Clover Electronics Module for INGA at NSC

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A proptotype NIM module containing Shaping amplifiers, TFAs. CFDs and logic circuitry for processing signals from a Clover detector has been developed. The circuits are realised in High density daughter card form using SMD components, while keeping the features and specifications at par with commercially available modules. The module has been tested successfully in-beam with INGA-HIRA setup.

The experimental facility like INGA consists of a large number of HPGe detectors. Each channel requires a Spectroscopy amplifier, Timing Filter Amplifier (TFA) and Constant Fraction Discriminator (CFD) and associated Logic circuits. Typical commercial electronic setup would require a large number of modules which occupy large area, interconnecting cables and connectors. The NIM module developed at NSC contains five channels of electronics to accommodate one clover with accompanying anti-Compton shield. The content of this double width NIM module is shown in fig 1.
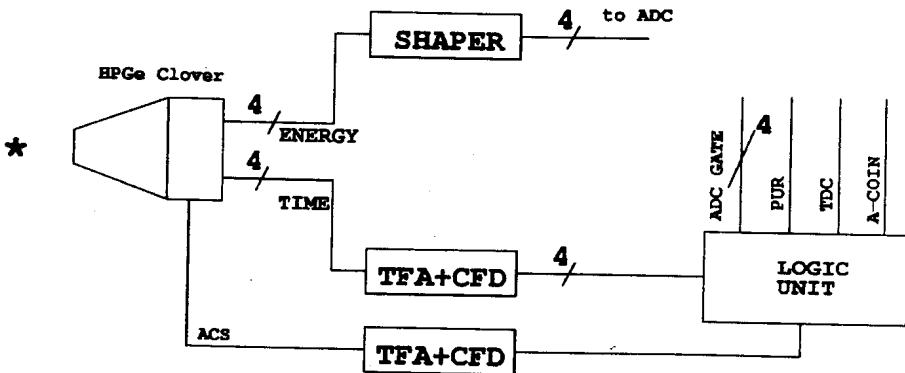

Fig 1: Block diagram of Clover Electronics

The high resolution spectroscopy amplifiers have fixed 3µs shaping constant and 3 fixed gain settings (1.5, 3 & 6 MeV) which are jumper selectable. The DC baseline is stabilized with Gated BLR, while P/Z and BLR (manual) threshold adjustments can be remotely voltage controlled. The unipolar output has the dynamic range of 8 volts across 50 ohms.

Four TFAs with fixed time constants and gain settings are provided for processing TIMING signals from Clover detector. The TFA is designed with single CFA gain stage and baseline is stabilized with twin diode restorer and high input impedence buffer. These amplifiers have rise time of better than 10 ns across their dynamic range of ±2.5 volts across 100 ohms. The CF Discriminator with amplitude & risetime compensation (ARC) is realized with fixed delay of 25 ns and fraction of 0.3. The Lower Level Threshold, WALK adjustment and Monitoring are possible on front panel. The CFD outputs from the individual Clover elements with width of 50 ns and dead time of 2 µs are available internally.

Anti–compton shield signal received from preamplifier is processed with identical TFA + CFD as mentioned above but without dead time. The raw timing logic signals received from CFDs from Clover detector and ACS detector are further processed to affect Anti–coincidence. The TFA and CFD outputs from the ACS are available on the front–panel for ease of adjustment. The logic functions performed are Pileup Rejection, Individual ADC GATing, Anti–Coincidence output and Delayed STOP signal for TDC. All these logic outputs are buffered and available in standard logic levels on the panel.

Performance

The module has been subjected to various tests at NSC with ^{60}Co and ^{152}Eu sources and in beam, in parallel with commercial modules. The typical results obtained are :

Resolution: 1.3KeV (122KeV), 2.0 KeV (1408 KeV) of ^{152}Eu @ 9 Kcps.
Integral non–linearity: ± 80 eV for ^{60}Co spectrum .
Stability: With ^{60}Co, no significant shift observed at 6 kcps in 55 hours.
The results obtained from in beam test will be reported.

Acknowledgement