A New Laser Buildung at FLASH for ORS, HHG, OCAS, EOS, CTR and all that

FLASH seminar 31. 10. 2006

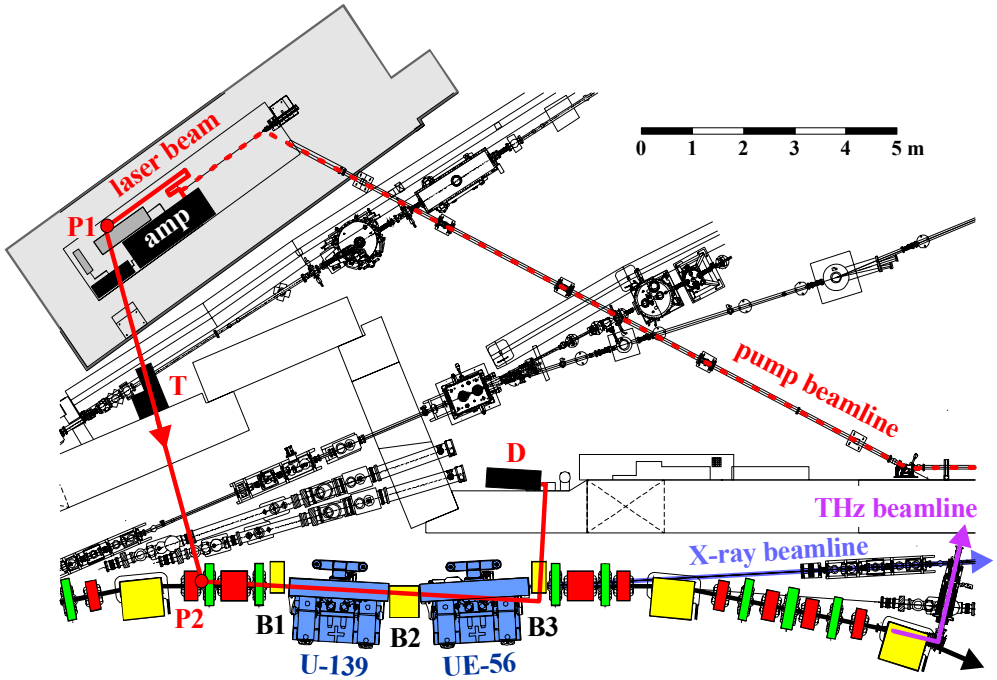
S. Khan, J. Rossbach, H. Schlarb, B. Schmidt, B. Sparr
(special thanks to L. Hänisch)

ORS = Optical Replica Synthesizer (new)
HHG = Higher-Order Harmonic Generation (new)
OCAS = Optical Clocks and Synchronization (Bdg. 26)
EOS = Electro-Optical Sampling (Container 28 g)
CTR = Coherent Transition Radiation (Container (28 g)

New buildung will be named 28 g
(I would have called it 28 ħ)

Laser-induced energy modulation

e.g. femtosecond slicing [1] at BESSY II [2]



[1] A. Zholents, M. Zolotorev, PRL 76 (1996), 912. [2] S. Khan et al., PRL 96 (2006) 074801.

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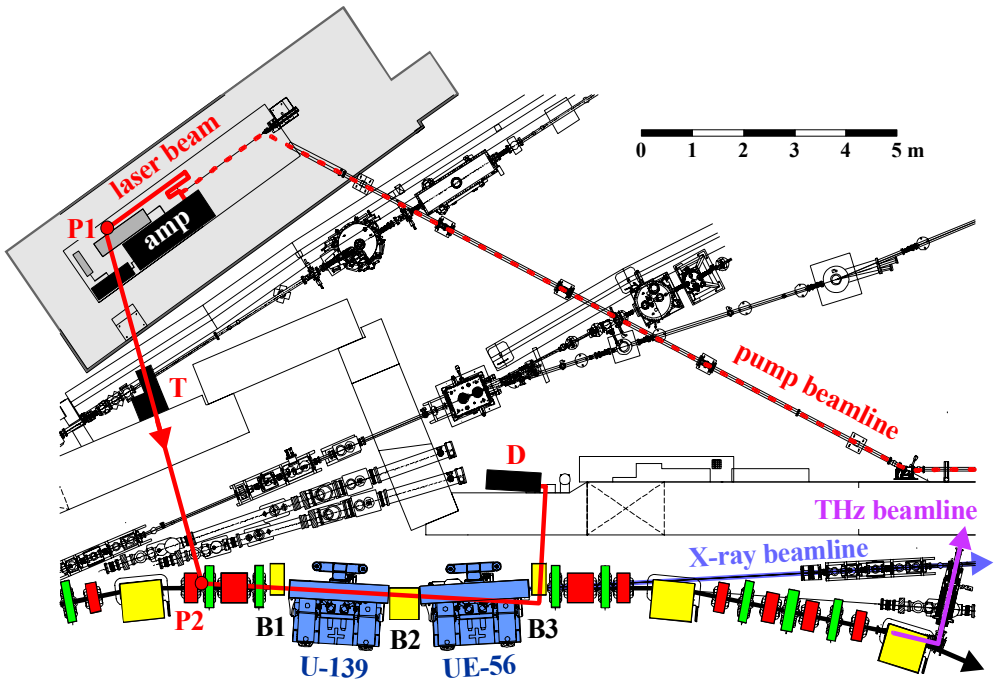

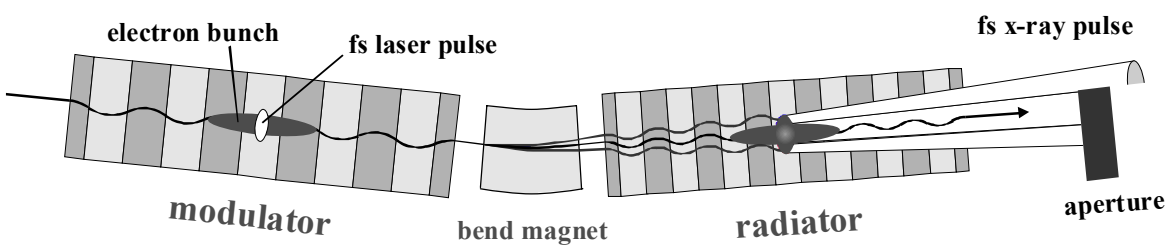

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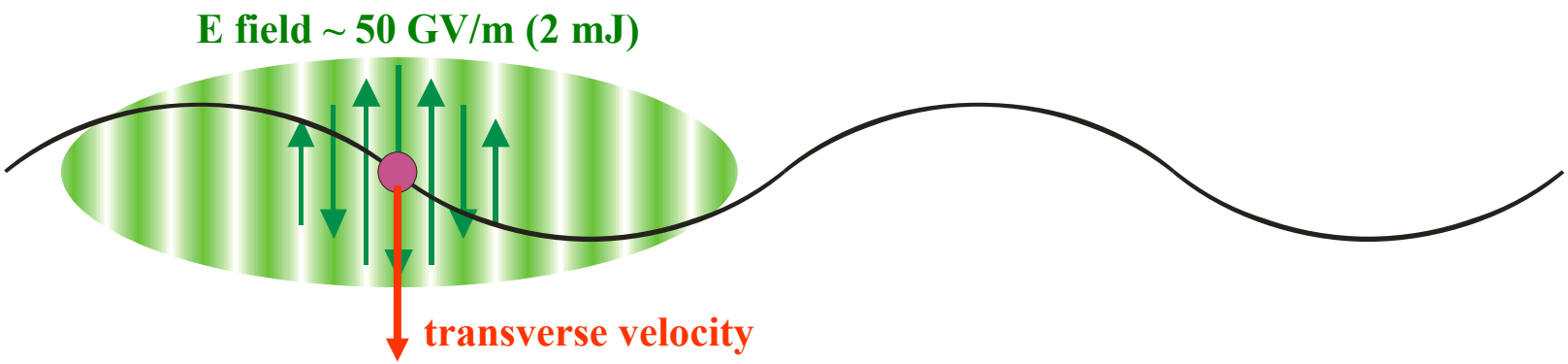

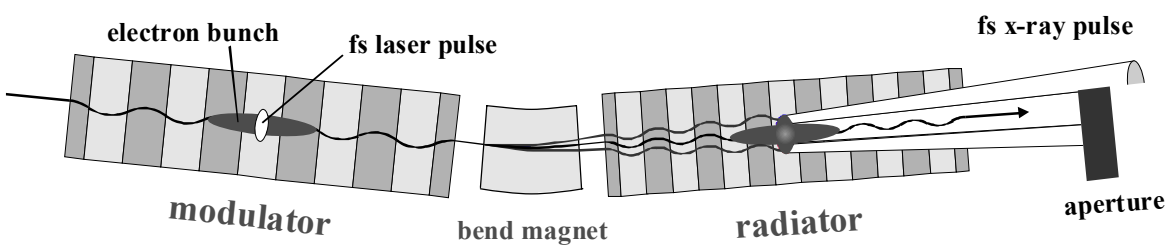

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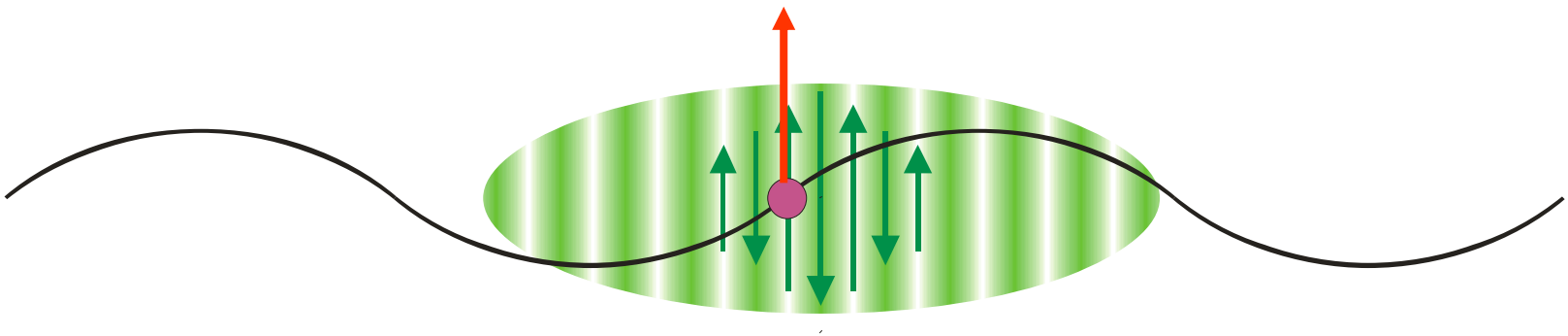

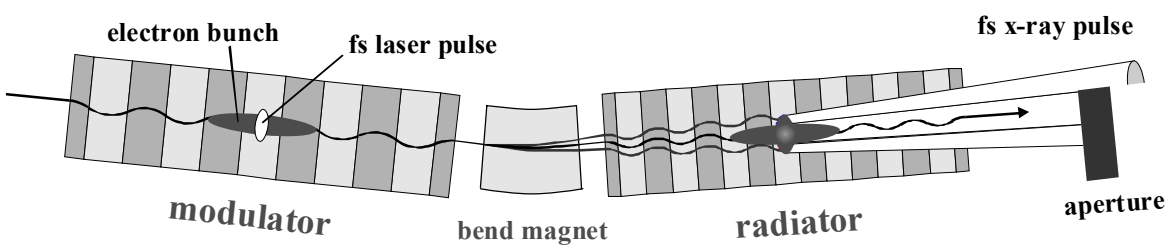

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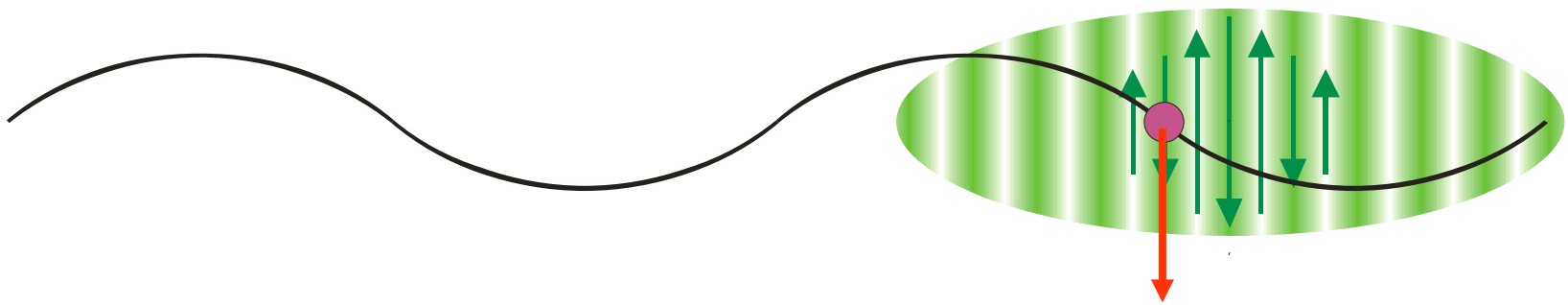
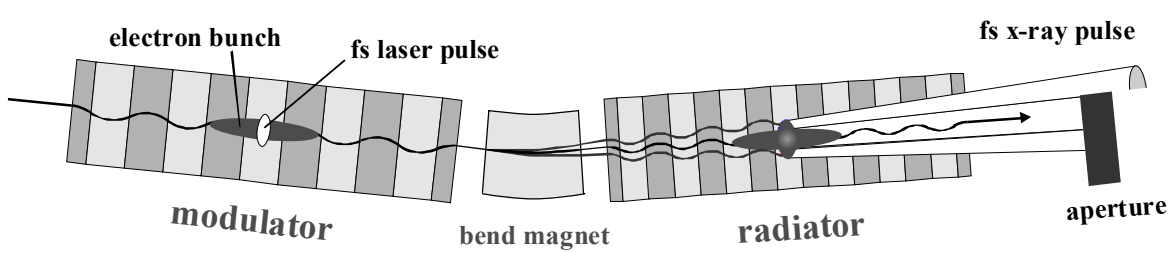
$$\lambda_{Laser} = \frac{\lambda_U}{2\gamma^2} \cdot (1 + K^2/2)$$





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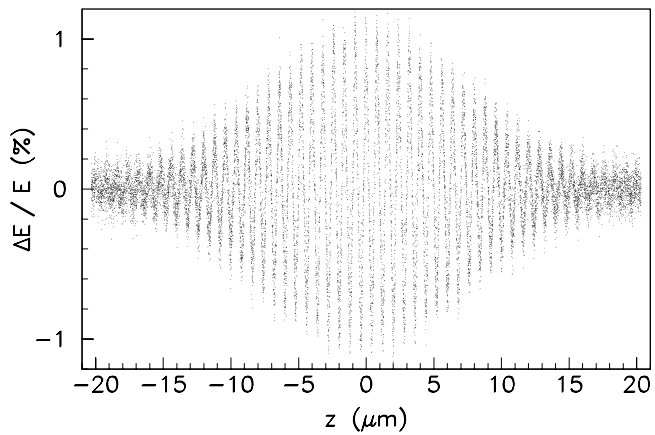

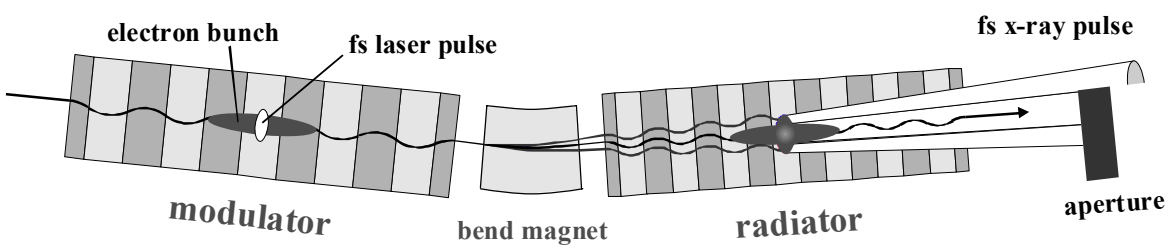

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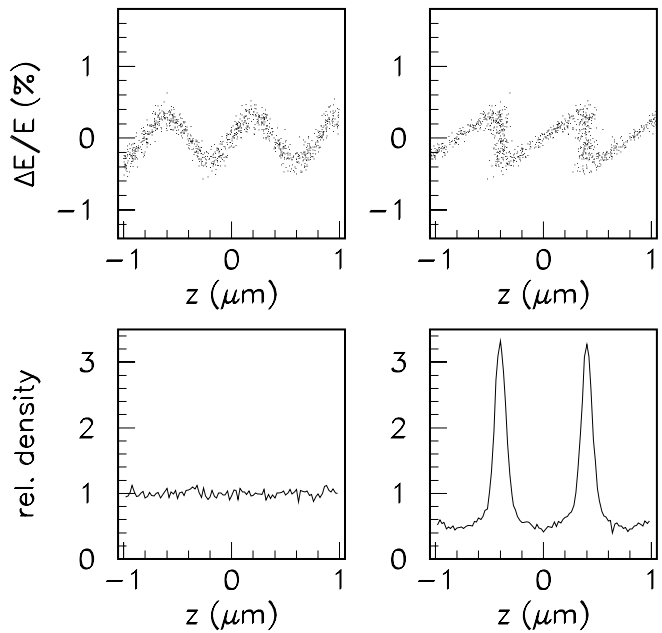
Laser-induced energy modulation

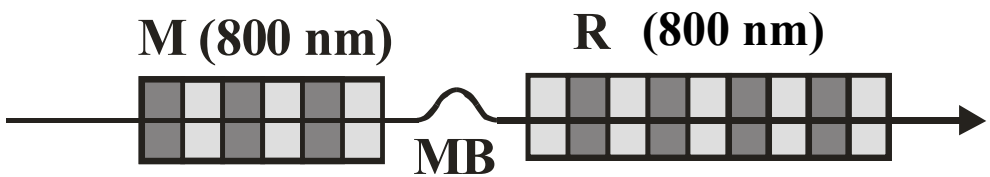
optical replica synthesizer [1]

energy modulation → density modulation → radiation at the same wavelength



use standard laser techniques to analyze coherent optical pulses (e.g. FROG [2])

status:
2 undulators ready by spring 2007 [3]:
5 periods, λ_U=20 cm



[1] E. Saldin, E. Schneidmiller, M. Yurkov, DESY Report 04-126 (2004)
[2] R. Trebino, Frequency-Resolved Optical Gating (Kluver 2000)
[3] V. Ziemann et al., EPAC 2006, 1200.

Laser-induced energy modulation

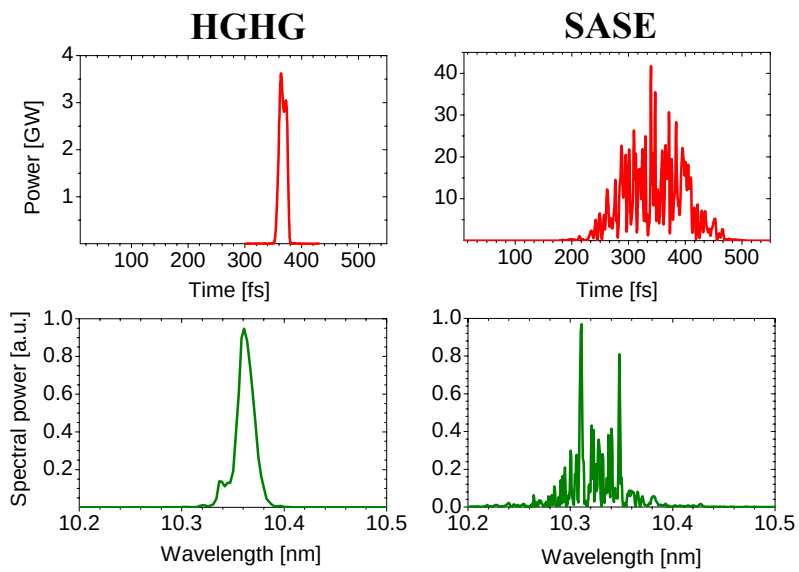
FEL seeding, e.g. HGHG [1] or attosecond generation [2]

energy modulation → density modulation → radiation at higher harmonics

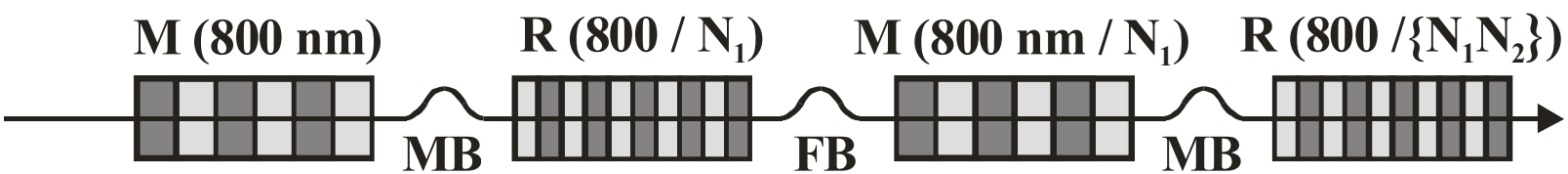
time structure

pump-probe synchronization

spectrum



from [3]



[1] L.H. Yu, Phys. Rev. A 44 (1991), 5178

[2] E. Saldin, FLS Workshop 2006 at DESY

[3] TDR of the BESSY VUV-FEL (2004)

Laser-induced energy modulation

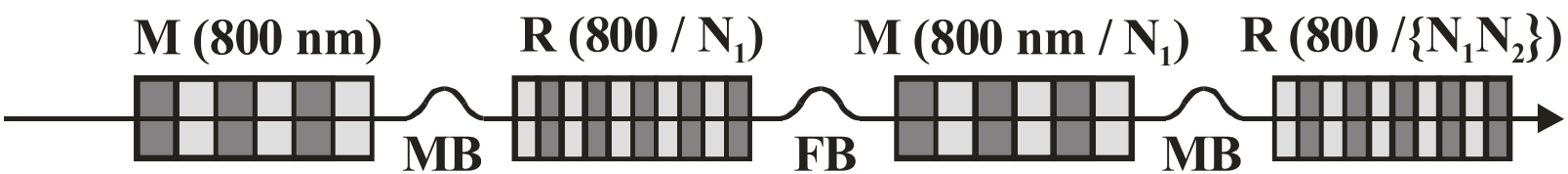
FEL seeding, e.g. HGHG [1] or attosecond generation [2]

energy modulation → density modulation → radiation at higher harmonics

but: cascaded HGHG
- is not yet experimentally demonstrated
- might not be suitable for Angstroem wavelengths

look for alternative approaches e.g. [3]
- seeding with higher laser harmonics (HHG)

gain hands-on experience !



[1] L.H. Yu, Phys. Rev. A 44 (1991), 5178
[2] E. Saldin, FLS Workshop 2006 at DESY
[3] G. Lambert et al., FEL 2006 (Berlin) ...

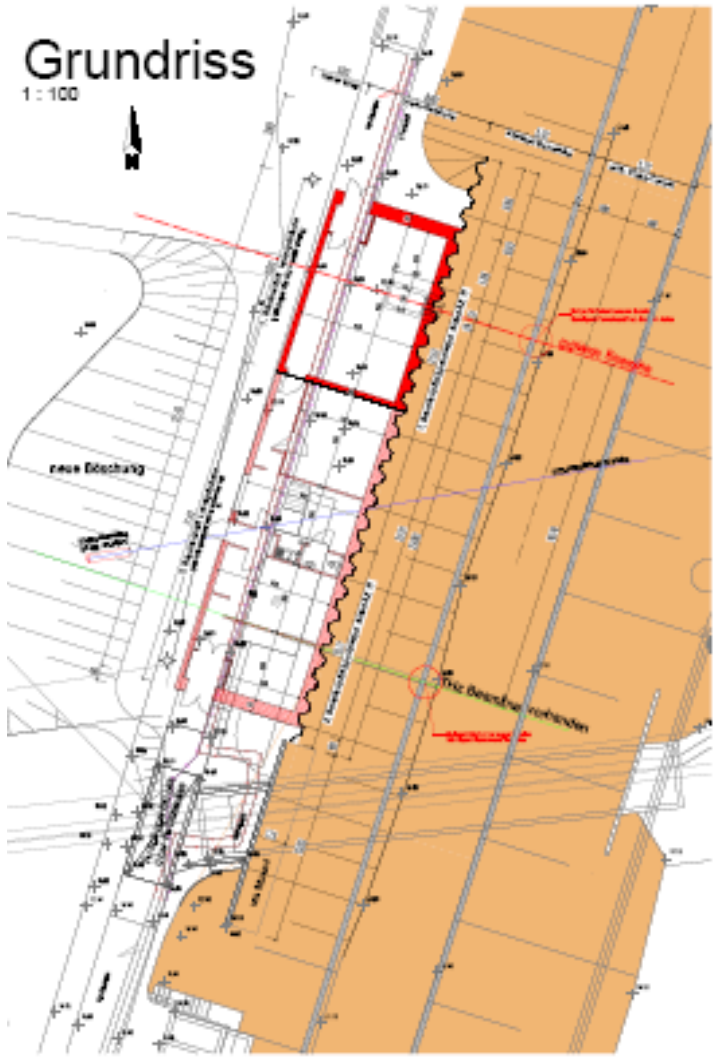
Motivation for a new laser building

- provide space for ORS in 2007
- provide more space for HHG or whatever comes up
- a more cosy home for EOS and CTR
- move OCAS closer to FLASH

Formal approach

- basic design, cost estimate 0.5e6 Euro (ZBAU et al.)
- proposal to the DESY management (23.06.06)
  (J. Rossbach, H. Schlarb, B. Schmidt, S. Khan)
- approved “in principle” (29.06.06)
- call for tenders for preparatory work
- work done in October
- call for tenders for the building underway

The site: adjacent to the FLASH tunnel



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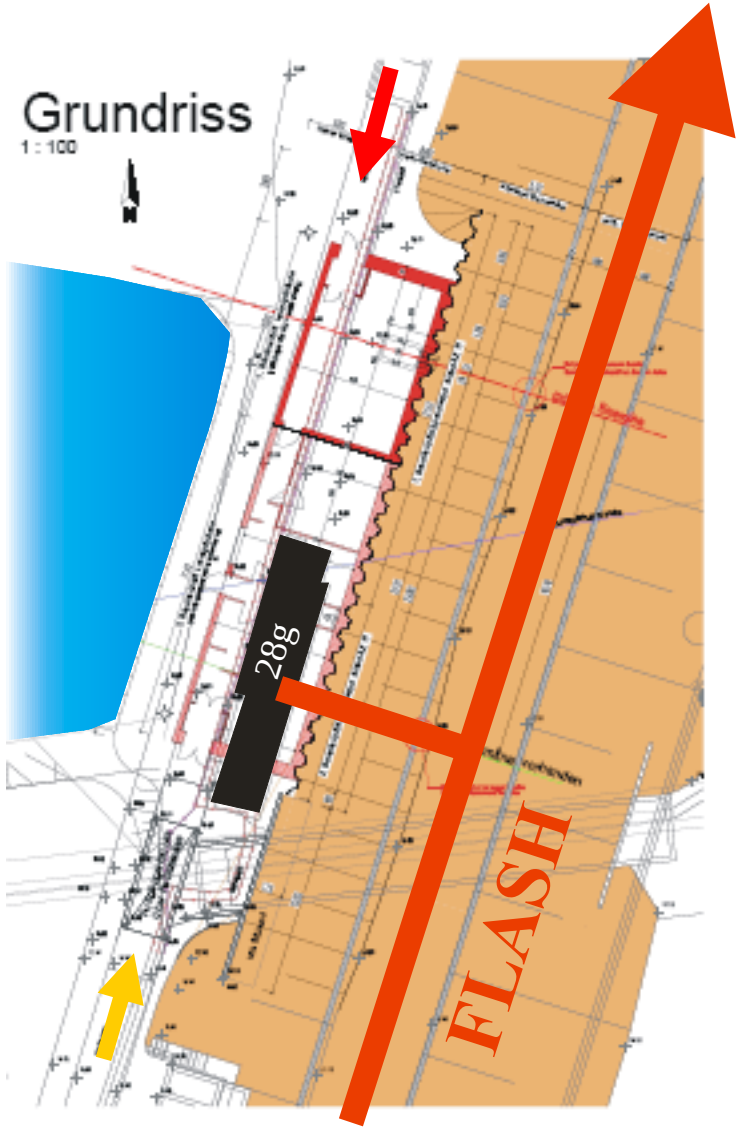

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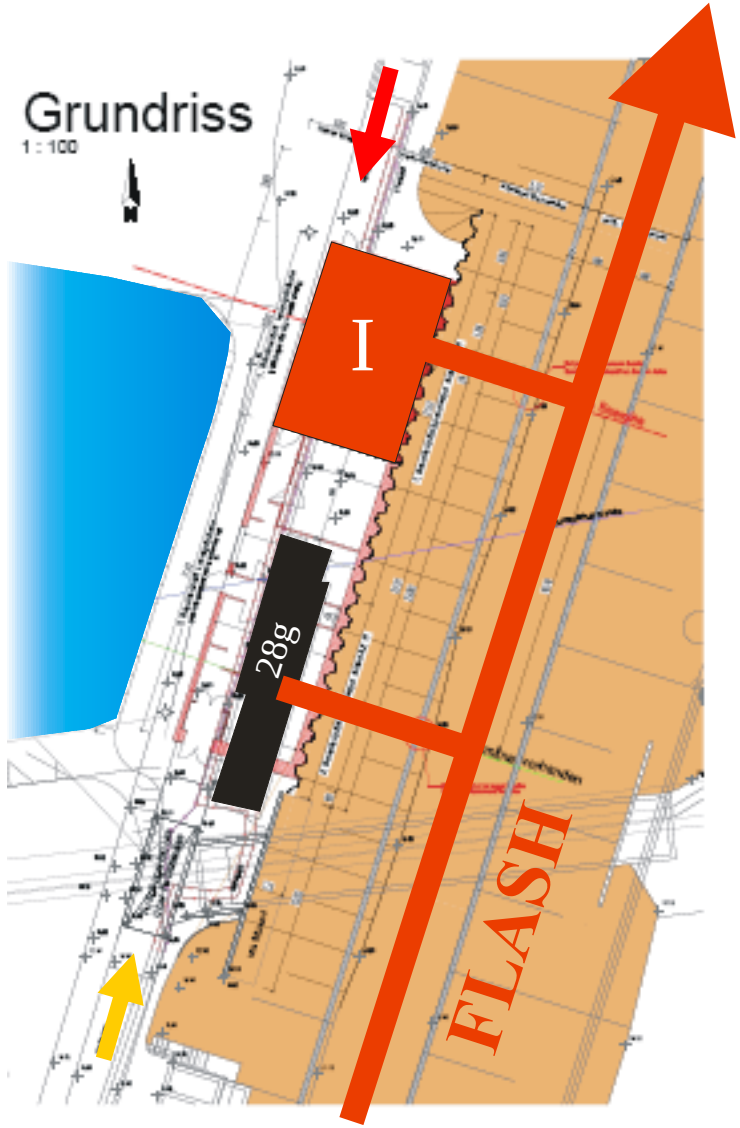
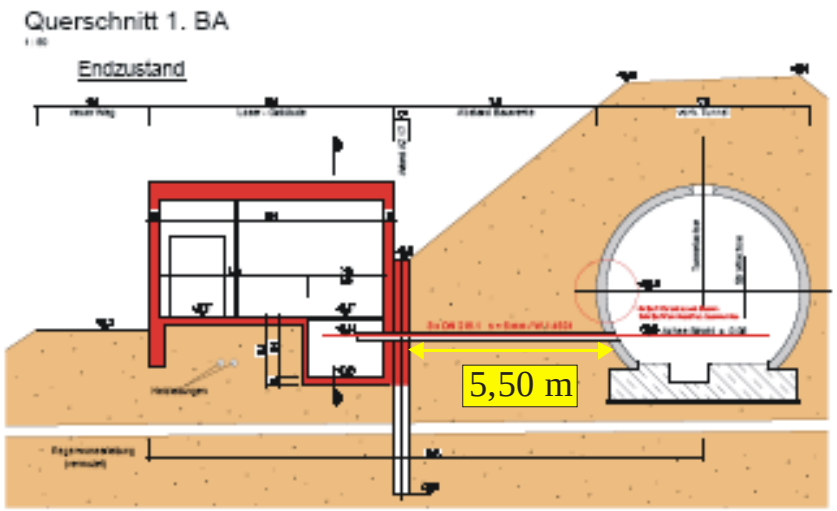
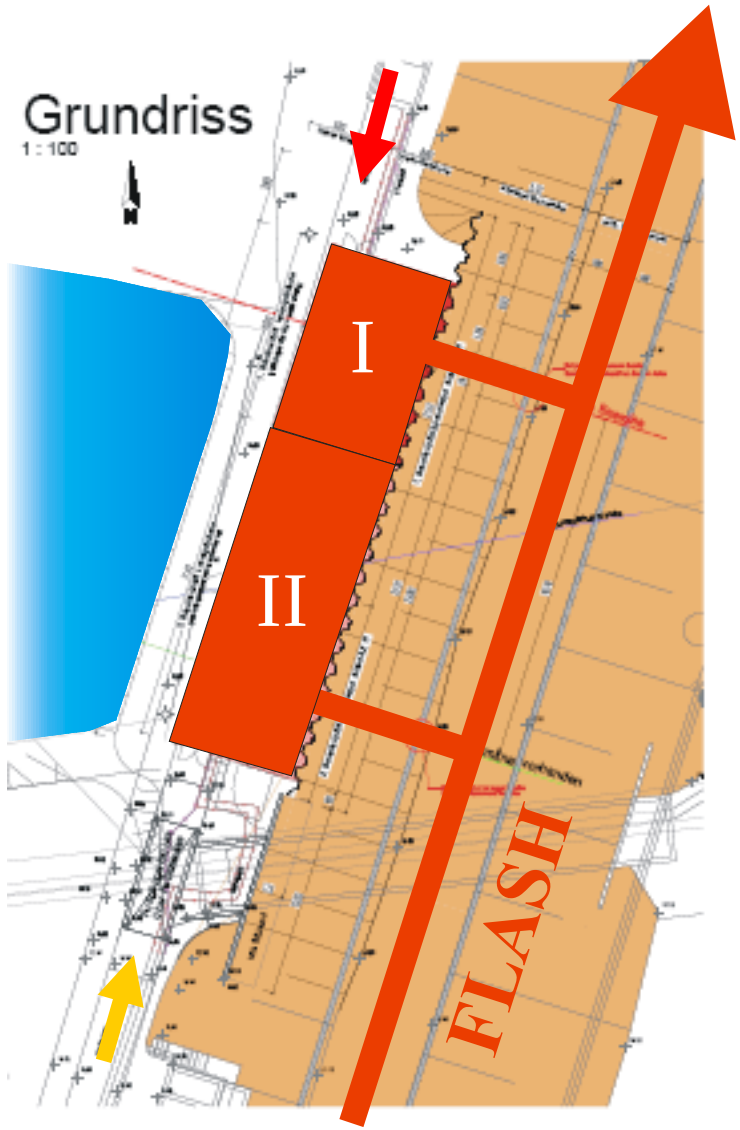


The site: adjacent to the FLASH tunnel

preparatory work:
- create more space
- 3 additional tubes



sheet pile wall
(“Spundwand”)

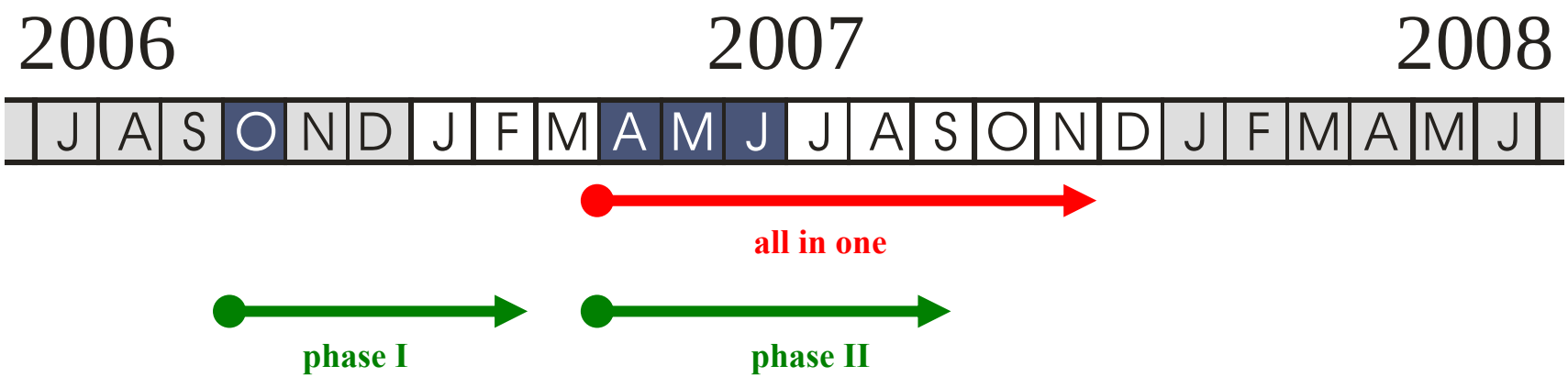


!!! watch out for explosives !!!
(bombs, grenades, mines, ammunition ...)

Schedule

either: **start spring 2007, complete end of 2007 (!)**

or: **start phase I October 2006, complete spring 2007**
start phase II spring 2007, complete end of 2007



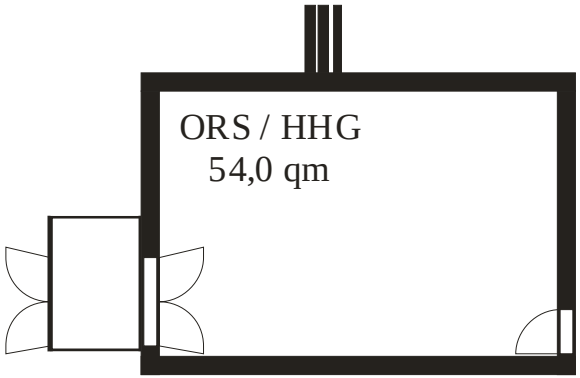
The building (preliminary)

call for tenders underway

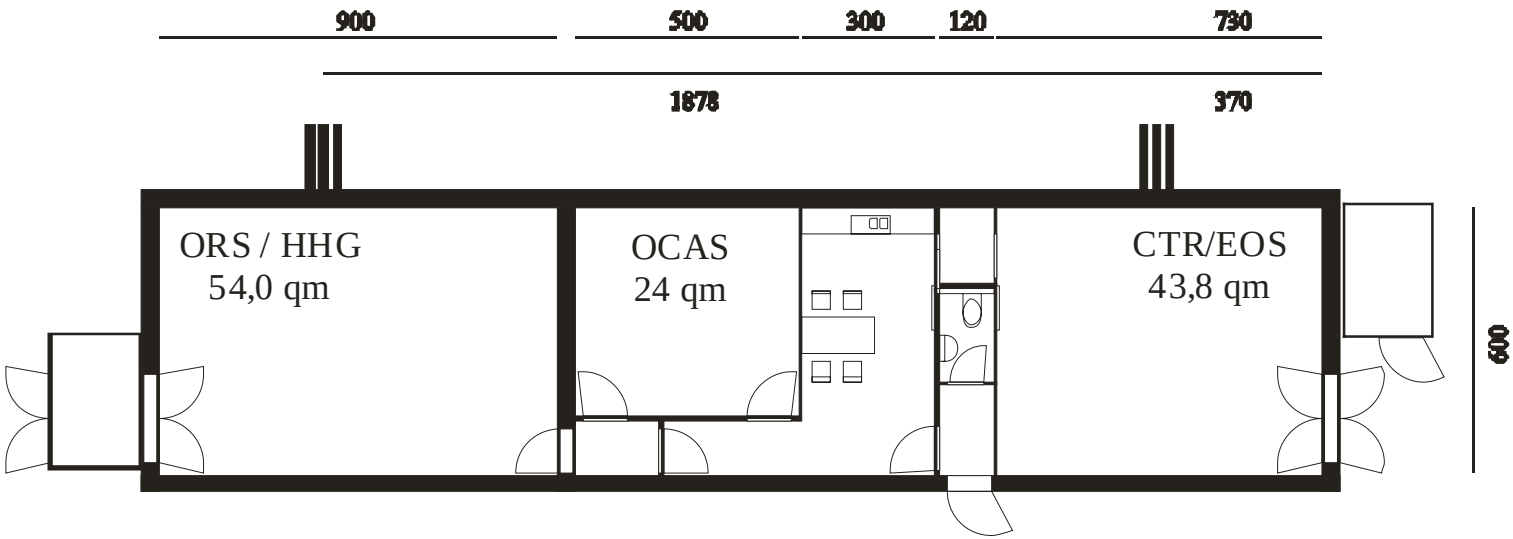
Design goals:

- laser environment
- have enough space
- do it in two phases
- provide flexibility
- laser safety

Phase 1



Phase II



Media etc.

electricity (J. Schäfer) total consumption 29 kW

cooling water (F.-R. Ullrich) from/to the FLASH tunnel

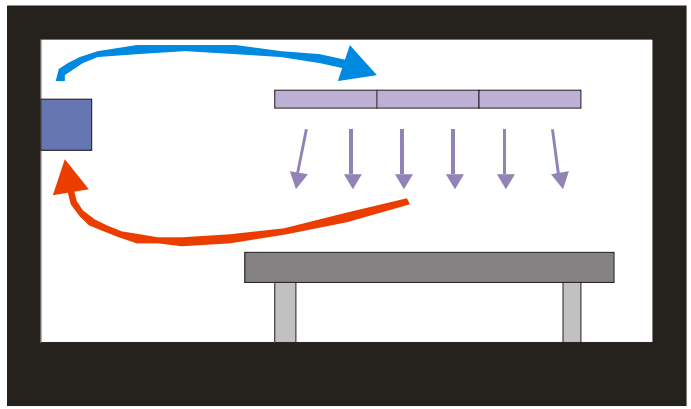
air conditioning (M. Köpke)

radiation safety (A. Leuschner)

laser safety (A. Knabbe, S. Schreiber)

fresh water (phase II)

waste water (phase II)



Holgers's slide show

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Next ...

this/next week (?): **cleaning of the pond**

starting December 06: **construction of phase I**