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Gain suppression studies at the CENPA tandem accellerator

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PIONEER is a next-generation experiment proposed at the Paul Scherrer Institute to perform high precision measurements of rare pion decays. By improving the precision by an order of magnitude on the charged-pion branching ratio to electrons vs. muons and the pion beta decay, PIONEER will provide a pristine test of Lepton Flavour Universality and the Cabbibo angle anomaly. At the centre of the experiment, a high-granularity active target (ATAR) will stop the pion and characterise its decay. The ATAR is being designed to provide detailed 5D tracking information, allowing the separation of the energy deposits of the pion decay products in both position and time. The chosen technology is Low Gain Avalanche Detectors (LGAD). These are thin silicon detectors with moderate internal signal amplification. Several types of LGADs still under development are being evaluated to achieve a ˜100% active region, such as AC-coupled LGADs (AC-LGADs) and Trench Insulated LGADs (TI-LGADs). Since a range of deposited charge from Minimum Ionizing Particle (MIP, few 10s of KeV) from positrons to several MeV from the stopping pions/muons is expected, the detection and separation of close-by hits in such a wide dynamic range will be the main challenge. Using the CENPA Tandem accelerator at the University of Washington,we studied the LGADs response of MeV-range deposits from a proton beam. This contribution will introduce the PIONEER experiment conceptual design and its physics case. The results of the test-beam study will also be presented.

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