

TRANSVERSE BEAM SIZE AND EMITTANCE DIAGNOSTICS USING TRANSITION AND DIFFRACTION RADIATION

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Transverse beam size and emittance monitoring is a crucial task in future linear colliders. Beam diagnostics is required at all stages of the beam production, acceleration and delivery. The diagnostics equipment has to be suitable for electron/positron beams from MeV to TeV energies with resolution from nanometres to hundreds of microns and beam intensities from a fraction to hundreds of nC.

Such a large diversity of the beam parameters implies a diversity of beam diagnostics. The state-of-the-art in transverse beam diagnostics is the Laser-Wire (LW). This technique is non-invasive, with large dynamic range and high resolution. However, the laser system is expensive and requires a team of qualified people to maintain its conditions.

Optical Transition (OTR) and Diffraction (ODR) Radiation techniques are promising to back LW up. Recent developments have demonstrated that a sub-micrometre resolution can be achieved using the OTR. ODR technique is non-invasive and has demonstrated an ability to measure the beam size as small as 14 μm . We have performed a series of experiments in KEK (Japan), CTF3 (CERN) and CsrTA (Cornell University). We have developed a sophisticated simulation code based on ZEMAX software package for optimization of optical systems. The next step is to develop a combined OTR/ODR beam size monitor covering a wide range of beam sizes and intensities.

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