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ELECTRON TAGGER TRIGGER AND DAQ

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This note gives a suggestion for the method of triggering and data acquisition for the electron tagger and luminosity monitoring for H1. The total number of channels is small - perhaps 80-100.

The tagger has two separate functions:

1. **Detecting Photoproduction.** For this one requires to send a trigger to the central trigger for combining with a calorimeter or other trigger to form a photoproduction trigger to initiate a normal readout of data. The rate of the electron tagger element will be high (perhaps 10^6Hz). The physics rate is of course only about 30Hz[1]. If the rate of coincidences with the calorimeter is still too high for final data recording (as seems probable) some additional counting down can be encorporated to give an appropriate final trigger rate. The trigger from the tagger logic must reach the central trigger unit at a fixed time relative to the beam crossing which was the origin of the event. This time must be not later than 20 beam crossings after the beam interaction.

   According to MC simulation, in order to select hadron photoproduction events (to have background from proton-residual gas interaction smaller than 10%) it is sufficient to detect one or two particles in backward part of main detectors and to estimate energy release in CBC, BBE and BWE calorimeters. Hence may be there is no need to have for electron tagger its own subsystem trigger controller. Probably it could parasite on the controller for one of the main detectors.

   The data will be put into a FADC which should be in a small FADC crate which has to be controlled with its own processor to extract only the relevant data. It is not sensible to mix with normal DC data in one crate. Relevant data will be only a very few well defined time slices since the signal is from a photomultiplier which gives good timing. A full scanner system should not be needed. The readout will then occur in the normal way as for the tracking data.

2. **Luminosity Monitoring.** For this one requires a stand alone system which counts events that satisfy an appropriate coincidence between the electron tagger and the forward γ-detector designed for luminosity measurements. For this purpose there must be no connection with the central trigger and DAQ at the single event level. It is anticipated that the trigger will be initially hardware based on discriminator outputs and relevant clusters finding between the two detectors. It is believed that this will need refining by software selection on-line in a processor which would need access to the pulse height in each of channels of each of the elements of both detectors. A 100MHz FADC is again the natural way to get the data to the processor but it is not possible to use the same FADCs as for the main data path as the luminosity monitoring data must be read both more frequently and completely out of synchronism with the main H1 data and thus with the photoproduction system. Hence we propose a second parallel FADC on each channel. A quite separate dedicated processor would be needed so that the data can be read out and processed on its own local trigger. The rate will be high, but provided the number of clusters is counted, it does not matter that it is significant.

   There is no need to record individual event data for off-line analysis. All that needs recording is the number of satisfactory monitor events. Hence a counter on these is needed which can be accessed by the central data acquisition system at regular intervals. One possibility would be to use one or more of the user scalars in a sub-system trigger controller. These scalars are quite numerous, so there should be no problem. Their contents are automatically recorded along with each normal event.

The preliminary block diagram of the first level electron tagger trigger is shown on Fig. 1. The cluster finder can be based on fast pipeline with boolean network. Procedure of the cluster finding is necessary because of the lack of discriminator method for cases when detected particles drop on the edge cells of Cherenkov hodoscope. The relevant "boolean pair" of cluster stop ADC and initiate the readout of constant part of data. After that ADC continue to operate in usual regime. Since the signals from photomultiplier should be measured with accuracy better than 1% (high space resolution requirement), it is necessary to have at least 8 bit (or more) ADC.

The FADCs could be F1001's, in which case the two sets would have to be in separate crates (they could be cheap low power crates and would not need the expensive high power ones needed for the DCs). Alternatively DL3000's could be used in two crates (again only requiring a single low current power supply).

References:

|1| S.V. Levonian et al, H1-report TR-113, October 1987

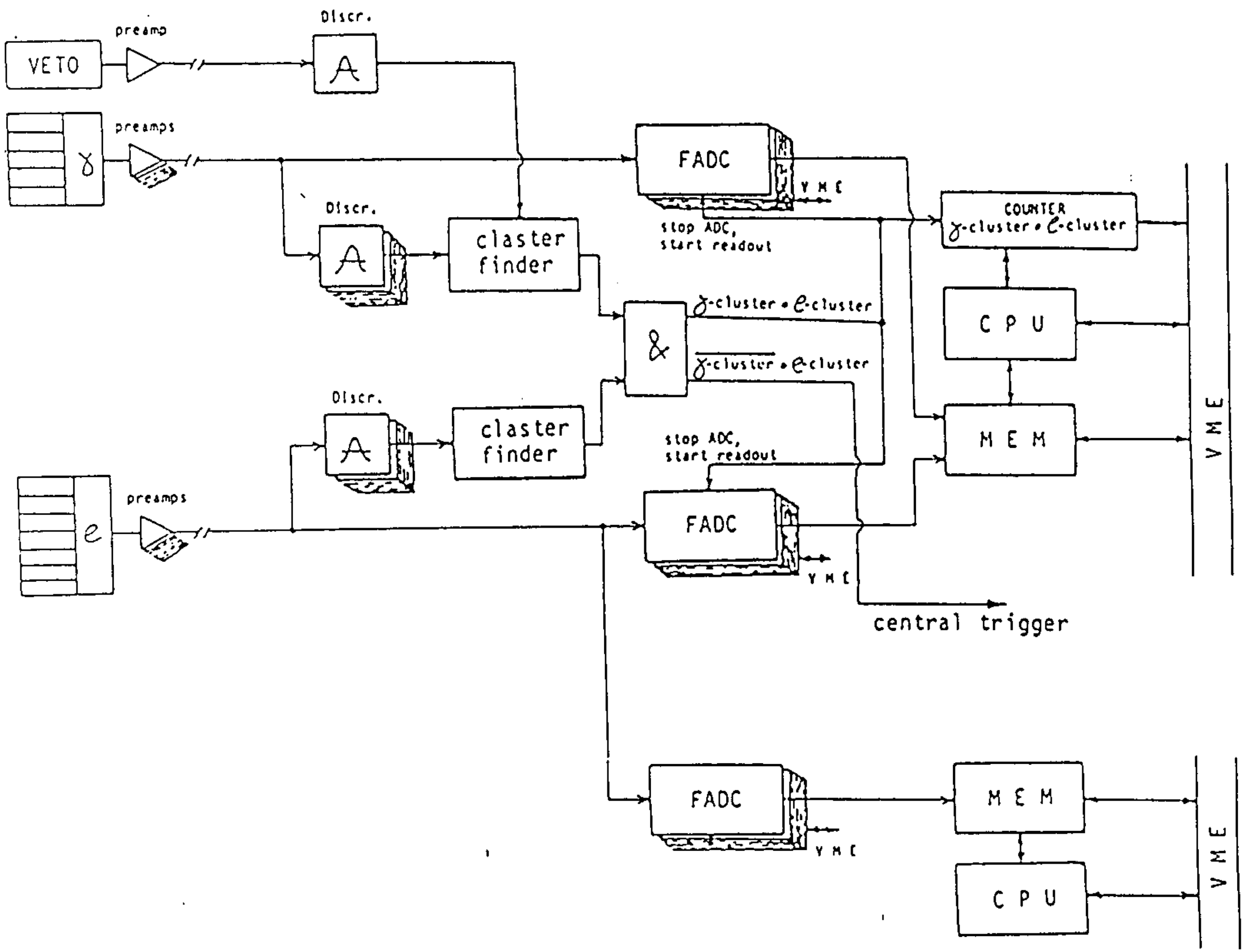

Figure 1.

Biock diagram of the first level luminosity monitoring and electron tagger trigger