Trickle Injection Status & Plans

Injection Background Monitoring

BaBar Data Acquisition

BaBar Detector Performance / Physics Analysis
Injection Background Monitoring

Trigger Monitoring

Times for each trigger generated
Current live display tool
Update at 1Hz
No deadtime
Capable for neutral and tracking triggers
Routinely archived

EPICs scalars summary
Used for setup/tuning (correlation plots)
Not archived
Detector Monitoring

BaBar readout and fast monitoring
Under development
Occupancies, Total Charge/Energy
Sample ~5 passes per injection
update at 20sec - 2min
Monitor detector exposure (protective)

Possible example
30 minutes of statistics
June 13, 2003
EMC extended readout
Special configuration
  not during BaBar data taking
  Ad hoc setup
  Hardware conflicts with interim
  trickle injection setup

Sample 136 usec (544 usec) per injection
  scan completes every ~10 seconds

Routinely archived during injection
  Not in a public database yet (SCP Hist)

No live display tool developed
Injection Background History
Bucket Dependence Monitoring

Data from the BIC
Routinely archived
Correlate to trigger monitoring
- tricky

No live analysis developed yet
Target output for SCP History
BaBar Data Acquisition

Deadtime ~ >10% (June 2002, 2003)
Due to small number of CPU intensive events in L3 Trigger processing
Solved by buffering upstream of the processing

Remaining Deadtime ~ 2-5% (June 2003)
Due (mostly) to DCH readout of rapid succession events with large DCH occupancies
    An anticipated bottleneck for future Lumi upgrade scenarios
    A proposal to fix is being drafted; 2 years to a solution

Mitigate deadtime by inhibiting detector readout during selected time intervals
    +-300 ns around passing of the injected bunch (determined by trigger time resolution)
    for the first 5-15 ms after injection.
    Choose as small a window as possible to remove the deadtime.
Inhibited time = 600ns x 10ms / 7.336us x InjectionRate = 1% at 10 Hz injection rate

An interim implementation is ready, a stable long term solution is being developed. The sampling triggers for detector readout of injection monitoring are tied to the implementation of the inhibit.
Interim solution:
Sampling triggers are generated on random passes of the injected bunch within a defined window (5-15ms).

Long term solution:
Sampling triggers are generated in a programmable sequence of passes of the injected bunch.

Interim solution may require frequent expert tuning
Delay generator clock is not tied to PEP-II clock (over 5-15 ms duration)
Least significant count is 39 ps =>
39ps x 10ms/7.336us = 50 ns (compare to 600 ns)
BaBar Detector Performance / Physics Impact

What is the impact of using trickle injection data for physics analysis?

Backgrounds are elevated for > 10 milliseconds

Example Studies:
DCH Tracking

Simulate an inhibit of +/- 500ns around injected bunch.
EMC Pi0 Mass Resolution (preliminary)

Within 1.5 usec inhibit window

Typical

Outside 1.5 usec inhibit window

Typical
Summary

BaBar needs to provide tools for injection monitoring and, likely, someone to monitor them.

Careful tuning is necessary to control large timescale backgrounds, but they will still exist.

Tuning / setup might be able to control HER injection backgrounds - needs to be demonstrated (or at least tried).

BaBar incurs readout deadtime at a fundamental level. A readout inhibit is necessary to mitigate deadtime. Inhibit deadtime ~ 1% at 10 Hz injection rate.

Physics samples may exclude 1 us x 10ms/7.336us x injectionRate = 1.6% rejected Lumi Overlaps (completely) data acquisition inhibit window.