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Resonant Diffraction Radiation from inclined Gratings as a Tool for Bunch Lengths Diagnostics

There exists considerable interest in studying new types of non-invasive bunch length diagnostics for sub-picosecond bunches. In this context coherent Smith-Purcell radiation (CSPR) is a good candidate because the use of grating causes wavelength dispersive radiation emission, i.e. a CSPR based monitor does not require any additional spectrometer.

In contrast to existing CSPR monitors a new scheme is proposed with two detectors placed at fixed positions, and a wavelength scan is performed by scanning the tilt angle between grating surface and beam axis. In this scheme the information of both detectors, positioned opposite to each other and perpendicular to the beam axis, can be combined by taking the intensity ratio of the signals from both detectors. The advantage of such diagnostics scheme is that one has not to rely on absolute values of the radiation yield, avoiding the need to know the sensitivity of each detector with high accuracy.

In contrast to CSPR which is emitted from a grating oriented parallel to the beam, the effect is termed coherent resonant diffraction radiation when the grating is tilted. In the report we present simulation results and a status of the experiment which is planning at bunched beam of the linear accelerator in Paul Scherrer Institut, Villigen, Switzerland with the following parameters: electron energy - 130-230 MeV, bunch length - 50-1000 fs, bunch charge -10-200 pC.

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