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Development of a Time Projection Chamber for Ion Transmission Imaging

At the LMU Department of Medical Physics a portable platform for proton irradiation of small animals is under development for pre-clinical research with tumor bearing mouse models. The platform intends to use beams available at clinical facilities. It consists of a custom beamline to produce particle beams of the needed energy range and focus and several beam monitoring and imaging systems, used for pre-treatment animal imaging, positioning control and range verification during treatment.

In this context, we are developing an ion transmission tomography system, which combines particle position information from tracking detectors with a residual energy measurement of the transmitted particles with energies between few and 80MeV. To ensure precise tracking even of the lowest energy particles and to measure their residual energy with high precision, we are developing a small-size Time Projection Chamber (TPC) as rear detector of the imaging system with a discharge insensitive floating strip Micromegas readout structure. It features a tracking region and a range detection region, in which transmitted particles are stopped by a set of 0.5mm thick Mylar absorbers, alternating with few mm wide gas layers.

We will outline the construction of a working prototype and present detailed results from a testbeam with 22MeV protons. We will discuss the behavior of field-shaping and of insulating absorbers and present the imaging capabilities of the complete system as simulated by FLUKA.

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