Trickle Injection Tests

The Main Issues for BaBar:

• Is radiation dose tolerable for BaBar?
• Can we keep trigger rate under control to take data with minimal deadtime?
• What is the optimal strategy to veto data from injection periods – preserve data background uniformity for physics analysis (if detector occupancy very different from normal, we may not want to use the event even if we can take them).

Will address only the last two points in this talk.
Basic Setup & Observations

• A LER injection trigger was used to drive a blanking gate to the fast control system, vetoing L1 triggers within a few ms after injection. A 3-5ms gate was sufficient to steady datataking.

• Detector data still showing effects of injection induced large occupancy events ~10ms after injection.

• Had significant dead time without blanking gate -> learned a dataflow->event level node distribution scheme deficiency. An improved scheme is being tested.

• A higher fraction (5% ) of L1 pass throughs are logged by L3 and a 30Hz cyclic pulser added to sample random beam crossing background for analyses.
Data for the Tests

Looked at data from runs 26400, 26403, 26404 (LER trickle injection with no trigger veto)

• Occupancy tests:
  Compare injection trigger itself with cyclic+pulsers triggers. Cannot look at subsequent injection bunch crossings easily for unbiased occupancy tests without a fixed delay trigger from the injection trigger.

• L1 Trigger and event size time structure
  Using all triggers or L1 pass throughs to enhance statistics in noisy regions -> normalization for absolute rate hard to work out, but good enough to see time structure.
Occancy check:

EMC clusters
Injection trigger itself
vs cyclic/pulsers.
(normalized to same
number of events)

One possible explanation
for the EMC occupancy
dip in outer endcap is the
Background source is
near the forward Q2.

May also explain IFR
forward endcap trips?
LER injection vs Pulser-cyclic (Feb/02)

Occupancy check

Detector data volume (in KB)

(again only for the LER injection trigger itself)
**L1 Time wrt LER Injection**

Time – Inj as a modulo 2 x ring turn of 873 ticks is done for only events 0.3-6ms after LER Inj.

*Trigger time within \( \pm 6 \) ticks (\( \pm 100\)ns) from Injection bunch crossing*
L1 pass through trigger only and within 0.3-6ms after LER Inj.

Detector occupancy fluctuations also confined to $\pm 20$ ticks ($\pm 330$ns) around the injection bunch crossing (even for the EMC !)
Average event size (KB) for L1pass events falling into the narrow window of injection bunch crossing. (blue line is normal condition L1pass size)

Unfortunately, it takes ~12ms to really quiet down.
Are early burst events after injection (<300μs) similar to the events in the aftershock (1-6ms)?

L1 passthrough triggers within narrow window of injection bunch return.
More comparisons: Immediate vs. later after LER injection

L1 pass EMC (LER Inj. Bunch Returns)

- No. of T50 EMC bumps
- EMC bump time
- EMC bump energy
- EMC energy sum
- EMC bump phi
- EMC bump theta

L1 pass Tracks (LER Inj. Bunch Returns)

- Tracks per event
- Track Q/Pt
- Track d0
- Track z0
- Track Phi
- Track theta
L1 pass FCT Lines (LER Inj. Bunch Returns)

More Comparisons:
Immediate vs. later after LER Injection.

L1 trigger types
Tickle Injection Veto Strategy

- Injection background fluctuations confined to narrow windows of ±100ns for L1 trigger and ±330ns for detector occupancy.
- Injection background fluctuations continue ~12ms after injection.

If injection rate is 1Hz:

a) Veto whole 12ms -> 1.2% dead time.

b) Veto whole 5ms -> 0.5% dead time.
   but suffer detector occupancy variation.

c) Veto ±400ns around injection crossing for 12ms
   only pays for 0.13% dead time.