

# L1CTT Status Report

Brigitte Vachon  
FNAL

on behalf of the L1CTT group

# Outline

---

- Recent developments and firmware status
- Monitoring/data quality
- Performance
- Trigger simulator (tsim\_l1ft, tsim\_l1fps)

# Recent Developments

---

All personality codes (front-end mapping) are in place

- CFT axial

- CPS axial

- CPS stereo

- FPS

Providing data to L2 pre-processors

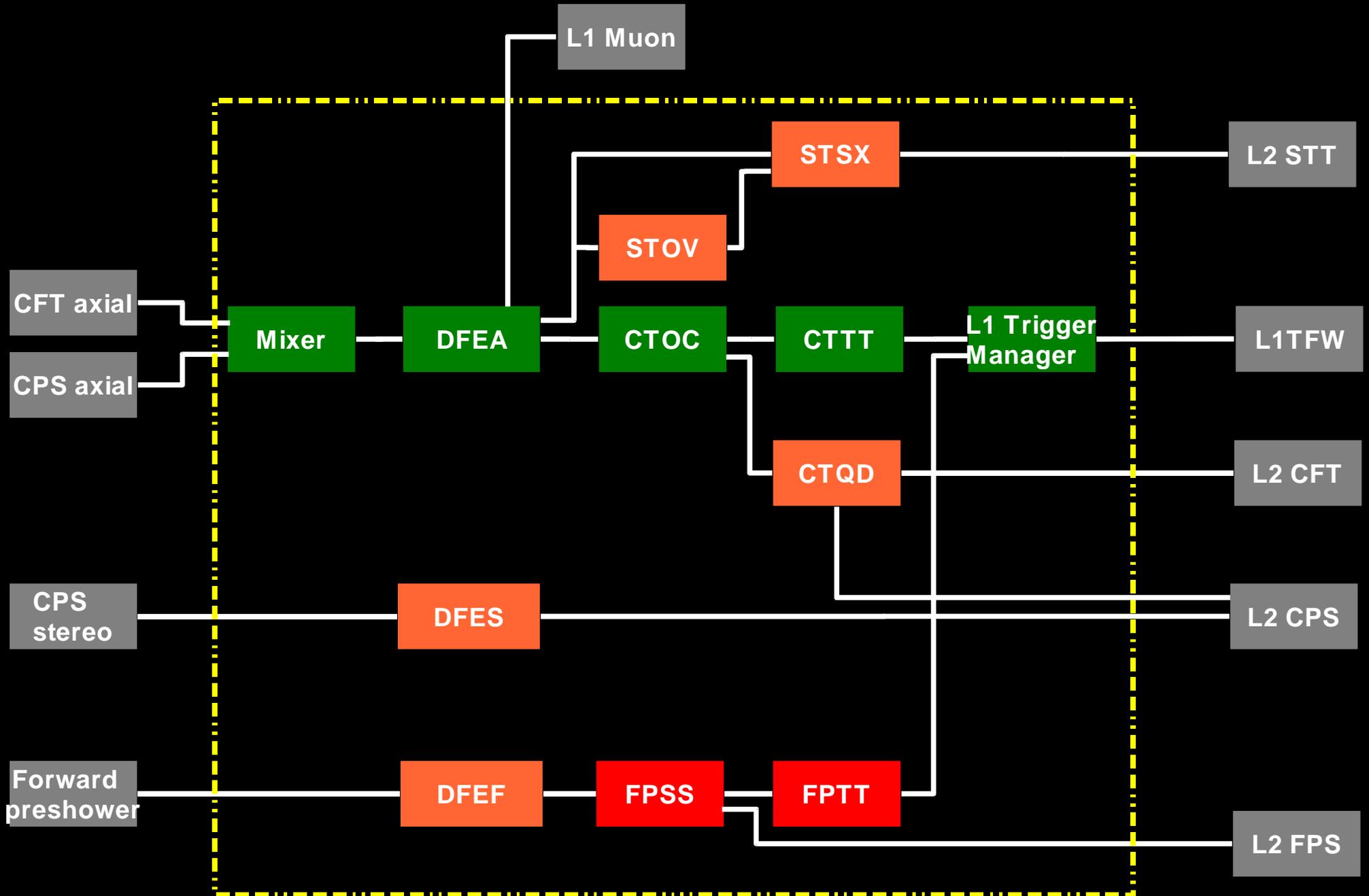
- CFT/CPS axial

- CPS stereo

- STT (capability to send test vectors)

In the process of certifying the CTT inputs

# L1 Central Track Trigger Firmware Status



# A/O Terms implemented

---

TTK(1,x)

- One track with  $pt > x$  ( $x = 1.5, 3, 5, 10$  GeV)

TTK(2,x)

- Two tracks with  $pt > x$  ( $x = 1.5, 3, 5, 10$  GeV)

TIS(x)

- Isolated track with  $pt > x$  ( $x=5, 10$  GeV)

TIL

- Isolated track with low home-sector occupancy  
with  $pt > 5$  GeV

TIQ(x)

- Isolated track in quadrant  $x$  ( $x = 1,2,3,4$ ) with  $pt > 5$  GeV

THT(x)

- Total fractional doublet hits occupancy in CFT  $> x$   
( $x = 5, 10, 20\%$ )

# CTT Monitoring/Data Quality

---

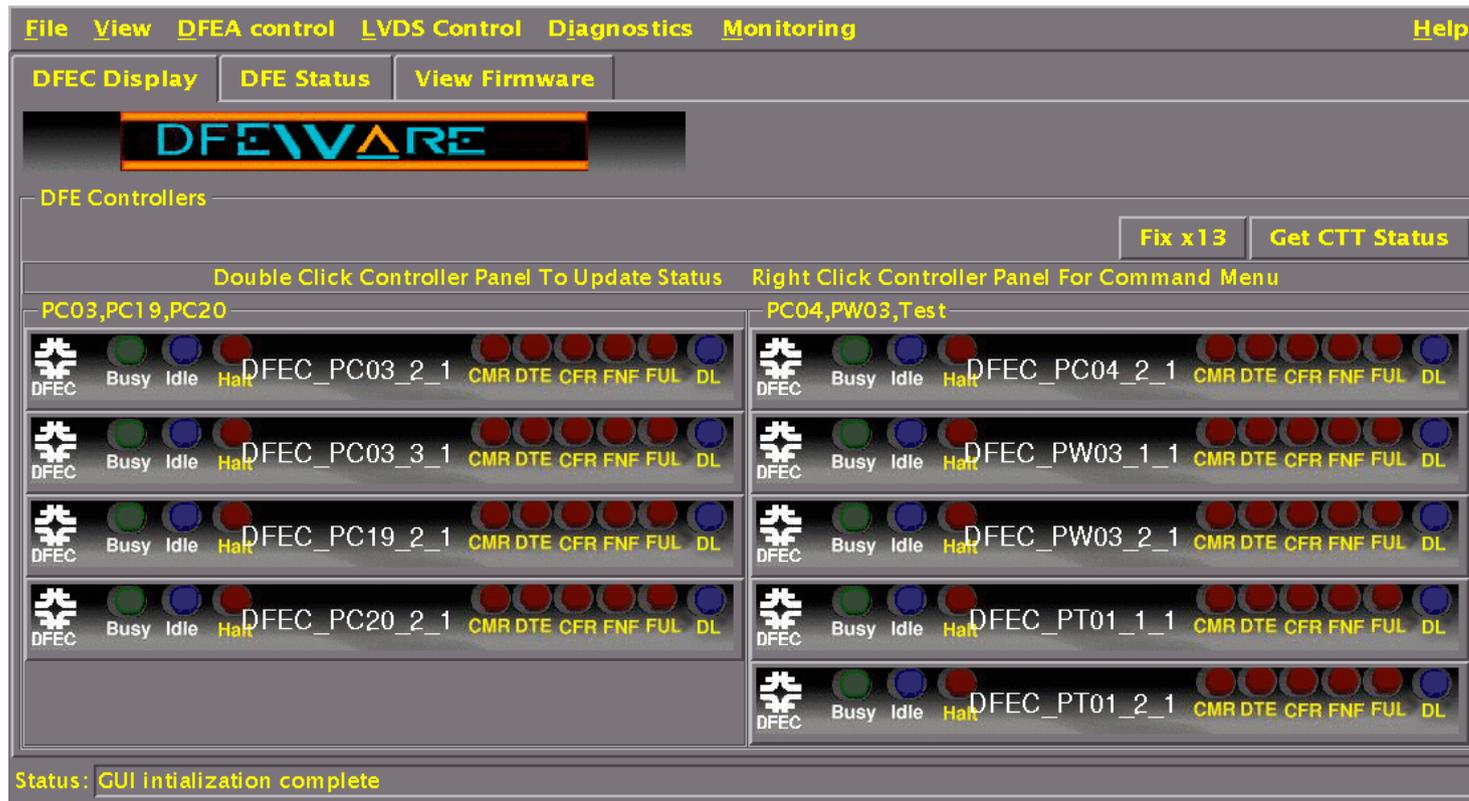
- Hardware monitoring (CFT shifter + CTT experts)
- CTT Examine compares data vs trigsim online (CFT shifter + CTT experts)
- A/O Term rates (CFT shifter + CTT experts)
- L1 xsec monitoring (CTT experts)
- Run quality database (CTT experts)

(Need to add CTT histograms for GM)

# Hardware Monitoring

## More than 100 DFE boards with over 840 FPGAs

- Status of firmware initialisation, firmware version
- Error bits: synch status, missing links, etc.
- Can inject test vectors into readout chains at almost every point



# A/O Term Rates Monitoring

The CTT A/O term rates are sensitive to any changes/problems/noise in the AFEs.

## Tool **AOTmon**:

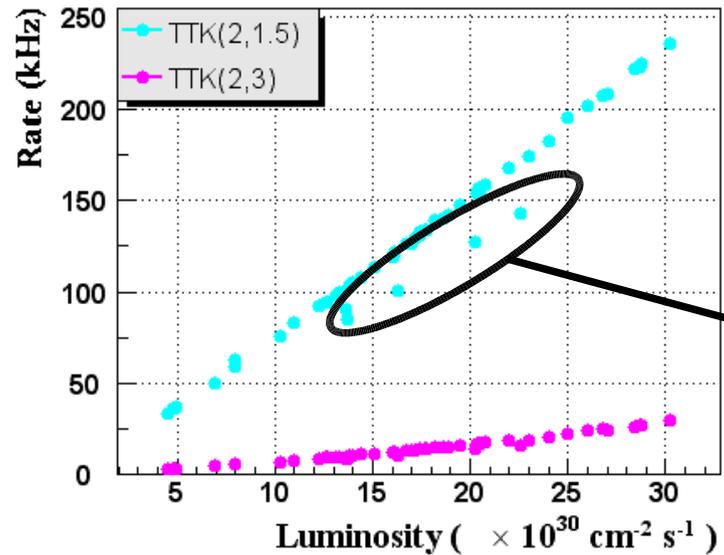
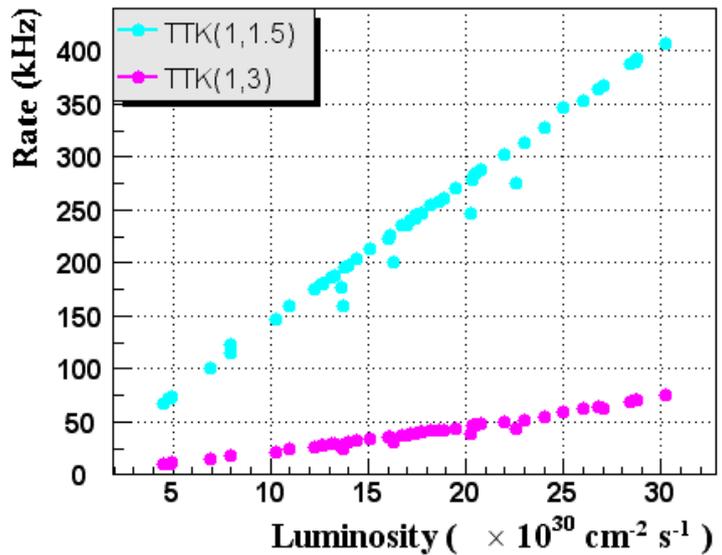
- CFT shifter takes 'snapshot' of rates for each new physics run.
- Info stored in ASCII file
- Can plot rates vs lumi/run

Could be useful for other trigger groups  
Many possible improvements

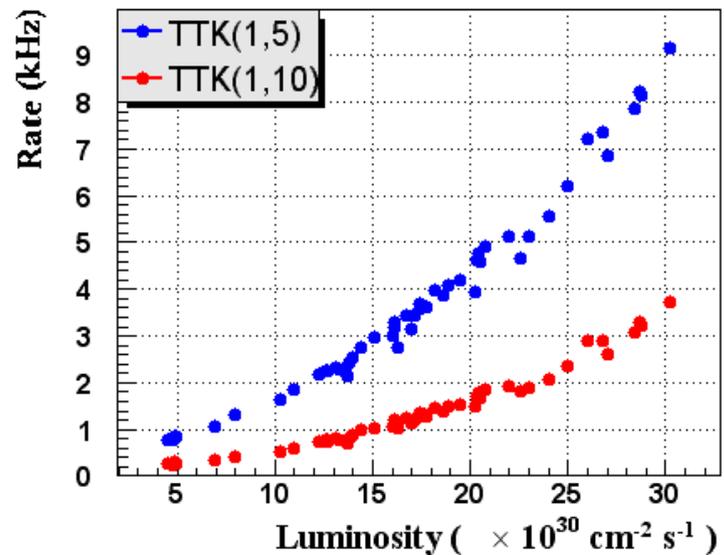
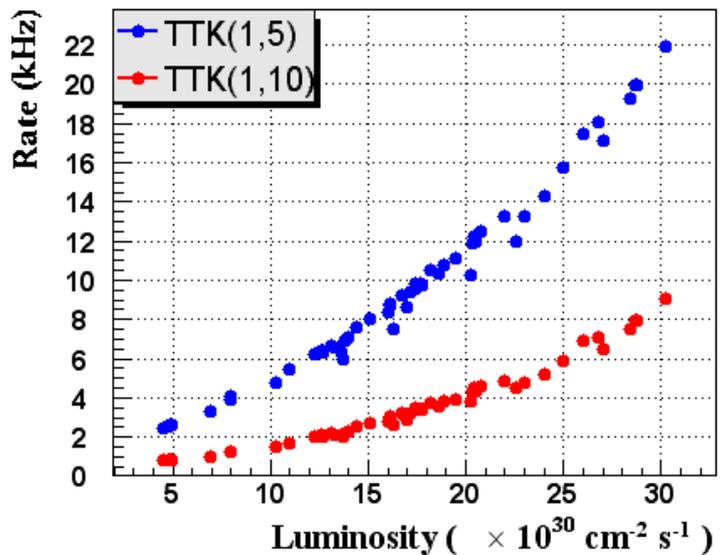
The screenshot shows the AOTmon software interface. At the top, there is a 'File' menu. Below it, a date and time display shows 'Wed May 28 22:23:46 2003'. There are input fields for 'Run Number' and 'Luminosity', with 'E30' displayed next to the Luminosity field. Below these are labels for 'L1 Accept' (448.687 Hz) and 'L2 Accept' (83.395 Hz). A table displays A/O term rates for various A/O numbers (0 to 11). The table has columns for A/O #, FIFO, Syn Err, Fired (Hz), and A/O. The 'Fired (Hz)' column shows values of 0.0 for A/O 0-10 and 0.0 for A/O 11. The 'A/O' column shows values of 5 for A/O 0-10 and 6 for A/O 11. A 'Take Snapshot' button is located at the bottom of the interface.

A/O #	FIFO	Syn Err	Fired (Hz)	A/O
0	21	0	0.0	5
1	21	0	0.0	5
2	21	0	0.0	5
3	21	0	0.0	5
4	21	0	0.0	5
5	21	0	0.0	5
6	21	0	0.0	5
7	21	0	0.0	5
8	21	0	0.0	5
9	21	0	0.0	5
10	21	0	0.0	6
11	21	0	0.0	6

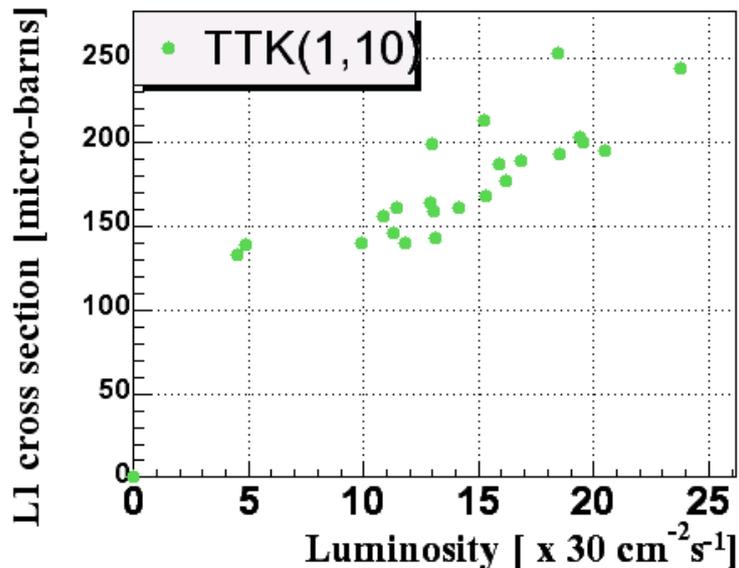
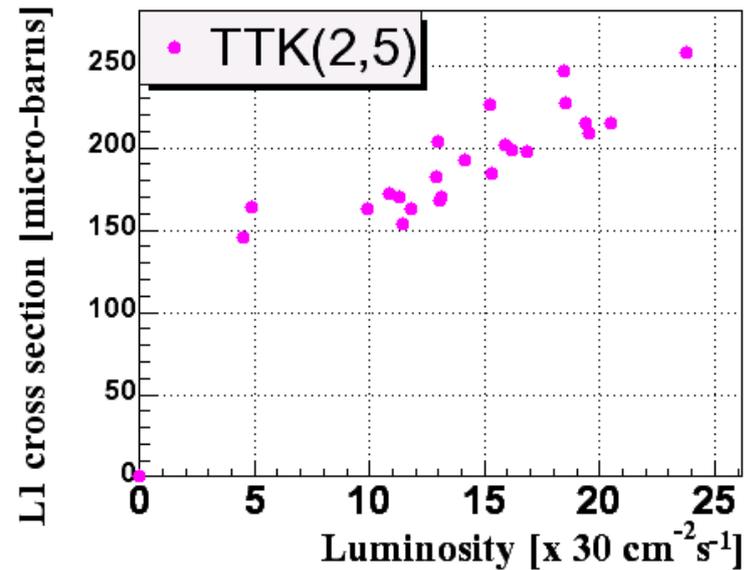
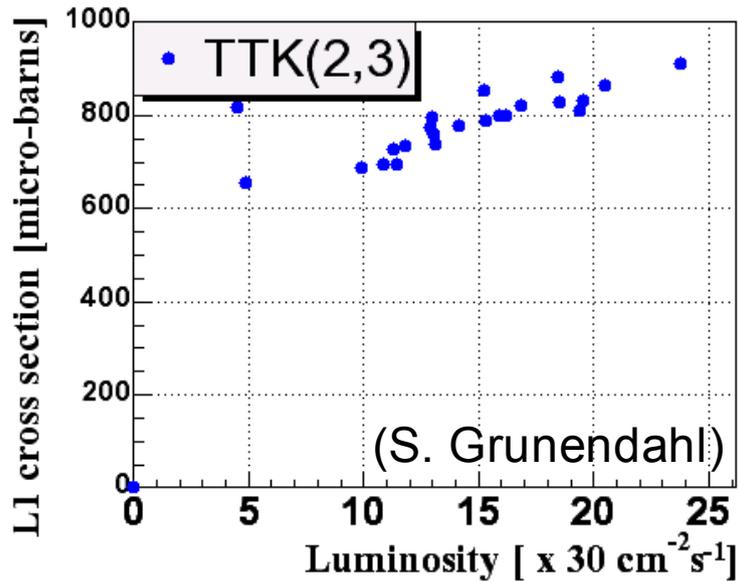
# TTK Rates vs Luminosity



Power Supply  
9A and 11B off



# L1 cross-section Monitoring



At the moment, using private code. (See Terry's talk this afternoon)

# Run Quality Database

- CTT has an entry in the run quality database
- Updated on a weekly basis by the CTT on-call expert (based on CTT checklist in the e-log)
- Developed "user-friendly" interface (to make it as painless as possible)

Component	Run Quality	Notes
Run Quality:	Reasonable	
L1CFT	Reasonable	Crate x13 out of the run
L1CPS	Reasonable	
L1FPS	Reasonable	
L1MUON	Good	
L2CFT	Reasonable	
L2CPS_AXIAL	Reasonable	
L2CPS_STEREO	Reasonable	
L2STT	Reasonable	
L2FPS	Reasonable	

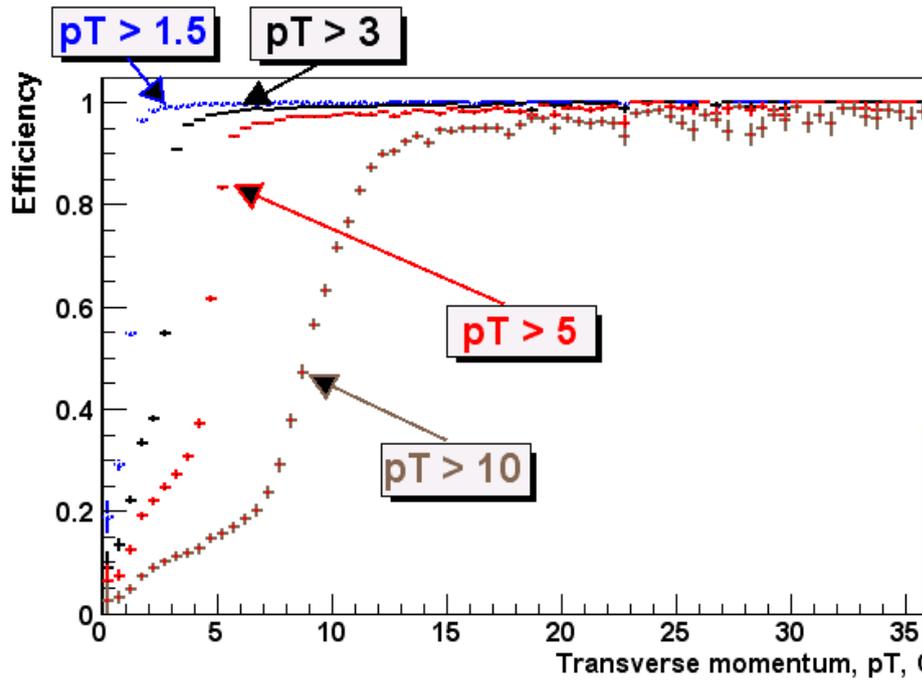
# L1CTT Performance

---

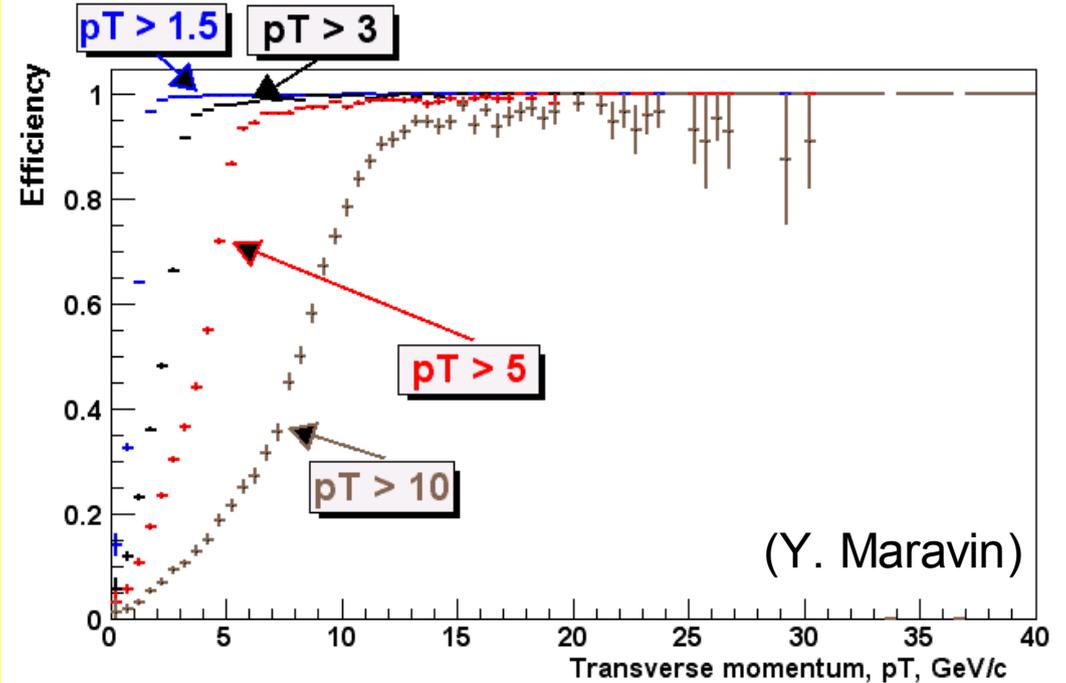
- Turn-on curves
- Efficiencies
  - TTK
    - L1CTT track vs offline
    - L1CTT track + CPS matching
- Fake rate

# TTK Turn-on Curves

Turn on curves for single track triggers

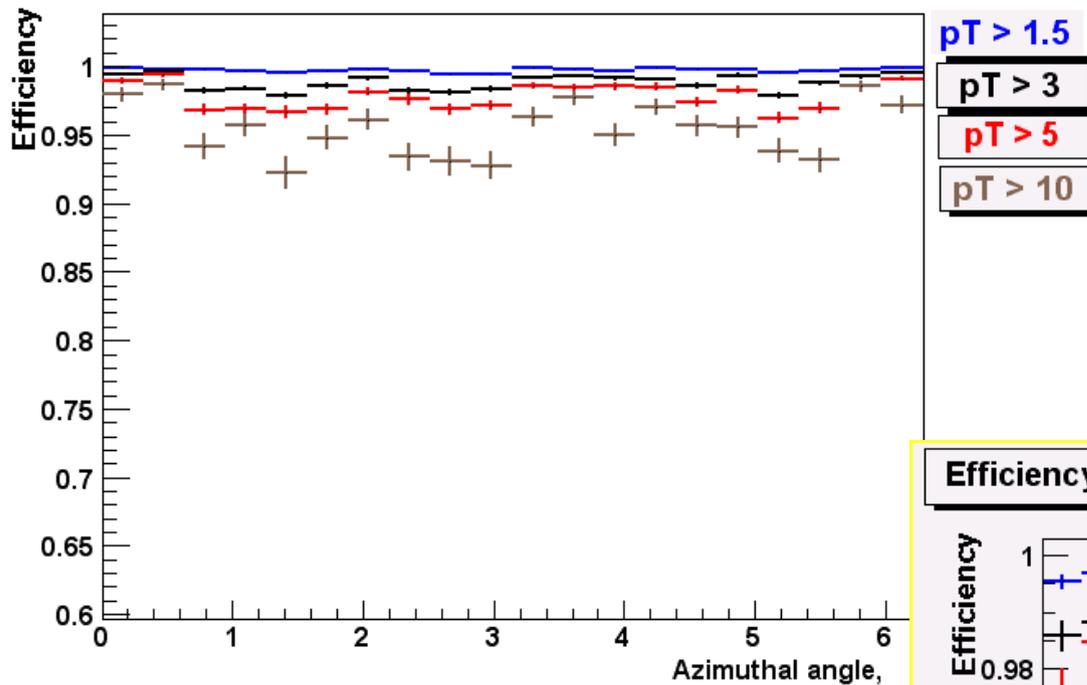


Turn on curves for double tracks triggers

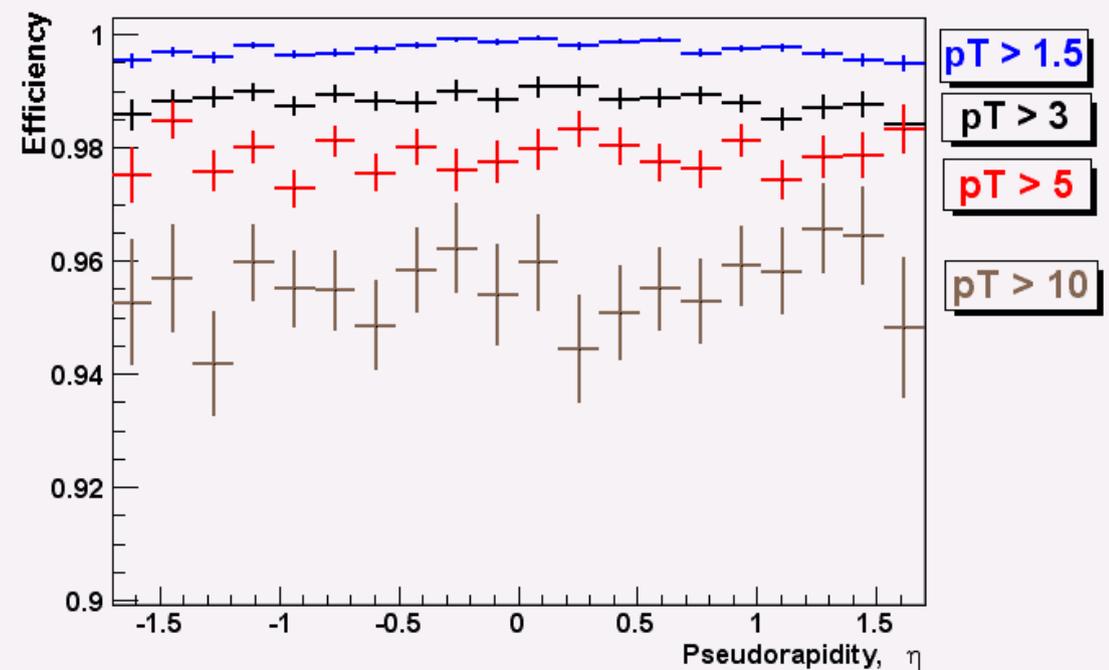


# TTK Efficiency

Efficiency of single track triggers as a function of azimuthal angle,  $\phi$



Efficiency of single track triggers as a function of pseudorapidity,  $\eta$

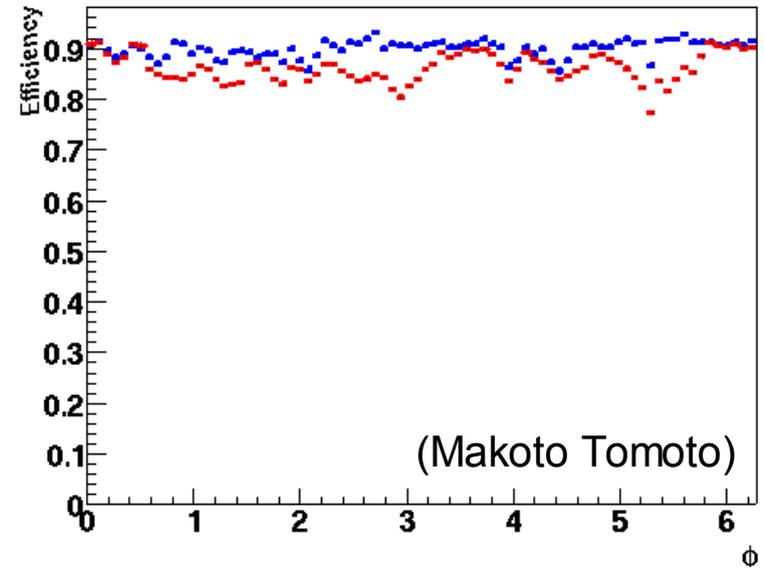
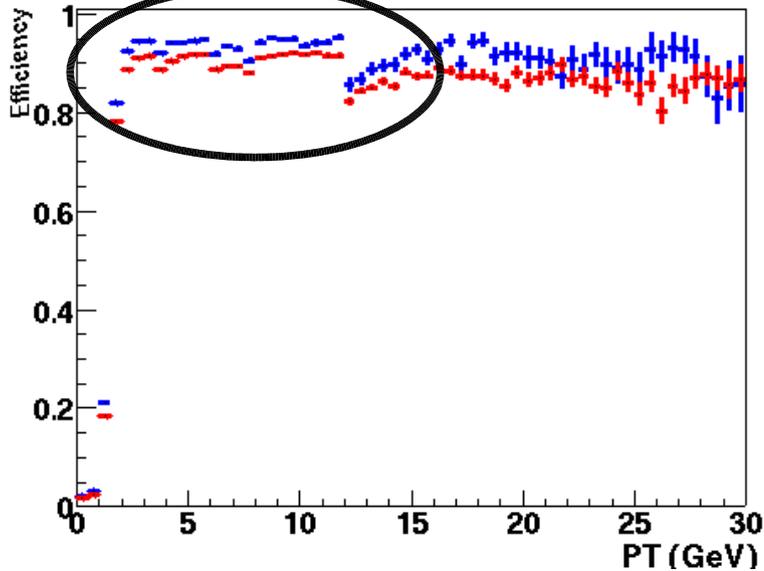
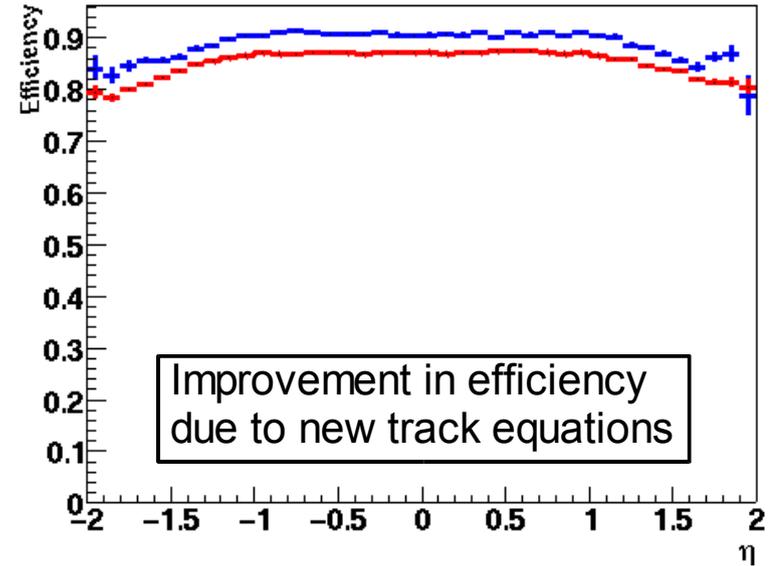


# L1 track efficiency (with respect to offline tracks)

— run 176880 (13 May 2003)  
eqns for only one supersectors

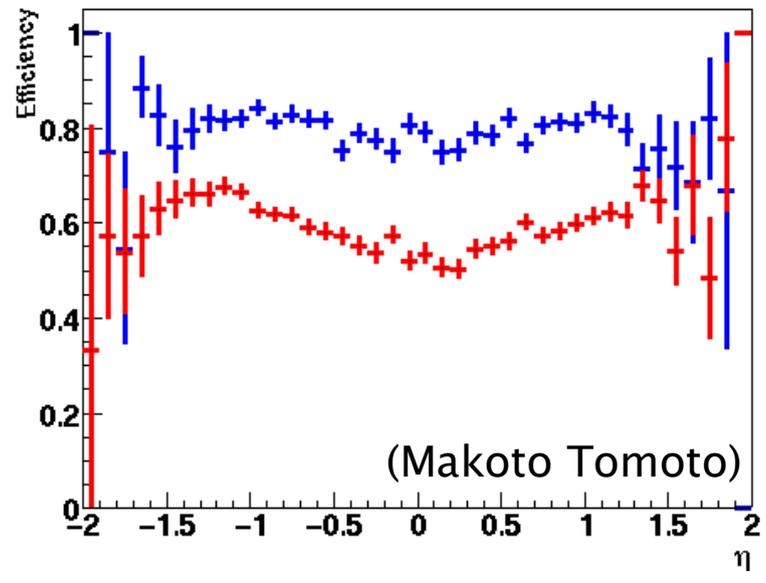
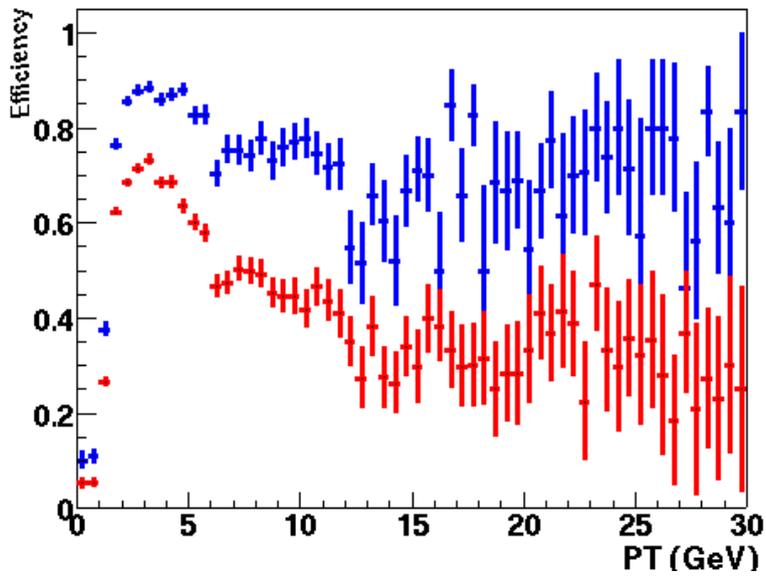
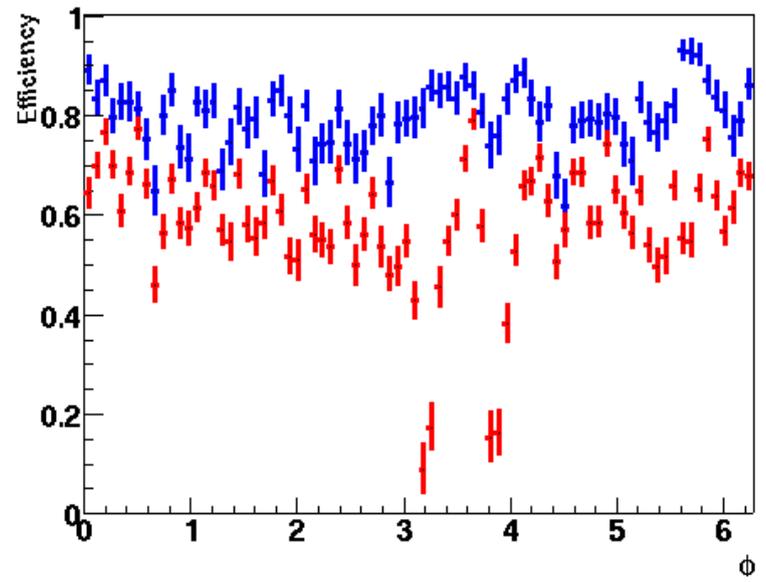
— run 177679 (2 June 2003)  
complete set of equations

Pt mis-matched between  
L1 tracks and offline tracks



# L1 track + CPS efficiency (with respect to offline tracks + CPS cluster)

- run 176880 (13 May 2003)  
dummy CPS mapping
- run 177679 (2 June 2003)  
with proper CPS axial mapping



## L1 Track efficiency independent of offline tracking (Y. Maravin)

- Use Z  $\rightarrow$  ee
- Select events with exactly 2 EM clusters matched to CPS clusters
- Look for L1 tracks within  $\pm 1$  sector of EM/CPS clusters

L1 track finding efficiency  $\sim 80\%$

---

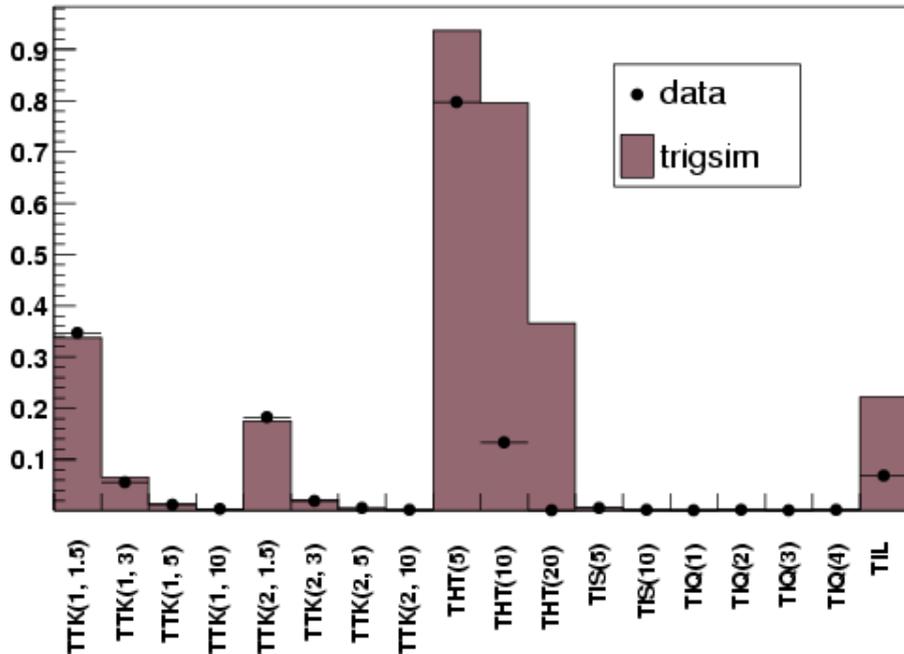
## Fake rate w/r to offline tracks

$$f = \frac{\text{L1 tracks with no associated offline tracks}}{\text{L1 tracks}} \sim 10\%$$

# tsim\_l1ft

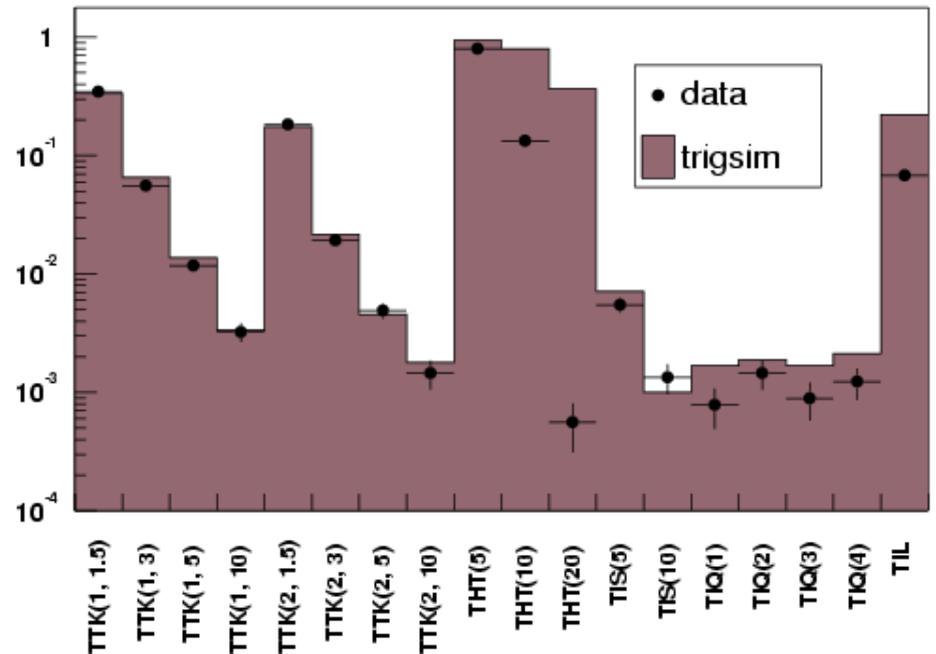
- discrepancy in fiber numbering fixed - improves agreement
- For TTK terms, tsim\_l1ft vs online agrees within ~20%

fraction of events firing A/O terms w/ bugfix



fraction of events firing A/O terms w/ bugfix

(C. Hensel)



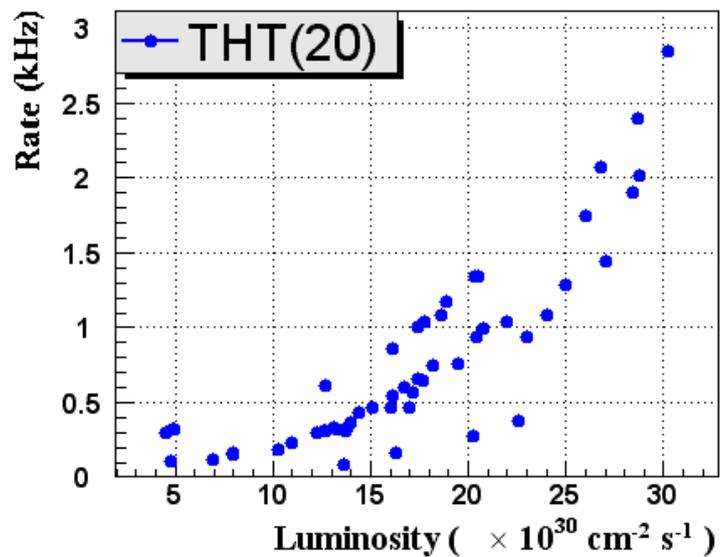
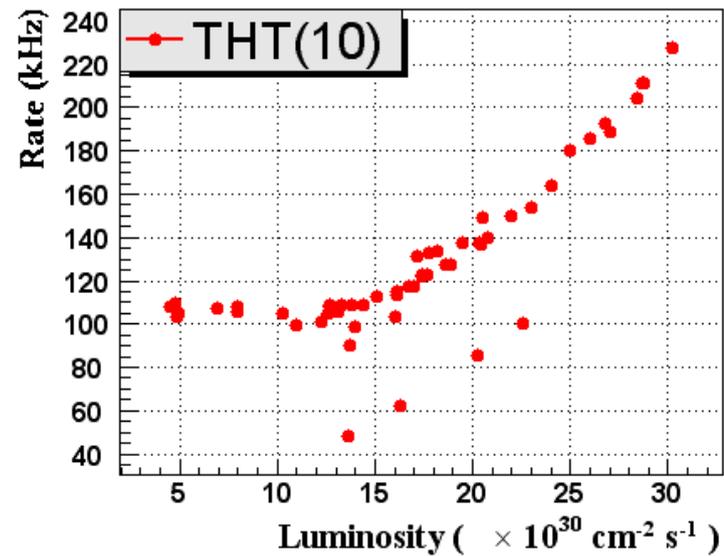
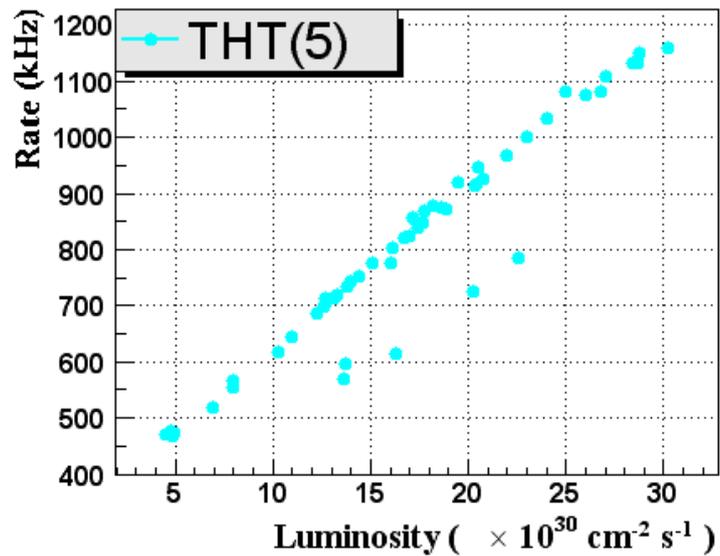
**tsim\_l1fps:** Work in progress, timescale of a couple of months

# Summary

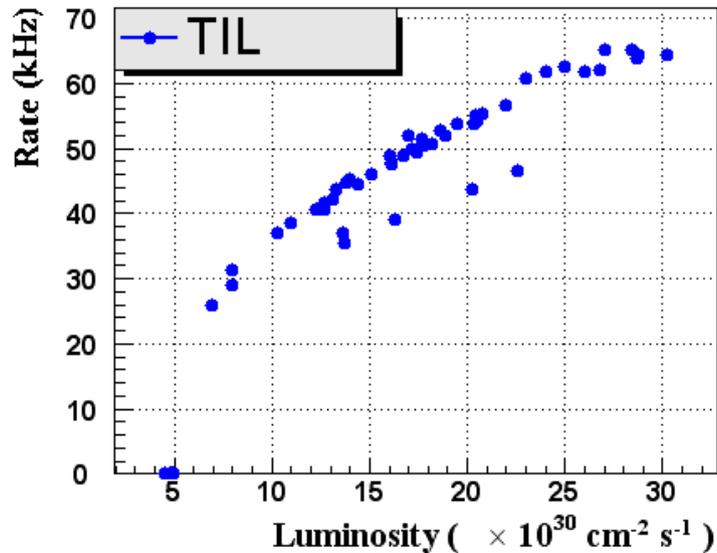
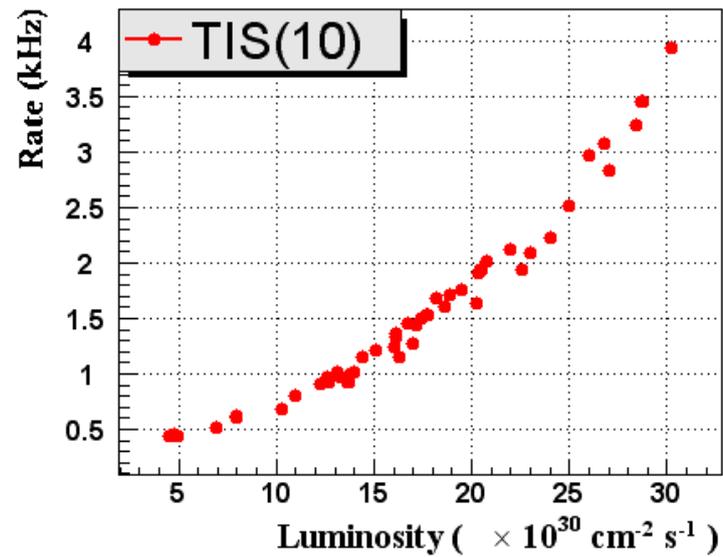
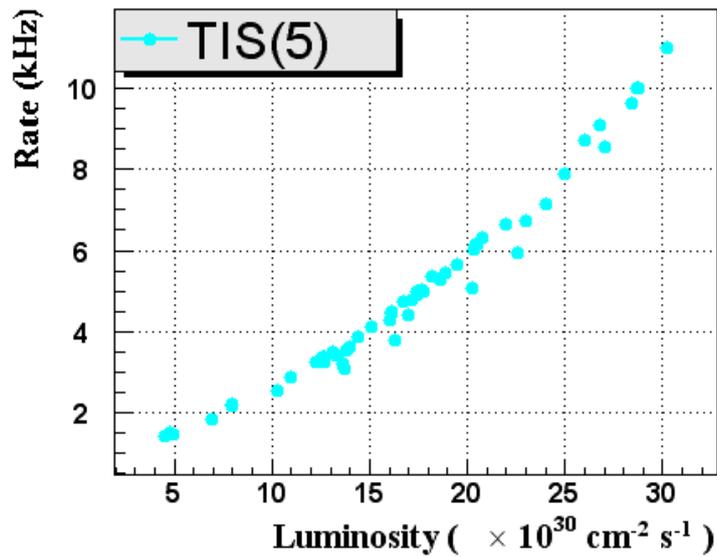
---

- Firmware writing/debugging well underway ("seeing the light at the end of the tunnel")
- Significant efforts focused on understanding performance
  - Turn-on curves
    - L1 track finding efficiency w/r to offline tracks: ~90%
    - L1 track + CPS efficiency w/r to offline tracks + CPS: ~80%
    - L1 track finding efficiency independent of offline tracks: ~80%
    - Fake rate w/r to offline tracks: ~10%
- Work on track equations optimization going on in parallel
- System closely monitored.
  - Tools developed to help monitor data quality.

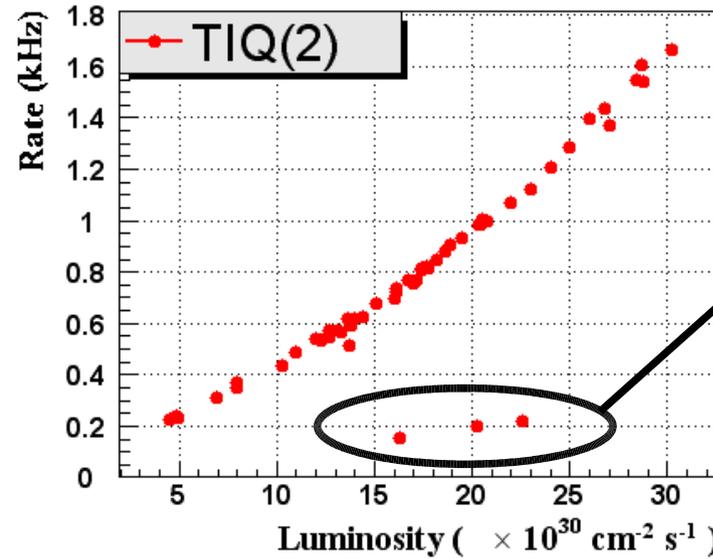
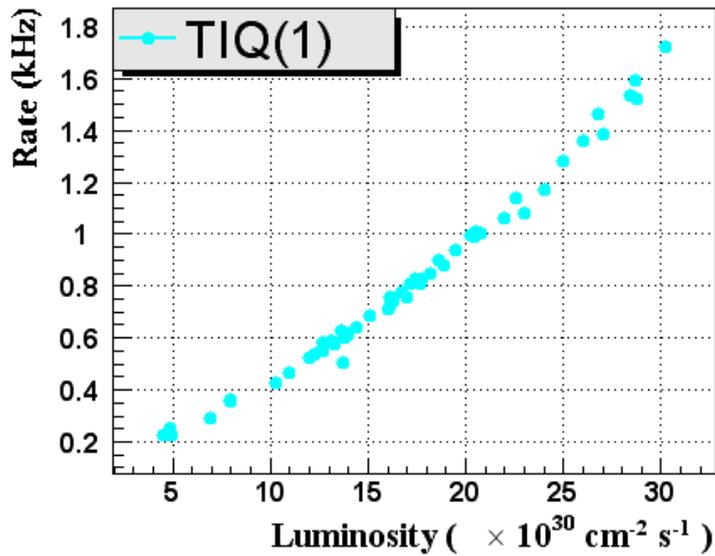
# THT Rates vs Luminosity



# TIS/TIL Rates vs Luminosity



# TIQ Rates vs Luminosity



Power Supply  
9A and 11B off

