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G. M. Bilei, O. Ciaffoni, M. L. Ferrer and L. Trasatti:

A CONTROLLER FOR DATA ACQUISITION FROM STREAMER TUBE CALORIMETERS

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In a calorimetric apparatus such as NUSEX or the proposed Gran Sasso experiment the signals coming from the read-out strips are discriminated, shaped and loaded into a chain of shift registers.

The data are then read out serially by a dedicated controller. It performs clustering and data transfer to the host computer.

We have built a controller[1] which is characterized by a microprocessor that controls the acquisition. The main features of this controller are:

a) very short acquisition time;

b) low cost.

Every controller has a TEXAS INSTRUMENTS microprocessor (TMS 9995) which controls the whole process. Data are transferred from the shift register to an internal RAM at a frequency of 1 MHz without any processing.

Immediately after the transfer the apparatus can go back to data acquisition mode, to minimize the dead time. The data stored in memory are then processed (clustering etc.) by the processor. Results of the elaboration are then transferred to the host computer where they are recorded on tape.

The prototype for the readout of the LeCroy(x)/SGS(o) cards has been built and tested using a CANDI 2 (microcomputer system designed in LNF)[2-9].

(x) LeCroy Research System Corporation - STOS I 4200 card.
(o) SGS-ATES Componenti Elettronici S. p. A. - Announced.

A standard CANDI 2 CPU board has been used, and a wire-wrap interface card has been built to interface the processor to a number of readout channels (this number can easily be adjusted). The final system will be built on a single card (CAMAC or EUROCARD) removing from the CANDI 2 CPU board some unnecessary items and adding the interface chips.

The main characteristics of this controller are:

1. Readout clock: 1 MHz.
2. Data are read in parallel from several (4-8) shift register chains. The full information from 4 readout channels (e. g. 4 wire planes in the Mont Blanc experiment) is stored in a time slightly longer than the shift time (1 microsecond/4 channels).
3. The preprocessing (clustering etc.) is carried out after the apparatus is back in data acquisition mode. The dead time is thus minimized because, if a second event happens while the preprocessing is being carried on, an interrupt to the CPU stops the elaboration and stores the second event in RAM (in the usual CANDI 2 configuration, 80 events fit into the RAM space). After that the CPU continues the elaboration of the first event.
4. The transfer of preprocessed data to the host computer takes place while the apparatus is in data acquisition mode.
5. The readout time is independent of the event configuration.
6. It is possible to test the shift register chain of the readout electronics injecting data at the beginning and reading them out at the end.

The acquisition time measured to read the whole apparatus (assuming 1600 strips per plane of detector) is:

1. 94 msec if every controller contains 4 channels;

3. 42 msec for controllers with 8 channels.

Note again that this is the total dead time, while in the existing systems the data transfer time to the host computer must be added.

The prototype has been tested using a plane of 32 tubes and one LeCroy readout card (Model 4200 card, the same used in the Mont Blanc experiment). We have collected data from cosmic rays, and from electrons coming from a radioactive source (Sr^{90}).

The link to the host computer will be performed either on a serial high speed line using the ETHERNET local area network or via CAMAC building an interface between the RAM of the controller and the CAMAC dataway.

REFERENCES

(1) - G. M. Bilei, Sistema di acquisizione dati a microprocessore per un rivelatore calorimetrico, Tesi di laurea, Università di Perugia (1983).

(2) - O. Ciaffoni et al., A CAMAC system controller using the TEXAS TMS9900 microprocessor as stand-alone and PDP11 connected unit, Frascati Report LNF-80/27 (1980).

(3) - O. Ciaffoni et al., Il nodo intelligente di acquisizione dati da CAMAC "CANDI", Frascati Report LNF-81/25 (1981).

(4) - O. Ciaffoni et al., Data acquisition system for cosmic ray muon background tests under the Gran Sasso tunnel, Frascati Report LNF-81/36 (1981).

(5) - O. Ciaffoni et al., CANDI, a microprocessor based CAMAC acquisition system with distributed intelligence features, Proceedings of the Summer School on "Data Acquisition for High Energy Physics", Varenna (1981).

(6) - O. Ciaffoni et al., CANDI, a microprocessor based CAMAC acquisition system with distrihuted intelligence features, EURATOM-ENEA Report 81.55 (1981).

(7) - M. L. Ferrer, CROSS-ASSEMBLER for TEXAS TMS9900 microprocessors, Frascati Report LNF-82/28 (1982).

(8) - R. Bertoldi et al., CANDI 2, un sistema di acquisizione dati CAMAC a microprocessore con interfacce verso calcolatori DEC e grafica a colori, Frascati Report LNF-82/85 (1982).

(9) - O. Ciaffoni et al., CANDI 2: Description and user manual, Frascati Report LNF-83/67 (1983).