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Material Budget Imaging in two and three dimensions

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The environment of test beam facilities and the utilization of high-resolution beam telescopes enable the application of a novel imaging technique, named Material Budget Imaging. This technique is based on the multiple Coulomb scattering of highly energetic charged particles in matter, leading to an effective deflection of the particles. Measuring the deflection angles and the incidence positions at a sample for a multitude of particles then enables a position-resolved determination of the sample's material budget. Combined with a rotation of the sample, a three-dimensional imaging becomes feasible.

Highly energetic particles in the GeV-range are able to traverse several radiation lengths of a given material. Thus, material budget images can reliably be acquired for high-density objects, showing a reduced number of artefacts than it is the case for many other tomographic imaging techniques, such as e.g. Computed Tomography.

In this contribution, we present the method of material budget imaging in two and three dimensions and demonstrate its potential and limits. We show first results from measurements performed at the DESY II Test Beam Facility and a comparison to images acquired via Computed Tomography.

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