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Bergen proton-CT project

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Proton therapy is a treatment method that utilizes the energy deposition of heavy ions to concentrate the dose delivered to a patient during the treatment of the malignant tumor. The Bergen proton Computed Tomography (pCT) collaboration is constructing a prototype detector capable of both tracking and measuring the energy deposition of ions in order to minimize uncertainty in proton treatment planning.

The pCT detector designed by the Bergen pCT collaboration is a high granularity digital tracking calorimeter, where the first two layers will be used to obtain positional information of the incoming particle and act as tracking layers. The remainder of the detector will act as a calorimeter. The tracking layers will utilize a carrier made of ˜200 μm thick carbon fleece, this is to minimize scattering effects. The calorimeter part of the detector will have the sensor chips mounted on aluminum carriers, there will also be a 3.5 mm aluminum layer in between each sensitive layer, which will act as absorber material. Each sensitive layer will be populated by 108 ALPIDE chip sensors, situated in a 12x9 grid to cover the entire 27 cm x 16.6 cm area of the detector. The ALPIDE chip was developed for the ITS2 upgrade at CERN and is a monolithic active pixel sensor manufactured using the 180 nm CMOS Imaging Sensor process by Tower Semiconductor. Each ALPIDE has a surface area of 30 mm x 15 mm and consists of a pixel-matrix with 512x1024 pixels.

This presentation will discuss the implementation of the design, present data taken with high-energetic (50-220 MeV/u) proton and ion beams at the Heidelberg Ion-Beam Therapy Center (HIT) in Germany, and present selected results from simulations.

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