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## First Lasing of the THz SASE FEL at PITZ

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The Photo Injector Test Facility at DESY in Zeuthen (PITZ) develops a prototype of an accelerator-based high-power tunable THz source for pump-probe experiments at the European XFEL. The PITZ injector is also the site for the development and preparation of the high-brightness electron source for the main linac of the European XFEL and has the same pulse train structure as the X-ray photon source of the XFEL. For the proof-of-principle experiments on high-power THz generation an LCLS- I undulator (on loan from SLAC) is installed in the tunnel annex downstream of the existing accelerator. The extension of the beam line consists of a bunch compressor and a collimation system in the main PITZ tunnel, as well as a matching section, the undulator and the THz diagnostic setup in the tunnel annex. A Self-Amplified Spontaneous Emission (SASE) FEL is used to generate the THz pulses. High radiation power can be achieved by utilizing high charge (up to several nC) electron bunches from the PITZ photo injector. A beam energy of ~17 MeV is used to generate THz radiation with a centre wavelength of 100  $\mu\text{m}$ . The transport of this space charge dominated electron beam and its thorough matching into the planar LCLS-I undulator with a strong vertical focusing is one of the project challenges. The installation of the first THz beamline setup was finished in summer 2022 and commissioning with electron beam started. A specially developed procedure for a high charge beam matching into the undulator was successfully tested resulting in a first THz pulse generation. The start-up THz diagnostics is based on pyrodetectors. First measurements of the THz generation from 1,2 and 3 nC bunches have been taken, the statistics properties analysis corresponds to the expected SASE performance. The gain curve for the 3 nC case reflects the onset of saturation regime.

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Yes

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