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SCOTT: A time and amplitude digitizer ASIC for PMT signal processing using multi time over threshold technique.

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The observation of high energy neutrinos produced in astrophysical phenomena would open a new window on the Universe. The very low neutrino cross section requires instrumented volumes at the cubic-kilometre scale. The European KM3NeT consortium is now in a preparatory phase towards the construction of such a large neutrino telescope in the Mediterranean Sea. Physics studies have shown that the Cherenkov light produced by the neutrino induced muon must be measured with a timing precision of less than 2ns RMS, and a charge estimate in a dynamic range of 1 to 100 photoelectrons. To comply with the high timing demand, a dedicated ASIC, named SCOTT, has been developed in an AMS BiCmos 0.35 μm process technology. It uses up to 16 adjustable thresholds to digitise the signals from large photomultipliers using the time-over-threshold technique. Each threshold channel is divided into three sub-circuits: fast comparators which thresholds are set by an internal 10-bit resistor string, a circular sampling memory and a “first in first out”(FIFO) digital memory. The sampling frequency is equivalent to a conventional ADC with an 800 MHz sampling clock. A detailed study was performed to process and analyse the data output of the ASIC. In particular, the choice of the number and level of the thresholds was optimised for pulses generated by a 10” photomultiplier tube. The methodology used for characterisation and the performance obtained in a broad charge dynamic range will be presented.

Authors: GUILLOUX, Fabrice (CEA); FERRY, Sophie Catherine (CEA - Centre d’Etudes de Saclay (FR)); FERRY, Sophie

Co-authors: VALLAGE, Bertrand (CEA - Centre d’Etudes de Saclay (FR)); Mr DELAGNES, Eric (CEA/DAPNIA); SCHULLER, Jean-Pierre (CEA); LOUIS, frederic (CEA)

Presenters: FERRY, Sophie Catherine (CEA - Centre d’Etudes de Saclay (FR)); FERRY, Sophie

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