

The D0 Muon System

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March 3, 2003 — Shifter Tutorial

- The Hardware
- Control Applications
- Troubleshooting

The D0 Muon System

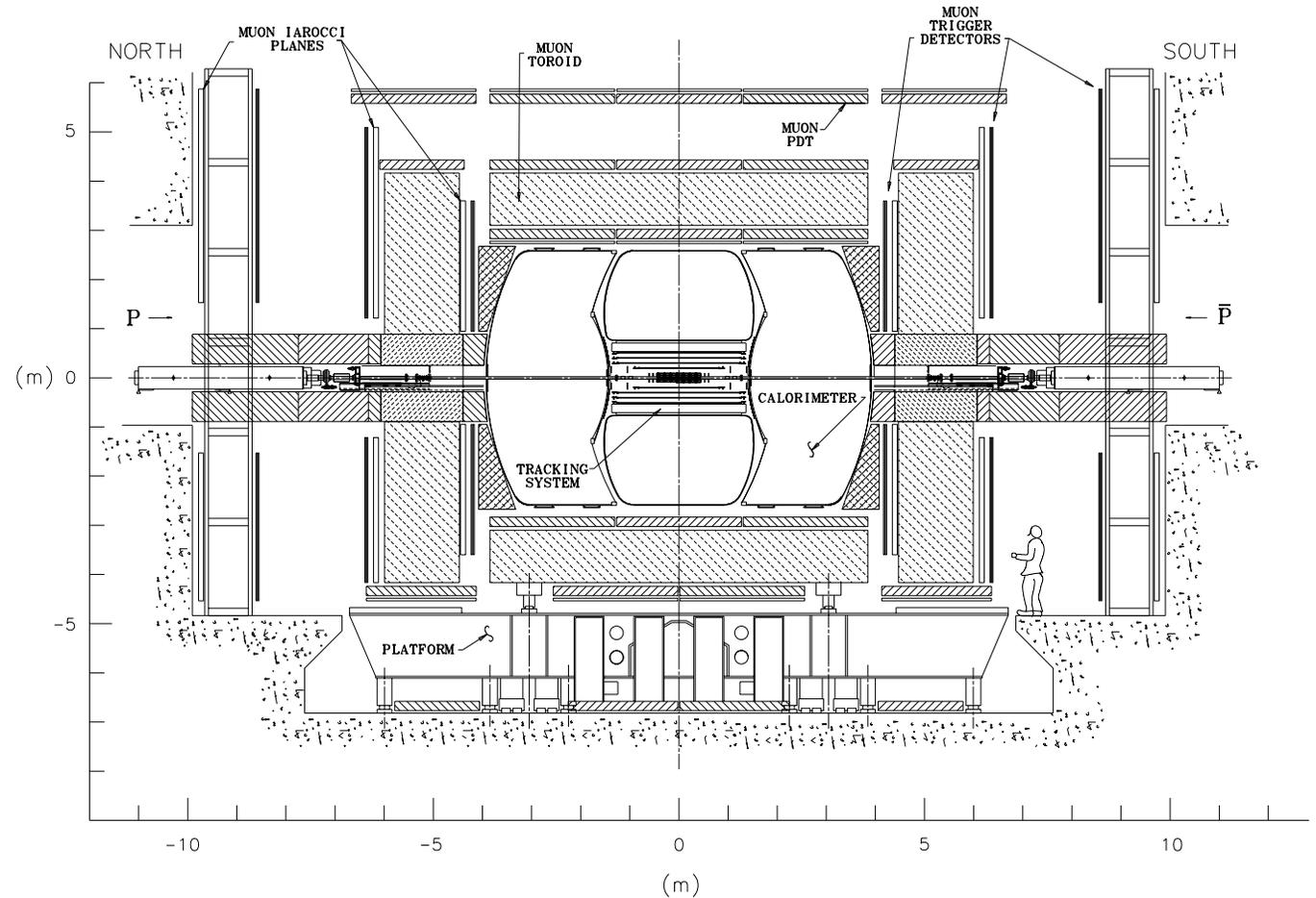
central: **Central Drift Chambers** **Central Scintillation Counters** ($|\eta| < 1$)

forward region:

**Forward
Mini-Drift Chambers**

**Forward
Scintillation Counters**

($1 < |\eta| < 2$)



Plotted Fri Sep 22 10:53:16 CDT 1995 by cease

The Muon Subsystems

Central Muon System:	WAMUS – Prop. Drift Chambers (PDTs) Central Scintillation Counters (CSC)
Forward Muon System:	FAMUS – Mini Drift Chambers (MDTs) Forward Scintillation Counters (FSC) – Pixels
Trigger:	L1 Muo

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)

Tasks during muon 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

Tasks during muon shift (2)

- **at the begin of a store**
after store scraping is completed: ramp Muon high voltages to 100% (full)
- **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
- **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
- **at the end of a run**
archive the histograms in the electronic logbook
after you have prepared everything for the new run:
complete the checklist for the last run

Tasks during muon shift (3)

- **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!)

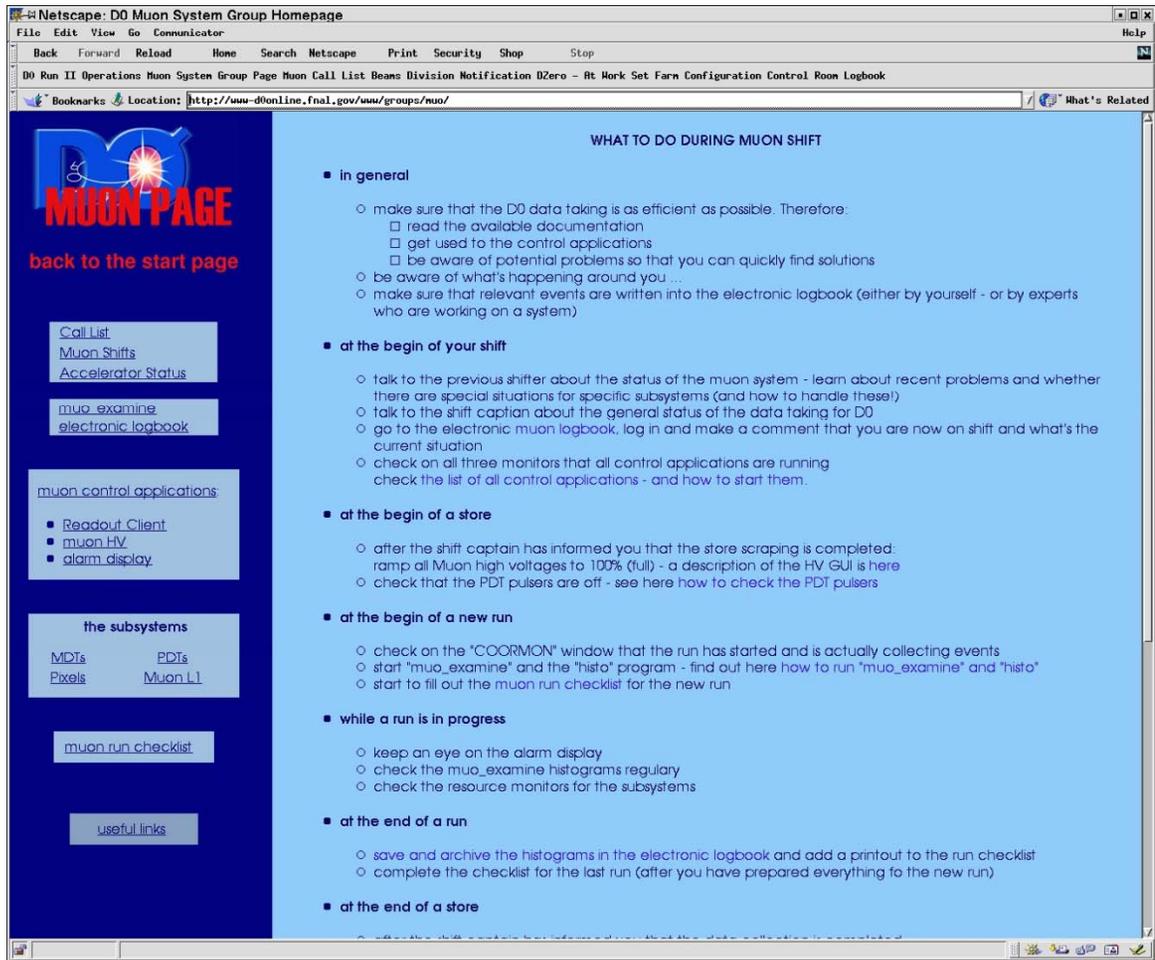
- **in between stores**

keep the system running

check for problems during zero-bias run: run muo-examine
while waiting on the next store check the accelerator status

Control Application for the Muon System

- documentation on the web \implies
- Logbook
- Readout Client
- Alarm Display
- HV display
- Resource Monitors



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:**
shifter's 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

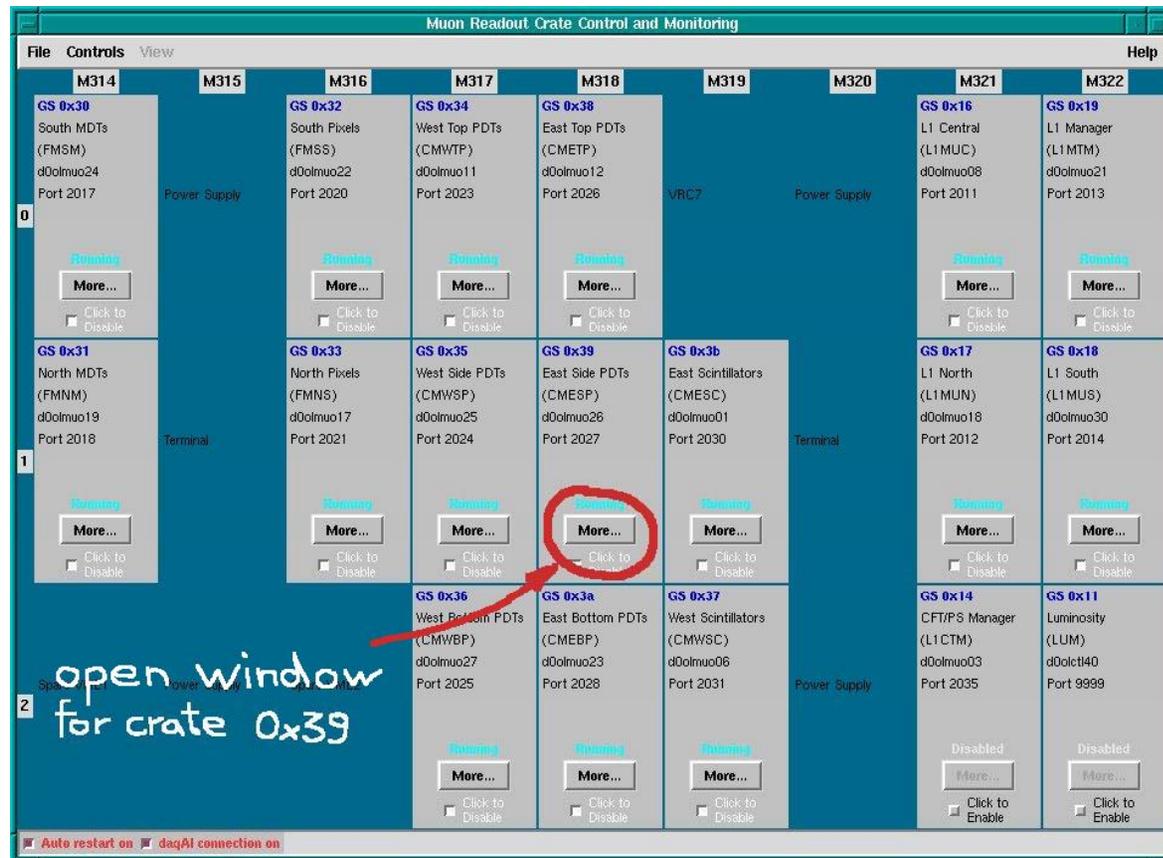
The screenshot shows the Logbook application interface. The top menu bar includes options like DAQ, CAPTAIN, CAI, CFT, CPS, EPD, EPS, ICD, LHM, MUD, SELECT, TMMHO, L3, L3, SMT, STT, Global Monitor, CONTROLX, MFC_OPS, Archive Report Page, and Tutorial. The left sidebar contains buttons for Log In / Log Out, Entry Signers, Administrator, Change Password, Search, Thread Explorer, Scheduler, Current Situation, Preferences, Checkpoint Recovery, About LogBook, Help, and Exit LogBook. The main content area displays a log entry for February 24, 2003, with fields for Saved Location, Date Created, Date Saved, Sequence Number, Category, Topic, Operator, and Selected Keywords. The entry text reads: "M Wobisch - on-call shift - I'm either in my office (x2344) or available by the PDT pager". Below the text is a screenshot of a graph showing oscillating current. Handwritten red annotations include: '1' around 'Log In / Log Out', '2.' around 'MUD', '3.' around 'Log', '4.' around the 'Text' button in the right sidebar, and 'drag & drop' with an arrow pointing to the 'Text' button. Another note says 'pictures: use .jpg format' with an arrow pointing to the graph image.

The Readout Client (1)

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)



→ access to detailed information for single readout crates)

The Readout Client (2)

readout status of
single muon crate

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

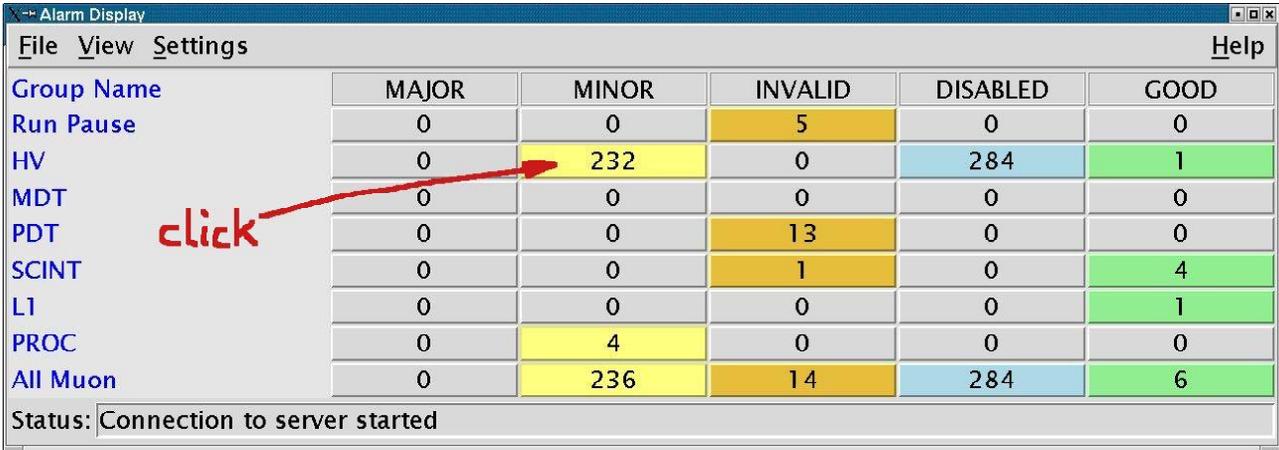
not responding or strange
behaviour: REBOOT crate
(if this does not help call expert)

The screenshot displays the 'Muon Readout Client' interface for crate 0x3a. The top section shows system status: 'System Status: Running', 'Last Status Change: Sun, 02 Mar 2003 17:22:10 CST', and 'Error Message: No Errors'. Below this, various counts are listed, including 'MFC Status: OK', 'SBC Status: OK', 'SBC DONE Count: 40523', 'SRQ Count: 40523', 'L2 ACCEPT Count: 40523', 'TFW INIT Count: 283', and 'Spurious SRQ Count: 0'. The right side shows terminal server port and tum number information. The main area is 'MRC Section Status', showing a grid of 12 sections (0A-11A and 0B-11B). Section 6A is circled in red with a '1.' next to it, indicating it was the section that caused the crash. A red arrow points to the 'SRQ Error Message: No Errors' field with a '2.' next to it. Another red arrow points to the 'Status: OK' field for section 8B with a '3.' next to it. At the bottom, there are buttons for 'start', 'stop', 'Get Setup from MFC', 'load setup to MFC', 'reboot crate', and 'Close'.

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

The Muon Alarm Display



The screenshot shows a window titled "Alarm Display" with a menu bar (File, View, Settings, Help) and a table of alarm counts. The table has columns for MAJOR, MINOR, INVALID, DISABLED, and GOOD. The rows represent different groups: Run Pause, HV, MDT, PDT, SCINT, LI, PROC, and All Muon. A red arrow points to the 'MINOR' cell for the 'HV' group, which contains the value 232. The word "click" is written in red next to the arrow.

Group Name	MAJOR	MINOR	INVALID	DISABLED	GOOD
Run Pause	0	0	5	0	0
HV	0	232	0	284	1
MDT	0	0	0	0	0
PDT	0	0	13	0	0
SCINT	0	0	1	0	4
LI	0	0	0	0	1
PROC	0	4	0	0	0
All Muon	0	236	14	284	6

Status: Connection to server started

check regularly

often: the simplest way to identify problems

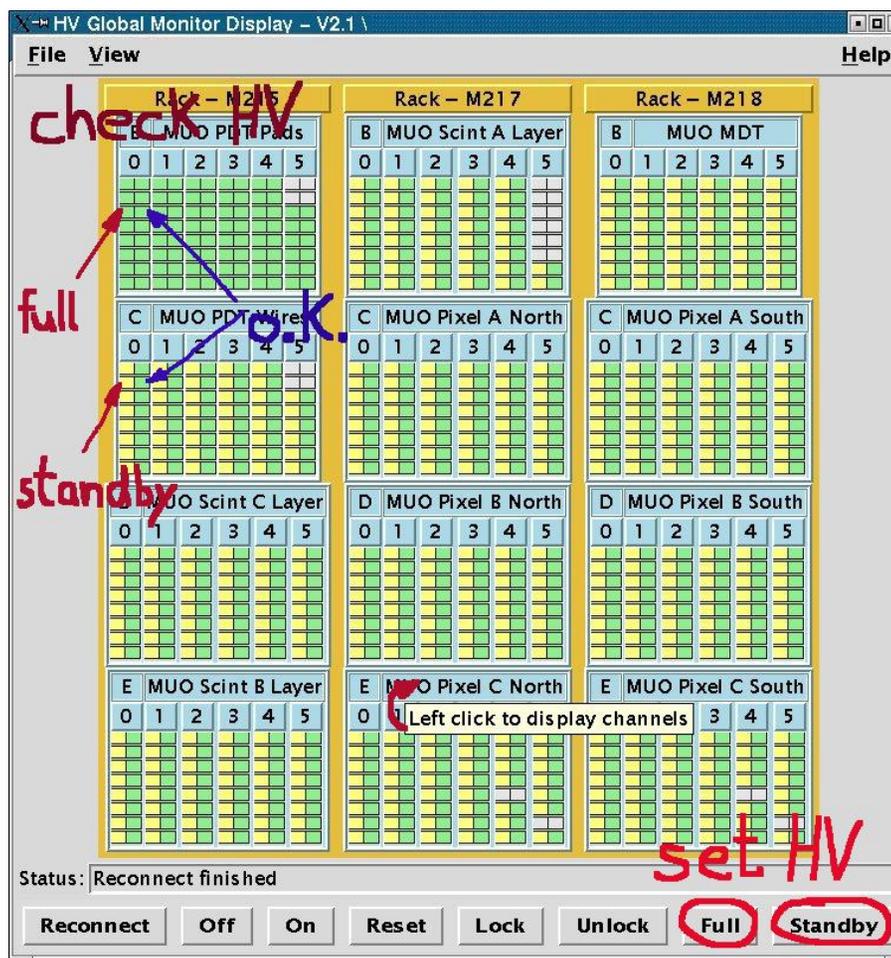
e.g.: when low voltages are not at their default values

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

The Muon HV Display (2)

two detailed displays: complete infos on single channels

HVC Channel Monitor Display - V1.18

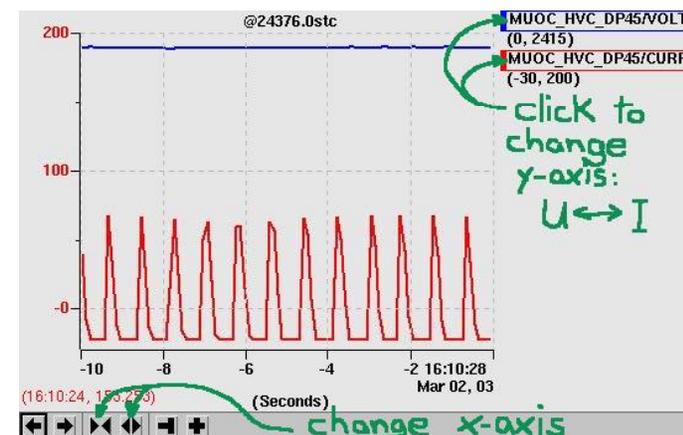
File View **Set HV** Plot Mode Help

MUO Pixel A North								MUO Pixel B North								MUO Pixel C North								MUO Pixel A South								MUO Pixel B South								MUO Pixel C South																																																																																																																																																								
Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State		Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State		Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State		Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State		Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State		Channel	V_Trip	V_Max	V_Set	V_Read	I_Read	State																																																																																																																																																		
MAN0	-3413	100	-3200	-1600.0	-1600.6	-0.8	Holding	MAN1	-3412	100	-3200	-1600.0	-1599.9	-0.8	Holding		MCN0	-3420	100	-3200	-1600.0	-1600.8	-1.2	Holding	MCN1	-3419	100	-3200	-1600.0	-1600.1	-0.9	Holding	MCN2	-3417	100	-3200	-1600.0	-1599.4	-0.5	Holding	MCN3	-3422	100	-3200	-1600.0	-1599.6	-2.0	Holding	MCN4	-3425	100	-3200	-1600.0	-1599.8	0.0	Holding	MCN5	-3411	100	-3200	-1600.0	-1599.9	-1.3	Holding	MCN6	-3416	100	-3200	-1600.0	-1600.3	-1.1	Holding	MCN7	-3415	100	-3200	-1600.0	-1600.3	-1.1	Holding	MCN8	-3414	100	-3200	-1600.0	-1599.9	-0.7	Holding	MCN9	-3418	100	-3200	-1600.0	-1600.3	-0.6	Holding	MCN10	-3416	100	-3200	-1600.0	-1599.9	-0.8	Holding	MCN11	-3417	100	-3200	-1600.0	-1600.8	-0.7	Holding	MCN12	-3419	100	-3200	-1600.0	-1599.9	-2.5	Holding	MCN13	-3413	100	-3200	-1600.0	-1600.6	0.3	Holding	MCN14	-3416	100	-3200	-1600.0	-1599.9	0.0	Holding	MCN15	-3420	100	-3200	-1600.0	-1601.0	0.2	Holding	MCN16	-3415	100	-3200	-1600.0	-1599.1	0.3	Holding	MCN17	-3418	100	-3200	-1600.0	-1600.6	-0.9	Holding	MCN18	-3415	100	-3200	-1600.0	-1599.6	0.0	Holding	MCN19	-3418	100	-3200	-1600.0	-1600.6	-0.9	Holding	MCN20	-3416	100	-3200	-1600.0	-1600.7	-1.2	Holding	MCN21	-3416	100	-3200	-1600.0	-1599.8	-3.1	Holding

Status: Reconnect Offline Online Off On **Ramp** Pause Resume Lock Unlock Reset

Handwritten notes:
 - "100% stable" with arrow pointing to V_Read column.
 - "click: single chan operations" with arrow pointing to a channel.
 - "click to monitor channel" with arrow pointing to a channel.
 - "all chan." with arrow pointing to the Ramp button.

helpful for troubleshooting: monitor voltage and current for single channels



allows to ramp single channels ⇒ helpful after trips

The Resource Monitors for the Subsystems: MDTs

MDT Nam	+5 (V)	-5 (V)	+12 (V)	-12 (V)	M Temp	V Temp	Status
NAET	4.95	-4.88	12.12	-12.00	25.58	0.00	Normal
NAWT	4.94	-4.88	11.88	-12.16	26.16	29.07	Normal
NAWB	4.94	-4.88	11.97	-12.16	22.97	29.07	Normal
NAEB	4.96	-4.89	12.12	-11.91	23.16	27.91	Normal
NBET	4.95	-4.91	11.98	-12.01	27.13	31.10	Normal
NBWT	4.94	-4.88	11.94	-12.06	25.00	0.00	Normal
NBWB	4.94	-4.88	11.97	-12.03	23.74	26.65	Normal
NBEB	4.92	-4.89	12.02	-12.09	22.97	26.55	Normal
NCET	4.94	-4.88	12.14	-11.95	23.64	28.49	Normal
NCWT	4.96	-4.90	11.98	-11.99	23.64	25.68	Normal
NCWB	4.96	-4.89	12.00	-12.01	20.54	23.26	Normal
NCEB	4.94	-4.89	11.99	-12.02	23.06	25.58	Normal

Unique way to get
detailed information
on subsystem status

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

The Resource Monitors for the Subsystems: PDTs

grey fields:

no communication on 1553

→ indicates

often that a PDT
is not responding

(needs powercycling)

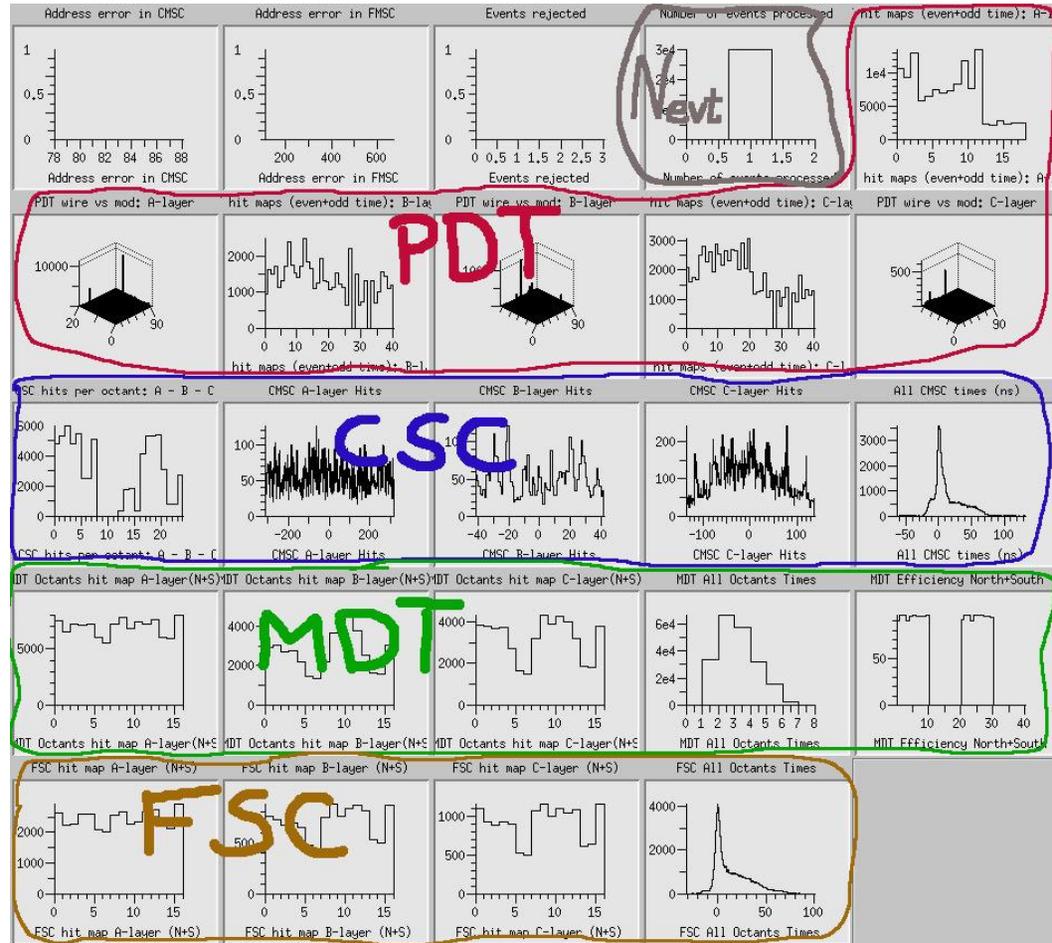
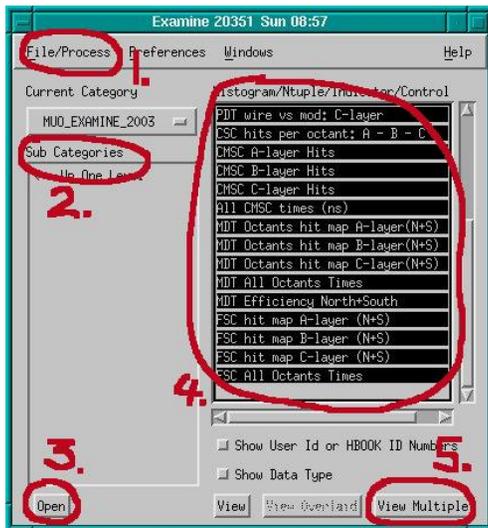
“hidden” buttons:

give detailed info on alarms

Octant 0	Octant 1	Octant 2	Octant 3	Octant 4	Octant 5	Octant 6	Octant 7			
PDT Name	+5 Digital	+5 Analog	-5 Digital	-5 Analog	Pressure	Temp	Status	Control		
Layer A										
MUO_PDT_016	4.92	5.26	-4.98	-5.41	3.62	31.2	Normal	Normal	Clear	Reset
MUO_PDT_026	4.98	5.07	-4.98	-5.48	3.81	17.6	Normal	Normal	Clear	Reset
MUO_PDT_036	4.98	5.26	-4.95	-5.38	3.81	23.6	Normal	Normal	Clear	Reset
Layer B										
MUO_PDT_106	5.05	5.46	-5.01	-5.54	1.18	18.0	Normal	Normal	Clear	Reset
MUO_PDT_116	5.15	5.52	-4.98	-5.54	0.10	24.0	Normal	Normal	Clear	Reset
MUO_PDT_136	5.18	5.49	-4.98	-5.48	4.99	24.8	Normal	Normal	Clear	Reset
MUO_PDT_146	5.05	5.56	-4.95	-5.48	1.38	19.2	Normal	Normal	Clear	Reset
Layer C										
MUO_PDT_206	5.08	5.49	-4.98	-5.51	0.70	27.2	Normal	Normal	Clear	Reset
MUO_PDT_216	4.98	5.46	-4.95	-5.45	0.99	21.6	Normal	Normal	Clear	Reset
MUO_PDT_236	4.88	5.49	-4.98	-5.45	1.18	19.2	Normal	Normal	Clear	Reset
MUO_PDT_246	4.92	5.49	-4.95	-5.60	0.80	15.6	Normal	Normal	Clear	Reset

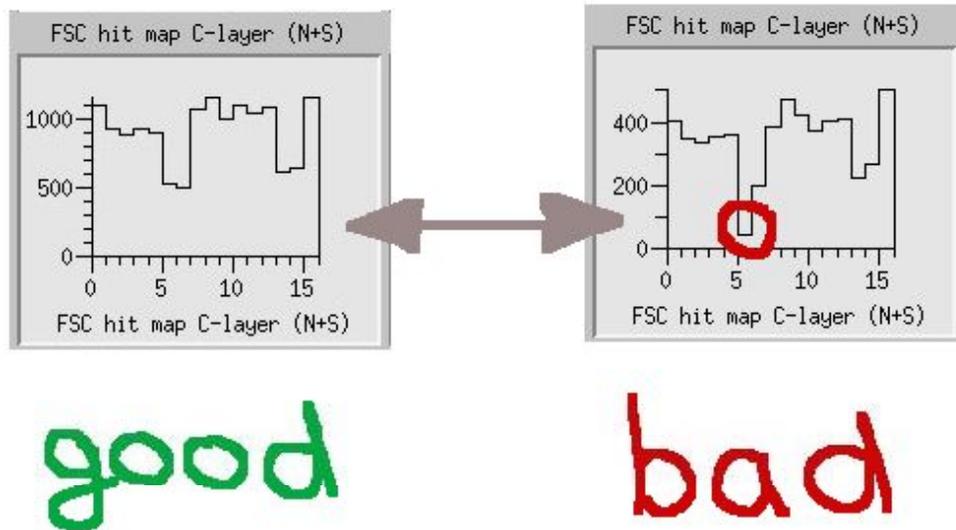
click for more info

Running MuoExamine and Histo



Checking Muo-Examine Histograms

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 — always the same section
⇒ 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 becomes more and more stable
big progress after January shutdown
- allows shifters to concentrate on “details” ↔ absolutely necessary to guarantee operation at high efficiency
- big progress with shifters documentation
still not “complete” — but is constantly improved
- feedback from shifters has helped to set up documentation
⇒ important for future progress
- in the near future:
merge muon and calorimeter shifts