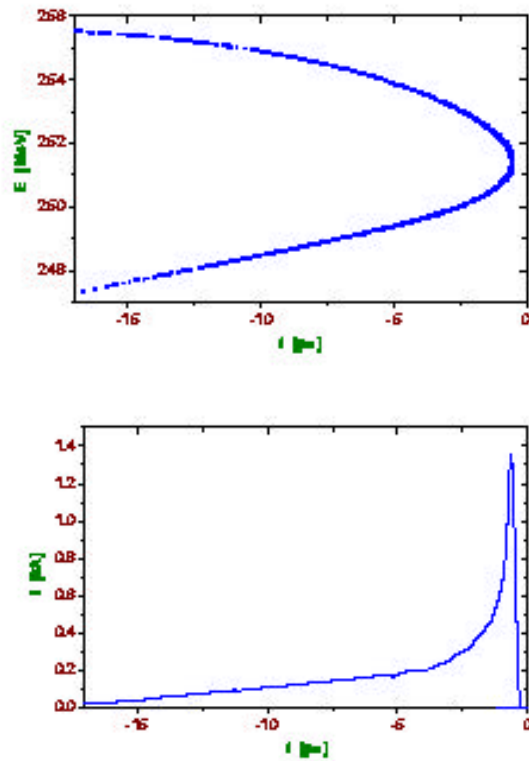
Fast Thermopile Detector
YBa₂Cu₃O₇ based Bolometer

Multi Channel Plate

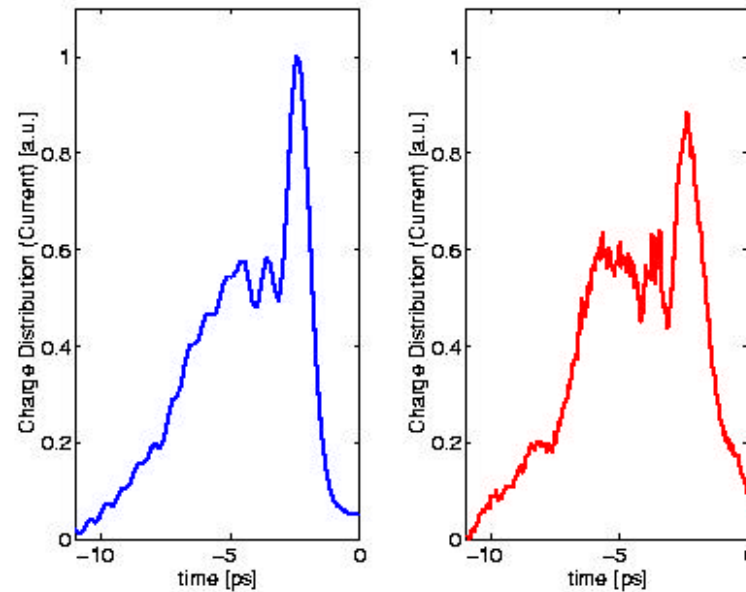
- Photon pulse energy 30-100 ? J
- Agreement of measurements

Electron bunch length

Simulation (P.Piot)



(earlier) measurement
M.Hüning et al.

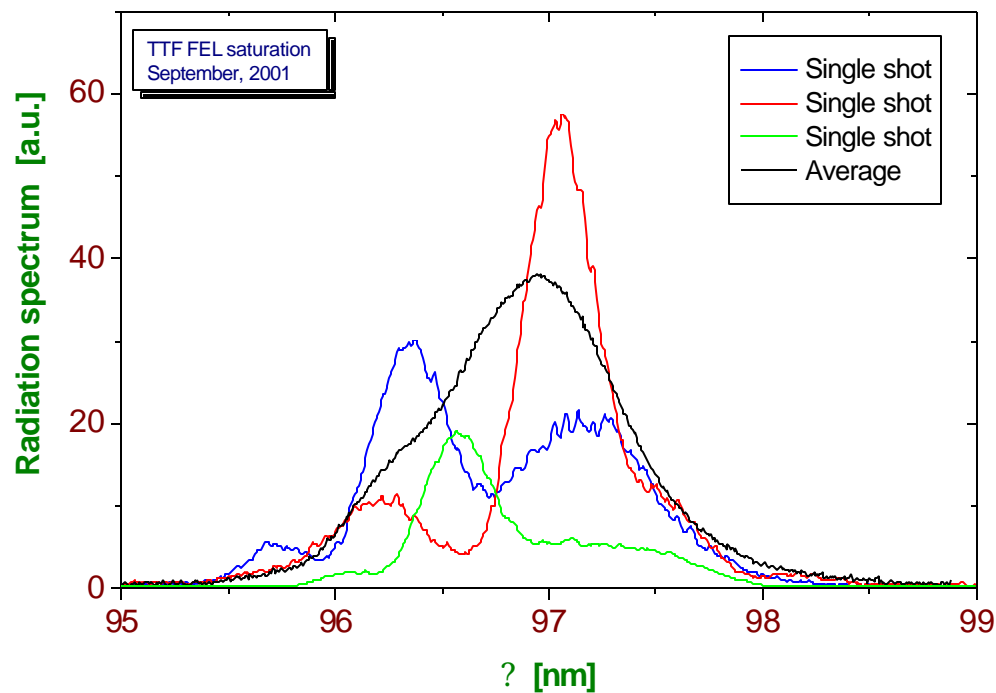


1. Very short (<500 fs) peak expected
2. High gain only from small part of bunch

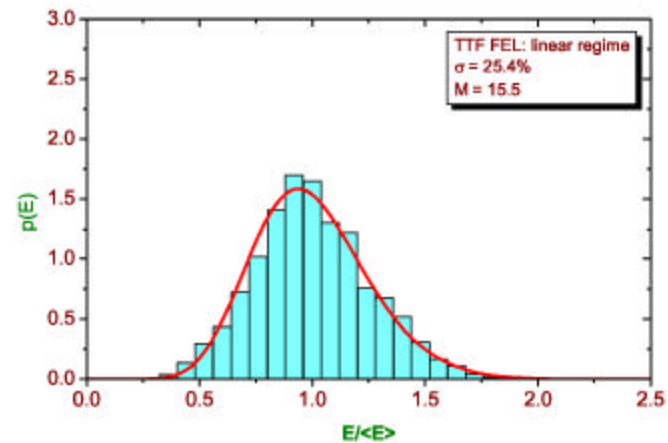
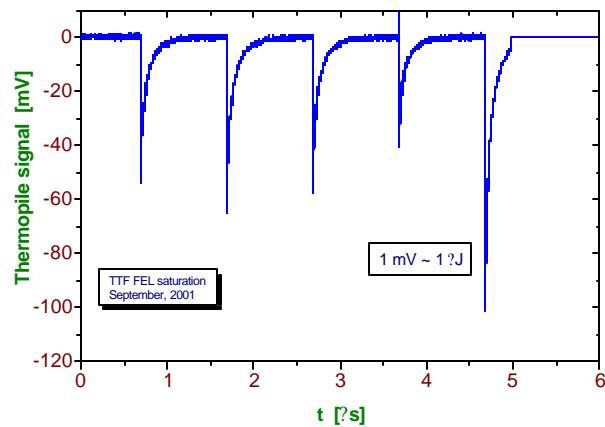
Coherence length known from spectrum bandwidth & from theory

✍ Number of spikes in spectrum provides photon pulse length

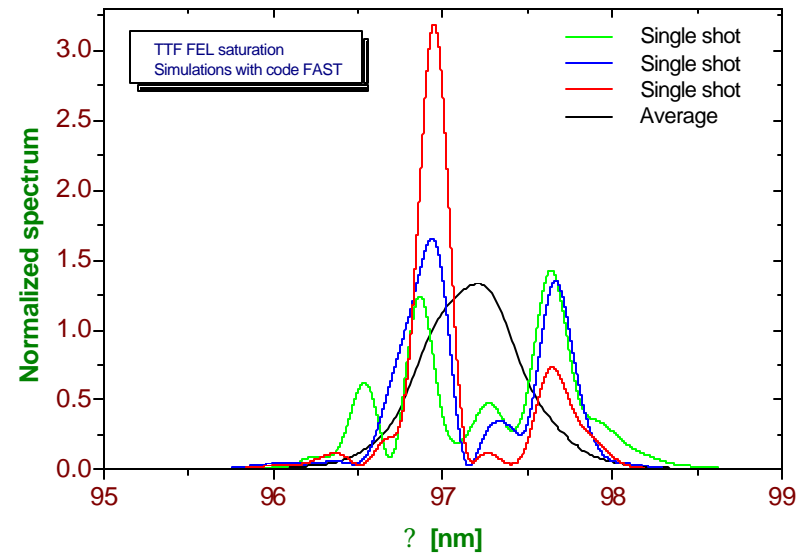
TTF SASE radiation spectrum
at saturation



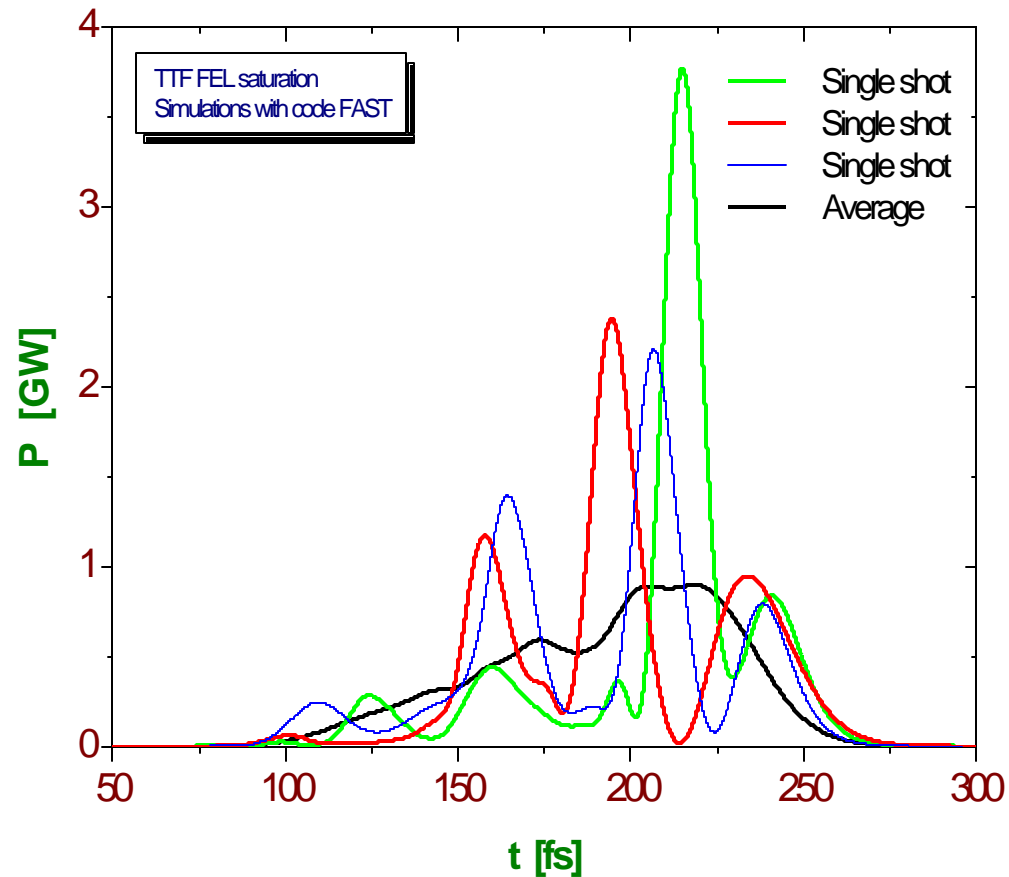
Fluctuation properties of SASE radiation at TTF



Spectrum simulated,
based on measured
fluctuations of pulse energy

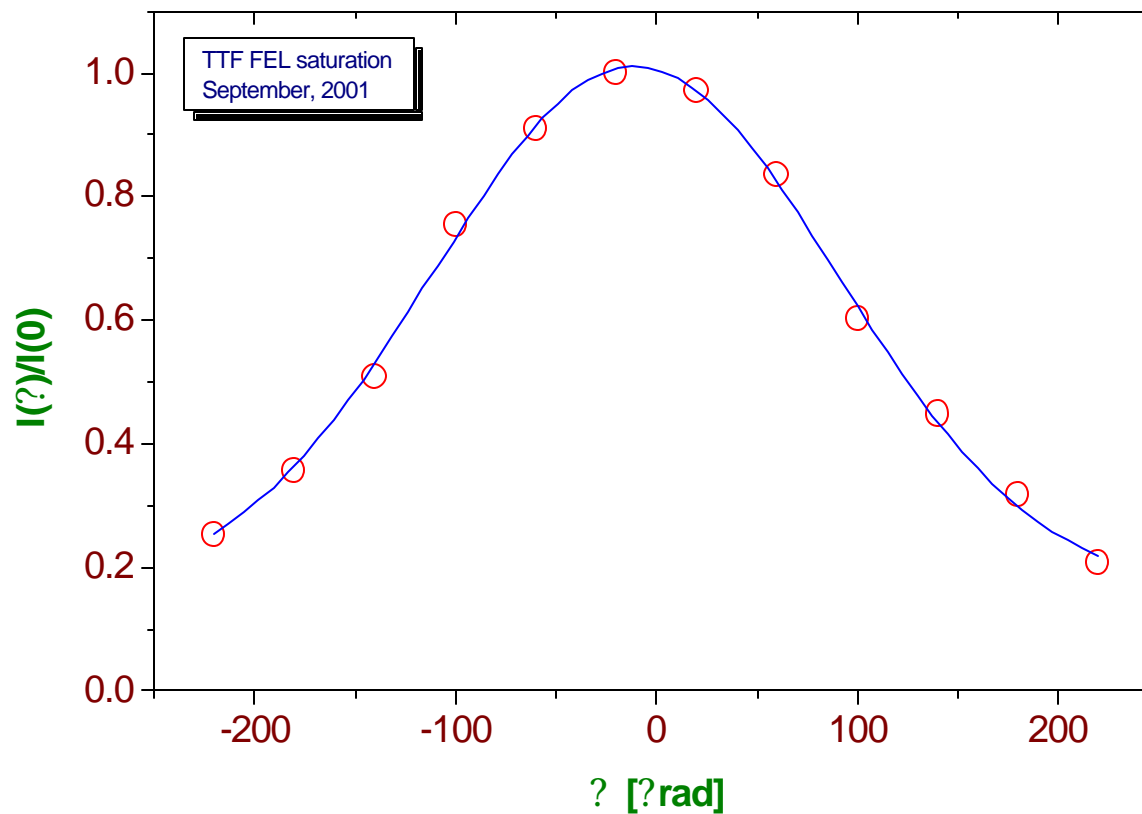


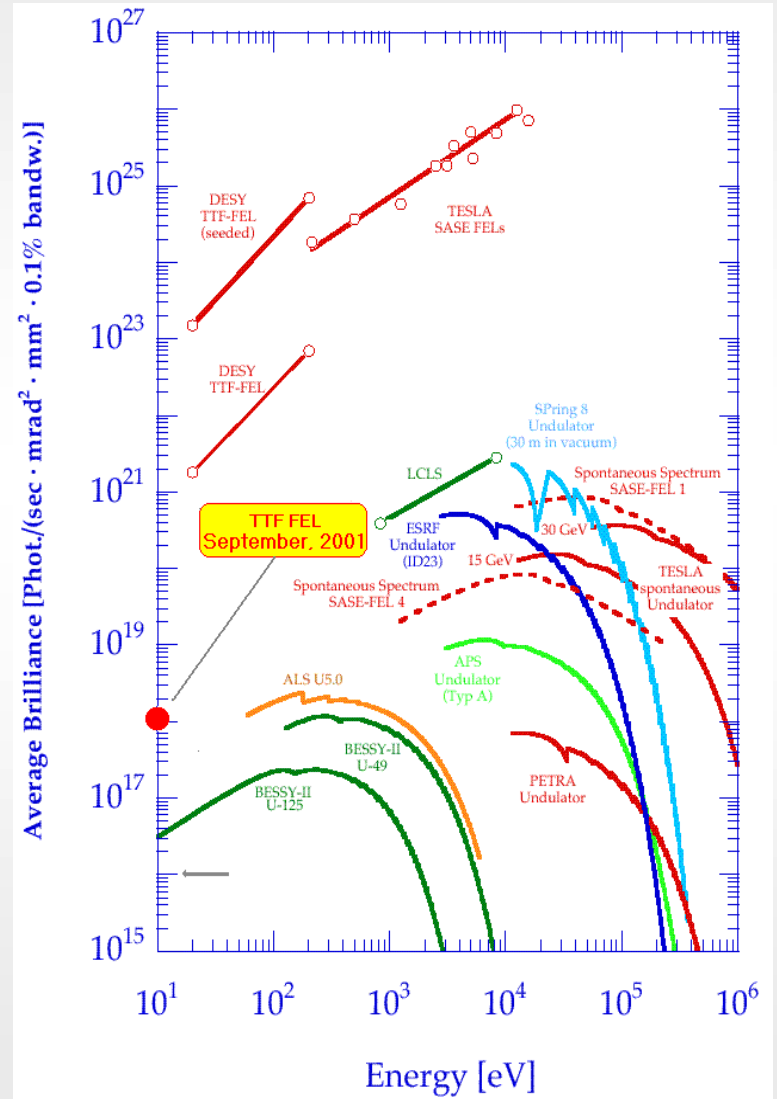
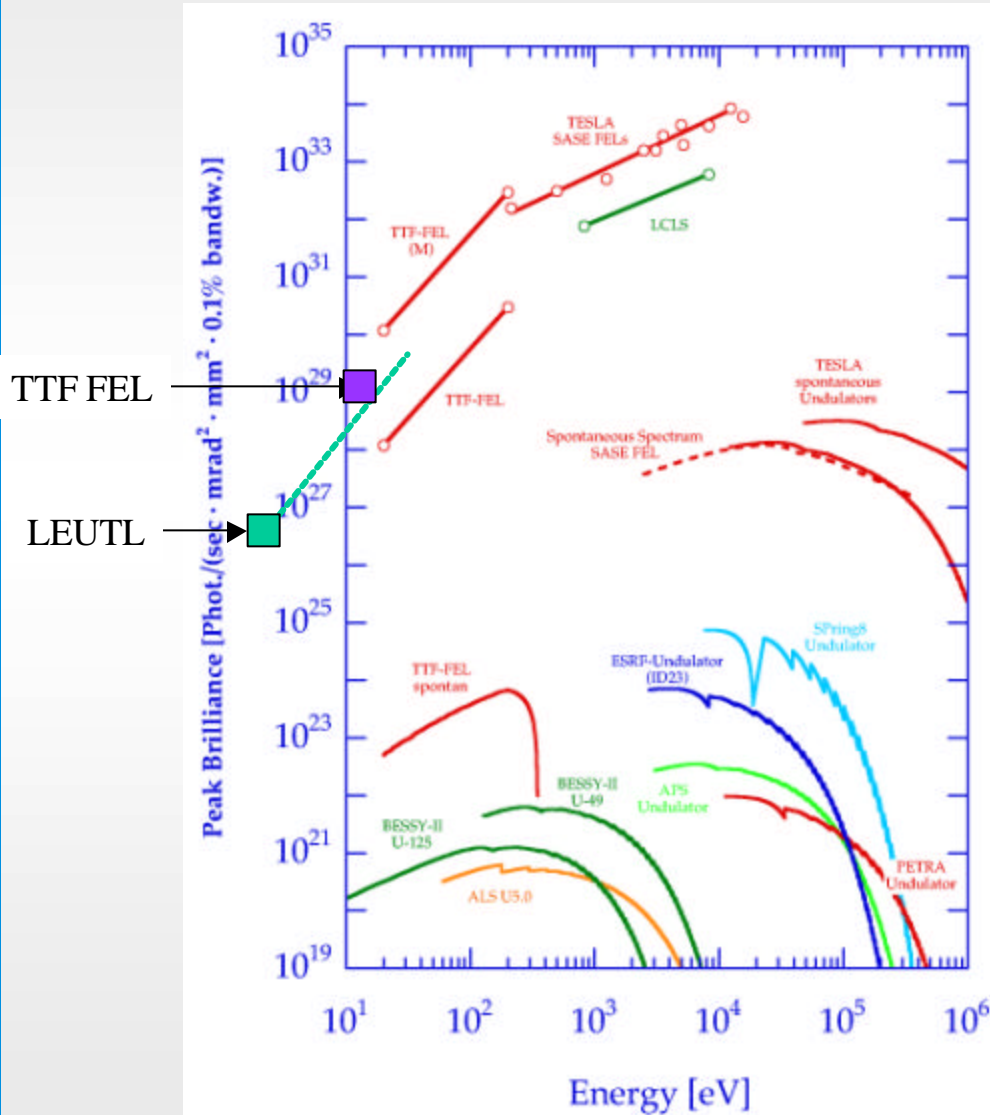
Simulation in time domain
based on measured fluctuation



Opening angle of radiation at saturation

✍ Transverse coherence





J. Rossbach/DESY

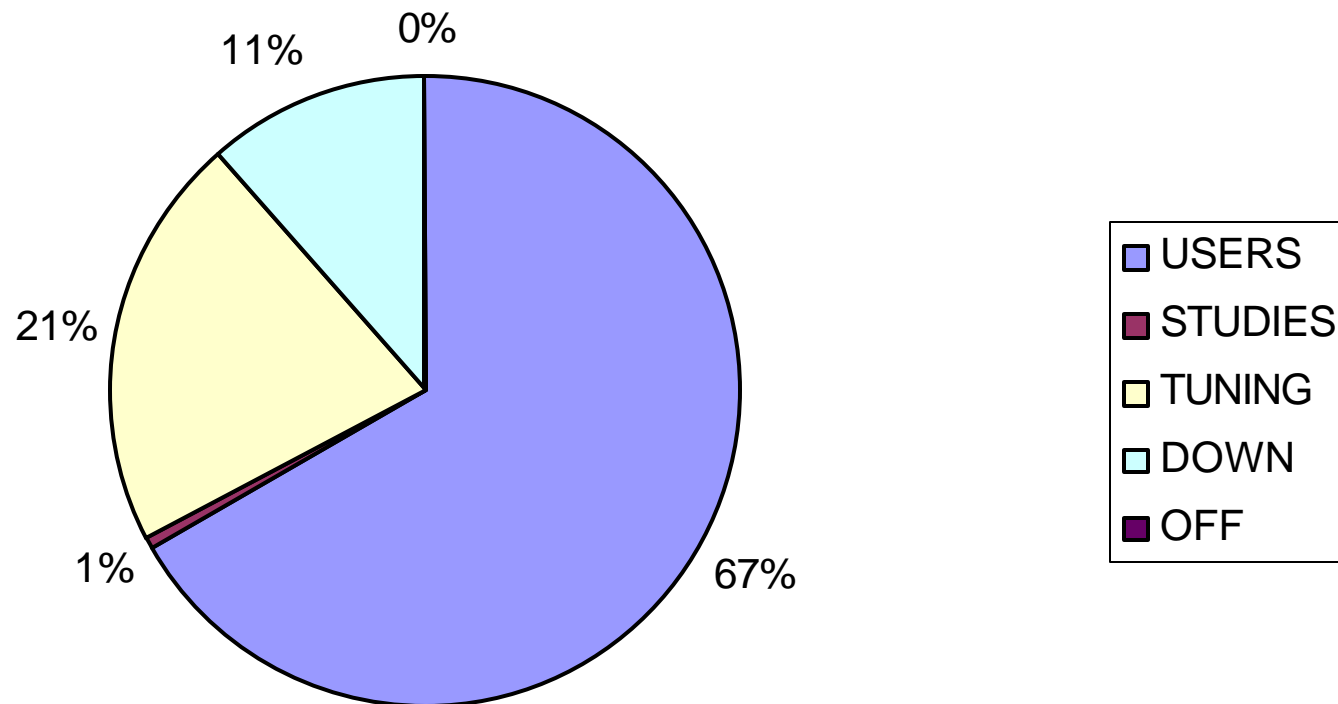
TTF meeting Frascati Nov.2001

Radiation pulse duration (FWHM)	50-100 fs
Radiation peak power	1 GW
Spectrum width	1 %
Bunch charge	2.8 nC
Charge in radiative part of bunch	0.2 nC

Peak brilliance above design value
Exceeds any source at this wavelength by >1000

TTF operations statistics

8.10.01 – 14.10.01



 Fruitful operation for users

Proposed publications

1. Nature:

A new, ultra-brilliant radiation source for VUV radiation

2. Phys. Rev. Lett.:

Generation of GW-level radiation pulses from a VUV
Self- Amplified Spontaneous Emission Free Electron
Laser operating in the femtosecond regime
(see talk by M Yurkov)

Conclusion

TTF FEL has demonstrated world record wavelengths and tunability far below the visible.

Peak brilliance is >1000 time above any other radiation source at this wavelength.

Full agreement with theory.

First VUV experiments just started

FEL outlook for TTF1:

User operation – reliability of TESLA systems

Long pulse trains