Tutorial: D0 Muon Shifts

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- The Hardware
- Control Applications
- Troubleshooting

The D0 Muon System

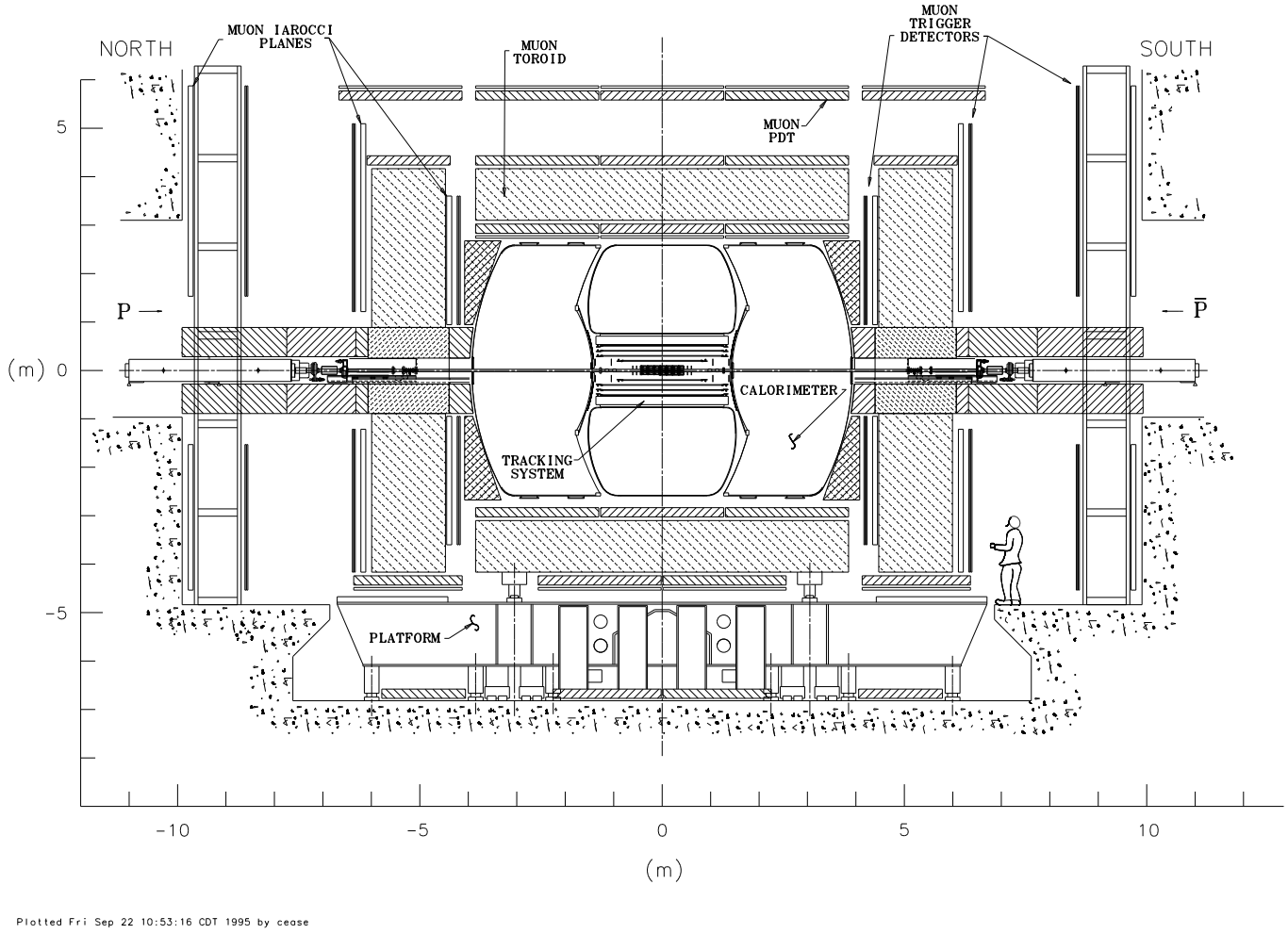
central: Central Drift Chambers Central Scintillation Counters $(|\eta| < 1)$

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)

Muon related tasks during calmuo 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

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 $\rightarrow$ 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 regulary / 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

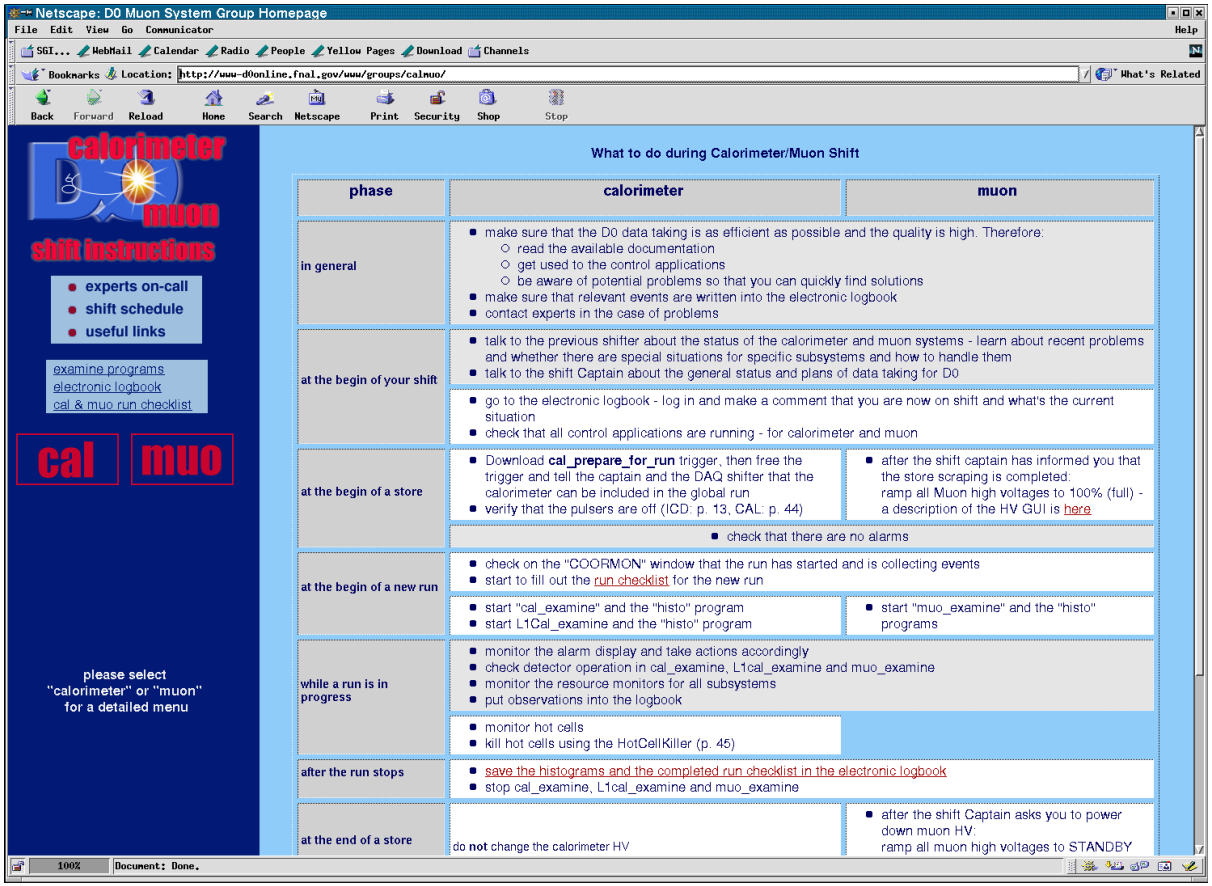
- **at the end of a store**
  after the shift captain has informed you that the data collection is completed: ramp all muon high voltages to STANDBY
  (yes: the PDT pads the standby value is equal to full value!)
  cal: do **not** change the calorimeter HV!!!! — **never change cal HV!!!**

- **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/calmuo/

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



The CalMuo Webpage

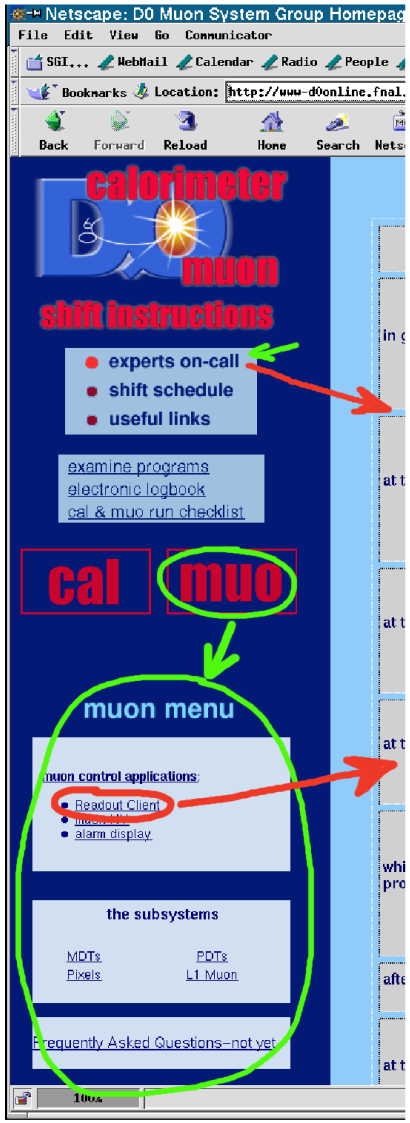
direct access to all documentation:

how to operate:

- Readout Client
- HV GUI
- alarm dislay

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

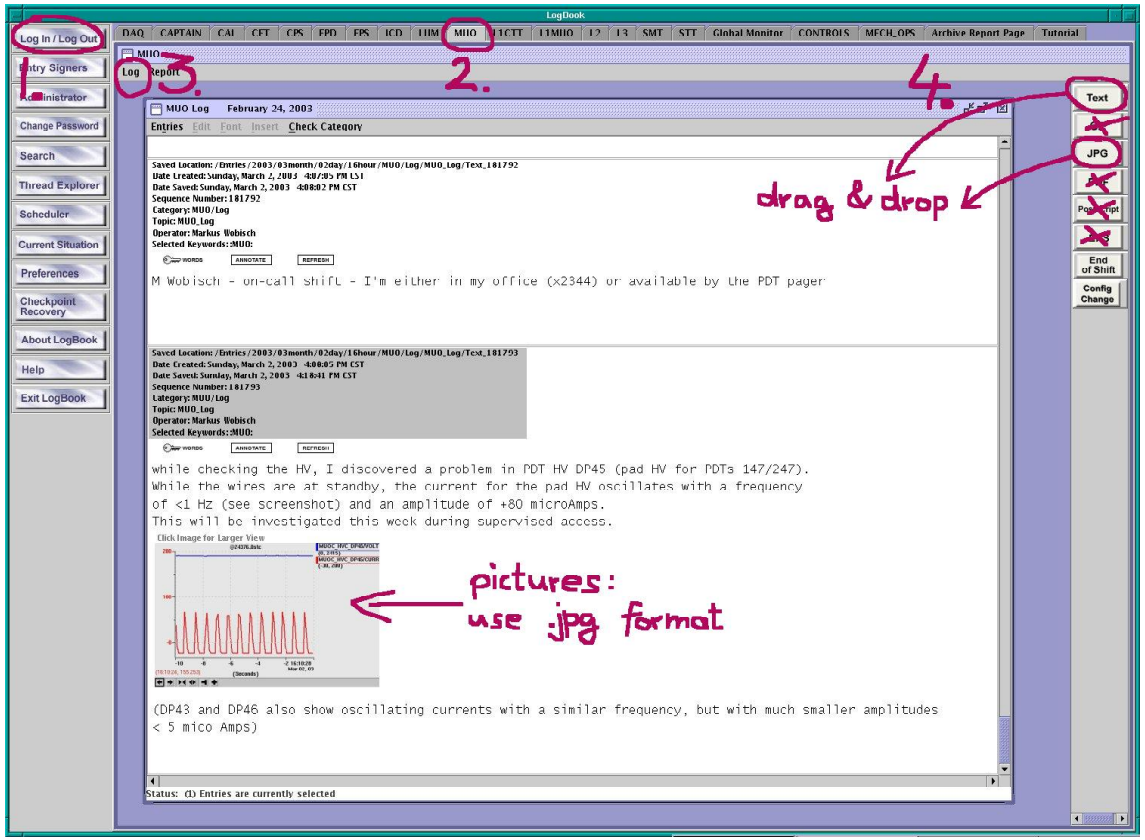
The Electronic Logbook

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



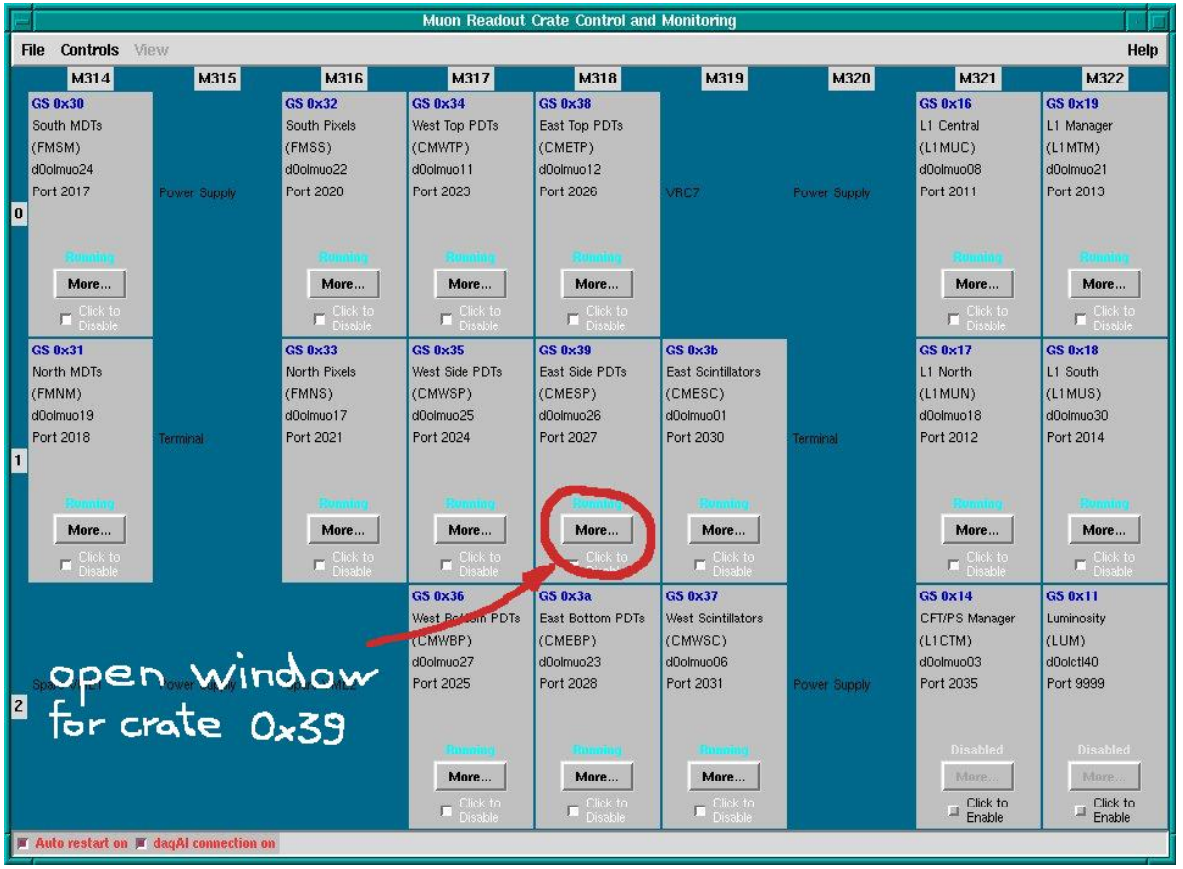
→ new logbook account “calmuo” – old cal & muo shifters passwords still valid

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)



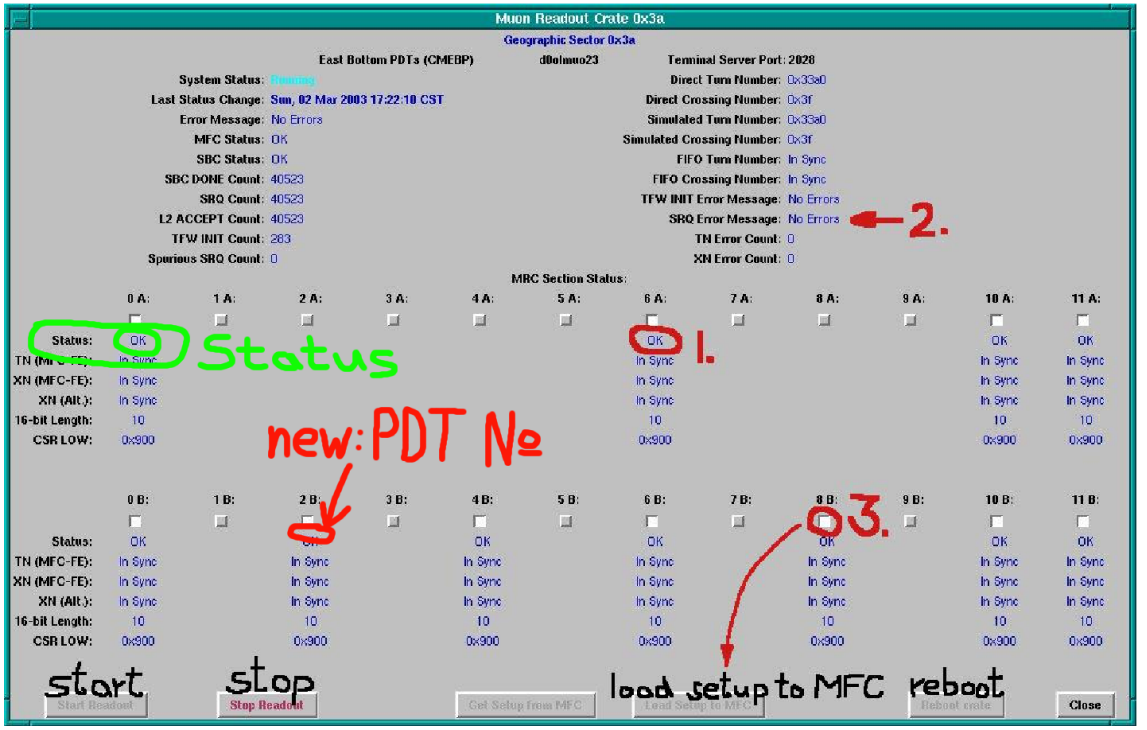
→ press button: **More ...** to access to detailed information for single readout crates

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 mesage (2.)

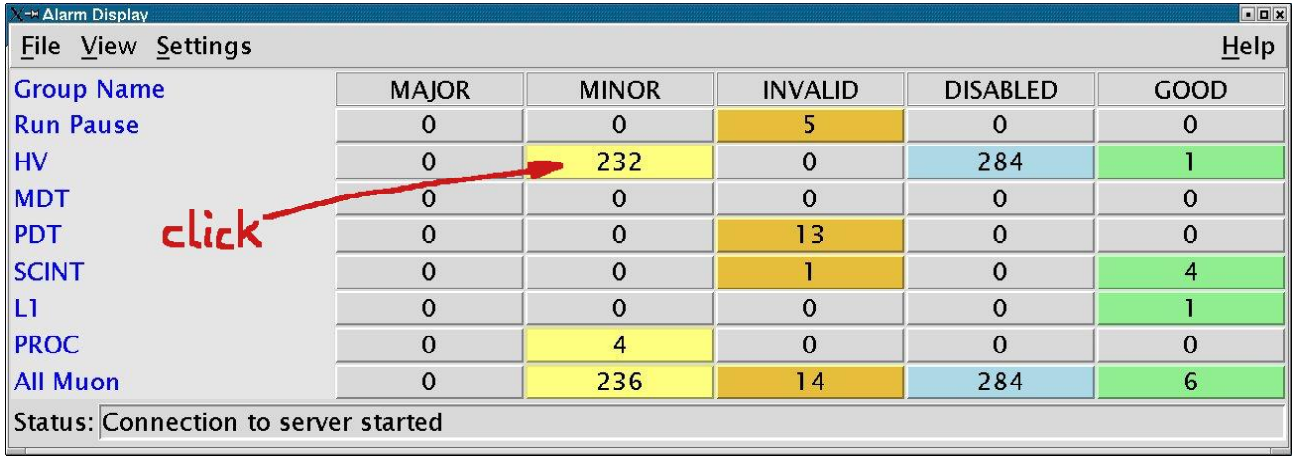
not responding or strange behaviour: **REBOOT** crate (if this does not help call expert)



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 ← experts task

The Muon Alarm Display



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
L1	0	0	0	0	1
PROC	0	4	0	0	0
All Muon	0	236	14	284	6

check regulary

often: the simplest way to identify problems

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

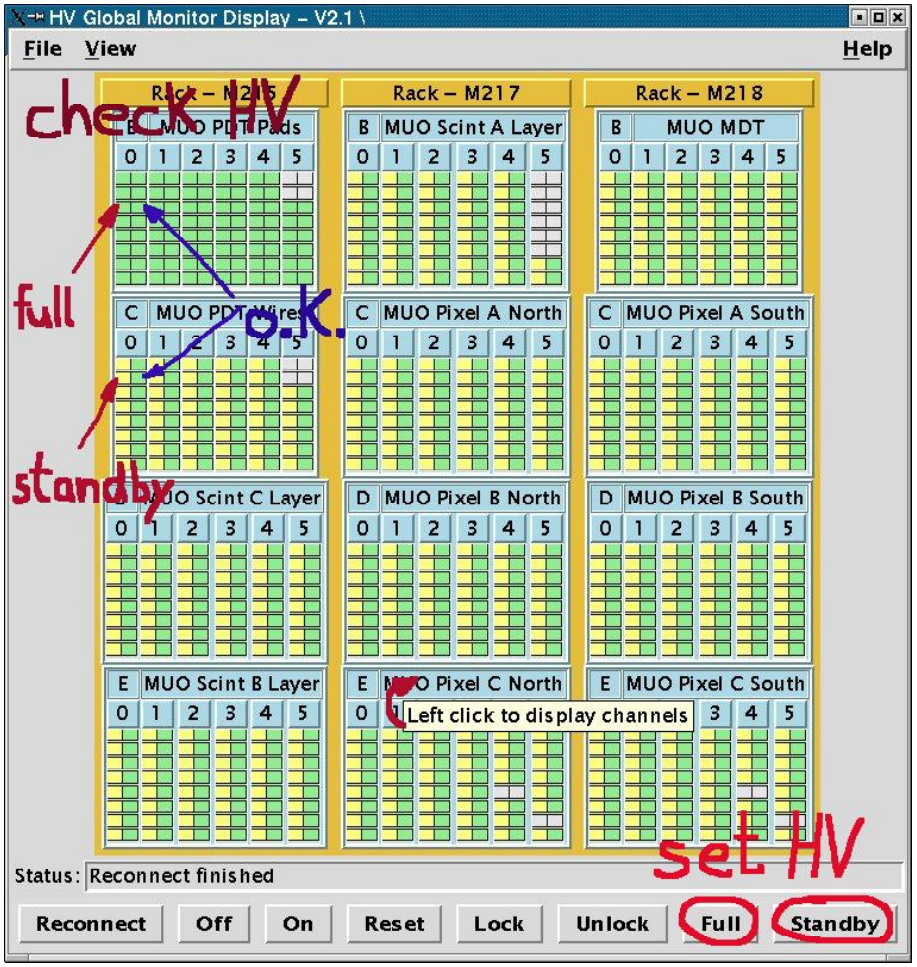
→ **never disable** alarms without contacting an expert

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

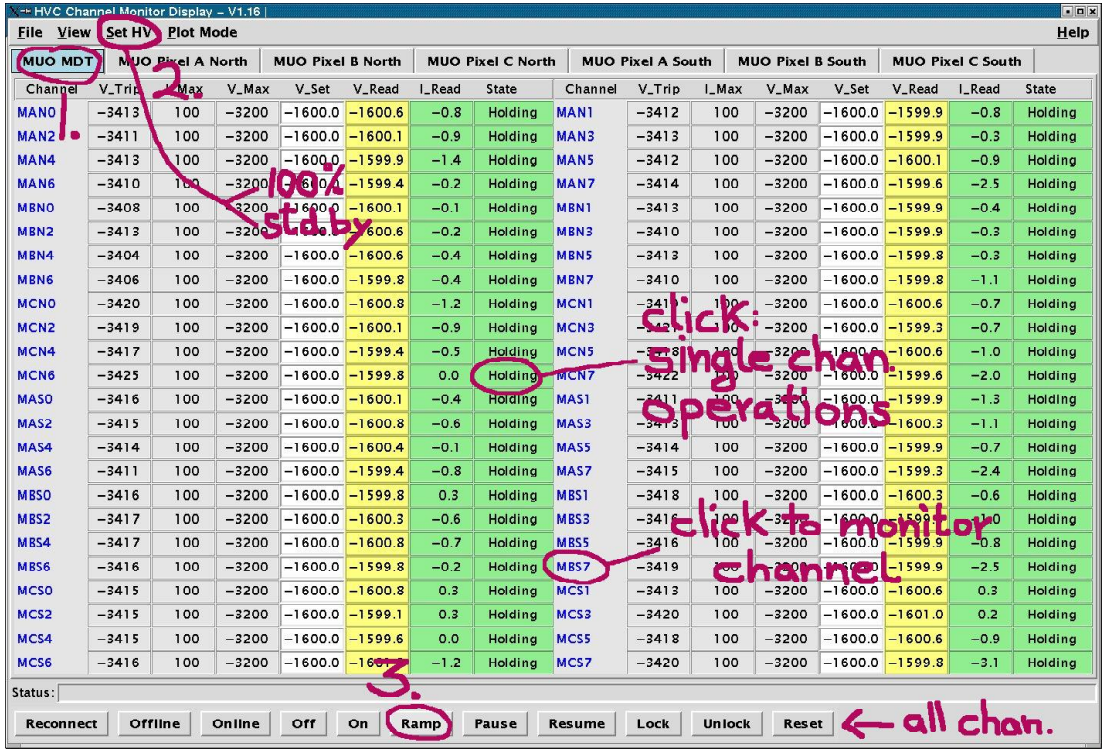
right column:
green, if setting corresponds
to nominal setting



ramp all muon HV channels by pushing a single button

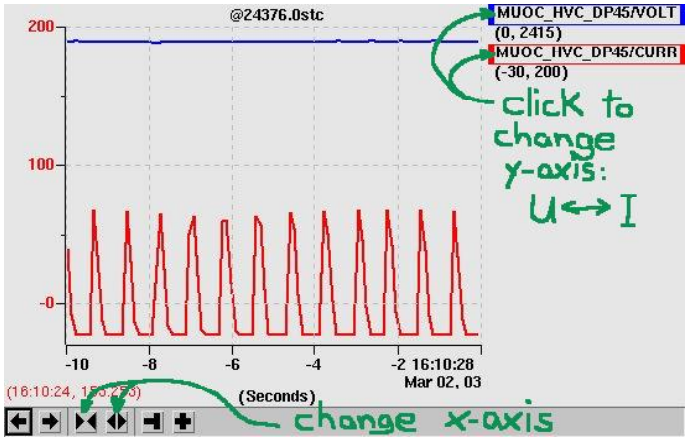
The Muon HV Display (2)

two detailed displays: complete infos on single channels



helpful for troubleshooting:

monitor voltage and current for single channels



(example of a **bad** HV channel!)

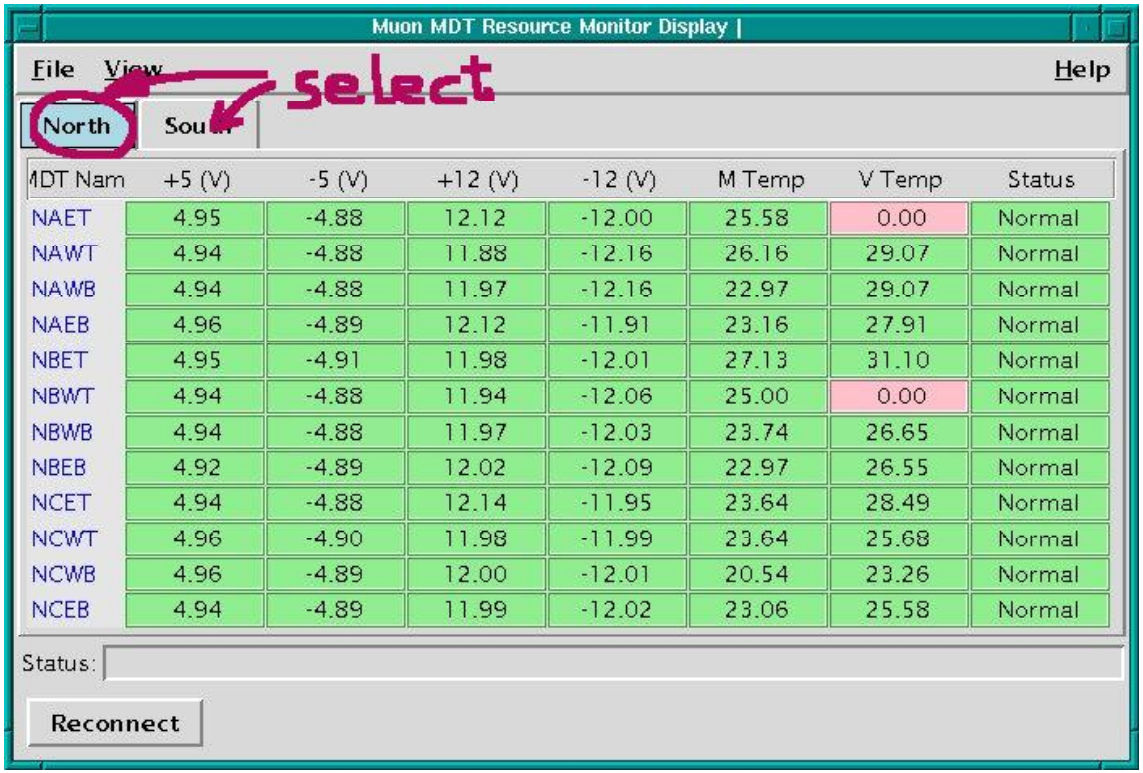
allows to ramp single channels ⇒ helpful after trips

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



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

⇒ This is what an expert needs to know when you page him/her at 2:00am!!!

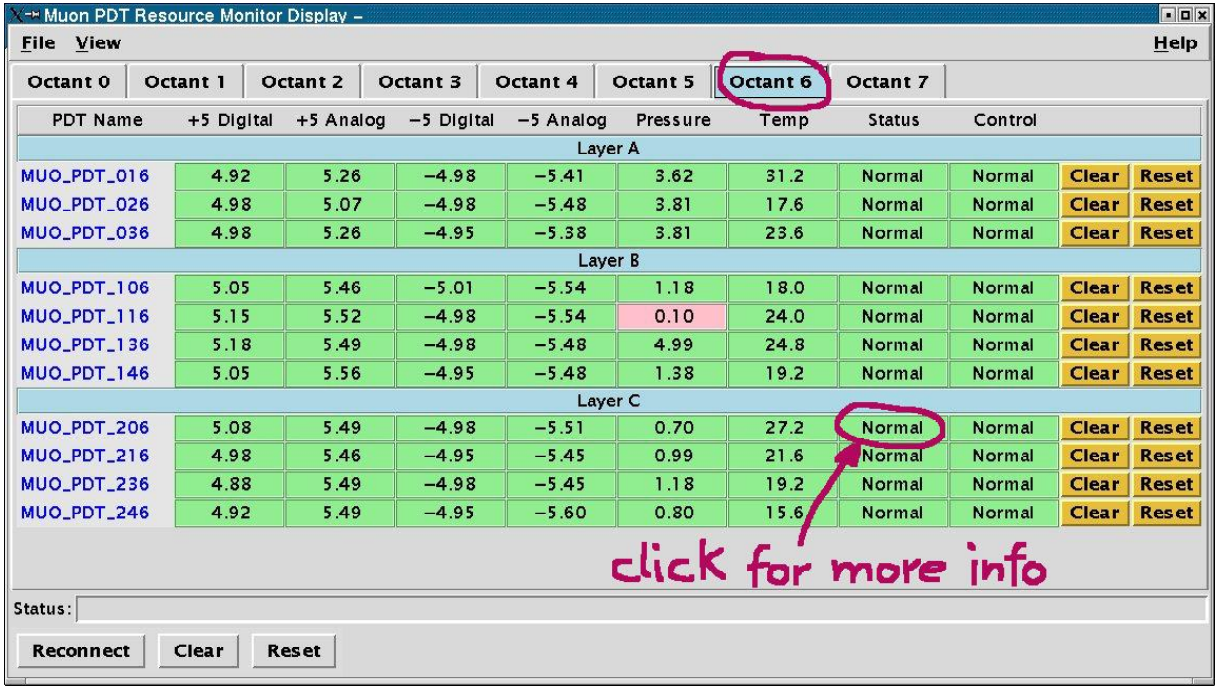
The Resource Monitors for the Subsystems: PDTs

"hidden" buttons:
give detailed info on alarms
→ very important to check whenever alarm occured

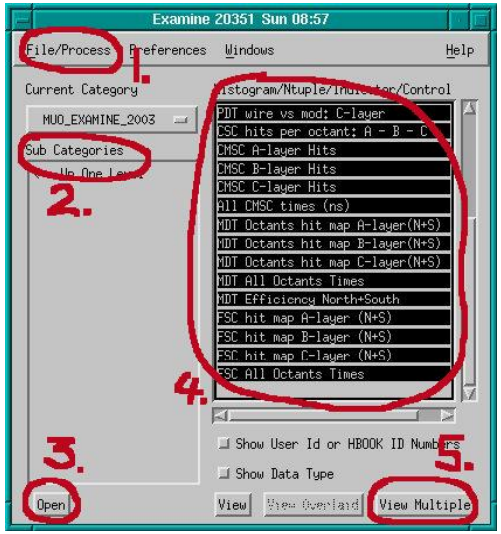
grey fields:
no communication on 1553
→ indicates that a PDT is not responding

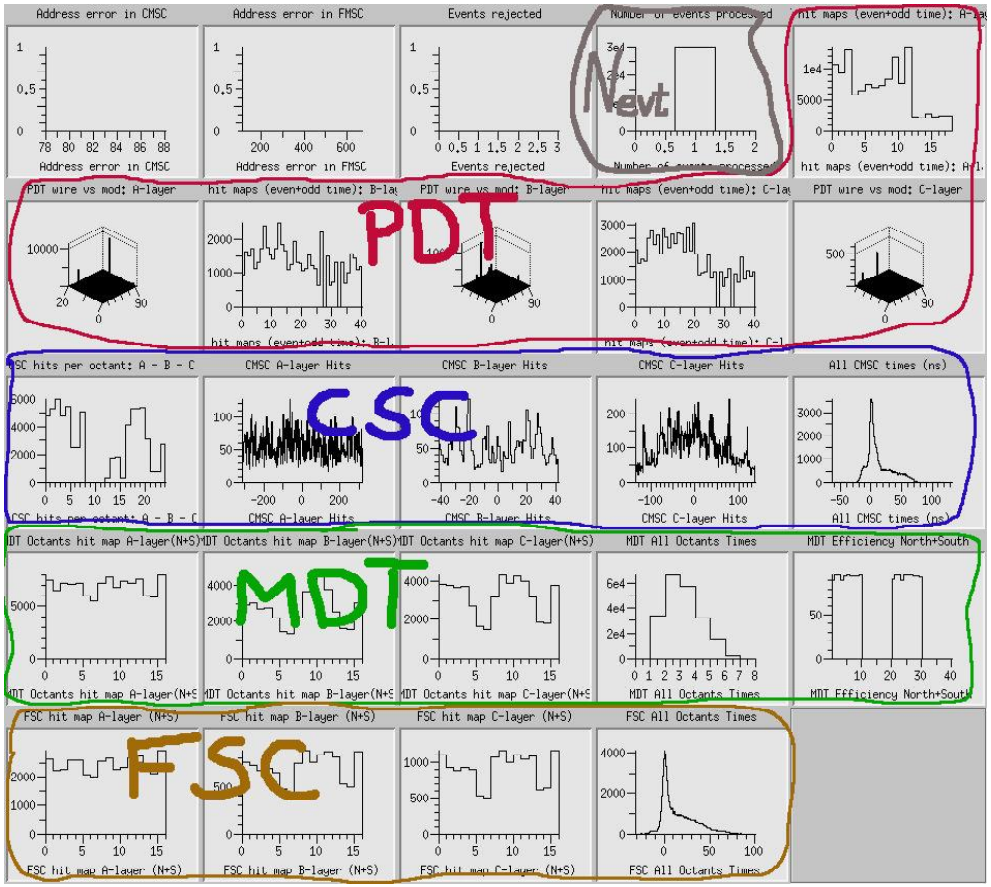
(needs powercycling
→ access needed
→ PDT has to be disabled from readout & from L1, L2)

→ select card for PDT octants 0-7



Running MuoExamine and Histo



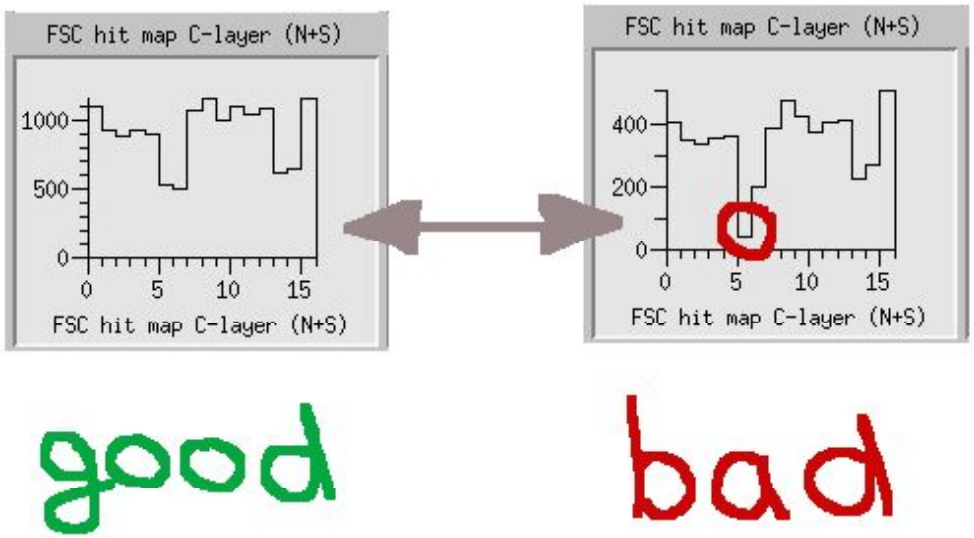


muo_examine reference histograms are available on the web page:

"examine programs" → "muo_examine reference histograms"

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!!

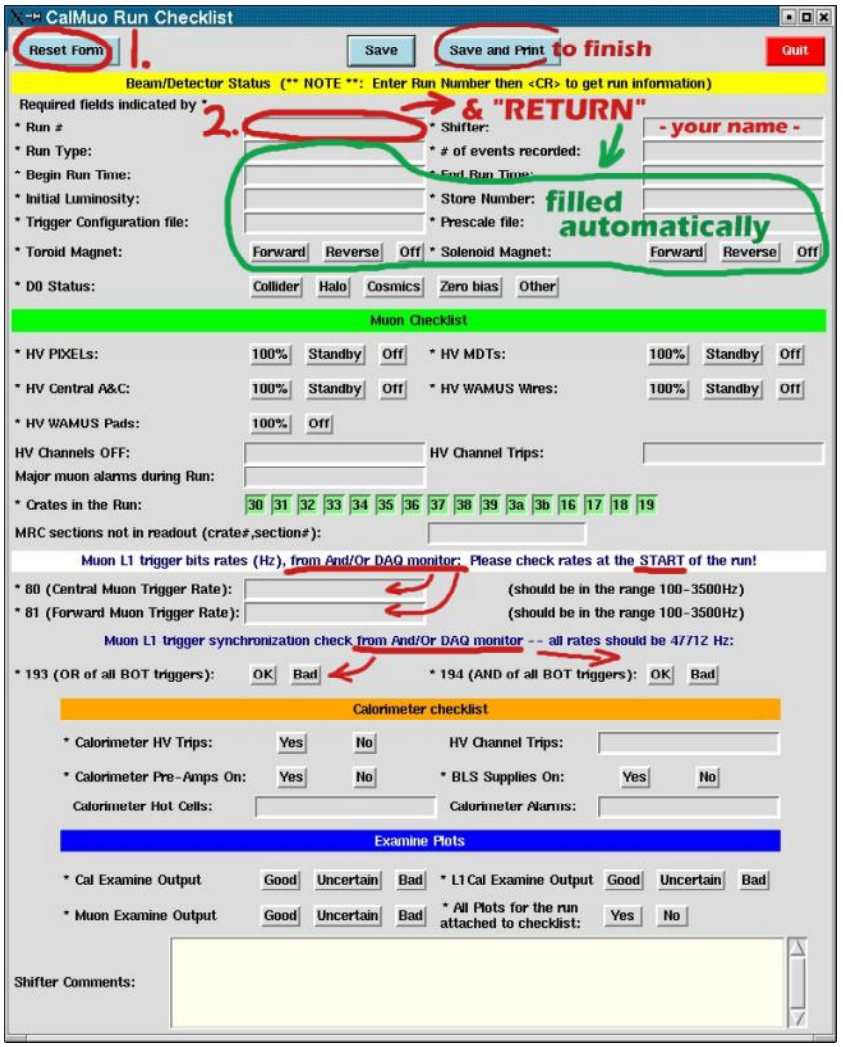
The Calmuo Run Checklist GUI

purpose:
archive cal & muo system
status for every run

some general information
(filled automatically
after inserting the run number)

some system details:
– tripped HV channels
– sections excluded from readout
– hot calorimeter cells

store in logbook –
together with examine plots



“frequent” errors

- HV failures
  trips $\rightarrow$ reset & ramp again (a few times)
  $\Rightarrow$ call expert

- crashes of readout crates
  $\rightarrow$ note section / keep statistics of frequency

  – always the same section??
  – so frequent that it disturbs overall data taking??

  $\Rightarrow$ 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 is pretty stable
- allows shifters to concentrate on “details” $\leftrightarrow$ absolutely necessary to guarantee operation at high efficiency
- at the moment: most frequent problems from the PDTs:
  $\rightarrow$ failure of front-end electronics at begin of store
  $\rightarrow$ often stops the readout $\rightarrow$ 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
  $\Rightarrow$ important for future progress