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Development of TPC Trigger Hodoscope for J-PARC E42/E45 hadron experiment

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We have developed HypTPC consists of TPC and the trigger hodoscope for the J-PARC E42/45 hadron experiments. The TPC Hodoscope has large scintillators of 80 x 7 x 1 cm to cover the TPC. Especially, to detect photons generated in a large area of a scintillator, a multiple MPPC signal readout is developed.
Generally, a method of applying a voltage to a Multi-MPPC is a parallel connection and a serial connection. In the case of parallel connections, a signal has a long tail due to the large sensor capacitance. MEG collaboration used four MPPC segments as a serial connection. However, in the case of a series connection, an extremely high voltage is required, and the gain is low. To avoid this problem, we have developed a method of summing signals after individually applying a voltage to each MPPC.
The multiple MPPC signal readout circuit consists of preamplifiers and a summing amplifier. The preamplifier is a differentiator circuit using an AD8000 ultra-fast opamp with short rising time. In the preamplifier, the MPPC has applied a voltage and the signal is amplified. The amplified signals are summed in a summing amplifier.
We also made a prototype detector and performed a cosmic-ray test. We have confirmed that the signal summing method has better time resolution than others. Currently, the TPC Hodoscope can simultaneously measure up to 32 MPPC signals.
In this presentation, we will discuss the function of the TPC Hodoscope's signal processing circuit and the results of cosmic ray test.

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