The Trigger Simulator

D0 Trigger Workshop

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Outline

- Goals and Design
- Documentation
- Inputs/Configuration
- Outputs
- Analyze
- P11 Status: L1/L2/L3
- How to use it

Goals

- Some Goals:
  - Evaluate trigger efficiencies and rejection on MC and data samples for triggers before they are run online
  - Test and debug online trigger software before it goes online
  - Verify performance of trigger algorithms and calculate efficiencies after the fact

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 Dugan and Serban
- 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 + analyze
  - trigsim_analyze - produce ntuple from trigsim output
  - tsim_l3 - wrapper L3 Scriptrunner
  - tsim_l1l2 - L1/L2 configuration files

Documentation, etc.

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D0 Trigger Simulator Homepage

Report a bug in the trigger simulation

General Info	Release Status
▪ Contacts ▪ Meetings ▪ Trigsim Docs ▪ Trigger Lists	▪ Next Production p11 ▪ Current Production p10 ▪ Old - Bad p09 ▪ Old - Good p08 ▪ test release
MC Samples	**Tools**
▪ General Recommendations ▪ QCD files in SAM ▪ Sample Ntuples	▪ Collected ROOT macros
Other Trigger Links	**Other Links**
▪ D0 Trigger ▪ TriggerMeister Home ▪ Levan's Working Page ▪ Trigger Database	▪ D0 Simulation ▪ Monte Carlo Challenge

Updated: *oneil@fnal.gov*

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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 which has been D0Simmed
  - Any raw data file (reco files too until DST)

Inputs and Configuration

- Trigger list comes from TriggerDB as XML file (see Elizabeth's talk)
- COORSIM turns XML into a set of "sim" files
  - level1.sim - configures L1Cal and L1Frm
  - epics.sim - configures L1FT and L1Muon
  - level2.sim - configures L2
  - level3.sim - configures L3

Outputs

- Two outputs of trigsim:
  1. EVPACK file containing RDC + L3 chunk
  2. ROOT file for analysis
- L1/L2 simulation inserts crates and modules into RDC to be used by L3 and written out
- Analyze packages can be run to fill global ROOT ntuple (more later)

Analyze Packages

- All components of L1/L2/L3 have associated “analyze” packages to turn chunk into ROOT
- All run as part of d0trigsim or independently on d0trigsim output file or raw data file
- trigsim_analyze runs analyze packages from all three levels. Called by d0_analyze.
- Not just bitmasks. Trigger objects too. Examples
  - all L1Cal towers
  - all L2 objects (jets, electrons, muons, etc.)
  - all L3 objects

Analyze Packages

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The Contents of the Trigger Simulation Rootuples

L1Cal	Package is l1cal_analyze
L1Cal_Debug	Package is l1cal_analyze
L1frm_Specific_Trigger	Package is tsim_l1frm
L1FT_Level1_Sim or L1FT_Level1_Dat	Package is l1ft_analyze
L1FT_Level2_Sim or L1FT_Level2_Dat	Package is l1ft_analyze
L1FT_Trigterms_Sim or L1FT_Trigterms_Dat	Package is l1ft_analyze
L1FT_bboardTT_Sim or L1FT_bboardTT_Dat	Package is l1ft_analyze
L1MuonMTCC_Sim	Package is tsiml1muo
L1MuonMTCN_Sim	Package is tsiml1muo
L1MuonMTCS_Sim	Package is tsiml1muo
L1MuonMTM_Sim	Package is tsiml1muo
L2calem	Package is l2calemworker
L2caljet	Package is l2caljetworker
L2calmet	Package is l2metworker
L2gblEM	Package is l2gblem
L2gblHead	Package is l2gblworker
L2gblJet	Package is l2gbljet
L2gblMuon	Package is l2gblmuon
L2gblTrack	Package is l2gbltrack
L2CTTCFT	Package is l2cttcft_analyze
L2CPS	Package is l2cps_analyze
L1_5SLIC	Package is l2mu_analyze
L2MU	Package is l2mu_analyze
L3J, L3KT	Package is l3fjettools
L3E, L3E2, L3EG	Package is l3femtools
L3DebugJ, L3DebugKtJ	Package is l3fjettools
L3DebugE, L3DebugE2, L3DebugEG	Package is l3femtools

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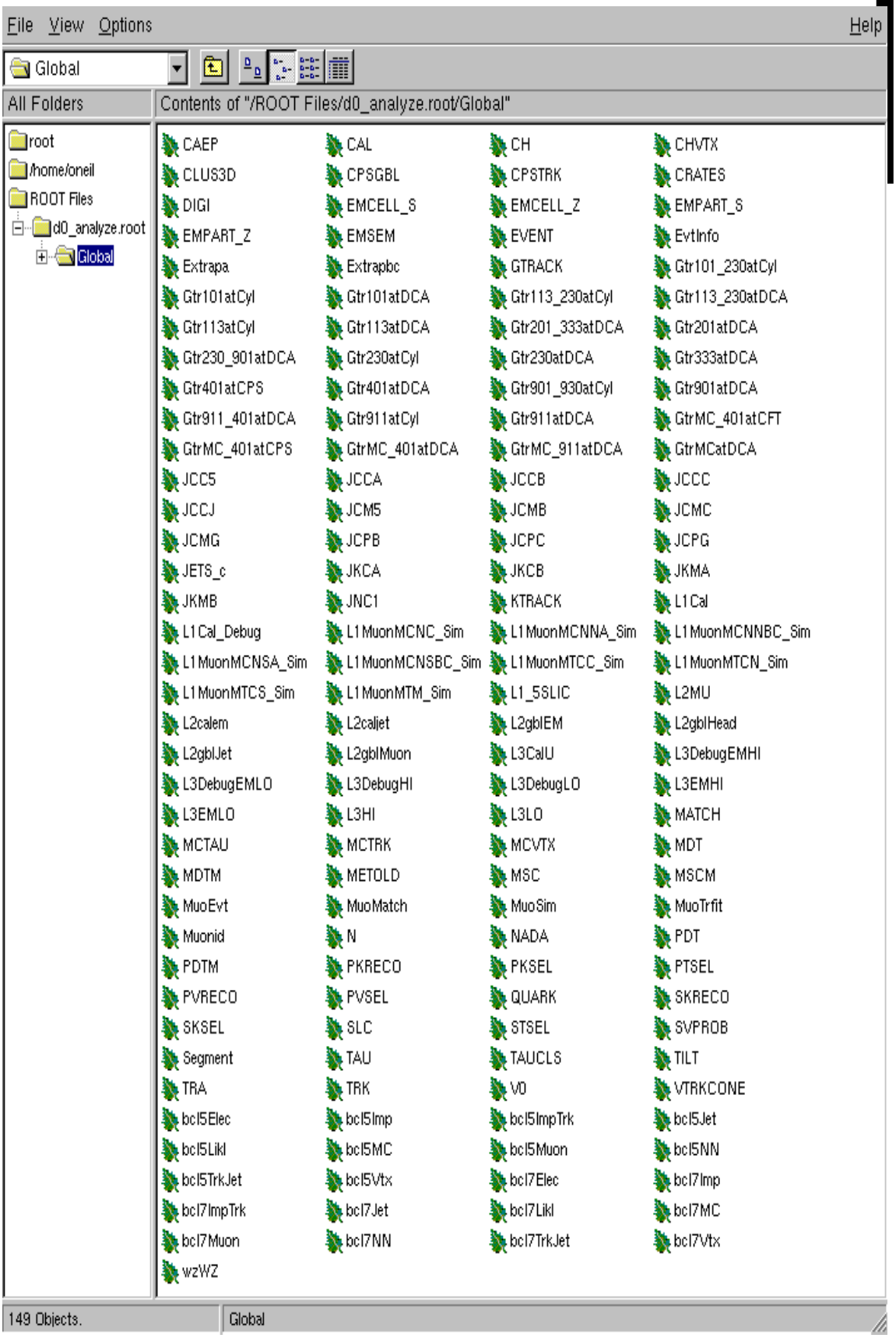
Analyze Packages: d0_analyze

- d0_analyze knows how to run trigsim_analyze, reco_analyze, mc_analyze. Example chains:
  - MC
    - run d0trigsim on d0sim output
    - run reco on d0trigsim output
    - run d0_analyze on reco output
    - analyze all-inclusive ntuple
  - Data
    - run d0_analyze on reco output from farm
    - analyze all-inclusive ntuple

Analyze Packages: d0_analyze



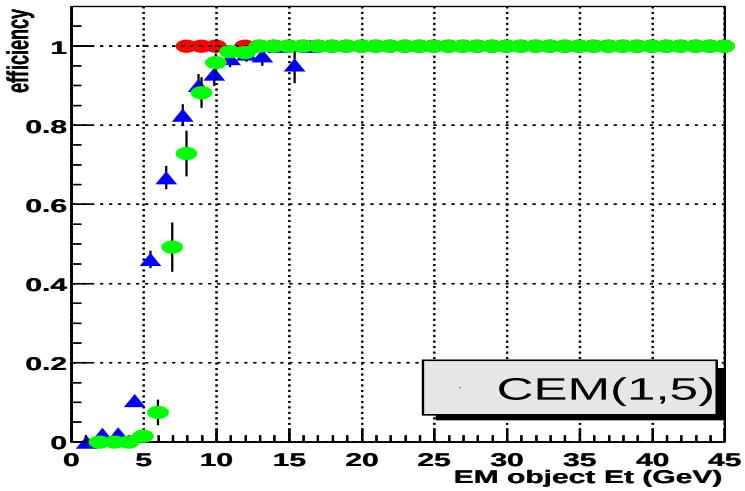
P11 Status - General

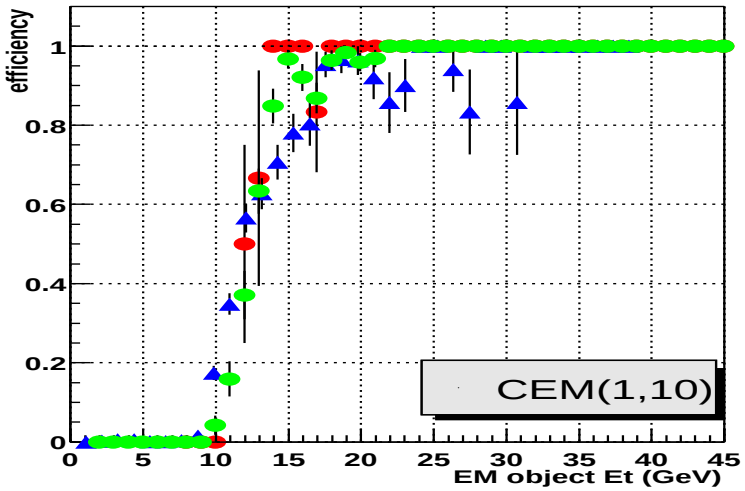
- p10 version has been stable for a long time, p11 now being tested (p11.05.00 and above).
- p11 release will be used to take data in L2 and L3. L1 knows how to unpack current data.
- Still seeing some crashes in p11.05.00 but major functionality improvements over p10....some teething expected...
- Preliminary timing looks promising - QCD Pt>40GeV, debug, 800Mhz PC - 4s/event, 220Mb memory used. All L2 and L3 scripts running on every event....

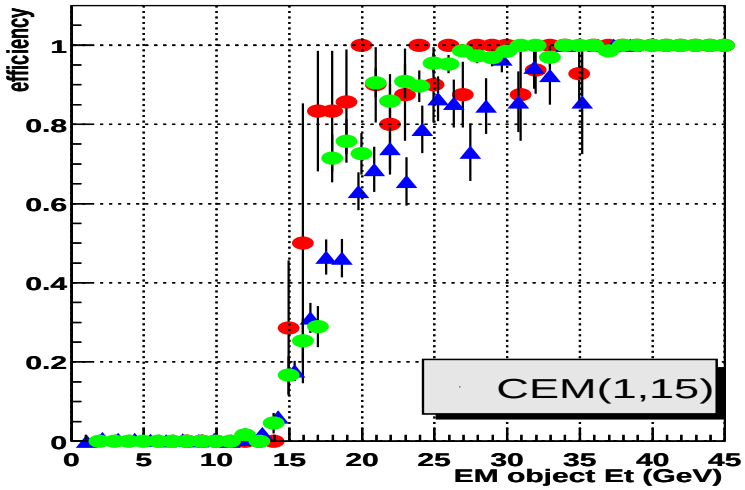
P11 Status - L1

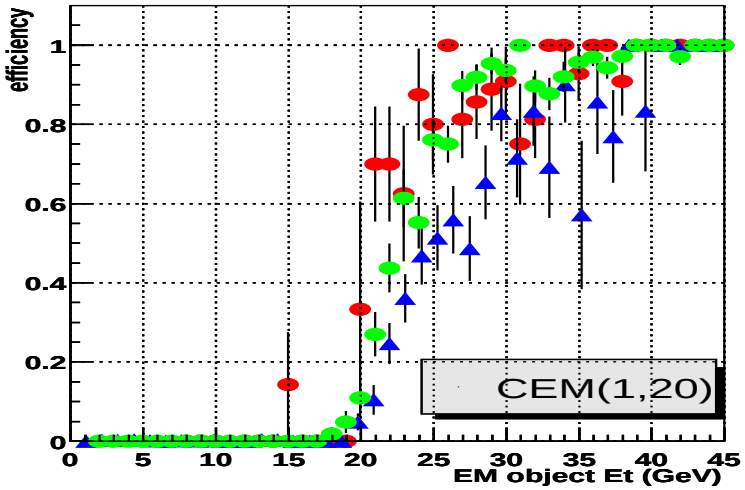
- L1 is only part of d0trigsim which is simulation
- Reads Front-End info, simulate and send to L2 and L3. Optionally “pass-through” real L1 data instead.
- Components:
  - L1Cal - tuned to data including noise, pedestals, gains, etc.
  - L1Muon - good agreement with data
  - L1FT - no data yet, all there “in theory”.
  - L1FRM - newly implemented packing/unpacking just like data. Has a known bug (bits all zero) so far in p11.

P11 Status - L1









P11 Status - L2

- All L2 preproccessors take inputs from L1 simulation, L2Muon also gets info from FEs.
- Runs on data by taking advantage of L1 “pass-through” modes.
- framework fully in place
- Components:
  - L2Muon, L2Cal, L2Global - like online plus other features
  - L2CTT, L2CPS - Not online yet, but waiting....
  - L2STT - Working but not fully integrated

P11 Status - L3

- Developed independently of L1/L2 simulation.
- tsim_l3 is offline wrapper for ScriptRunner, also runs standalone
- If it is in L3, it is in d0trigsim
- If you want to certify your L3 tool/filter this is the way to do it!

Using d0trigsim

- User interface provided by runD0TrigSim script in the d0tools package
- The cookbook (revised)

```
setup D0RunII release_no |eg. p11.05.00
setup d0tools -t         |get latest
runD0TrigSim -filelist=myfiles.dat
```

- Only input you need to provide is list of inputfiles. Default trigger list is used if none provided.
- What else can it do? SAM, batch, debug, maxopt ??? How do I find out?

Using d0trigsim

- Ask script for help

```
runD0TrigSim -h
Command to run D0TrigSim_x.                                                    Apri

Usage: runD0TrigSim [...]

Example
-------

To run D0TrigSim_x out of the p11.05.00 production release,

   setup n32                # on d0mino only
   setup D0RunII p11.05.00

   runD0TrigSim -filelist=mydata.dat

where mydata.dat contains a list of files to process.
```

Using d0trigsim

```
Command line options:
---------------------
    D0TrigSim-Specific
    ------------------
    -trglst       - name of trigger list xml file to use
    -trglstpath   - path to the trigger list xml file
    -l1l2only     - run only L1/L2 simulation
    -l3only       - run only L3 simulation

    General
    -------

    -h        - Get help.

    Global parameters
    --------------------

    -exe=exe            - Name of executable
    -rcp=rcp            - Name of framework rcp script
    -rcppkg=rcppkg      - Name of framework rcp package
```

Using d0trigsim - eg - easy

- login to a system with D0Code installed (eg. clued0, d0mino)
- create a text file (files.list) containing list of inputfiles to process (using full paths). Files all contain RawDataChunks (eg. standard MC from farms)
- run d0trigsim with default triggerlist on 5 events

```
setup D0RunII p11.05.00
setup d0tools -t
runD0TrigSim -filelist=files.list -num=5
```

- Creates subdirectory and fills it with goodies!

Using d0trigsim - eg - analyze it!

- I want a combined reco+trigsim ntuple. Can I use d0_analyze on the output?
- Copy out the trigsim EVPACK outputfile and created another text file (files_d0analyze.list) listing it as the inputfile

```
setup D0RunII p11.05.00
setup d0tools -t
rund0analyze -filelist=files_d0analyze.list
```

Using d0trigsim - eg - on data

- I want to run d0trigsim on data
- L1Cal inputs not stored in data, want tsim_l1cal to “passthrough”

```
setup D0RunII p11.05.00
setup d0tools -t
setup d0cvs
newrel -t p11.05.00 myarea
cd myarea
addpkg tsim_l1l2
xemacs tsim_l1l2/rcp/tsim_l1cal.rcp
 (bool rawdatapassthrough = true;)
runD0TrigSim -filelist=files.list -num=5 -localrcp
```

Using d0trigsim - eg - simfiles

- What if you have hand-edited level3.sim to change a threshold? How do you override default? (or level1.sim, level2.sim, epics.sim)
- create directory named “trigsim”, copy new level3.sim file into directory. It will override default.

```
setup D0RunII p11.05.00
setup d0tools -t
mkdir trigsim
cp level3.sim trigsim
runD0TrigSim -filelist=files.list -num=5
```

Using d0trigsim - eg - triggerlist

- What if you want to run using your own triggerlist? Is this difficult?
- ...not if it works....

```
setup D0RunII p11.05.00
setup d0tools -t
runD0TrigSim -filelist=files.list -num=5 -trglst=tsim_p09-1.00.xml
```