USER GUIDE of the Acquisition GUI – also Real-Time (ANTS2 script GUI)

→ The GUI script is executed in **ANTS2 scripting tool**
→ Previously, the **websocket server in the TRBReader** application must be **listening.**

TO BE PERFORMED ONCE (e.g. in new installations) / PREPARATION:

- TRBReader (the software for "unpacking" of binary .HLD files, explore and calculate the integral of the signals waveforms) can be downloaded from GitHub:

https://github.com/andrmor/TRB3reader

- TRBReader can be running either in a remote machine or in the same machine as ANTS2 script for GUI acquisition. The *ip_server* variable should be initialized accordingly.

- TRBReader requires some **setting configurations**:

i) Set the name of the FPGAs (in the TRB3 board) that control the two ADCs AddOns

In TRBReader "TRB3" tab:

List of *datakinds* in HLD files to process:

→ 49936 (hex: c310)
→ 49937 (hex: c311)

ii) In **TRBReader the channels mapping** must be writen. The mapping is the correspondence between hardware/board channels and logic channels – logic numbers correspond to the typical SiPMs layout our group use for the array of 64 sensors (SiPM#0 in the upper leftcorner of the squared array)

In TRBReader "Channels" tab:

→ Mapping (hardware channel numbers sorted by logical number):

0 47 45 46 4 43 41 42 2 1 35 44 6 5 39 40 8 3 33 34 12 7 37 38 10 9 11 32 14 13 15 36 84 63 61 62 80 59 57 58 86 85 55 60 82 81 51 56 88 87 53 54 92 83 49 50 90 89 91 52 94 93 95 48 16 17 64 65 18 19 20 21 22 23 24 25 26 27 28 29 30 31 66 67 68 69 70 71 72 73 74 75 76 77 78 79

→ Channels with negative polarity:

By default channels are assumed to have positive polarity.
Hardware channels with negative polarity:

0-15, 32-63, 80-95

iii) **Signals extraction method**: "Integrate waveform" from **11** to **28** (when 30 samples are acquired). Other methods are availble, such as take the maximum of each waveform.

- **Useful tip:** In the **CTS web browser** (see how to access below: step 2.) one can export some of the TRB3 acquisition configurations (such as the trigger thresholds):

In the upper part of the web page:
Export CTS Configuration as TrbCmd script as shell script

Actually one file/script called “cts-dump.sh” is being called in the preparation of TRB3: when the button “Connect TRB3 DAQ” is pressed.

- How to change the number of digitized samples per waveform?

In the web browser control “BufferConfig” (e.g. http://10.0.0.1:1234/addons/adc.pl?BufferConfig) there are configurable parameters for each FPGA controlling an ADC (set the parameters for the two FPGAs in case of two ADC AddOns). Example:

- Number of **samples**: 30
- Number of **samples after trigger**: 60
- **Downsampling**: 2 (20MHz instead 40MHz? - confirm)

The “number of samples after trigger” to be set can be calculated as follows:

Specified “**SamplesAfterTrigger**” = “Real” # of samples after trigger × downsampling × 2

E.g: **60** = 15 × 2 × 2

The same value of number of samples must be used as “number of words”. This can be set in other “tab” (webpage) called “ConfigProcessor”: http://10.0.0.1:1234/addons/adc.pl?ConfigProcessor :

- Number of **Words**: 30

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- Special notes on the allowed throughput using 1 Gbit Ethernet connection:

In TRB3 documentation (Ref: in http://trb.gsi.de/ click “TRB3 Documents”, where there is a table of specifications) it is writen than the maximum throughput when using only 1 Gbit Ethernet connection is ~95 MBytes/s.

Example:
→ if 30 samples per signal waveform are being used and the events trigger rate is ~2KHz:

2 kHz x 64 channels x 30 samples x 4 bytes per sample[1] = 15.36 Mbits/s

→ The **maximum events trigger rate** for a throughput of 95 Mb/s:

95 MB/s / (64 ch x 30 samples x 4 bytes) = 12,3 kHz.

→ If **20 samples** per waveform: **18,5 kHz**
→ If **15 samples** per waveform: **24,7 kHz**
→ If **12 samples** per waveform: **30.9 kHz**

1 People from GSI TRB3 group told that each sample is digitized with 4 bytes.

STEPS when using TRB3 GUI Acquisition:
USER GUIDE

1) **Open TRBReader** and **launch websocket server**

→ Server tab → "Configure Websocket server"

E.g. for localhost → IP: **127.0.0.1** , Server port: **12345**

→ Press *Start*

2) Run the **ANTS2 script "GUI TRB3 Acquisition**"

→ Write in the beginning of the script the **IP address** of the machine that is running TRBReader (and will process the .HLD files).

E.g. If it is the same machine that is running ANTS2, localhost, use:

var ip_server = "ws://127.0.0.1:"

3) **Connect TRB3 DAQ**

When the button "**Connect TRB3 DAQ**" is pressed one *ssh* command is sent to the TRB3 controller (Odroid) to execute one script (on the controller machine) to launch the acquisition system.

The values of the **trigger thresholds** (see 4.2) will be set with the values in the GUI text fields "*Thrs CTS Ch9*" and "*Thrs CTS Ch10*". They can be changed at any moment pressing the button "*Change Thrs*".

The acquisition system can be disconnected pressing the button "Disconnect TRB3 DAQ"

One can monitorize if TRB3 is already available for acquisitions using the CTS control webpage (see below). It can take some seconds to prepare the sytem (typically ~25s) .

A round **Yellow** signal will appear in the CTS web browser controller whenever the CTS is available for acquisitions. **Red** signal means that the system is not available and **Green** means that an acquisition is being performed.

4) **CTS web control** of TRB3

4.1) Central Trigger System (CTS controler)

http://10.0.0.1:1234/cts/cts.ht

4.2) Web browser tab for configurations (e.g. number of samples, trigger thresholds)

http://10.0.0.1:1234/addons/adc.pl?BufferConfig

5) Acquisition

Acquisitions can be performed for a certain amount of time (in seconds)
Previously the directory for the .HLD files and the size of the files must be specified.

6) **Processing of .HLD files**

Using the settings in the TRBReader (e.g. Signals extraction method – integration window) the .HLD files will be processed and the resulting files (.DAT) will be saved in the same directory of the acquired files.

Use the button **"Process .HLD files"**

7) Real-Time acquisitions

→ Fill the text field with the real-time configuration settings:

- Directory and size of the .HLD files
- **Real-time buffer size (this buffer works in FIFO mode)**

→ Select if **Chi2 monitoring** is desired (checkbox type selection)

This option must be selected before starting the real-time acquisition.
If chi2 monitoring is desired, some parameters must be defined:

- Chi2 reference value
- Number of events for which Chi2 will be averaged for control
- Goodness margin factor (value between 0.0 and 1.0)

→ Select if **.HLD files are to be deleted** after processing. This can be changed in real-time!

8) Pedestals

8.1) Acquire Pedestals

Define:

1) Directory and **2) size of .HLD files** (by default the directory is called "Pedestals" and the its path is taken from the GUI text field of the directories for Acquisition

3) Acquisition time (seconds)

8.2) Process .HLD files from pedestals
8.3) Calculate Pedest als
8.4) Set Pedestals in ANTS2 loading data pre-processing

9) Calculate LRFs

The directory with a Flood Field data (already processed) must be set.

→ The **LRFs parameters** are taken from the respective GUI text fields:

- Compression factor
- Switchover
- Smoothness

→ **Press** the button **"Calculate NEW LRFs"**