

FRONTEND ELECTRONICS OF THE TELESCOPE ARRAY DETECTOR

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We report the details of the design and performance of the frontend electronics of the Telescope Array detector which will be built to record the passage of extremely high energy cosmic rays through the atmosphere via air fluorescence. We have already developed the third version of prototype of the frontend most electronics module, so called "Signal Finder prot-3 (SF3)", to be installed for many input channels of PMTs and tested if it can provide good performance for the aim of mass production. The advanced features of SF3 are: 1) AD conversion with 12-bit resolution and 5MHz continuous sampling using a pipelined ADC chip. 2) 16-bit dynamic range using High/Low 2-range scheme at the frontend charge successive integrators (CSI). Here the least count sensitivity is taken equal to one photoelectron in 200ns integration time. 3) on-flight software recognition of fluorescence signal by the DSP attached to each channel. 4) the recognition results every 25.6μ are sent to the trigger module, so called "Track Finder (TF)", which generates event trigger after searching for a track in 3-dimensional space; XY (camera) and T (time) coordinate by software. The on-flight software on individual DSP has been completely developed as well as the hardware. The results of the SF3 performance are demonstrated calculating the final detection sensitivity from our simulation study and field experiments with a prototype telescope and a camera system.