SANE Triggers and DAQ

Triggers that will exist from GEP-III:

* **HMS single-arm**
* **Bigcal single-arm**
* **HMS & Bigcal coincidence**
* **Cosmic**
* **Laser for gain monitoring**
* **Pulser for pedestals**
* **Force Sync and scaler read (every 2 sec)**
* **Helicity Gate**

SANE Triggers

For SANE, need one extra trigger: Calorimeter AND Cherenkov. This will be primary trigger for production running.

Needed because Calorimeter-only rate expected to be 50 to 100 kHz (mostly π^0 events).

Coincidence rate with Cherenkov expected to be about 1 to 2 kHz (including accidentals), of which about 50% will pass off-line software cuts for good electrons.

This will work if Cherenkov rate below 1 MHz for a threshold that gives reasonable efficiency.

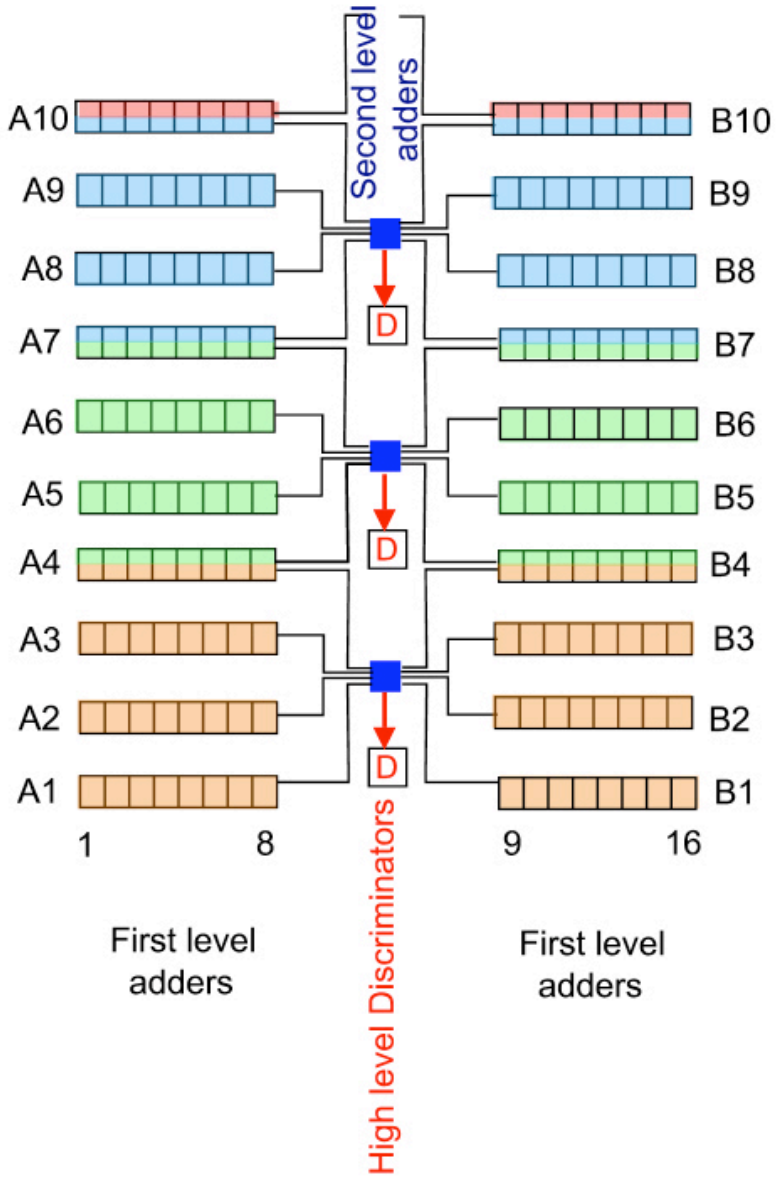
Tests during GEP-III will test assumed BigCal and Cherenkov rates in conditions similar to SANE (although without the target magnetic field)

BigCal

Bigcal trigger sums groups of 64 blocks, each of which then passes through a discriminator

The 40 groups are ANDED together to form a master BIGCAL logic signal

First and second level Adders, high level Discriminators



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CFP

Cherenkov

The signals from the 8 Cherenkov PMTs will be analog-summed using a spare BIGCAL summer, and the output will pass through a discriminator and be logic ANDED with the BIGCAL trigger to form the master SANE trigger. This will use existing standard NIM modules.

Backup Plan I

If the test run shows much higher Cherenkov rates than expected, can lower accidental rates towards acceptable level using programmable coincidence box which will only allow the physically allowed BIGCAL groups associated with a particular Cherenkov mirror.

This module was used in HKS for a similar purpose. This will require a separate discriminator on each Cherenkov PMT, and will have reduced efficiency and increased complexity.

Backup Plan II

If trigger rates still too high (>4 kHz), we will increase BigCal threshold. Rates drop VERY quickly with increasing threshold, with only a small loss of physics (I.e. lowest Bjorken x, the least important for the d_2 moment).

Careful gain matching of PMTs will optimize performance (planned to be done continuously using π^0 mass from 2 gammas, after initial calibration with e-p elastic events)

DAQ

Same as for GEP-III (trigger supervisor in Hall C, etc.). Total trigger rate including prescaled calibration triggers during normal running, and coincidence rate for BIGCAL calibration runs, are expected to be below 2 kHz in all cases. Comfortably within present Hall C DAQ capability.

Event size should be similar to GEP-III. Extra words from tracker, Cherenkov, and Lucite TDCs (and ADCs for all but tracker) partially offset by lower luminosity, so less BigCal hits.