# Calmuo Shift Tutorial: The Muon System

Markus Wobisch, Fermilab

December 7, 2004

- 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

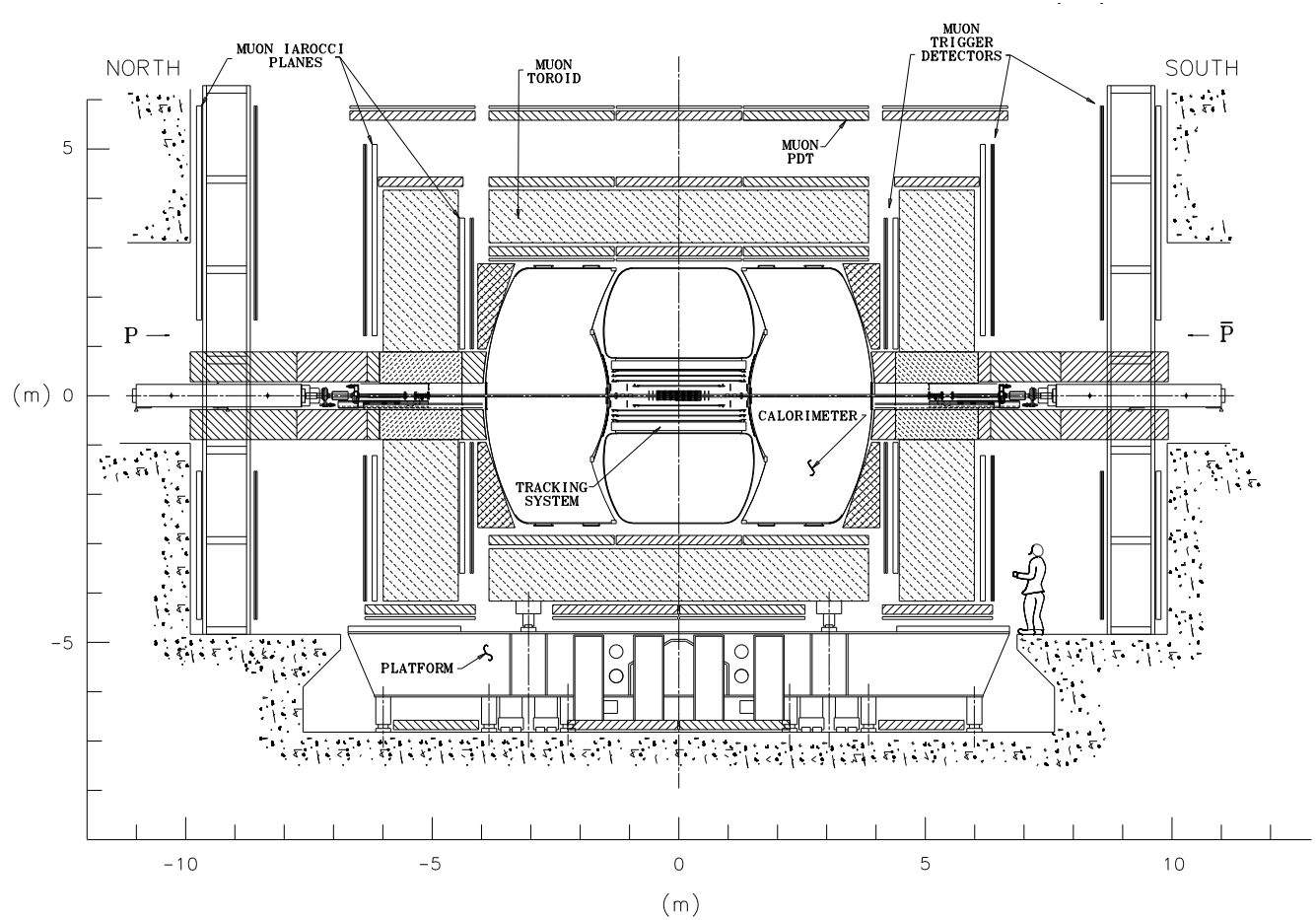
central: Central Drift Chambers  Central Scintillation Counters  $(|\eta| < 1)$

forward region:

Forward
Mini-Drift Chambers

Forward
Scintillation Counters

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



# The Muon Subsystems

| | |
|---|---|
| Central Muon System: | WAMUS – Prop. Drift Chambers (PDTs)<br>Central Scintillation Counters (CSC) |
| Forward Muon System: | FAMUS – Mini Drift Chambers (MDTs)<br>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)
  **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 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

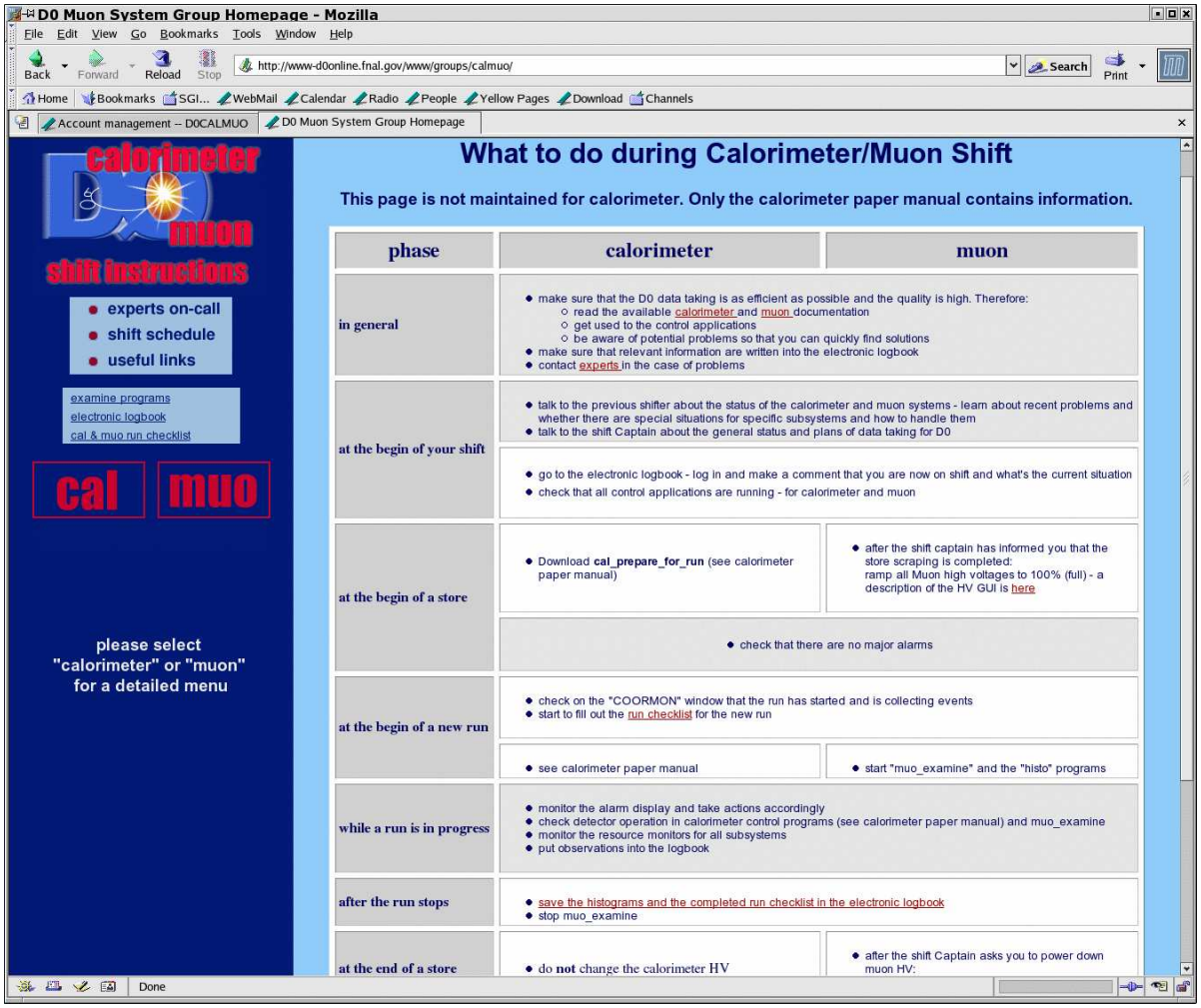
- **at the end of a store**
  after the shift captain has informed you that the data collection is completed: ramp all muon high voltages to STANDBY
  (yes: the PDT pads the standby value is equal to full value!)
  **cal:** do **not** change the calorimeter HV!!!! — **never change cal HV!!!**

- **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

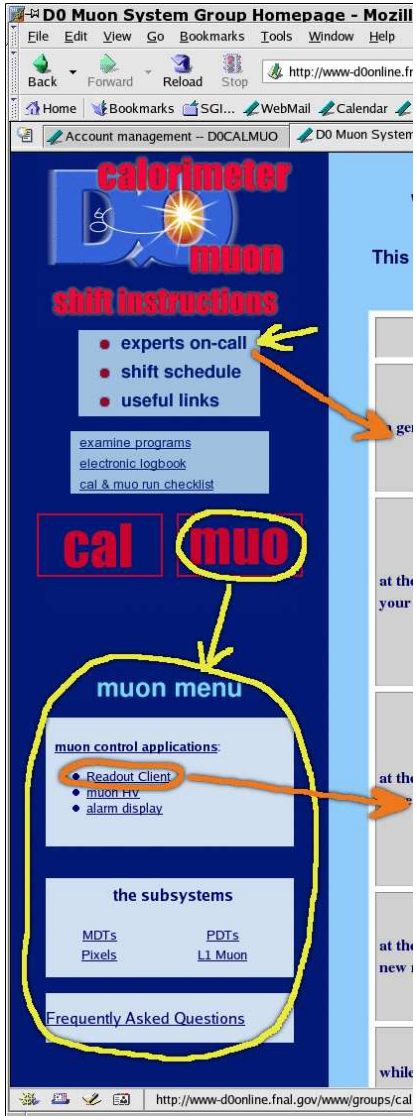
direct access to all documentation:

how to operate:

- Readout Client
- HV GUI
- alarm dislay

information on muon subsystems:

- MDT / Pixel
- PDT / L1muo



# *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
  (e.g. disable crates from readout)

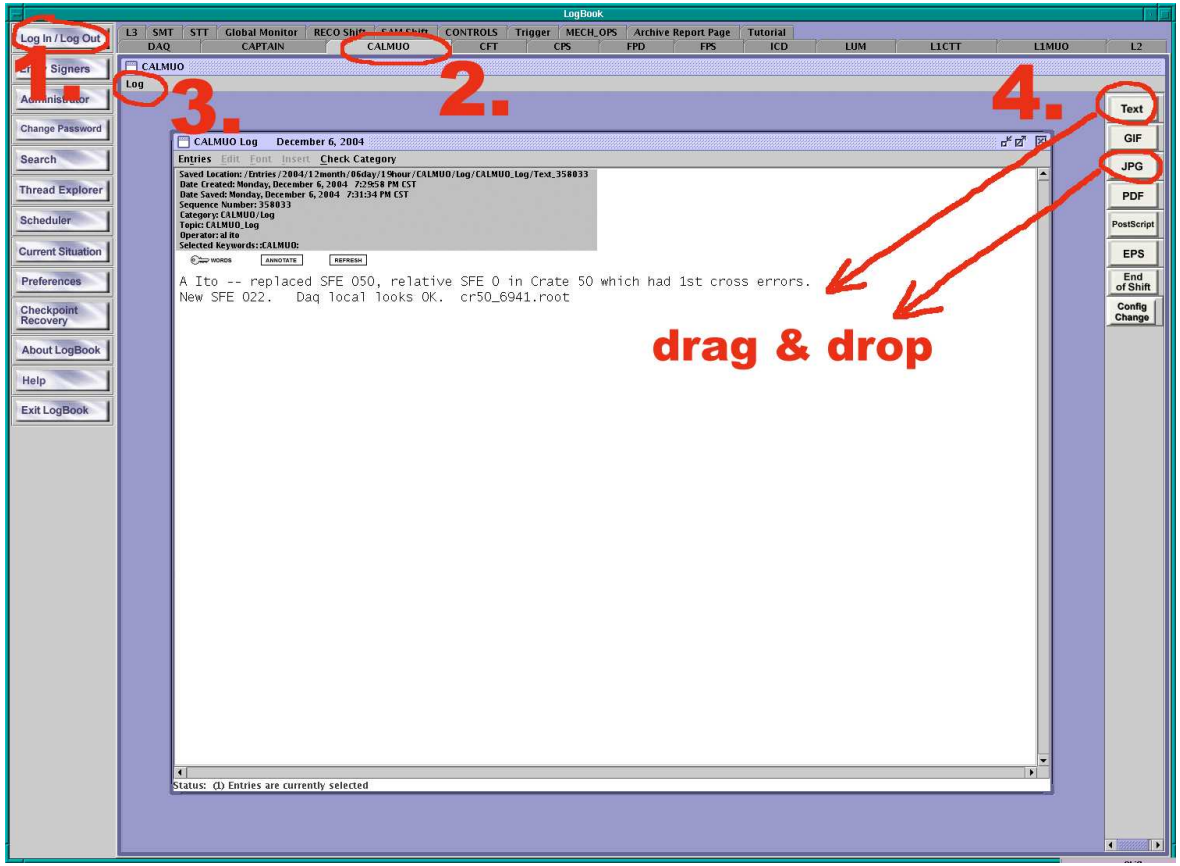
# The Electronic Logbook

important: communication between shifters and experts

all relevant events
→ logbook

make sure that experts make notes about their work

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



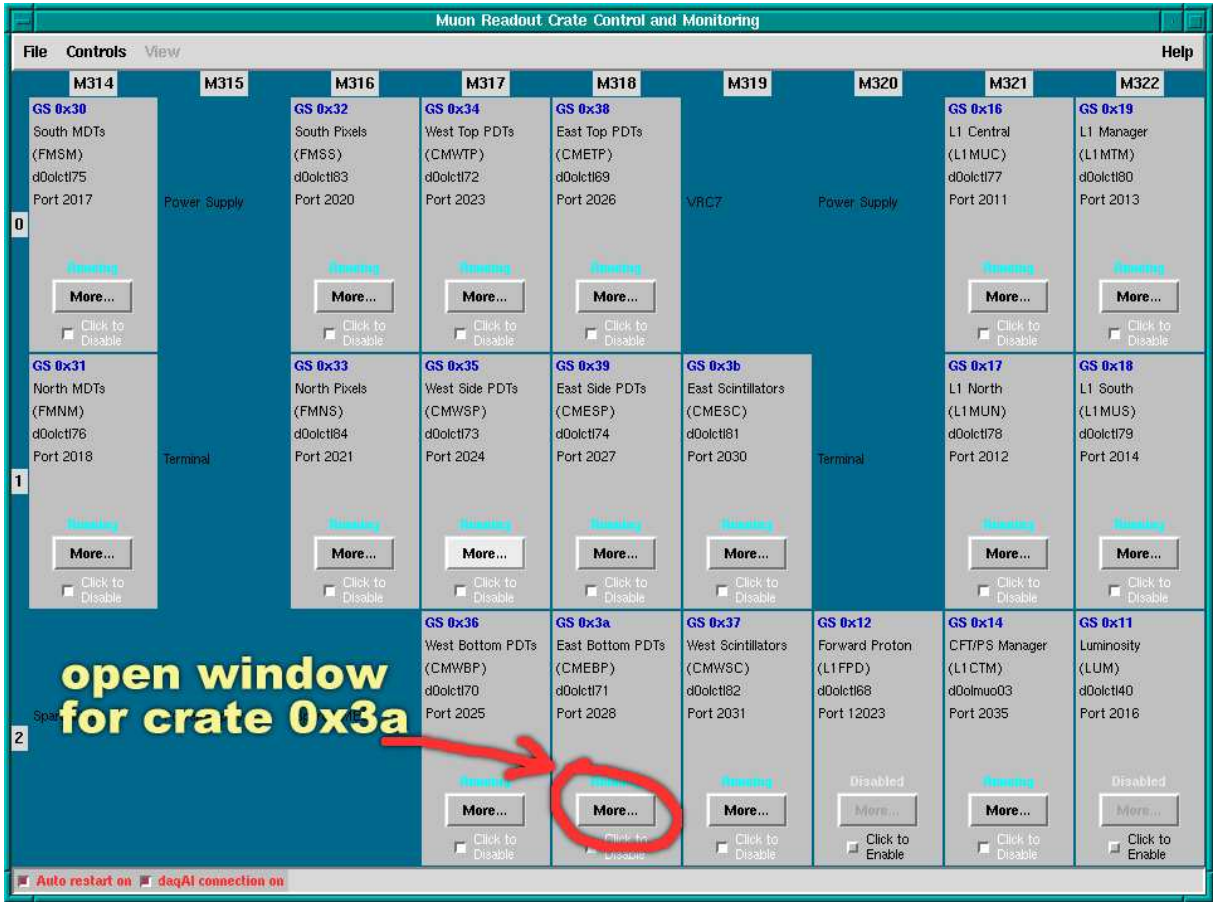

→ sign up for logbook account before your first shift (ask M. Wobisch or DAQ shifters)

# 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 configuration (yellow)



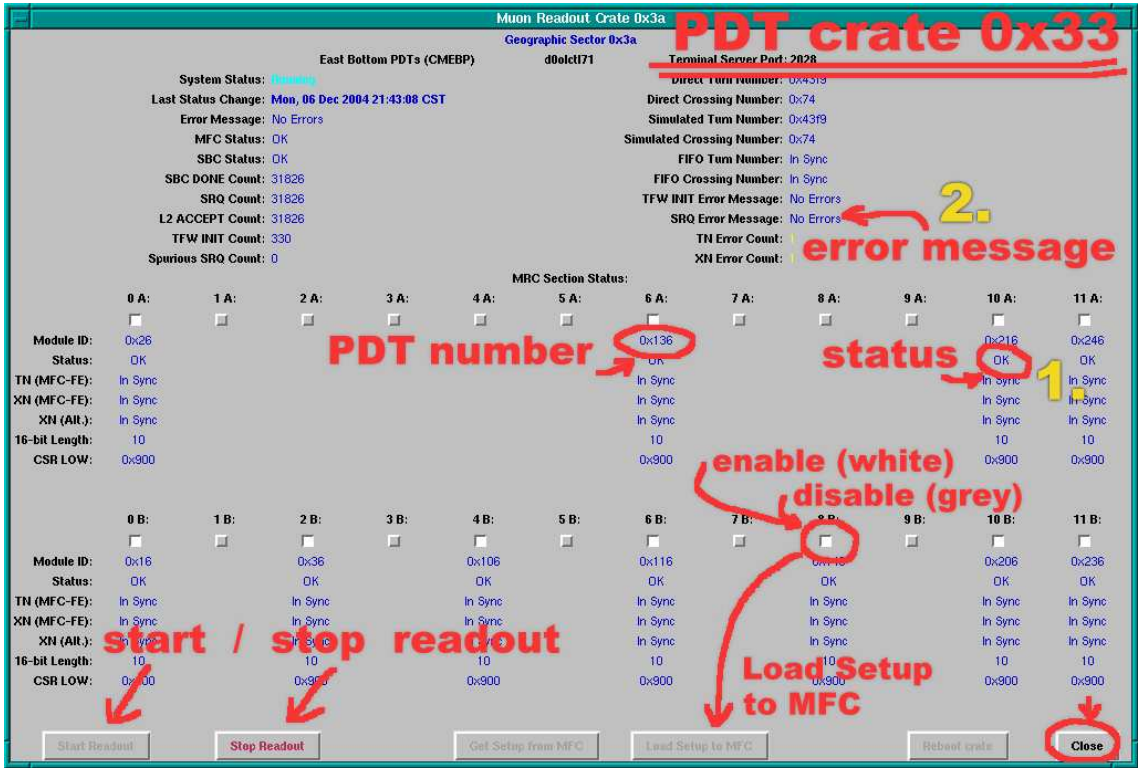

→ press button: **More ...** to access to detailed information for single readout crates

# 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.)

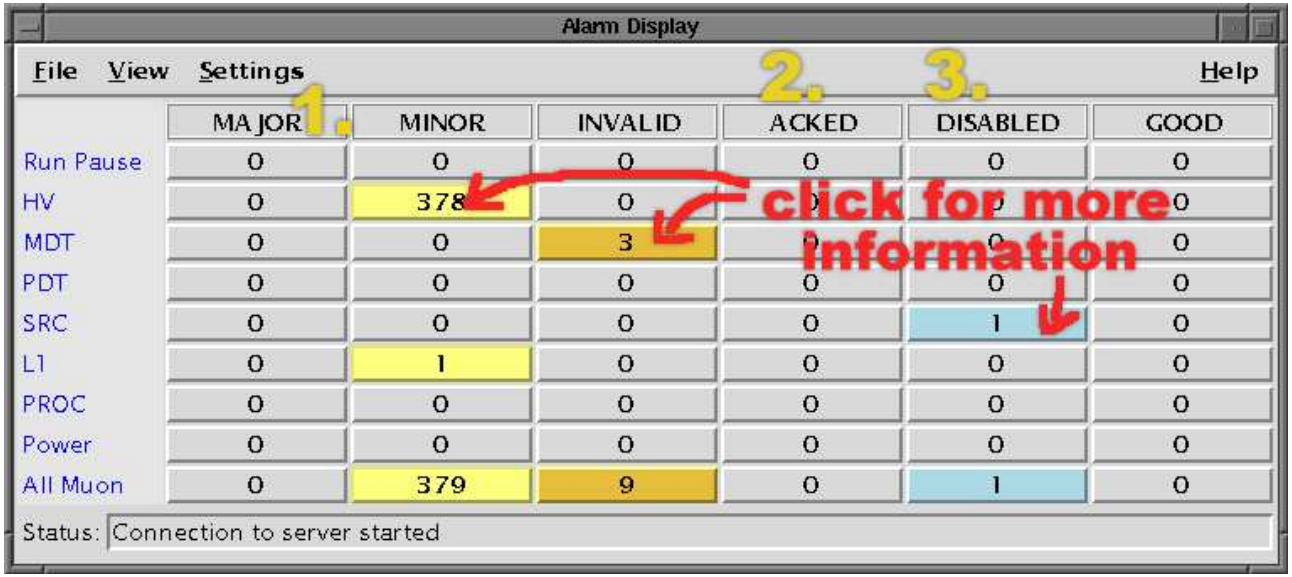
not responding or strange behaviour: **REBOOT** crate
(if this does not help call expert)




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 in-/excluding channels: they also **must** be in-/excluded from L1 and L2
L1: see L1 muo page / L2: automatically after DAQ shifter has reinitialized 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 fields 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

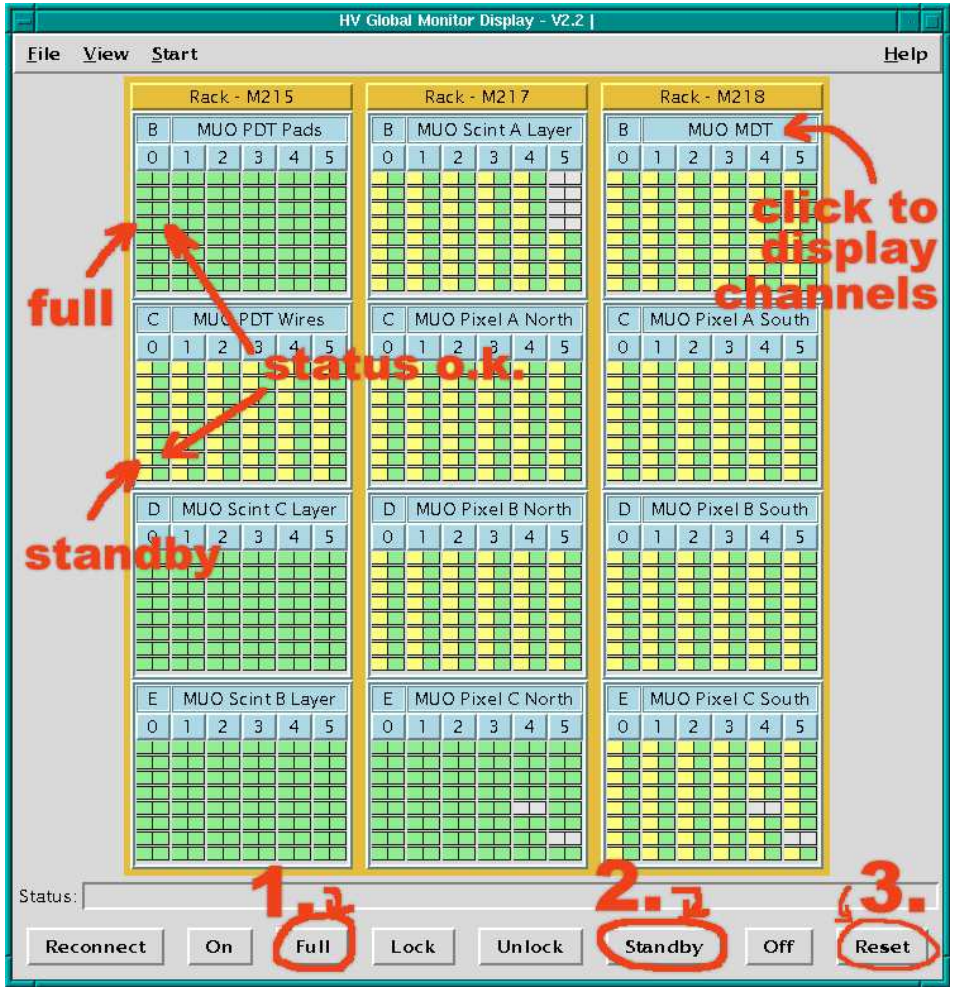
→ **never acknowledge/disable** alarms without contacting an expert

# The Muon HV Display (1)

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

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

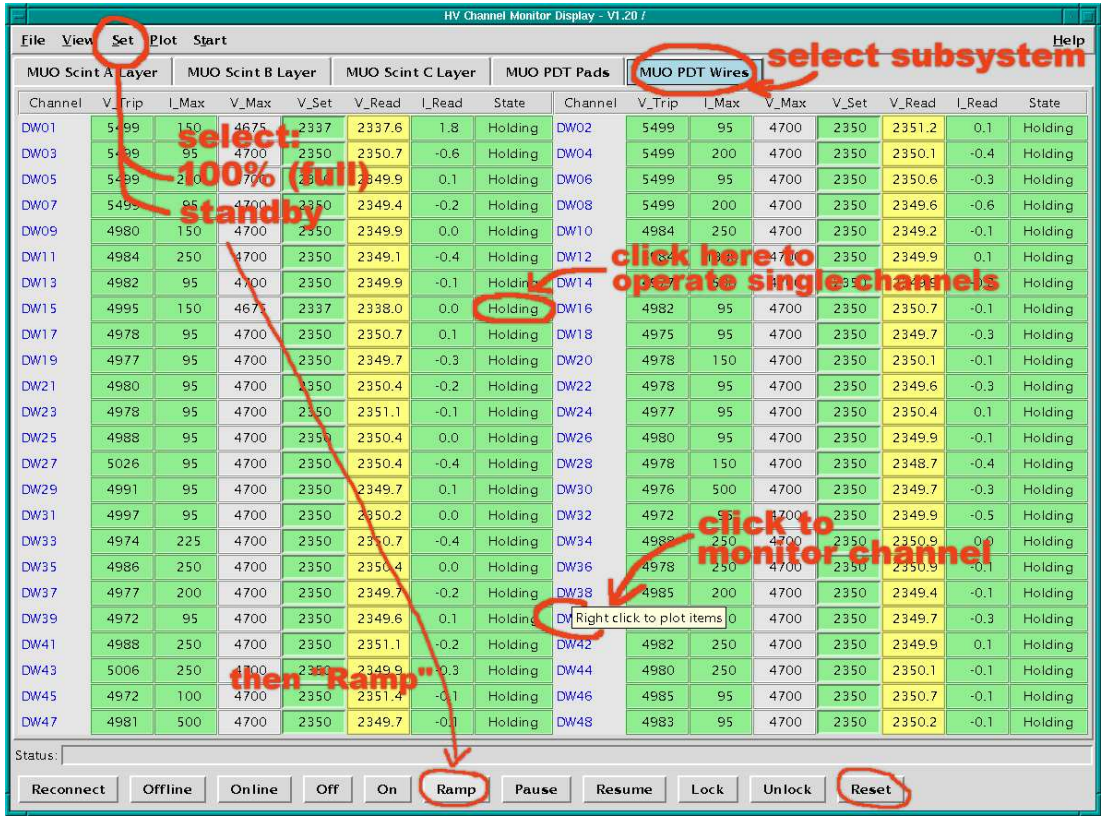
right column:
green, if setting corresponds
to nominal setting




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

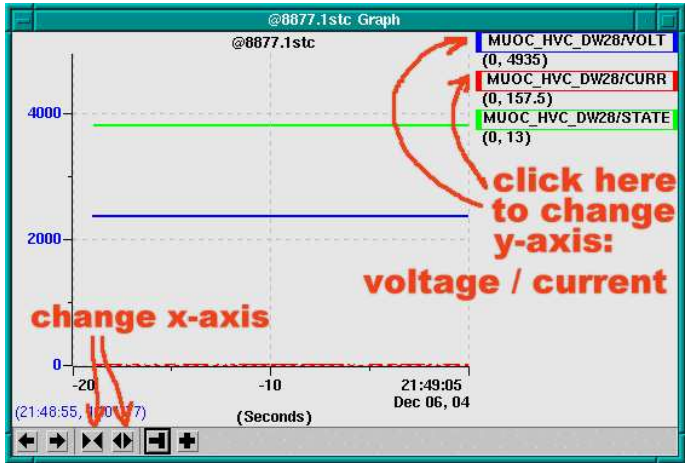
# The Muon HV Display (2)

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!

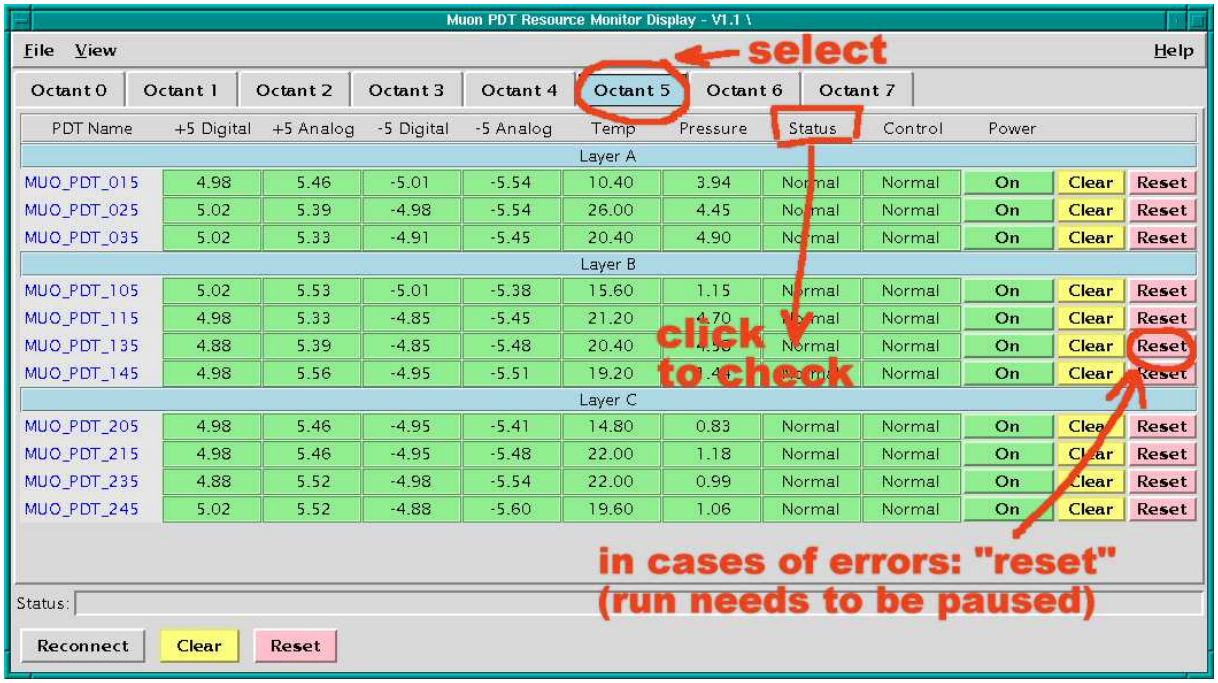
allows to ramp single channels ⇒ helpful after trips

# The Resource Monitors: PDTs

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

usually status field: **NORMAL**

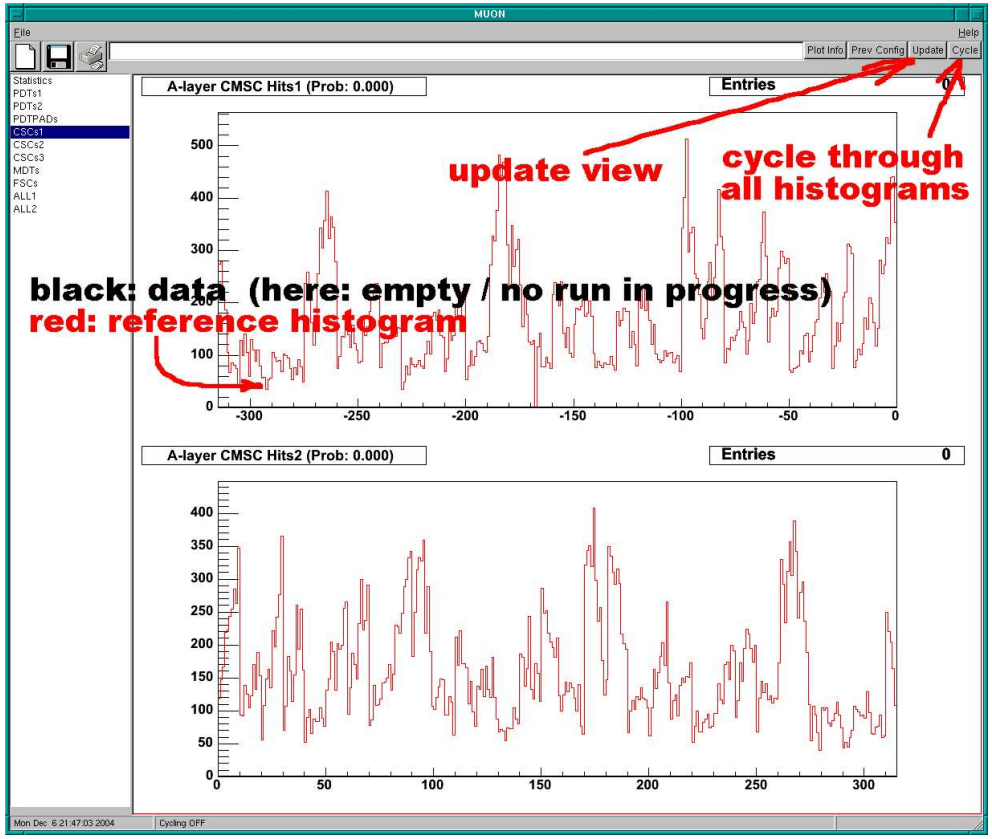
when status field is red:
click on **ALARM** for
more information
⇒ write into logbook




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

⇒ This is what the expert needs to know when you page him/her 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

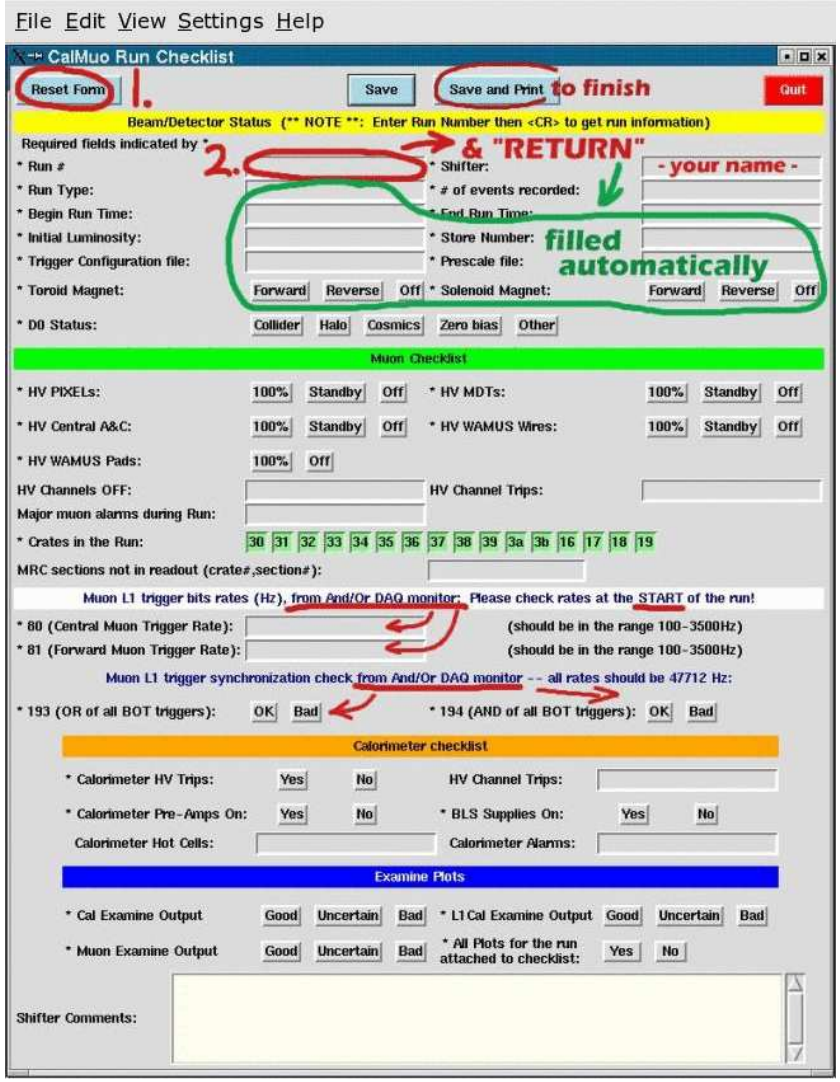
# The Calmuo Run Checklist GUI

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 $\rightarrow$ 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

# *conclusions*

- operations of the muon system is pretty stable
- allows shifters to concentrate on “details” $\leftrightarrow$ absolutely necessary to guarantee operation at high efficiency
- 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
- **BIG THANKS to the shifters!**