A Users Guide
for the DAQ operator

The Experts

November 14, 2023 - 19:28

Contents

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Daily News for the Operator

2024/01/01 Happy New Year!

Part II.
General Advice

(updated 30.11.2023)

1. Main Tasks

- Operate the data acquisition, mainly using the Control GUI.
- Monitor the status of the whole system, mainly using the Tactical Overview.
- Monitor some detailed performance data using the Hmon Plots (see ”the main windows“).
- Make entries to the logbook about configuration changes and important issues.

2. DAQ Shifts

- Your first shift should be one of the day shifts, not a night shift. During the day availability of experts is better, so you can get more help.
- Before your first shift, you are asked to stay in the counting house for one shift as a ”trainee“, together with another operator. This is necessary to learn how the system looks like, how errors show up and how to get to the right procedure to solve them.
- There will always be a DAQ expert or DAQ professional on call. We’ll try to arrange shifts in a way that a knowledgeable operator is ”close by“ (e.g. online) for inexperienced operators.
- If you do a remote shift (e.g. during a cosmics run), make sure you have access to the DAQ VNC (hades70:1) and the main web server (`http://hades33/mon`). Access from outside GSI needs an SSH tunnel made with your account. Some hints are listed here.

3. General To-Do’s

- The DAQ operator should always be present in the **Mumble channel** “Operators Corner” - DAQi will provide some audible (sometimes even recognizable) hints if something is wrong.
- If you notice something noteworthy in the Hmon monitoring, use the **“Hmon Snapshot”** button to store the current plots for later analysis.
- Don’t hesitate to **call the professional / expert** if there is a problem you can’t solve or you don’t fully understand!
- Almost **everything can be accessed** from the web page (`http://hades33/mon` and the Control GUI (icon on desktop)
- At the end of the shift, make a summary entry to the logbook about DAQ issues. To take notes during the shift, there is a **paper logbook** you can use to keep track about minor issues or error statistics.

- **Before making changes** to configuration or doing a power cycle, don't forget to stop triggering (Start Stop Trigger) to prevent corrupted data from being recorded.
- Whenever there is a **beam pause** of more than 2-3 minutes, switch eventbuilders to "No Files". When beam comes back, check in the EB Summary monitor that all building nodes are still active after switching back to "beam" files.
- **If one board is missing, do not panic!** Do not risk many seconds of possible data taking for one missing board. As a rough guide 2 MDC and/or 4 RICH boards missing is acceptable. If a board goes missing after an hour of data taking, you can restart the DAQ, but don't do it too often in case of frequent failures.
- Please don't do any power cycle without asking an expert – unless it is explicitly stated in the manual or help texts.
- Whenever possible, but at least once a day, when there is a break >15 minutes, a **full restart** of the system should be performed. Talk to the DAQ expert to get this done!

4. More Remarks

- Please **keep an eye on the rate plots** ("Main Screen 4" on the web page). If you notice any asymmetry between sectors / parts of detectors, try to do a reload of thresholds for the detector. If this doesn't help, talk to the detector expert, e.g. a power cycle of the frontends might be necessary.
  - e.g. in ECal a row of 8 green dots appear (-> ECal Padiwa Powercycle)
  - e.g. in TOF one sector has a lower/higher rate (-> Tresholds TOF)

  Special attention is needed after a power cycle!
- After a break, **Eventbuilders need some time to recover**. Wait a bit and don't try to restart them more than once per minute. Also try to use "Reset" from the Web browser EB interface or the GUI for a 'softer' reset.
- In most cases a **reboot of a subsystem is the better option** compared to a power cycle. If all boards of a subsystem are present, do a reboot, but not a power cycle. Check the missing endpoints - **if the boards you want to reboot are missing, it won't work** (apart from MDC).
- Some actions can be done **without a DAQ restart**:
  - All actions from the "Settings" column can be done while DAQ is running
  - All "Powercycle Padiwa" requires you to stop trigger before, load thresholds after and start trigger again.

Part III.
Control

5. DAQ control window

(updated 2023-10-27) Most control tasks can be done using the DAQ Control GUI, only few things need access to other tools.

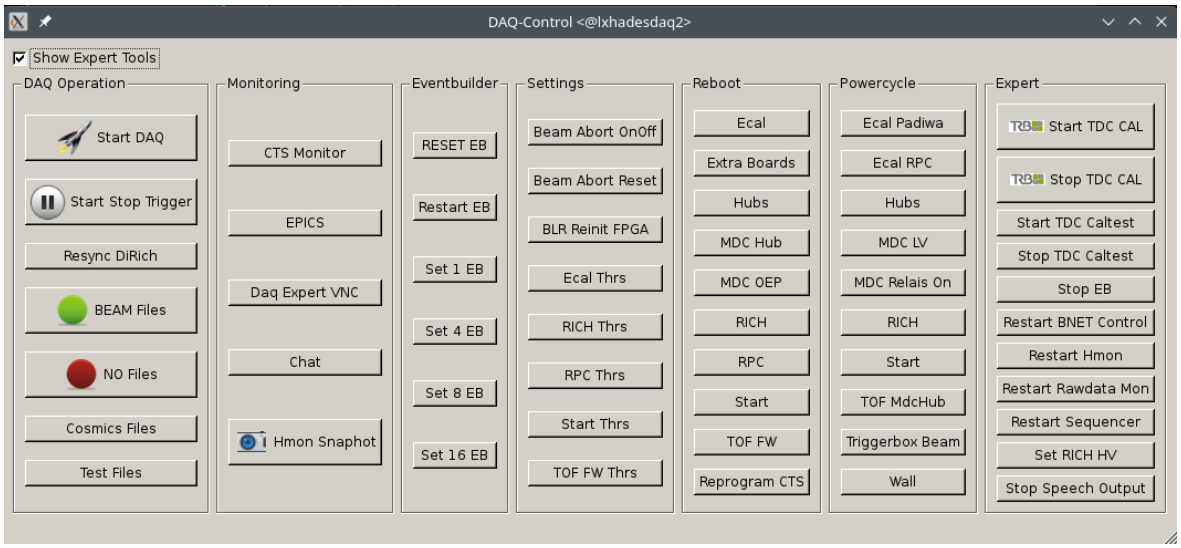


Figure 1: DAQ Control Window

DAQ Operation

Start DAQ The main script to restart the DAQ. Standard solution if some problems appear (red blinking).

Start Stop Trigger Interrupt sending triggers to stop data taking for a while appears)

Resync DiRich Tries to recover failing RICH front-ends

BEAM files Start recording files triggered with accelerator beam. These appear with prefix ”BE” in eventbuilder monitor and are accounted in the runtime database (logbook).

COSMICS files Start recording files triggered without beam by cosmic radiation. These appear with prefix ”CO” in eventbuilder monitor and are accounted in the runtime database (logbook).

TEST file Start recording any kind of test files. These appear with prefix ”TE” in eventbuilder monitor and are NOT accounted in the runtime database. Test files are not stored permanently on Lustre!

NO FILE Stop recording any kind of file. This will close previous files. Note that eventbuilders are not stopped by this, but continue running without writing files. However, the QA and raw DAQ monitoring clients are still delivered with data in this state.

Monitoring

CTS Monitor The monitor for CTS settings and scalers. One instance should be open for experts, but usually not needed by the operator

Epics Opens a VNC with the EPICS control for power supplies and links to other detector controls mainly for experts

Daq Expert VNC This VNC is typically used by experts to remotely control the system. In the control room only used to see actions by the expert.

Chat A terminal based chat window, not used during beam time

Hmon Snapshot Creates a copy of all plots and windows in Hmon for documentation

Eventbuilder

Reset EB Resets the eventbuilder, e.g. empties all buffers.

Restart EB Start eventbuilders again (with most recent settings). It needs to be followed by clicking ”BEAM file” (or ”TEST file” or whatever) to start recording data again.

Set N EB Sets the number of running instances of eventbuilders and restart the building network with the new configuration. Change only on request. E.g. 1 EB for cosmics, 16 EB for beam data.

Settings

Beam Abort OnOff Toggles the beam-abort (in-)active

Beam Abort Reset Reset the beam abort error message in the tactical overview

BLR Reinit FPGA Reconfigures the analog trigger collection board from TOF / RPC. Use when rates from TOF/RPC or M2 are wrong.

XXX Thresh Reload thresholds for the named detector. Use if something seems to be wrong with frontend settings

Reboot

SYSTEM Reboots FPGA boards of the names system. Only affects boards that are currently online (not “missing endpoints”), takes just a few seconds.

Reprogram CTS Reprograms the CTS with its firmware

MDC OEP Special reboot procedure for MDC front-ends - takes a while, should only be used if necessary

Powercycle

This section offers buttons to cycle the low voltage supplies of several detector systems. These are convenience shortcuts to avoid operations on the full detector control system GUI. A power cycle may be necessary in some situations to reset the DAQ front-end boards.
MDC LV opens a new window to cycle the electronics of an individual chamber.

Expert Tools

This section is visible only when the "Show Expert Tools" box on the upper left corner is checked.

Start TDC CAL Start calibration run for the trb3 TDCs. This will disable the regular CTS trigger inputs and send special calibration events with a 500 Hz pulser. At the same time, the event-builders will record files of prefix "TC".

Stop TDC CAL Stop the calibration run for trb3 TDCs that was started with the above button. This button has to be pressed when all DAQ input subsystems as shown in the eventbuilder input nodes have turned from blue to green color. On pressing, the "TC" files are stopped and the new calibration is used for the next data taking runs. For more info see sec. 15.

Start TDC Caltest Records a file with calibration triggers to test current calibration. Should be stopped after 30 seconds.

Stop TDC Caltest Return to normal data taking, calculate calibration status

Stop EB Stop eventbuilders. For expert and testing purpose only!

Restart BNET Control Restart the DABC master process that controls the building network (BNET). This process also delivers the eventbuilder monitoring at `https://hades33/eb`

Restart Hmon use to activate changes in main monitoring

Restart Rawdata Mon Restart the DABC analysis of the raw data contents. Use this button if `https://hades33/rawmon` is not working

Restart Sequencer Restart automatic HV control procedures in EPICS

Set RICH HV Switches on all RICH HV lines and sets all HV modules to the correct supply voltage setting. If only one module is already switched on, this button will ramp down all HV modules instead. During ramp up keep an eye on `hades33/mon/monitor.cgi?6-RichRatev2` maximum rate should not exceed 1 MHz for longer times

Stop Speech Output Silence speech output of DAQ issues

Part IV.
Monitoring

6. Tactical Overview

Figure 2: Tactical Overview

The Tactical Overview gives a comprehensive view of the status of the DAQ system. During normal operation all fields should be green indicating a normal status. Colors change as errors get more severe (green - yellow - orange - red - red blinking).

Hovering the mouse over a field shows more details, and a click opens a window with some further information and troubleshooting advice.

Please note:

- Under certain conditions (e.g. one subsystem not working perfectly, no beam or cosmics data taking) not everything will be green. Try to memorize the pattern to find out if anything changes during the run.

- Not all colors are working perfectly. Some vary between error and good states - this can be either acceptable or not. Check the documentation of each field to see which applies.

- Note the special colors: black - unsued field. white - failure of script. olive - acknowledged non-perfect condition.
- Often several errors appear at once - you'll have to find out what is the cause and what is just a result. Some help texts tell you to "look elsewhere". Eventbuilder problems can't be fixed while there is a DAQ problem.
- Errors are often listed with the network address of the corresponding front-end board. Check the table of addresses [13] to find out which subsystem it belongs to.
- The error handling guides are usually written to be executed step by step. If the system is back to normal, there is no need to do the remaining steps (but be sure to read the full text either way).

7. Hmon Plots

Most monitoring can be accessed via the main web interface, available on http://hades33/mon. The most important windows to be open at all times are the "Tactical Overview" and the ones listed in the "Operator Monitor" box. They should be arranged on the upper left screens so that they can be seen from everywhere in the counting house.

The description of the plots shown and the features to look out for are listed below.

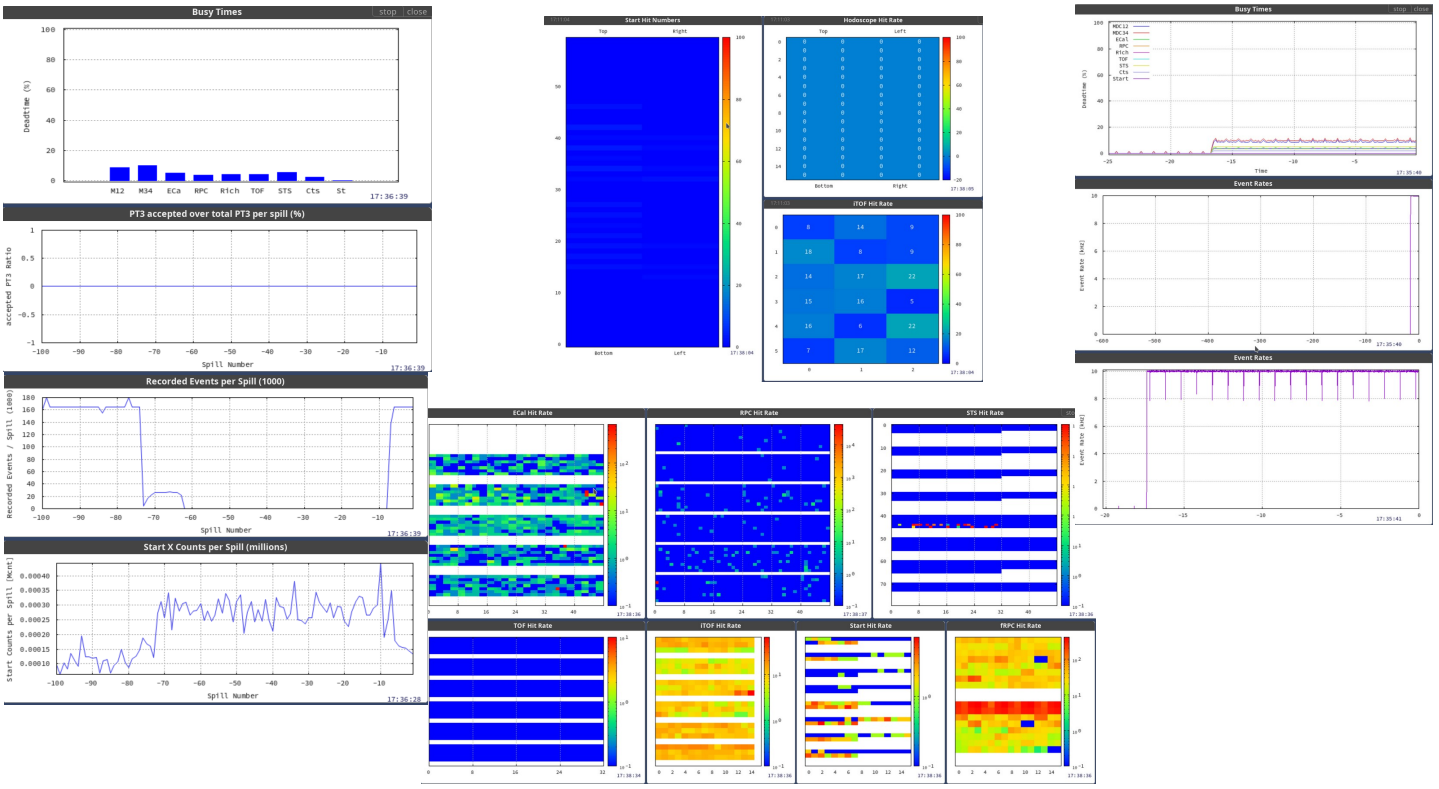


Figure 3: Main Hmon Windows (without EB monitor and Tactical Overview)

Busy times

Several plots show the busy time of the system, either as bar graph with the current value, or as histogram with the history of the last minutes.

Busy time (dead time) is the time where a detector system is processing/transporting the recorded data and cannot accept another data acquisition trigger.

The relative dead time of sub systems should stay roughly constant, and the total amount should be within useful limits.

Hit Rate Plots

A set of rate plots in heatmap style show the rates of each channel in each subdetector (RICH has a separate display not in the main operator windows). Each box corresponds to one channel, order is by nework addresses and channel numbers, not by physical location, although there can be a correlation.

The color axis should be limited, i.e. too high rates are usually cut. Rates are always given in Hz per channel.

For Start, Hodo and iTOF there is a second window with positional maps that can be used to determine the position of the beam on these detectors.

Eventrates

The rate of recorded events is shown in two plots over different time windows. These can be used to judge the rate of data taking, but should not be used to make conclusions about the beam shape.

Counts per Spill

Two plots show the number of events per spill and number of hits in Start per spill. These are updated once per spill and can be used to judge the beam intensity and uniformity of spills.

Trigger accepted over total

There is a plot showing the ratio of actual events and the number of events that where triggered. This gives a reasonable approximation for the effective dead time of the detector and the efficiency of data taking.

EB (Event Builder) Summary Window

Description: Overview over Event Builder Servers. The event building servers (computers in the rear counting house) serve two purposes:

1. Receiving data streams from the read-out boards and (input node)

2. Combining the received data belonging to the same event and writing it to disc (building node)

The input nodes and the building nodes are software processes running on the same computer(s).

What to check: The total data rate and the total event rate should be approximately the same in the input node and building node table (there is a delay of several seconds). If this is not the case, the total data/event rate field in the building notes table will turn red. Every of the *n* input nodes gets approximately 1/n of the total data rate produced by HADES. If the load is not balanced, the respective field in the table turns red. The *dropped events* rate should be close to zero.

Calib info: The top right box in this window shows the timestamp of the last TDC calibration and if it was successful or not.

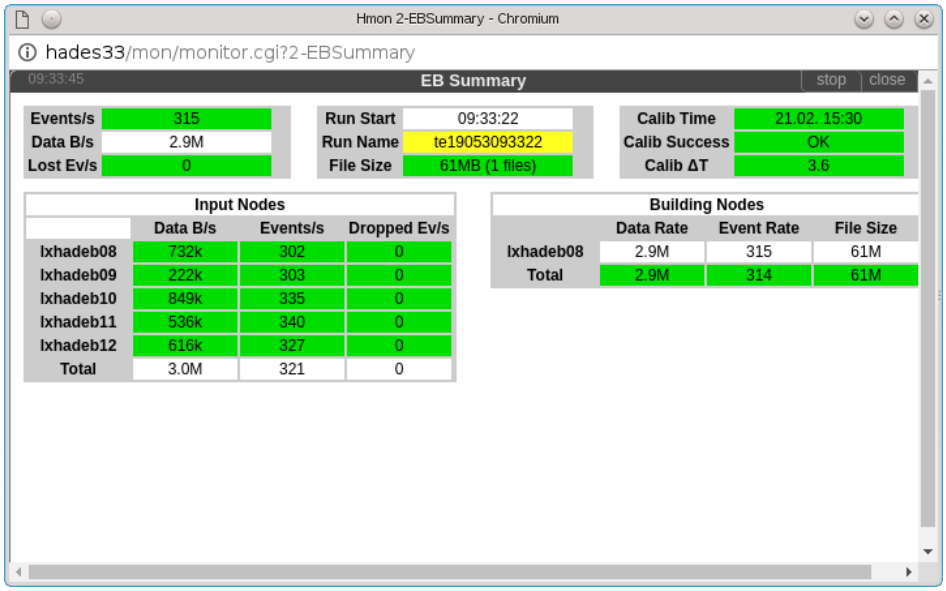


Figure 4: Eventbuilder Summary window in hmon

Next to the EB status is a list of the latest written data files. The BNET master node offers a monitoring and control GUI on a webserver at the address `http://hades33/eb/`. This interface is usually not needed for the DAQ operator, but gives additional ways to debug error situations. The necessary information about event builder status can be found in the main monitoring page under "EBSummary".

8. Daqtools

!Experts only!

Detailed data and tables are available from using Daqtools (`http://hades33/daqtools`). These pages make direct accesses to the DAQ, so that a few access rules are necessary:

- Close windows you don't use
- Set the update rate to a reasonable value (Settings don't change every second!)
- Always have "Use Cache" activated
- Be careful. All changes to registers have a direct effect on the system

Part V.
Handling Procedures

9. Power Cycles

The main power supplies can be controlled. A full list for the experts can be found in section 14. Before doing a power cycle, please stop the trigger using “Start Stop Trigger” in the control window.

MDC Chamber

If a few MDC boards fail (with a "FEE error" or "MBO w/o data") and a DAQ restart doesn’t help (or is needed frequently), a power cycle of one MDC chamber can be performed: Read the address of the failing board (e.g. 2045) from the Tactical Overview. Use the Icon "MDC LV Powercycle" and select the corresponding button (here 204x). Afterwards, the correct FPGA design needs to be loaded to the OEP. Click the “RebootOEP” button. After 10 seconds all OEP are rebooted and DAQ can be started again. If rebooting of the OEP fails, first run a DAQ start-up until the script complains “OEP design too old”. Close the window and try “Reboot OEP” again.

Full MDC

If it’s unclear which part of MDC causes an error, or if there is a larger number of boards failing, you can do a complete MDC power cycle using "MDC Group" in EPICS instead of using the "MDC LV Powercycle".

RICH

All boards of the RICH subsystem (addresses 7xxx and 82xx) are powered by the supplies in the "RICH Group". Use the button "RICH Powercycle" to switch them off and on again. When all power supplies are active again (see the list in EPICS -> “RICH LV”), do a DAQ restart.

Sometimes the power cycle triggers the temperature interlock for RICH power supplies. The 3.3V supply might be blocked and doesn’t switch on - restart DAQ, then try to switch on this powersupply again.

CTS

After a power cycle the CTS needs to be programmed manually using “Reprogram CTS” and “BLR Reinit FPGA” to set up the analog multiplicity board again.

Other Subdetectors

Check section 14 to see which power supply to switch.

Full Powercycle

A full powercycle should only be done after contact with an expert. Follow the guide for the “Daily DAQ reboot”.

9.1. Jörg’s helpful tips

ECAL / RPC

- After an ECAL powercycle most often a ECAL Padiwa powercycle is needed. You can check this looking at the ECAL rate plot seeing weird structures (e.g. 8 green dots in a row) or completely missing parts.

TOF

- After the TOF powercycle check if the rates in all sectors are equal - if not a "Thresholds TOF" is needed.
- If settings thresholds doesn’t work in the first try, repeat it a couple more times.

"Everything failed" / ’Invaild’ messages during startup

If suddenly TRBnet fails (normally indicated by almost every button on the tactical display blinking red), you usually can solve the problem by using the Reboot buttons. Start with RICH, ECAL, RPC and then the rest. Try to restart after a couple of reboots before continuing. Rarely a full power cycle is needed.

General remark

- Sometimes some MDC boards are missing for a longer time such that the tactical overview informs you to take action. Very often a DAQ restart is sufficient to get these boards working again. If however after some minutes the exact same MDC boards go missing again, you should consider a LV power cycle of the respective sectors when you restart the DAQ next time.
- If boards frequently fail to reboot after a power cycle you might consider switching off the beam for the power cycling and subsequent startup procedure. You can do that via the PC in the server room.

10. Full Power Cycle / Daily DAQ reboot

This should be performed at least once a day, when there is a break of 15 minutes. Steps listed under the same item can be done in parallel.

1. Switch off beam on control panel
   Switch EB to No File

2. MDC power supply group off (EPICS)
   Common Group power supply power off (EPICS)
3. Common Group power supply power on (EPICS)
4. (wait 10 seconds)
5. RICH power supply group power on (EPICS)
   - Check that all supplies are on. Sometimes the 3.3V supply doesn't switch on due to an interlock.
6. Start DAQ (it won't run, that's fine)
7. Reprogram CTS
   BLR Reinit FPGA
   ECAL Padiwa Powercycle
   Start Powercycle
   Triggerbox Beam Powercycle
8. Start DAQ
9. MDC power supply group on (EPICS)
   MDC LV Turn On All Relais
10. Reboot OEP
11. Start DAQ
    - In case of corresponding message, redo Reboot OEP as necessary and try again.
12. Check Eventbuilders getting data
    Check all FEE to deliver proper signals. Load thresholds or do another Fee/Padiwa powercycle
    Check if there are no 'MBO without data' - otherwise do a powercycle for this chamber, Reboot OEP, Start DAQ
13. Switch on beam

11. Eventbuilder Control

During beamtime shift, data taking can be controlled by the main DAQ Operator GUI (Fig. 1). The GUI box **Eventbuilder Tools** offers all relevant commands as shortcut buttons.

Restart with different number of builder nodes

Depending on the data rate delivered from the DAQ, it may be necessary to adjust the number of builder nodes, i.e. parallel files written. For cosmics usually only 1 builder is enough, for full beam operation it may be 16 builders.

To restart the builder network with different number of parallel files, use the buttons **Set N EB** in the ”Eventbuilder” box of the DAQ control GUI (section 5).

Restart of BNET master control process

The master control process handles the run synchronization and overall monitoring of all nodes of the event buiding network (BNET). **It is necessary to restart the BNET master whenever the setup of the server processes have been edited, or the DABC installation has been updated!**

To restart it, press the button **Restart BNET Control** in the expert section of the DAQ control GUI.

TDC calibration

The calibration of the trb3 TDC finetime counters is currently handled in the eventbuilder input nodes with the DABC software. The eventbuilder software has to aquire calibration information for each trb3 channel with special ”calibration runs”. In these runs the CTS will operate a pulser trigger of a few 100 Hz with a dedicated *calibration trigger* of type D. The trb3 boards will then produce special calibration data that is used to find out the channel-specific corrections. This calibration information is stored by DABC and will be used in all subsequent runs to mark the raw data from trb3 systems with correction factors for each hit message. The calibration meta information extracted from the calibration run is kept as file for each input subsystem on the eventbuilder server. It is also archived automatically to the tsm and /lustre storage into the subfolder *cal*

Since the TDC fine time calibration may change due to temperature changes or other long term drifts, it is necessary to repeat the calibration sometimes. The Tactical Overview shows information about the last calibration. If this display turns red, usually a calibration run has to be performed. Don’t do a calibration without an expert present.

On top, regular *Calibration Test* runs should be done to monitor the status of the calibration.

Part VI.
Online QA

Part VII.

Expert Section

12. DAQ Network Devices

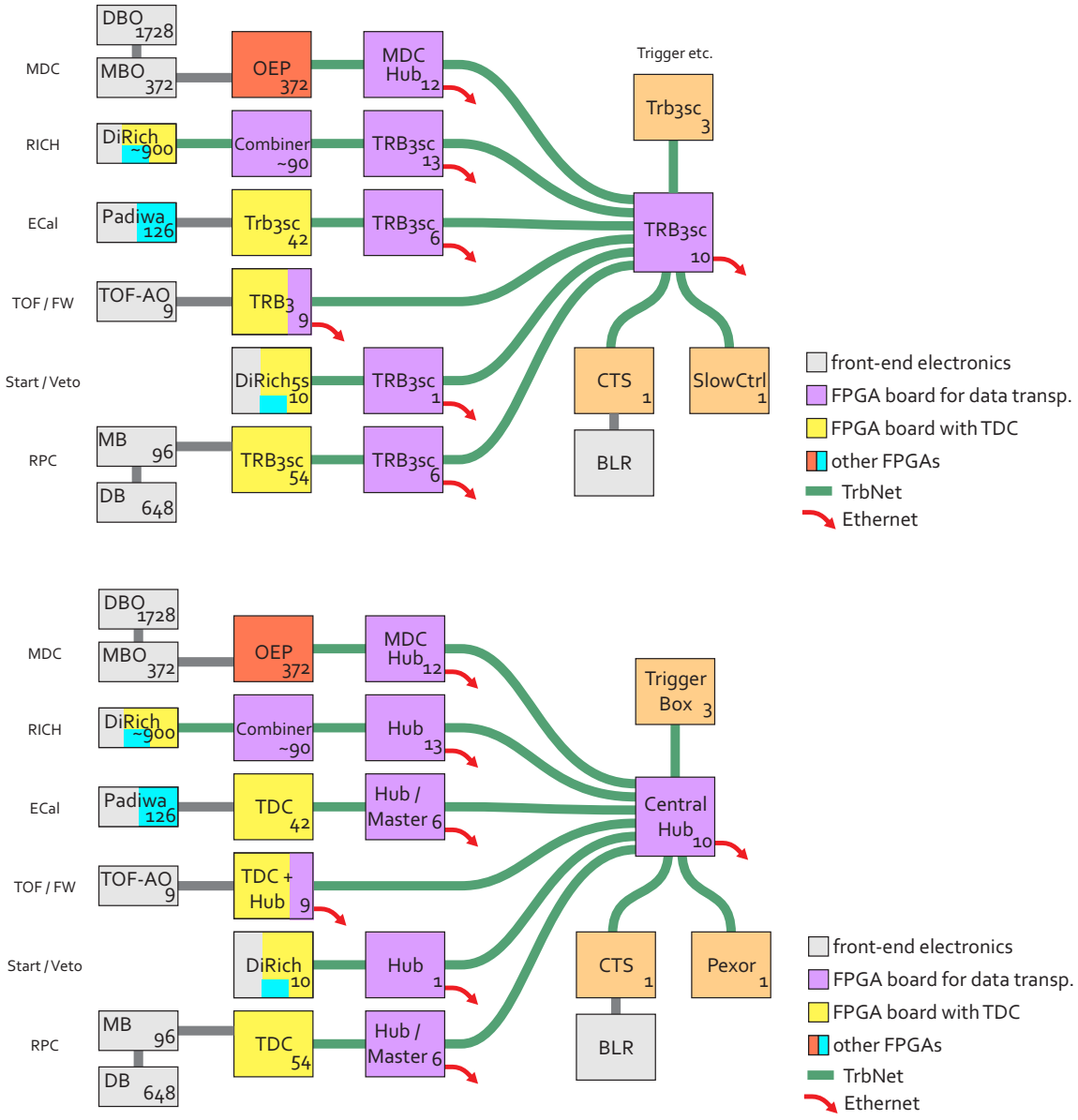


Figure 5: DAQ network with different labels. Labels by type of board and by function (names as often shown in Hmon). Numbers show the amount of boards in Hades

13. Addressing scheme

Address(es)	Board(s)	Description
0000 - 01FF	Trigger	CTS: 0002, 0003; Triggerbox 0010; 2nd Triggerbox 0100, Beam Abort 0130, RICH Control 0110, ECal pulser 0120
1000 - 17FF	MDC Concentrator	2nd digit: inner(0) / outer(1) MDC; 3rd digit: sector (0-5), 4th digit FPGA (0-4)
2000 - 2FFF	MDC OEP	2nd digit: MDC layer (0-3); 3rd digit: sector (0-5); 4th digit MBO (0-F)
5000 - 50FF	Start	Start/Veto. 3rd digit: 0: Start, 1: Veto, 4th digit: FPGA (0-7)
5800 - 58FF	RPC	3rd digit sector (0..5), 4th digit TDC (0..8)
5C00 - 5CFF	TOF	3rd digit sector (0..6), 4th digit TDC (0..3)
5D00 - 5D0F	iTOF	4th digit TDC (0..5)
6000 - 60FF	Ecal	Ecal read-out. 3rd digit: Sector, 4th digit: Readout Board (0-6)
6400 - 64FF	STT	3rd digit detector part (0-7), 4th digit FPGA (0-6)
6700 - 67FF	Wall	3rd digit board (0..2), 4th digit TDC (0..3)
6800 - 68FF	f-RPC	3rd digit board number (0-1), 4th digit FPGA (0-3)
7000 - 7FFF	RICH	DiRich modules. 2nd/3rd digit backplane number, 4th digit: DiRich (0-11)
8000 - 80FF	Central Hub	central hub
8100 - 81FF	MDC Hub	Hub for inner MDC (3rd digit 0) or outer MDC (1), 4th digit (0-5)
83C0 - 83DF	RICH Hubs	Hubs for old RICH, 4th digit: hub number (0..13)
84C0 - 84CF	RPC Hubs	Hubs for RPC, 4th digit: sector (0..5)
86C0 - 86CF	TOF Hub	Hubs (central FPGA TRB3), 4th digit: sector(0..6)
8700 - 870F	Wall Hub	4th digit: board(0..2)
8800 - 88FF	Central Hub	Central Hubs with GbE
8880 - 88BF	Start Hub	Hubs for timing detectors, 8880: Start, 8890 Veto
8900 - 89FF	Pion Tracker Hub	3rd digit: station
8A00 - 8AFF	Ecal Hubs	4th digit: pseudo-sector
8B00 - 8BFF	STT Hubs	3rd digit board number (0-9)
8C00 - 8CFF	f-RPC Hubs	3rd digit board number (0-1)
8D00 - 8D00	iTOF Hub	
F000 - FDFF	Test Setups	
FE00 - FFFF	Broadcasts	Broadcast addresses

Table 1: Network Addresses

Address	Description
ff7f	all boards with GbE
fffe	all boards with Hubs
fe40	Hubs: Trb3 central FPGA
fe61	Hubs: Trb3sc crate master
fe65	Hubs: in central crate
fe66	Hubs: RICH
fe11	MDC: Hubs, peripheral FPGA
fe15	MDC: Hubs, central FPGA
fffd	MDC: OEP
fe51	RICH: DiRich
fe52	RICH: Combiner
fe4c	TDC: Veto, STS
fe47	TDC: TOF, fRPC, FW
fe71	TDC: ECal
fe73	TDC: RPC
fe74	TDC: iTOF
fe76	TDC: Start

Table 2: Broadcast Addresses

14. Power Supply control

There are several interfaces for control, depending on the supply.

EPICS Power from the control GUI

MDC/TOF/Trigger MDC Hubs, TOF Trb & Fee,

ECAL/RPC ECal Trb, RPC Trb, ECal pulser, Trigger distribution in ECAL

Central RICH Hubs, Central Hubs

ForwardWall Forward Wall Trb & FEE

RPC LV Group of 2 supplies: RPC Fee (no DAQ), RPC DCS

RICH LV Group of 9 supplies: RICH Fee

MDC LV Group of 6 supplies: MDC Fee

Webbrowser `http://hades33:2222`

RichFans Coolings fans on RICH

ECal 1/2/3 ECal Padiwa (two channels per sector)

CentralControls Channel 2: Trigger fanout at CTS, Triggerbox, Beammonitor
Channel 3+4: CTS Trb, BLR, some DCS modules

Start

Veto Hodo Trb, Hodo Fee

Power Switches Web interface and/or a button in the control GUI

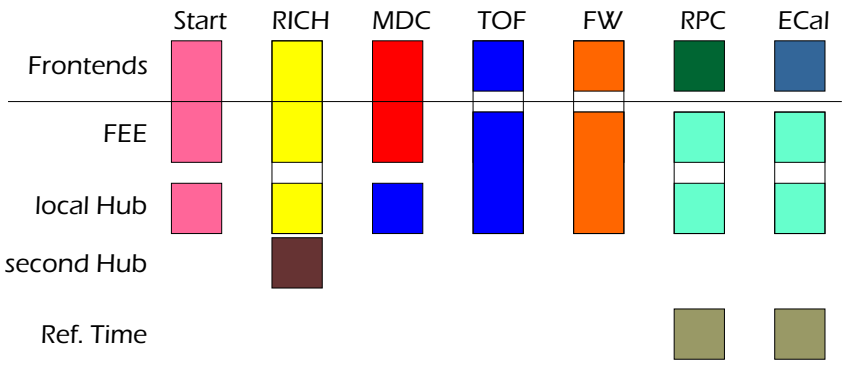
ECal Laser `http://haepcp15`

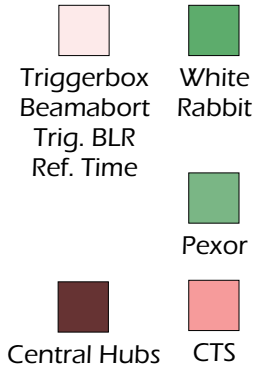
White Rabbit PC `http://haepcp10`

Pexor PC `http://haepcp02`

Trigger Scope Network `http://haepcp11`

Some reference values can be found at in the document repository under `DAQ/PowerSupply.xlsx`





	Power Supply Name	GUI Button	Procedure
	Start	Start	DAQ restart
	Central	Hubs	DAQ restart
	RICH Group	RICH	DAQ restart
	MDC/TOF/Tri	TOF MdcHub	2x DAQ restart
	MDC Group	MDC LV	see MDC powercycle
	RPC Group		RPC thresholds
	ECAL/RPC	ECAL RPC	see Ecal powercycle
	EcalRack		
	FWALL	WALL	DAQ restart
	ECal 1-3	ECal Padiwa	ECal thresholds
	CentralControls -> RefFan		DAQ restart
	CentralControls -> CTS		DAQ restart
	haepcpXXX		DAQ restart
	haepcpXXX		none

access via EPICS
access via Web GUI
switch via own GUI
no remote access

Figure 6: Regions of power supplies

15. TDC Calibration procedure

The calibration needs to be done by an expert, because the output of the Eventbuilders needs to be checked carefully. An error done during calibration will have an immediate effect on all recorded data rendering it useless if no extensive post-processing is done.

The calibration procedure might take a while and therefore should only be done during planned breaks, e.g. periods without beam.

1. Be sure that the beam is off and no other data source may interfere with the calibration pulser!
2. If possible, ramp down HV in the detectors to minimize the contribution of noise and cosmics in the recorded data.
3. **Remove old calibration** files, as they will corrupt the new calibration is some larger changes happened. There is /bin/deletecalfiles.sh to help. Use **Restart EB** to disable the old calibration.
4. Do a **reboot of the TDC** boards, especially of ECAL
5. **DAQ restart**.
6. Make sure all boards (MDC can be ignored) are up, running and delivering data.
7. Disable the ECal threshold setting script (kill ecal_set_thresholds.pl on hades33)
8. Click the Button **Start TDC Cal** in the DAQ operator GUI. This will disable all inputs of the CTS and put it into the special calibration mode (trigger type D, 500 Hz pulser). The eventbuilders will start writing files with prefix ”TC”.
9. **Change pulser** to 1500 Hz in the CTS GUI to speed up data taking.
10. Check the Tactical Overview for an increasing calibration status (orange field in the last row). For details, check the eventbuilder BNET GUI (Fig. **??**). The ”Input nodes” box shows for each eventbuilder server the subsystems (”HUBs”) which send data to them from the cave. These are labeled with their trbnet hub address, e.g. ”0x83c1”. During calibration, the trb3 systems will turn to a blue color. The ”Run control” caption of the webpage will show the state ”Calibrating”.
11. When the calibration status reached 100%, calibration can be stopped by pressing the **Stop TDC Cal** button in the DAQ control GUI. Don’t issue any other EB-related command and wait.
    In the BNET GUI all of the input hubs have turned to green color, the calibration statistics is sufficient. In this state the ”Run control” state will show ”Ready”. It can take several minutes until this is reached, depending on the configured calibration precision in the setup.
12. The eventbuilders will close the calibration run files and will archive the most recent calibration information. The trigger settings of the CTS will be restored to the values just before the calibration procedure.

13. Wait about two minutes to make sure the calibration procedure has been completely finished. Then do a quick TDC Calibration Test as detailed in the next section.

14. Be sure that the beam or the desired trigger source is switched on before starting beam or cosmics files again!


WARNING

While there is some output from eventbuilders about the quality of the calibration procedure, the only reliable way to generate a detailed report on the quality is the test procedure described below.

15.1. TDC Cablibration Test

The easiest way to check that TDC deliver proper data is a calibration test run. It can be done at any time, and requires to stop data taking for about one minute. Noise and signals from the detectors will have an influence on the results - this either needs to be taken into account or high voltage needs to be switched off.

1. Make sure all boards (MDC can be ignored) are up, running and delivering data
2. Make sure beam is off and no other data source (noise, pulser) can interfere with the calibration pulser
3. Disable the ECal threshold setting script (kill ecal_set_thresholds.pl on hades33)
4. Use The **TDC Caltest** buttons to make a short test run. 20-30 seconds (10k-15k events) are usually sufficient.
5. After stopping the run, CTS settings should be restored to normal values automatically.
6. Go back to normal data taking - do a DAQ restart, check HV, beam etc.
7. Root analysis of the data starts automatically. Plots are published on `http://hades33/calib`. The whole analysis runs for a couple of minutes (about 50s per GB of data)
8. After this has finished, data is further analyzed by hmon_tdcchanerrors_monitor.pl. It starts automatically and outputs its plots in Hmon - Calibration Test Plots.


WARNING

Do not try to judge the calibration quality from the main plots seen on `http://hades33/calib`. You might use this interface to look at some detailed data. Only the overview plots on "Calibration Test Plots" contain the information (and presentation) needed to see possible issues.

Manual File Selection

You can also run a manual analysis with any hld files as input:
Connect to hades63, screen 'tdccalib'. Create a list of all files to analyse, e.g. 'ls /store/*/*/*/tc22018114* | tee list22018.hll. link this file to list.hll and run dabc_exe tdcmon.xml, and wait 50 seconds per GB of data. Plots are published on `http://hades33/calibtest`. Afterward, run hmon_tdcchanerrors_testmonitor.pl (with edited data source in the script) in the hmon directory, then check the resulting plots in Hmon - Calibration Test Plots.

16. Eventbuilder Controls

The BNET master server of offers a monitoring and control GUI on a webserver at the address http://lxhadeb07:8099/?browser=fix. It is also available as part of the hmon webserver at http://hades33/eb/. When this address is opened in any web browser (e.g. firefox, chrome), the default GUI displays the state of the BNET as shown in figure 7. This screenshot explains the main graphical elements and the functionality of the most important buttons. Besides the control buttons, Clicking on any active object gui elements (i.e. the text is underlined as a hyperlink), an appropriate plot or text information will show up in the main display area. Just holding the mouse over a display element will after few scondes usually open a hover window showing additional information, or a tooltip help. Note that the checkbox for "Monitoring display" has to be enabled to update the display frequently every 2 seconds.

For each BNET input node row, the UDP receiver ports are listed with the trbnet address of the sending hub (if any data has yet been received!). The color of each hub shows the actual state of data receiving:

Green : Data is received properly (TDC calibration runs: Calibration is sufficient)

Yellow/Red : No data is currently received (TDC calibration runs: Calibration is not ready, or calibration file not yet existing)

Blue : TDC calibration runs only: Calibration is ongoing, but statistics not yet sufficient)

Figure 8 describes the GUI elements related to data taking and file writing. The respective buttons on top allow to select the next run type and to start and stop datataking at any time. Note that the BNET processes are not restarted when changing the run type as with the old eventbuilders, but continue even when writing to files is stopped. In this case, just the filename display will become empty and the builder node color turns yellow. Clicking on any of the rate and file size numbers allows to watch the trending graph of the assigned value in the display area.

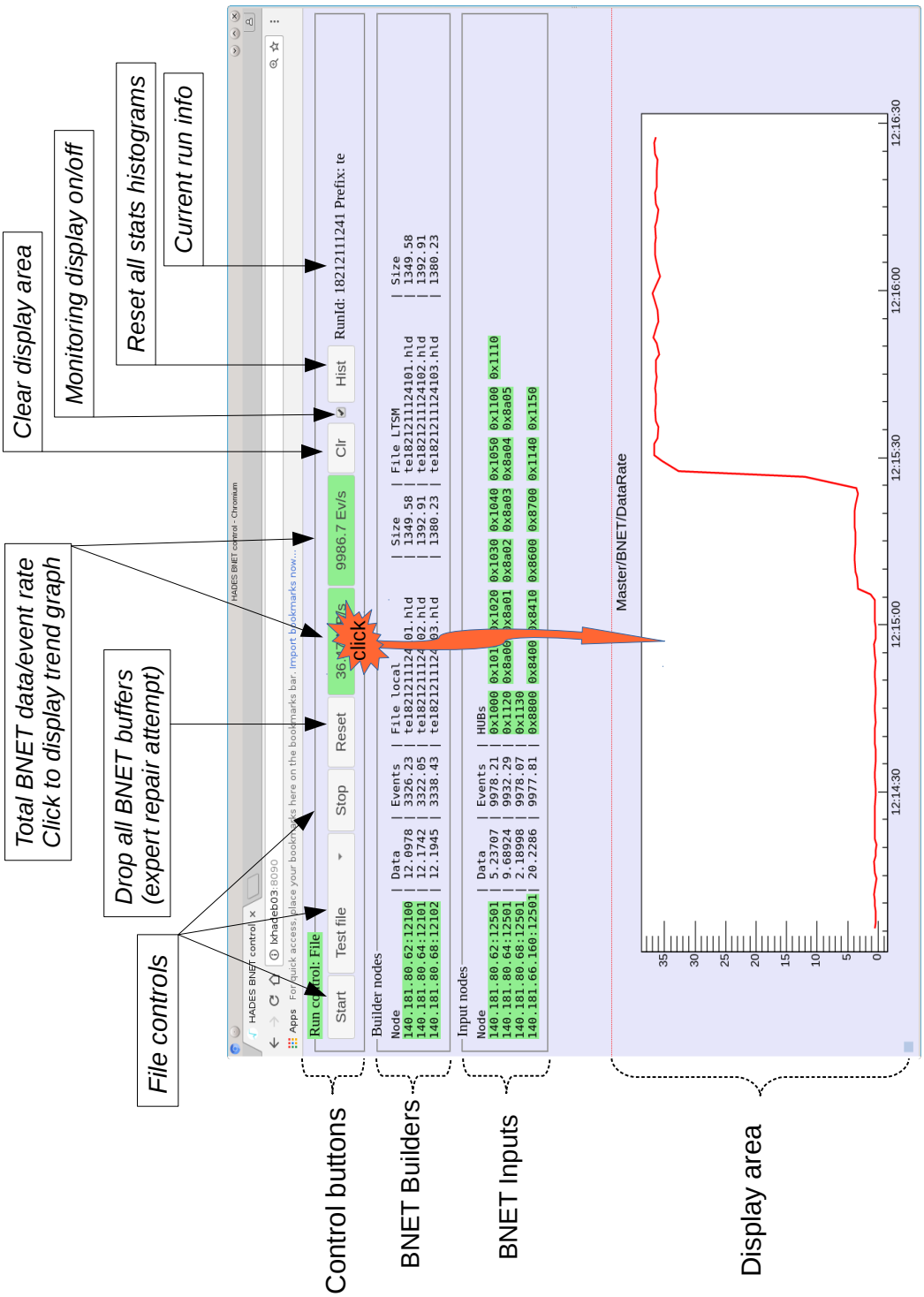


Figure 7: BNET web GUI: overview

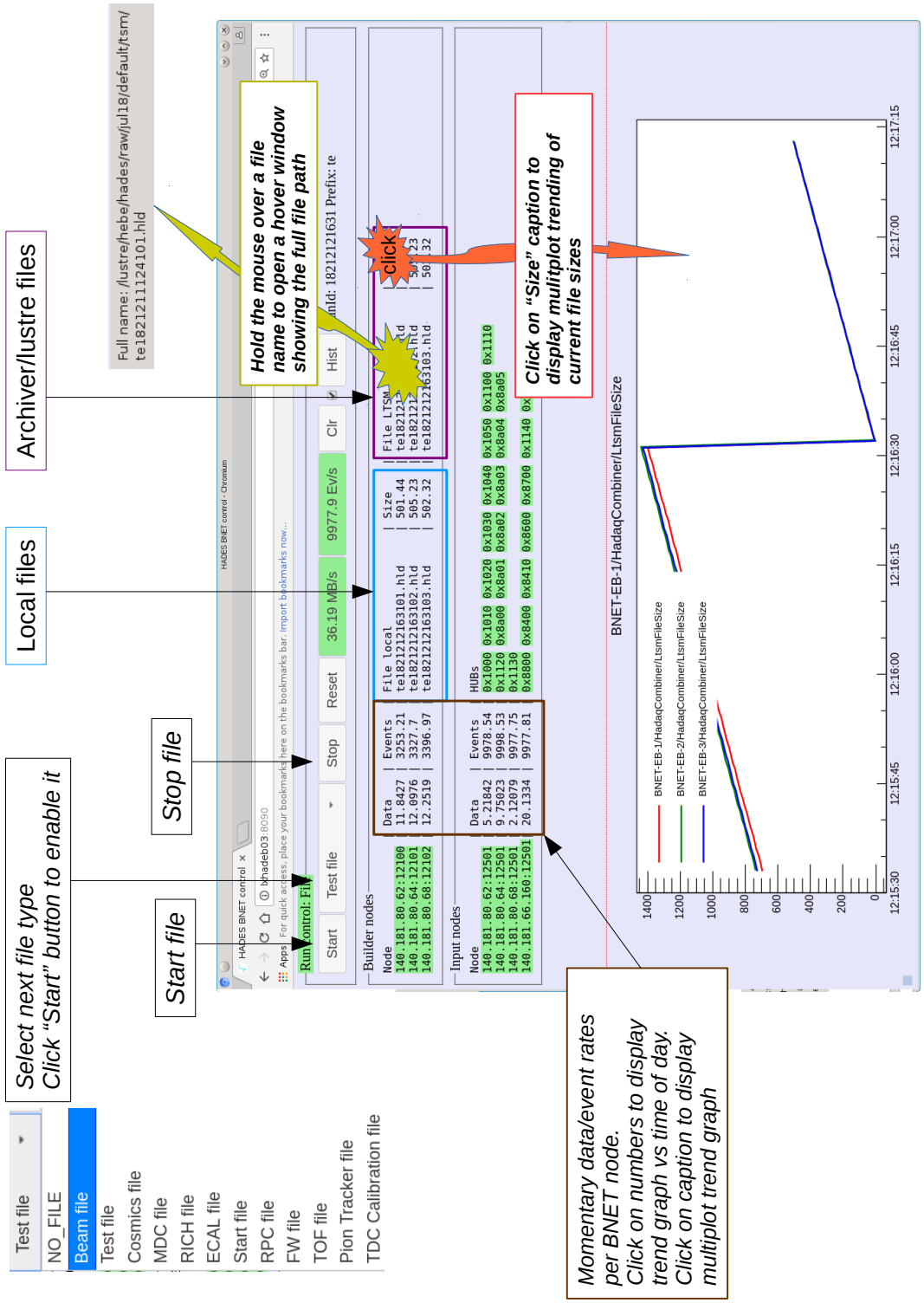


Figure 8: BNET web GUI: file and run control

17. Trigger Collection

The documentation of the trigger box can be found in the main document repository as linked on the monitoring web page.

18. List of Hmon Windows

AtmosPress Atmospheric Pressure from MDC sensors

CTSRates Rates on the inputs and outputs of the CTS

CtsMuxRatio Ratio between the two CTS histogramming channels

DutyFactor Q-Factor of the beam micro-spill structure

EBCPU Processor Usage of all main servers

EBDisks Disk Usage of all main servers

EBSummary Central plot of eventbuilder status

ECalRate Rates on all ECal channels. Shown are the six sectors and for each the rates on fast and slow channels and their ratio

EcalHVCMap Ecal HV Currents (position)

EcalHVCurr ECal HV Currents (list)

EcalHVVMap ECal HV Voltages (position)

EcalHVVolt ECal HV Voltages (list)

EcalSimpleRate ECal rate of all channels

Environment Temperature, Pressure and Humidity over time

EvtsPerSpill Number of recorded events per spill

GbeRate Amount of data on each Ethernet link

HodoPosition Position of the beam on the hodoscope

HodoRate Rate on all channels of the Hodoscope

HodoRatePlot Rate on all channels of the Hodoscope

HodoRate*_0 Rate on all channels of the Hodoscope

HodoSpillShapeAnalysis*_0 Spill structure from Hodoscope

MDCBusy Time of busyness of each MDC front-end motherboard (MBO).

MDCFailure Front-end Errors recieved by DAQ.

MDCHV Current HV & ionisation current measurement of field & cathode wire layers inside each of 24 drift-chambers.

MDCLV Current status of LowVoltage front-end power of each of 24 drift-chambers.

MDCPressure Current measurement of overpressure inside each of 24 drift-chambers, also with trend plot.

MDCRates Data rate by each MDC front-end motherboard (MBO).

MDCReflow Current status (sensor measurements) of the reflow gas system, supplying the plane 3 & 4 drift-chambers.

MDCRetransmission Number of retransmitted data words by each MDC front-end motherboard (MBO).

MDCRetransmissionRate Rate of retransmitted data words by each MDC front-end motherboard (MBO).

MDCTemperature Temperature measured on OEP (optical-end point board) for each MDC front-end motherboard (MBO).

MDCTokenMiss Lost tokens for each MDC front-end motherboard (MBO).

MDCTriggerError Errors in trigger signals recieved by each MDC front-end motherboard (MBO).

MdcPressure outdated ?

MdcPressurePlaneX Trend plot of overpressure inside each of 6 Plane X drift-chambers.

MdcScales Trend plot of the air temperature inside the cave

MicroSpillStructure The beam intensity in 20us bins, from Start detector

Muxhist Rates from two monitoring channels in the CTS

Pt3AcceptRatio Ratio of provided triggers to accepted triggers for main PT3 trigger

QA Main tactictal overview

RichGas Plots showing the gas sensors of the RICH

RichHV RICH HV settings

RichInnerTemp Display of the temperature sensors attached to the spokes inside the RICH detector

RichMagnet Display of the magnetic field sensors attached to the spokes inside the RICH detector

RichRate RICH rate per channel (ordered by DiRICH-Nr.)

RichRatev2 Two dimensional display of the RICH rate

RichTempHistoDiRICH Temperature history of sensors in the RICH

RichThresh Two dimensional display of the DiRICH threshold settings

RpcRate Rate on all TDC channels of RPC

RpcTofRate Rates of RPC and TOF combined

RpcTofSectorRate Rates of RPC and TOF combined

SpillInfoHodoX_0 Spill structure measured in Hodo

StartCountSpill Start counts per spill

StartPosition Mean position of the beam on the Start detector

StartPositionRMS Width of the beam in all four parts of the Start detector

StartRateNumbers Rates from all TDC channels of the Start detector, with numbers in the plot

StartRateSimple Rates from all TDC channels of the Start detector

StartRate*histbar Rates from the Start detector, separate for X and Y direction

StartSpillShapeAnalysis*_0 Analysis of the spill shape and regularity based on X or Y part of Start detector

TDCErrors TDC Error numbers

TdcCal TDC Calibration quality analysis, from EB

TdcCalMon TDC Calibration quality analysis, from extra script

TofRate TOF rate on all channels

Triggerbox Triggerbox, basic information

Vacuum Vacuum in the beam pipe

busy Busy Times of Subsystems, bargraph

busyhist Busy Times of Subsystems, over time

chat Messages from the VNC chat window

datarate DAQ data rate, 10 minutes

eventrate DAQ event rate, 1 minute long

eventratelong DAQ event rate, 10 minutes long

eventrateshort DAQ event rate, 20 seconds long

hldlast List of latest hld files written to disk

hubmon Monitor for link activity on DAQ hubs

logfile Logfile with DAQ error messages

mdchvCx Trend plot of ionisation current measurement of field & cathode wire layers inside each of 6 Plane x drift-chambers.

mdchvVx Trend plot of high voltage measurement of field & cathode wire layers inside each of 6 Plane x drift-chambers.

richvolt RICH LV voltages and currents, bargraphs