Contribution ID: **157** Type: **Poster**

Common control and readout board for the Calorimeter and Tracker Front-end electronics of the SuperNEMO experiment.

Wednesday 25 September 2013 18:20 (1 minute)

SN_CROB board is the common Control and Readout Board for the Calorimeter and Tracker Front-end electronics of the SuperNEMO experiment.
SuperNEMO is the next-generation (0□□□) experiment based on a tracking plus calorimetry technique. The demonstrator is made of a calorimeter (700 channels) and a tracking detector (6000 channels). These detectors front-end electronics use an unified architecture based on similar crates. SN_CROB board gathers the front-end data from the calorimeter or tracker FEBs and sends them through Ethernet link to the DAQ. It extracts the Trigger Primitive from the front-end data and sends them through serial link to the Trigger Board.

Summary

Experimental search for the neutrinoless double beta decay (0□□□) is of major importance in particle physics because if observed, it will reveal the Majorana nature of the neutrino (□=□) and may allow an access to the absolute neutrino mass scale.
SuperNEMO is the next-generation (0□□□) experiment based on the technique of tracking and calorimetry detector. The construction of SuperNEMO demonstrator (one module) has started in 2012 and its installation is expected in 2014 in the Modane Underground Laboratory (LSM) located in the Frejus tunnel in France. Competitive results are expected by 2015.

The SuperNEMO demonstrator module is designed to measure both energy and time of flight of each beta particle emitted from □□ decays in the central source foil and to reconstruct their trajectories in order to guarantee the signature of 0□□□ decays.
The demonstrator is made of a calorimeter (700 channels) and a tracking detector (6000 channels). These detectors front-end electronics use an unified architecture based on six similar crates that each host up to 20 Front-End Boards (FEB) and one SuperNemo Control and ReadOut Board (SN_CROB).

The Calorimeter Front-End Board (FEB) is a 16 channels board, which performs the acquisition of the calorimeter channels. This FEB works on the principle of circular memory using a 40 MHz clock reference and a sample frequency between 1.28 and 3.2 GHz.
The Tracker FEB is a 108 channels board, it performs the acquisition of the tracker channels. The Tracker FEB is based on a specific time stamper ASIC dedicated to the time measurement of Geiger cells with a resolution of 12.5ns.
If a first trigger occurs in due time, the corresponding data are sent through the backplane from the Calorimeter and /or Tracker FEBs to the SN_CROB.

The SN_CROB board gathers the front-end data from the calorimeter or tracker FEBs and sends them through Ethernet link to the data acquisition (DAQ) system. It extracts the Trigger Primitive (TP) from the front-end data and sends them through serial link to the Trigger Board (SN_TB). Moreover SN_CROB distributes the clock, the trigger and the control signals for all the boards in a crate. It can also provide its own clock. On each SN_CROB, four Fe-PGA each receive the data from five FEBs and one Ctrl-PGA (the board driver) performs the actions which are not specific to a data channel and is in charge of copying and sending through the experiment's control system the data stored into the Fe-PGA for spying purpose.

With respect to trigger, we extract the TP from each Fe-PGA and send them to Ctrl-PGA. Then from the Ctrl-PGA, we compute the TP and build the Crate Trigger Word (CTW) which contains informations about hit

multiplicity, particle zoning and event identification. It is sent to the SN_TB through serial link.
Concerning data, they are extracted from each Fe-PGA and sent to Ctrl-PGA which then sends them to the DAQ through Gigabit Ethernet transceiver. The communication between FPGA is ensured by a dedicated protocol based on a parallel interface for byte transmission.

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Session Classification: Poster