NP04 Status Update

People at CERN this week: Anna, Alessandro, Renan, Julio, Jairo, Manuel and Laura

30/05/2024

GOBIERNO DE ESPAÑA

MINISTERIO DE CIENCIA E INNOVACIÓN

Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

TASK LIST

NP04 PDS data taking plan

- Data taking optimization .... 🟠
  - New PDS shifters trained last week!! ....(20/05/2024) ✅
  - First data taking scripts already committed in PDS repo → `/scripts/daq_acquisistion/` .... ✅
  - Analog chain, timing, bias configurations scripts need to be translated to `general_daq_config.json` (see example)→ DAQ team handles this and the data taking process will be simpler.. 🟠
- SPE Calibration of all channels .... 🟠
  - New routing of the fibers ....(27/05/2024) ✅
  - Take runs with the new configuration in all APAs (endpoints & channels)..(27/05/2024) ✅
  - Analyse the runs and fine-tune the last parameters.. 🟠
  - Set the final calibration list for all the channels to have enough light.. 🟠
  - Calibrate full-stream endpoints.. 🟠
- IV curves .... 🟠
  - Organized data in `/eos/experiment/neutplatform/protodune/experiments/ProtoDUNE-II/PDS_Commissioning/ivcurves`.. ✅
  - Check results on some problematic channels (i.e. some in ep 112 are seeing less waveforms than the rest)
  - Start using trim values to configure the operating voltage “personalized” for each channel
  - Include the voltages in the general_daq_config.json file (readapt existing scripts)
- Offline Analysis .... 🟠
  - Make data paths easily available for all analyzers → scripts to handle and save `rucio` paths .... ✅
  - Decode `raw_data.hdf5` + save in `/eos/experiment/neutplatform/protodune/experiments/ProtoDUNE-II/PDS_Commissioning/waffles/2_daq_root`.. ✅

Data taking process

Documentation in constant evolution to make sure we all know how to manage the situations

New PDS experts-shifters (Renan, Julio, Jacob) !!

To take data you need to be in a daq server and run some configurations:

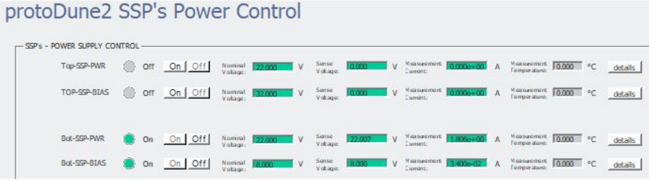
1. Configure timing interface → align all the clocks
2. Configure the analog chain → configure channels, threshold

daphne_interface ⟶ scripts/configuration

3. Set up the Bias of the SiPMs (output from the IV-curves)

daphne_interface ⟶ scripts

4. [Optional] Setup the Bias led configuration for calibrating

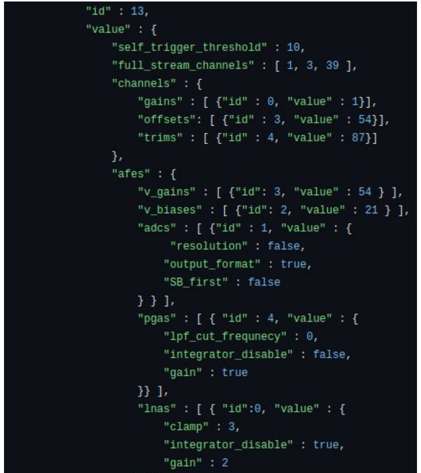


protoDune2 SSP's Power Control

SSP's - POWER SUPPLY CONTROL

Top-SSP-PWR	○ Off	On | Off	Nominal Voltage: 22.000 V	Sense Voltage: 0.000 V	Measurement Current: 0.000e+00 A	Measurement Temperature: 0.000 °C	details
TOP-SSP-BIAS	○ Off	On | Off	Nominal Voltage: 32.000 V	Sense Voltage: 0.000 V	Measurement Current: 0.000e+00 A	Measurement Temperature: 0.000 °C	details
Bot-SSP-PWR	● On	On | Off	Nominal Voltage: 22.000 V	Sense Voltage: 22.007 V	Measurement Current: 1.806e+00 A	Measurement Temperature: 0.000 °C	details
Bot-SSP-BIAS	● On	On | Off	Nominal Voltage: 8.000 V	Sense Voltage: 8.000 V	Measurement Current: 3.400e-02 A	Measurement Temperature: 0.000 °C	details

Soon will be migrated to the general_daq_config.json



```
"id" : 13,
"value" : {
    "self_trigger_threshold" : 10,
    "full_stream_channels" : [ 1, 3, 39 ],
    "channels" : {
        "gains" : [ {"id" : 0, "value" : 1}],
        "offsets": [ {"id" : 3, "value" : 54}],
        "trims" : [ {"id" : 4, "value" : 87}]
    },
    "afes" : {
        "v_gains" : [ {"id": 3, "value" : 54 } ],
        "v_biases" : [ {"id": 2, "value" : 21 } ],
        "adcs" : [ {"id" : 1, "value" : {
             "resolution" : false,
            "output_format" : true,
            "SB_first" : false
        } } ],
        "pgas" : [ { "id" : 4, "value" : {
            "lpf_cut_frequnecy" : 0,
            "integrator_disable" : false,
            "gain" : true
        }} ],
        "lnas" : [ { "id":0, "value" : {
            "clamp" : 3,
            "integrator_disable" : true,
            "gain" : 2
```

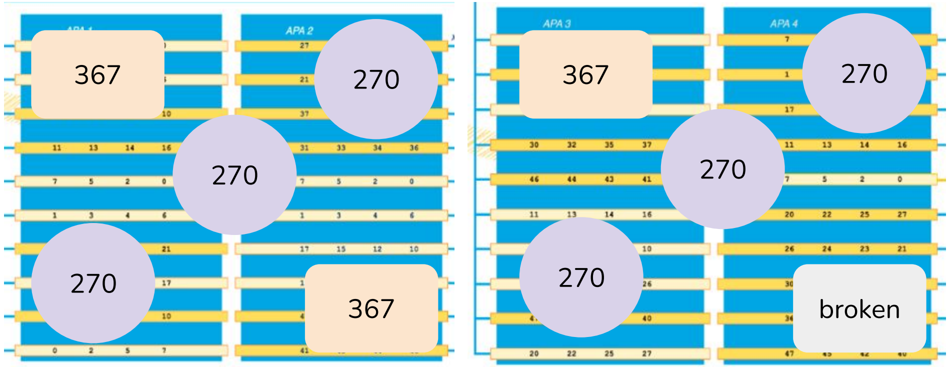
Working to translate and test the information that is on the scripts to the .json

(Manuel, Laura)

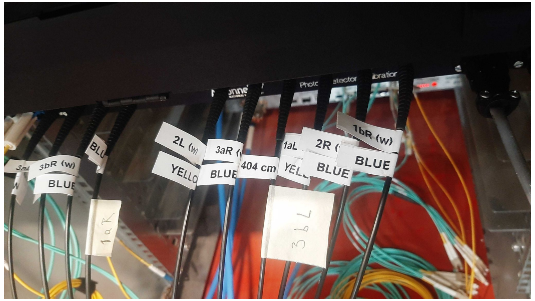
SPE Calibration (I)

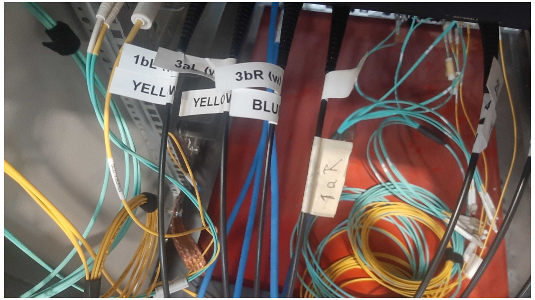
Details on how to turn the LEDs for calibrating → here (Jairo, Laura)

- New routing of fibers so that we have the same geometric distribution in both sides



- Test runs to see the light coverage depending on the channel
    - Change the LED(s) voltages
    - Change the LED(s) width

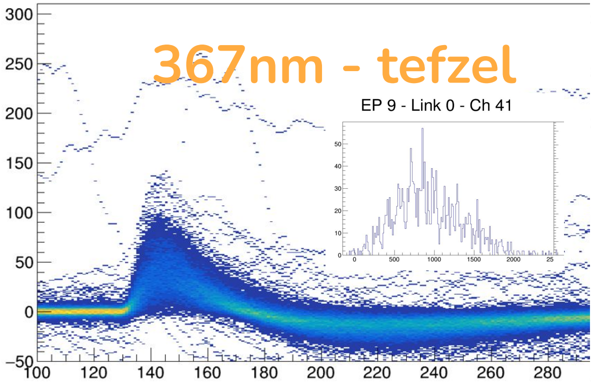




SPE Calibration (I)

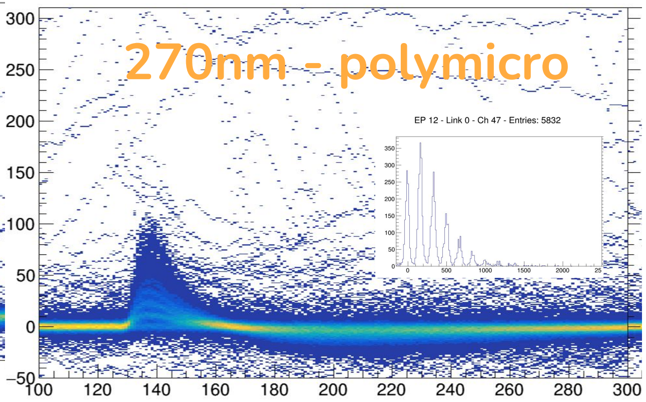
- Reasons for change of leds: low SNR due to the wider rising time

EP 9 - Link 0 - Ch 41

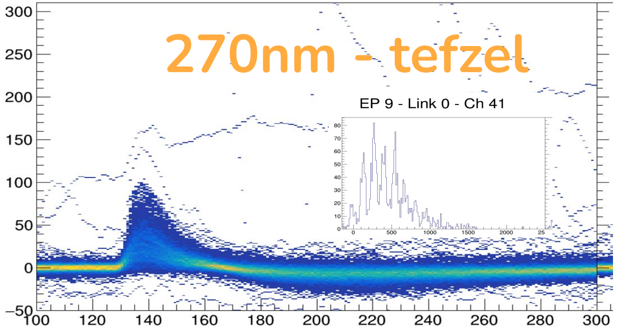


367nm - tefzel

EP 12 - Link 0 - Ch 47

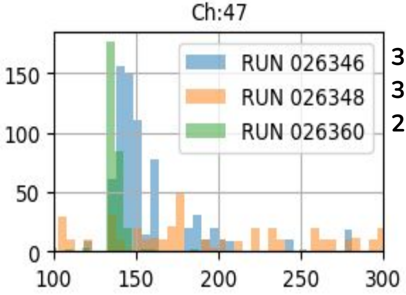


270nm - polymicro



270nm - tefzel

Wvf PeakTime (EP 112)



367nm + width_ticks: 3

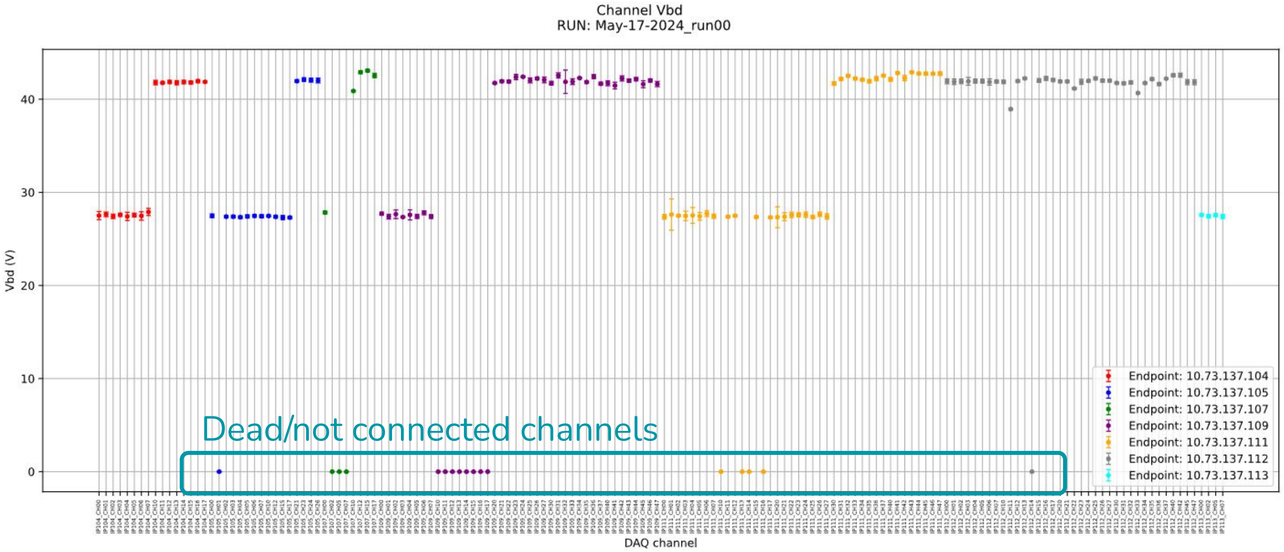
367nm + width_ticks: 1

270nm + width_ticks: 1

IV Curves

During this week Anna and Alessandro have been studying:

- The bias of the problematic channels we have detected
- Deploying the scripts needed to configure not only the bias voltage [ALL AFE same value] but a trim voltage [ONE per channel] allowing us to have more precision per channel in the applied voltage :)



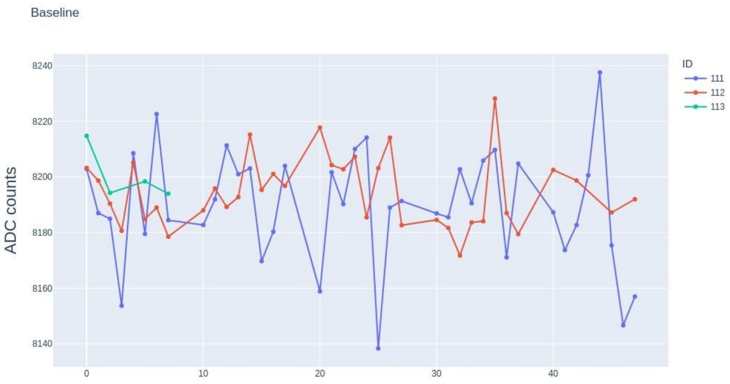
Dead/not connected channels

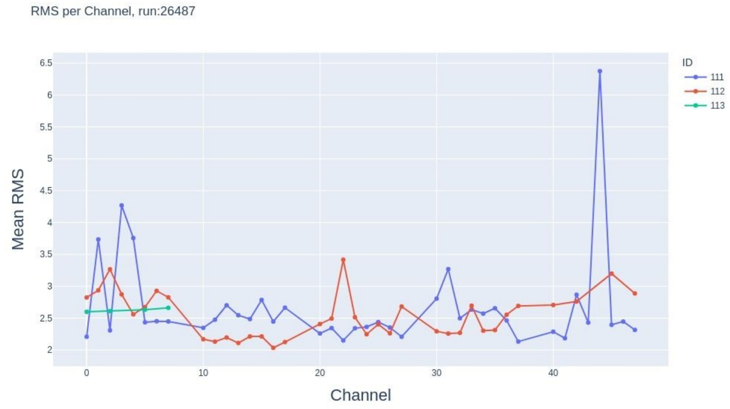
checking the fluctuations

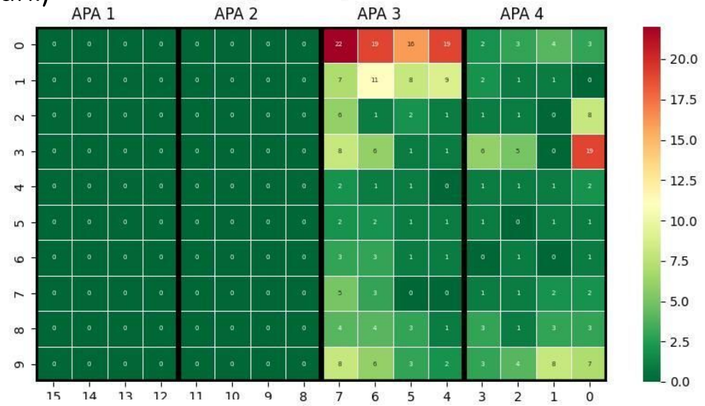
→ See Anna’s talk later for more details

Online monitoring

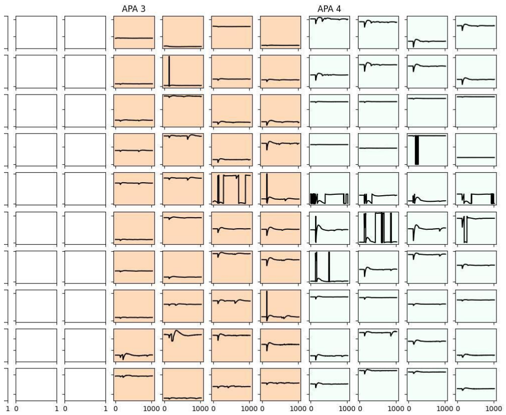
Tool for check that the data we are acquiring is ok → here (Thanks Renan!)

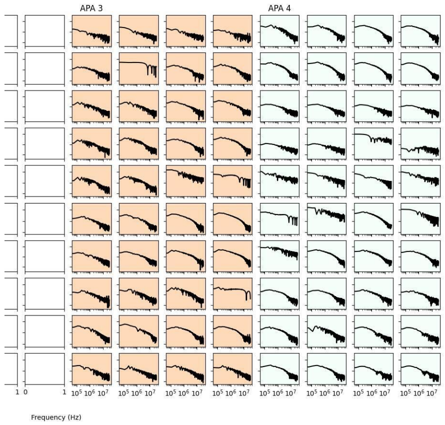

Baseline


RMS per Channel, run:26487


Trigger Heat Map, Run:26487

	APA 1				APA 2				APA 3				APA 4			
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	22	19	16	19	2	3	4	3
1	0	0	0	0	0	0	0	0	7	11	8	9	2	1	1	0
2	0	0	0	0	0	0	0	0	6	1	2	1	1	1	0	8
3	0	0	0	0	0	0	0	0	8	6	1	1	6	5	0	19
4	0	0	0	0	0	0	0	0	2	1	1	0	1	1	1	2
5	0	0	0	0	0	0	0	0	2	2	1	1	1	0	1	1
6	0	0	0	0	0	0	0	0	3	3	1	1	0	1	0	1
7	0	0	0	0	0	0	0	0	5	3	0	0	1	1	2	2
8	0	0	0	0	0	0	0	0	4	4	3	1	3	1	3	3
9	0	0	0	0	0	0	0	0	8	6	3	2	3	4	8	7


Mean Waveforms, Run:26487


FFts, Run:26487

Offline analysis

We are processing the raw hdf5 files to extract the relevant information for the PDS analysis:

- Shared files paths (generated with `rucio`) → it's easy to read a txt file than setting up rucio, so once someone makes the effort we share them in `/eos/experiment/neutplatform/protodune/experiments/ProtoDUNE-II/PDS_Commissioning/waffles/1_rucio_paths`

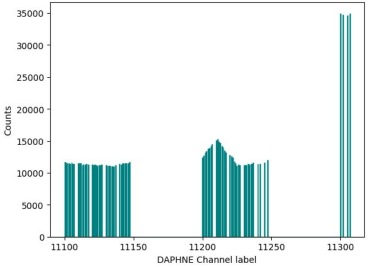
  How? just run `python get_rucio.py` in whatever `lxplus` machine you want inside your updated `daq environment`
- Common decoded files *extracted* from the `raw.hdf5` files: `/eos/experiment/neutplatform/protodune/experiments/ProtoDUNE-II/PDS_Commissioning/waffles/2_daq_root`
- We are converging into a format that convinces all the analysers (**let us know** if you want info to be included!)
  - raw_waveforms
    - adcs
    - channel
    - (if self-trigger) timestamp, threshold, baseline
  - metadata
    - run number
    - date
    - nrecords
    - det
    - ...

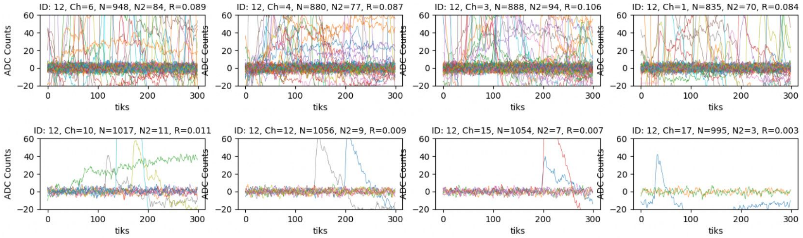
Offline analysis

Problems we are encountering:

- **Duplicated waveforms** 👻 → appear in “all runs” and we have been applying some filters to avoid them
  - Runs to test the reason for the duplications:
    - Wesley suggested to take a run without the pre-configuration → **0.0%** duplications
    - Run with pre-configuration but DAQ trigger rate=1 Hz → **0.0%** duplications
    - Run with pre-configuration but DAQ trigger rate=10 Hz → **0.1%** duplications
    - Run with pre-configuration but DAQ trigger rate=20 Hz → **46.2%** duplications
  - Is an acquisition problem we (or DAQ) need to solve. We are currently making and analysing other tests together with the DAQ team to solve this issue as soon as possible.

- Strange waveforms per channel distributions → may be related with the voltage (use of trim would fix it)





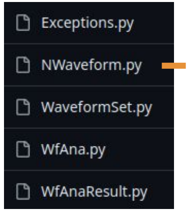
Offline analysis → WAFFLES

Updates in waffles workflow → here (Thanks Julio, Renan & Jairo!)

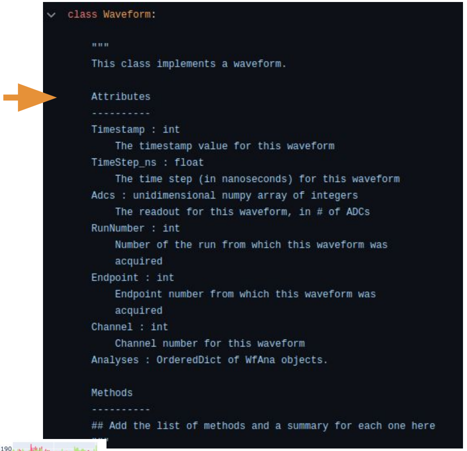
Ongoing work & next steps:

- Improve the decoder from hdf5 files to remove duplications
- Coding the classes and structure of the framework
  - Waveform
  - WaveformSet
  - WvfAna
- Converting the notebooks used standalone to read the .root files and be more efficient in plotting
- Testing interactive app to make some plots that need a processing of the files

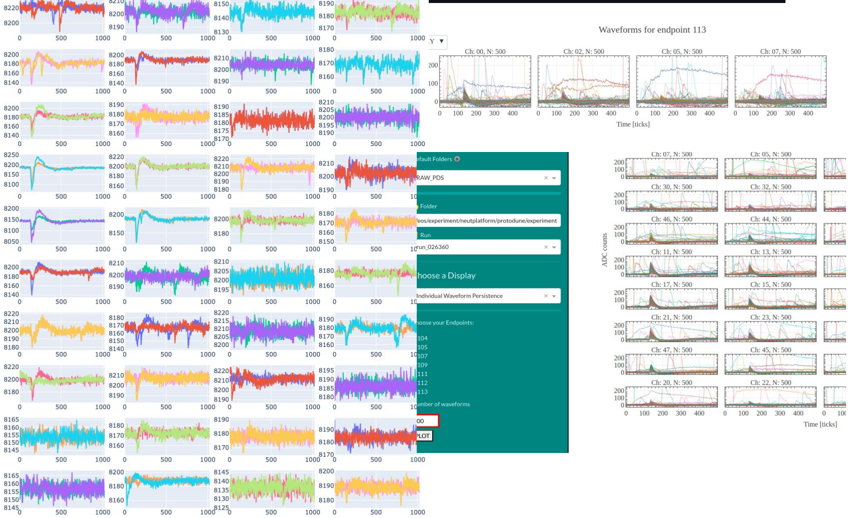
→ We expect an increase of code commits in the coming week(s) + a more clear workflow on the PDS analysis → **more efficient and transparent for all the analysers**.



Exceptions.py
NWaveform.py
WaveformSet.py
WfAna.py
WfAnaResult.py

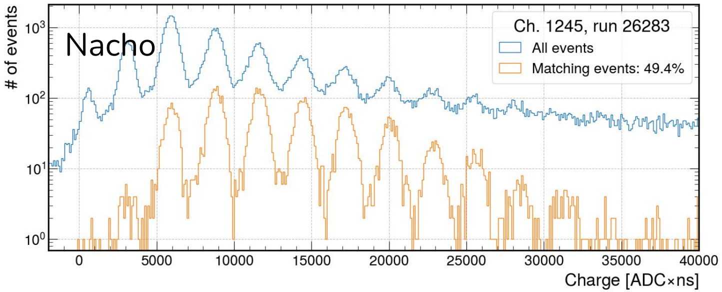


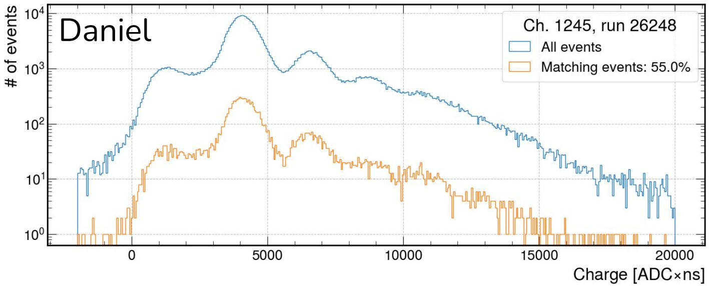
```
class Waveform:

    """
    This class implements a waveform.

    Attributes
    ----------
    Timestamp : int
        The timestamp value for this waveform
    TimeStep_ns : float
        The time step (in nanoseconds) for this waveform
    Adcs : unidimensional numpy array of integers
        The readout for this waveform, in # of ADCs
    RunNumber : int
        Number of the run from which this waveform was
        acquired
    Endpoint : int
        Endpoint number from which this waveform was
        acquired
    Channel : int
        Channel number for this waveform
    Analyses : OrderedDict of WfAna objects.

    Methods
    ----------
    ## Add the list of methods and a summary for each one here
```



Self-trigger analysis

From 13th to 17th May self-trigger tests were performed (Carlos, Antonio, Nacho, Henrique)



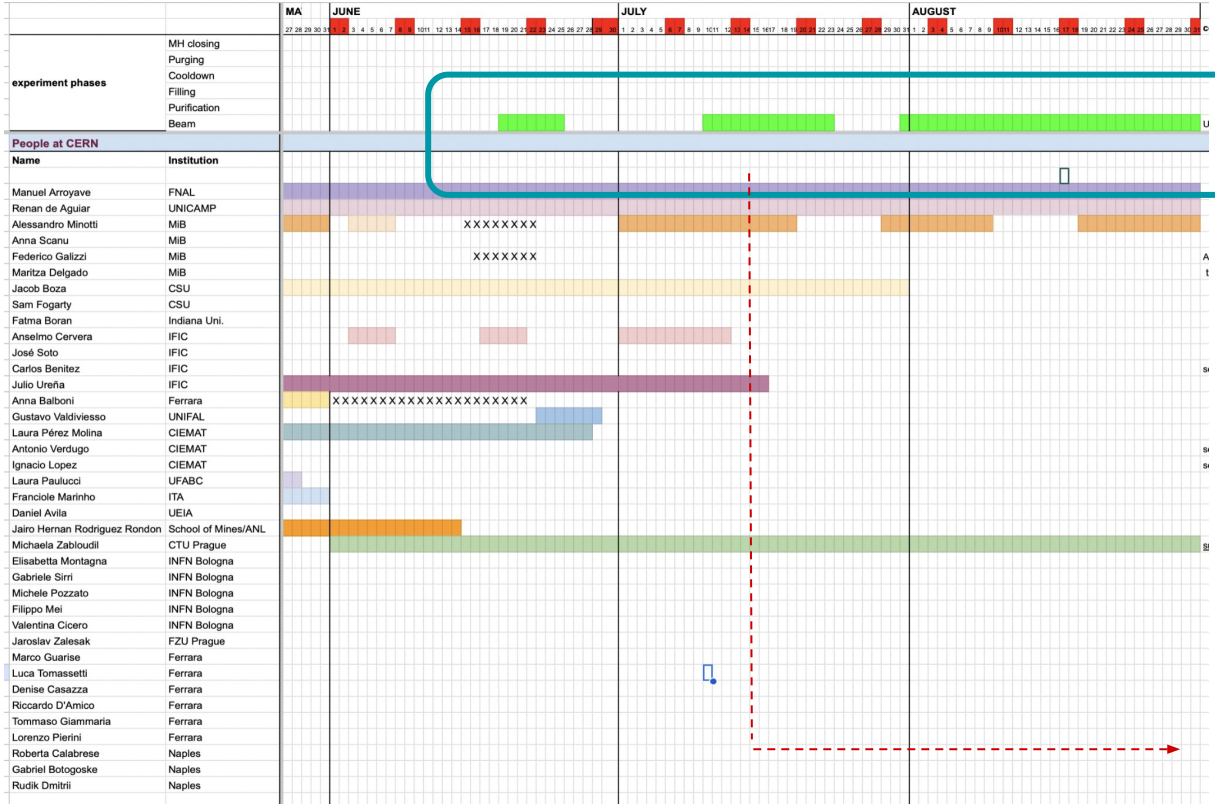


Future steps and ongoing work

- Carlos is multiplying the links
- Daniel is implementing trigger primitives
- Nacho is improving the self-trigger with the output from the tests
- Esteban released a new firmware we need to install + he is testing the all the algorithms in standalone mode

→ We need to test the whole system again, look at the bandwidth vs threshold (without duplications this will make sense) & determine the trigger we will work with :)

Schedule & Peoplepower



MA JUNE JULY AUGUST

experiment phases

- MH closing
- Purging
- Cooldown
- Filling
- Purification
- Beam

People at CERN

Name	Institution
Manuel Arroyave	FNAL
Renan de Aguiar	UNICAMP
Alessandro Minotti	MiB
Anna Scanu	MiB
Federico Galizzi	MiB
Maritza Delgado	MiB
Jacob Boza	CSU
Sam Fogarty	CSU
Fatma Boran	Indiana Uni.
Anselmo Cervera	IFIC
José Soto	IFIC
Carlos Benitez	IFIC
Julio Ureña	IFIC
Anna Balboni	Ferrara
Gustavo Valdiviesso	UNIFAL
Laura Pérez Molina	CIEMAT
Antonio Verdugo	CIEMAT
Ignacio Lopez	CIEMAT
Laura Paulucci	UFABC
Franciole Marinho	ITA
Daniel Avila	UEIA
Jairo Hernan Rodriguez Rondon	School of Mines/ANL
Michaela Zabloudil	CTU Prague
Elisabetta Montagna	INFN Bologna
Gabriele Sirri	INFN Bologna
Michele Pozzato	INFN Bologna
Filippo Mei	INFN Bologna
Valentina Cicero	INFN Bologna
Jaroslav Zalesak	FZU Prague
Marco Guarise	Ferrara
Luca Tomassetti	Ferrara
Denise Casazza	Ferrara
Riccardo D'Amico	Ferrara
Tommaso Giammaria	Ferrara
Lorenzo Pierini	Ferrara
Roberta Calabrese	Naples
Gabriel Botogoske	Naples
Rudik Dmitrii	Naples

Assigned beam time

More people may be needed from 15th July