

Radiation Source ELBE Upgrade Considerations

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The Radiation Source ELBE at Helmholtz-Zentrum Dresden-Rossendorf (HZDR) is a user facility based on a 1 mA - 40 MeV CW SRF LINAC. Presently HZDR is considering upgrade options for the ELBE or its replacement with a new CW, SRF LINAC-based user facility. A part of the user requirements is the capability to generate IR and THz pulse in the frequency range from 0.1 through 30 THz, with pulse energies in the range from 100 uJ through a few mJ, at the repetition rate between 100 kHz and 1 MHz.

In addition to the high pulse energy IR-THz capability, an addition of short wavelength probes is considered. It is envisioned that the IR-THz beams and short wavelength probe beams could operate simultaneously.

The two flavors of short wavelength probes are under consideration. One of them is the ultrafast electron diffraction (UED) made with an electron beam of a few MeV beam energy, and bunch length as short as 10 fs. Another kind of short wavelength probe can be a photon beam in UV and VUV wavelength range generated by FELs.

The CW SRF accelerator technology presently used at ELBE would allow construction of a CW FEL system(s) with statistical and spectral properties superior to a SASE FEL. We present a preliminary consideration on the possible performance of a UV oscillator operating in the wavelength range from 150 nm through 450 nm. Such an oscillator could be used as a continuously tunable, high repetition rate seed for an HGHG FEL system operating in the wavelength range from 50 nm through 150 nm. The UV oscillator and the VUV HGHG FEL could operate with pulse energies of at least 30 uJ, and with pulse length on the order of 100 fs. In this contribution, we outline the key accelerator and FEL aspects of the concept, which will allow achieving such photon beam parameters.

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