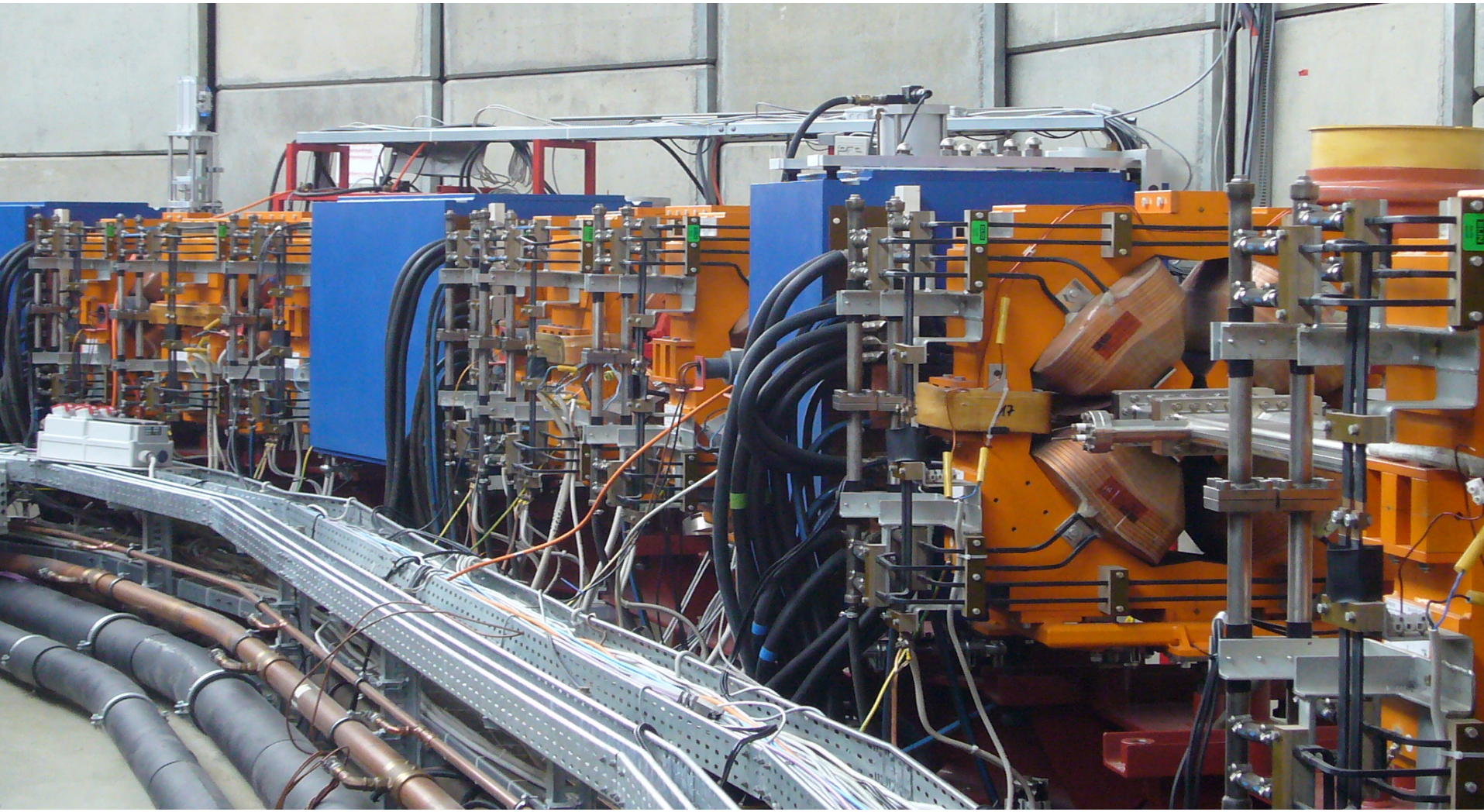
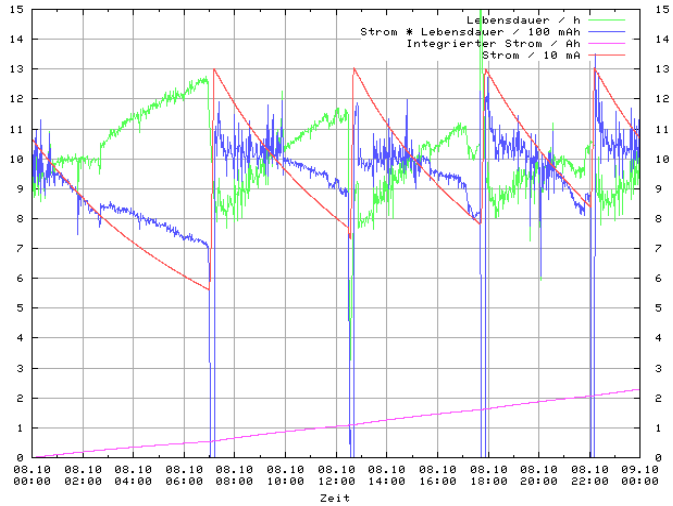
DELTA: Status and New Projects

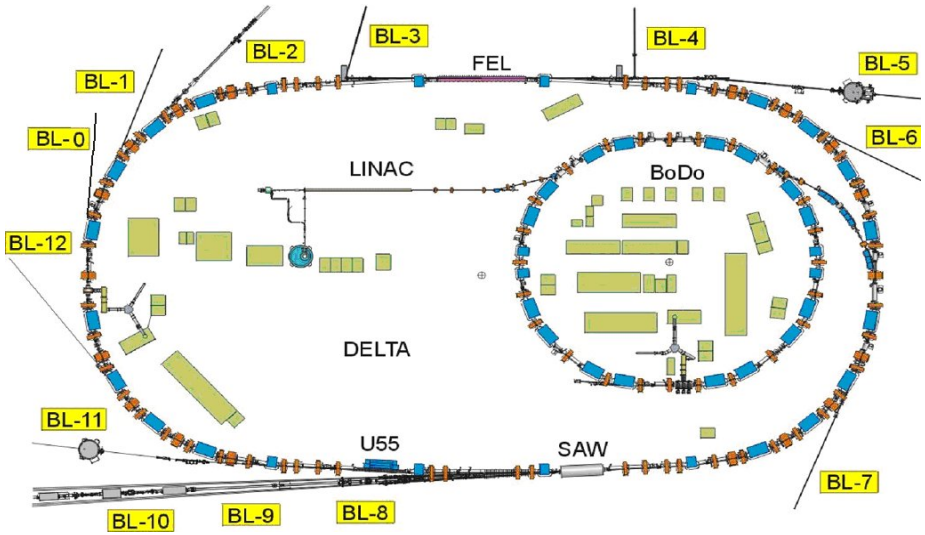
Holger Huck

ESLS 2009



- Statistics
- Beam Stabilization
- Seeding Project





circumference	**115.2 m**
energy	**1.5 GeV**
beam current	**130 mA**
lifetime	**8-11 h**
hor. emittance	**15 nm rad**
energy spread	**0.1%**
bunch length	**36 ps**

DELTA Team

W. Brembt, G. Dahlmann, T. Dybiona, A. Erpelding, J. Friedl, J. Fürsch, P. Hartmann, B. Hippert, H. Huck, S. Khan, P. Kortmann, P. Lindemann, H. Rast, B. Riemann, H.P. Ruhl, D. Schirmer, G. Schmidt, G. Schünemann, P. Towalski, T. Weis, K. Wille

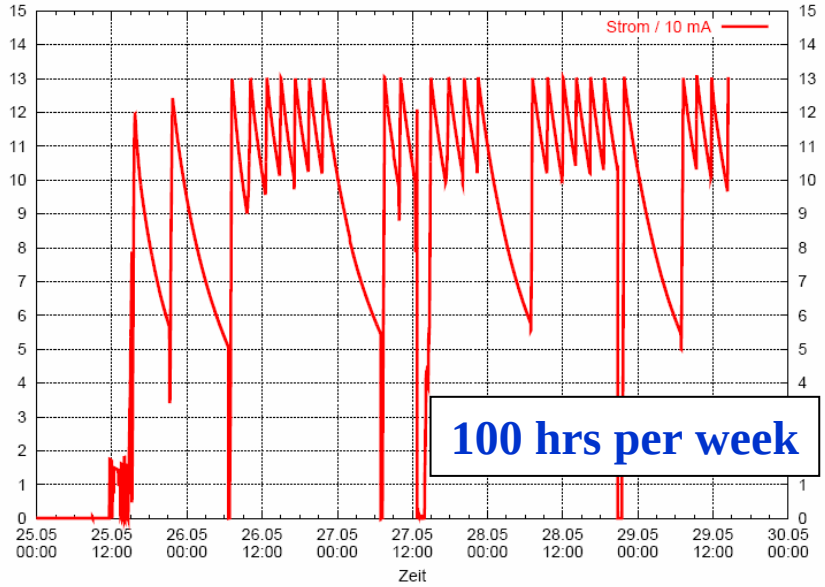
User Operation

Operation 2008

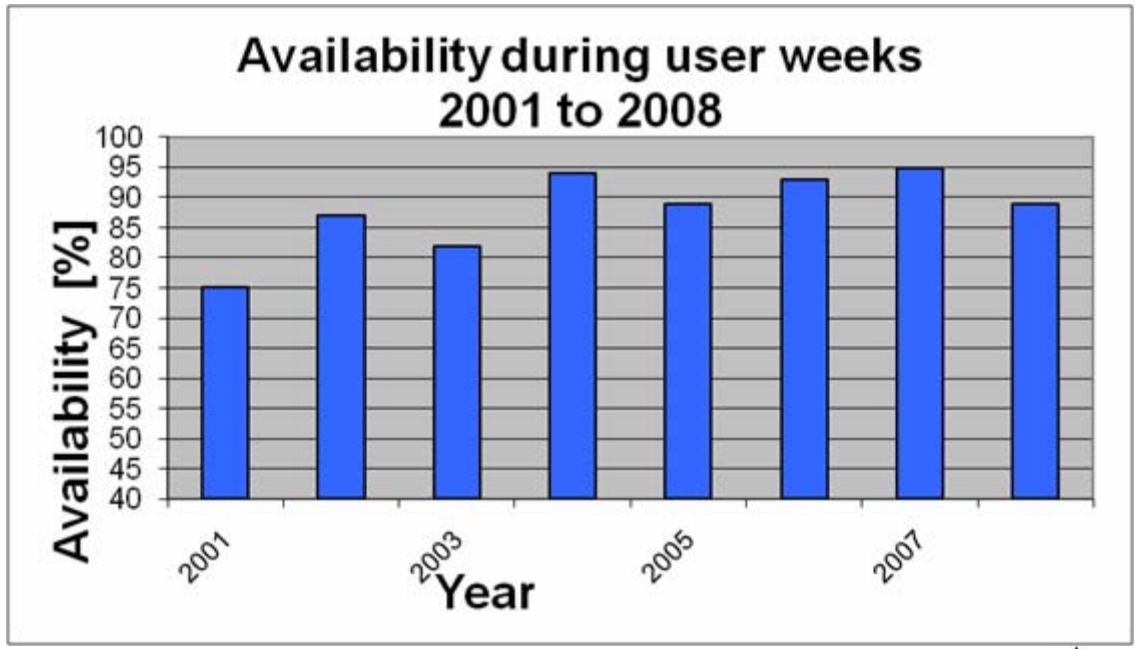
-30 weeks (3000 hrs).

-2000 hrs user operation.

-1000 hours machine optimisation and machine physics

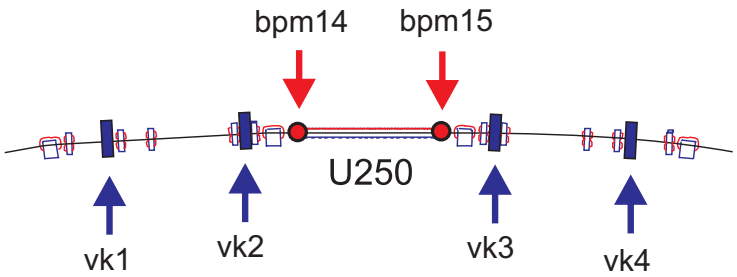


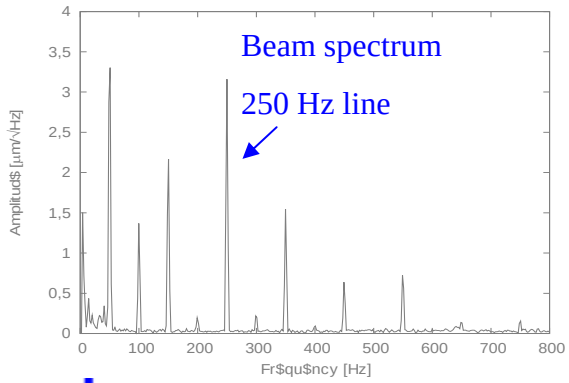
Performance 2008:
91,6% Availability

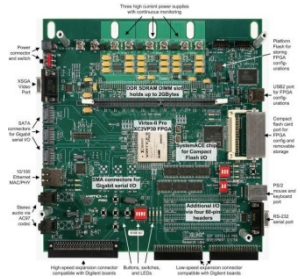


Fast Global Orbit Feedback

- will be designed and tested at DELTA (G. Schünemann, P. Towalski)
- prototype for all FAIR storage rings (GSI)
- collaboration with GSI and FZJ
- works with Libera- and Bergoz- BPMs (10 kHz)
- based on an FPGA board and the „Diamond Communication Controller“

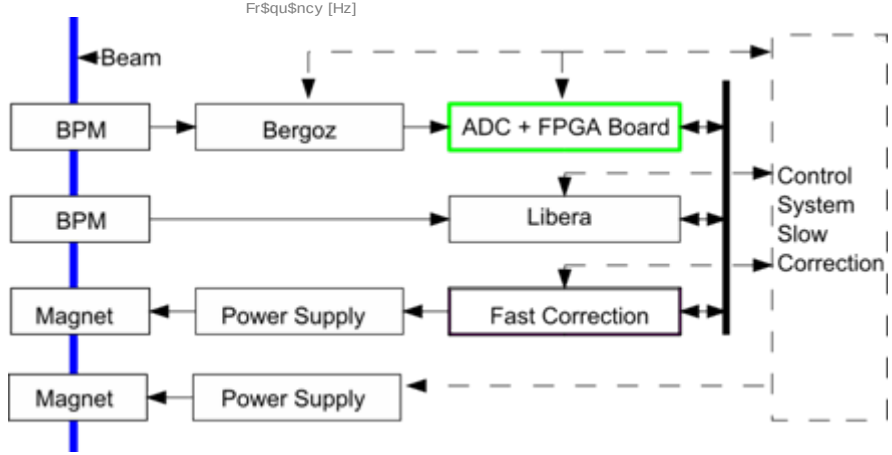






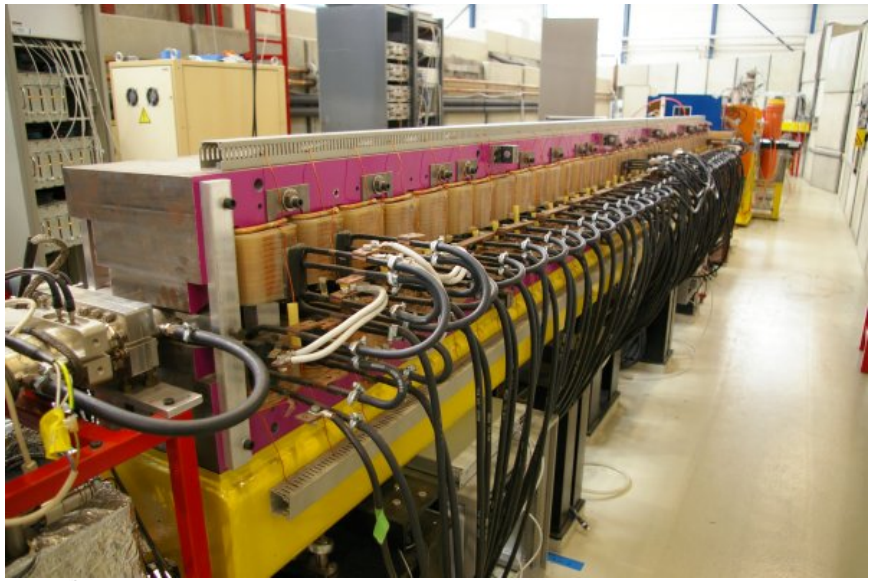
local feedback successfully tested,
0 dB point @350 Hz

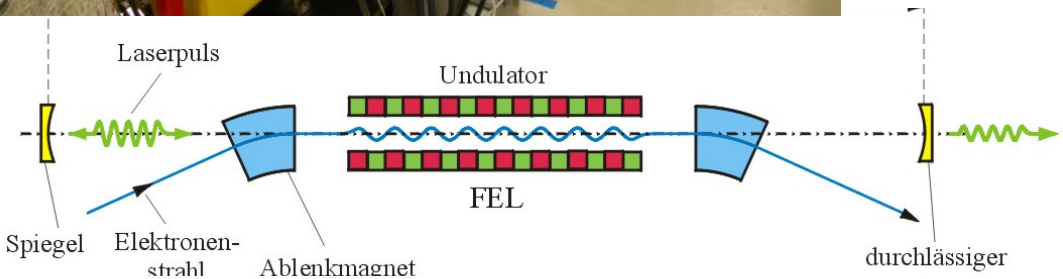
global version: prototype for FAIR



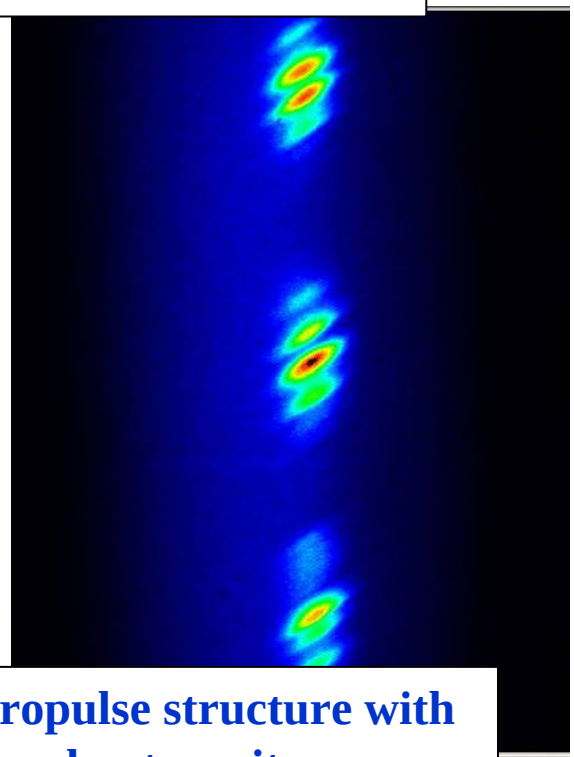
FEL Studies (2007/08)

- 470 nm, 540 MeV
- different bunch patterns
- Q-switching or natural rep.rate



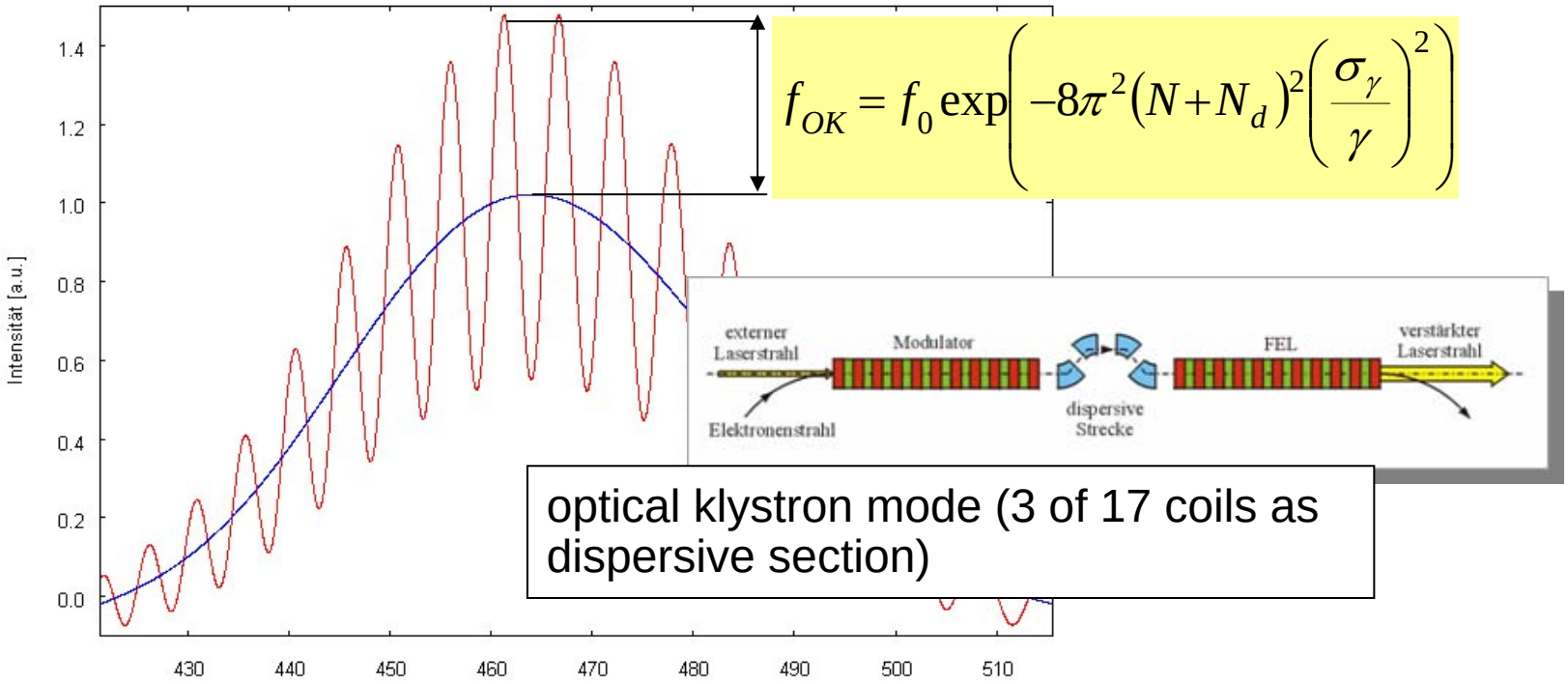


laser light attenuated by 10^3 -> simult. measurement of laser and bunch



macropulse structure with detuned opt. cavity

direct energy spread measurement



$$f_{OK} = f_0 \exp\left(-8\pi^2 (N+N_d)^2 \left(\frac{\sigma_\gamma}{\gamma}\right)^2\right)$$

optical klystron mode (3 of 17 coils as dispersive section)

direct energy spread measurement

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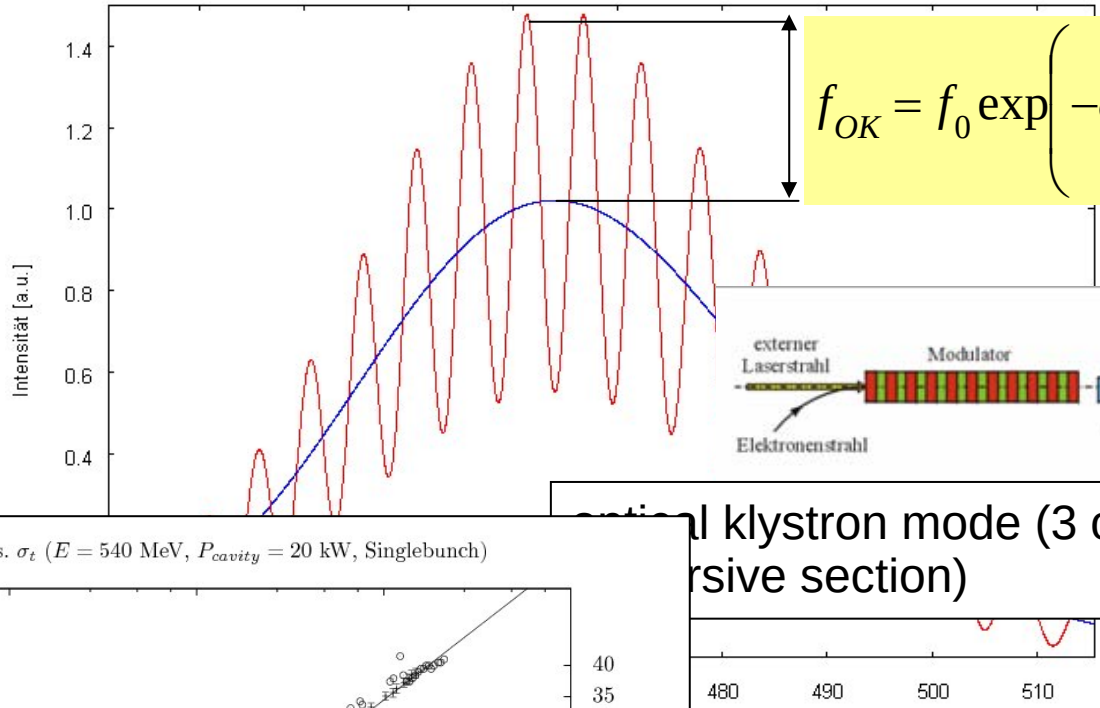
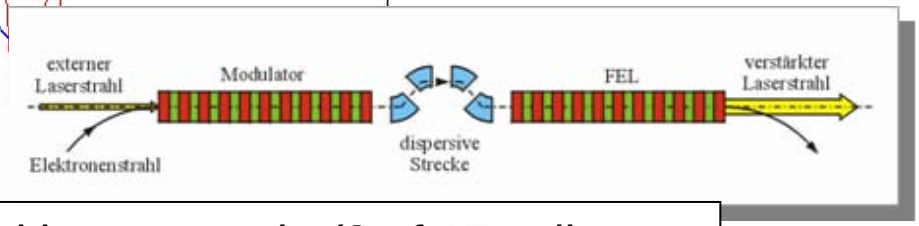
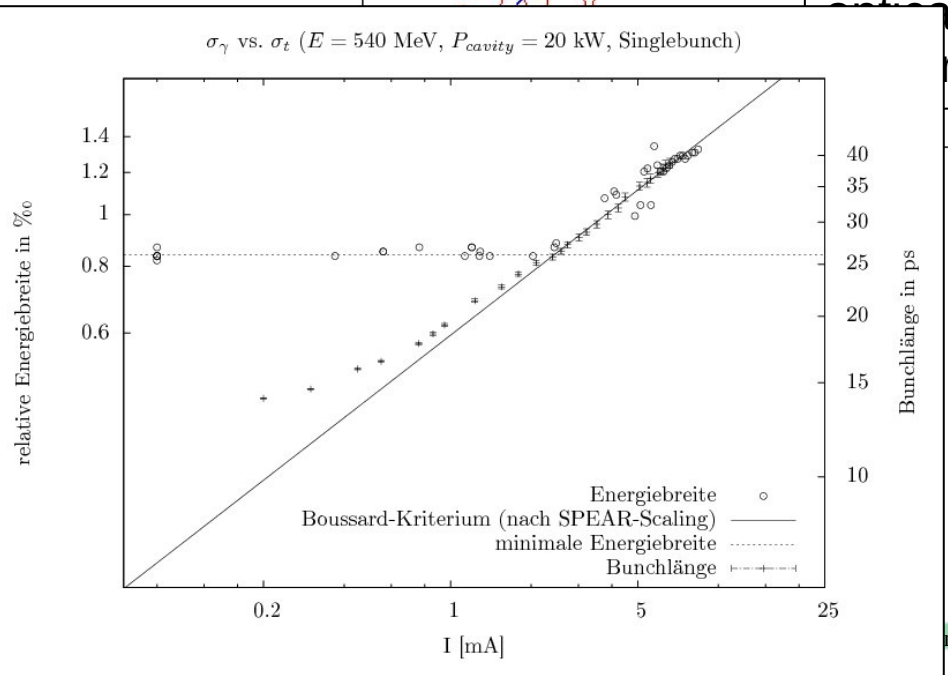


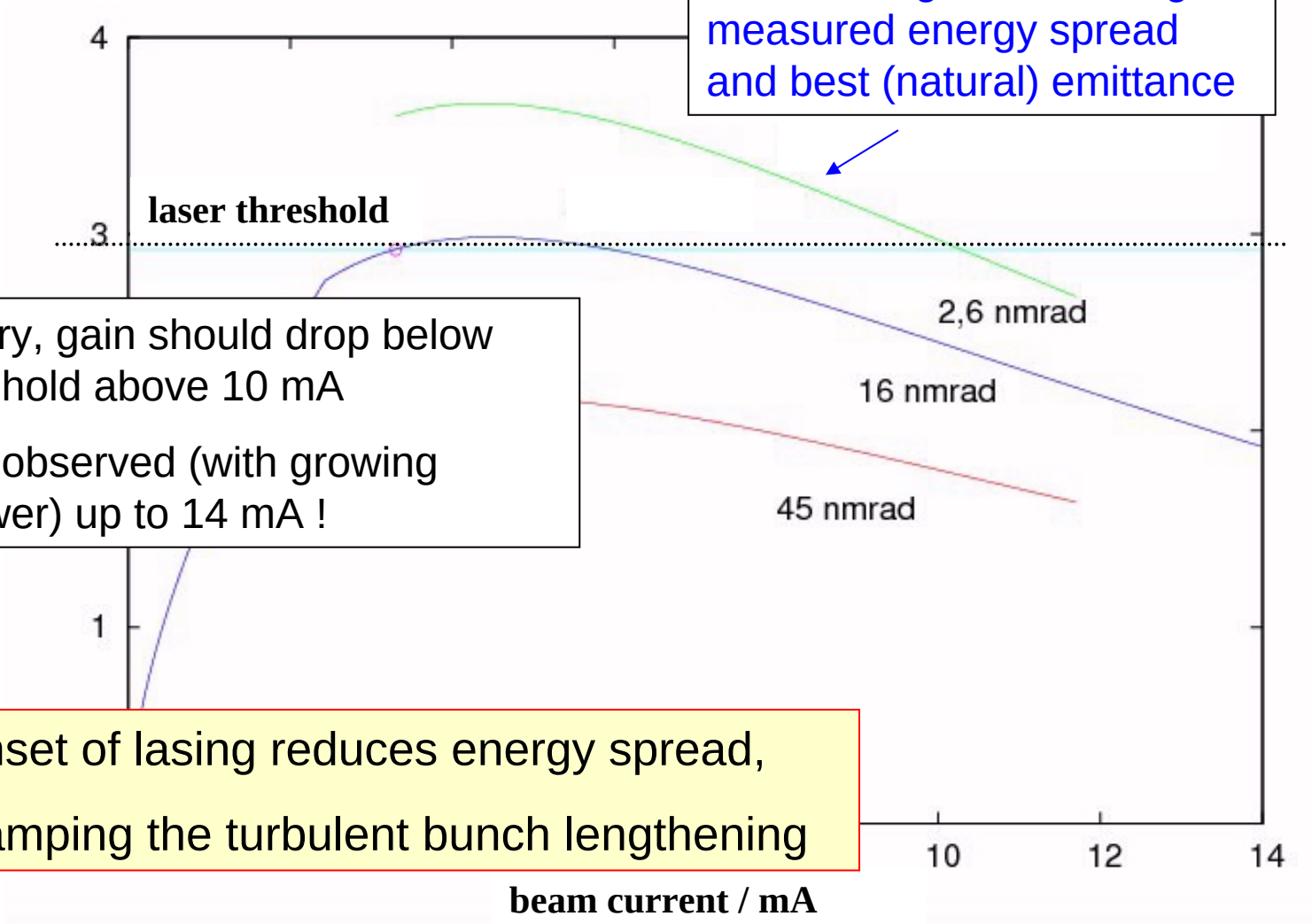


optical klystron mode (3 of 17 coils as dispersive section)



FEL Studies (2007/08)

theoretical gain assuming measured energy spread and best (natural) emittance



- From theory, gain should drop below laser threshold above 10 mA
- But lasing observed (with growing output power) up to 14 mA !

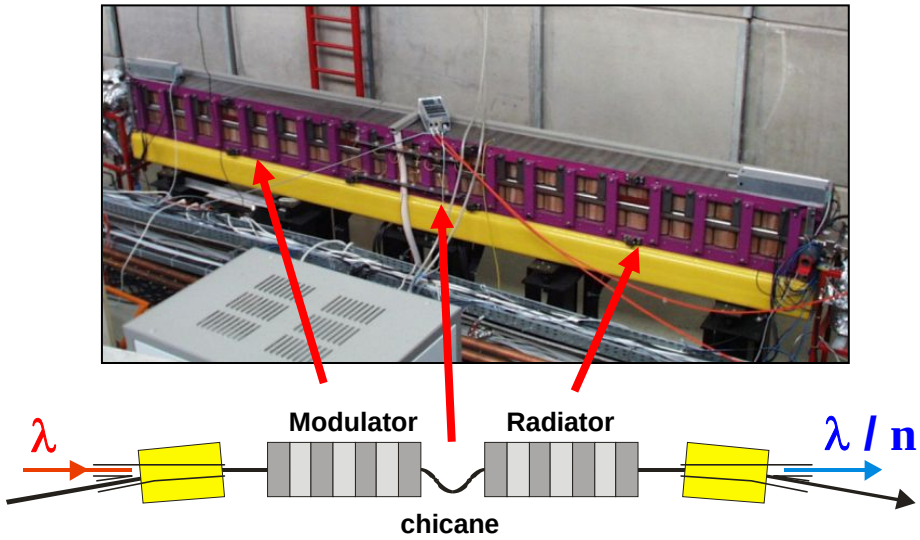
onset of lasing reduces energy spread,

damping the turbulent bunch lengthening

Seeding Project

- „light source for ultra-short VUV- and THz-pulses“

Prof. Shaukat Khan

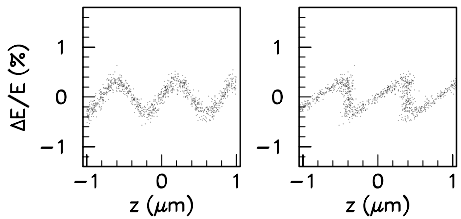


U250 FEL undulator
“optical klystron"

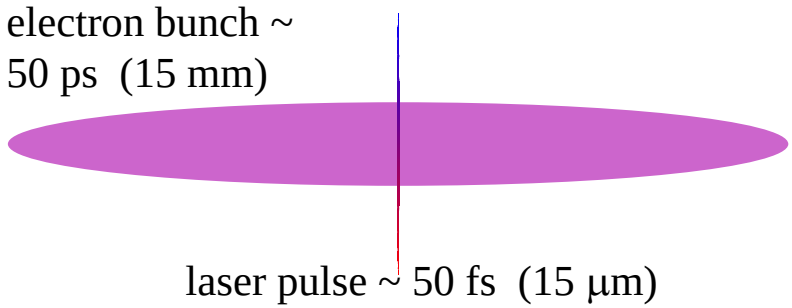
See also:
- UVSOR-II (Japan)
- ELETTRA (Italy)
- Femtoslicing @BESSY
- sFLASH @DESY

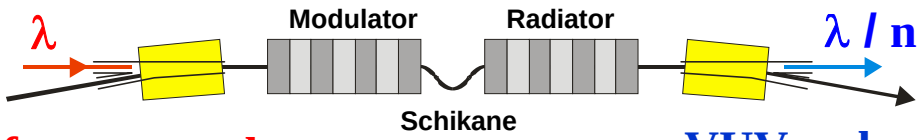
Seeding Project

- **generating ultra-short VUV- and THz-pulses**



energy modulation **density modulation**



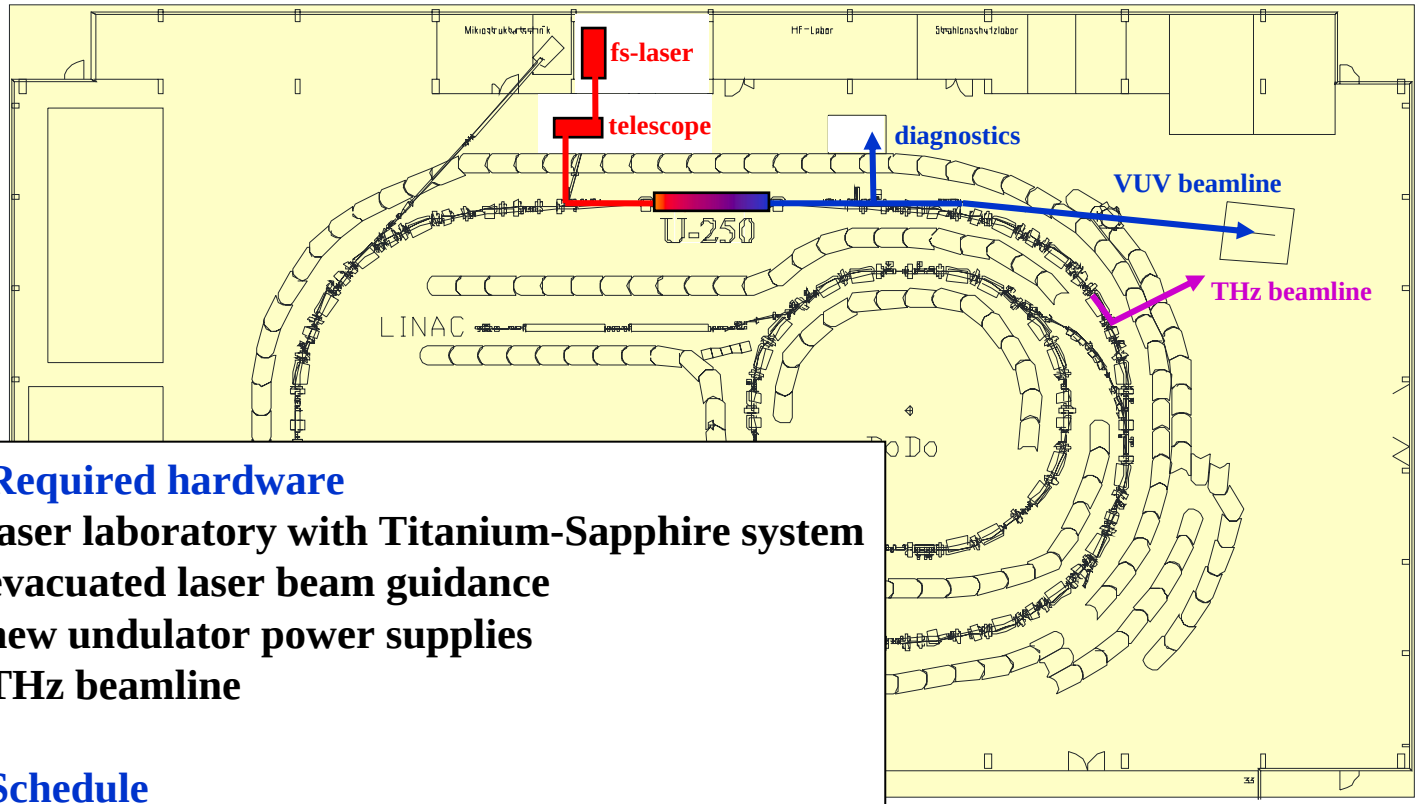


femtosecond laser pulses

VUV-pulses:

coherent
short wave (λ / n)
ultra short (50 fs)
synchronous to laser

Seeding Project



Required hardware

- laser laboratory with Titanium-Sapphire system
- evacuated laser beam guidance
- new undulator power supplies
- THz beamline

Schedule

- work will start this winter
- first experiments 2011 / 2012…

Summary

- 6 beamlines in operation
- 2 beamlines under construction
- New projects underway