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High Resolution Neutron Detection using Gridpix chips

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The world of detectors used in thermal neutron scattering instrumentation has changed. By alerts on the future Helium-3 supply, critical to perspectives of the large-scale research infrastructures, the run on substitutional technologies started. Most of the solutions could be adapted from developments of particle physics and are comprised of one or more layers of Boron-10. The Time Projection Method achieves a very high resolution by projecting ionization tracks onto a highly granular readout. The University of Bonn develops a novel system based on reconstructing boron conversion tracks using the Timepix - CMOS based chips with 55 micrometer sized pixels operated at clock speeds up to 80 MHz. Each matrix of 256 x 256 pixels is equipped with an InGrid - microstructured aluminum meshes 50 micrometer ontop of the pixels serving as a charge amplifier. In a first prototype with 8 Timepix chips, which are arranged in parallel to a boron layer, the track topology with this unrivaled high resolution has been studied. By reconstructing the origin of the conversion ions a time resolution of <50 ns and a spatial resolution of 100 micrometer has been achieved. As this setup now allows the full reconstruction of the conversion tracks down to the electron level the understanding of the track topology can help interpreting the signals in more coarsely resolved systems. The aim of the project is to prove the feasibility of realizing a neutron Time Projection Chamber.

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