Level 1 Three Track Trigger Board Shutdown Status Report

Trigger Hardware Group

October 24, 2003

Pre-shutdown status

- Three 3 track boards assembled
- Much 3 track development over the spring and summer
  - Firmware modifications
  - Front end code amended to accommodate either 2 or 3 track trigger board manually
  - Simulation code was developed
- Primary struggle was the interface with the XTRP data boards
- By September simulated track data piped through board gave satisfactory results

Beam Data Analysis

- Test with beam run just before the shutdown
- About 120,000 events to tape

- Have spent much of shutdown evaluating simulation and 3 track trigger word discrepancies
  - Led to some simulation modification
  - Uncovered OR-ing problem
  - Discovered some firmware errors

Simulation

- XTRPSim code is modified to simulate 3tt board
  - 3TrackTrigger file parallels TrackTrigger
  - Uses a tcl toggle to select 2 or 3 track simulation
  - Not yet been added to package
- Some modification after beam test, now operates as expected
- Helped track down firmware error sources
- Led to unpleasant discovery

Board Algorithm Problem

- Phi and Pt mapping done in separate rams
- As-is, the board ORs all phi rams together BEFORE they bits are ANDed with pt rams
- Thus for some events, there is no meaningful correlation between phi and pt cuts
- Not a fatal error, but will require some further board modification
- Plan to debug board completely first

Firmware Errors corrected

- Found one of the combinatorics was incorrect
  - 689 was 669, simulated this effect
  - Errors disappeared
- Discovered FPGAs that accept tracks were not all getting correct track list
  - Due to timing errors
  - Correction of this will apparently fix most remaining problems
  - New firmware has been tested
    - fixes most track list errors
    - fixes most trigger word errors

Sanity checks

- Verified no 3 track trigger bits are set for events where no tracks are passed
- Ran over data, flagging bogus triggers
  - That is, if bit for single track of pT > 7 Gev is set, then bit for single track of pT > 3 GeV is also set
  - Good check that there is no random trigger bit selection
  - Used 15 such tests and found no flags set
- Plan to expand these checks to include entire run
  - Current statistics at about ~20,000 events

Status Summary

- Plan to continue testing during shutdown
  - Front-end automation will be ready for testing next week
  - Plan L2 torture tests using fake tracks from beam errors to statistically confirm timing errors solution
  - Complete sanity checks
- Upon completion of these tests will request beam test
  - only need COT/XFT
  - low luminosity is fine
- Explore algorithmic alternatives