Contribution ID: **74**

Type: **Poster**

The trigger system for the electromagnetic calorimeter of the COMET experiment.

Thursday, 5 September 2019 16:55 (20 minutes)

The COMET detector will include a electromagnetic calorimeter (ECal). The ECal signals will used for energy deposition measurement and for triggering. For triggering, the calorimeters signals will transformed into special short-shaped analog signals. These signals will then digitally processed with special algorithm, which allows one to obtain a set of logic signals necessary for event selection and a time-tag signal for time alignment of time measurements.
The final design and performance of the front-end and trigger electronics of the electromagnetic calorimeter of the COMET experiment will be presented.

Summary

The COMET Phase-I experiment is seeking to measure the neutrinoless, coherent transition of a muon to an electron (mu->e) conversion in the field of an aluminium nucleus, mu-N -> e-N, with a single event sensitivity of 3.1*10^-15. The COMET detector will consist of several subsystem, one of each will be electromagnetic calorimeter (Ecal). The Ecal system will consists of segmented scintillating crystals (LYSO). It is placed downstream of the straw chamber detector and serves the following three purposes: to measure the energy of electrons (E) with good resolution, to add redundancy to the electron momentum (p) measurement and to provide the ratio E=p for electron identification. The Ecal will also provide an additional hit position to the electron track trajectory at the location of the Ecal, to cross-check the tracker-based electron trajectory. The Ecal also provides the trigger signals, carrying the timing with respect to which the electron events are referenced. Independent and redundant measurements of the energy of electrons are of critical importance to separate true signals of mu-N -> e-N conversion from background tracks that conspire to mimic a signal. For the photon readout will used avalanche photodiodes (APDs) with typical gains of 50–100. Due to lower gain of APDs compared with that of SiPMs, fast and low noise analogue electronics is required to amplify the APD signal. A preamplifier board was developed. The amplifier output is designed to be differential so that the signal can be transmitted over relatively long distances without suffering from noise. The front-end preamplifier board has 16 channel charge sensitive preamplifiers (CSPs) for the readout and 4 channel analog adders for the trigger. The ECAL consists of up to 2400 crystals in an approximately circular array. The trigger is required to give a good time resolution (to keep the readout windows around the trigger time as narrow as possible) and good energy resolution (so as to select energy clusters in the signal region rather than background). Since the energy deposition can be divided among couple crystals, it is necessary to do the summation. On the other hand, at E ˜ 100MeV, if from the entry point of particle to the boundary of the summation area is at least one crystal, then almost all energy will be summed. Thus, if we take the sum of 4x4 crystals, when the particle enters in the middle 2x2 crystal, effectively all the energy will be taken into account. It is therefore proposed to select the basic trigger unit (cell) the group of 2x2 crystals (corresponding to one crystal module of the ECAL), and to determine the total energy by using the sum of an array 2x2 trigger cells (i.e. 4x4 crystals). All possible combinations of the sums 2x2 trigger cells will calculated and the maximum energy found in one of these combinations will be used. Now this algorithm is implimented in pre-trigger board FPGA and whole front-end and trigger system successfully tested.

Primary authors: EPSHTEYN, Leonid (Budker Institute of Nuclear Physics); Dr GRIGORIEV, Dmitry (Budker Institute of Nuclear Physics); Mr SHOUKAVY, Dzmitriy (B.I.Stepanov Institute of Physics of the National Academy of Sciences of Belarus); Dr YUDIN, Yury (Budker Institute of Nuclear Physics)

Presenter: EPSHTEYN, Leonid (Budker Institute of Nuclear Physics)

Session Classification: Posters

Track Classification: Trigger