Contribution ID: **53** Type: **Poster**

FAD - a Modular Assembly of the Fast and Portable Front-End Channels for the ALICE TRD Testing Bench

FAD-a modular assembly of the fast (320 MHz input pulse BW at 20 Db gain factor) and portable (120x30 mmˆ2 PCB per 4-input unit) front-end electronic channels, each aggregating linear adders, amplifiers, LED type threshold discriminators and output ECL shapers, has been designed to implement primarily the ALICE TRD testing bench. An initial series of the FAD based modules is prepared to provide triggering and registering events within a 160-output scintillator system, which verifies the ALICE TRD chambers by using cosmic or X-rays.
The FAD concept is mainly distinguished by a widely extended input dynamic range, allowing to registrate and to discriminate the detector signals of 1.1 ns rise time and 20 fC charge as minimum.

Summary

The present R&D is aimed at creating a newly compact, portable and rather fast
appliance, performing the mostly used input front-end functions of an analog channel within conventional detector electronics, and also allowing an experimentator to use it as an elementary unit while composing a stack of these channels in quantity over the limit assigned per unit.
In distinct from schematics of any wide spread manufactured signal discrimanators, the given FAD (Fast Adder/Amplifier/Discriminator) deliver physicists a feasibility of linear, prompt on the FAD inputs, summing any random selected pairs of detector signals with next amplifying pulse sums by a gain factor of 10 or 20.
This featuring leads to some FAD's advantages such as an extended dynamic range of accepted detector signals, and a better signal to noise ratio as well.
Another distinction is the FAD can admit signals coming both from a scintillator with an attached PMT, and/or from a MWPC-like detector; that goes right because of input high voltage capacitors foreseen as optionally mounted in the FAD boards.
A basic FAD unit handles up to 4 input signals accepted thru high-frequency on-board coaxial connectors. The unit contains two identical channels, where each channel comprises a linear adder of 2 detector signals from the adjacent inputs, a fast amplifier of the sum pulse, a high-speed leading edge discriminator (LED) of this amplified sum, and a fast ECL- compatible output signal shaper as well.
Due to application of the best slew rate commercial SMDs, like 1 GHz operational amplifiers and high-speed comparators from ADI, the FAD is able to support 320 MHz input pulse bandwidth at the 20 dB gain factor.
Therefore, the basic FAD unit, of the 120x30 mmˆ2 printed circuit board (PCB) dimensions, can be taken for a very fast and wide range front-end cell.
It goes to sum, to amplify, and to discriminate, according to regulated threshold settings, 4 detector signals of above 1.1 ns rise time and 20 fC charge as minimum, producing 2 balanced (+/-) and their "OR" ECL signals in outcome.
The first series of NIM standard modules, based on the FAD units, is prepared to provide triggering and registering events within a 160-output scintillator detector system, which is under construction to verify the ALICE TRD chambers by exposing them in cosmic background or stimulated X-ray radiation.
Each of those NIM front-end electronic modules accumulates an assembly of 4 basic FAD units, thus providing 16-input (8-channel) segment of the system. There are also some additional schematics to elaborate an accurate setting of the controlled FADs'

threshold, and to convert all FADs' "OR" ECL signals into 2 output NIM-level signals of an adjusted duration.
The series of 10 manufactured modules, lined in a system row, where discriminating threshold can be set either separately for each module, or jointly by a "daisy-chain" for a group of applied modules, completely cover all needs of the pointed 160-output(80-channel) ALICE testing bench, which should be considered like a pilot experience to further application and development of the FAD concept.

Author: Dr EFIMOV, Leonid (Joint Institute for Nuclear Research (JINR))

Presenter: Dr EFIMOV, Leonid (Joint Institute for Nuclear Research (JINR))