ICARUS Data Acquisition Meeting


A.R. introduced the meeting recalling that we have decided to produce a short document that describes the DAQ system.

The solar neutrino events selection and the related background rates have been studied in previous proposals and presented recently in the Technical Memo ICARUS–TM–97/05. In the note only the background events that can generate tracks with energy greater than 5 MeV were considered as significant. This is considered the threshold for a solar neutrino analysis. Considering the ICARUS detector equipped with neutron and photon shield, the main background source is the natural radioactivity in the Hall that can produce up to 3 events/day above this cut.

For the online data reduction operation, Daedalus chip is requested to select signals above 500 KeV with ≈100% efficiency (3 fC = 18500 e− or ≈9/10 ADC counts), so, taking into account the foreseen electronic noise (≈100×200 KeV equivalent), the wire threshold should be around 300 KeV. Therefore any event depositing energy down to ≈300 KeV will produce visible data after the Daedalus. At this stage the rate of events to be expected in the 600 ton with such a low threshold is difficult to estimate. It was agreed that an online data acquisition event rate of 1 KHz is reasonable and tolerable.

It was suggested to decide as soon as possible the implementation of the DAQ. A.R. described briefly a possible DAQ structure, already presented in the previous meeting, that foresees online filtering in order to reduce events rate. He suggested that the final selection of the events should be based on large volume information, centralizing as much as possible single hit information from all the wires (one single unit or at least one unit per half module).

A.K. presented the data rates expected in this new scenario, underlining the necessity for online filtering. After discussions, it was agreed that one should assume the following figures:
• data acquisition event rate 1KHz
• minimum time window (Daedalus) 64 or 128 samples around ROI
• Daedalus 16 channels at a time trigger + 16 channels left + 16 channels right
  ⇒ 16 x 3 x 3 views x 128 samples x 2 B/event
  ⇒ 40 KB/event
• total data rate 40 MB/s
• estimated yearly produced data without online filtering: 1200 TB (~120000 tapes of 10 GB)
  • it would require a tremendous effort to build an offline analysis system that is capable of handling such data volume.

A.K. pointed out that there are two possible solutions proposed so far:
• The first solution consists of a quasi online filtering system where all the data are read out and stored in an online database. The database will allow for a delayed processing of the data by a farm of workstations. The delay can be used to calculate precise calibration and detector status data.
• The second solution consists of a highly scalable online filtering system. Here the hits are extracted from the raw data on crate level and sent into a decision tree which calculates energy sums and performs tracking for low energy data. Energy sums and tracks are used to select events. Only for accepted events will the raw data be sent from the crates into the database for offline analysis. Both solutions have advantages and disadvantages: the first solution would offer the possibility to use calibration data and detector status information obtained in an intermediate analysis step, while the second one is more scalable and will not require a large online database.

A.K. also explained that it is quite conceivable to design a system that can be used for both solutions: in the beginning of data taking all data are stored and as the understanding of the detector and confidence into the filtering algorithms increase more filtering will be performed online, thus reducing the output rate considerably.

It was agreed to design a "Quasi Online Filtering" system able to collect 1 KHz of raw data (40 MB/s) and scalable until 5 KHz (200 MB/s). A.K. and S.V. will write a document illustrating the proposed DAQ system.

F.P. recalled that there is the possibility to use the collection signals in order to enable the Daedalus acquisition of induction signals, in order not to suffer from a priori worse S/N on induction planes.
It was suggested that the analog sum of the wire signal, available on each analog board, could be exploited to perform an external fast trigger logic. Further studies are needed to understand the usefulness and the implementation of this option on the DAQ structure described above.
S.C. pointed out that it has never been studied how to combine signals coming from the crates and how to distribute the necessary signals (such as the absolute time marker) to all the front end boards. Inside the group of PD there is not enough manpower to face this new task, so it was suggested to ask to the Executive Committee and to the Collaboration to organize a working group on the global control signals generation and distribution.