

ProtoDUNE Photon Detection Update

March/April 2019

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ProtoDUNE PD Update, March/April 2019

PDS Test Run: March 18th – April 7th

- Calibration Module Runs
- Stability Runs
- Noise Runs
- Cosmic Ray Tagger Runs
- Cosmic Telescope Runs
- Test runs have been recorded:
[on this google sheet.](#)

Run #	Run Goal	Run Time (min)	Ext Trigger	Data Stream	SFP Internal/Ext	APAs Included	TPC Includes?	CRT Includes?	Trigger rate	configuration file	HV (V)	Flashing LED	pulse height	pulse seqs	pulse seqs	pulse width	special instruction	#triggers	Comment	
2	Ex								25	last_run_confg_001	1800	Ru50a5uLLuLLUR	0x0010008	0x001FFFF	0x008	0x0				
3	MPPC Cal	7218	~20min	DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nominal MPPC Bias	100000	HV=0
4	MPPC Cal	7243		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias+1.0V	100000	HV=180
5	MPPC Cal	7251		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias+0.5V	100000	HV=0
6	MPPC Cal	7255		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias-0.5V	100000	HV=0
7	MPPC Cal	7283		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias-1.0V	100000	HV=130
8	MPPC Cal	7287		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias-1.5V	100000	HV=140
9	MPPC Cal	7272		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFFF	?	0x0	nom MPPC Bias-2.0V	100000	HV=170
11	MPPC Cal	7224		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nominal MPPC Bias	100000	HV=0
12	MPPC Cal	7245		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias+1.0V	100000	HV=180
13	MPPC Cal	7252		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias+0.5V	100000	HV=0
14	MPPC Cal	7259		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias-0.5V	100000	HV=0
15	MPPC Cal	7264		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias-1.0V	100000	HV=130
16	MPPC Cal	7268		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias-1.5V	100000	HV=140
17	MPPC Cal	7273		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFFF	?	0x0	nom MPPC Bias-2.0V	100000	HV=170
19	MPPC Cal	7225		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nominal MPPC Bias	100000	HV=0
20	MPPC Cal	7248		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias+1.0V	100000	HV=0
21	MPPC Cal	7253		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias+0.5V	100000	HV=0
22	MPPC Cal	7260		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias-0.5V	100000	HV=0
23	MPPC Cal	7265		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias-1.0V	100000	HV=130
24	MPPC Cal	7269		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias-1.5V	100000	HV=160
25	MPPC Cal	7274		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFFF	?	0x0	nom MPPC Bias-2.0V	100000	HV=170
27	MPPC Cal	7226		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nominal MPPC Bias	100000	HV=0
28	MPPC Cal	7249		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias+1.0V	100000	HV=0
29	MPPC Cal	7254		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias+0.5V	100000	HV=0
30	MPPC Cal	7261		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias-0.5V	100000	HV=0
31	MPPC Cal	7266		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias-1.0V	100000	HV=130
32	MPPC Cal	7270		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias-1.5V	100000	HV=160
33	MPPC Cal	7275		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x302	0x001FFFF	?	0x0	nom MPPC Bias-2.0V	100000	HV=180

Calibration Module Run

- Reminder of Layout
 - 5 diffusers per drift volume
 - Three are out of commission
 - UL-RaS, UR-DaS, Center-DaS
- Test Runs
 - Bias scans, varying LED pulse peak height
 - Verifying photosensor calibrations
 - Individual LED Runs
 - Verify PD-tracking
 - Stability Runs
 - Check for module consistency & degradation

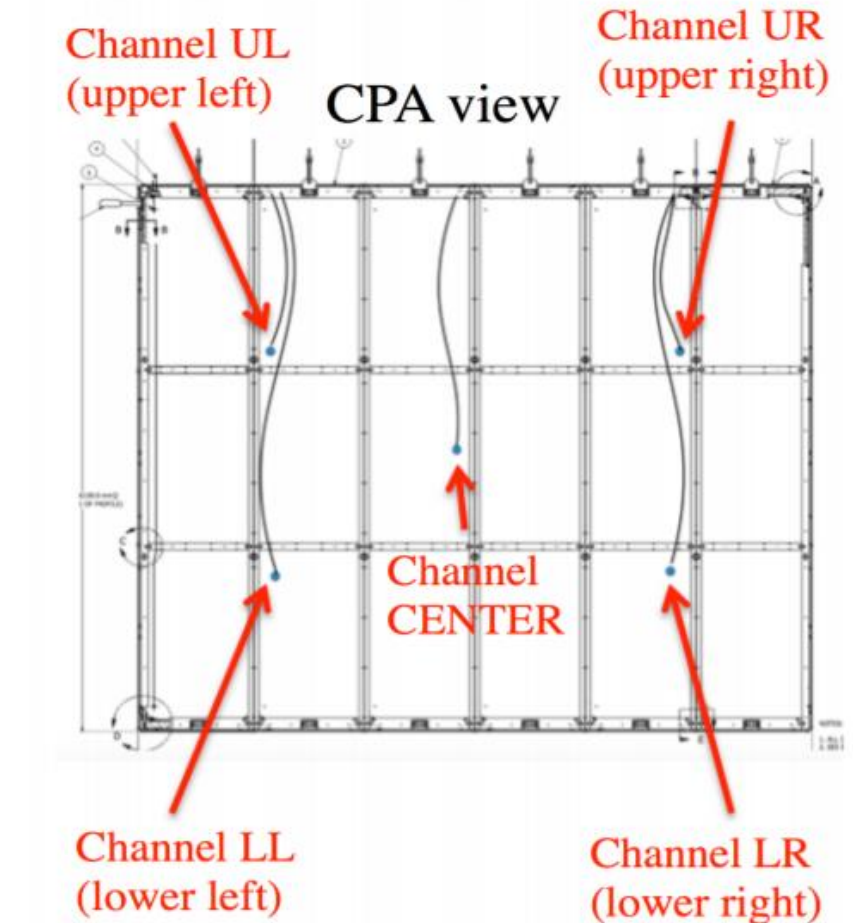
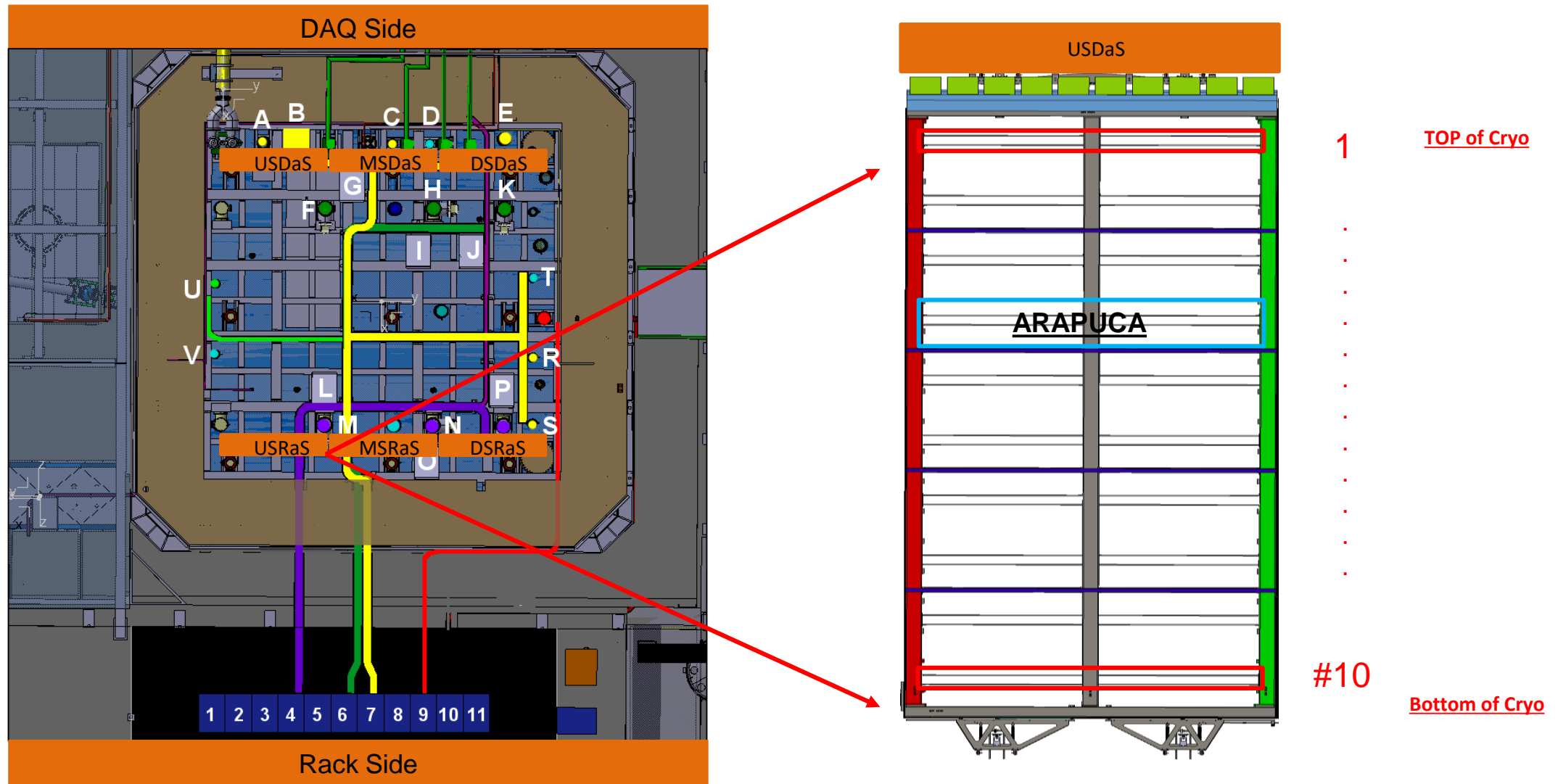


Figure 2: An CPA view from APA, with five light diffuser locations.

Zelimir Djurcic, et al.
[DUNE-doc-#11191-v3](#)

PD Module Layout



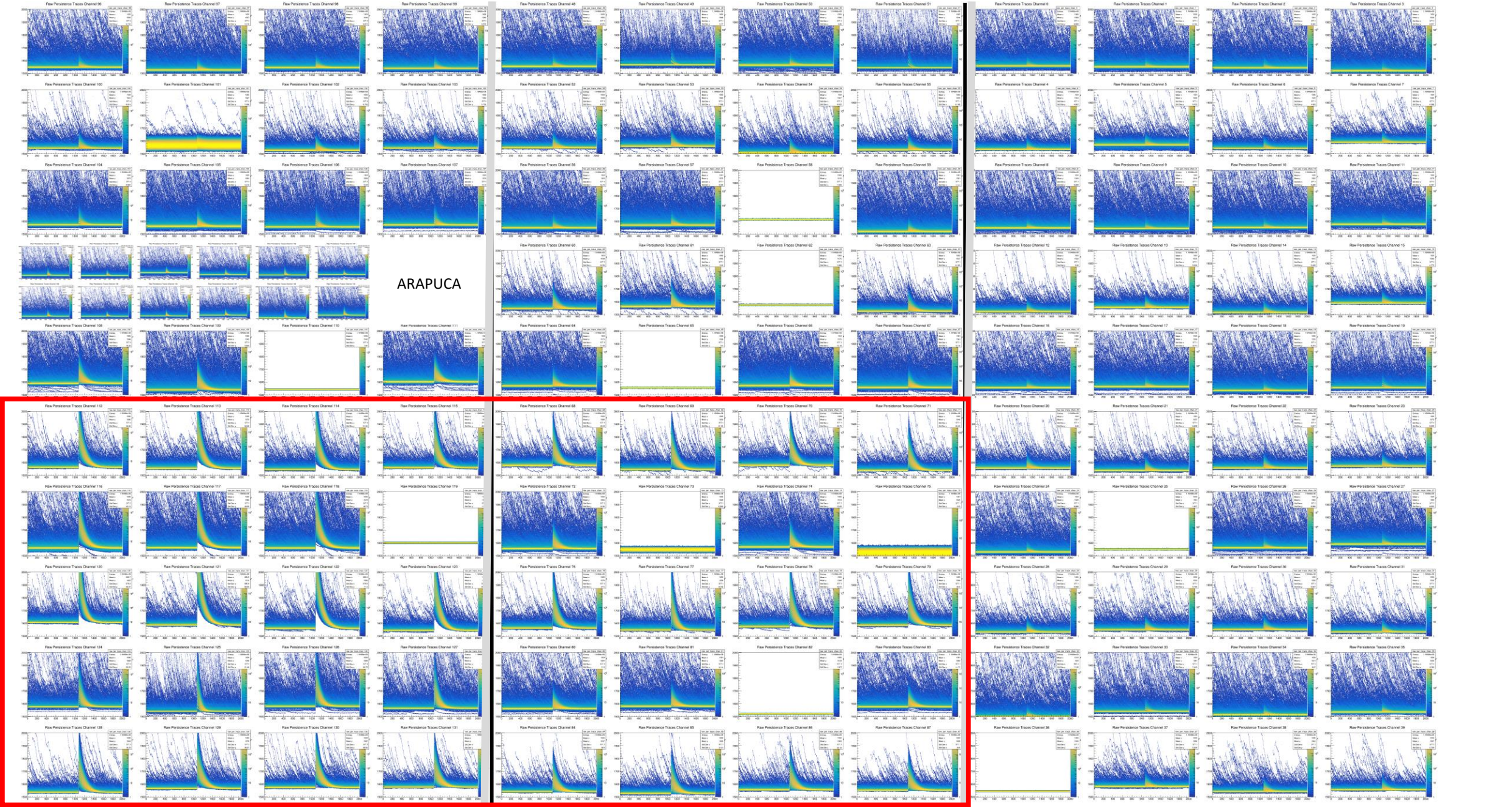
APA_1_3_Run_Run7435 Raw Data Persistence Traces- Flashed Lower-Left Diffuser

APA-3

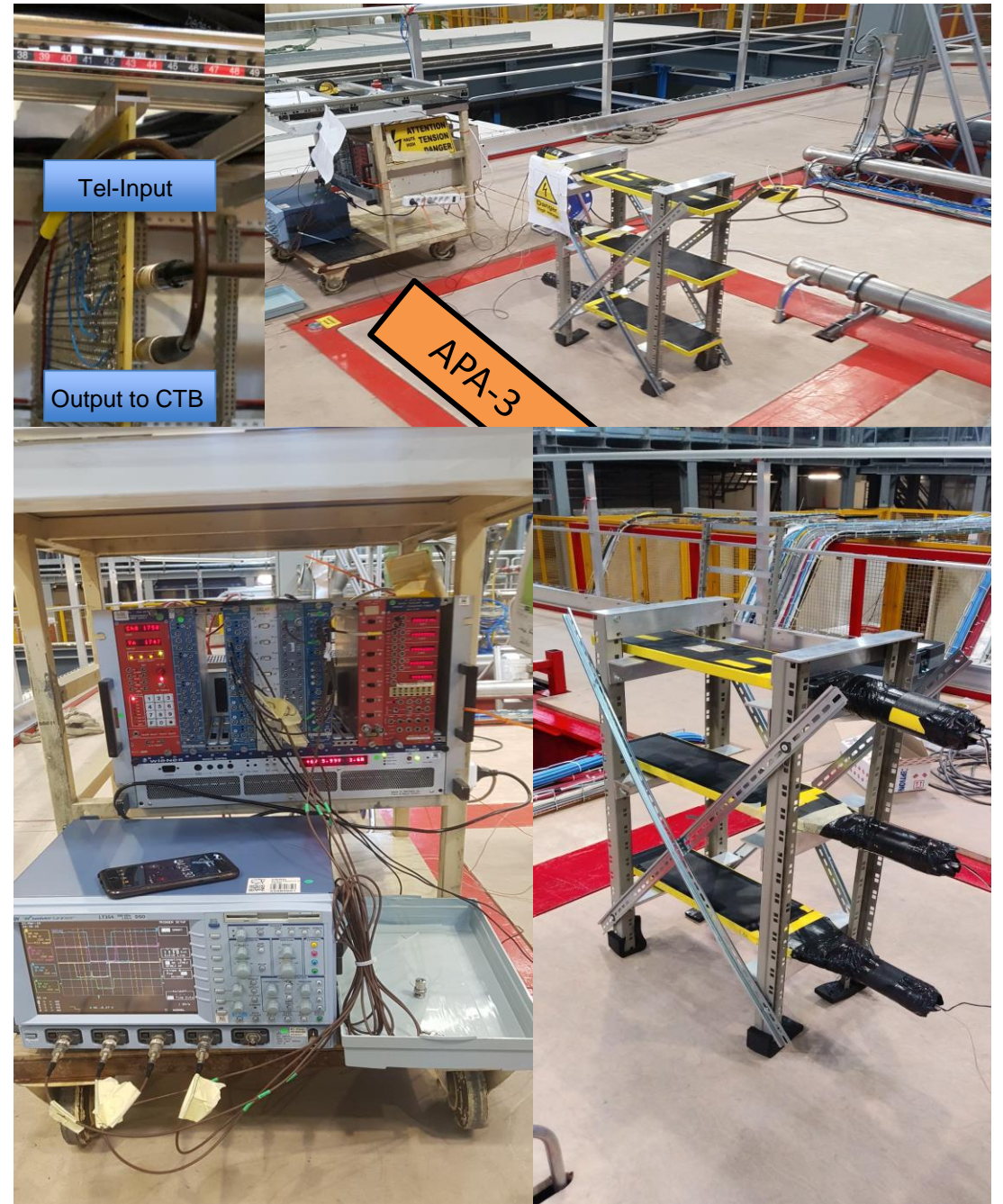
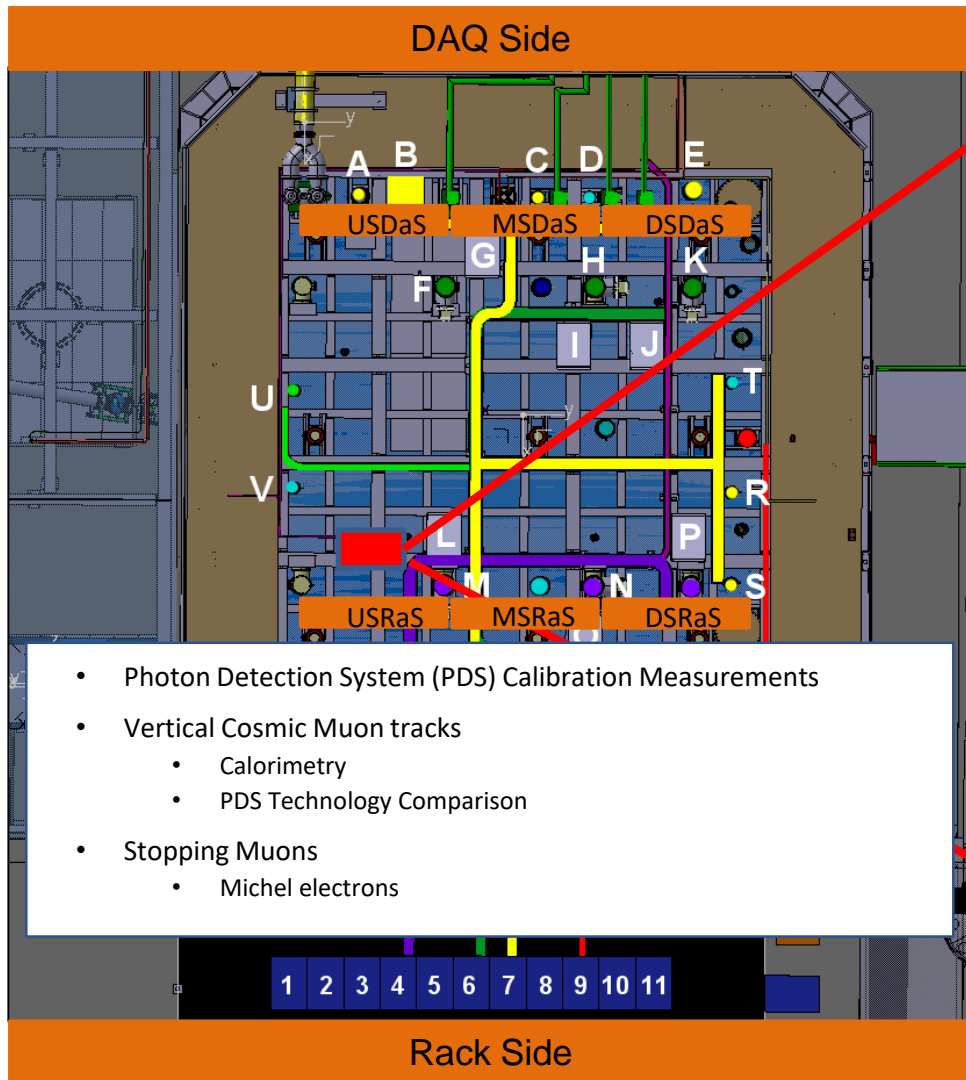
APA-2

APA-1

ARAPUCA

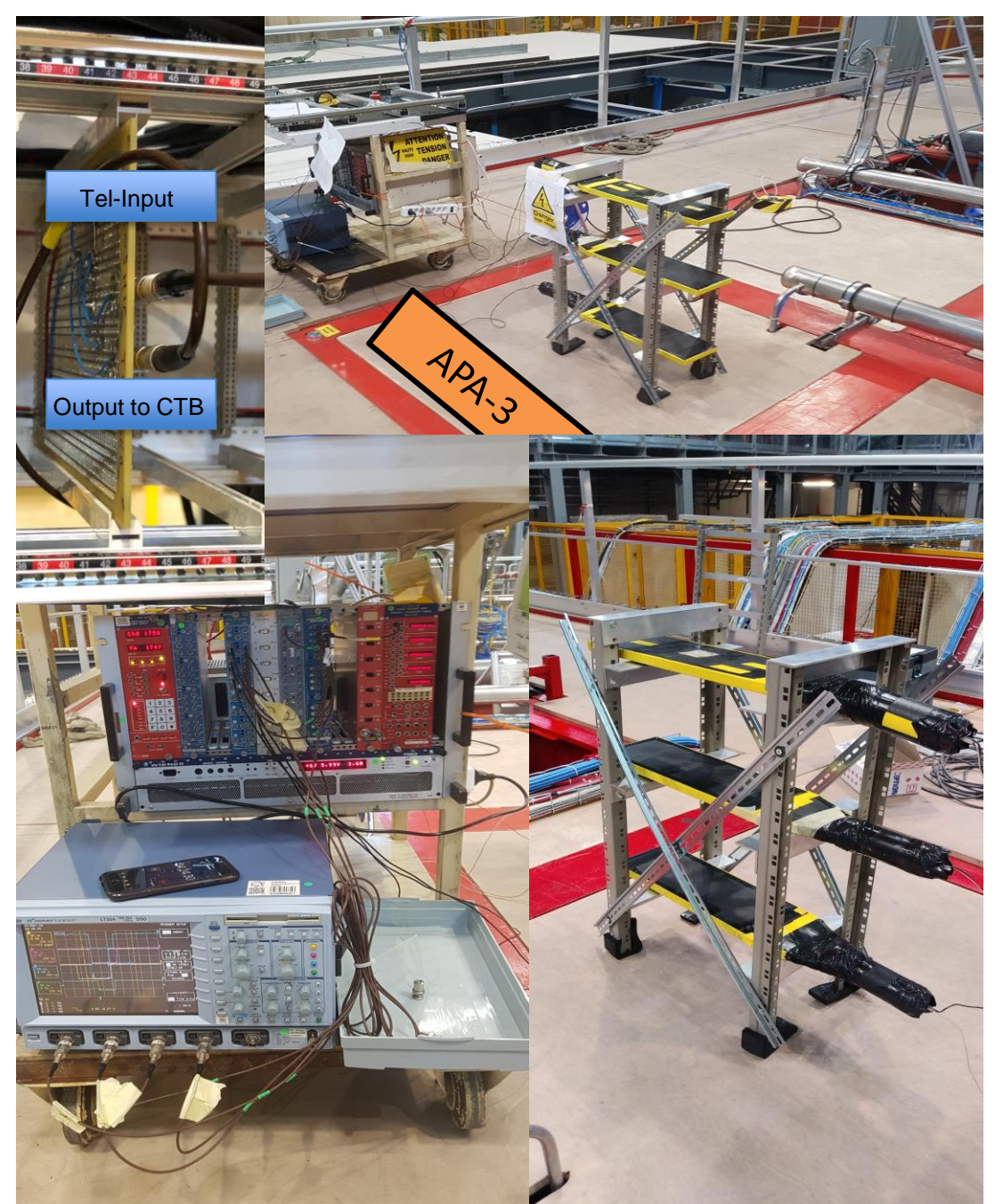


Cosmic Telescope

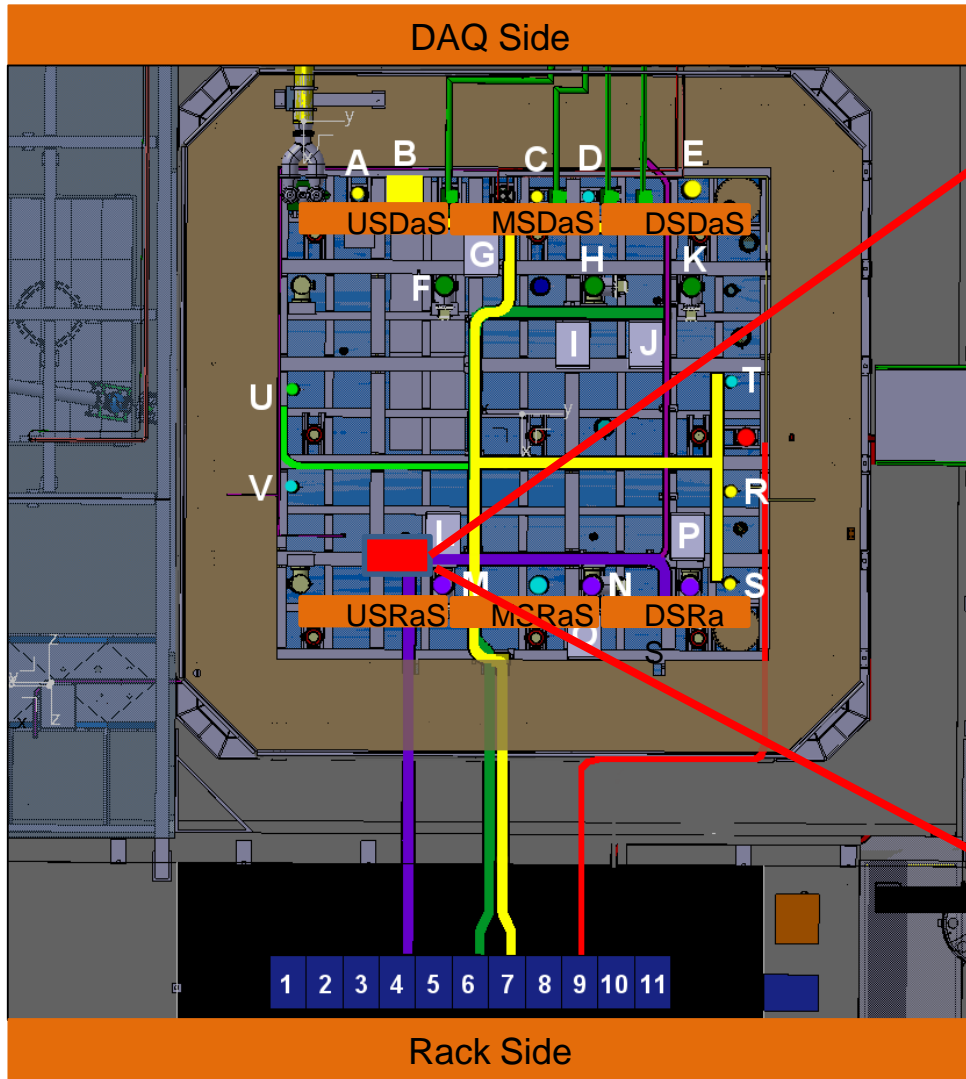


Cosmic Telescope

- Using 3-fold coincidence
 - 3 Scintillating Paddles
- Designated CTB trigger input
 - Thank you Xavier!
- Reading out w/ DAQ!
 - Many sample runs available
 - [Please see hyperlink](#)
- Still in progress
 - Verify all triggers are accounted for
 - Looking into dropped events
 - Verify tracks with TPC



Cosmic Telescope “Above” APA3

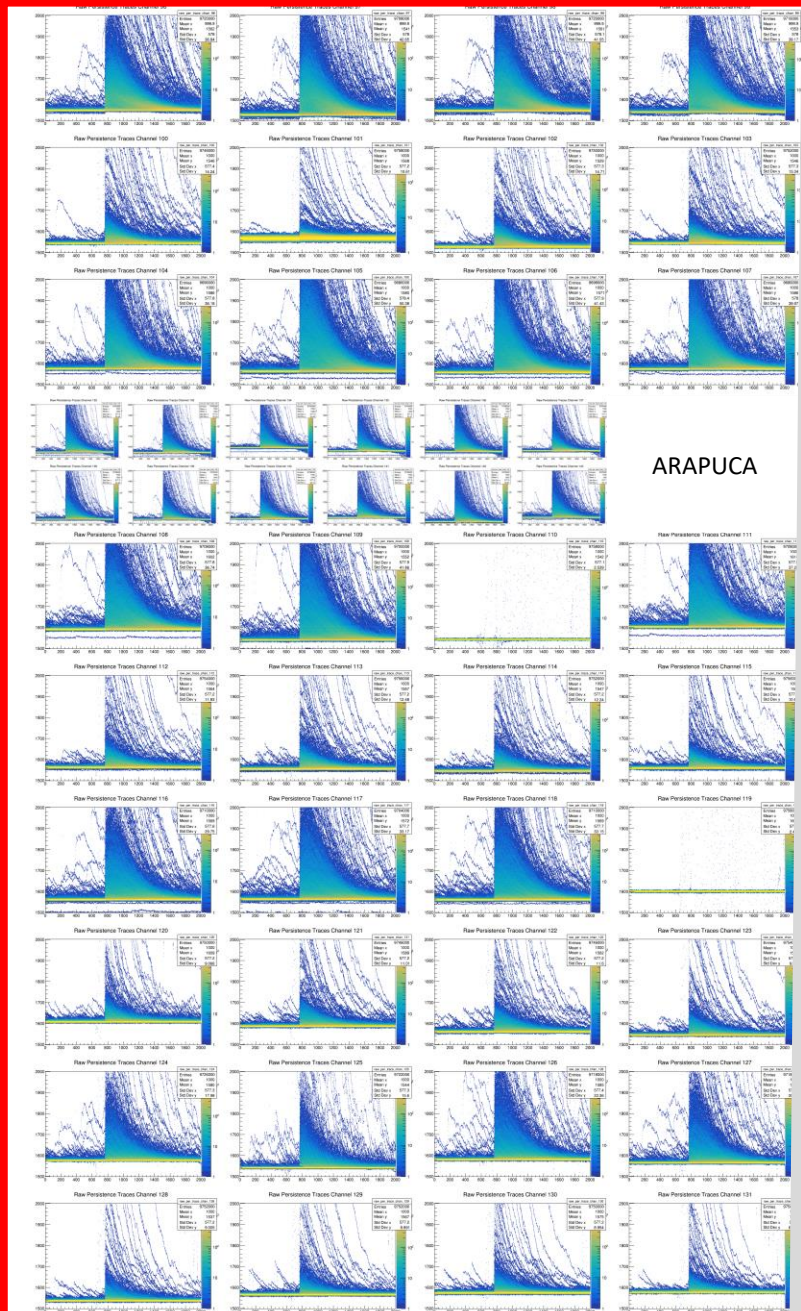


APA_1_3_Run_Run7278 RAW DATA- Persistence Traces – Telescope Above APA3

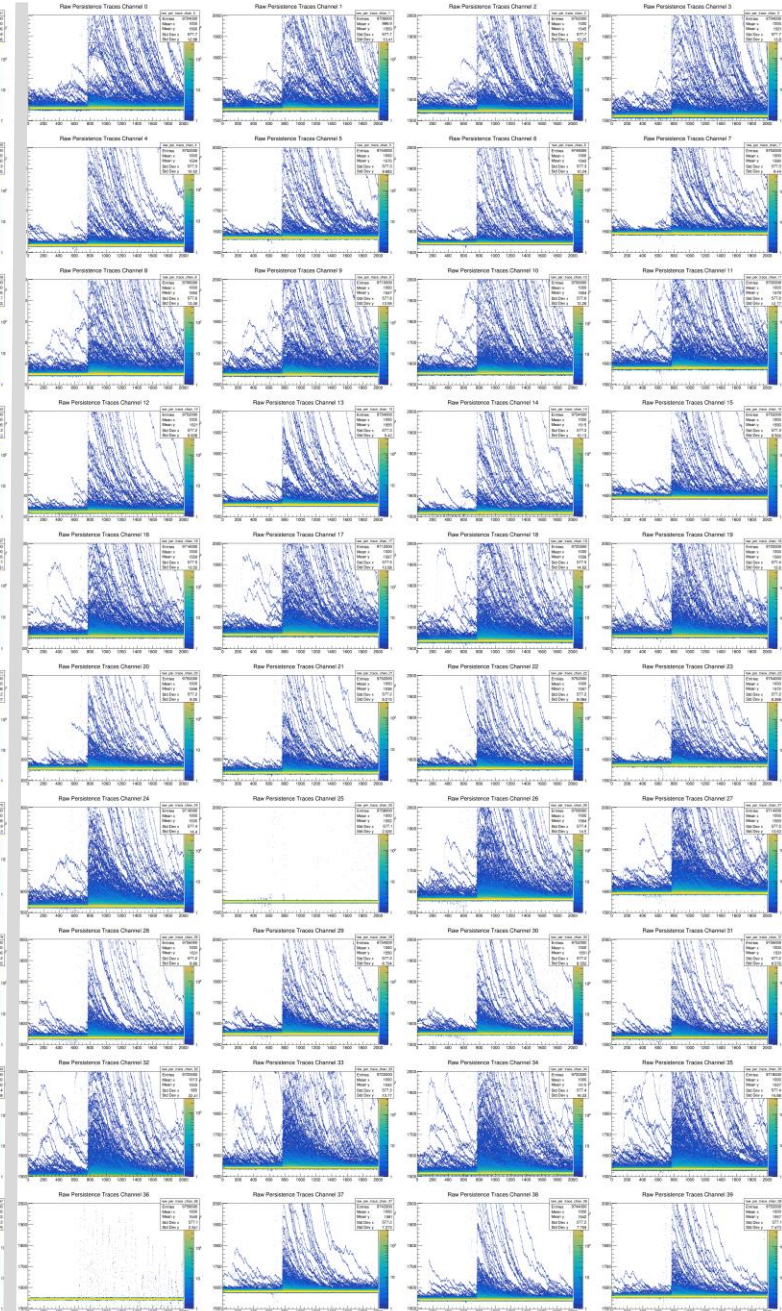
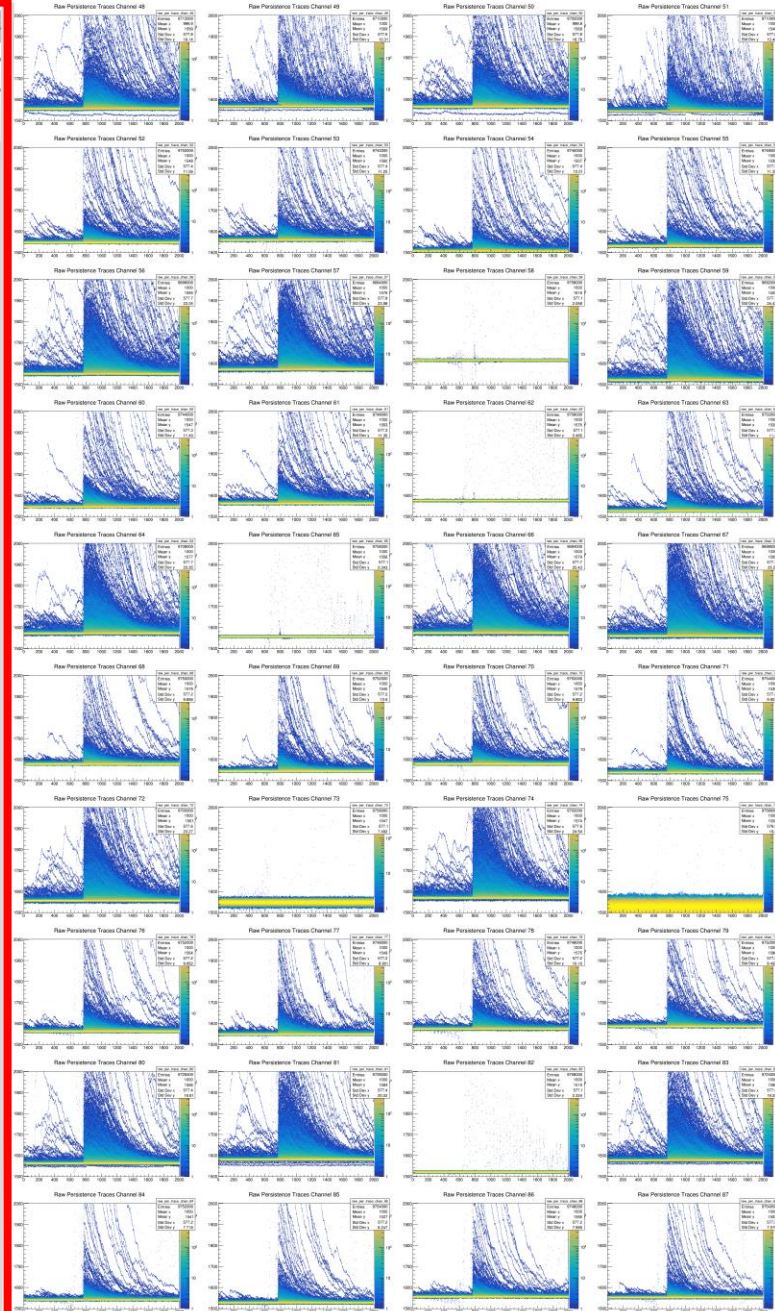
APA-3

APA-2

APA-1

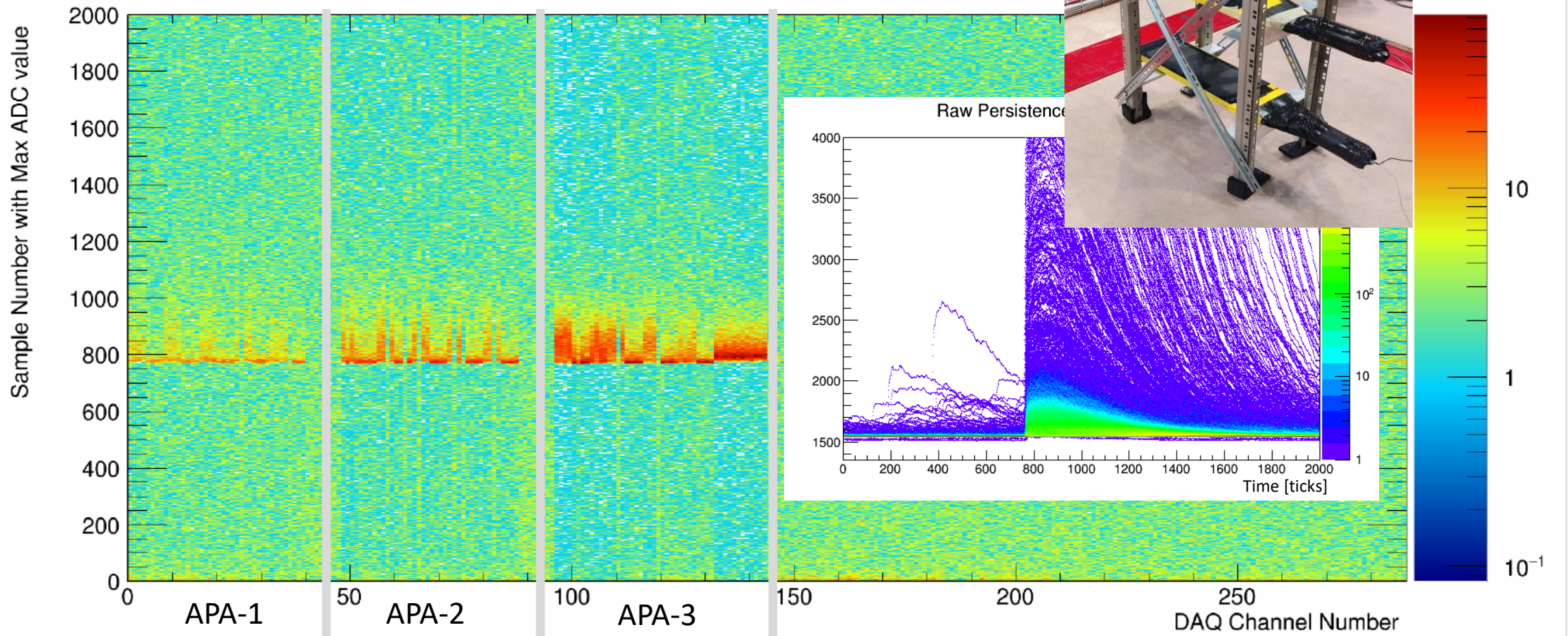


ARAPUCA



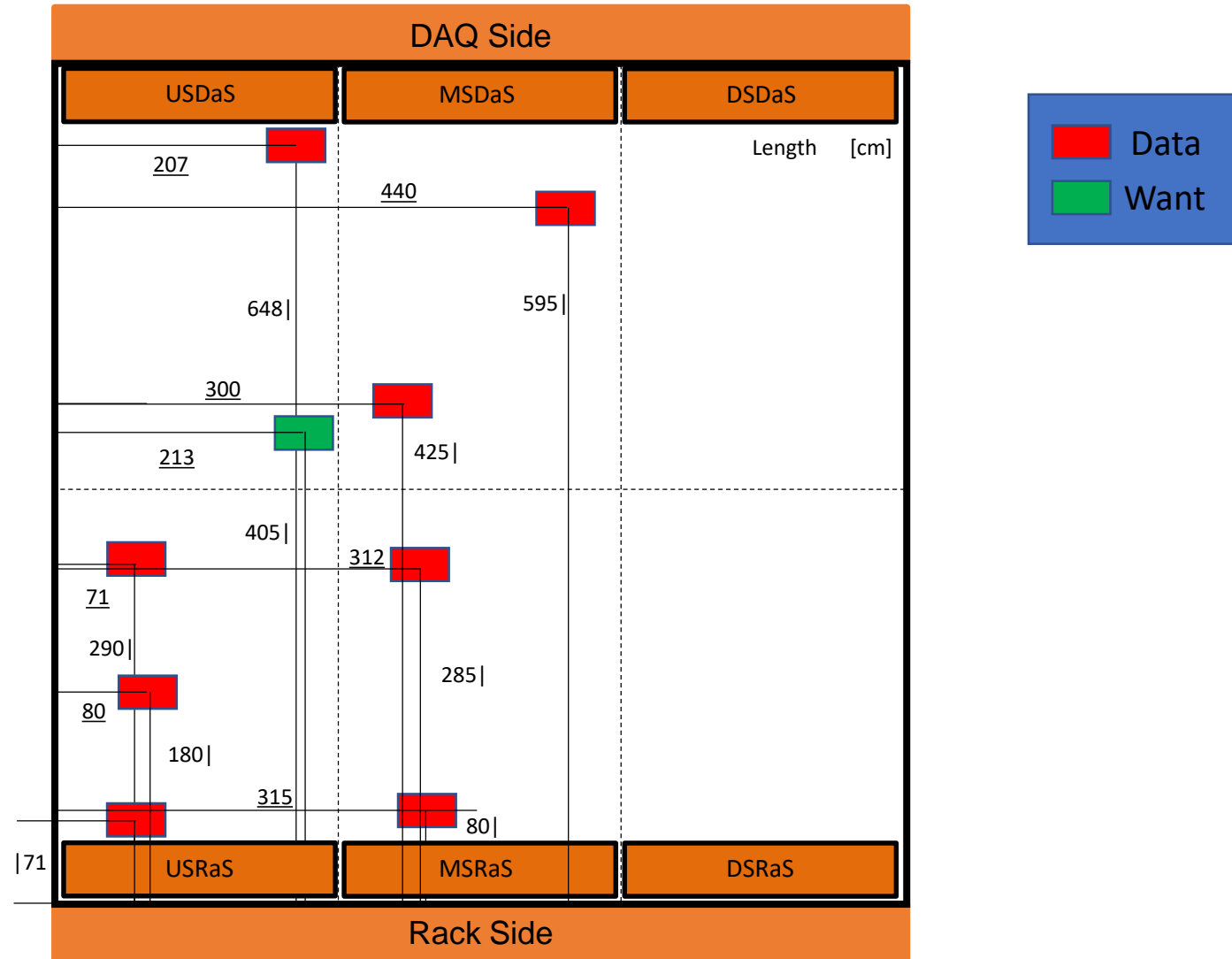
Telescope alignment →

Run 7278



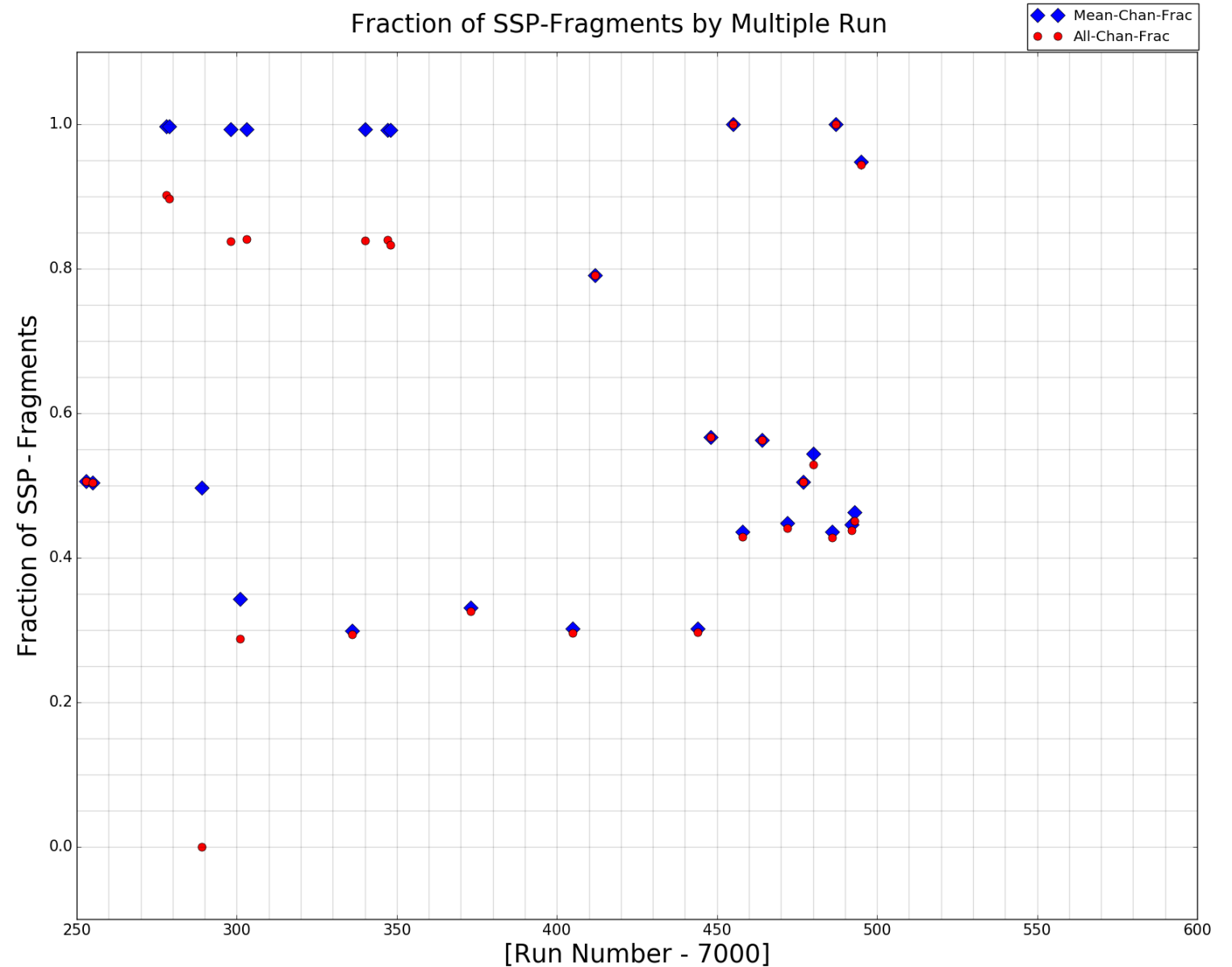
Thanks, Leon!

Cosmic Telescope Measurement Positions



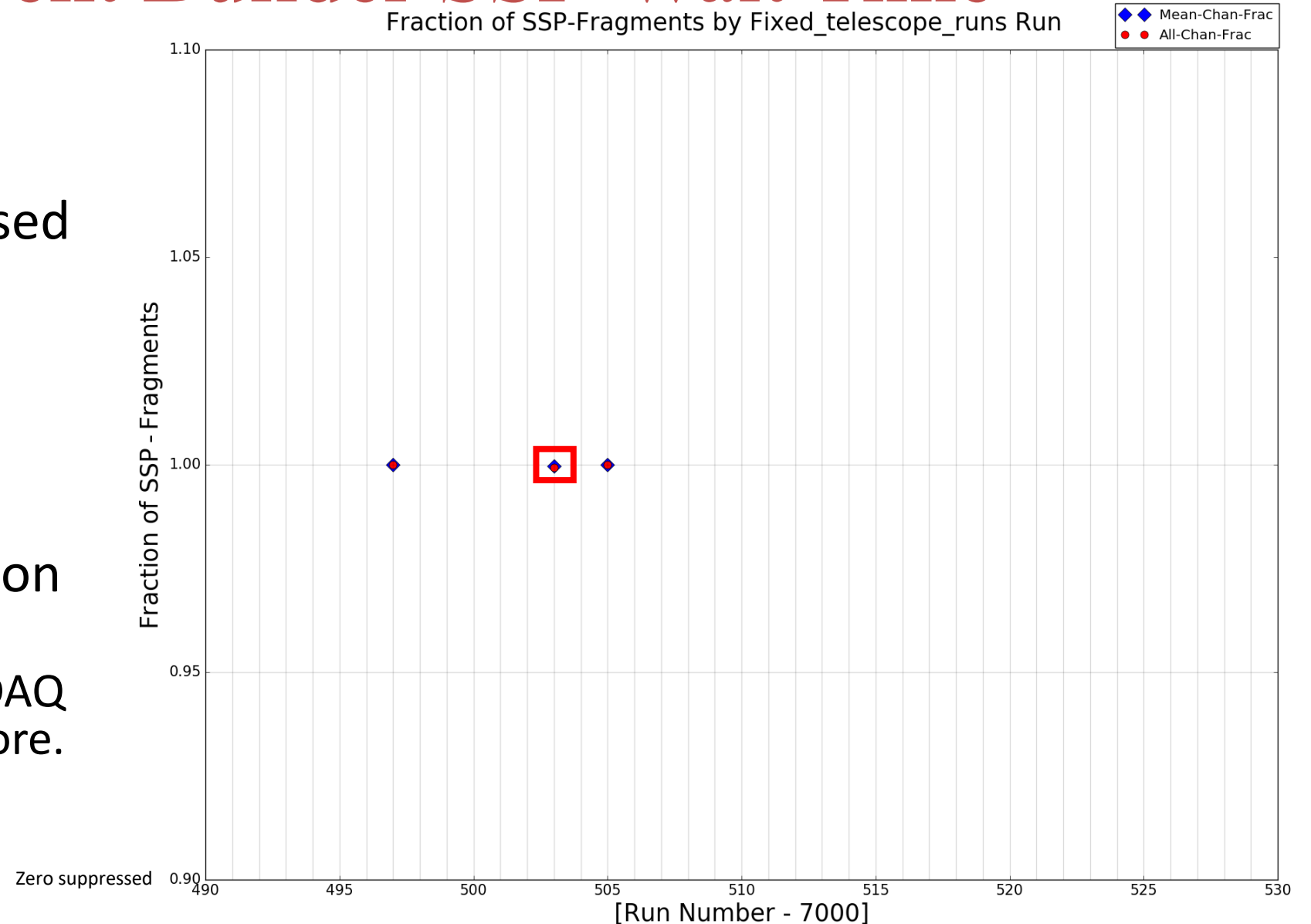
Multiple Runs

- Found many dropped SSP-fragments when looking at recent runs
 - Varied per run
- Problem has been notified to DAQ group
 - Further investigation are being looked into today (DAQ Friday)



Increased Event Builder SSP-Wait Time

- DAQ group increased Event Builder wait time in order to recover most dropped SSP-fragments
- Further investigation is ongoing.
 - But should let a DAQ Expert explain more.



PDS Test Run: March 18th – April 7th

- Calibration Module Runs ✓
- Stability Runs ✓
 - Many taken
- Noise Runs ✓
- Cosmic Ray Tagger Runs ✓
- Cosmic Telescope Runs ~ ✓
 - Many taken, but still ongoing
- Test runs have been recorded [on this google sheet.](#)

Run ID	Run Goal	Run Time (min)	Ext Trigger	Data Stream	SFP Internal/Ext	APAs Included	TPC Includes?	CRT Includes?	HV (V)	Flashing LED	Pulse Height	Pulse Sels	Pulse Sels	Pulse Width	Special Instruction	Comment	
7218	MPPC Cal	~20min	DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFF	?	0x9	nominal MPPC Bias
7243	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x686	0x001FFF	?	0x9	nominal MPPC Bias+1.0V
7251	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x686	0x001FFF	?	0x9	nominal MPPC Bias+0.5V
7255	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFF	?	0x9	nominal MPPC Bias-0.5V
7283	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFF	?	0x9	nominal MPPC Bias-1.0V
7287	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFF	?	0x9	nominal MPPC Bias-1.5V
7272	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x689	0x001FFF	?	0x9	nominal MPPC Bias-2.0V
7224	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias
7245	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias+1.0V
7252	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias+0.5V
7259	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias-0.5V
7264	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias-1.0V
7268	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias-1.5V
7273	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x577	0x001FFF	?	0x9	nominal MPPC Bias-2.0V
7225	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias
7248	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias+1.0V
7253	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias+0.5V
7260	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias-0.5V
7265	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias-1.0V
7269	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias-1.5V
7274	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x491	0x001FFF	?	0x9	nominal MPPC Bias-2.0V
7226	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias
7249	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias+1.0V
7254	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias+0.5V
7261	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias-0.5V
7266	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias-1.0V
7270	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias-1.5V
7275	MPPC Cal		DCM	calibration	Ext Only	ALL	No	No	75	?	Any	ALL	0x3D2	0x001FFF	?	0x9	nominal MPPC Bias-2.0V