Tilman K. Rügheimer*, Thilo Michel, and Gisela Anton
Physikalisches Institut, Friedrich-Alexander-Universität

Design study of an HPD using the pixelated readout chip "Timepix" for photoelectron detection

Pixelated semiconductor sensors can be used for photoelectron Detection in an HPD vacuum tube. The feasibility of the concept was recently Shown with the production of the LHCb RICH detector system.
This paper presents our design study and first simulations of a new HPD combining the high spatial and temporal resolution of the "Timepix" readout chip (65k pixels, f=100 MHz clock frequency) bump-bonded to a silicon sensor. The detection time within a frame can be determined on a timescale of 1/f=10 ns during continuous data acquisition. Due to the signal processing and digitization in each pixel of the sensor, the HPD has excellent single photoelectron resolution. It comprises a TDC and an ADC in each pixel and can stand very high rates. Potential applications are neutrino telescopes such as KM3NET.