

Low Energy Proton Detector Using APDs for the PENELOPE Experiment

PENELOPE is a neutron lifetime measurement experiment at the Forschungsreaktor Muenchen II aiming to achieve a precision of 0.1 seconds. The detector for PENELOPE consists of about 1250 Avalanche Photodiodes (APDs) with an total active area of 1225 cm². The detector and electronics will be operated at the high electrostatic potential of -30 kV, the magnetic field of 0.6 T. This includes shaper, preamplifier, ADC and FPGA stage. In addition the APDs will be operated at 77 Kelvin. The 1250 APDs are divided into 14 groups of 96 channels each including some spare. Each group is processed by one FPGA card which reads out the 12-bit ADC with 1MSps. Also a complete new firmware was developed for the detector including a self-triggering readout with continuous pedestal calculation and configurable signal detection. The data transmission and configuration is done via the Switched Enabling Protocol (SEP). It is a time-division multiplexing low layer protocol which provides determined latency for time critical messages, IPBus and JTAG interfaces. The network has a n:1 topology and thereby reducing number of optical links.

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