Calmuo Shift Tutorial: The Muon System

Markus Wobisch, Fermilab

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- The Hardware
- Control Applications
- Troubleshooting

this tutorial can be found on the calmuo shift webpage:
http://www-d0online.fnal.gov/www/groups/calmuo/ under “useful links”

The D0 Muon System

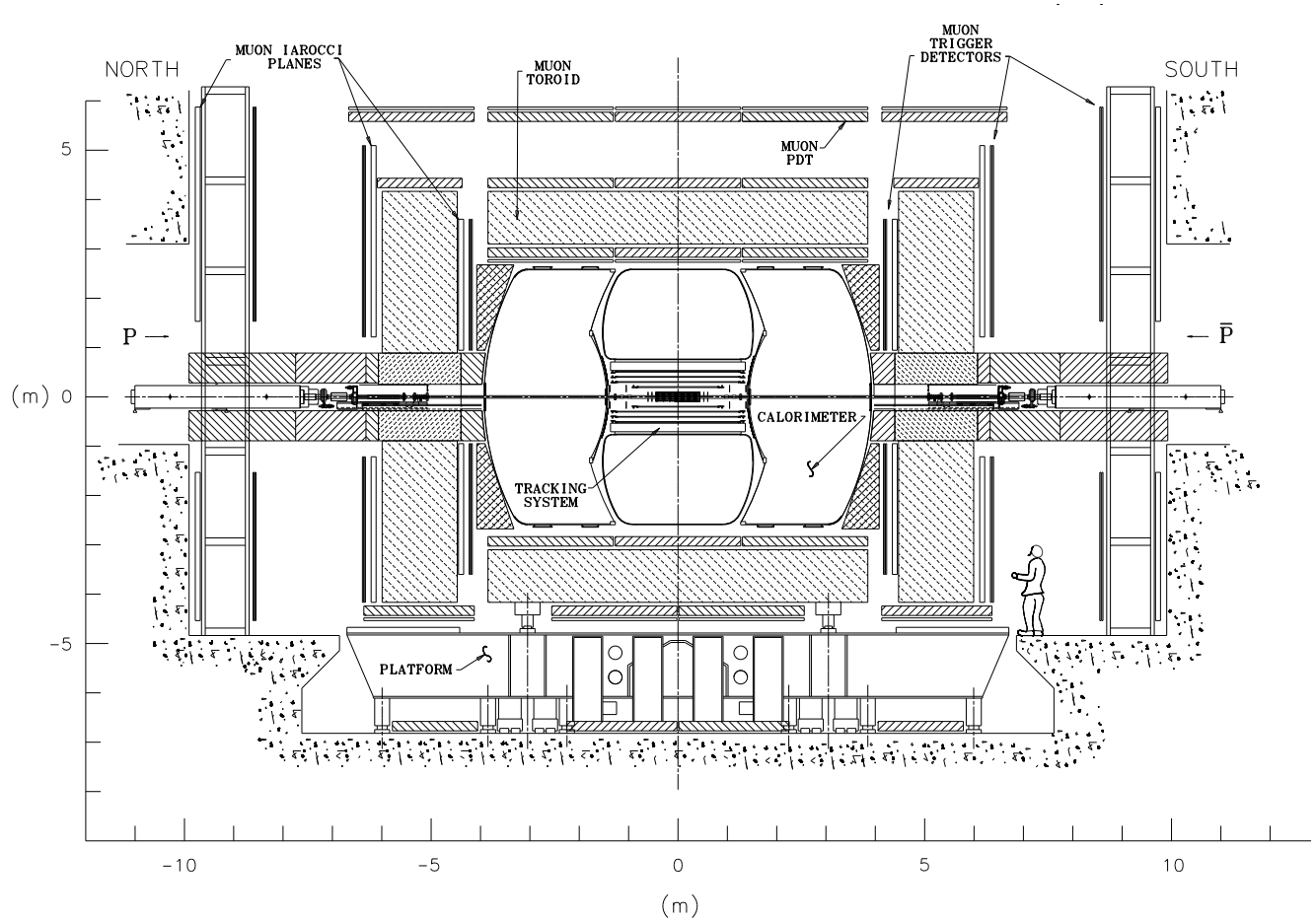
central: Central Drift Chambers Central Scintillation Counters $(|\eta| < 1)$

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: tasks during calmuo 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: tasks during calmuo shift (2)

- **at the begin of a store**
  after store scraping is completed: ramp Muon high voltages to 100% (full)
  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 regulary / check the resource monitors for the subsystems
  cal: monitor hot cells — kill hot cells using “HotCellKiller”

Muon: 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

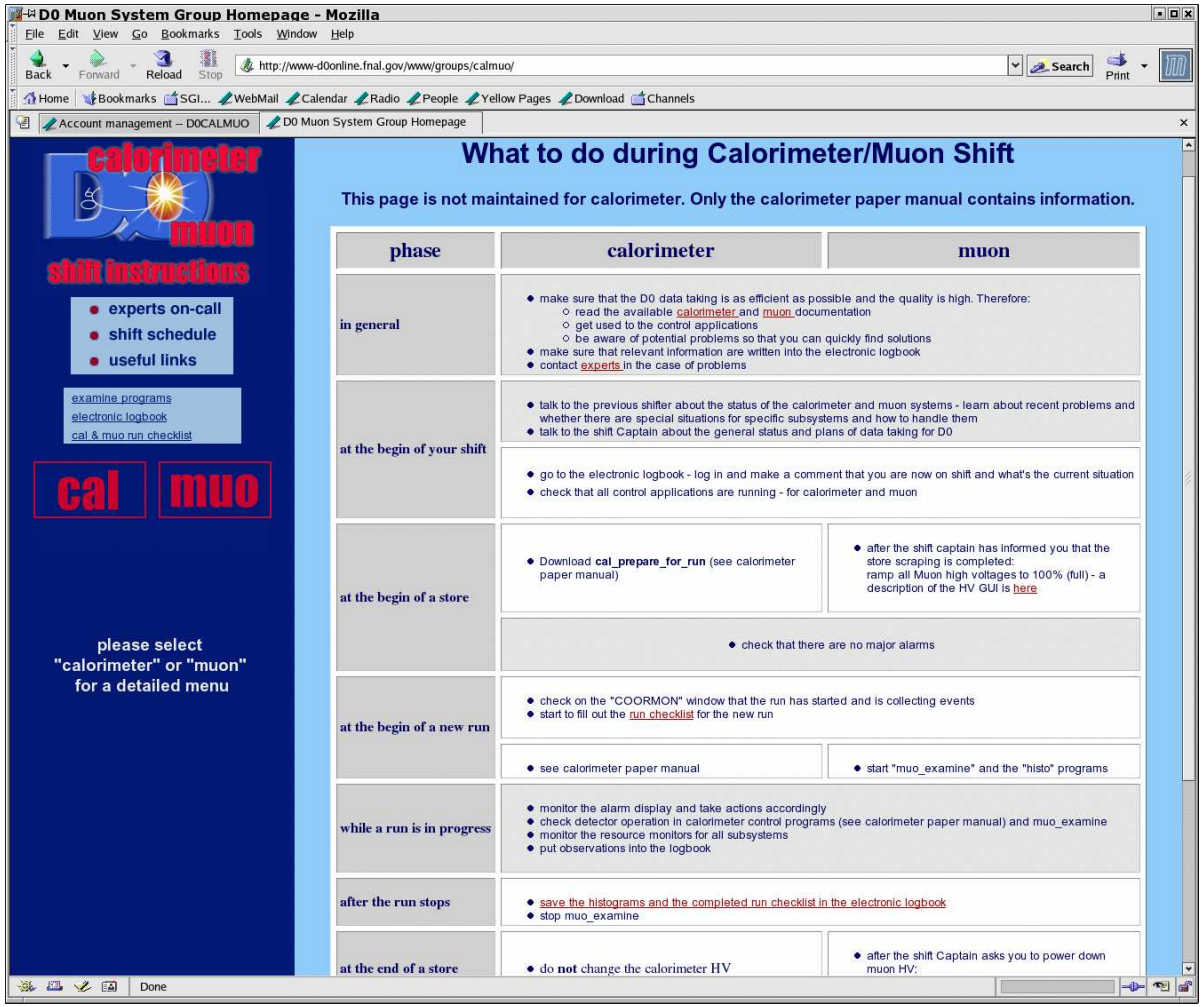
- **at the end of a store**
  after the shift captain has informed you that the data collection is completed:
  ramp all muon high voltages to STANDBY
  (yes: the PDT pads the standby value is equal to full value!)
  cal: do **not** change the calorimeter HV!!!! — **never change cal HV!!!**

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

Muon System: Control Applications

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

Muon Shift Web Documentation

- **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

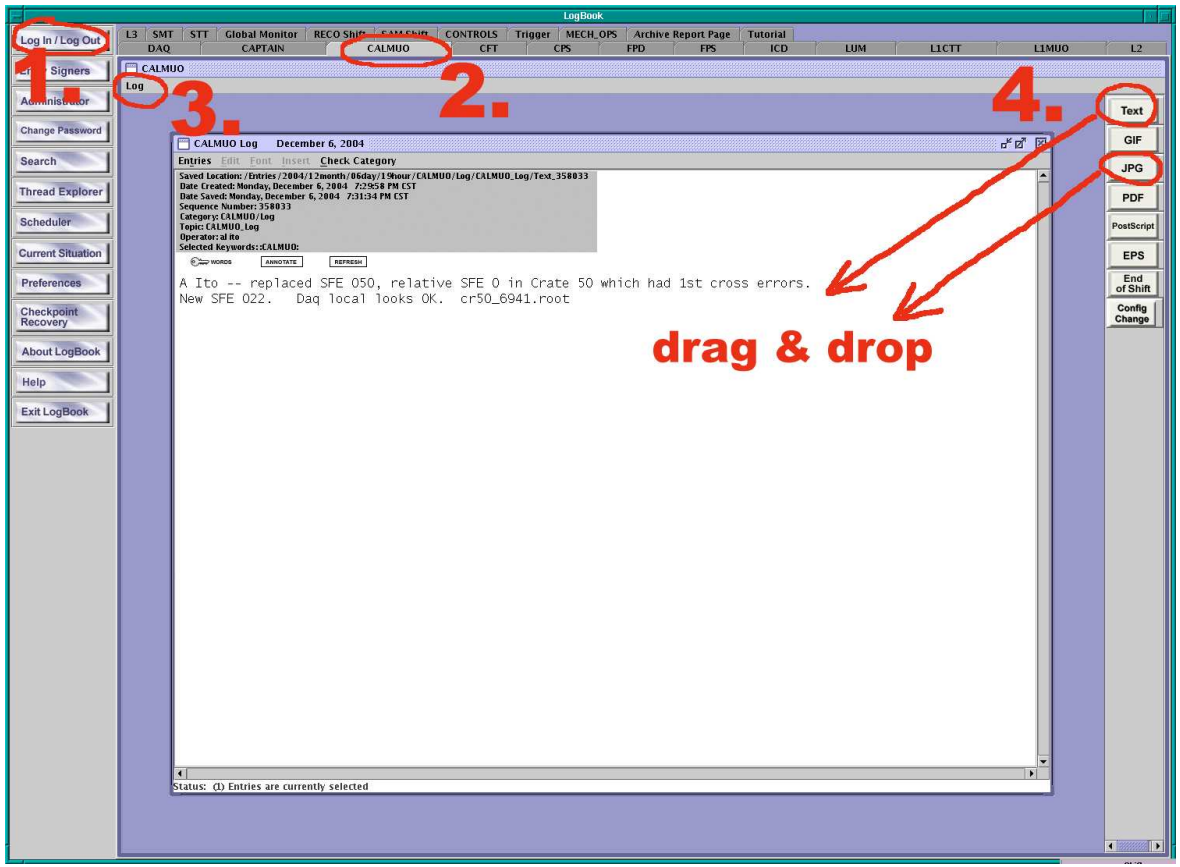
- **real problems:**
  shifters task: call/page experts!
  all decisions have to be made by experts
  (e.g. disable crates from readout)

The Electronic Logbook

important: communication between shifters and experts

all relevant events → logbook

make sure that experts make notes about their work



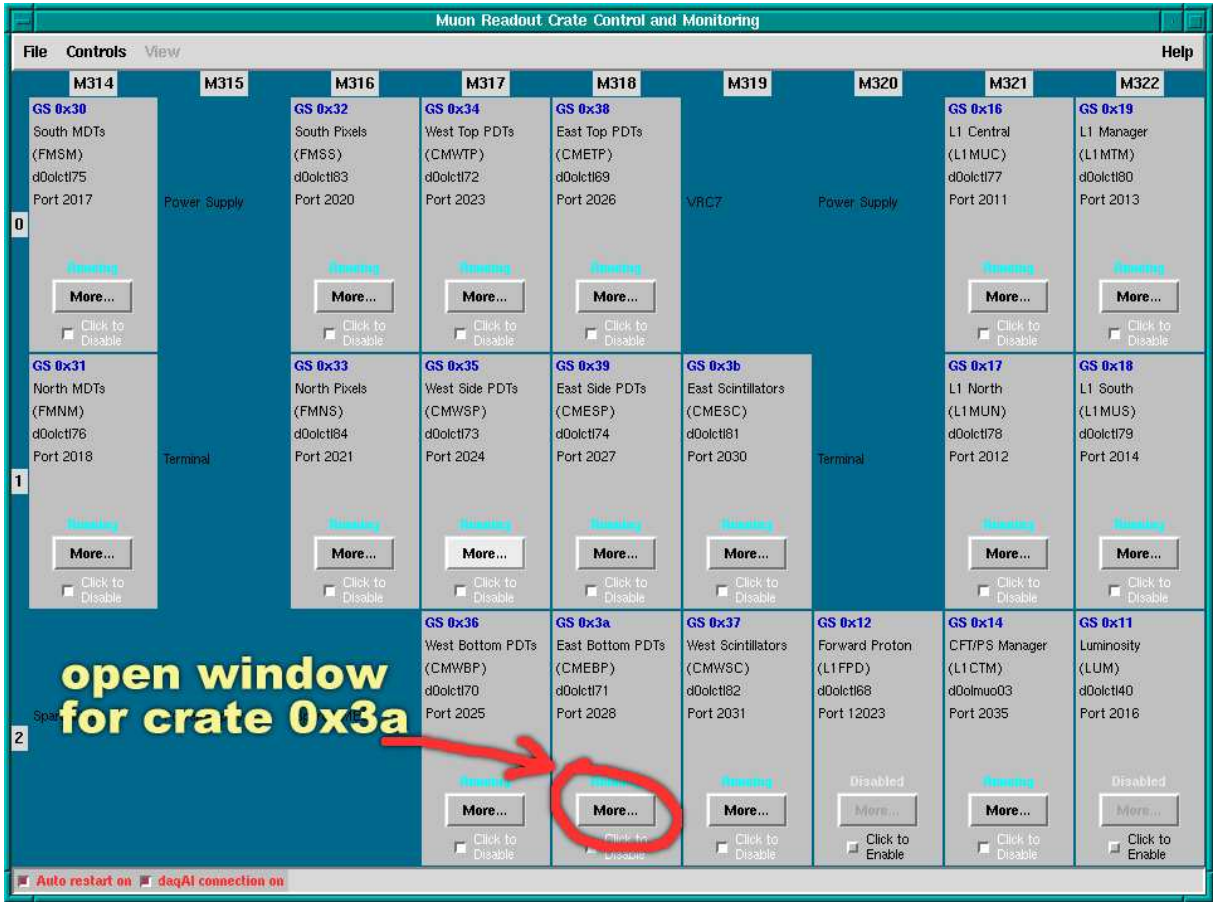
→ sign up for logbook account before your fi rst shift (ask M. Wobisch or DAQ shifters)

The Readout Client (1)

GUI layout corresponds to physical layout of the readout crates in MCH3

overview on the muon readout status

indicates:
stable readout (blue: “Running”) readout errors (red) and/or deviations from the default confi guration (yellow)



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

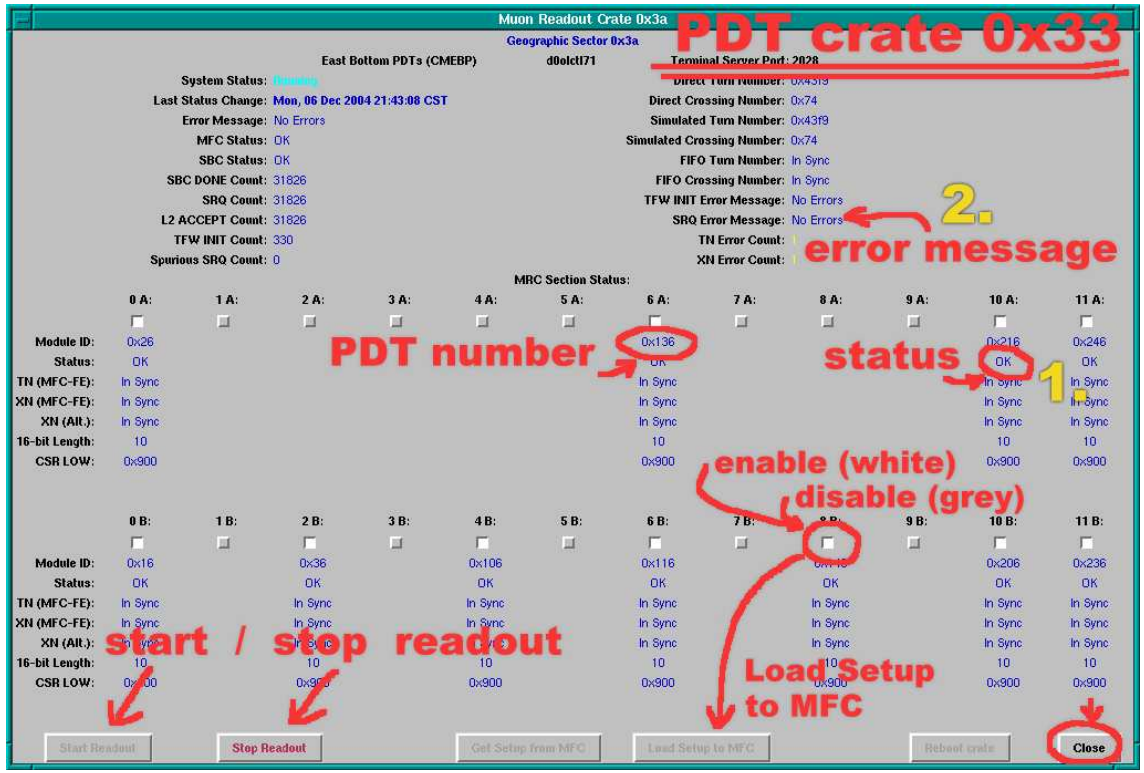
→ make sure bottom left two features are enabled)

The Readout Client (2)

readout status of single muon crate (check status)

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

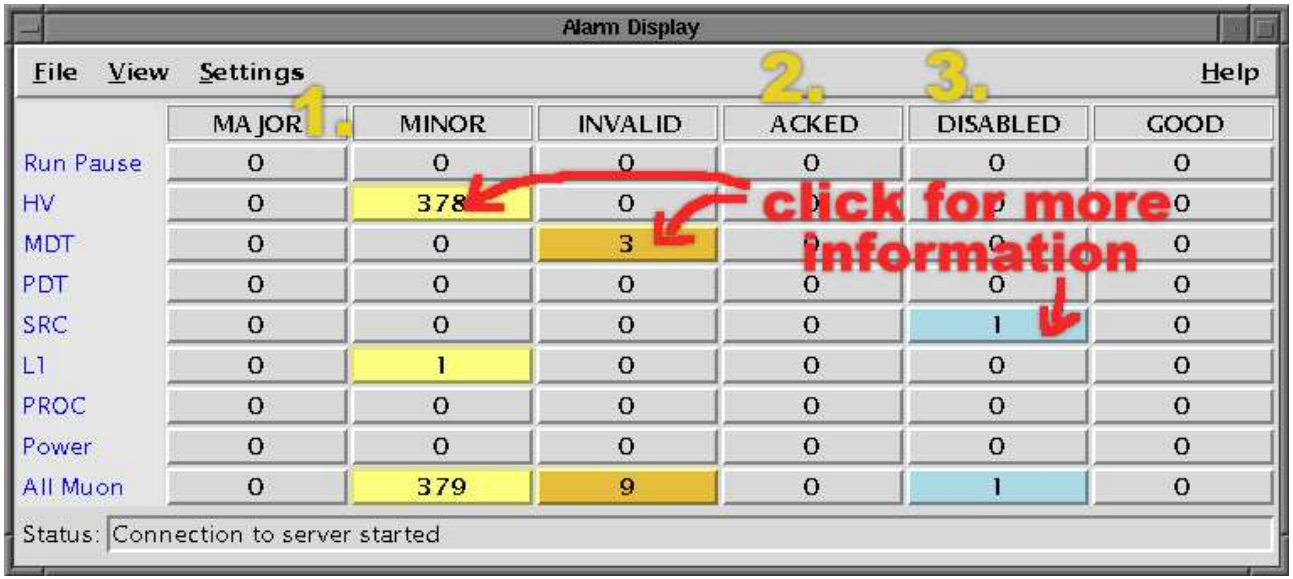
never **REBOOT** crate (call Readout expert if needed)



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

when in-/excluding channels: they also **must** be in-/excluded from L1 and L2
see “Muo” → “Troubleshooting” → “How to Disable a Muon Section ...”
(after disabling: reinit Coor)

The Muon Alarm Display



	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
Run Pause	0	0	0	0	0	0
HV	0	378	0	0	0	0
MDT	0	0	3	0	0	0
PDT	0	0	0	0	0	0
SRC	0	0	0	0	1	0
L1	0	1	0	0	0	0
PROC	0	0	0	0	0	0
Power	0	0	0	0	0	0
All Muon	0	379	9	0	1	0

check regulary!!! (keep running below the readout client)

- often the easiest way to identify problems / click on fi elds for more information
- (1.) Major Alarm ⇒ call/page expert! (while waiting for expert: try to understand)
- (2.) Acknowledge: acknowledge **single** occurence / fluctuating alarms will return
- (3.) disable: completely ignored / if a minor alarm becomes major you won't see it

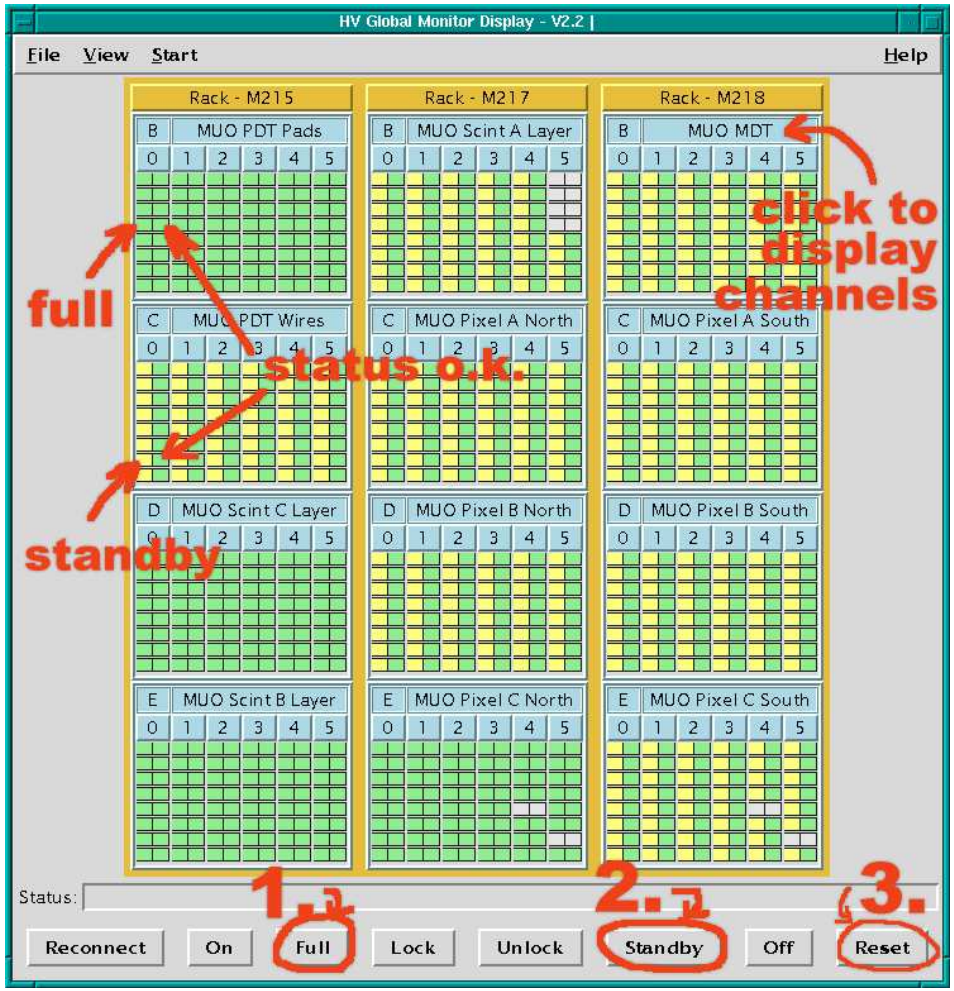
→ **never acknowledge/disable** alarms without contacting an expert

The Muon HV Display (1)

fi rst 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

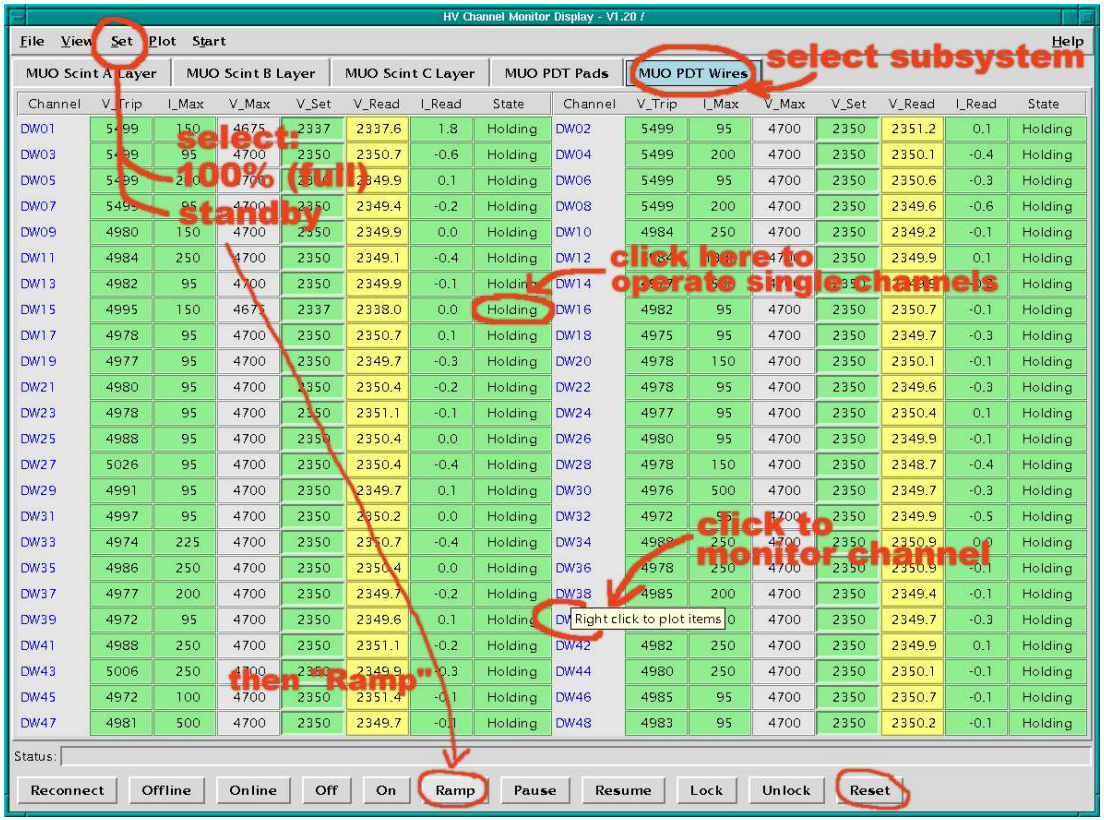


⇒ ramp/reset all muon HV channels by pushing a single button (1., 2., 3.)

important!!! ⇒ check that ramping was successful (in rare cases: single channels don't ramp)

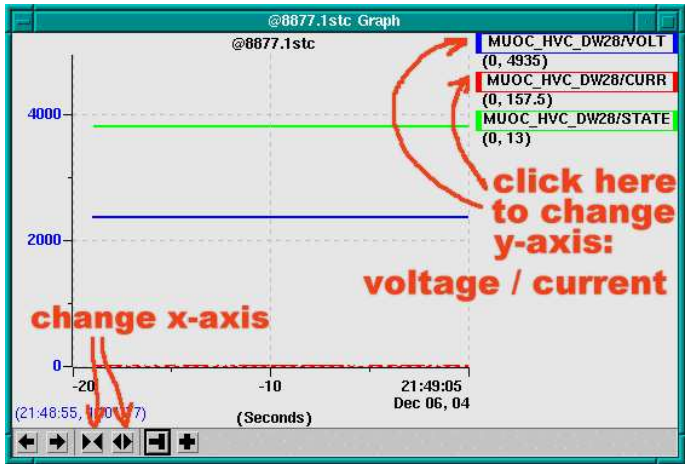
The Muon HV Display (2)

two detailed displays: complete infos on single channels



helpful for troubleshooting:

monitor voltage and current for single channels



(example of a good HV channel - no peaks)

important to check after HV trip!

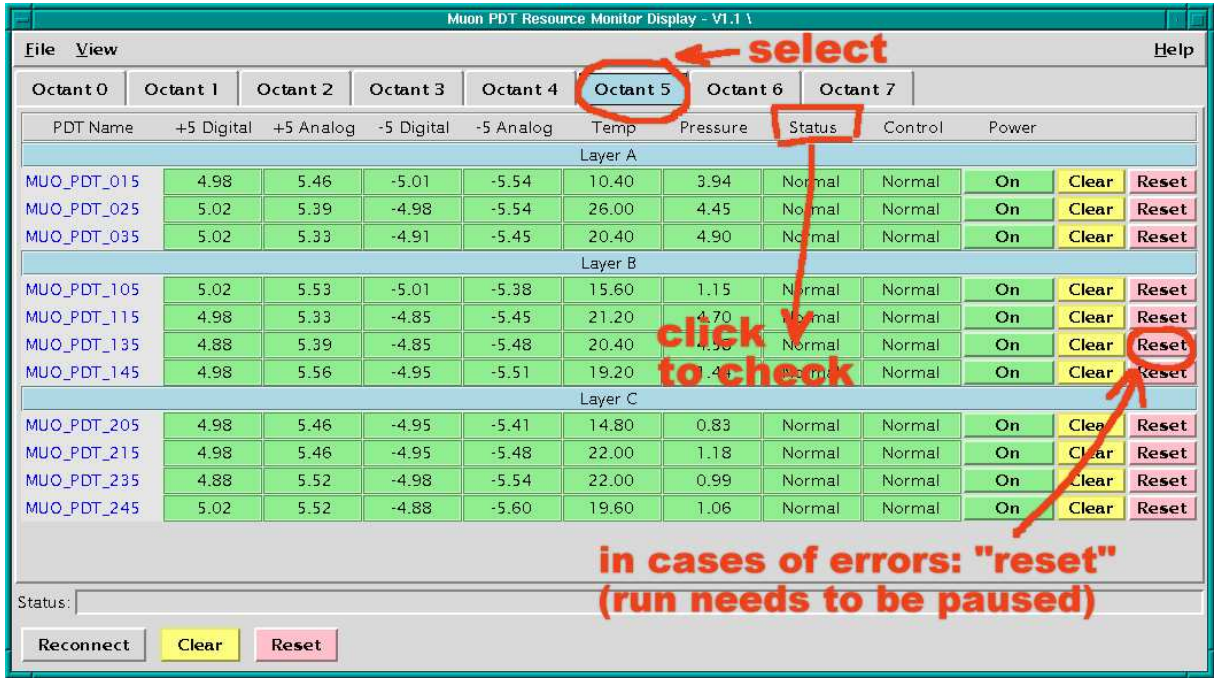
allows to ramp single channels ⇒ helpful after trips

The Resource Monitors: PDTs

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

usually status fi eld: **NORMAL**

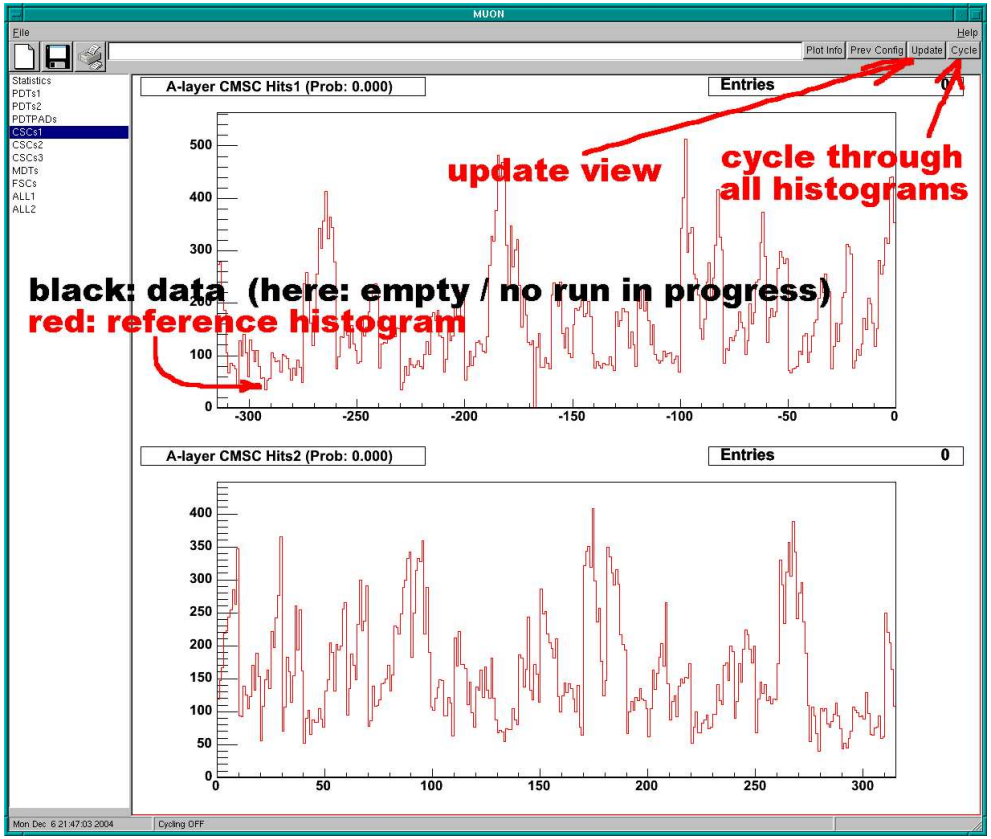
when status fi eld is red:
click on **ALARM** for
more information
⇒ write into logbook



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

⇒ This is what experts need to know when paged at 2:00am!!!

MuoExamine and Browser



instructions how to run examine and the browser are on the webpage and posted in the controlroom

$\Rightarrow$ run examine all the time to and compare to the reference histograms in red

most important: check for empty (=dead) channels
(some fluctuations can always occur)

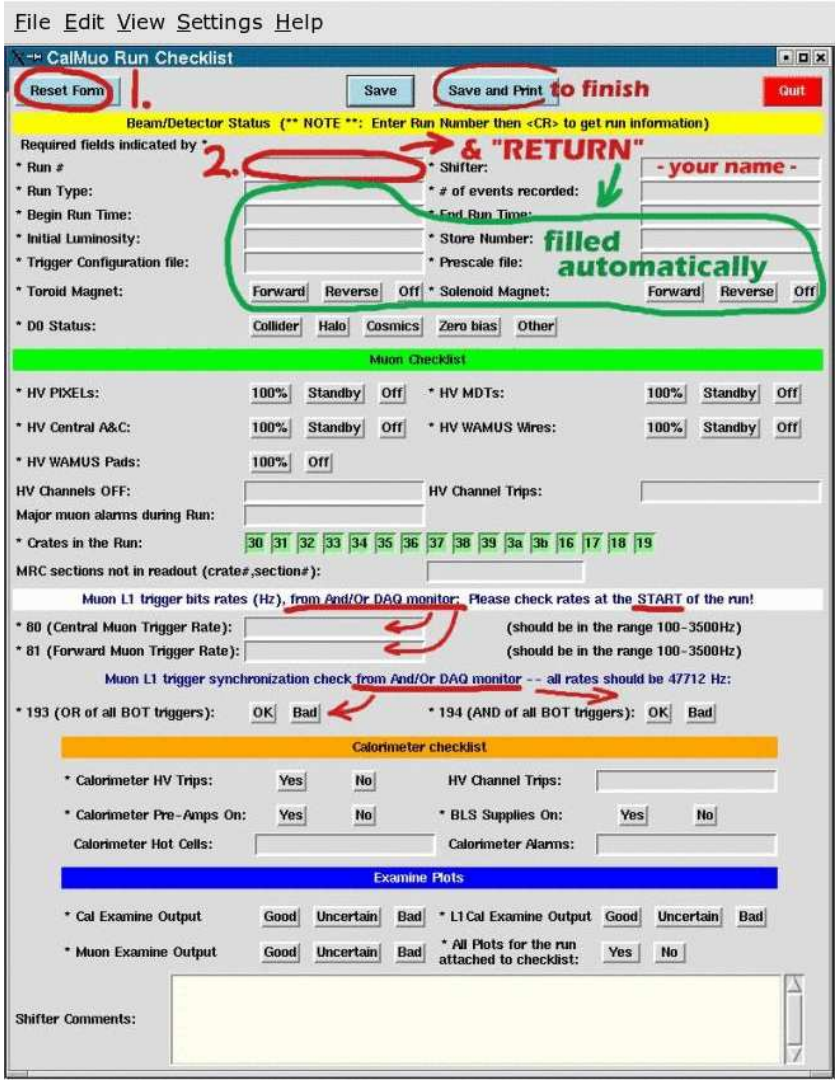
The Calmuo Run Checklist GUI

purpose:
archive cal & muo system
status for every run

start/operate as described on web page

some general information
(fi lled 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 $\rightarrow$ trips
  $\Rightarrow$ reset & ramp again (a few times)
  $\rightarrow$ check correlation with high background
  frequent $\Rightarrow$ call expert

- crashes of readout crates
  $\rightarrow$ note section in logbook / 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

  exclude from L1: shifter’s task (guided by expert)
  exclude from L2: automatically after DAQ shifter has reinitialized Coor

- major alarm: one PDT shows L1 error + FEB error (not a big deal!!!)
  – try to reset once (on PDT resource monitor / after run is paused)
  – try to powercycle PDT (on PDT resource monitor “ON” / after run is paused)
  – call/page PDT expert (expert will ask you to disable both alarms & keep running)

conclusions

- operations of the muon system is very stable
- allows shifters to concentrate on “details” $\leftrightarrow$ absolutely necessary to guarantee operation at high effi ciency
- 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

- this tutorial provides useful information on the muon system operation — but really important: before your fi rst shift you must have one or two “shadow shifts” (together with experienced shifter)

- **BIG THANKS to the shifters!**