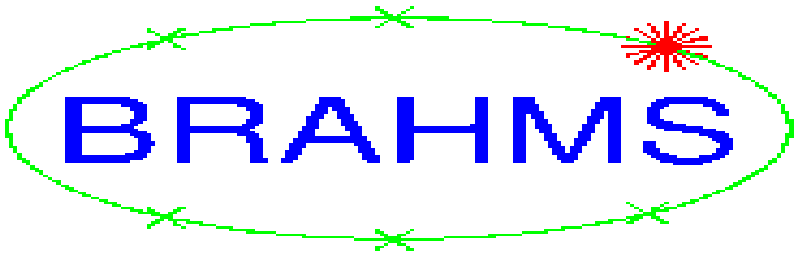

DAQ situation
Trigger Setup and Considerations
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DAQ issues

Konstantin left BNL recently, for Triumph.

- Major setback for development of new DAQ features
- Loss of expertise in diagnosis hardware problems (VME, HV,FASTBUS..)
- Tasks covered by KO

1. Front end code Event builder, event pool, Run Control
2. Database storage (RUNDB)
3. TPC pedestal program
4. Data formats mapping of detectors.
5. HPSS access
6. HV systems
7. Utility scripts for operator.
8. Interface to RHCI CDEV (magnets read…)
9. Problem diagnosis
10. Cluster maintenance and upgrades

Dealing with DAQ

- The DAQ system is in fact up and running –
- Developments for this years run can be kept small
  - Adding of modules, Camac Fastbus
- Shared responsibility until more permanent solution can be found.
  1. Front end code, Event builder, event pool, Run Control
  2. Database storage (RUNDB)
  3. TPC pedestal program (*JIJ)*
  4. Data formats mapping of detectors. (*KH,FV*)
  5. HPSS access
  6. HV systems (*software – Truls, CEJ) hardware - RAS*
  7. Utility scripts for operator.
  8. Interface to RHCI CDEV (magnets read…)
  9. Problem diagnosis
  10. Cluster maintenance, networks and upgrades (B.McBreen)

Introduction

- **Expected Beam Rates**

Beam	Luminosity	Min Bias	Central (10%)
Au+Au	2 10**26	1,200	120
(EM)	2 10**26	2,000	
Si+Si	4.4 10**28	75,000	7,500
p+p	10**31	400K	-

- In 2000 run the luminosity was at end having ZDC minimum bias rates of about 200. (10% luminosity), albeit with a very large *diamond* size. (sigma~(cm)
- The diamond size will be about 5n sec ~ sigma 20-25 cm.

Triggers used in 2000 run.

- Beam Beam Counter derived triggers.
  - #1 requiring >= 3 hits in Right and Left array Big tubes.
  - #5 Requiring >=2 hits in Right and left with a wide time gate (10nsec)
  - #6 Requiring 2 specific tubes in left and right array hit with a narrow time window,
- ZDC
- # 4 Min bias for EM and nuclear cross section. Threshold about .3 neutron at 65 GeV (25 mV).
- Synchronization #8 . trigger at a rate of ~ 1 sec.

Criteria for triggers

- Reduce DAQ rate
  - Reduction of overall amount of data written
  - Keep dead times at reasonable levels (<50-70%)
- Select rare event.
  - Must be efficient i.e. reduction factor >2-3 at least for events of interest
  - Must be unbiased
- Keep the number of different triggers as small as possible.
  - Simplicity in analysis

Triggers in 2001 running

The triggers must be better organized, and less ad hoc than was done this year.

Min Bias trigger to be downscaled.

- Au-Au running based on ZDC 1n-1n.
- Min bias interaction trigger –
  - Spectrometer data requirement
  - Be at least 80% of interaction

Centrality trigger; a 10-20% trigger

BB based on small tubes count (non-linearity does not matter;

Tiles multiplicity

Rhic-clock based (scaled down by large factor to give a rate in the order of ~1 /sec or less the data stream. The possible configurations are listed. Note that not all are possible in given fill, and depends on requests by experiments

- Collisions with filled beam bunches in both directions
- Only one bunch filled
- Both bunches filled

Spectrometer trigger requiring hits in H1 and H2 for complete tracks. The usefulness of just requiring H1 and H2 depends on background and will have to be studied with the real detector. This may also require implementation of

Data-rates and dead time.

The Brahms triggering is event driven.

The original proposed physics program is based on collecting ~50 central events/sec and up to 200 other with a DAQ dead-time of up to 50%.

The basic readout time for the TPC is given by the following estimates.

1. Drift time in TPCs 22 cm/ (1.4 ?sec/cm) = 15 microsec.
2. Transfer time to readout board 1152*157 [timebins]*20 [sec] / 2[words/transfer] = 1.8 msec.
3. The data transfer introduces additional dead time from the receiver board of the pedestal-suppressed data to PPC via the VME back plane. This is the largest contributor in the present setup.

The readout of other components i.e. Fastbus and Camac are all below about 1.5 msec and do not contribute significantly to the dead time.

Comments and note

- ZDC signal arrives earlier by 40 nsec (installation of faster cables)
- Take the min bias interaction from req. any one or two big tubes in each side
  - The large tubes are well aligned to start with.
  - Simple circuitry.
- The choice of BB vs Mult tiles should be based on merit. Needs justification and evaluation of efficeincy
- Spectrometer trigger
  - Logic should be setup, and bit-latches made so we can evaluate from early runnir how well this works
- Vertex selector
  - Implement TAC (gated by some int, and start-stop left right). Can probably not b level one. Should be looked into.

Level 0 and 1

Level 0 trigger (pre-trigger)

A level 0 trigger is used to start up the following activities

1. Send a signal to the TPC gating grid, and the trigger/clock VME module.
2. Send the gate to the camac TDC's and Fastbus ADCs.
3. Start the logic to wait for level 1 decision, and interrupt of DAQ. This logic also generates local busy for the level 0 electronics.
4. Some of the level 0 triggers are in fact also level 1 i.e. they should be accepted regardless of the a later veto decision, other are really only pre-triggers. The circui should be divided in a nice way to make this veto override clear.

LVL1 decision

– Can be made at any time following the LVL0 and before either the ~10 ?sec TP(drift time, or the MPI (Measure Pause Interval) on the Fastbus modules.

– Level 1 decision comes in two flavors.

- – A positive decision based on one of the LVL0 triggers i.e. they must be accepted. E.g. scaled down Beam-Beam. (veto override)
- – A veto decision e.g. by a vertex selection circuit, or by a 'better' tracking. Th will be started up e.g. by Beam-Beam requirements; or by H1&H2 requirements.

Work to be done

- Alignment of trigger times at LVL0 start
  - Can be done now either at input, .
  - Re-sync with RHIC clock for beam related triggersaor with a re-sunc with the rhi clock for beam related events.
- Implementation of level 1 i.e. fast clear circuits.
- Some easier handling of non beam-based triggers i.e. pulsers, LED etc.
- Utilities – scripts, programs to setup beam-beam, monitor scalers must be written and improved.
- Considering building most of this into a VME module. Could be ready sometime during the run, not at beginning.
- Investigate effectiveness of FS trigger
  - Using existing data
  - Evaluating from MC.
  - Evaluate what additional electronics might be needed.