DAQ Tutorial (Calorimeter)

Norm Buchanan

May 17, 2005
Outline

- Calorimeter Overview
- Shifter Tasks
- GUI Descriptions
- To do during store
- To do between stores
D0 Detector

Forward Mini-drift chambers

Central Scintillator

Forward Scintillator

Shielding

Solenoid, Tracking System
Si, SciFi, Preshowers

Electronics, Trig, DAQ
DØ LIQUID ARGON CALORIMETER

END CALORIMETER
- Outer Hadronic (Coarse)
- Middle Hadronic (Fine & Coarse)
- Inner Hadronic (Fine & Coarse)
- Electromagnetic

CENTRAL CALORIMETER
- Electromagnetic
- Fine Hadronic
- Coarse Hadronic

1m

y

x

z
Overview cont...

Liquid Argon
- Electromagnetic
- Fine hadronic
- Coarse hadronic

Scintillating
- Inter-cryostat detector

~55,000 readout channels
Precision Readout

- preamp crates
- BLS card
- preamp

pulser signal injection

Trig. sum

Bank 0
- SCA (48 deep)
- SCA (48 deep)

Bank 1
- SCA (48 deep)
- SCA (48 deep)

BLS Card

ADC → DAQ

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Control of System

- **Pulser**
- **Timing and control Card**
- **Calorimeter**
- **BLS**
- **ADC**
- **Trigger system**

Receives trigger, accelerator, clock information
Samples BLS shapers at the signal peak and base.
Keeps track of the memory location of crossings.
Generates busy signal when system is not ready.
Coordinates pulser calibration.

12 T&C boards and 1 controller board is used
L1 Calorimeter Trigger

BLS Card

Cal Preamp

Precision Readout

Trigger Pickoff

Analog TT Sums

CTFE Card

40 x 32 Trigger Towers
0.2 x 0.2 in $\Delta\eta \times \Delta\phi$

2560 differential analog
Trigger pickoff signals

EM EM+H Compare & Sums

E $\rightarrow$ Et

ADC

1280 EM samples
1280 HD samples

to L1 Trigger Framework
How is it all related?

**Physics display**

**Cathedral**
- Preamps (and PSs)
- 1 Crate per ADC crate
- 2 PS per crate (1 + backup)

**Platform**
- BLS cards (and PSs)
- 6 Crates per ADC crate
- 1 PS per 2 BLS crates

**MCH 3**
- ADC cards (and PSs)
- 12 Crates
- 1 PS per 2 ADC crates
Be familiar with the console
Run and watch the examines
- Cal data quality
- L1 CAL examine
Make sure all GUIs are opened
- Supply GUI, alarm display, taker, logbook etc...
Look for alarms or unusual conditions (pink=trouble)
Use the logbook
- fill out the end of run summary and paste plots
- note anything out of the ordinary (such as calling expert)
Take pedestal calibration runs between stores
Assist expert with taking NLC calibrations
Lego plot $E_T(\eta,\phi)$

Alarms/Status

Cal utilities

Examines and taker
CALMUO Web Page

Shifter’s guide
On-call contacts
Shift schedule
Useful links

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A script that properly starts cal utilities

What you need to know

- `start_cal all` (starts all standard GUIs)
- `start_cal` (lists all possible arguments, when in doubt use this)

Some useful commands

- `start_cal supply` (starts Supply GUI)
- `start_cal alarm` (starts alarm watcher)
- `start_cal hv` (starts high voltage GUI)
- `start_cal D0run` (change to d0run user)
- `start_cal rmi` (starts rack monitor GUI)
- `start_cal ioc` (starts IOC monitoring)

- `start_cal dq_calο` (cal examine)
- `start_cal dq_monitor`
- `start_cal l1examine_d0ol23`
- `start_cal l1examine` (l1cal examine)
- `start_cal calib` (calibration GUI)
\textbf{GUIs - Alarms}

```
"\texttt{start\_cal\ alarm}\"
```

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<th>MAJOR</th>
<th>MINOR</th>
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<th>ACKED</th>
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Status: Connection to server opened

- Watch out for \textcolor{red}{pink} (major) alarms
- Check that disabled are "known" - disabled list
“start_cal rmi”

Platform

MCH (3 for CAL)

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Keep an eye on the archiver status!
Supply GUI cont...

16 pages (TABS) of information

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<th>RLS C N</th>
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</table>

Global

- Turn On All
- Turn Off All
- Reset All

Status: "Not started"

Reconnect | Archive | Exit
It's important to be able to give details to experts.
Supply GUI – pulser

Pattern status: 0="OFF"  1="ON"

All “OFF” for physics running!
Supply GUI – Shifter Mode

- **Pedestal subtracted zero suppression (cut: 1.5 \( \sigma \))**
- **Pedestal version**
- **Status word should be 0x10**
- **Occupancy ~7% to 12%**
- **Pulser status (Off for physics)**
- **BLS Mode Normal = -3 ticks (3x132ns)**
- **ADC error word**

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<th>STATUS</th>
<th>LITRAN</th>
<th>ADC ERR</th>
<th>BLS_MODE</th>
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- **ADC error word**
“start_cal hv”

### HV GUI

**Change individual channel**

**Change all channels**

**Can enter voltage by hand**

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<td>385</td>
<td>3263</td>
<td>500</td>
<td>2000</td>
<td>2000.0</td>
</tr>
<tr>
<td>405</td>
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<td>0</td>
<td>2000</td>
<td>2000.0</td>
</tr>
<tr>
<td>425</td>
<td>3250</td>
<td>500</td>
<td>2000</td>
<td>2000.0</td>
</tr>
<tr>
<td>445</td>
<td>3252</td>
<td>500</td>
<td>2000</td>
<td>2000.0</td>
</tr>
<tr>
<td>465</td>
<td>3250</td>
<td>500</td>
<td>2000</td>
<td>2000.0</td>
</tr>
</tbody>
</table>

**Status:**

- **Reconnect**
- **Offline**
- **Online**
- **Off**
- **On**
- **Ramp**
- **Pause**
- **Resume**
- **Lock**
- **Unlock**
- **Reset**
**Before Store**

*cal_prepare_for_run* is a special configuration file that sets up the calorimeter for the coming store.

**Do not** press “Start” in taker
**Do not** free trigger in taker

```
change trigger commissioning/cal/cal_prepare_for_run-2.4
```

```
“start_daq taker”
```

Also: - check for major alarms
 - check pulsers are OFF
During Store

Start and/or watch examines

dq_calo

自动启动新运行
 (...still keep an eye on it)

启动/重新启动:

start_cal dq_calo

start_cal
dq_monitor

l1examine

Shifter restarts with each new run

启动:

start_cal

l1examine dq_calo

init

start

to stop:

stop

quit

Calorimeter

L1 Cal trigger
DQ_calo – Overview

- examine behaviour settings
- plot directory
- plot windows
- event-type stats
- additional diagnostics
- noise and/or missing crates
- bad cells
**dq_calo** (healthy example)

Be familiar with the plots
Be alert - look for changes
Paste anomalies in logbook
Compare various plots
Communicate with GM shifter

Zero bias

Jets

Powerful tool for shifter ... and experts!
Bad

BLS cable harness problem

REALLY Bad!

Problem with pedestals
Be familiar with the plots
Be alert – look for changes
Paste anomalies in logbook
Compare various plots
Communicate with GM shifter

Sorry to be repetitive, but...

One page for EM, one for HAD

Trigger $E_T$ and hits in ($\eta, \phi$)
If a CAL cell is causing problems with L3 rates, it may have to be killed.

- Discuss with captain
- Page expert
- Have coordinates of cell ready (phys. or elec.)
- In coordination with expert:
  
  ```
  start_cal D0run
  start_cal
  HCKiller
  ```
- Ask for run to be stopped and trigger freed
- Enter coords -> Kill -> Save
- Download cal_prepare_for_run
- Resume running and make sure problem fixed!
End of Run

- Save histograms and paste in logbook
- Complete CALMUO checklist
- Get ready to restart l1examine

- If store ends, set MUON HV to STANDBY
- **CAL HV stays up always**
Perform pedestal calibration
- No beam in machine (ask Captain)
- If time is short take gain 8 only – otherwise take gain 1 as well

Keep system running, monitor examines

Help out experts
- Assist with NLC “ramp runs”
- During access assist with running diagnostics
- Make entries in logbook
- After any changes be sure pedestals are taken

Shift cancellation
- During extended Tevatron downtime shifts may be cancelled
- Check with Captain, CAL expert, and MUON expert first
Pedestal Calibration

How to run GUIs
- Select “Cal”
- Select “Pedestal”

Follow instructions in manual

Ask for CAL and SMT crates
Use taker to start each run
Never stop calib run with taker!
After runs taken, give back SMT
Record run #’s in logbook
If Ped Diff plot looks bad, page expert
Link pedestals
Paste Ped Diff plots in logbook
Good Pedestals

Pedestal Value

Pedestal RMS

Gain 8

Gain 1
Post-repair Pedestals

Typical of hardware change

Watch edges
Starting calorimeter pedestal calibration run.
SMT is off.
Run 195816 x8, run 195817 x1. These two runs went OK.

Bad Channels:

3 1 3 0 6 578.11 63.37 576.80 55.25 4567.73 18.30 4 E-ped8
4 9 5 2 11 579.97 99.99 575.42 50.72 4586.80 66.11 4 E-ped8
Calibration looks OK to me so I linked the pedestals.
**Summary**

- All details of shifter duties and troubleshooting can be found in the CAL shifter’s guide (white binder or web)
- If in doubt... page expert!