

NP04 PDS preparation for first beam

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First beam

- Link to NP04 coordination meeting last Tuesday with status of all subsystems and information about beam <https://indico.cern.ch/event/1425642/>
- First continuous beam will start next Wednesday at 18:00
- We will have 7 days of beam
- The first beam will be +7 GeV
- In principle NP04 people will be allowed to change beam settings
 - CESAR application will be used. Training needed. Will ask Christos about strategy for that
- 3 ms DAQ window with 250 μ s pre-trigger
- Current e- lifetime > 30 ms

Shifts

- Spreadsheet to signup for shifts

https://docs.google.com/spreadsheets/d/1_yYS8HMSpZ4zBtYIxE36sWsXQkeOvJc31goupQsWrf4/edit#gid=590800126

- Only 3/28 shifts covered by PDS people. Need more PDS shifters. Red slots available

	A	B	C	D	E	F	G	H	I
			MONDAY 17/06/2024	TUESDAY 18/06/2024	WEDNESDAY 19/06/2024	THURSDAY 20/06/2024	FRIDAY 21/06/2024	SATURDAY 22/06/2024	SUNDAY 23/06/2024
MORNING 06:00-14:00		Jonathan Hancock	Jonathan Hancock	Danaisis Vargas Ushak Rahaman	Jake Goudeau	Rohit Raut Steven Timm	Danaisis Vargas		
AFTERNOON 14:00-22:00		Michaela Zabloudil	Danaisis Vargas Yinrui Liu	Jonathan Hancock Rohit Raut	Michaela Zabloudil Yinrui Liu	Danaisis Vargas Jonathan Hancock	Jonathan Hancock Yinrui Liu	Laura Pérez Molina	
NIGHT 22:00-06:00		Danaisis Vargas	Pip Hamilton Steven Timm	Anselmo Cervera Pip Hamilton	Danaisis Vargas Pip Hamilton	Pip Hamilton	Pip Hamilton	Pip Hamilton	

		MONDAY 24/06/2024	TUESDAY 25/06/2024	WEDNESDAY 26/06/2024	THURSDAY 27/06/2024	FRIDAY 28/06/2024	SATURDAY 29/06/2024	SUNDAY 30/06/2024
MORNING 06:00-14:00		Will Dallaway	Jake Goudeau Rohit Raut	Will Dallaway				NO SHIFT
AFTERNOON 14:00-22:00		Tiago Alves Emanuele Villa	Miriama Rajaoalisoa Soamasina Herilala Razafinime		Jonathan Hancock	Jonathan Hancock		NO SHIFT
NIGHT 22:00-06:00		Jonathan Hancock Pip Hamilton	Jonathan Hancock Pip Hamilton					NO SHIFT

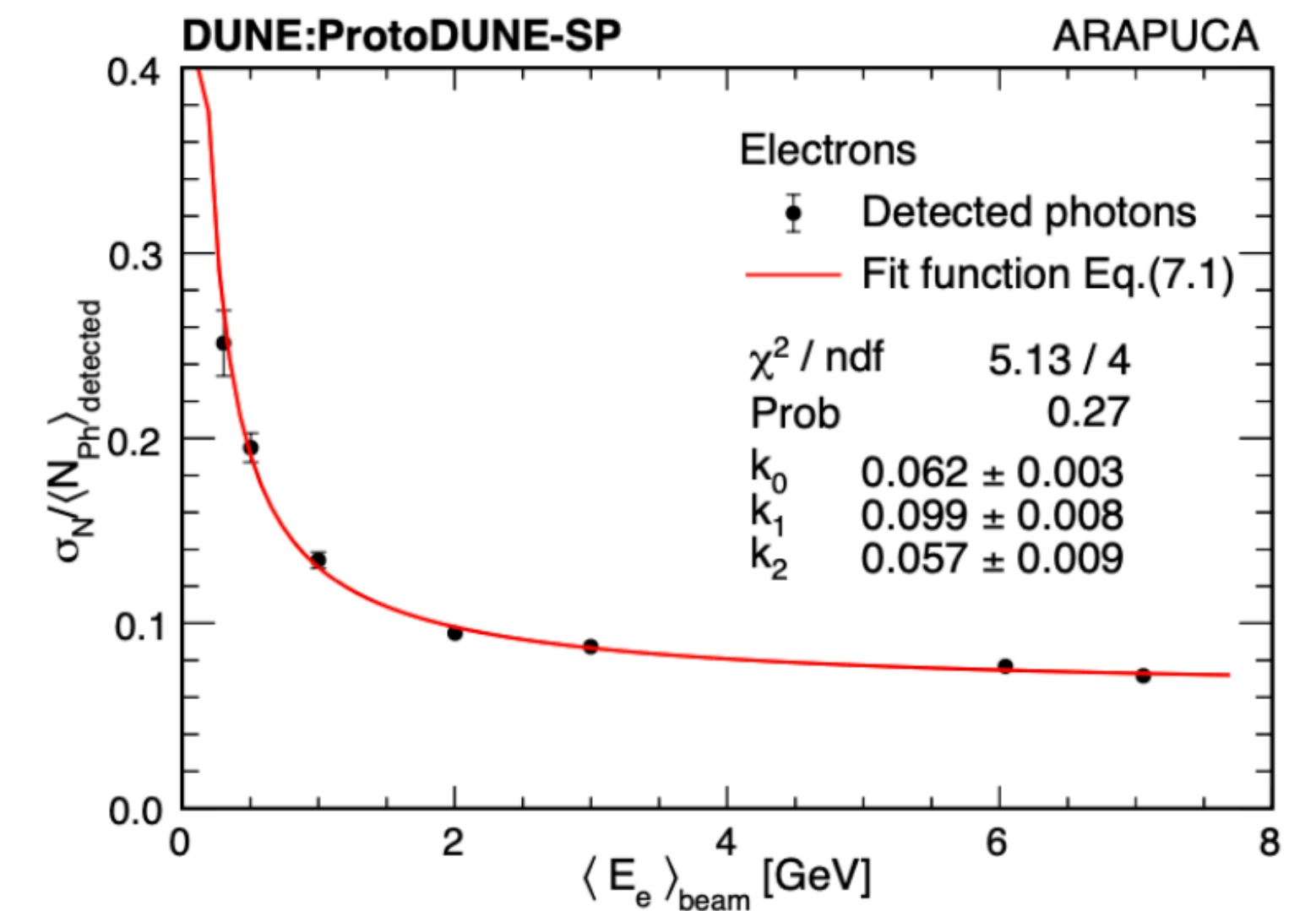
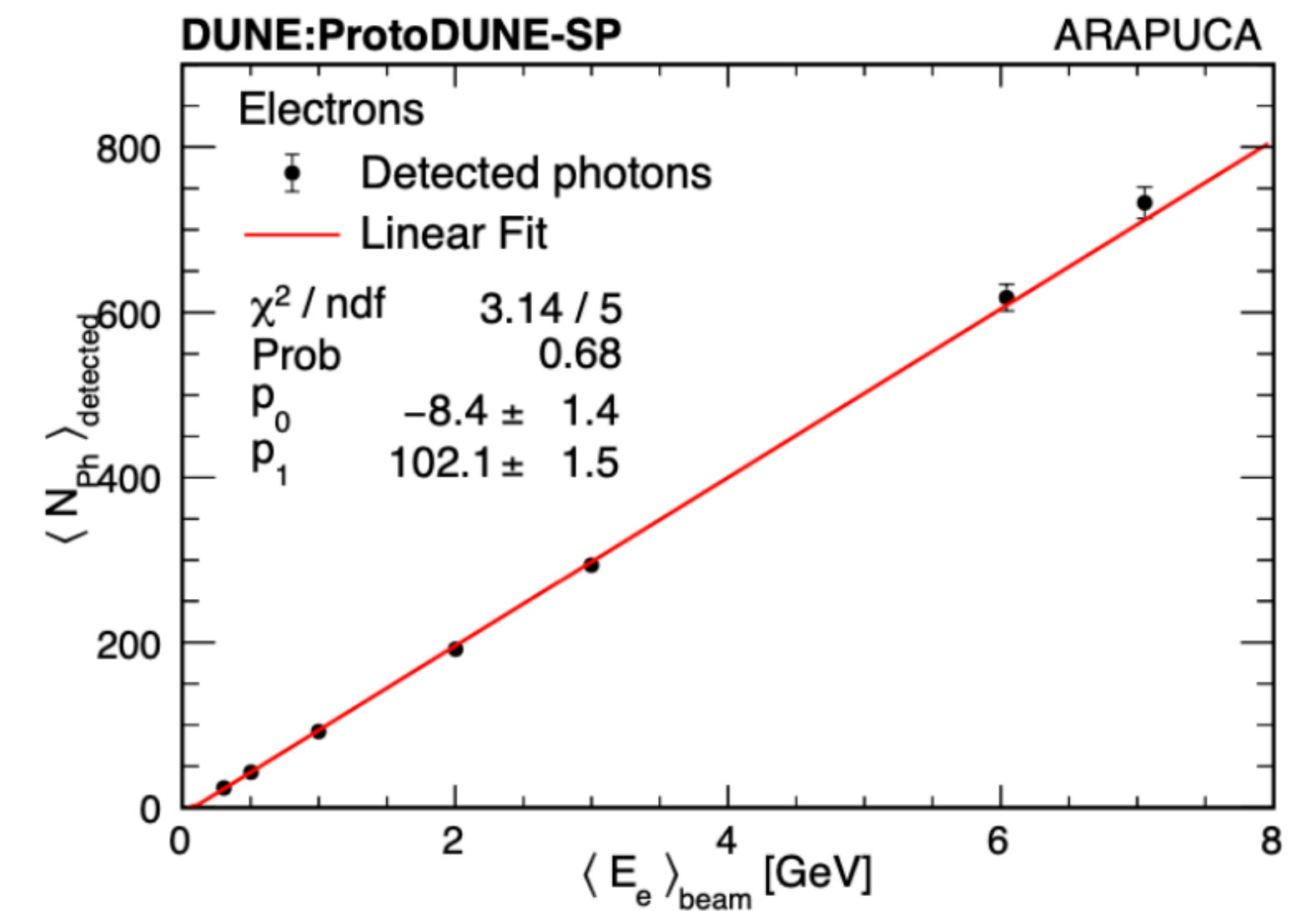
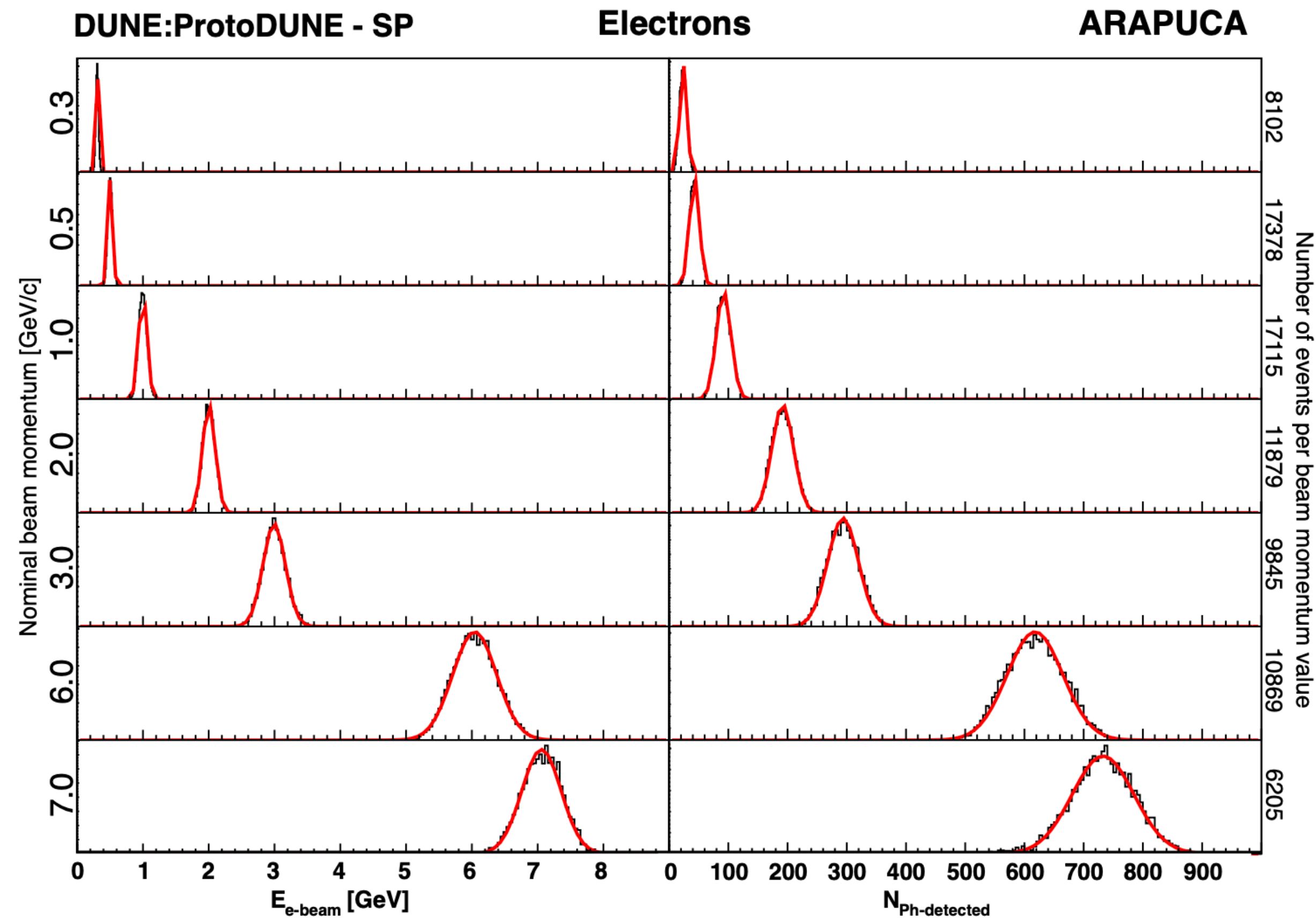
What do you need to do with the first beam and for how long

- What we want to do:
 - Compare PDS and beam timing. Study PDS timing resolution
 - Light yield vs beam energy and particle type
 - Light yield spatial and time distribution
 - Light yield for various detector conditions (HV, XA OV, ...) ?
 - Self trigger-rate vs threshold
 - X-ARAPUCA efficiency studies. Need MC. Maybe for later
- We don't have special requests but scan over beam momenta and particle types would be great !!!!
 - We need to understand how many beam settings can be afforded in a week, how difficult is to change setting, expected statistics vs time, ...

What do you need to do with the first beam and for how long

- In principle no calibrations during beam time:
 - IV curves and LED calibrations to be done immediately before
- Are there plans (is it possible?) to modify cathode HV during beam time ?
- It would be useful to have a random trigger (TI command probably) to monitor noise, FFTs, DCR, cosmic rate, ...
- CRT trigger also useful to remove cosmic bkg
- Request to have regular tau slow calibration during beam time

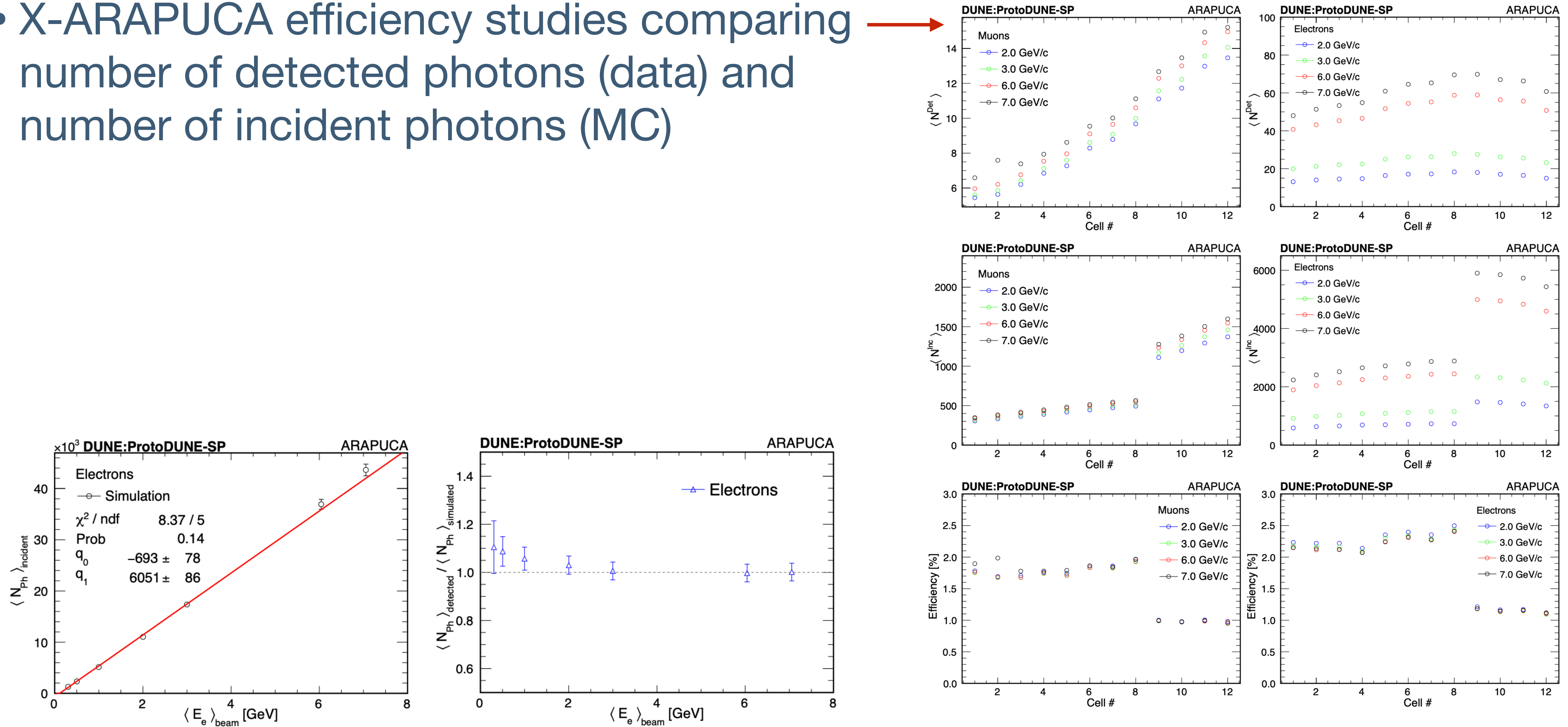
Light yield vs beam energy



- Ideally, this study should be done for all other beam particle types

Studies requiring MC simulation

- X-ARAPUCA efficiency studies comparing number of detected photons (data) and number of incident photons (MC)

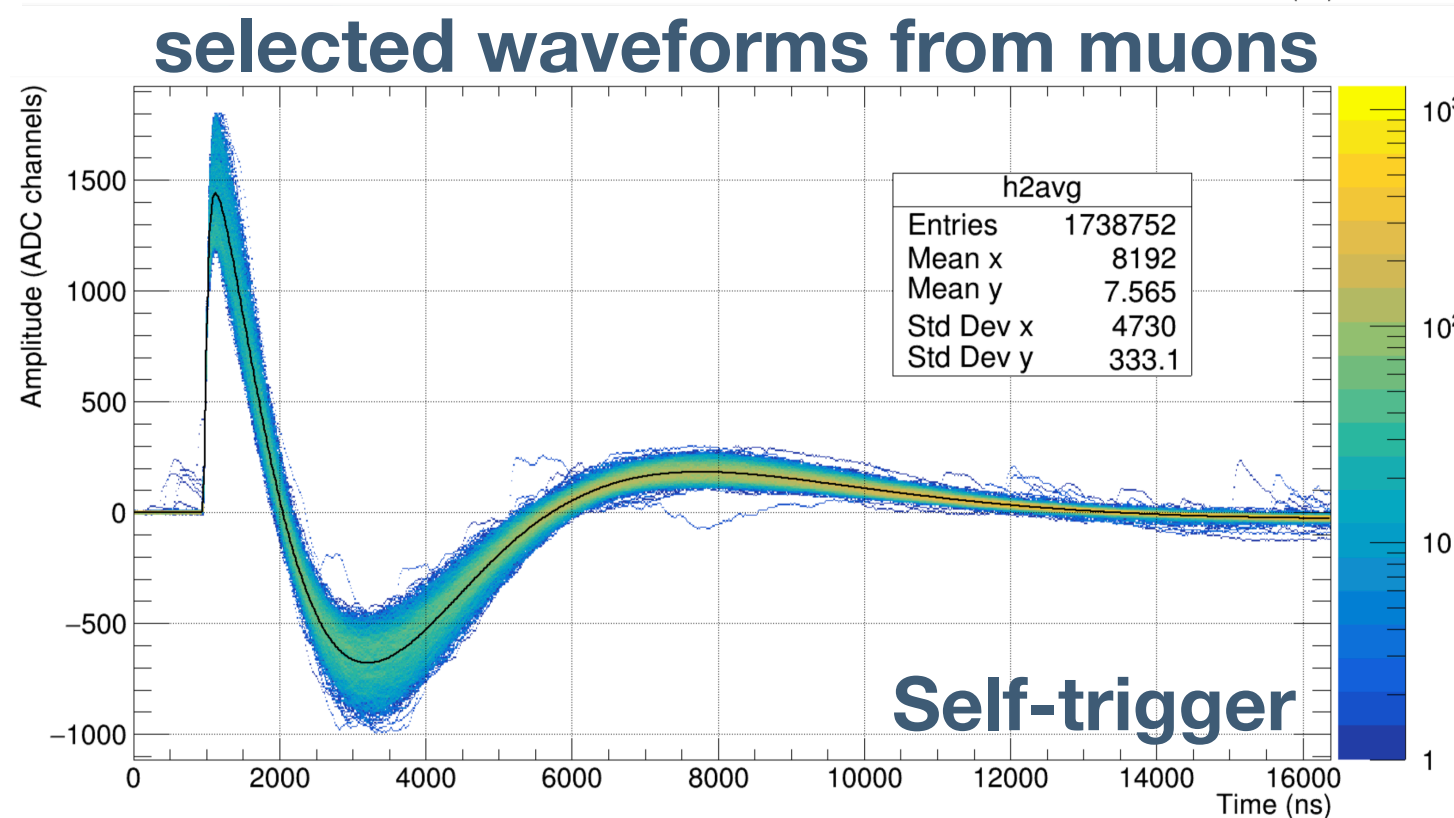
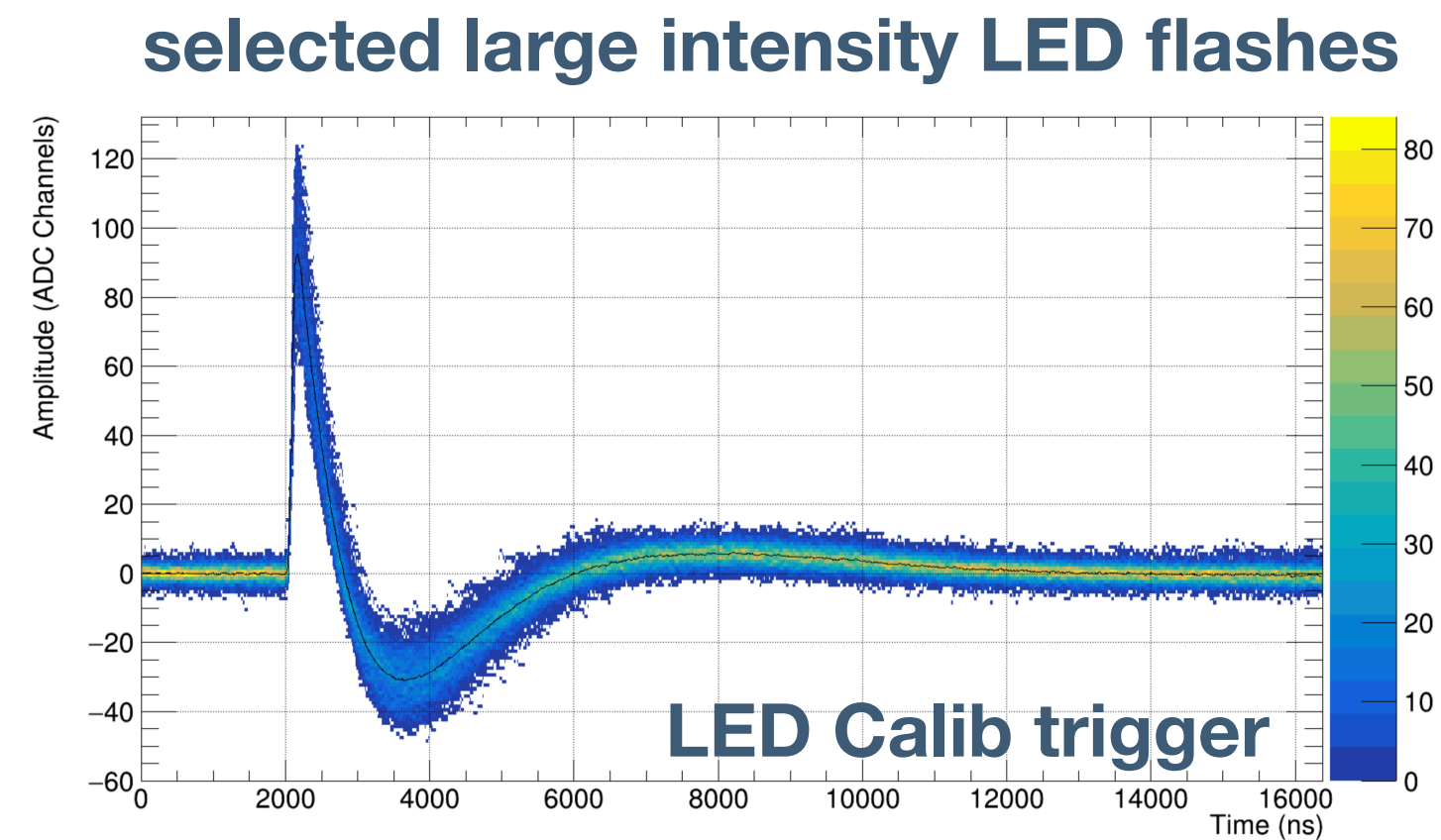


Backup

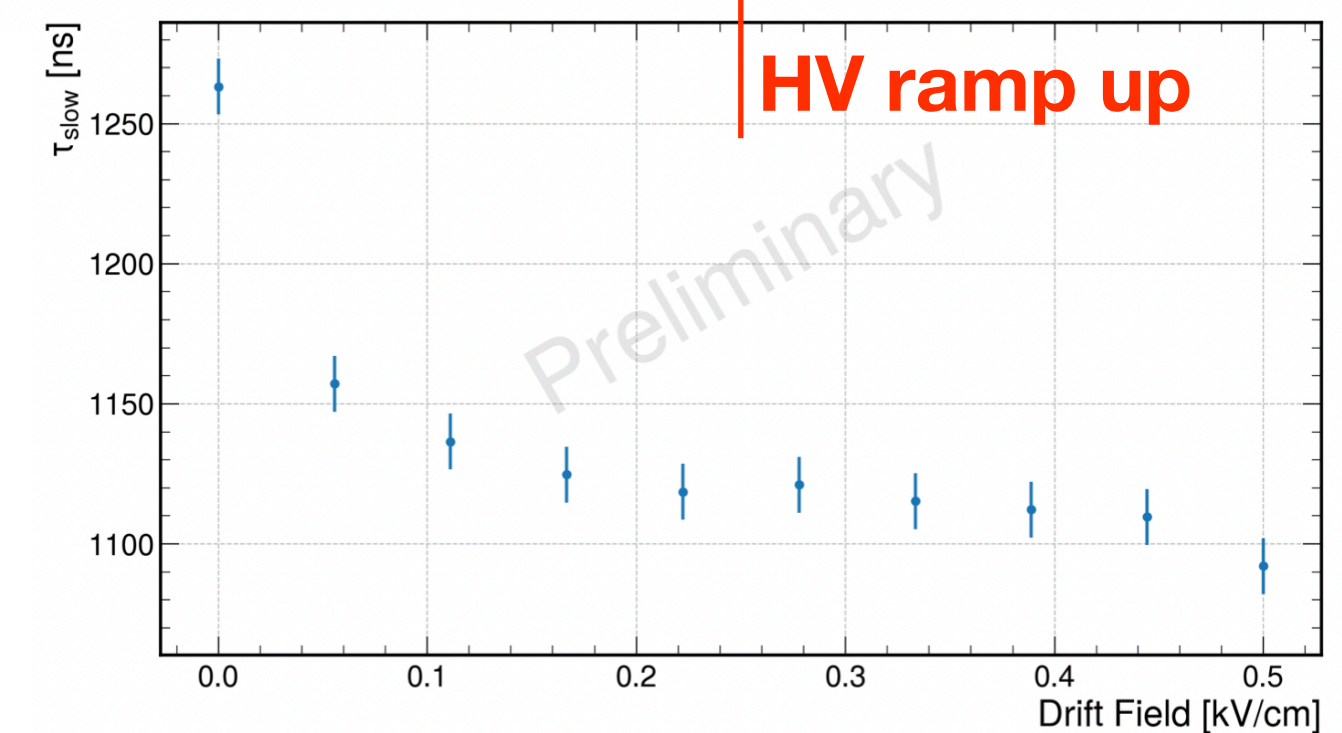
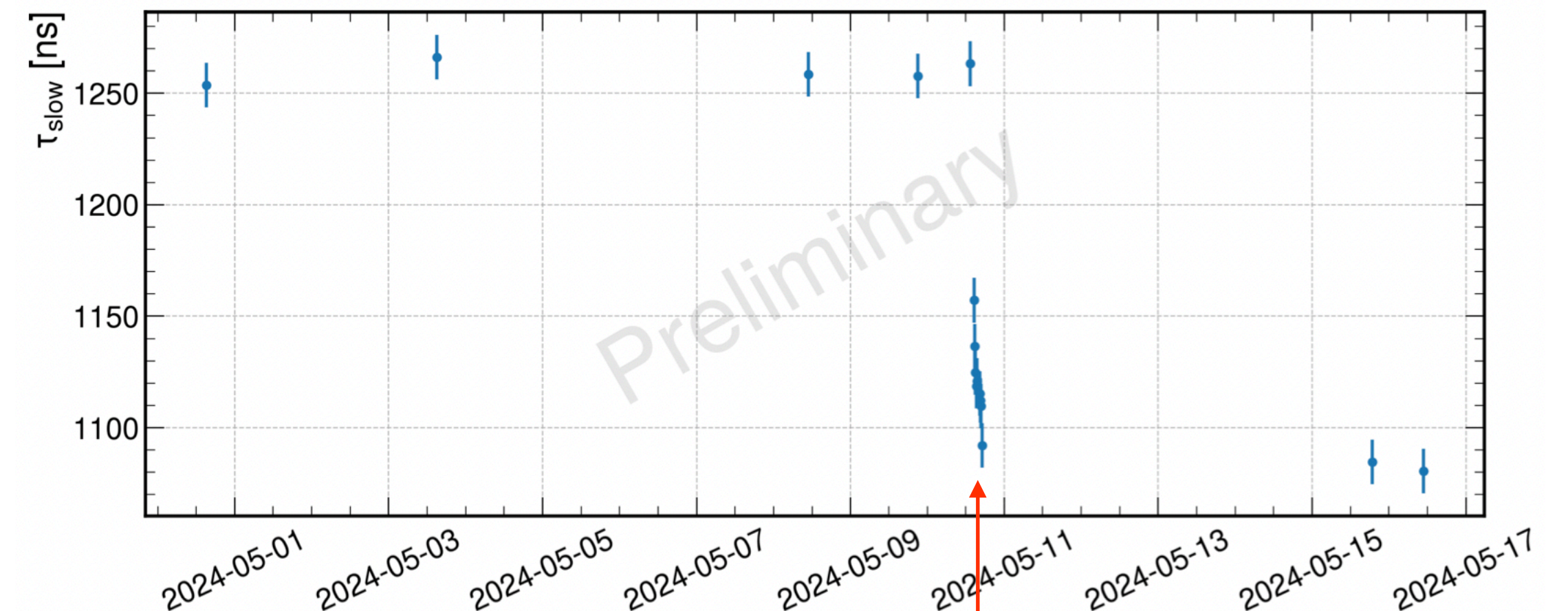
		Momentum (GeV/c)			
		1	2	3	6 - 7
e	TOF (ns)	0, 105	0, 105	–	–
	XCET-L	1	1	1	1
	XCET-H	–	–	1	1
μ / π	TOF (ns)	0, 110	0, 103	–	–
	XCET-L	0	0	0	1
	XCET-H	–	–	1	1
K	TOF (ns)	–	–	–	–
	XCET-L	–	–	0	0
	XCET-H	–	–	0	1
p	TOF (ns)	110, 160	103, 160	–	–
	XCET-L	0	0	0	0
	XCET-H	–	–	0	0

First *physics* result

- Measurement of the slow component of the liquid argon scintillation light
- Use LED pulses for deconvolution of detector effects and cosmic muons for the actual analysis



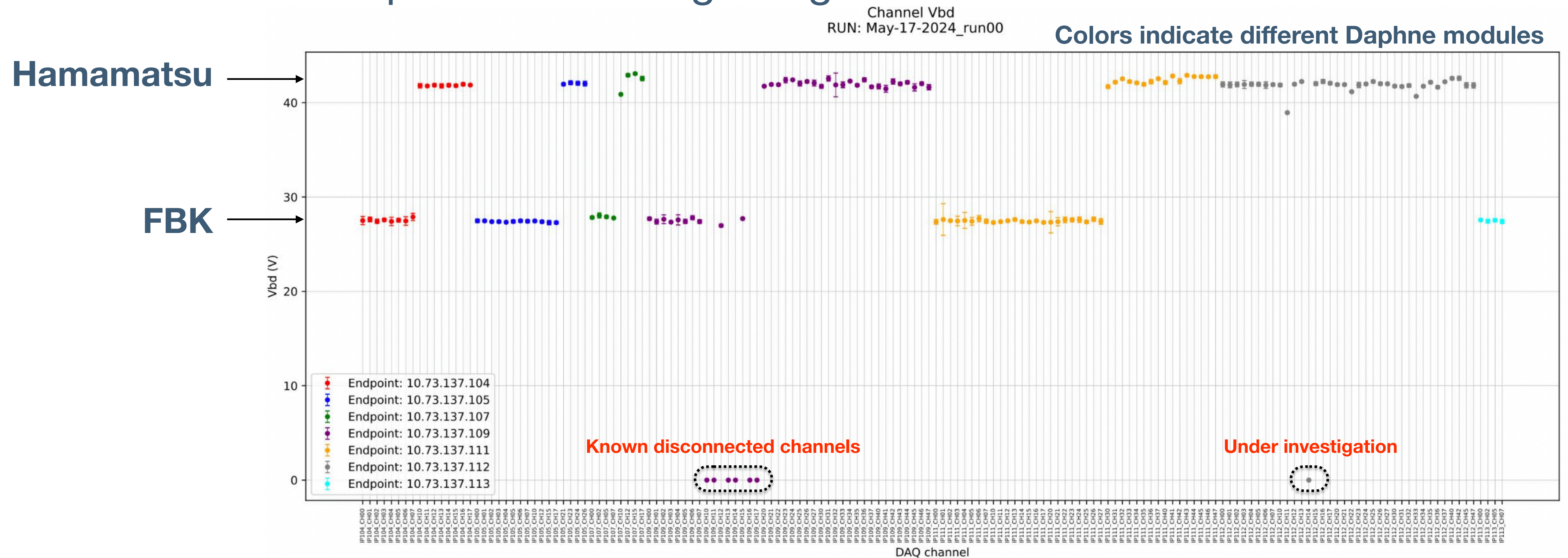
evolution with time of τ_{slow}



τ_{slow} vs drift field during HV ramp up

160 channels

- 4% dead channels (known since installation). Few other channels under investigation
- All channels alive provide meaningful signals



However ...

- We have been observing problems since last Wednesday:
 - Misalignment with timing interface: investigating fibers and transceivers
 - During some runs FELIX didn't receive data even when DAPHNE was sending them (checked with DAPHNE SPY buffers)
- Trying to debug them together with Wes
- With those problems, progress in the last few days have been slowed down and most of the activities to be done now, will be delayed

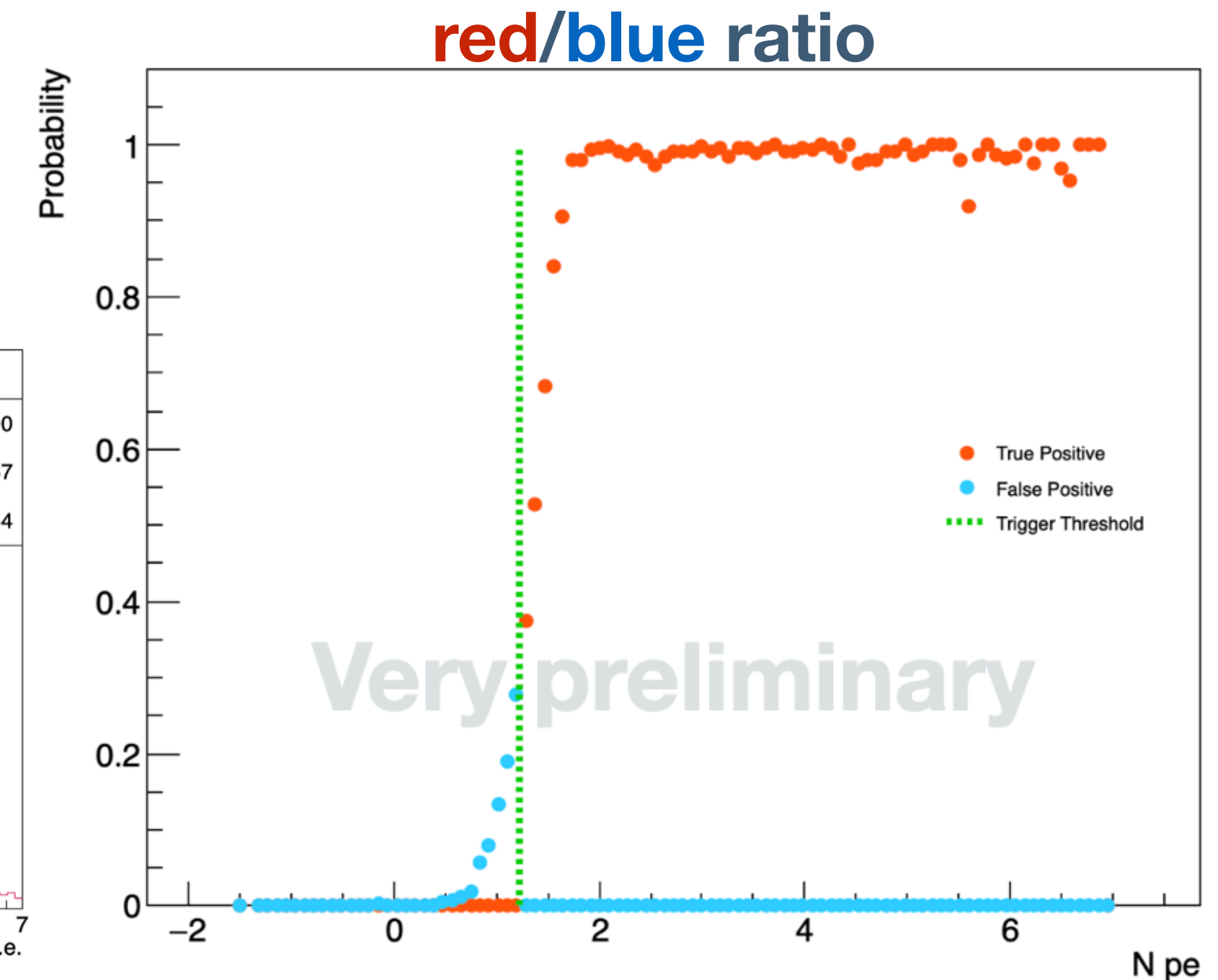
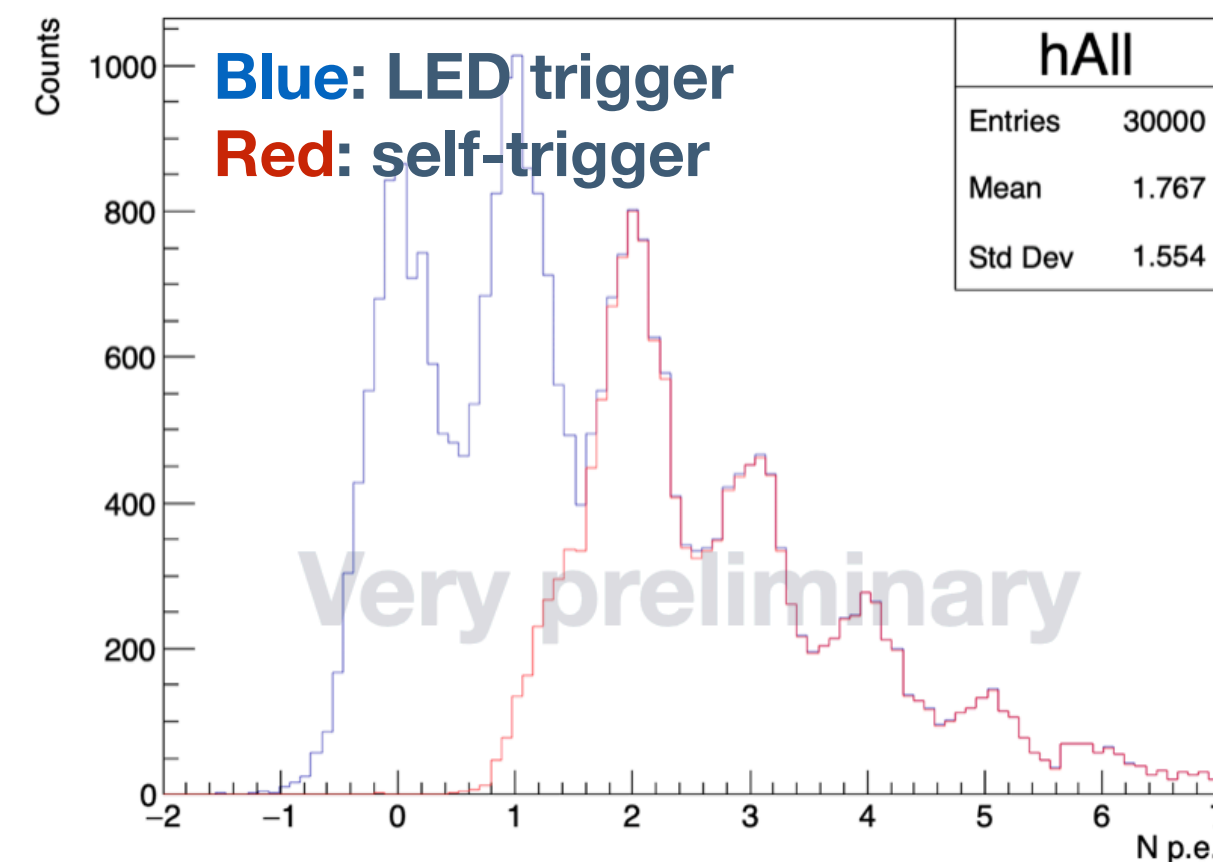
What you plan to do between tomorrow and Tuesday

- Select a **self-trigger** algorithm among the 4 being currently benchmarked
- **Self-trigger rate** vs threshold
- **LED calibration** system has been successfully commissioned but systematic calibration is pending (1 day)
- Commissioning of **APA1** in full streaming mode
- Finalize **Data Quality Monitoring (DQM)** plots for shifters
- **Shift checklist:** DCS and DQM regular checks
- Take regular runs with **all subsystems**
- Increase the number of **FELIX fiber links** to relax the bandwidth pressure for self-trigger mode APAs (2-4). **Hard for next week but to be kept in mind**

Items in blue not possible if current problems are not solved

Self-trigger algorithms

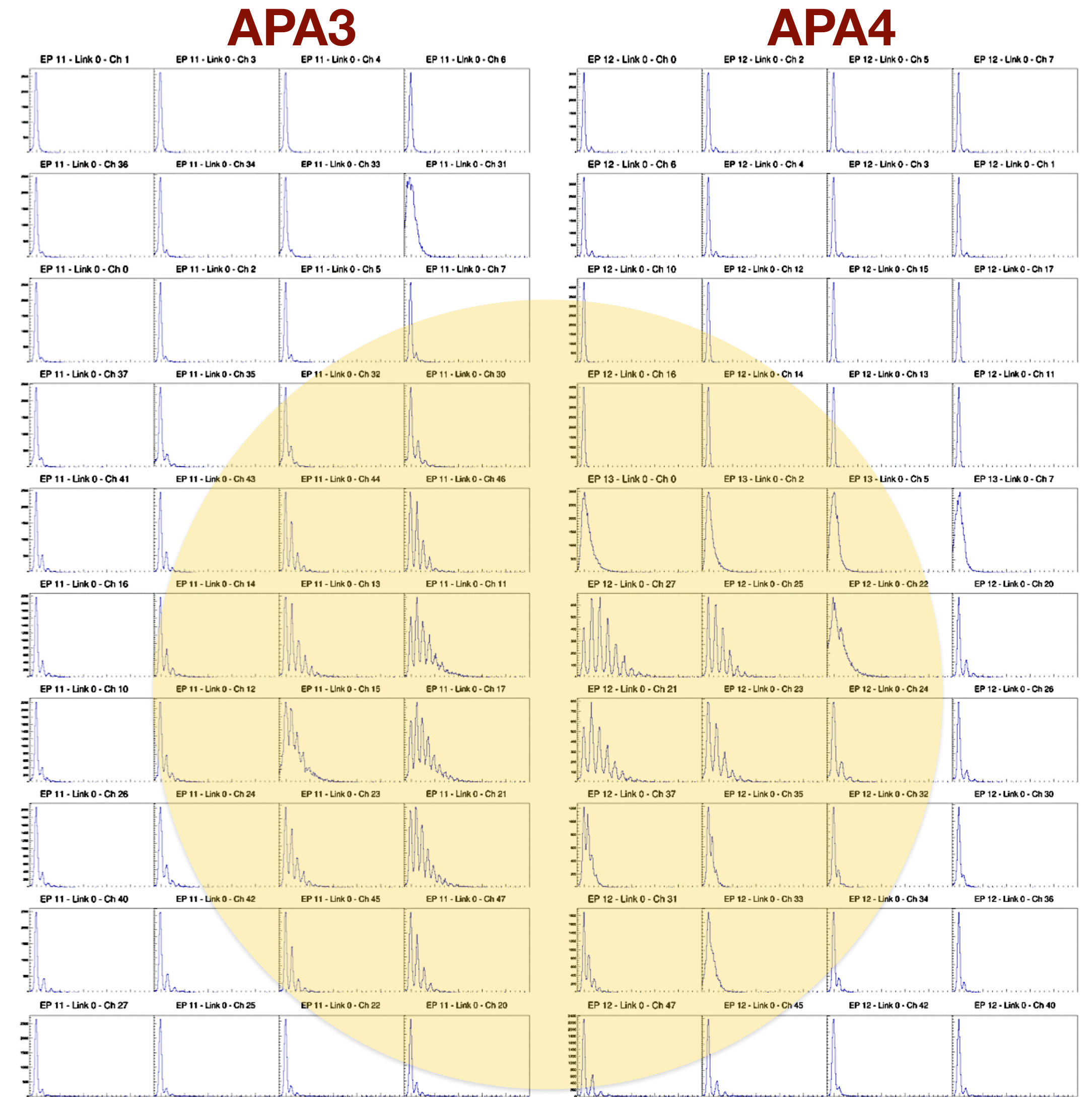
- Select one of the algorithms for next week
- The final algorithm for august will be most likely a combination of several
- Two independent efficiency tests:
 - Standalone test bench in MiB laboratory with LED pulser (shown in the plots)
 - NP04 studies with LED calibration system
- Results of all algorithms to be presented at next NP04 PDS meeting on Thursday



LED calibration

- LED calibration system with 5 independent diffusers in each side of the cathode
- Applications:
 - Characterise single photo electron (spe) response for all channels
 - Self-trigger efficiency studies
- Tune intensity to obtain suitable spe spectrum in all channels: **DONE** except for **APA1**
- Ongoing systematic calibrations

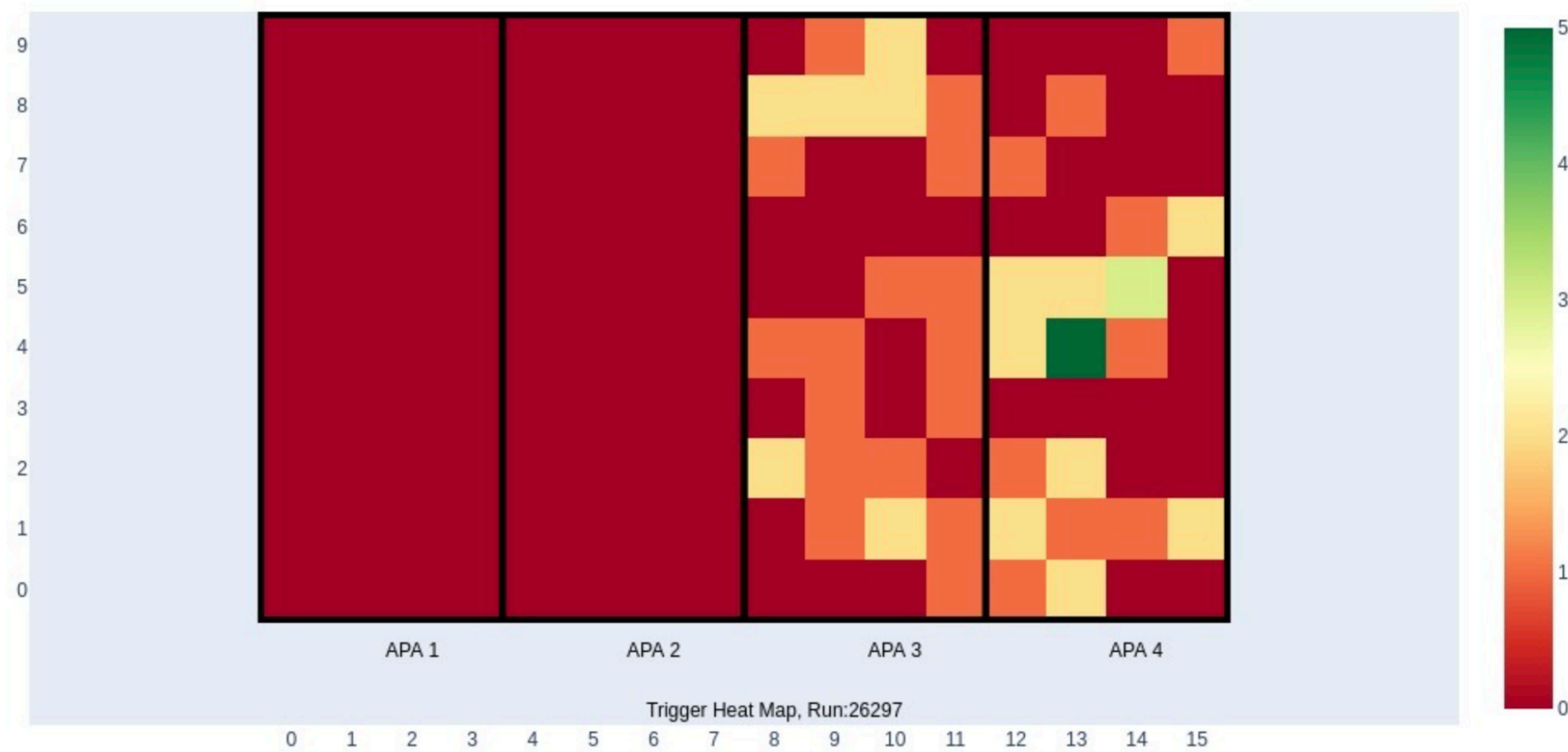
Example with only central diffuser ON



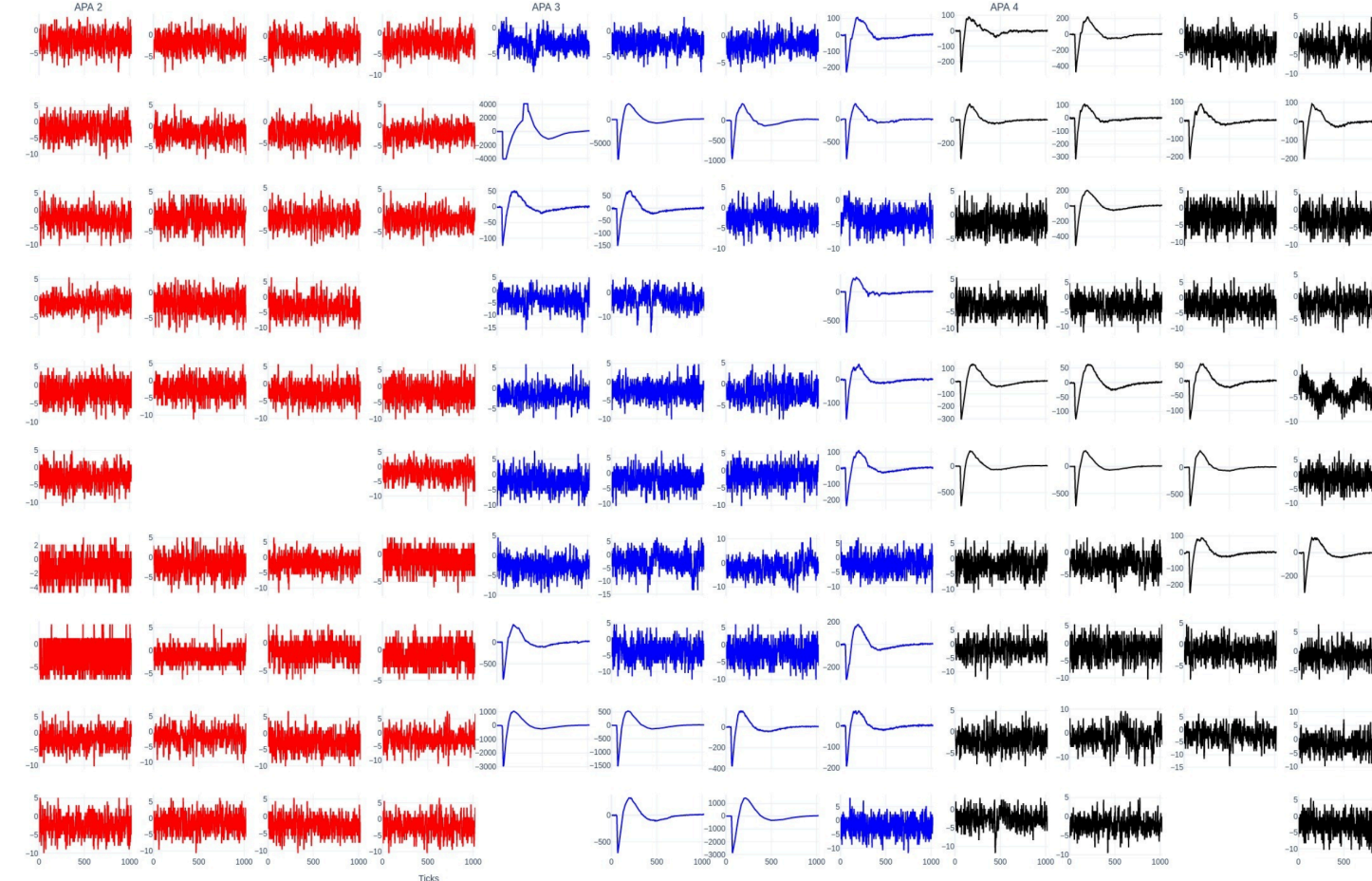
DQM plots for shifters

- Few **DQM** single record plots are ready through “official” DAQ dqmtools

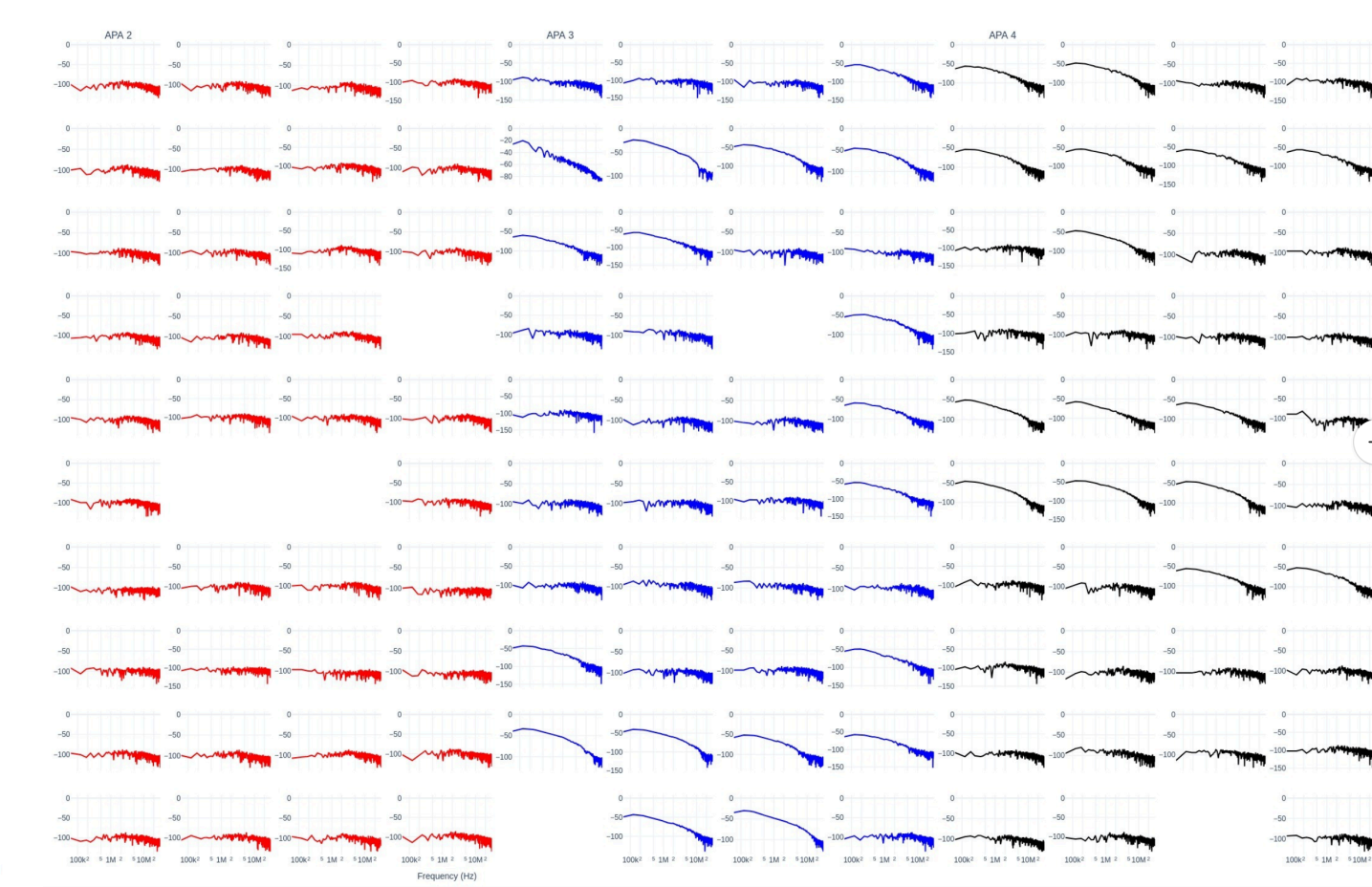
Trigger rate per channel



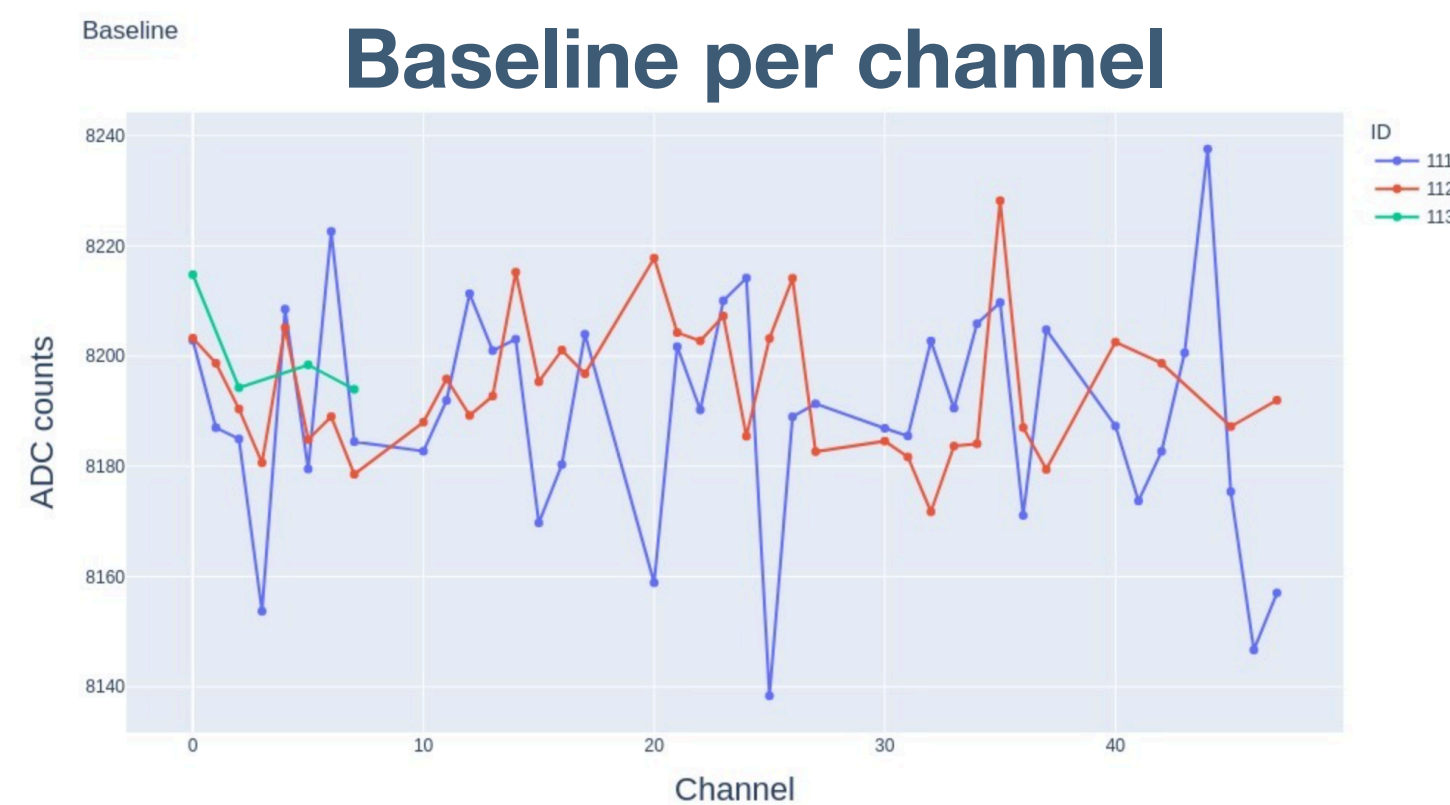
Average waveform per channel



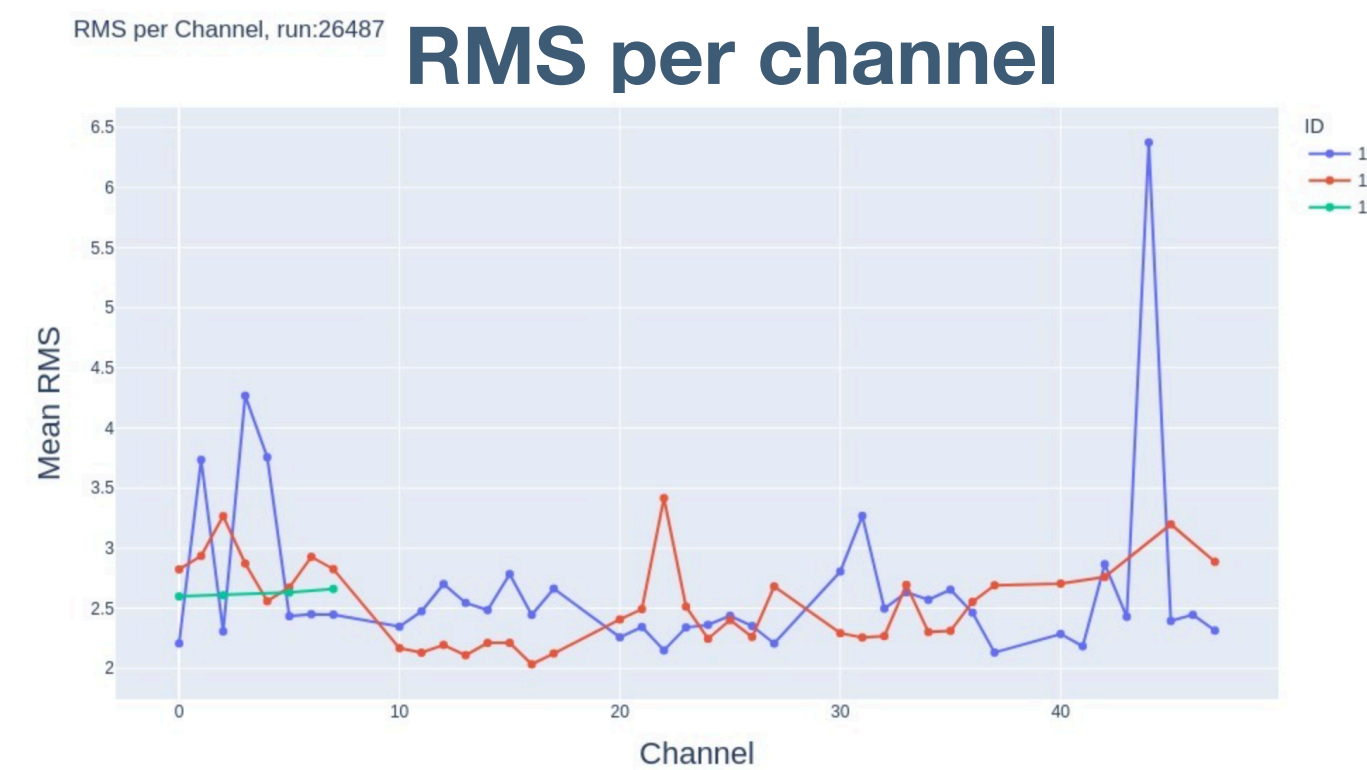
FFT per channel



Baseline per channel



RMS per Channel, run:26487



Statistical plots

- But statistical plots are not currently possible
- Working on a custom set of plots to be automatically updated using a different application. Considering to options for automatised visualization:
 1. PDS waffles display (dash)
 2. `dqm_display.py`, which automatically shows latest version of a plot

The image shows two side-by-side screenshots of a web application. The left screenshot is the 'WAFFLES DISPLAY' dashboard. It features a teal header with the 'WAFFLES DISPLAY' logo. Below the header, there are several sections: 'Default Folders' with a 'Select...' dropdown; 'Folder' with an 'Enter the folder' input field; 'Run' with a 'Select a file...' dropdown; 'Choose a Display' with a 'Home' dropdown; and 'Choose your Endpoints:' with a list of checkboxes for endpoints 104, 105, 107, 109, 111, 112, and 113. Below this is a 'Number of waveforms' section with a '500' input field and a 'PLOT' button. The right screenshot is the 'DUNE PDS TOOLS' main page. It has a teal header with the text 'DUNE PDS TOOLS'. The main content area has a white background with the heading 'Welcome to our main page!' and a house icon. Below the heading, there is instructional text: 'For visualizing you need to make sure that the .root files for the run you are interested in are already processed. If not, go to your terminal and execute `python 00_HDF5toROOT.py`. Once the .root files are ready, you need to select the folder where they are located.' This is followed by a bulleted list of instructions: 'There are some default folders available for you to choose from that will pick the data that is in the common /eos/ folder.', 'If you do not want any of those you can just enter your folder in the Folder', 'Then you need to choose between the runs that are inside Run', 'Choose your visualizer with the dropdown menu :)', 'Finally, you need to select the endpoints to want to visualize and if it proceed the number of waveforms to accumulate.', and 'Do not forget to push the Plot button to produce them.'

Increase bandwidth for self-trigger

- APA2-APA4 will operate in self-trigger mode
- Enabling proper reduction of the self-trigger threshold (to 1.5 p.e.) requires increasing the bandwidth
- We could use up to 4 FELIX links for each DAPHNE. This requires **new firmware** (almost ready) and **adding more fibers** to APA2-4 daphnes

