Coherent THz pulses from linear SRF accelerators: Perspectives for naturally synchronized THz pump probe experiments and novel electron beam diagnostic

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At the ELBE accelerator at the HZDR a new electron beamline, providing for femtosecond electron bunches with nC bunch charges and repetition rates in the 1 – 200 KHz regime is currently constructed. The 40 MeV electrons will be used in photon-electron interaction experiments with TW and PW class laser and for the generation of broad band and narrow bandwidth coherent THz pulses in the frequency range between 0.1 THz – 3 THz. Similar to previous work at the prototype THz pump probe facility at FLASH [1,2] the natural synchronization between light pulses generated by the same electron bunch shall be employed for fully synchronized experiments between narrow and broad band THz pulses. The pulse energies are expected to exceed the 100 microJ limit at scalable repetition rates between 1 and 200 KHz (cw), thereby the coherent THz facility will represent a worldwide unique facility. Besides user experiments the laboratory is also foreseen as a test bed for THz-based electron bunch diagnostics (arrival time, bunch form, …) on cw linear accelerators. The current status of the project and planned experiments are presented