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PMF the front end electronic for the ALFA detector

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The front end electronic (PMF) of the future ATLAS luminometer is described here. It is composed by a MAPMT and a compact stack of three PCBs which deliver the high voltage, route and readout the output signals. The third board contains a FPGA and MAROC, a 64 channels ASIC which can correct the non uniformity of the MAPMT channels gain thanks to a variable gain preamplifier. Its main role is to shape and discriminate the input signals at 1/3 photo-electron and produce 64 trigger outputs. Laboratory tests performed on few PMFs have showed performances in good agreement with the requirements.

Summary

The PMF (Photo Multiplier Front end) is the front end electronics designed for the ATLAS luminometer ALFA (Absolute Luminosity For ATLAS) made of 20 staggered U-V scintillating fiber layers inserted in Roman Pots (eight in total). Each of these plans is made of 64 fibers. The PMF consists of a 64 channels photomultiplier (MAPMT) and a very compact stack of three different PCBs (3x3 cm2), mounted directly on the back and in the shadow of the MAPMT: a board which brings the high voltage to the MAPMT, an intermediate board used to send the signals to connectors located on the edge and, finally, a board with the readout chip MAROC (Multi Anode Read Out Chip), directly bonded on the PCB, on one side and a FPGA on the other.

The 64 inputs MAROC ASIC allows correcting for the gain spread of MAPMT channels thanks to a 6 bits variable gain preamplifier. For each channel the signal is shaped (fast shaper, 15ns) and discriminated to produce a trigger output. A multiplexed charge output is also produced both in analog and digital thanks to a Wilkinson ADC. The main requirements are the following: 100 % trigger efficiency for a signal greater than 1/3 of a photoelectron, a charge measurement up to 30 photoelectrons with a linearity of 2 % or better and a cross talk of 1 % or less. The performances of the second version of MAROC were checked successfully during the year 2007 at LAL-Orsay. A nice dispersion of the trigger output (± 5 fC) was, in particular, observed.

A sample of PMFs was produced during autumn 2007 as a prototype. Laboratory tests were performed both at LAL and CERN respectively on the third PCB (the one with MAROC) and on a full PMF equipped with a MAPMT illuminated by a LED. They were carried out using dedicated test board and acquisition software and have allowed the approval of the design and the green light for the final production and integration with the detector.

Beam tests of a complete Roman Pot, equipped with 23 PMFs, will take place during summer 2008 for two periods and will conclude the test phase and mark the beginning of the final production.

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