Function/Diagnosis/Triage of Global Trigger List Operations

DAQ Shifter Tutorial

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Introduction

- Function of the Trigger List is to configure D0-DAQ for data taking
- Trigger list contains
  - Physics triggers
  - Monitoring triggers
  - Commissioning triggers
- Online examines provide a finer look at quality of data
- This talk provides info and debugging tips on how to tell:
  - Is the system OK?
  - If not, how to focus in on the source of the problem via triggers
    - Trigger rates, XS are good first indicators of something gone awry
What's Normal: Rate Limits

- **L1 Rate:** 1.4kHz current 2.5kHz max 6kHz design
  - Current limit imposed by 5% FEB from SMT readout
  - Max limit imposed by SVX chip -- L1Busy

- **L2 Rate:** 800hz current 1kHz max 1kHz design
  - Current limit imposed by muon FE crates
  - Max limit imposed by Calorimeter readout

- **L3 Rate:** 50hz current 75hz max design
  - Reprocessing time -> 50hz chosen as 16M events/week average
  - Running near max limit, L3 Disables may affect data can affect Lumi determination

- Note: Rates are matched to rate limits via prescales.
  - At the present time, tuning prescales is an iterative process.
  - Not always possible to hit L1, L2, L3 target rates with desired mix of triggers.

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Daq Rate Plots

- By Design:
  - Quick means of monitoring current online conditions from outside CR
  - Created to collect data used to monitor, maintain prescales
- Collects info from different sources (not necessarily in sync)
  - Trigmon (P.Laurens): L1 & L2 rates, L1busy, L2busy, L3 disable
  - Beams Div. Current Status: lumi, store number
  - Lumi reports (M.Begel): average rate to tape, pauses, scl inits
  - Runs database: Runs collected, prescale file

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Ideally:

Tuned prescale sets will give saw-toothed pattern at L1, L2, L3

Trigger rate should:

- smoothly decrease over time
- should ~follow lumi

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Example of Noisy Rate Plot
Possible Rate Problem?

Possible Crosscheck:

Compare to run taken with same prescale set:

- Get list of runs, stores, prescale files for trigger list from:
  http://www-d0.fnal.gov/trigger_meister/private/www/tl_desc/global.html
  Linked from TriggerMeister and TriggerBoard homepage

- Change.log file in official/trigname-prescales to check prescale file has not changed

- Archived daq rate plots are at:  http://www-d0online.fnal.gov/www/groups/tm/daqrates/
  Linked from TriggerMeister homepage
Daq Rate Plots -- Some details

- Runs on d0ol15:
- Data collected once/minute
  - Data written to 2 text files
  - Text files available back to Fall, 2002
  - Currently, files at /scratch2/d0tm/TMtools/daqrates/TMtools/py/daq_rates
- Plots updated once/minute until store number changes
- Sample text file:

<table>
<thead>
<tr>
<th>Date</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>Lumi</th>
<th>L1Bz</th>
<th>Store</th>
<th>L2Bz</th>
<th>L3Dis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sat Jul 26 07:23:02 2003</td>
<td>956.86</td>
<td>633.96</td>
<td>47.63</td>
<td>25.89</td>
<td>2224</td>
<td>0</td>
<td>3.40</td>
<td>2821</td>
</tr>
<tr>
<td>Sat Jul 26 07:23:02 2003</td>
<td>956.86</td>
<td>633.96</td>
<td>47.63</td>
<td>25.89</td>
<td>2224</td>
<td>0</td>
<td>3.40</td>
<td>2821</td>
</tr>
<tr>
<td>Sat Jul 26 07:30:01 2003</td>
<td>961.82</td>
<td>637.40</td>
<td>48.75</td>
<td>25.86</td>
<td>2348</td>
<td>0</td>
<td>3.50</td>
<td>2821</td>
</tr>
<tr>
<td>Sat Jul 26 07:31:02 2003</td>
<td>964.44</td>
<td>641.48</td>
<td>47.12</td>
<td>25.83</td>
<td>2410</td>
<td>0</td>
<td>3.60</td>
<td>2821</td>
</tr>
<tr>
<td>Sat Jul 26 07:32:01 2003</td>
<td>959.34</td>
<td>633.72</td>
<td>49.60</td>
<td>25.88</td>
<td>2477</td>
<td>0</td>
<td>3.50</td>
<td>2821</td>
</tr>
</tbody>
</table>

store2821.txt lines 453-457/1421 32%

- Can read file(s) into roottuple for different look at data

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Example plots from daq_rates data

  - Lumi >5E30 cm\(^{-2}\) sec\(^{-1}\)
    - i.e., we are in a store
  - L3 rate >5hz
    - i.e., we are running

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If the system is broken
(or bleeding slightly)
How to determine
where put the bandage
(or what to amputate)
Individual Trigger Rates:
What's a Normal rate?

ImTrigger: Ratio of rates  (by Han Do)

- Compare current XS to value obtained during reference run
- Easy to spot problem trigger -- All bars should be at 1

by Trigger

- L1 Ratio
- L2 Ratio
- L3 Ratio

Ideally, this is what we want!

We need to make it more robust

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ImTrigger: Ratio of Rates

- Not-So-Good Points
  - Program is undergoing shakedown, needs polishing
  - Ratio is sensitive to:
    - quality of reference run
    - sampling period of data (?)
    - tracking triggers have non-linear increase with lumi
  - For example, if ratio is x10 for a trigger, is it real or a fluke?
    - To answer such a question, a nice complementary program to lmtrigger could be stripmon (suggestion by Michiel)
    - More about stripmon later
ImTrigger: Trigger Status Page
(also available on ImExpert gui)

Select combination of L1, L2, L3
(buttons toggle on/off)

Get relative rates here

Get Absolute rates here
- sensitive to sampling?
- Can compare these rates to predicted ones in prescale files

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Prescale Files

- Contain expected:
  - trigger rates at target luminosities
  - L2, L3 rejections
- Uses same reference run as lmTrigger

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Daq_Monitor -- L1 Rates

Info from prescale files useful when used in conjunction with daq_monitor

![Image of graph showing L1 rates and names]

<table>
<thead>
<tr>
<th>L1 Name</th>
<th>Measured L1 Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afatzz_nvu</td>
<td>0.0</td>
</tr>
<tr>
<td>ALiveB_nvu</td>
<td>0.757</td>
</tr>
<tr>
<td>L1Mu_download</td>
<td>0.8</td>
</tr>
<tr>
<td>LICTT_download</td>
<td>0.62</td>
</tr>
<tr>
<td>CEM(1,3)_nvu</td>
<td>1.154</td>
</tr>
<tr>
<td>CEM(1,6)_nvu</td>
<td>0.385</td>
</tr>
<tr>
<td>CEM(1,9)_nvu</td>
<td>0.962</td>
</tr>
<tr>
<td>L1 Name 2</td>
<td>Measured L1 Rate</td>
</tr>
</tbody>
</table>
Trigstripmon

- By I.Hall and R.Schwienhorst
- Online monitoring gui
- Part of a collection of tools that are configurable
  - Can plot any quantity in L3MonServer vs time.
- Easy to run. On an online machine type:
  
  ```
  [toole@d0o1l15 ~]$ setup d0online
  [toole@d0o1l15 ~]$ setup l2monitor_displays
  Word too long.
  [toole@d0o1l15 ~]$ setup l2monitor_displays
  [toole@d0o1l15 ~]$ trigstripmon
  [toole@d0o1l15 ~]$ 
  ```
- Opens 2 GUIs, a manager and a display
- Triggers only available by spec_trig number.
  - spec_trig <-> L1 name map in daq_monitor
  - Ability to select on trigger names in the works

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Trigstripmon

1. Click box in upper manager to select chart in display

2. Select trigger info to be displayed in that chart by clicking on box in lower window

Plots:
- L1 Accept rate (white)
- L2 Accept rate (blue)
- AOR rate (brown)

Manager

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PostMortem
Digging up Trigger Info after a run has expired
Run DB

- First place to look to determine
  - What trigger list was run
  - Time of run
  - Store number
  - Prescale for each trigger
  - Run Quality ratings
  - Magnet values

Linked from
TriggerMeister homepage

http://d0db.fnal.gov/run/

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More Info on Run: Luminosity Reports

- Provided by Luminosity ID group
  http://www-d0online.fnal.gov/
  www/groups/lum/reports/runs/

- Linked from:
  - TriggerMeister homepage
  - Lumi ID homepage

- Each global physics run has one

- Availble ~15 minutes after run has ended

- Top part of page contains info pertaining to whole run
  - Configuration
  - Time, Duration
  - Lumi
  - Live Fraction
  - Number of events

Run: 178150

Start: 2003 Jun 16 15:57:26 CDT (LBN#2436212)
End: 2003 Jun 16 19:57:31 CDT (LBN#2436468)
Duration: 4.00 hours
Config: official/global_CMT-11.04 (Physics)
Crane List: 10.13-14,16-19,11-23,30-3b,40-4c,50-53,60-6b
Store: 2692
Run Comments: Trigger Bit Map

Integrated Luminosity

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount (nb^-1)</th>
<th>Fraction of Delivered</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivered</td>
<td>283.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down</td>
<td>4.79</td>
<td>1.7%</td>
<td>global disables or bad data in this run</td>
</tr>
<tr>
<td>Lost in DAQ</td>
<td>0.00</td>
<td>0.0%</td>
<td>including all concurrent runs</td>
</tr>
<tr>
<td>Recorded</td>
<td>265.89</td>
<td>93.7%</td>
<td>including concurrent normalizable runs</td>
</tr>
</tbody>
</table>

Live Fraction by Exposure Group

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Normalizable</th>
<th>Unnormalizable</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live</td>
<td>94%</td>
<td>51% / 50% / 49%</td>
<td></td>
</tr>
<tr>
<td>Decorrelated Dead</td>
<td>2%</td>
<td>2% / 3% / 3%</td>
<td>L2/L3/C0/OR disables</td>
</tr>
<tr>
<td>Correlated Dead</td>
<td>4%</td>
<td>48% / 48% / 53%</td>
<td>FEB, SkipNextN</td>
</tr>
</tbody>
</table>

Events

| Lost in DAQ | 0.00%         |
| Rate to Tape | 40.0 Hz       |
| Stream Events | 576889, 285 |
| TOTAL       | 576889, 285 |
| all         | 576889, 285  |
| monitor     | 0, 0          |

Transitions

| SCL inits | 6 |
| Pauses    | 2 (0.06 hours) |

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Lumi Reports II
Further down in Report

- Plot of rate to tape vs lbn (time)
- List of normalizable triggers in this run
  - L1 XS
  - L2 XS
  - L3 XS
  - # of events
    (really high number could indicate problem)
  - Plot of XS vs lbn
    - For quick debugging: I copy directory of pics to another machine and use gthumb (linux)
    - /luminosity/data/www/runs/178k/plots/178150

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gthumb snapshot of Run 178150 Triggers
Tying Peak in Rate Plot to a Trigger

Hot Cal Tower?
Hot Cal Cells?

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What is a Normal Rate for a Trigger?

- Could look at XS vs run number for a trigger
- Use **THIS** in TMtools package
  - Newer, but usable --> Work in progress
  - To run on clued0:
    - Type in trigger name
    - Select plot variables
    - Click Run
- **THIS** plots XS values from lumi reports
- Note: **THIS** is slow

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XS vs Run webpage

- Newer, but usable --> Work in progress
- **THIS** is run for all triggers in list, output is posted on a website:

Subsets of plots based on interests
XS vs Run Webpage

- For each trigger, plot of
  - L1XS vs. Run
  - L2XS vs. Run
  - L3XS vs. Run
  - text file of data
More Run-based Info on a Trigger

- **GetRuns.py script (E. Gallas)**
  - For a given trigger, returns:
    - List of runs
      - run number
      - start time,
      - duration of run
      - store number
      - Trigger list
      - other things
  - To run, type:

    ```
    toole@stamp-clued0:~> mkdir test
toole@stamp-clued0:~> cd test
toole@stamp-clued0:~> setup d0cvs
toole@stamp-clued0:~> cvs co TMtools
toole@stamp-clued0:~> setup D0RunII
toole@stamp-clued0:~> cd TMtools/py/GetX
toole@stamp-clued0:~> ./GetRuns.py -tname E1_SHT20 -file
    ```

Typing `GetRuns.py` w/o any arguments returns a help file
### GetRuns Output

#### Results:
These 141 Official Runs contained triggers with Trigger Name Version = EL_SHT20 / 0

<table>
<thead>
<tr>
<th>RUN_NUMBER</th>
<th>START_TIME</th>
<th>DURATION</th>
<th>STORE</th>
<th>PRESONAME</th>
<th>RECORDING TRIG_CONF/NAME/VERS</th>
<th>TL_NAME/VERSION</th>
<th>BIT_CONF/NAME</th>
<th>L2_BIT_CONF/NAME</th>
<th>L1_BIT_CONF/NAME</th>
<th>L1_PRESCALE</th>
<th>EG_NUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>177314</td>
<td>2003-05-26 23:48</td>
<td>0.2</td>
<td>0.3</td>
<td>0.25</td>
<td>official/special/global_LMT_test-12.00 global_LMT_test-12.00 EL_SHT20 / 1</td>
<td>10 EL_SHT20</td>
<td>9</td>
<td>9*EL_SHT20</td>
<td>9*CEM[1,11]_nur2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>177698</td>
<td>2003-06-02 21:16</td>
<td>0.2</td>
<td>0.3</td>
<td>0.25</td>
<td>official/special/global_LMT_test-12.01 global_LMT_test-12.01 EL_SHT20 / 1</td>
<td>10 EL_SHT20</td>
<td>9</td>
<td>11*EL_SHT20</td>
<td>9*CEM[1,11]_nur2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>177500</td>
<td>2003-06-02 21:23</td>
<td>0.2</td>
<td>0.3</td>
<td>0.25</td>
<td>official/special/global_LMT_test-12.01 global_LMT_test-12.01 EL_SHT20 / 1</td>
<td>10 EL_SHT20</td>
<td>9</td>
<td>11*EL_SHT20</td>
<td>9*CEM[1,11]_nur2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Some of the things available for monitoring, debugging, reviewing the performance of a trigger list

**During the Run:**

- Daq Rate plots
- Daq monitor
- Prescale files
- LmTrigger/lmExpert
- Trigstripmon

**After the Run:**

- RunDB, scripts
- Luminosity reports, and trigger plots
- XS vs run number plots