

EUROFEL-Report-2006-DS4-026

EUROPEAN FEL Design Study



Deliverable N°: D 4.5

Deliverable Title: Specification of parameters and commissioning of laser system at ELETTRA

Task: DS-4

Author: De Ninno et al.

Contract N°: 011935

**Project funded by the European Community
under the “Structuring the European Research Area” Specific Programme
Research Infrastructures action**

The Elettra storage-ring FEL operated in seeded single-pass configuration

“Specification of parameters and commissioning of laser system”

Seed laser has been purchased, commissioned and installed in the experimental hutch

Transport optics has been studied and successfully tested

Synchronization with electron beam has been successfully implemented

For the specification of system parameters see:

- F. Curbis, G. De Ninno, Proceedings FEL Conference 2005
- F. Curbis, H. P. Freund, G. De Ninno, Proceedings FEL Conference 2006

Seed laser

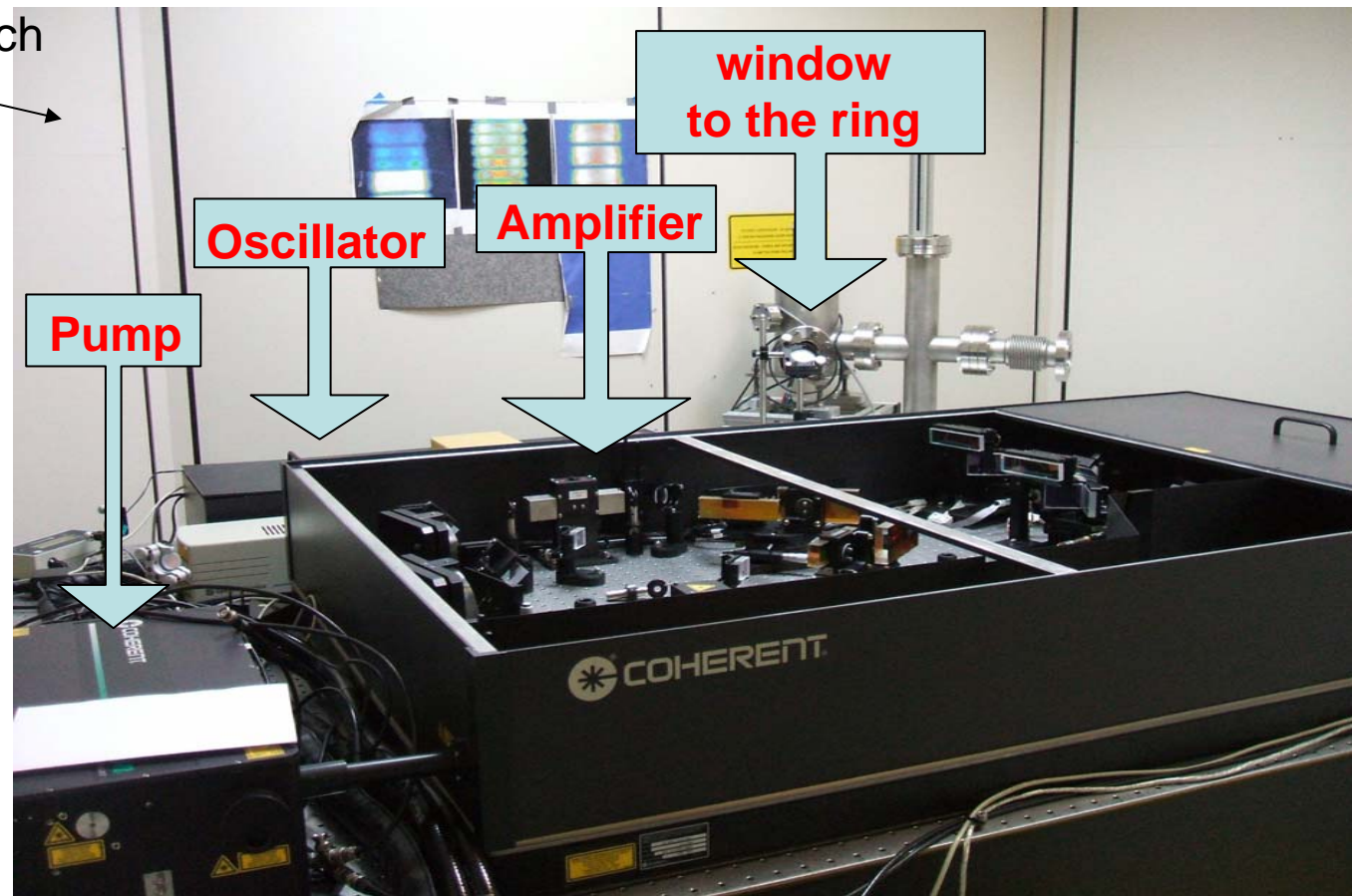
Oscillator: Ti:Sapphire laser (100 MHz repetition rate, wavelength: 780 nm, synchronized to ring RF/5)

Amplifier: dual-pulse duration regenerative amplifier. Legend model of Coherent . Repetition rate ≤ 1 kHz, Pulse energy 2.5 mJ.

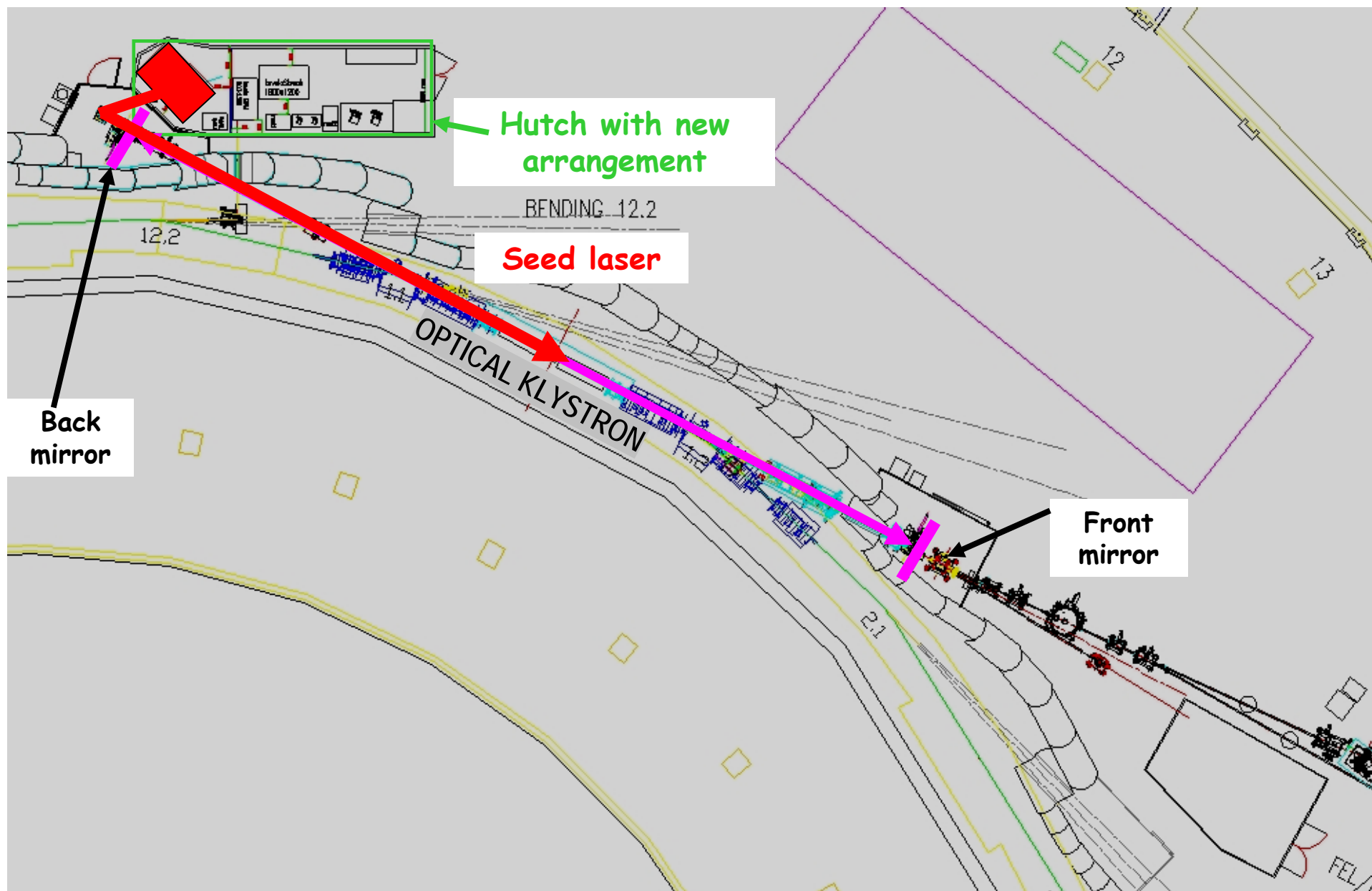
FEL experimental hutch

2 compressors:

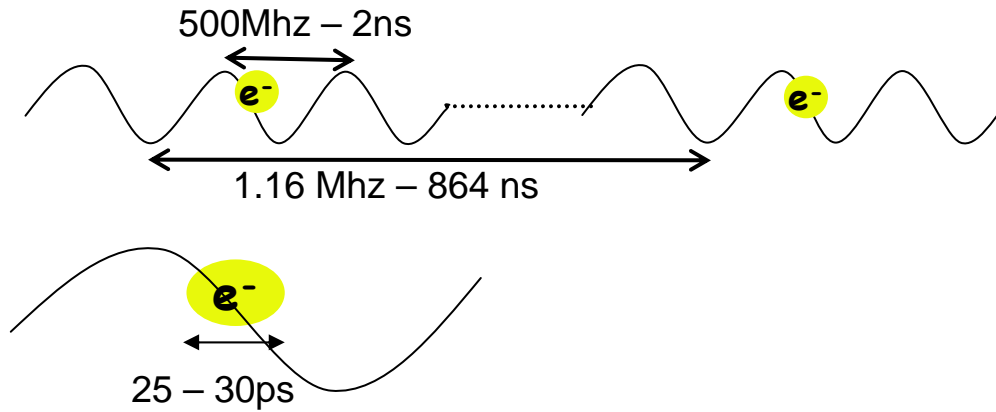
there is a flipper which allows to switch from 1 ps to 100 fs of pulse duration



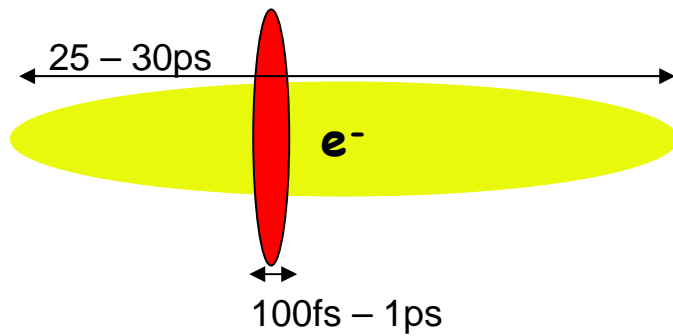
General layout of the Elettra SRFEL



Synchronization



Single bunch configuration



Electron bunches are
25-30 ps long:
synchronization not a big deal

Present status

- Laser ready: aligned and synchronized with the electron beam
- Reliable electron-beam optics installed

Next steps

- Start with fundamental of Ti:Sa (780 nm) and get third harmonic in air at 260 nm.
- In the coming months : generate third harmonic of the Ti:Sa and get coherent radiation in the VUV.

Conclusions and Perspectives

If theoretical results are confirmed, the Elettra SRFEL will be the first facility in the world able to provide coherent optical pulses with different durations (100 fs – 1 ps), significant power (~ 1 MW) and variable polarization in the VUV spectral range (120 – 50 nm).

This will open up the possibility of very interesting studies in many new areas of science

Expected performance

Wavelength (nm)	120-50
Peak power (W)	$10^6 - 10^5$
Pulse duration (fs)	100-1000
Repetition rate (Hz)	10-100+
Spectral width	Same as the seed pulse



**attractive, ready-to-use
test facility for CHG
planned on next generation
single-pass FELs**

The project team

G. De Ninno, E. Allaria, M. Coreno, F. Curbis, M. B. Danailov, B. Diviacco, L.

Romanzin, C. Spezzani, S. Tileva, M. Trovò

Thanks to:

M. Ferianis (Diagnostics and Synchronization)

E. Karantzoulis (Electron-beam optics)