

Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

Optical Metrology of Relativistic Particle Beams at the HL-LHC

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Diskussionsleitung: Prof. Dr.-Ing. B. Schmauss

Optical technologies are increasingly being applied in the field of Accelerator Physics to improve diagnostic tools for the metrology of relativistic particle beams. This talk reviews several new optical techniques under development for the future High Luminosity upgrade of Large Hadron Collider, including its injector chain at CERN.

Essential particle accelerator beam parameters are monitored traditionally using mechanical invasive devices, such as wire or slit scanners and SEM grids, which typically obstruct part of the beam being measured. The high beam intensities at CERN's new accelerator would damage these conventional beam diagnostics. By replacing the mechanical wire with a laser beam, a continuous optical measurement can be made non-invasively, by exploiting photo-detachment of H⁻ ions, recorded by downstream diamond detector. We report on the development of such a laserwire system for the Linac4 injector at CERN.

In future, the particle bunches at the LHC will be rotated by crab-cavities to ensure head-on collisions that maximise the luminosity in the particle physics detectors. A novel electro-optic diagnostic is being developed to rapidly monitor the transverse shape of individual 1ns bunches, by exploiting the Pockels effect in birefringent crystals. First measurements from a recently tested prototype will be reviewed.