Joint DESY and University of Hamburg Accelerator Physics Seminar

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(16:00 in Room 459/30b)

A Bunch Compressor for Small Emittances and High Peak Currents at TTF2

Frank Stulle

DESY / MPY

Abstract

To drive a Free Electron Laser (FEL), electron beams with a high quality and a high peak density are needed. At TTF2 the peak current of the electron beam must reach up to 2500A and a transverse emittance lower than 2 mm mrad has to be preserved. Unfortunately the bunches produced by the RF gun have a too small peak current. Therefore they must be longitudinally compressed in bunch compressor chicanes.

The compression at TTF2 is done in two stages. The first stage is a modified version of bunch compressor 2 which was already used at TTF1. The second stage is a new bunch compressor, the so called BC3. Since the electron density is very high when passing the new chicane, strong coherent synchrotron radiation (CSR) is emitted by the electrons. This radiation leads not only to an overall energy loss of the bunch but also to a non–uniform energy redistribution along the bunch. Particles at the tail of the bunch lose energy whereas particles at the head gain energy. Due to the dispersion in the chicane this leads to a growth of the transverse emittance. Different chicane layouts are compared in computer simulations to find a chicane which minimizes emittance dilution.

CSR can not only lead to an emittance growth, but also to an amplification of small modulations in energy or charge density. This effect shows a strong dependence on the frequency of the modulation, the emittance and the uncorrelated energy spread. It is studied if and in which frequency range the amplification can become important in BC3.

D.P.Barber (MPY), J.Rossbach (Univ. HH), P.Schmüser (Univ. HH), and M.Vogt (MPY).