



EUDET Pixel Telescope Data Taking Manual - Updated Version 2009

EUDET JRA1 Group

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Abstract

This manual is intended to help users to take data using the EUDET pixel telescope. You will find detailed explanation on how to power up the telescope, how to start the run control and pictures of important items.

1 Introduction

The aim of this document is to help users to take data with the EUDET pixel telescope. It is intended to provide all necessary information in a simple way and to provide help in case of known problems. Thus no technical details are explained here. For this please refer to our EUDET JRA1 webpage [1].

In **Section 2** it is explained how the hardware of the telescope is switched on. **Section 3** describes the DAQ software while the topic of **Section 4** is the TLU control utility.

Here the status of the telescope in August 2009 is described. Since the development of the hardware and the DAQ software is still in progress, changes to the presented information are possible. Please report comments to *ingrid.gregor@desy.de*. The data manual from September 2007 is mostly obsolete and should not be used anymore.

Important: We ask all the telescope user group to document the data taking in an electronics logbook. If this is not done, the possibilities that we give support during the data analysis is limited. So please write down any changes to the system, any problems etc. We usually use a simple Google spread sheet, but this is up to the user groups as long we have access to the information.

2 Switching on the hardware

In general the telescope is already turned on when you start data taking, but there might be the situation that the hardware is partially or completely turned off. In summer power outs or just glitches are rather frequent. Then you can refer to this section to make sure that you do it the right way.

2.1 VME-Crate

After a power cut check if the VME-Crate is turned on. It also houses the CPU communicating to the rest of the telescope. It should be turned on first. The power switch of the VME-Crate is located at the front side of the device.

2.2 Cooling

A **Huber** cooling device, as shown in Figure 1, is used for the pixel telescope. The cooling device uses water as cooling liquid. A typical operating temperature is 14° C. At room temperature it takes about 20 minutes until the telescope is cooled after the cooling system was switched on. Please do not reduce the temperature much lower to avoid condensation water and corrosion. These steps need to be followed to switch it on:

- Switch on the power of the cooling device.



Figure 1: The Huber cooling device

- Press the button **Set**.
- Adjust the temperature using the wheel to 14° C. Probably it is already set to this value.
- Press the button **Set** again.
- To start the pump press the rightmost of the three blue buttons.

Please also check the water level inside the cooling device ones a week. The device stops cooling if the level is too low and will start an alarm noise. But the sound is probably not audible in the control room.

2.3 Power supplies for Sensors

The power for the telescope sensors is provided by two AGILENT E3644A power supplies. Each power supply provides an electric potential of 8V. By connecting the "-" potential of the upper and the "+" potential of the lower supply, +8V and -8V are provided. Please do not touch the cabling.

To switch on the power supplies follow this procedure:

- Press the **Power** button.
- Press the button **Recall** three times. Otherwise the default values would be wrong.
- Press the **Set Limits** button.



Figure 2: Power supplies for the sensors. Please check them after a power cut or glitch.

- Enable the output using the **Output On/Off** button. This should be done for both power supplies at the same time, best by using two hands.

When the sensors get turned on, the drawn current of the upper power supply (+8 V) should be around 3.7 A while the lower one should be about 1.6 . These are the numbers for six MimoTel. After the chips are properly programmed the currents should decrease to 2.6 A and 0.8 A. The starting of the DAQ software (EUDAQ) automatically takes care of the sensor programming.

3 Running the DAQ software

The DAQ software is running on the MAC in the control room. In the first subsection a short tutorial is given how to take a run. The further subsections list the available configurations and provide help in case of problems.

3.1 Starting EUDAQ

- If necessary login as user **eudet**.
- Open a shell and enter the directory **home/eudaq**. The software can be started by the command **./STARTRUN**.
- Several windows are opening. The data taking is controlled in the window **eudaq Run Control** which is shown in figure 4.

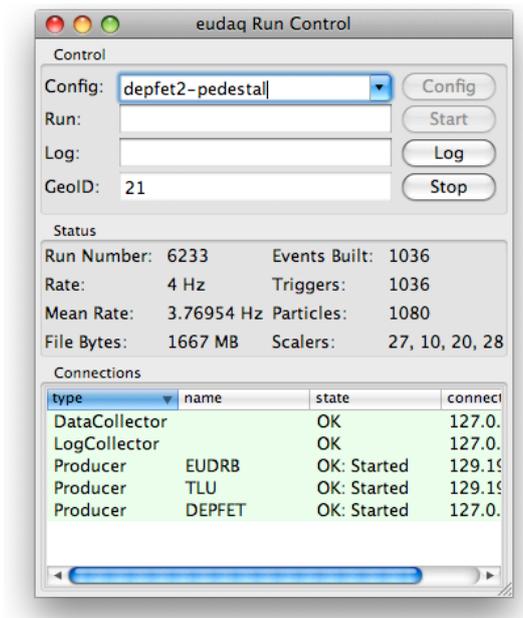


Figure 3: The EUDAQ Run Control window. You can select the configuration from many different possibilities. In the status part you can see the Run number, the current rate and the scaler numbers. In the lowest part of the window you can see the state of all the different producers. In case of a problem the underlying colour changes to red.

- Choose a configuration and click on the button **Config**. Wait until the state of the TLU and EUDRB producers is “Configured”. This is necessary after any changes of the setup. Some configurations are listed in subsection 3.2.
- Runs can be started by hitting the button **Start** and are stopped using the button **Stop**. Please be patient and don’t press too fast the next button. Also don’t forget to change the GeoID if the geometry of the setup was changed.
- In the run control window status you can see the Run number, the current trigger rate and also the scaler numbers. In the lowest part of the window you can see the state of all the different producers.
- Log messages are displayed in the window **EUDAQ Log Collector**. In case of a problem the underlying colour changes to red. The user can add own log messages by typing some text in the run control window after **Log:** and then press the **Log** button.
- The data quality can be monitored in the window **EUDAQ Root Monitor**. Plots are shown for the whole telescope and for the individual boards. Some plots need a certain number of events to be filled. Hence they typically appear after a few minutes. If the window was closed and needs to be restarted, please read 3.4.1.

- Before the size of the output files reaches the limit of 2 GB, the output file is changed automatically and the data taking continues with a new run number.

3.2 Available configurations

Data can be taken using different configurations. Here some configurations relevant for the normal user are summarised:

- **beam:** Data is taken in RAW mode.
- **beamzs:** Data is taken using zero suppression. This is the default running mode.
- **ped:** A pedestal run is taken.

3.3 Pedestals

About every 8 hours pedestal should be taken and uploaded to the system. Also if you had a power cut and everything was powered off and on, please take another pedestal and upload it. All together this takes about 15 minutes.

3.3.1 Taking Pedestals

First you should close the shutter (go to the beam computer in HNA453 and press the yellow door in the "H6 Access Command" window. After about 5 minutes the flash light on the area door will turn to yellow. Now you would also be able to do a key access. After this you take a pedestal file with 500 events (configure eudet-pedestal).

Don't forget to press the button "end of key access" on the area door and "beam on" in the access command window. Otherwise you will wait a long time for the beam.

3.3.2 Uploading to the System

In eudaq/bin you start the pedestal uploading process `./pedestal.sh xxxx` in eudaq/bin. Here xxxx is the run number of the new pedestal just taken. The script will take a few minutes, during this the native file format is converted to lcio format, then the pedestal calculation script is run over the lcio data and histograms and pedestals are created. The plots are currently not displayed yet (under construction). Finally the output is copied to the MVME6100. When the next data run is started, this new pedestal file will be used for the threshold setting for the zero suppressed mode.

3.4 Troubleshooting

In the following subsections instructions are given how to solve simple problems during data taking.

3.4.1 Restart Root Monitor

In case the Root Monitor window was closed, it can be restarted from the command line. Therefore go to the directory `home/eudaq/bin/`. To restart the Root Monitor type `RootMonitor.exe -f [run number]`. During data taking the run number can be found in the `eudaq Run Control` window. It is also possible to connect the Root Monitor to the run control. Therefore type `./RootMonitor.exe -r eudet.local` at the command line.

3.4.2 Crash of DAQ software

Just restart the software by typing `./STARTRUN` again. This kills all previous processes.

3.4.3 Check if sensors are programmed

Watch the currents at the displays of the power supplies. The currents reduce at the moment the sensors are programmed. But this is a bit too difficult when you are sitting the control room. In Section 5 you will find some reference plots to check if the sensors are alright.

4 The TLU Control Utility

The program `TLUcontrol.exe` allows to control the trigger logic unit and to run it stand alone. This can be useful for test purposes. In the following, it is described how to start this utility.

- The EUDAQ program should be exited (`./KILLRUN`)
- Open a shell on the MAC in the control room and type `ssh root@tlupc`. No password is necessary.
- Enter the directory `/home/eudet/eudaq/tlu`.
- Help is available typing the command `./TLUcontrol.exe -h`.
- The control utility can be started by the command `./TLUcontrol.exe -d [x] -a [y]`. Here `x` is the mask for enabling DUT connections and `y` is the mask for coincidence of external triggers. To calculate the masks add the following numbers: 1 for PMT1, 2 for PMT2, 4 for PMT3 and 8 for PMT4. For detailed configuration issues check the helpfile.
- The program can be stopped by `Ctrl-c`.

5 Reference Plots

In this section you will find some reference plots how things should look like when everything is working as it is supposed to work as well some examples of obvious problems.

5.1 RootMonitor

The Root Monitor is automatically started when EUDAQ is started. If not, please go to section ???. In order to speed up the monitoring, it is programmed such a way that only preselected plots are displayed. You can select from the categories "Main Histogram", "CDS Lego Plot" and "Board Displays". In Main Histograms all you can find for example correlation plots, needed during data taking.

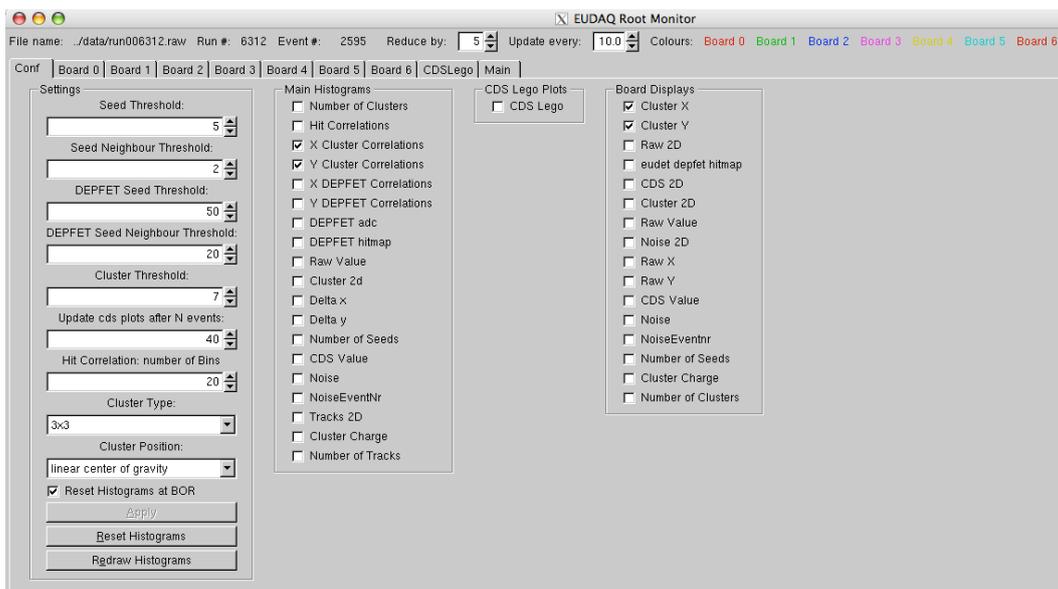


Figure 4: The Root Monitor. Please select the plots you want to have displayed and press "Apply".

5.2 Noisemap

As you should take a pedestal about every 8 hours, you should also take a look at the noise maps. After a power cut or other problems you should also take a new pedestal file. In Figure 5 example plots from board 0 and board 5 are displayed. You can see on each sensor the division in fours subarrays, the little "hot spots" at each of the sub arrays. The scale is fixed from 0 to 15 ADCs but should be on average below 4. In the plot for board 5 there is a "blob" of dead pixels in the second from left array. This is normal as this sensor is from the very first batch of MimoTels where a production

problem occurred. We kept the sensor in our system as this blob was always very useful when debugging our system.

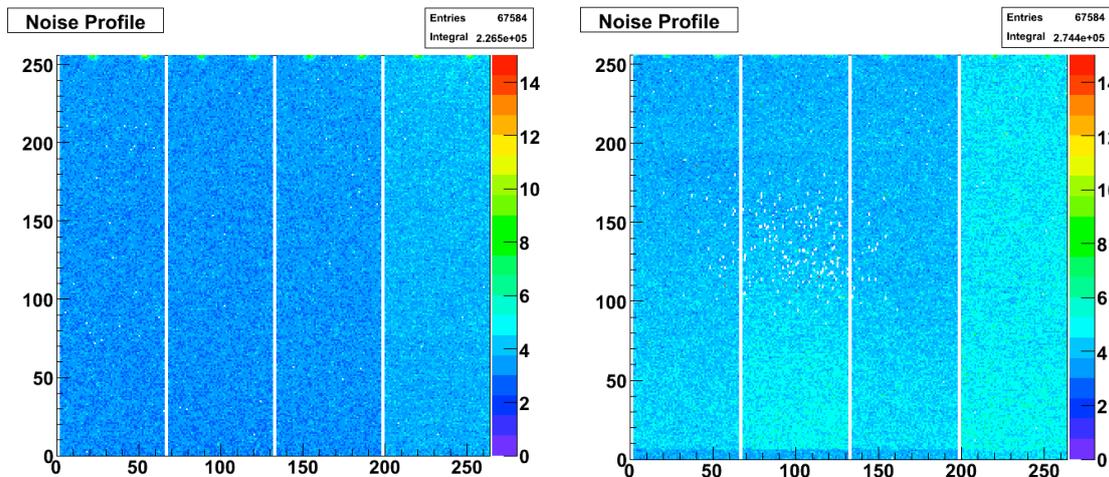


Figure 5: 2D noise map of board0 (left) and board 5. Please note the "blob" of dead pixels on board 5. This is a feature of this sensor and we left it in the system as we grew fond of it

We had the situation, that due to a power cut, the sensors were turned off and this was not noticed by the users. Data taking is rather difficult without sensors. In Figure 6, left-hand side, the 2D noise for an example sensor while being turned off is shown. The little hot spots on the top of the arrays are not visible and the noise is in general extremely low. The final proof that the sensors are turned off can be seen in Figure 6 on the right side. Here the RAW values show clearly that no signal is arriving at the ADC board.

5.2.1 Beam Data

As soon you take data with the beam on, you should check if really everything is ok. The quickest way to see that this is the case is the correlation plots. For this select "X Cluster correlations" in the Root Monitor. In Figure 7 the X Cluster Correlation plots for board 0 to 1 and board 2 to 3 are shown. The line indicates the correlation between the hits in X of the first board versus the hits in x on the second board. In the right plot the line is flipped as this is the correlation between the two sensor boxes. The orientation of the sensors are rotated between boxes

Acknowledgement

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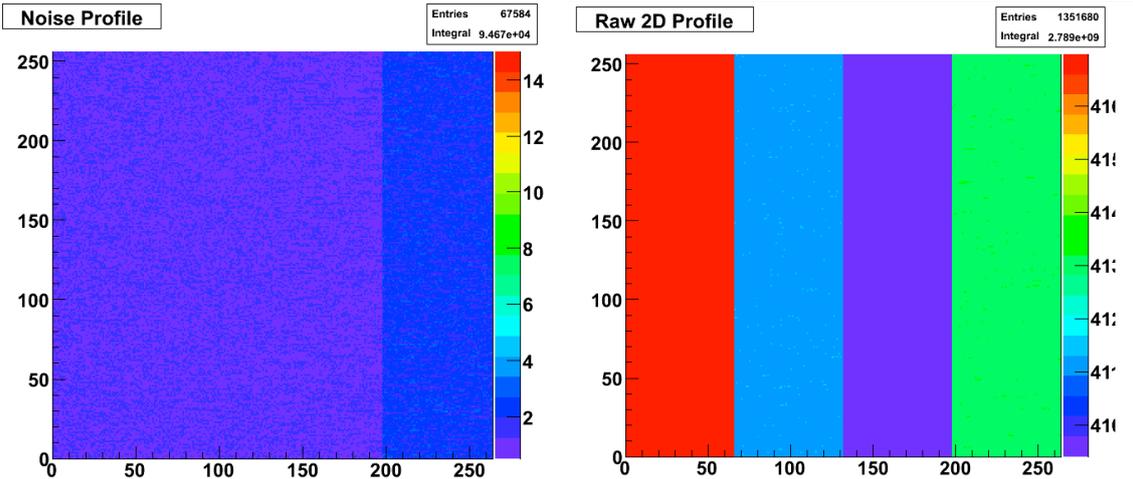


Figure 6: 2D noise map and 2D raw signal of one board when the sensors are turned off. When you do not see the little hot spots at the top of the plot in the noise, you should check the 2DRaw plot. There you can clearly see that the sensors are turned off.

References

[1]

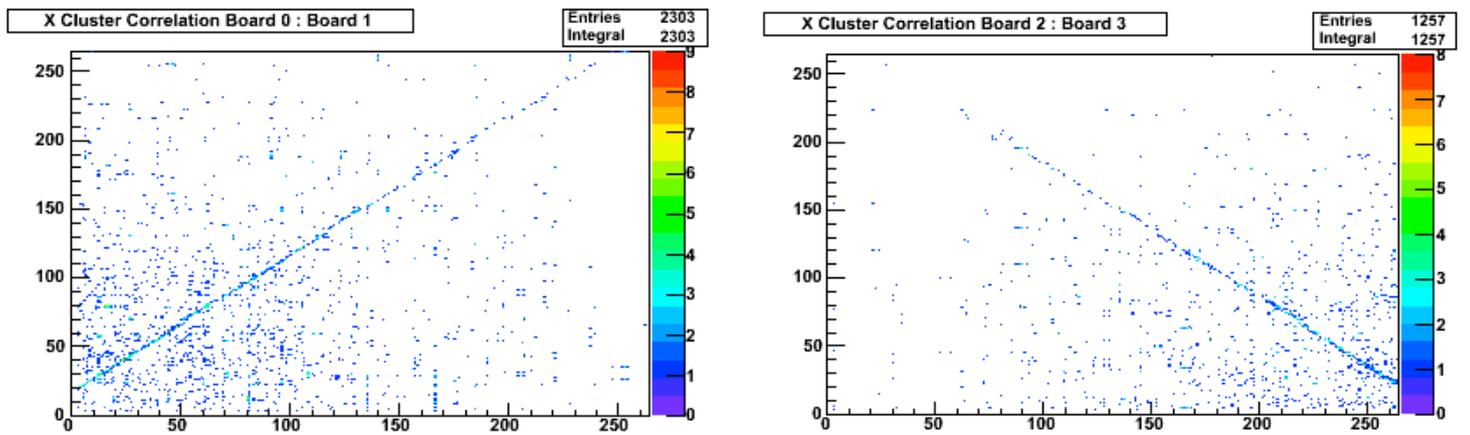


Figure 7: X Cluster Correlation plots for board 0 to 1 and board 2 to 3. The line indicates the correlation between the hits in X of the first board versus the hits in x on the second board. In the right plot the line is flipped as this is the correlation between the two sensor boxes. The orientation of the sensors are rotated between boxes.