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Rate Monitoring and Triggers
Target–DAQ IF

- **Introduction**
- **Requirements:**
  - ▷ Target Steering
  - ▷ Rate Determination & Monitoring
  - ▷ Emergencies
  - ▷ Distribution of Wireposition
- **Target Setup 98**
- **Pretrigger Capabilities:** muon and ecal
- **Interfaces to other Trigger Levels** SLT, FLT ?
- **Emergencies, Vetos**
- **Summary, List of Requests**

Reminder: Target Requirements

- 40 MHz while 10^7 sec/year $\Rightarrow$ reliable and save operation, low backgrounds and no spikes to achieve high running efficiency

- i.a. equally distributed on all wires

- constant rate only small fluctuations, similar contributions from all bunches

$\Rightarrow$ efficient monitoring is required:

- challenge (problem) - highly selective trigger: > 6 orders of magnitude (B's on tape in sub Hz region). I.e. from farm output one will not learn much about initial rate behaviour.

- ideal case: to know for each bx the number of interactions, the wire on which they took place and the number of background tracks

- real experiment - capability is rather limited, should aim and work for an efficient monitoring:

  global rates with high precission

  bx-bx variations and fluctuations in time

  distribution on wires

  timing of interactions, ...

Target: Counter Setup 98

- **Triggerring:** has to be removed
- **Si-Pad:** exit window of VDS-vessel, a=$\mathcal{O}(1\%)$
  $\Rightarrow$ effort to understand the system, stability ?
- **Veto Counters:** 2 sets, similar to 97
- **E-Beam Counter:** similar to 97 (space ?)
- **TMS:** at least in 1. target station
- **Charge Integrators:** for all wires
  $\Rightarrow$ effort: calibration, stability ?
- **Bar Counters etc.:** install several scintillating counters on main platform (and muon ?) if there is space
- **Info from HERA-B Detector:**
  - ▷ μ-pretrigger
  - ▷ ECAL-pretrigger inhibit
  - ▷ SLT-vertex

What does the Target Provide

- rough independent rate determination $\mathcal{O}(10\%)$, time integrated measurement of individual wire contribution, monitoring of background (p and e)
- external info (HERA, ZEUS, ...) as in 1997
- Emergency/Interlock System with HERA:
  ok to move wires, emergency retraction by HERA, beam dump interlock by HERA-B, ...?
- fluctuation monitoring and timing monitoring
  (40 MHz FADC and $\mathcal{O}$(GHz) FADC)
- part of interfaces to pretrigger and SLT (subject of further consideration) and maintenance of monitoring
- distribution of information:
  DB (and sharc to SLB ?)

Rate Measurement and Monitoring

- targetsteering: no high precission required, but very reliable and deadtimeless rate
- 'luminosity' determination
  delievered-lumi = interaction rate (pretrigger)
  taken lumi - counting of B's or $J\psi$'s to monitor eg. efficiency of triggers (?)
  $\Rightarrow$ high precission
- tuning & optimizing target operation: distribution on wires, bunch contributions and periodical fluctuations
- understanding the trigger !!!
  cp. examples with bx-bx or peridical rate fluctuations or nonuniform distribution on wires
  $\longrightarrow$ where have all the B's gone
  $\Rightarrow$ important to put effort into the monitoring schemes, possibilities at least to me not really clear

$\Rightarrow$ what can we do

Pretrigger Capability

only pretriggers receive unbiased information
$\Rightarrow$ most qualified systems for global rate monitoring, incl. all kind of fluctuations and variations.

- ECAL-pretrigger inhibit (cp. next talk)
  - ▷ very precisse, MC-errors should be small
  - ▷ VME-IF on card
  - ▷ sharc-IF (20 MB/sec)
  - ▷ analog or digitial (1bit) output could provide a easy reliable signal for target steering

- Muon pretrigger second system very valuable for cross check
  - ▷ technical realisation seems to be more difficult, detailed discussion necessary
  - ▷ capability to measure in addition asymmetries for time integrated measurement of individual wire contributions

Calibration ? $\leftarrow$ GEANT

$*$ we need the information for the calibration of our small acceptance counters

SLT for Vertex Distribution

in 2nd step of SLT at least for potential B events the vertex (which wire) is determined
$\Rightarrow$ use info for equalization of i.a.'s on wire

- ▷ only small rate $\mathcal{O}(1\ \mathrm{kHz})$, i.e. 100 Hz per wire
- ▷ info distributed over 200 nodes, how to get it out ?
- ▷ already a large bias on sample

Random Triggers

because of the high reduction factors in our trigger chain, we should foresee a powerful random trigger system

- ▷ take events from each individual bunch
- ▷ SLT vertex distribution seperated between accepted events and random triggers

Info from FLT and FARM
efficient monitoring strongly required to setup and understand the systems

Distributing the wire Position

wire thickness (50-100μm)
movements: typical less than 1μm/sec
only in emergency cases more (20μm/sec)
time stamp exact within 1 sec

- ▷ DataBase as in actual configuration
- ▷ ethernet broadcasts etc., e.g. only if position deviates more than 1μm.
- ▷ write position with a sharc into a SLB

Emergenmcies & Veto System

one needs some connection to the control system, e.g.

- ▷ everything ok, target can be moved, or inhibit target operation
- ▷ one could even imagine a forced retraction of the targets in an emergency case
- ▷ inhibit beam dump, e.g. beofre HV down, VDS and RF-wires retracted
- ▷ ...