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Time resolved UED with the SRF Photoinjector in Sealab

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Ultrafast Electron Diffraction (UED) is a technique used to observe dynamical changes in the structure of materials. It consists of a pump-probe scheme in which a laser pulse excites the target structure and a subsequent electron bunch scatters in the sample producing a diffraction pattern. The time resolution of MeV UED experiments is mainly governed by the electron bunch length and the time of flight jitter between the laser and electron pulses at the target. Hence, high brilliance and stable electron beams are needed. The SRF Photoinjector test facility in Sealab is a high brilliance and high current electron source being currently commissioned at Helmholtz-Zentrum Berlin (HZB). It offers unique possibilities to perform UED experiments since the original design composed by a L-band SRF electron gun followed by three L-band SRF booster cavities provides several knobs to manipulate the longitudinal phase space and time of flight fluctuations of the electron bunches. In order to accomplish the high brilliance beam, the longitudinal phase space of the bunch is linearized at the target while the time of flight jitter is kept as low as possible. In summary, we discuss the basic requirements for such experiment, the strategy to improve the time resolution and the outlook of the UED project in HZB.

Summary

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