The D0 Muon System

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March 3, 2003 — Shifter Tutorial

- The Hardware
- Control Applications
- Troubleshooting

The D0 Muon System

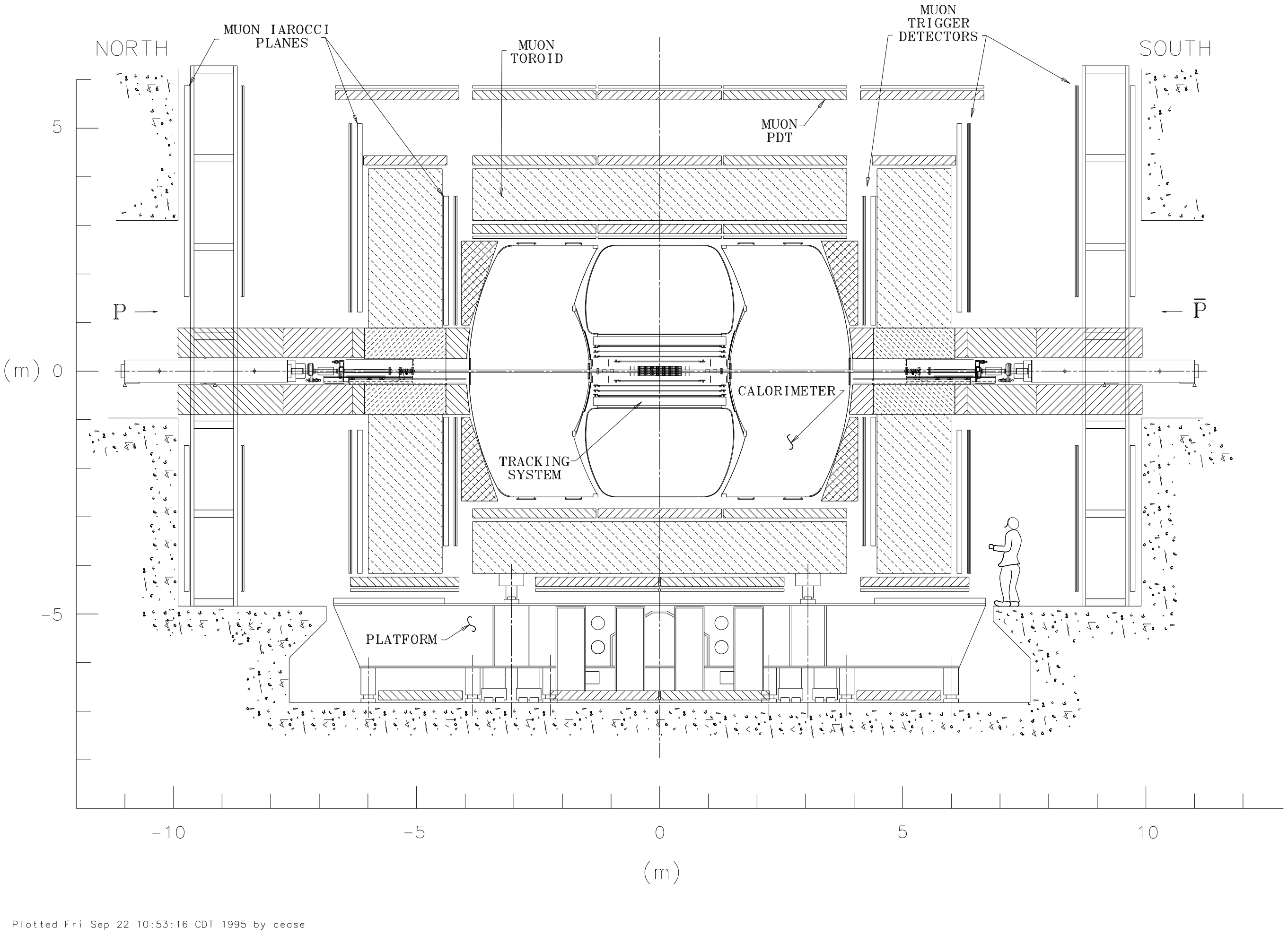
central: Central Drift Chambers   Central Scintillation Counters $(|\eta| < 1)$

forward region:

Forward
Mini-Drift Chambers

Forward
Scintillation Counters

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



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 $\rightarrow$ as efficient as possible
  read documentation / get used to control applications
  know potential problems
  be aware of what's happening around you ...
  relevant events $\rightarrow$ electronic logbook

- **shift begin**
  previous shifter $\rightarrow$ current status
  recent problems / special situations for specific subsystems
  shift captain $\rightarrow$ 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 regulary / 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

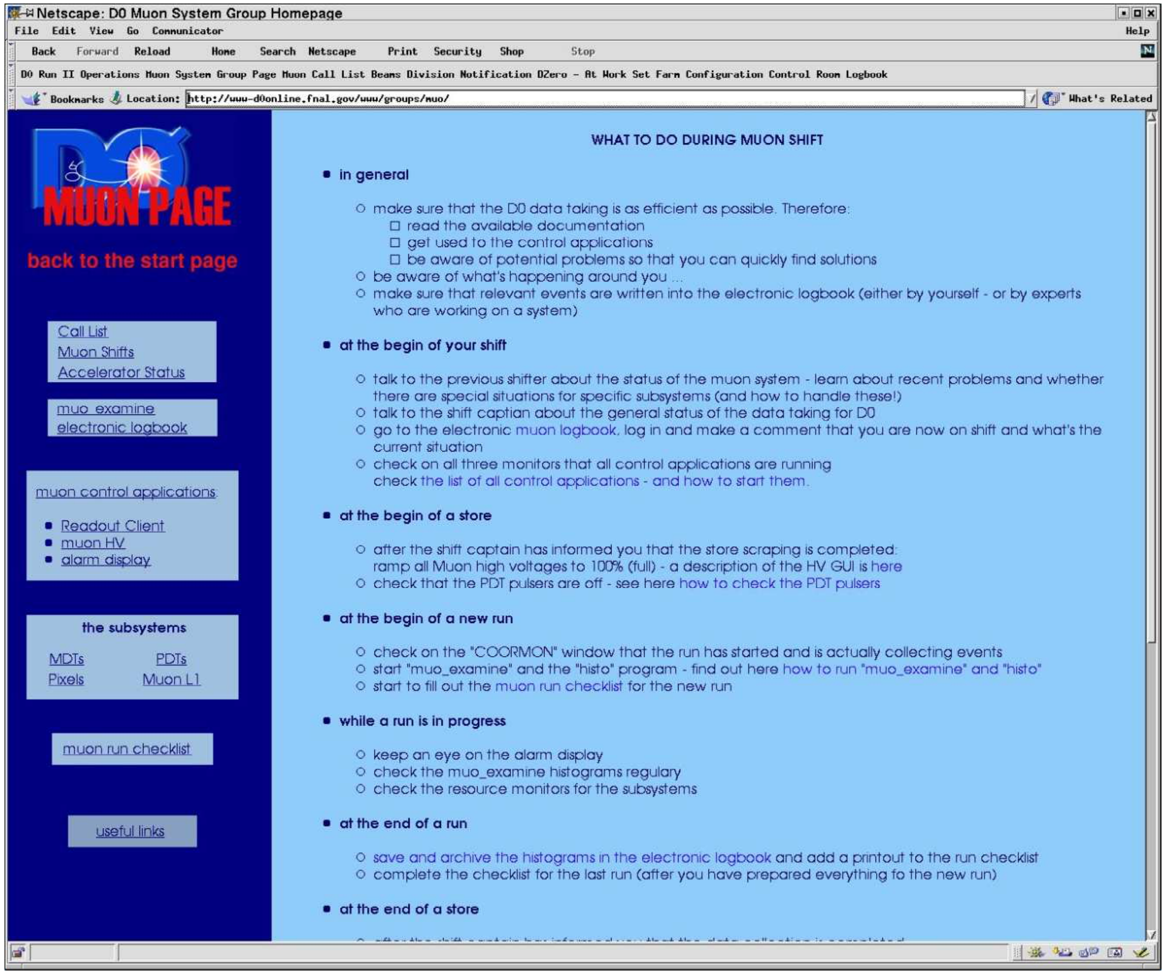
Tasks during muon shift (3)

- **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 ⟹
- 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:**
  shifters task: call/page experts!
  all decisions have to be made by experts

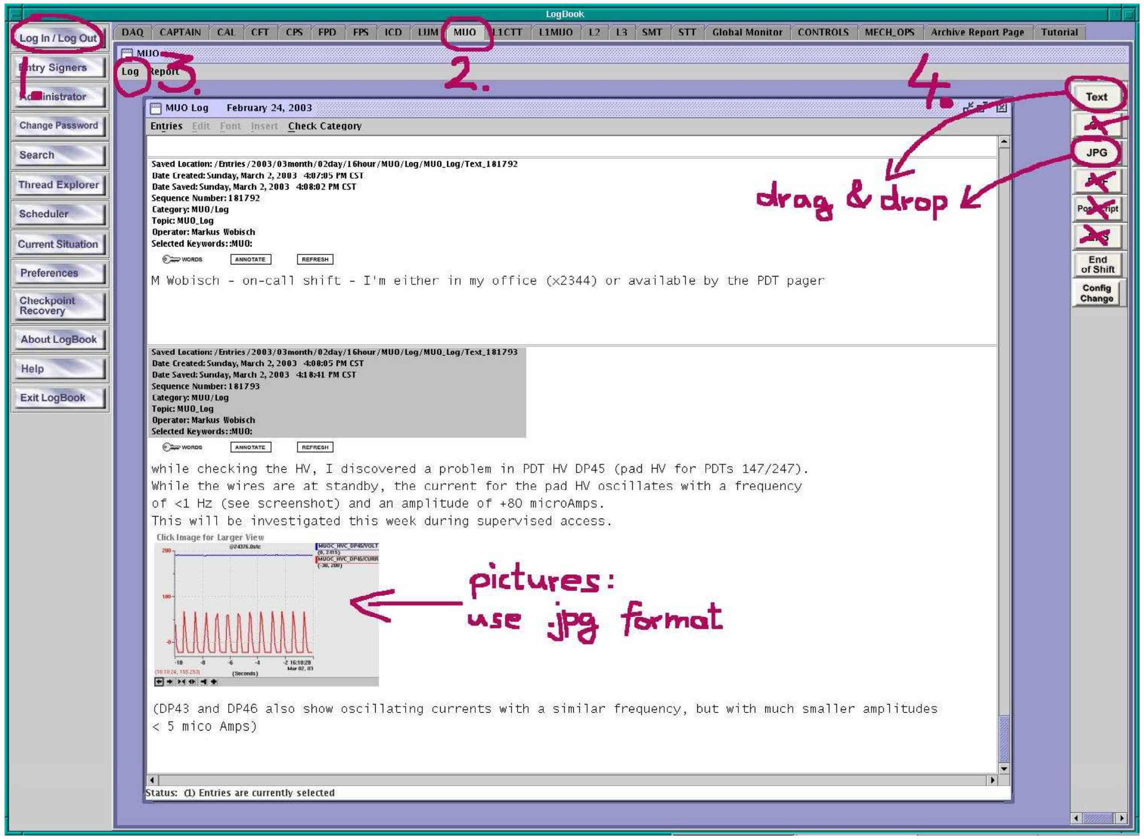
The Electronic Logbook

important: communication
between shifters
and experts

all relevant events
$\rightarrow$ logbook

make sure that experts
make notes about
their work

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

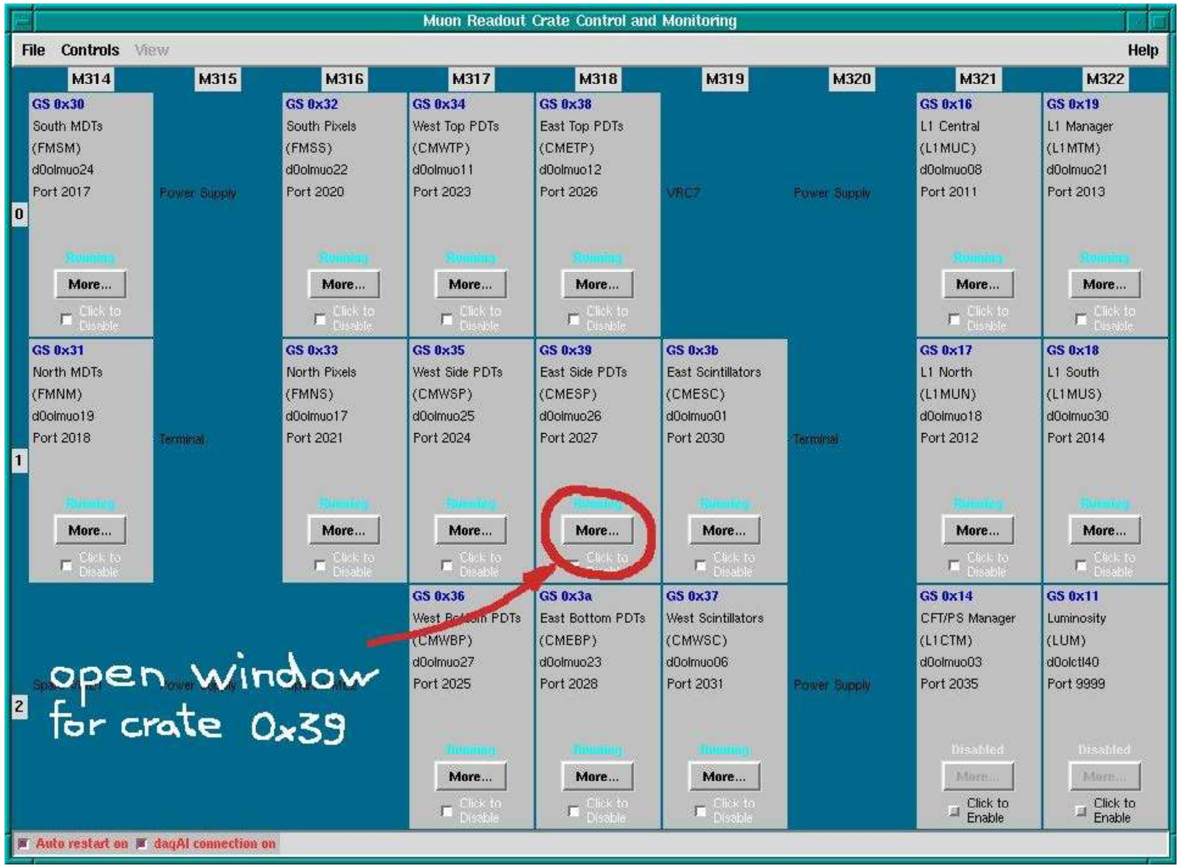


The Readout Client (1)

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)



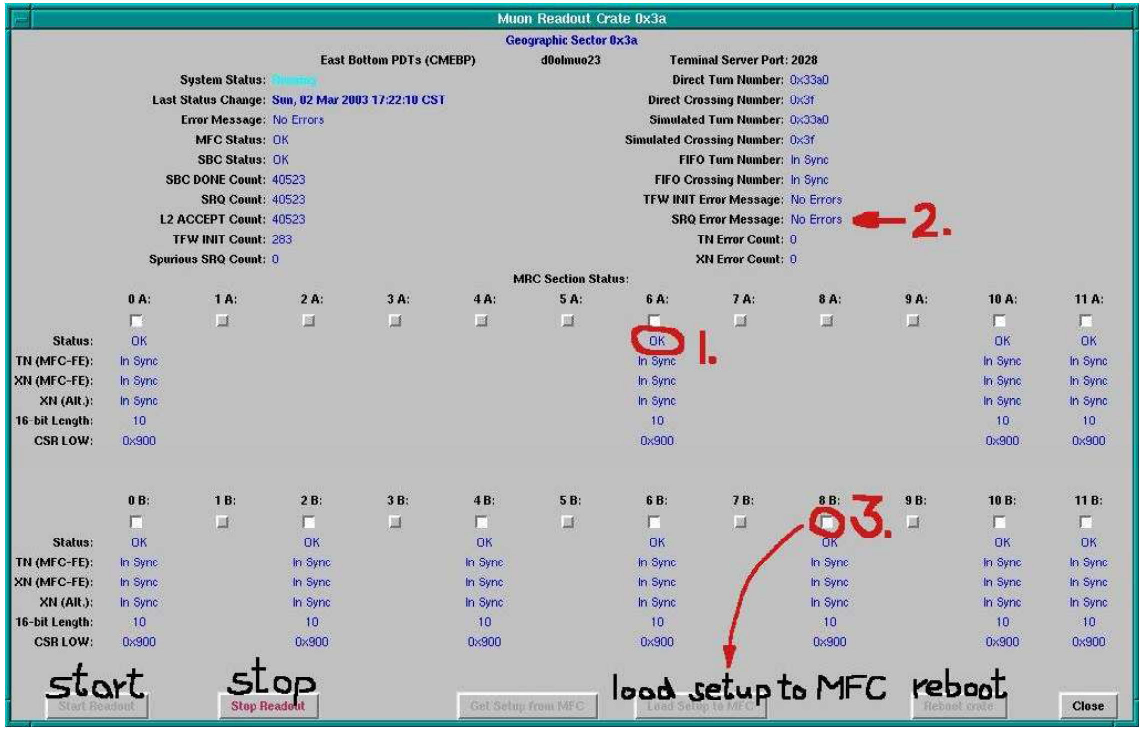
→ access to detailed information for single readout crates)

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 mesage (2.)

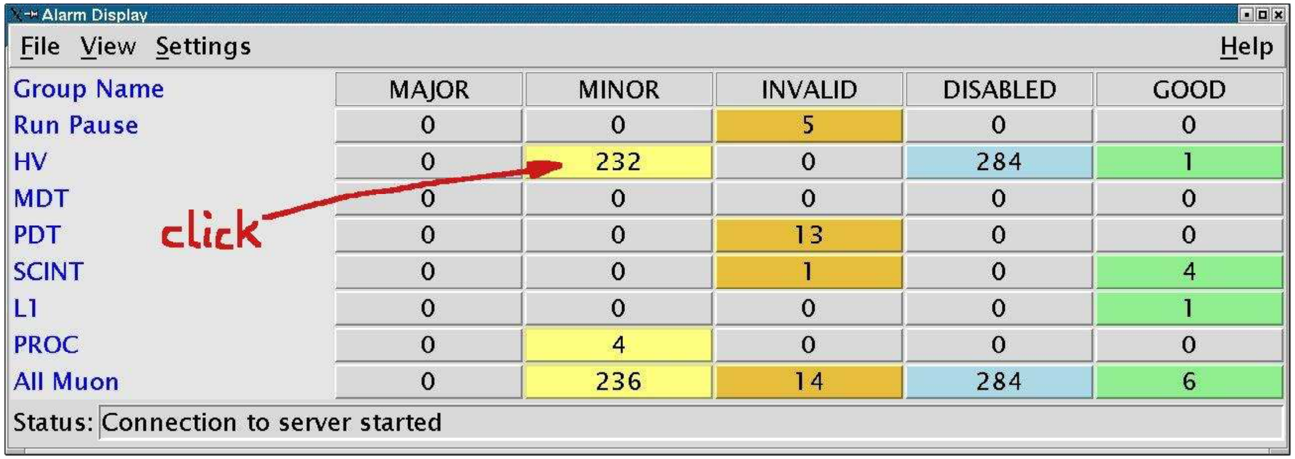
not responding or strange
behaviour: REBOOT crate
(if this does not help call expert)



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

The Muon Alarm Display



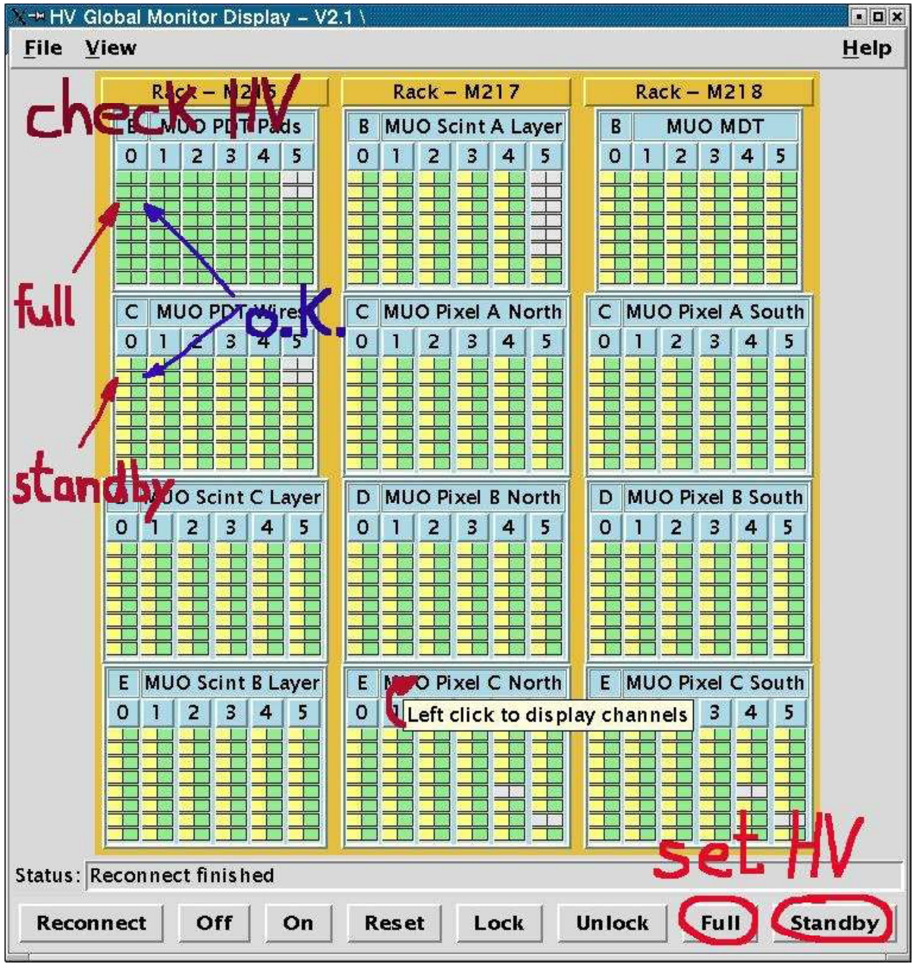
check regulary

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)



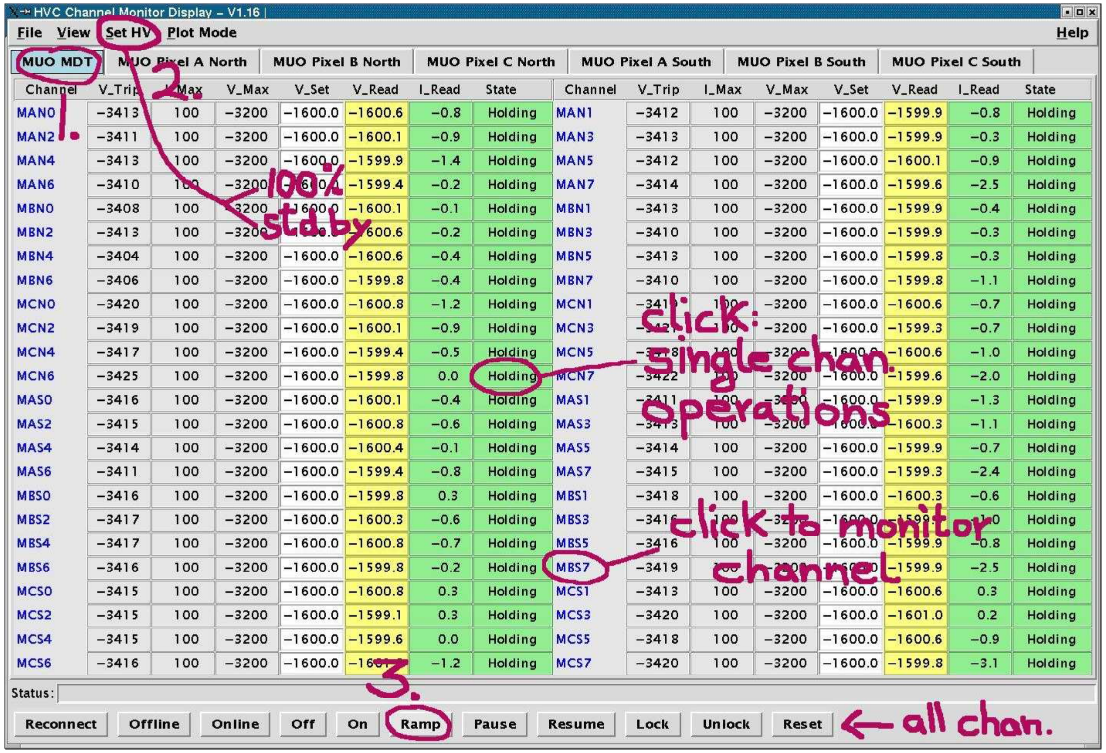
left column:
green: 100%
yellow: standby
red: trip

right column:
green, if setting corresponds
to nominal setting

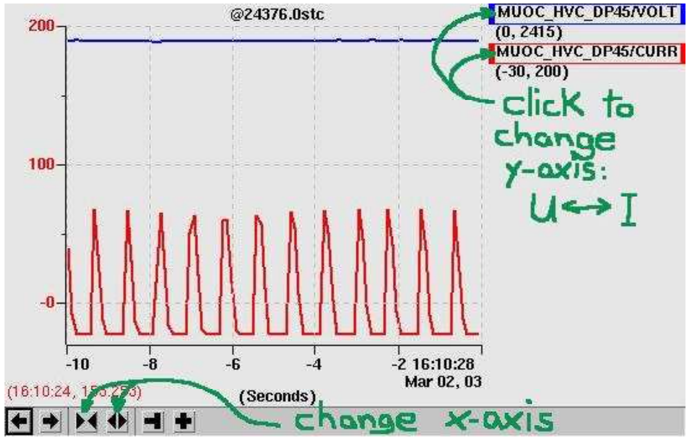
ramp all muon HV channels by pushing a single button

The Muon HV Display (2)

two detailed displays: complete infos on single channels



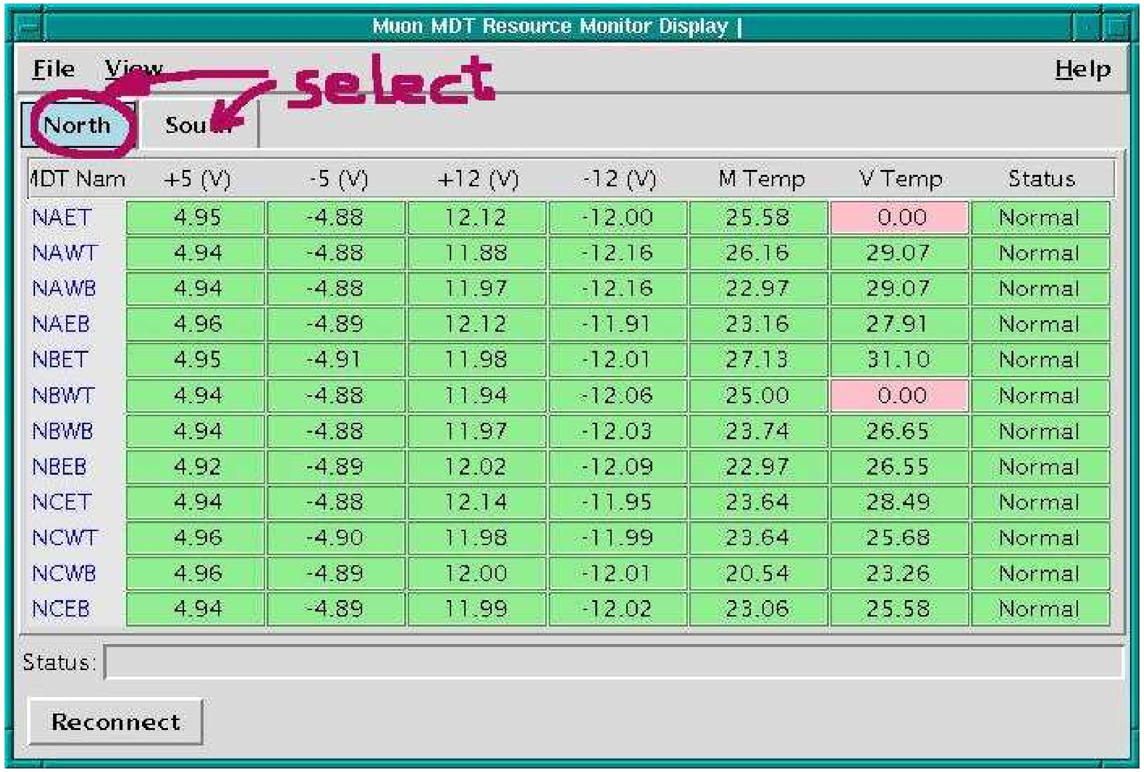
helpful for troubleshooting: monitor voltage and current for single channels



allows to ramp single channels ⇒ helpful after trips

The Resource Monitors for the Subsystems: MDTs

Unique way to get detailed information on subsystem status



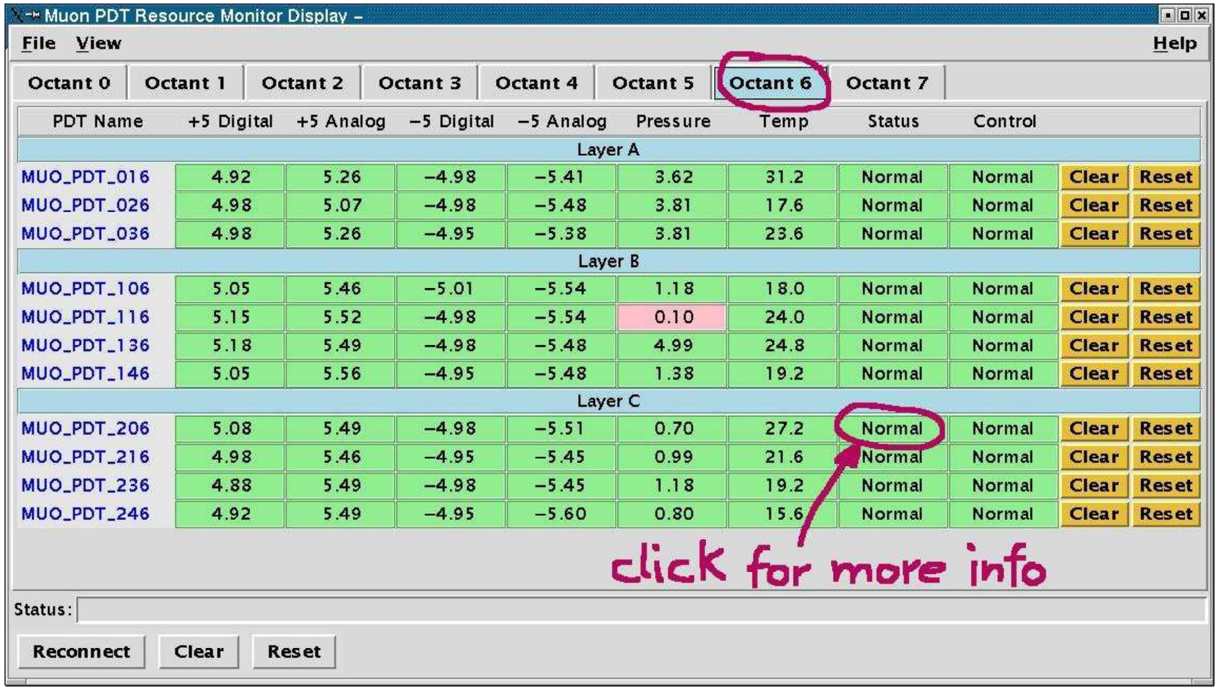
MDT Nam	+5 (V)	-5 (V)	+12 (V)	-12 (V)	M Temp	V Temp	Status
NAET	4.95	-4.88	12.12	-12.00	25.58	0.00	Normal
NAWT	4.94	-4.88	11.88	-12.16	26.16	29.07	Normal
NAWB	4.94	-4.88	11.97	-12.16	22.97	29.07	Normal
NAEB	4.96	-4.89	12.12	-11.91	23.16	27.91	Normal
NBET	4.95	-4.91	11.98	-12.01	27.13	31.10	Normal
NBWT	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

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

The Resource Monitors for the Subsystems: PDTs

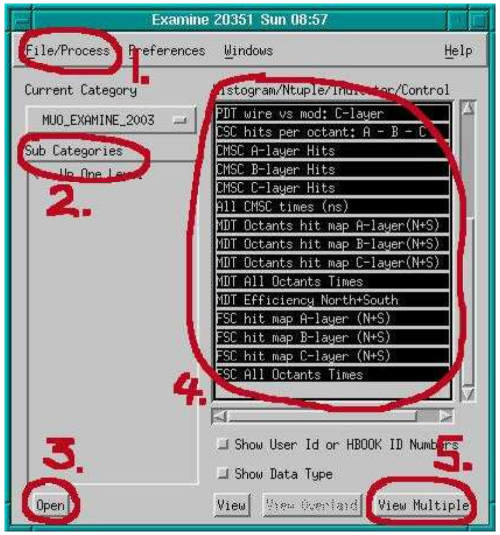
grey fields:
no communication on 1553
→ indicates
often that a PDT
is not responding
(needs powercycling)

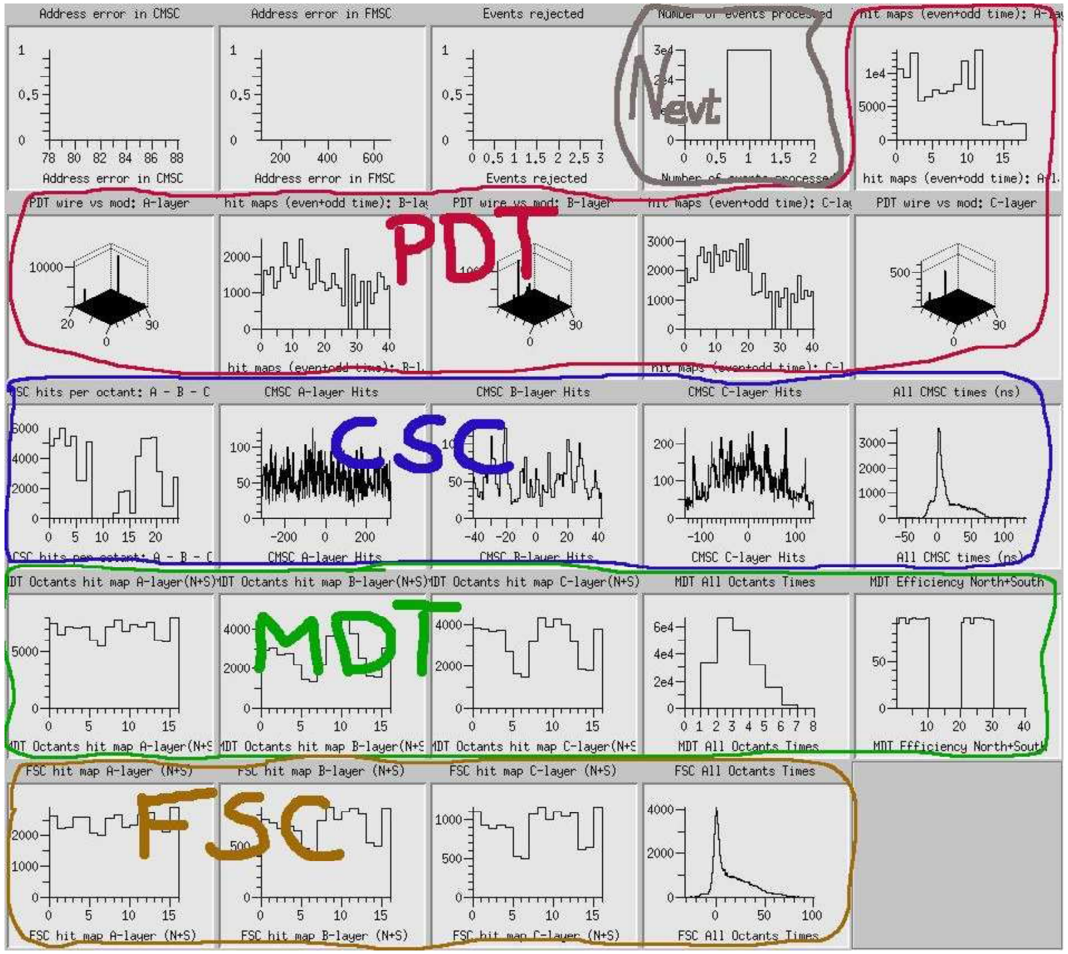
"hidden" buttons:
give detailed info on alarms



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

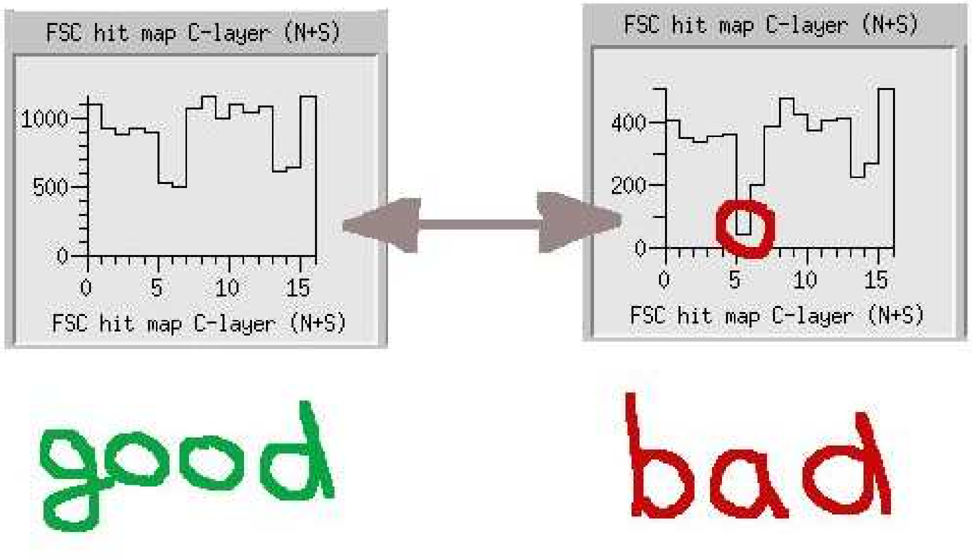
Running MuoExamine and Histo





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 $\rightarrow$ reset & ramp again (a few times)
  $\Rightarrow$ call expert

- crashes of readout crates — always the same section
  $\Rightarrow$ 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” $\leftrightarrow$ 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
  $\Rightarrow$ important for future progress
- in the near future:
  merge muon and calorimeter shifts