Tutorial: D0 Muon Shifts

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June 3, 2003

- The Hardware
- Control Applications
- Troubleshooting
The D0 Muon System

central: Central Drift Chambers  Central Scintillation Counters  ($|\eta| < 1$)

forward region:

Forward Mini-Drift Chambers
Forward Scintillation Counters ($1 < |\eta| < 2$)
## The Muon Subsystems

<table>
<thead>
<tr>
<th>Central Muon System:</th>
<th>WAMUS – Prop. Drift Chambers (PDTs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central Scintillation Counters (CSC)</td>
</tr>
<tr>
<td>Forward Muon System:</td>
<td>FAMUS – Mini Drift Chambers (MDTs)</td>
</tr>
<tr>
<td></td>
<td>Forward Scintillation Counters (FSC) – Pixels</td>
</tr>
<tr>
<td>Trigger:</td>
<td>L1 Muo</td>
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</tbody>
</table>
Hardware Locations

- Readout crates: Movable Counting House 3rd floor (MCH3)
- High Voltage power supplies: Movable Counting House 2nd floor (MCH2)

(shifter may need to powercycle those crates, e.g. after a power failure)
Muon related tasks during calm uo shift (1)

- **general**
  D0 data taking → as efficient as possible
  read documentation / get used to control applications
  know potential problems
  be aware of what’s happening around you ...
  relevant events → electronic logbook

- **shift begin**
  previous shifter → current status
  recent problems / special situations for specific subsystems
  shift captain → general D0 status
  make sure that all control applications are running
  and check that no (unknown) errors are present
Muon related tasks during calmuo shift (2)

- **at the begin of a store**
  after store scraping is completed: ramp Muon high voltages to 100% (full)
  
  **cal:** download `cal_prepare_for_run` & free the trigger
  check that there are no alarms

- **at the begin of a new run**
  start "muo_examine" and the "histo" program
  start to fill out the muon run checklist for the new run → use checklist GUI
  
  **cal:** start "cal_examine", "L1Cal_examine" and the "histo" programs

- **while a run is in progress**
  keep an eye on the alarm display / check the muo-examine histograms regularly / check the resource monitors for the subsystems
  
  **cal:** monitor hot cells — kill hot cells using “HotCellKiller”
Muon related tasks during calmuo shift (3)

- **at the end of a run**
  archive the histograms (muon and cal) in the electronic logbook after you have prepared everything for the new run: complete the checklist for the last run

- **at the end of a store**
  after the shift captain has informed you that the data collection is completed: ramp all muon high voltages to STANDBY (yes: the PDT pads the standby value is equal to full value!) **cal:** do **not** change the calorimeter HV!!!! — never change cal HV!!!

- **in between stores**
  keep the system running
  check for problems during zero-bias run: run the examine programs
Control Application for the Muon System

new webpage: http://www-d0online.fnal.gov/www/groups/calmuо/

- documentation on the web
- Logbook
- Readout Client
- Alarm Display
- HV display
- Resource Monitors
direct access to all documentation:

how to operate:

- Readout Client
- HV GUI
- alarm display

information on muon subsystems:

- MDT / Pixel
- PDT / L1muo
The Muon Shift Documentation on the Web

- **purpose:**
  provide *basic* knowledge about the muon system and the muon control applications that helps to *identify* and *locate* problems.

- **only very limited:** solve problems

- **real problems:**
  shifters task: call/page experts!
  all decisions have to be made by experts
The Electronic Logbook

important: communication between shifters and experts

all relevant events → logbook

make sure that experts make notes about their work

practical aspect: only use .jpg pictures smaller storage size faster remote access

→ new logbook account “calmuo” – old cal & muo shifters passwords still valid
GUI layout corresponds to physical layout of the readout crates in MCH3 overview on the muon readout status

indicates:
readout errors (red) and/or deviations from the default configuration (yellow)

→ press button: More ... to access to detailed information for single readout crates
The Readout Client (2)

readout status of single muon crate (check status)

after crash: **STOP** and **START**
check field (1.) to identify the section which caused the crash
note the error message (2.)

not responding or strange behaviour: **REBOOT** crate
(if this does not help call expert)

excluding sections when they crash at the first event: only after contacting the experts!!
**STOP** readout — disable channel — **Load Setup to MFC** — **START** again

when excluding channels: they also **must** be excluded from L1 and L2
later, when including: don’t forget to include in L1 and L2

← experts task
The Muon Alarm Display

<table>
<thead>
<tr>
<th>Group Name</th>
<th>MAJOR</th>
<th>MINOR</th>
<th>INVALID</th>
<th>DISABLED</th>
<th>GOOD</th>
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</thead>
<tbody>
<tr>
<td>Run Pause</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>HIV</td>
<td>0</td>
<td>232</td>
<td>0</td>
<td>284</td>
<td>1</td>
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<tr>
<td>MDT</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PDT</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>SCINT</td>
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<td>0</td>
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<td>0</td>
<td>4</td>
</tr>
<tr>
<td>LI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PROC</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All Muon</td>
<td>0</td>
<td>236</td>
<td>14</td>
<td>284</td>
<td>6</td>
</tr>
</tbody>
</table>

check regularly

often: the simplest way to identify problems

e.g.: when low voltages are not at their default values
The Muon HV Display (1)

first page:
overview on all channels for all muon subsystems
(more details: click on channel name)

left column:
green: 100%
yellow: standby
red: trip

right column:
green, if setting corresponds to nominal setting

ramp all muon HV channels by pushing a single button
two detailed displays: complete info on single channels

helpful for troubleshooting:
monitor voltage and current for single channels

(example of a bad HV channel!)

allows to ramp single channels ⇒ helpful after trips
The Resource Monitors for the Subsystems:
MDTs

Unique way to get detailed information on subsystem status

usually status field: **NORMAL**

when status field is red:
click on **ALARM** for more information
⇒ write into logbook

⇒ always check after readout crashed to identify source for an error

⇒ This is what an expert needs to know when you page him/her at 2:00am!!!
The Resource Monitors for the Subsystems: PDTs

“hidden” buttons: give detailed info on alarms
→ very important to check whenever alarm occurred

grey fields: no communication on 1553
→ indicates that a PDT is not responding
(needs powercycling
→ access needed
→ PDT has to be disabled from readout & from L1, L2)

→ select card for PDT octants 0-7
Running MuoExamine and Histo

[Image of software interface and data charts]

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shifter tutorial: “D0 Muon Shifts”
June 3, 2003
Some errors are easy to spot:

Really helpful if shifter can identify such deviations
If you see such deviations — immediately page experts!!
“frequent” errors

- HV failures
  trips → reset & ramp again (a few times)
  ⇒ call expert

- crashes of readout crates
  → note section / keep statistics of frequency
  – always the same section??
  – so frequent that it disturbs overall data taking??
  ⇒ call expert / probably bad section has to be taken out of the readout

**important:** this section also has to be excluded from L1 and L2
conclusions

- operations of the muon system is pretty stable
- allows shifters to concentrate on “details” ↔ absolutely necessary to guarantee operation at high efficiency
- at the moment: most frequent problems from the PDTs:
  → failure of front-end electronics at begin of store
  → often stops the readout → call expert / disable PDT
  (current hypothesis: due to high radiation – under investigation)
- shifters documentation in a good shape
  still not “complete” — but is constantly improved
- feedback from shifters has helped to set up documentation
  ⇒ important for future progress