

USERS GUIDE AND REFERENCE MANUAL FOR THE *MUX FADC* (2GSAMPLES/S MULTIPLEXED FIBER-OPTIC FADC DATA ACQUISITION) SYSTEM OF THE MAGIC TELESCOPE

F. Goebel
<fgoebel@mppmu.mpg.de>

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Abstract

This document describes the operation of the data acquisition (DAQ) and the readout electronics of the MAGIC telescope after the installation of the MUX FADC system in January 2007.

The document is divided in 2 parts: The **Users Guide** section should be read by the shift crew before any data taking. It describes the steps that have to be followed before and after data taking. It also contains information on how to handle the most frequent problems that may occur during data taking. The **Reference Manual** is a more complete description of the functionality of the MUX DAQ and the readout electronics. This is primarily meant as a reference for experts.

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1 USERS GUIDE

1.1 Operation during normal conditions

1.1.1 Procedure before Start of Data Taking

To start the DAQ program of the MUX FADC system log in as `magic` on `muxdaq` and type `StartMux`. It is advisable to start the DAQ remotely from a console in the control room, because you should have a look at the DAQ program from time to time (see section:??). You will get a prompt `MuxDaq >` which tells you that the DAQ is running. You can type in some commands. However, under normal conditions the data taking should be handled only from the central control (Arehucas).

The 4 racks with all the electronics of the MUX FADC system should normally be switched on all time. So, before data taking you just have to turn on the receiver board rack in the electronics room. The switch for the receiver board is located on the wall behind the racks. It is the big red 380 V switch on the wall.

In order to avoid overheating of the electronics and the computers, the fan for the extraction of the hot air should be on all the time. Only if the temperature in the electronics room rises above 20 degrees you also have to switch on the airconditioning

The airconditioning of the electronics room will only work if all the doors to the electronics room are closed. Therefore, **please keep all doors to the electronics room closed while the electronics and the airconditioning are on!**

1.1.2 Procedure after Data Taking

The receiver boards consume a lot of power and should therefore be switched off after data taking. It is advisable, though not mandatory, to stop the DAQ program. Just type `QUIT` inside the DAQ program (after the `MuxDaq >` prompt).

1.2 Trouble Shouting

Below you find some steps you may follow if you encounter certain kinds of errors while operating the MAGIC data acquisition chain. If this does not help contact the experts:

Florian Goebel fgoebel@mppmu.mpg.de Tel: +49 89 32354 349, +49 89 41310729, +49 179 2542172

In any case notify the above experts of any problems you have encountered and the measures you have taken.

1.2.1 General Checklist

For any kind of error, make sure that all the components are switched on. For the successful data taking with the MUX FADC system the following components must be on an running:

- `muxdaq` (the main DAQ server), `muxana`, `muxraid1` and `muxraid2`. These servers and RAID systems are located in the comuter rack next to the camera rack
- `pc3` (a TTL output card controlling the trigger veto is controlled by `pc3`).
- `muxcrate<1>-<5>`. These are the black crates which contain the Acqiris MUX FADC boards and a PC board running Linux. They are in the 4 MUX FADC boards on the left side of the electronics room. The crates can be switched on and off by the red power button. Please, do not switch them off.

- receiver boards and trigger (otherwise the MUX FADC system will not get any triggers)

Check if the DAQ is in nominal state. You can check this by typing the command `STATE` in MuxDaq. About 10 seconds after starting MuxDaq all 5 crates should be `connected`. If one or more crates do not go to `connected` state after 20 seconds, try to stop MuxDaq, run `KillMux` and then start again with `StartMux`.

1.2.2 WARNING messages displayed in MuxDaq

In general you don't have to worry much about WARNING messages. They are just WARNING. In particular the WARNING message like: `WARNING: SecLvlTrigNumber (= 1048503) increased by: 1048503 in` whenever a new run is started is normal. You should also worry if you get this message for almost every event. In the best case this just means that something is wrong with the trigger number.

1.2.3 Integrity Error messages displayed in MuxDaq

As long as these errors are not frequent (less than one error in several runs) you don't have to worry. The errors effect only one event. You should start to worry and not it in the runbook if the errors become more frequent (one error basically in every run).

If the erros become very frequent (one error every few 100 events) you may try to stop and restart the MuxDaq. Also check all the cables connected to the muxcrate giving errors. The crate number is indicated as a red label attached to the harddisk of each crate. Unfortunately, the crate number displayed with the Integrity Error (0-4) is one less than the crate number written on the muxcrate (1-5), so make sure you correctly identify the crate. Another solution might be to cool down the muxcrate which gives problems with the airconditioning tubes. If all that does not help, call the expert.

1.2.4 The DAQ goes to some strange state in Arehucas or the L2 trigger rate is ok but the DAQ rate (all displayed in Arehucas) is 0

The MuxDaq may have crashed (hardly ever observed, please report). Please, restart MuxDaq again. The MuxDaq got stuck and does not respond anymore. In particular it cannot be killed. In this case check if you can access the directory where the rawdata is stored e.g. with `> ls /mnt/raid1/muxdata/<yyyy>_<mm>`. If this does not work, the RAID system, which is being accessed both from muxdaq and from muxana, is blocked. Check if muxana is running properly and if you can access that same directory from `magic@muxana`. If muxana hangs, it may have to be rebooted.

1.2.5 The electronics or computer racks can not be switched on or went off by themselves

If the power is unexpectedly off, most likely some fuses have blown. If only some racks do not get power the fuses on the wall behind the old (Siegen) FADC racks (right side) may have blown.

If all racks are off, the fuse behind the big UPS in the garage may have blown. Open the right most (out of three) fuse boxes on the wall behind the UPS and check for blown fuses.

1.2.6 The receiver boards beep

This is most likely the overheat alarm of the receiver boards. You may temporarily press the `Alarm Off` button to stop the beeping. If the overheat problem does not go away the beeping will start again after some time.

Please, stop data taking and switch off the electronics for some minutes. Check whether the electronics room is not sufficiently cooled (temperature should be below 20°) and try to find the reason (doors

closed, airconditioning and fans on, pipes from airconditioning routed towards the receiver boards?). If you cannot find any obvious way how to cool down the temperature in the electronics room, you may open the backside of the receiver board rack, which helps to cool down the receiver electronics. Switch the receiver boards on again after some minutes and restart data taking.