Seeding project for the VUV-FEL

funded by HGF-Strategiefonds Program (01SF9935/1)

Project Goals / Deliverables

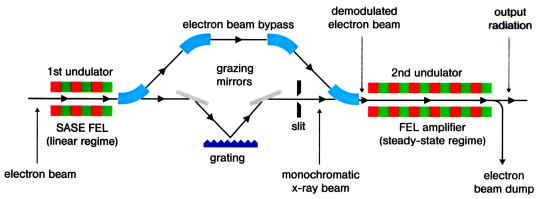
- **Self-Seeding will deliver FEL beam with almost full coherence, both transverse and longitudinal**
- **Narrow bandwidth → ≈ 50x higher peak brilliance with pulse energies comparable to usual SASE FEL**
- **Wavelength range from about 60 - 6.4 nm**

Self-Seeding Principle

Idea: **seed a SASE FEL with a fully longitudinally coherent, narrow bandwidth laser pulse**

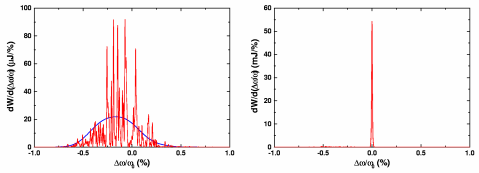
Approach: **no sufficiently intense table top lasers available in the VUV and soft X-ray region**

→ use monochromatized radiation from another SASE FEL as a seed



Spectral power distribution

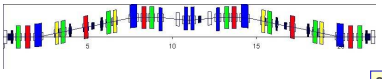
behind 1st undulator **behind 2nd undulator**



J. Feldhaus, E.L. Saldin, J.R. Schneider, E.A. Schneidmiller, and M.V. Yurkov, Opt. Comm. 140, 341 (1997)

Realization

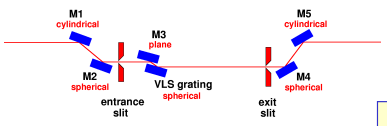
Electron Bypass :



11 steerers, 8 dipoles, 8 quadrupoles (vert. foc.), 6 quadrupoles (hor. foc.), 4 sextupoles

37 magnets total

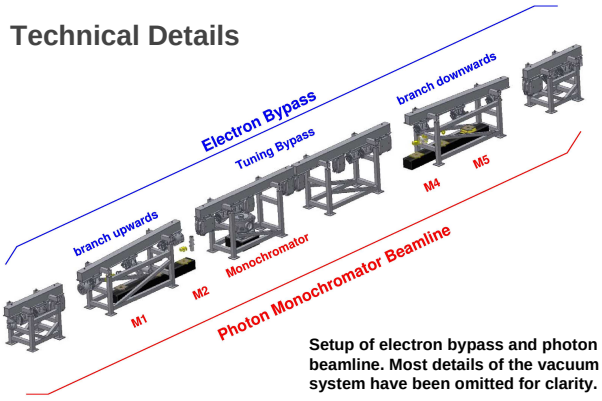
Photon Monochromator Beamline :



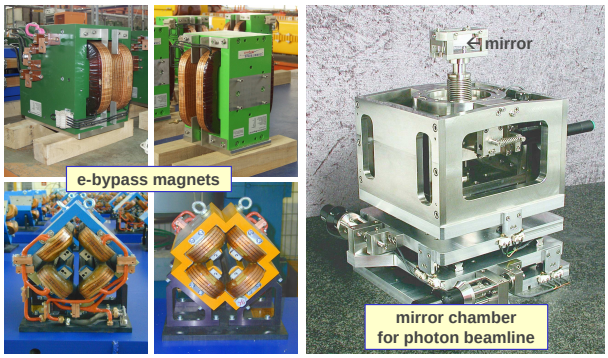
6 optical elements

Total length: 22m

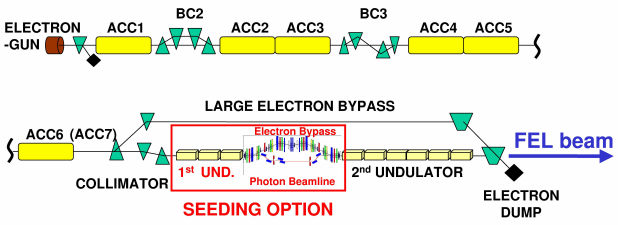
Technical Details



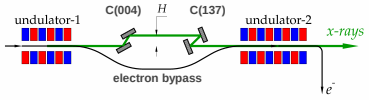
Setup of electron bypass and photon beamline. Most details of the vacuum system have been omitted for clarity.



Integration into the VUV-FEL User Facility

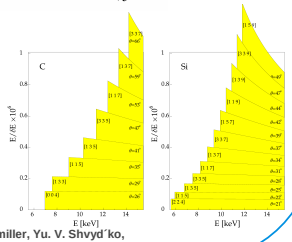


Outlook: XFEL with meV Bandwidth



Monochromator requirements:
- **monochromatization :** $E/\Delta E = 0.7 \times 10^6$
- **tunability range of a few keV**
- **resistance to high heatload**

Concept:
first two crystals (pre-monochromator)= thin diamond crystals, third and fourth crystal = high-index reflection from diamond or silicon



E.L. Saldin, E.A. Schneidmiller, Yu. V. Shvyd´ko, M.V. Yurkov, Nucl. Instr. and Meth. A 475, 357 (2001)

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