

Instructions for testbeam 2016 (for daq version 4.7)

Updated: 20161026

This document should be used together with the “*Pictures of setup 20161026*”.
<http://www.hep.lu.se/eudet/daq/doc/beam201610.pdf>

Start up and shutdown the DAQ programs

NOTE: startup and shutdown of the DAQ programs is normally only needed at the very beginning and end of a testbeam period, or in case of a crash.

Computers

There are two computers:

flctpc-lundmon – for monitoring and control
flctpc-lunddaq – for data acquisition

They should be switched on at start of testbeam periods, and shutdown at end of testbeam period.

How to login on flctpc-lundmon

user: ilcdaq
passwd:*****

If there is no terminal window open, open one.

How to login on flctpc-lunddaq

To login on the console or remotely use same user and password as on flctpc-lundmon. Logging in from flctpc-lundmon do not require a password. Login on the flctpc-lunddaq is normally not needed, except for copying files.

How to start up the data acquisition

Login in on flctpc-lundmon, unless already logged in. If there is no terminal window open, open one.

Then do on flctpc-lundmon:
>localdaq

localdaq (which is a script that can be found in \$HOME/bin) login on flctpc-lunddaq and starts up the readout task in a xterm window (named ILCSERVER). In this xterm window are currently many cryptic debug outputs written. It opens as well an xterm window from flctpc-lunddaq, this window can be used to edit configuration files if needed. After a few seconds is the graphical run control program user interface (GUI) started.

If the window with the readout task does not appear, and/or most of buttons in the GUI are cyan, and the 'STATUS' button is red at startup, then the readout program on flctpc-lunddaq has not managed to start. In that case take the following steps.

- 1) exit the GUI
- 2) on flctpc-lunddaq check in /misc/ilcdaq/log-v4.7 for the file ilcserver.pid and remove it if it exists
- 3) if it does not exist, wait for a few minutes. If the readout has recently been shutdown then it may be that the network connection is not yet closed.
- 4) close the xterm window opened from flctpc-lunddaq
- 5) do localdaq again

if the RCUs to be used are not switched on before starting the DAQ program, then one must perform a scan for DRORCs and RCUs from the run control program, after that the RCU has booted. The same power supply is also the main power supply for the FECs. *It takes some minutes for the RCU to boot.* The scan is done from the menu 'DRORCs' → 'Find DRORCs' and then 'RCUs' → 'Find RCUs', the latter is described under 6) in the section *How to power on the electronics*.

Exited the GUI by mistake? – type the command 'startgui' to start it again.

How to start the online monitoring system on flctpc-lundmon:

>startmon

startmon (which is a script that can be found in \$HOME/bin) that starts up the monitor task in a separate window (named MONITOR) and a presenter (named MONVIEW) as the user interface. Press 'online' in the presenter to connect the presenter to the monitor task. Sometimes this fails (Do not know why), then retry by doing:

>stopmon

>startmon

Event Display in the monitor task

For the event display is a mapfile needed that maps RCU#, Channel# to x,y coordinates, it must be called mapchvsxy.txt (as a link to the mapping file) and be in the same directory as the monitor program, which is /home/ilcdaq/ilcdaq/monitor-v5.3. Format is, one line per channel:

RCU#	CHANNEL#	X	Y
------	----------	---	---

In the file histos.dyn, in the same directory, is the definition of the 2-dimensional event display histogram. One need to change the x and y to the correct values.

These files are only read at program start. If they are changed then restart the monitor and presenter.

Temperature monitoring

You need to update the list of FECs whose temperatures are monitored. Therefore, go to ilcdaq/tempserver on the lundmon computer and update "sensors.cfg" which is a link to the current configuration file. Create your own configuration file and modify "TEMP.STATUS 0|1" according to your setup (the FEC Numbers are written on the FECs and should be written down during the installation). 0 means do not use, 1 use. Then, renew the link

```
rm sensors.cfg  
ln -s sensors-fecs-NewDate.cfg sensors.cfg
```

How to shutdown data acquisition

How to close down the monitoring system:

```
>stopmon
```

stopmon (which is a script that can be found in \$HOME/bin) kills the presenter and the monitoring task.

One can also press 'exit' in the presenter and do 'ctrl-c' in the monitoring task window.

When the monitoring task is stopped it crashes with some crash output written into the window.

How to close down the data acquisition:

After having stopped DAQ (how see below), 'EXIT' the GUI and do 'ctrl-c' in the daq xterm window (named ILCSERVER). Type 'exit' in the xterm window opened from flctpc-lunddaq for editing configuration files

End of testbeam period? - do shutdown of the computers (monitor and daq) as well.

Powering on/off the electronics

How to power on the electronics

See also the Picture guide

- 1) switch on the compressor (outside the control room)
- 2) open the valve in the test area
- 3) make sure the air flow at the electronics ring
- 4) switch on the readout electronics power supply in the test beam area.
- 5) wait for the red LED on the optical link on the RCU to become green and wait some minutes for the RCU to boot before doing next step. Sometimes it happens that the green light never appear. Try once more to power off and then on again. This normally helps.
- 6) in the run control on the monitor computer do in the menu 'RCUs' → 'Find RCUs'. When doing this and the RCUs that has booted should show the FEC power status in red for all FECs for the RCUs used, else they will be in yellow. Continue to Find RCUs until the FEC power status is red for all RCUs used.
- 7) power on the FECs – click 'PowOn', this will also load lookup tables if 'Load lookup tables at power on' is checked (which it normally should be), i.e. it will take some time. **If 'STATUS' goes red an error occurred:** retry by checking 'Load lookup tables at Start DAQ' and click 'StartDAQ'. Afterwards do 'StopDAQ and uncheck 'Load lookup tables at Start DAQ'. In the FEC power status must used FEC be in green, unused in red/white/lightred.
- 8) set and load PCA16 settings – click 'PcaLoad'.
- 9) It takes roughly 30 minutes until the temperature becomes stable and data taking can start (look at the temperature monitor box, or analyze the temperature as described further down in this document. If there is a problem with the temperature monitoring, please refer to the temperature monitoring section later in this document)

Power settings:

cyan/blue indicates the status of FECs for RCUs not readout, or RCU with unknown status, according the configuration file, where blue means that the FEC should have been on if the RCU was readout. Cyan means it should have been off.

For FECs in an RCU to be readout red indicates that the FEC is powered off and green that it is powered on. White mean that the FEC is off but should be on. For FECs 0,1,2 and 16,17,18 it can also mean that they are powered but not readout, since these power bits are in common with the power of FEC 13,14,15 and 29,30,31, respectively.

When the GUI is started all are cyan/blue. The status is updated when powering on or 'Start DAQ', or when doing 'Find RCUs' for scanning for ready RCUs.

PCA16 settings:

Polarity – checked is positive polarity and unchecked negative polarity of input signal. We have it checked.

Shutdown – checked mean that the PCA16 chip is switched off. Should be unchecked.

Preamplifier enable – checked is that the output is before the shaper.

Gain – 12, 15, 19, 27 mV/fC is the gain of the amplifier when Preamplifier enable is unchecked, and 5.25, 5.50, 5.80, 6.50 mV/fC is the gain of the amplifier when Preamplifier enable is checked.

Shaping – 30, 60, 90, 120 ns is the shaping time when Preamplifier enable is unchecked, 10, 30, 60, 80 ns when Preamplifier enable is checked.

Decay time – 0-2500 (0-1.5V) is the decay time in preamp enable mode, in shaper mode it does not influence very much.

When changing the PCA16 settings the DAQ must in status 'DAQ stopped'. Click 'PcaLoad' to load the new settings.

How to power off the electronics

See also the Picture guide

The DAQ must be in status 'DAQ stopped' in the run control.

- 1) Power off the FECs from the run control – click 'PowOff'. FEC power status should become blue/lightblue.
- 2) Switch off the power supplies in the testarea
- 3) Close the compressed air valve in the testarea
- 4) switch off the compressor outside the control room

Taking data

A screen shot of the run control Graphical User Interface (GUI) is further down.

How to make a Physics run

- 1) Stop DAQ in the run control
- 2) tick 'Physics' run
- 3) tick 'pedestal subtraction' and 'zero suppression' (if these are wanted).
- 4) select 'readout events' and set number of events to take, 0=until manually stop run.
- 5) click 'Start DAQ'.
- 6) if the online monitor is to be used set 'monitor' to a nonzero value, the value is a 'downscaling' factor; 0= no monitoring, 1 = as many as possible, N = every Nth event.
- 7) If data logging is wanted tick 'Logging', else untick it. ***If you do not want logging be sure it is unticked before starting a run.*** The logging flag is always remembered from the *last run started*, i.e. doing untick and 'StopDAQ' 'StartDaq' without a new run, then the logging flag will still be set if the last run had it set.
- 8) click 'Start run'.
- 9) click 'Stop run' when wanted, if event to read is nonzero, then the run will stop automatically after that number of events

Look regularly at the event display in the presenter (see section of the presenter), the see track quality, and if the noisy channels have increased.

Keep an eye on the temperature. This can be seen in the run control display or on the temperature monitor box. These show the FEC with the highest temperature. See also the section on the Temperature monitor further down in this document.

Data files when logging data

Data are stored in /misc/ilcdaq/data on flctpc-lunddaq with the filename readout-<runnb>_<filenb>.dat. Maximum file size is 2GB, after that is the file closed and a new file is started with one higher file number. The data files must be copied somewhere, else the disk will quickly be full. The disk on flctpc-lunddaq is 450GB.

How to make a pedestal run

Pedestals are calculated by the online monitor task. Pedestals are dependent on the PCA16 settings, i.e. there must be pedestal files for the settings used if one want to use pedestal subtraction/zero suppression. i.e. *for each PCA16 setting one must make a pedestal run.*

- 1) Stop DAQ in the run control
- 2) Close the beam shutter
- 3) Change the trigger cable in the NIM trigger crate to 'Pulser'.
- 4) Untick 'pedestal subtraction' and 'zero suppression'
- 5) tick the pedestal check box
- 6) If new PCA16 wanted, set them and load PCA16 the wanted settings.
- 7) Start DAQ
- 8) select 'monitor events' instead of 'readout events'
- 9) set number of events to use in the calculations, e.g. 300 should be enough.
- 10) Untick 'Logging'. We normally do not log pedestal runs.**
- 11) start run
- 12) the run will stop automatically after the number of events requested are monitored
- 13) remember to set back to 'readout events' and number of events to read to what it should be (0 = infinite or until stop run) for physics run.
- 14) Put back the 'Beam' trigger cable in the NIM trigger crate
- 15) Open the beam shutter
- 16) Stop DAQ to prepare for 'Physics' run.

Then you must analyze the pedestals as described in the next section.

Analyze the pedestals

the files are stored in \$HOME/root/pedestals (one file for each possible RCU) on flcptc-lundmon. The files are named pedestals-<rcuid>-<pac16 settings in hex>-<decay time in decimal>.new.

The pedestal files must be analyzed in the directory \$HOME/ilcdaq/analys/pedestals and then copied to flcptc-lunddaq:

- 1) run the command './anasum.sh new' in \$HOME/ilcdaq/analys/pedestals. The result is stored in the file new/combined.pdf
- 2) Open the file new/combined.pdf with acroread, and check the result. Pedestals are in red (left scale), the RMS of the pedestal are in blue (right scale).
- 3) With the command 'pedsync' (a script in \$HOME/bin) will all new pedestal files in the directory \$HOME/root/pedestals be copied to the DAQ computer (to the directory /misc/ilcdaq/config-v4.X on flcptc-lunddaq) with the same file name but with extension .ldat.

Pedestals should be roughly around 100, the rms not more than 1. Normally there are channels which have higher pedestals (dead channels/grounded pads) and larger rms (noisy channels). Not used FECs have a pedestal of 1023, and RMS of 0. Else is it dependant on the settings and setup, one learn by experience how it looks for this specific setup. Example can be found below.

When to take a new pedestal run

After a power on. **NOTE:** the pedestals are not stable until roughly 30 minutes afterwards. After a short power off may it be shorter, look at the temperature.

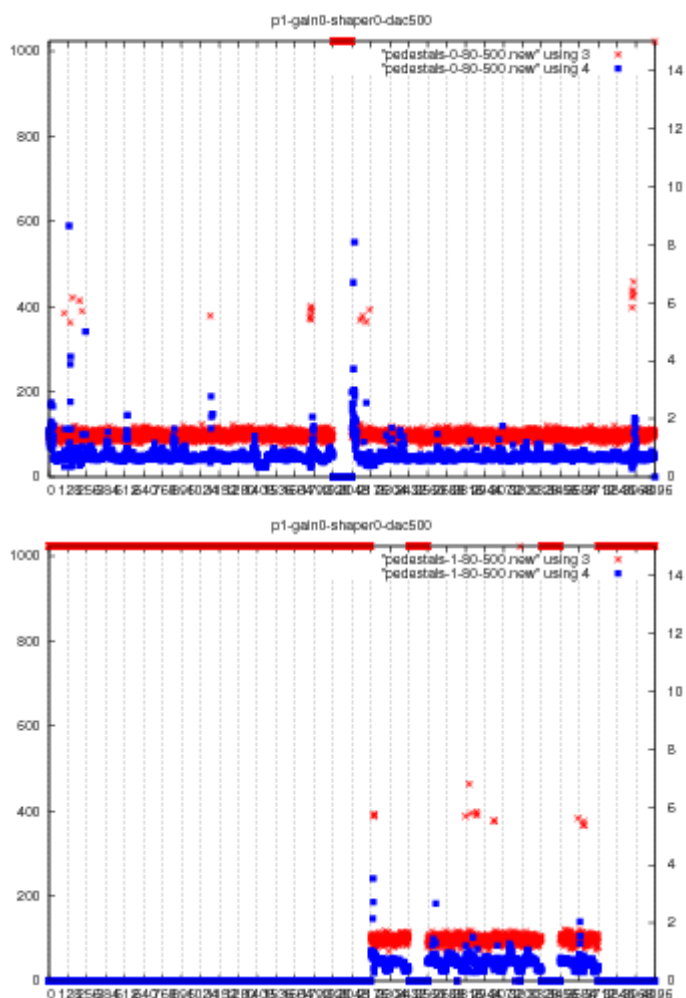
When changing PCA16 settings

When the temperature of the electronics has changed

When the event display look noisy

When the number of clusters per event has increased (the plot NBCLUSTERS) in the presenter (see section about the monitoring).

A good rule is to make it regularly anyway.



The graphical user interface

Status of FEC power

Load PCA16 settings

Power on FEC

Power off FEC

DRORCs RCU0 FEC ALTRO Tests

Power settings

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 RCU0

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 RCU1

RCU2 RCU3

☒ Load lookup tables at power on ☐ Load lookup tables at Start DAQ **Alarm**

PCA settings

☒ Polarity ☐ Shutdown ☐ Preamp enable 27 mV/fC Gain 120 ns Shaper 0 Decay time **Pcaload**

DAQ Active

Stop DAQ

Running

Pause

Stop run

Status

SCRIPT

Events: 125

Run:16752
[2010-03-04 14:26:19]

Exit

Run type: ☒ Physics ☐ Pedestals ☐ Test

Run mode: ☒ Pedestal subtraction ☒ Zero suppression ☐ Logging

Monitor 1 **Read events** 0

Log window:

```
[2010-03-04 14:26:14] SRV:*PCA SR 134 DAC 0 ERR 0
[2010-03-04 14:26:15] Stopping DAQ
[2010-03-04 14:26:15] SRV:*STATUS DAQ 0 RUN 0 LOG 0 MON 1 EVT 431 TYPE 3 MODE 1 RUNNB 16
[2010-03-04 14:26:18] Starting DAQ
[2010-03-04 14:26:18] *START CONTROL 1 MODE 1 TYPE 3 LOAD 2
[2010-03-04 14:26:18] SRV:*STATUS DAQ 1 RUN 0 LOG 0 MON 1 EVT 431 TYPE 3 MODE 1 RUNNB 16
[2010-03-04 14:26:18] Retrieving power status...
[2010-03-04 14:26:18] SRV:*POW S0 1 RCU0 C0000 P0 0 S1 1 RCU1 440000 P1 0 S2 1 RCU2 48 P2 0
[2010-03-04 14:26:18] Retrieving PCA settings...
[2010-03-04 14:26:18] SRV:*PCA SR 134 DAC 0 ERR 0
[2010-03-04 14:26:19] Starting run
[2010-03-04 14:26:19] SRV:*STATUS DAQ 1 RUN 1 LOG 0 MON 1 EVT 0 TYPE 3 MODE 1 RUNNB 1675
[2010-03-04 14:26:21] Retrieving status...
[2010-03-04 14:26:21] SRV:*STATUS DAQ 1 RUN 1 LOG 0 MON 1 EVT 19 TYPE 3 MODE 1 RUNNB 167
[2010-03-04 14:26:22] Retrieving status...
[2010-03-04 14:26:22] SRV:*STATUS DAQ 1 RUN 1 LOG 0 MON 1 EVT 27 TYPE 3 MODE 1 RUNNB 167
[2010-03-04 14:26:32] SRV:*UPD EVT 125
```

Temperature alarms:

[2010-03-04 14:25:45] ALARM level: 1 sensor: 1 value: 44

[2010-03-04 14:26:36] Sensor with highest value: 1 value= 44

Readout settings

How to change run configuration and parameters

- 1) stop run
- 2) stop DAQ
- 3) change configuration if needed. All settings can be changed by editing adequate configuration file. The configuration files are on flctpc-lunddaq in the directory /misc/ilcdaq/config-v4.X). The most common settings can be changed from the run control as described below. Let an expert change settings not done from the run control.
- 4) start DAQ. First power on FEC again if FEC configuration to read was changed, and in this case also reload the PAC16 settings.
- 5) Start run

configuration files are on the flctpc-lunddaq computer in the directory /misc/ilcdaq/config-v4.X. These files are described in another document (in the readout document under further documentation further down). They are ASCII files and editable with an editor. Normally is there only a few values that needs to be edited.

The most frequently changed settings can be done from the run control as:

Setting active FECs

The FECs to read and power are set from the run control in the menu FECs → RCU#. This will open a window where FECs to be read can be set. After changing this one must do 'PowOn' and 'PCA Load' and reload lookup tables.

Reloading of the lookup tables can either be done at power on, or at start daq. When running normally should it be done at power on, and not at start daq. It take some time to download the lookup tables into each ALTRO channel.

(The lookup tables are needed to invert data in the ALTRO.)

ALTRO settings

Zero suppression threshold, number of samples to read, time samples before a cluster, time samples above the threshold, time samples after a cluster to store, pre samples to take before the trigger.

These are set from the run control. Choose 'ALTRO' in the menu -> 'settings' -> Physics. There one can change these settings.

They are read and loaded next time one do 'Daq Start'. i.e. one must do Stop DAQ and Start DAQ for the new settings to be loaded into the electronics.

Data Monitoring

Using the presenter

After starting the monitoring tasks:

Click 'Online' - this connects to the online monitoring task

- 1) choose RCU and FEC to monitor – only one FEC at a time can be monitored
- 2) Change FEC when needed – then press 'FEC to monitor' – all histograms are cleared.
- 3) press 'Getevent' to fill one event histograms (e.g. time distributions, event display). The display is not automatically updated, click again on the wanted histogram.
- 4) Change the value of and click 'Altro to show' too view another ALTRO in the selected FEC.
- 5) 'Time distribution' and 'Pulse Height histograms' show all 16 channels for an ALTRO.
- 6) 'Clear' will clear all histograms. Histograms are not cleared at a new run!

A screenshot of the presenter is shown below.

Single event histograms are filled when 'Getevt' is selected.

General:

Event display – color coded pulse heights for all channels and one event

Time display – color code times for all channels and one event

NBCLUSTERS – show the number of clusters found in events.

HMAXCHTIME – time for maximum found pulse height

HMAXCHADC – maximum pulse height for each channel

for the FEC selected:

HPH – pulse heights for individual channels

HTIME – time distribution for a single event

Time histograms – show time distribution for all channels in selected FEC for a single event.

Pulseheight histograms – show the pulse height histograms for all channels in selected FEC.

For selected RCU:

HCHEXIST – plots of found channels (none should be missing for FECs readout)

Debug:

LENGTH_2AEE – data length for channels with h/w readout error

LENGTH_2AAA – data length for channels with no readout error

EVENTNB_DIFF – differences in event number between readout/DBOX and readout/TLU.

ERR_REG1 – bit pattern of RCU trailer error register 1 bits

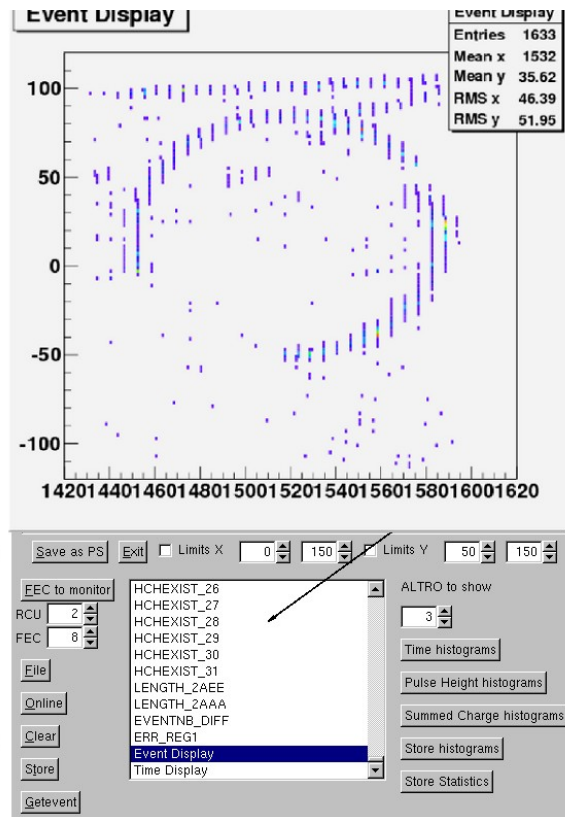
ERR_REG2 - bit pattern of RCU trailer error register 2 bits

NBCLUSTERS - number clusters per event, in the testbeam 200907 gave < 2000 clusters acceptable file sizes:

500 -> 600MB for 20000 events

2000 -> 3GB for 20000 events.

FECNBCLUSTERS - number of clusters per channel (all FEC superimposed).



Display individual histograms

Scale histograms in x/y

Select ALTRO chip to show

Show times for all channels

Show pulseheights for all channels

Save canvas as ps-file

Send FEC to monitor

Select RCU & FEC

Select online monitor

Clear Histograms

Fill single event histograms

The presenter

Temperature monitoring

If there is no connection with the tempserver, then "BOOT" will be displayed on the display of tempmon box. When configured by the tempserver, it will change its status and a temperature will be shown for the selected sensor after a short moment. The tempserver must be running on the lundmon computer and send the configuration to the tempmon box.

If the tempserver is not running, go to ilcdaq/tempserver and run the script `./tempserver.sh`. The configuration file for the tempserver is `tempserver.cfg`. This file defines which port and network interface to use for the tempmon box, the IP address and port of the alarm handler (the monitor computer itself) and the temperature limits for alarms. The alarm handler is the run control user interface, which must be running for alarms and automatic switch off.

You need to update the list of FECs whose temperatures are monitored. Therefore, go to `ilcdaq/tempserver` on the lundmon computer and update `"sensors.cfg"` which is a link to the current configuration file. Create your own configuration file and modify `"TEMP.STATUS 0|1"` according to your setup (the FEC Numbers are written on the FECs and should be written down during the installation). 0 means do not use, 1 use. Then, renew the link

```
rm sensors.cfg
ln -s sensors-fecs-NewDate.cfg sensors.cfg
```

(One can have the `tempserver.sh` to run regularly as a cronjob, by editing the crontab entry

```
crontab -e
#0,5,10,15,20,25,30,35,40,45,55 * * * *
(/home/ilcdaq/ilcdaq/tempserver/tempserver.sh > /tmp/tempserver.cron 2>&1 )
```

and remove the `#` at the beginning of the row. Then it checks every five minutes if the tempserver runs.)

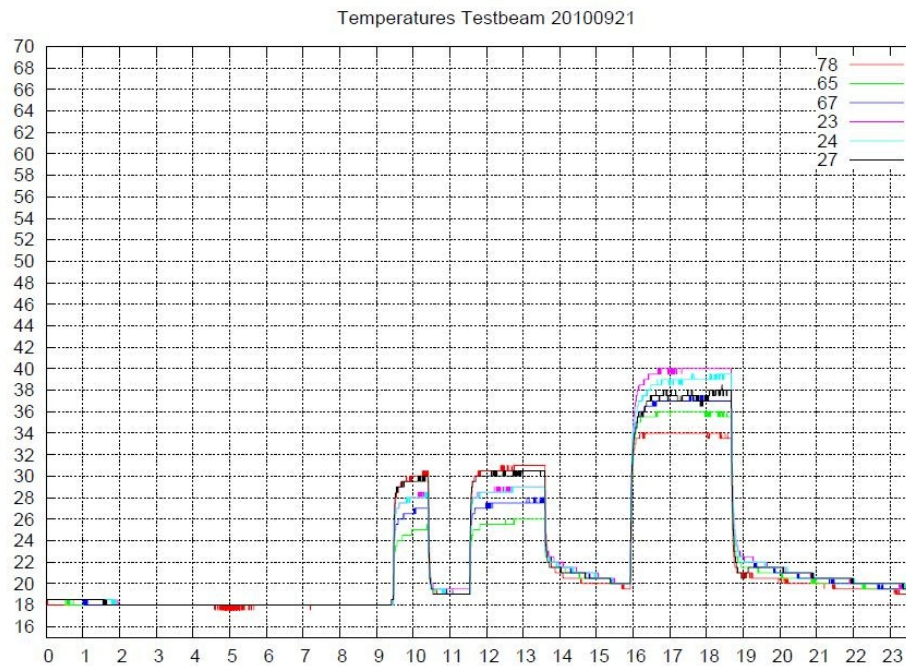
In the run control computer are the temperature values logged. These can be analyzed for a given day with the command `'tempplot YYYYMMDD'`. The result is plotted in a pdf file. The name of the file is output from the command.

The sensor with the highest temperature is displayed on the microprocessor box, as well as in the run control.

In case of too high temperature there is a software controlled automatic power off of the FECs (at 60 degrees). If there is a run going on will this first be stopped. In the case the software do not work is there NO automatic hardware switch off. **For safety, the temperature should always be manually monitored.**

If there has been an automatic shutdown the 'Alarm' indicator in the run control becomes red and all actions in the run control are blocked until one has clicked on the red 'Alarm' indicator. This is to prevent accidentally switching on the power again without any cooling.

Example of temperature plot from the 'tempplot' command. The legend is the FEC card number. The temperature should be below 45 degrees. If the temperature increases above that then one can try to increase the compress air pressure, else one must switch off the electronics.



Copying data, pedestal, and configuration files

Data files are written into the director /misc/ilcdaq/data on flctpc-lunddaq, as the file readout-<runnb>_<filenb>.dat. For every run with data logging are the used pedestal files copied to /misc/ilcdaq/pedstore, and the used configuration files copied to /misc/ilcdaq/configstore. These must be copied to external disks. The configuration and pedestal files will have the run number attached to the file name.

The files in /misc/ilcdaq/data must regularly be deleted, else the disk (500GB) will become full.

The trigger system

Trigger system is in a NIM crate. The parallel port on the DAQ computer is used to communicate with the trigger (reset,enable). The trigger is either a beam trigger or pulser. One must swap the cables when choosing the trigger source. Pictures and a drawing is shown in the document:

<http://www.hep.lu.se/eudet/daq/doc/beam201209.pdf>

as well as pictures of other parts of the system.

Further documentation

presenter:

<http://www.hep.lu.se/eudet/daq/doc/presenter-v2.2.pdf>

run control:

<http://www.hep.lu.se/eudet/daq/doc/gui-v2.8.pdf>

monitor:

<http://www.hep.lu.se/eudet/daq/doc/monitor-v5.2.pdf>

readout:

<http://www.hep.lu.se/eudet/daq/doc/readout-v4.4.pdf>

dataformat:

<http://www.hep.lu.se/eudet/daq/doc/dataformat-v4.6.pdf>

Pictorial of setup 201209:

<http://www.hep.lu.se/eudet/daq/doc/beam201209.pdf>

This document can be found as:

<http://www.hep.lu.se/eudet/daq/doc/instructions-201209.pdf>