



XFT Data Volume Studies + Possible Solutions

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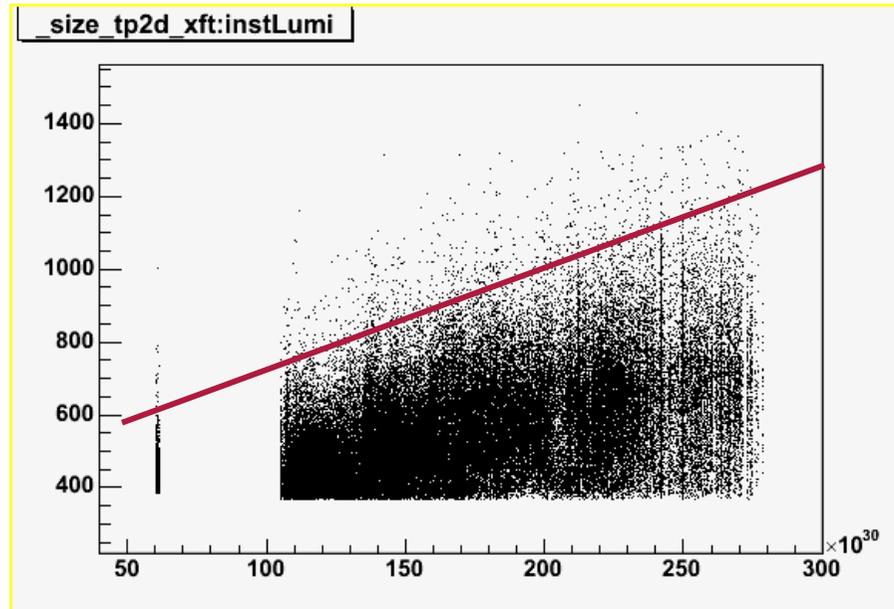


Large Data Volume

- Current limitations of combined system
 - Ran fine for whole store with initial Luminosity 190e30
 - Data corruption when initial Luminosity 240e30
 - Both XFT alone and L2CAL alone are known to work fine up to 240e30
- Hypothesis
 - Data gets corrupted due to high load on PCI bus and/or buffer sizes of input FIFO in FILAR channel
- Solutions to reduce load on PC
 - Split to more XFT inputs (6 XFT configuration)
 - Use more than 1 PC for inputs
 - Reduce total size of XFT data (firmware changes)

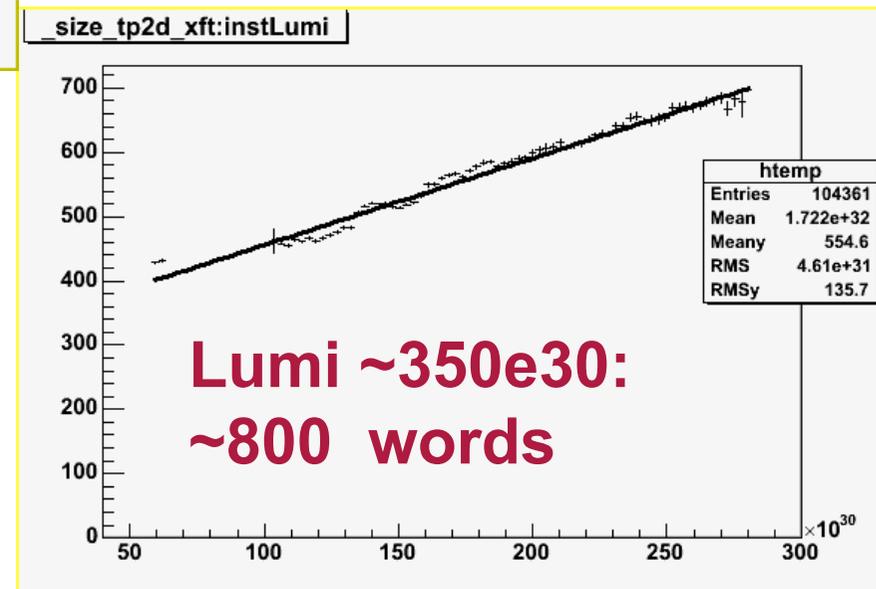


Total XFT Size



- Including all highest luminosity runs to date from dstream data
- ~100'000 events in total
- Mean progresses ~linearly
- Tails also seem to progress linearly

- Mean of the data size should not be a problem
- Tails are likely to be the issue
- Higher luminosity -> More frequently several high occupancy events in a row





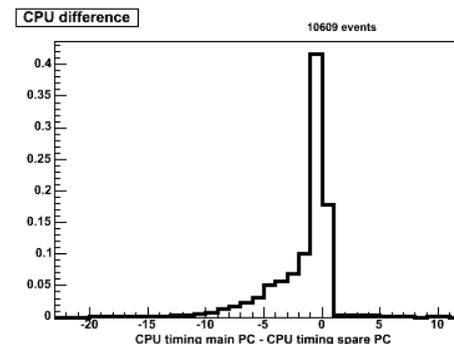
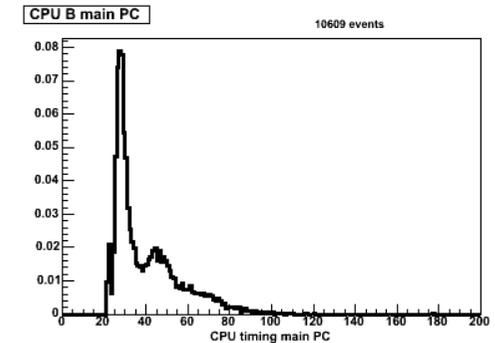
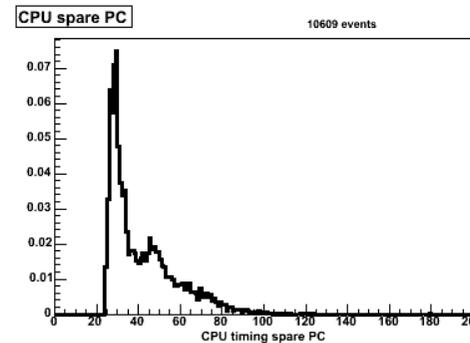
6 XFT Implementation

- Splitting the XFT data into 6 inputs to the PC will reduce data size per FILAR input
- Easier to balance the loads between PCI buses
- Total data size to PC remains the same
- Hardware and firmware validated and working fine
 - 6th Pulsar board validated since last Thursday
- FER code changes to enable/disable Pulsar input channels from database
 - set via CardEditor
- All PC code changes implemented and tested in beam and between stores



6 XFT Tests

- If still use 1 PC, the old inputs (not SVT) need to be merged
 - Merged code written and tested
 - Tested in beam with 6 XFT and merged old inputs up to Lumi $\sim 200e30$
 - Tested at EOS with 6 XFT, 4 L2CAL and merged old inputs
 - Still need to investigate additional latency for merging old inputs
 - Preliminary studies show that tails in latency are significantly increased
 - Tails up to $\sim 20\mu s$ when using 6XFT + merged old input configuration





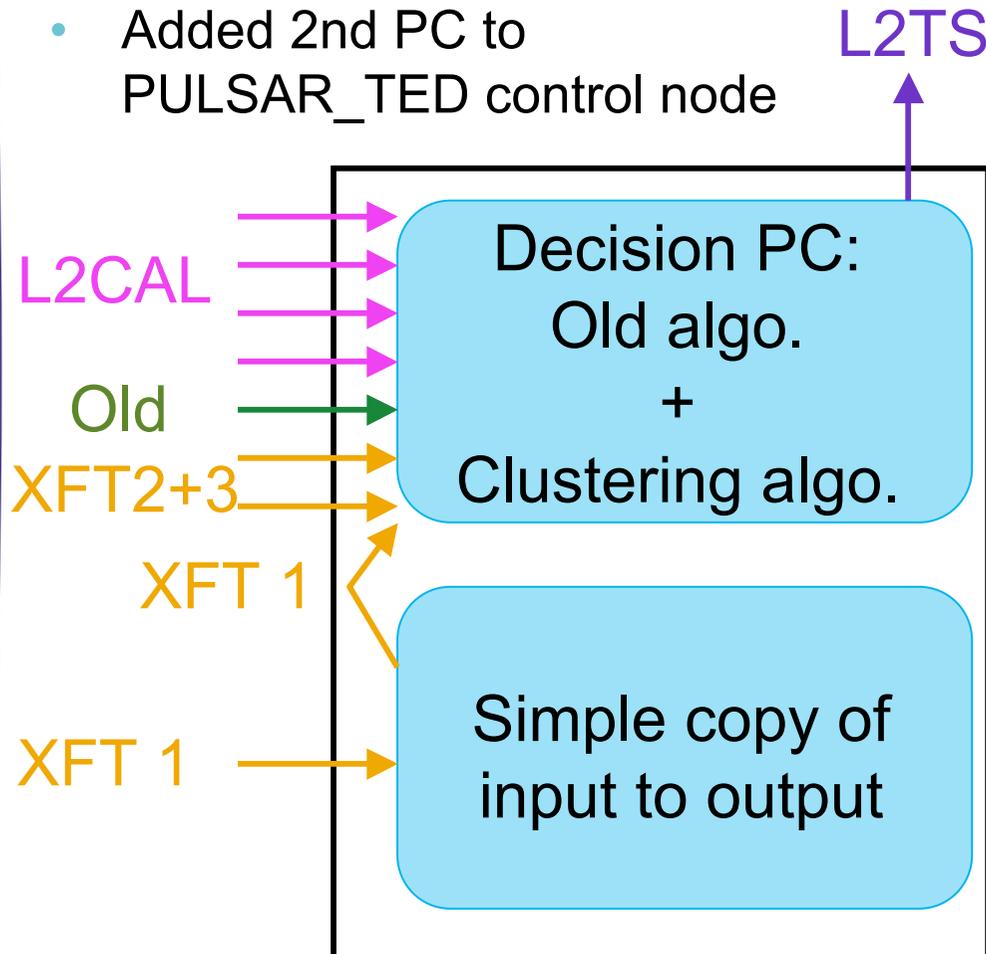
6 XFT Tests

- If use 2 PCs
 - Many alternatives presented in a previous talk
 - 2nd PC as “fast abort” for XFT
 - 2nd PC doing all L2CAL related algorithms and transferring output of clustering to decision PC
 - ...
 - Would remove the problem not just push it back
 - Control nodes (designed for ATLAS) are designed for multi-PC processing farms
 - Can't investigate further until have more PCs
 - Especially if moving to driving with 1 of the new PCs



2 PC “Proof of Principle”

- Use 2nd PC as a “pass through” for XFT1
- Added 2nd PC to PULSAR_TED control node



- Copied code to 2nd new PC
- Enabled only 1 channel
- Copied input to Solar output
- Worked first try!
- All commands (e.g. HRR) passed on to both PCs in control node
- Data always in sync
- No problems seen in 1/2h running at EOS

Configuration using 2 PCs is in principle possible



Studies Related to Reducing Total XFT Data Size

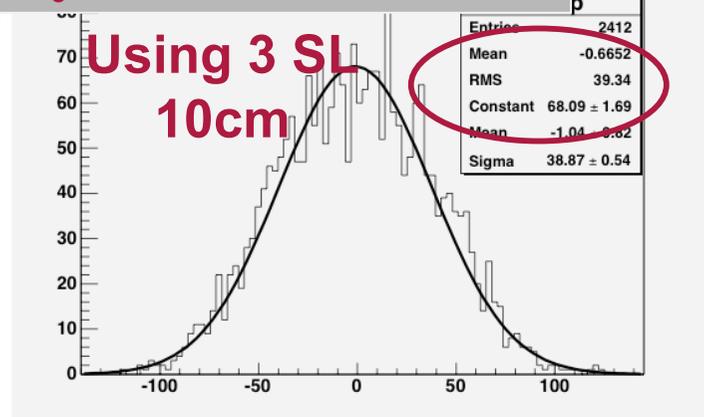


Reducing Data Size: Removing SL3

It has been suggested that removing SL3 might help with the data volume

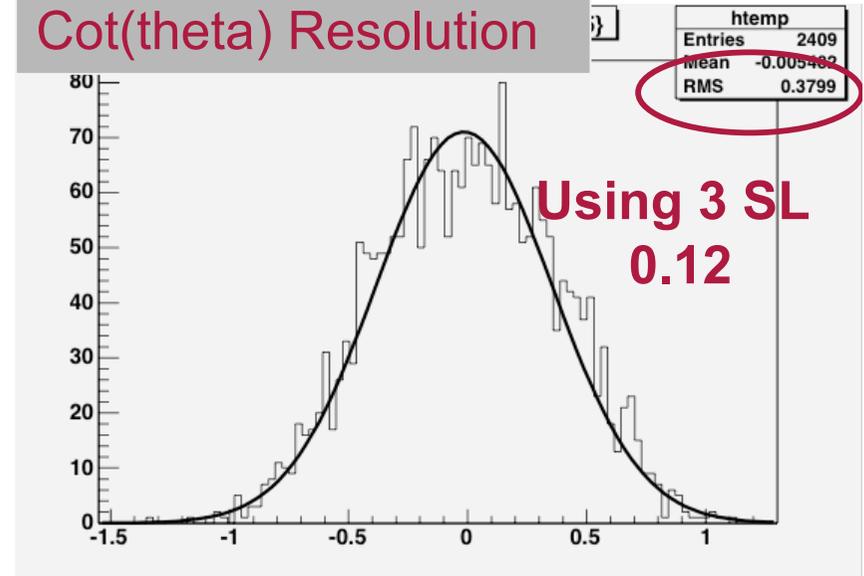
- SL3 highest occupancy
- High lumi might be all firing anyway
- Investigated the degradation to the resolution at low lumi
 - Only have 2 points not 3 so always a straight line
 - Removing 1 powerful fake rejection at lower luminosities

Z₀ Resolution



L2 Upgrade Review 19th June 2007

Cot(theta) Resolution



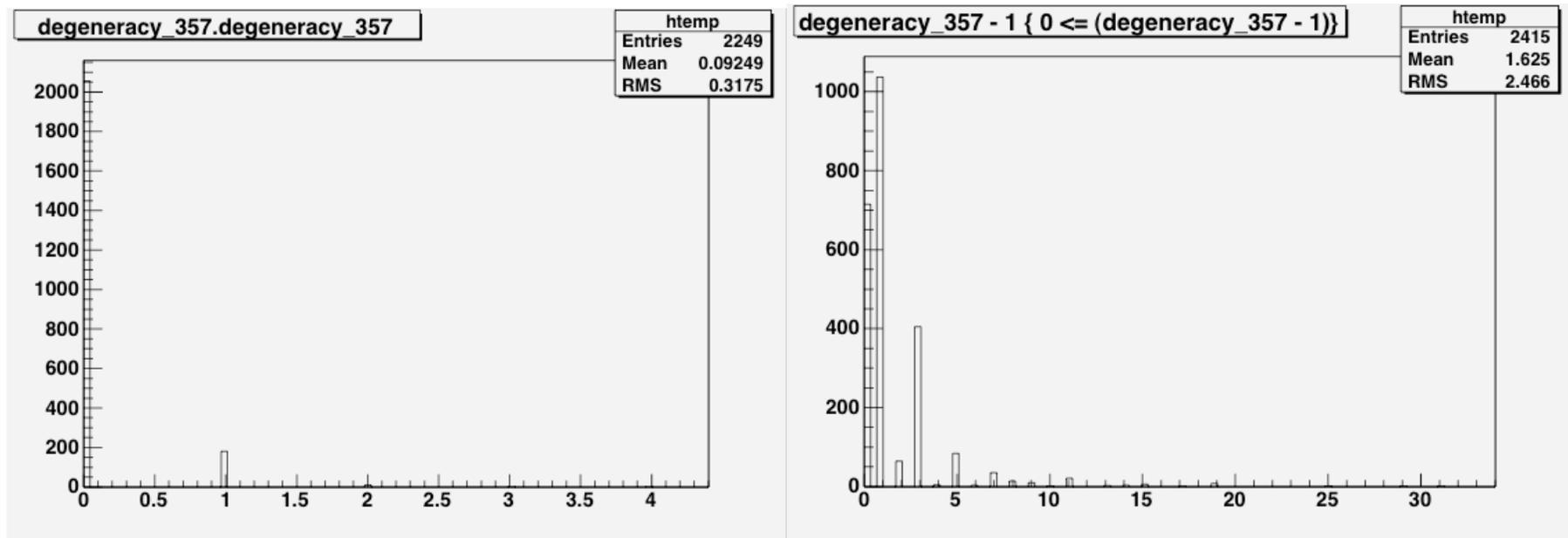
Lumi 80-90e30. High quality muons

- Cleaner than data ever could be!
- Cot(theta) resolution 3 times worse
- Z₀ resolution ~4 times worse
- # hit combinations per axial track increases dramatically (see next slide)



Reducing Data Size: -SL3

- Degeneracy in possible stereo tracks when including SL3 or not
- 0 degeneracy = 1 possibility
- > 0 degeneracy: have to randomly pick 1 combination



- Luminosity dependence being investigated....
- Note : Clean environment! Real data will look much worse



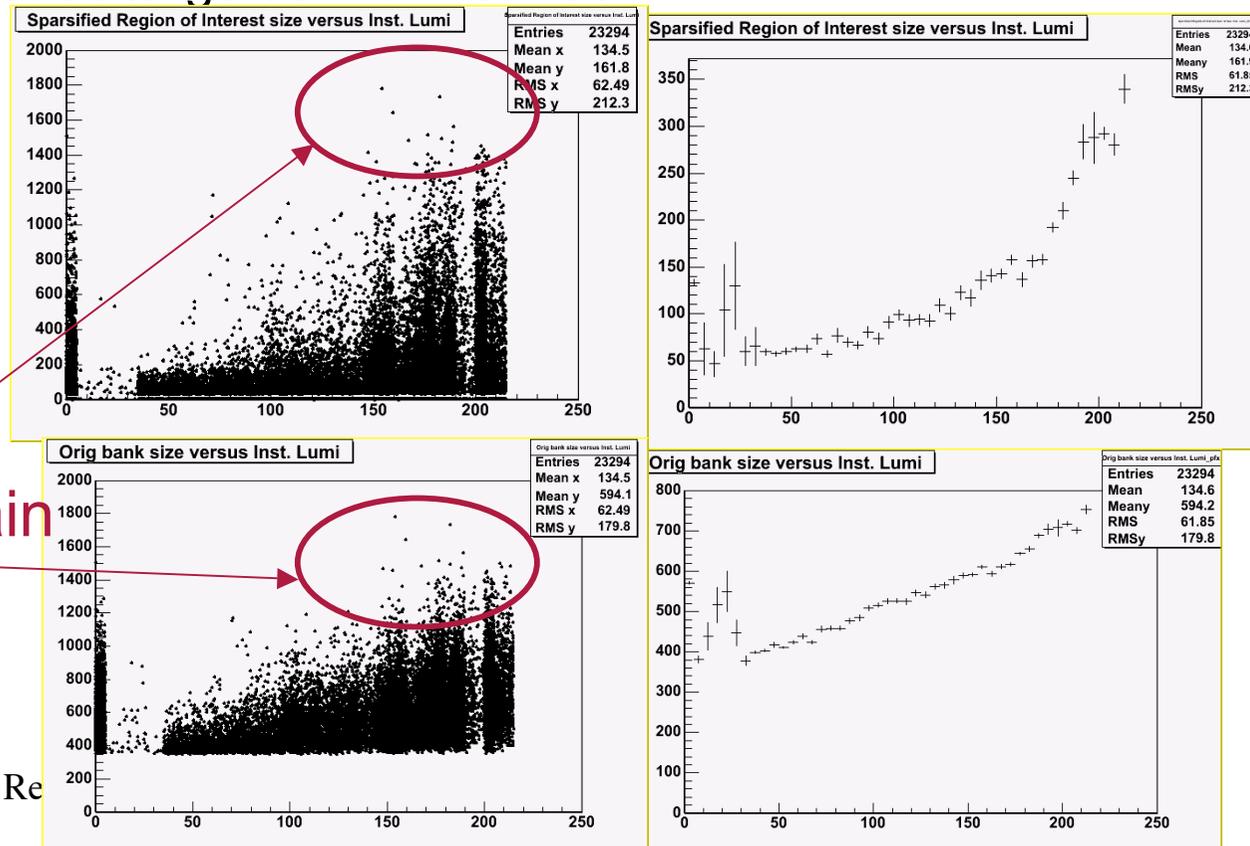
Regions of Interest

- Concept is the following
 - Only the information related to regions containing tracks that L2XFT algorithms could be interested in are sent to the PC
 - These regions are to be defined by L1 bits for example
 - “Uninteresting” regions send empty packets
 - Requires firmware changes in Pulsar board
 - Need L1 bits as inputs
 - Need fast abort infrastructure when no regions of interest present
 - Stereo reconstruction algorithm written such that all cells within 3 cells of the expected hit are considered
 - Consider all finders that need to be read out in order to get the whole region around the track to be confirmed



Regions of Interest

- Would need to implement a fast-abort based on L1 trigger bits
- Only send to PC data from finders located within 3 cells of axial track
- Non-linear increase in mean size after sparsification
- Prereq: L1 CMX trigger, track $p_T > 4$ GeV
- Tails just as large as with no ROI



Tails remain



Conclusions

- XFT with 3 inputs well well for current luminosities without integrated system
- Many possible solutions to the combined XFT + L2CAL operational problems at high luminosity
- Would like a quick temporary solution that has a chance of working at high lumi
 - e.g the 6 XFT + L2CAL + Merged old if additional latency not an issue
 - Available for Trigger Fest before Shutdown so as not to slow down algorithm development
- For the future we also need a proper solution that is guarantied to work at high lumi
 - e.g. develop in parallel the 2 PC solution
 - Available as soon as possible with minimal extra time-investment
- These temporary and long-term solutions could be one and the same or slight variations of each other



Backup



SL3 SL5 SL7 sizes

