The Trigger Simulator in P15

All DØ Meeting

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Outline

- Design of d0trigsim
- Trigsim “issues”
- p15 Status
- Major new features
- Performance (L1)
- Future Plans

Basic Design

- Simulate L1 Trigger Hardware
- Wrapper L2 and L3 online code for offline use
- Configure using lists from trigger db
- Seamless switch between data and MC inputs
- Output trigger objects as well as bit-masks
- All output formats identical to online

Documentation, etc.

- Trigsim coordinators are Angela Bellavance and Dugan O'Neil
- Discussion list: d0trigsim-users@fnal.gov
- Webpage:
  http://www-d0.fnal.gov/computing/trigsim/trigsim.html
- CVS packages:
  - d0trigsim - configure and run L1/L2/L3
  - trigsimcert - trigger tree from TMB
  - trigsim_analyze - ntuple from trigsim output
  - tsim_l3 - wrapper L3 Scriptrunner
  - tsim_l1l2 - L1/L2 configuration files

Inputs and Configuration

- d0trigsim requires two inputs:
  1. data or MC file
  2. trigger list
- Input data or MC file must contain Raw Data Chunk (RDC). Examples
  - MC file from farms (DST, not thumbnail)
  - Any raw data file
  - NOT real data DST - inputs are not all there

Inputs and Configuration

- Trigger list comes from TriggerDB as XML file
- COORSIM turns XML into a set of “sim” files
  - level1.sim - configures L1Cal and L1Frm
  - epics.sim - configures L1FT and L1Muon
  - level2.sim-stripped - configures L2
  - level3.sim - configures L3

Outputs

- The output of trigsim is an EVPACK file containing the RDC + L3 chunk
- L1/L2 simulation inserts crates and modules into RDC to be used by L3 and written out
- L3 creates and fills offline L3 chunk
- No root output anymore (p15)

Issues

- d0trigsim executable has been around a while now (2 years) and has had its strengths...
  - Very easy to use
  - L2/L3 run same code online and offline. Essential part of certification/verification
  - Studying trigger objects is pretty easy at all three trigger levels
  - Generally “just works” on MC with default list

Intro

- ...and weaknesses
  - Not so easy to use
  - Finding a version that will run correctly on the data files you like has always been painful
  - Using trigger lists other than default has always been painful
  - Analysis tools have been lacking (eg. d0_analyze/thumbnail, etc.). Trigsim runs, but how do I use the output? Trigsim crashes producing my ntuple!

P15 Status

- Note: p15 marks compiler transition from KCC to gcc
- Certification samples (MC) all ran without problems in the test releases leading up to p15
- p15.00.00 worked out-of-the-box! However, we had some problems running analyze packages on its output....problem was only in the analyze.
- p15.01.00 is already online in L2. p15.02.00 being certified for L3 now.

Major Developments

- Major change to running d0trigsim: no root file produced by d0trigsim anymore!! d0trigsim executable just runs trigger code. Analysis code must be run in seperate executable.
- Configuration from XML trigger lists is much easier.
- MC farms are running d0trigsim in standard chain (p14 so far)
- L1CTT runs on data
- STT joins L2. More coming in pass releases.
- More/improved tools in L3.

p15 Analysis Executables

- d0trigsim on farms means less trigsimming and more analyzing.
- Problems with HepTuple are common. Limitations of HepTuple are many. Advantages of HepTuple are none. Stop using HepTuple.
- trigsim_analyze: runs over d0trigsim output file. Output looks just like old d0trigsim root file. d0tools script available.
- trigsimcert: runs over thumbnails. Intended to largely replace trigsim_analyze. Should be very easy to merge with reco or other TMB outputs.

trigsimcert

- Very new! In CVS, but not released. Still under development, suggestions welcome. Primary author is Josh Dyer.
- Separate classes for each trigger level: L1Cert, L2Cert, L3Cert.
- Easy to add standard trigger variables to personal or group TMB analysis package.

Analysis Examples

- d0trigsim + trigsim_analyze:

```
setup D0RunII p15.02.00
setup d0tools -t
runD0TrigSim -filelist=myfiles.txt -format=mc
runTrigAnalyze -filelist=trigsimmed_files.txt -format=mc
```

End up with root file containing “traditional” analyze output.

Analysis Examples -2

- d0trigsim + make thumbnail:

```
setup D0RunII p15.02.00
setup d0tools -t
runD0TrigSim -filelist=myfiles.txt -format=mc
runreco -filelist=trigsimmed_files.txt -format=mc_reprocess
  OR
UnpThumbNail_x -rcp $SRT_PUBLIC_CONTEXT/thumbnail/bin/runThumbNail.rcp
```

End up with thumbnail file containing L1/L2/L3 trigger info.

Analysis Examples -3

- Now use your favourite TMB analysis program. eg.

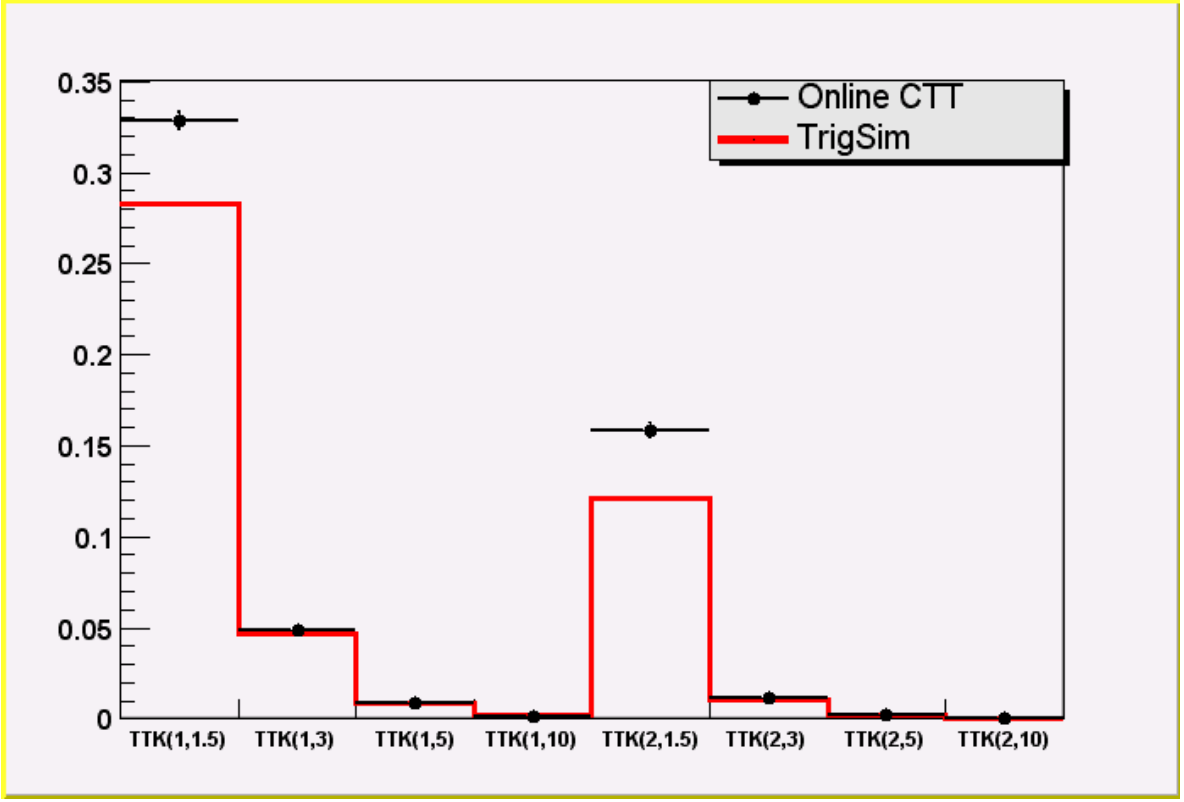
```
addpkg trigsimcert version
d0setwa
gmake trigsimcert.all
ln -s trigsim_output_file inputfile
trigsimcert_x -rcp trigsimcert/rcp/runCertAnalyze.rcp
```

Trigger Lists

- Changes to L3 code, XML generator mean that hand-editing of triggerlists or *.sim files for different running conditions should no longer be necessary (eg. MC vs. data input).
- Default MC list in TriggerDB. Simfiles from this version used on MC farms.
- Problems persist. Latest online trigger list uses COOR resources that are not available offline. Procedure for testing before making new lists available needs to be put in place....

L1CTT on Data

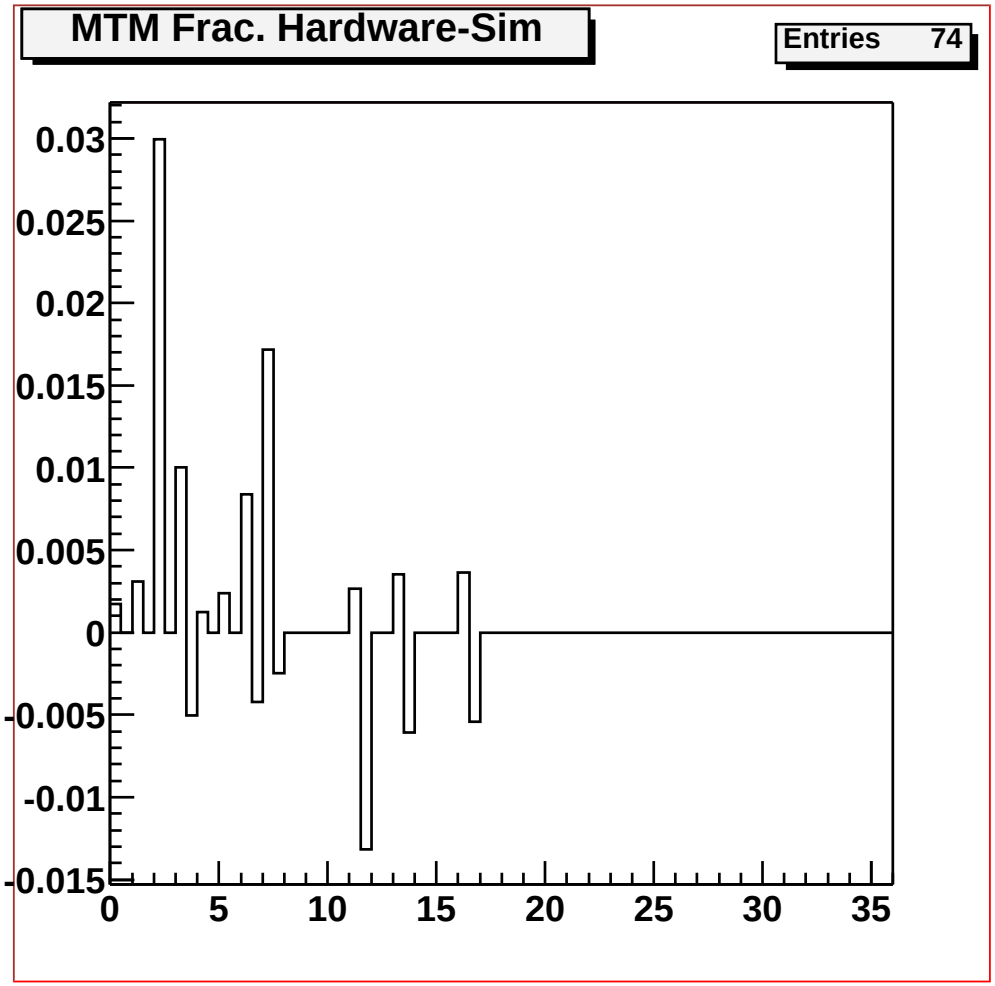
- L1CTT is becoming available! d0trigsim vs. online comparisons possible



L1Muon on Data

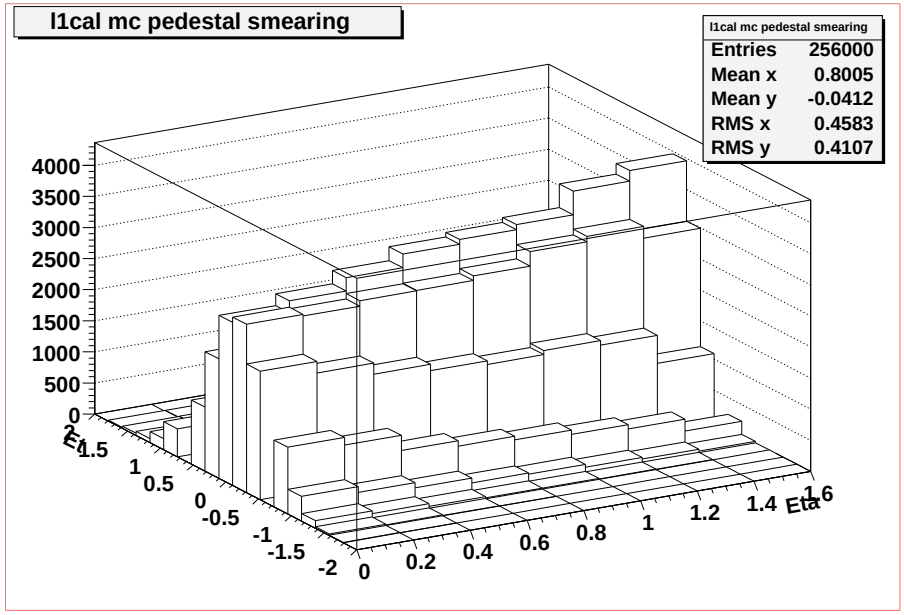
- Simulation of scint trigger with addition of A-layer wire terms is in p15.02.00
- Agreement of single muon triggers better than 1%
- Agreement of dimuon triggers about 3% (still working on small bug in sim)

L1Muon on Data



L1Cal Status

- Little change from late p13.
  - Different eta coverages should be recognized in data (by run number)
  - Realistic noise and smearing terms are available and adjustable via rcp



L3 Tools/Filters

- Impact parameter B-tagger available
- Primary vertex, cal non-linear corrections, etc. were available late in p13 but will really start being used heavily in p15

Future Plans/Issues

- Trigger configuration problems should now (p15) be gone from the trigsim side. Need work on COOR resources
- Analysis tools need more more work - finish trigsimcert
- l1frm and l2global being skipped when running on data. Jim Kowalkowski working to find the cause.
- L2STT improvements continue to be put into p15.
- p15 certification efforts in L3
- As of now, Angela is the onsite trigsim expert. My contributions become remote.