Proposal for a Beam PID Trigger Based on the Beamline Time-of-Flight for the ProtoDUNE Experiments

Jonathan Paley, Fermilab

Fermilab has proposed to build a high-precision time-of-flight (ToF) detector system to identify beam particles in the ProtoDUNE experiments at CERN. The baseline design of the system consists of two prototype large-area picosecond photodetectors (pLAPPDs) from Argonne National Laboratory separated by 28 meters in the H2 and H4 beamlines. The microchannel plate based pLAPPD detectors have been demonstrated to have a timing resolution of 50 ps or better. With the baseline of 28 m and 50 ps timing resolution, the system can provide greater than 3-sigma particle identification (PID) separation between pions, kaons and protons up to nearly 10 GeV/c.

The proposal here is to build a beam PID trigger based on the beam ToF system that can be used to enhance the amount of data recorded for beam

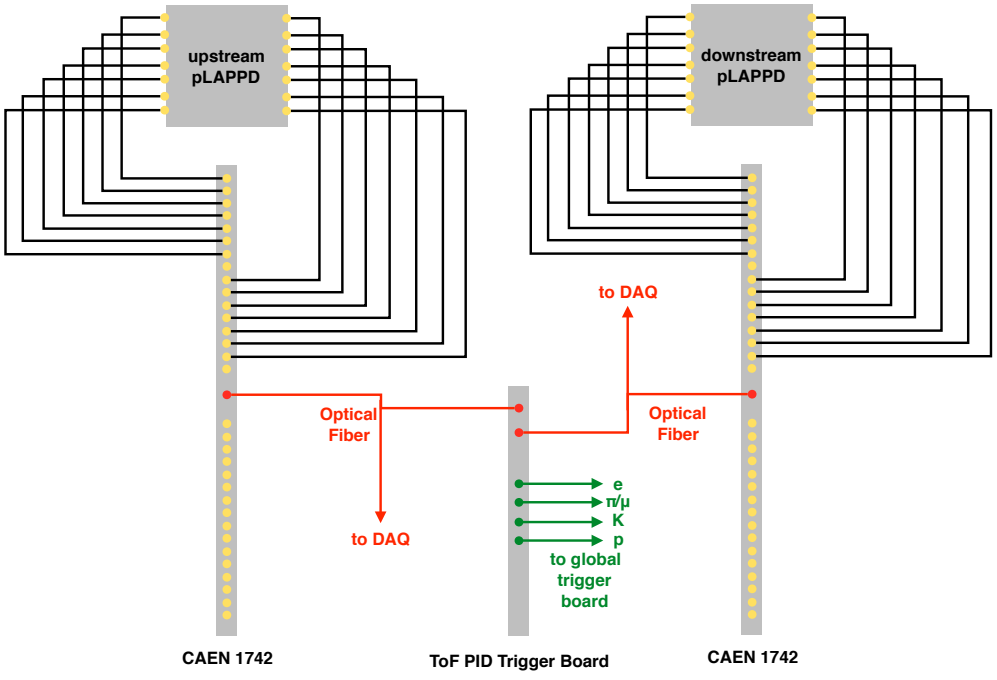

Figure 1: Schematic of the pLAPPD-based beamline ToF system, including the proposed beam PID trigger.

particle species, in particular pions, kaons and protons. A schematic of the system is shown in Figure 1. The analog signals from the pLAPPDs will go into a waveform digitizer (baseline design is the CAEN 1742 VME module). The time-stamped digitized data will be read out via a split optical fiber, one copy going directly to the protoDUNE DAQ, the other copy to the proposed ToF PID trigger board.

The PID trigger board will look for coincidences between the two ToF detectors, do some fast analysis to measure a ToF. NIM or LVDS signals for each particle type (electron, pion/muon, kaon and proton) will be sent via individual cables to the central trigger board, which will make the final decision on the trigger to record.