Fachbereich
Angewandte Naturwissenschaften

Studiengang: Physikalische Technik

TECHNISCHE HOCHSCHULE LÜBECK

Bachelor-Abschlussarbeit

Thema:

Monte Carlo simulations of light
Estimating and comparing the photon rates of different
sources at the Beam Gas Curtain monitor's camera

Zusammenfassung:

This thesis aims at giving a rough estimation of the photon rates and with that the ratio of signal to background radiation on the Beam Gas Curtain's camera, an instrument to measure the concentricity and position of the Hollow Electron lens's electron beam relative to the LHC's proton beam, by imaging photons from the spontaneous emission of a neon gas jet, crossing the particle beams.

The Monte Carlo simulation software MolFlow+ and SynRad+ were used to simulate the photons resulting out of the beam-gas interactions, the thermal radiation from the electron gun cathode as well as the synchrotron radiation from the bent proton beam.

The results show a high amount of synchrotron radiation in comparison to the signal originating out of the spontaneous emission of the gas jet, which can threaten the functionality of the BGC and a negligible amount of thermal radiation. At the same time, they reveal possibilities for further investigations and improvements to the BGC's design, most importantly, a mask to shield the camera from background radiation.
The main uncertainty of the results lies within the rough approximation of various simulation parameters, as no measured data was available.