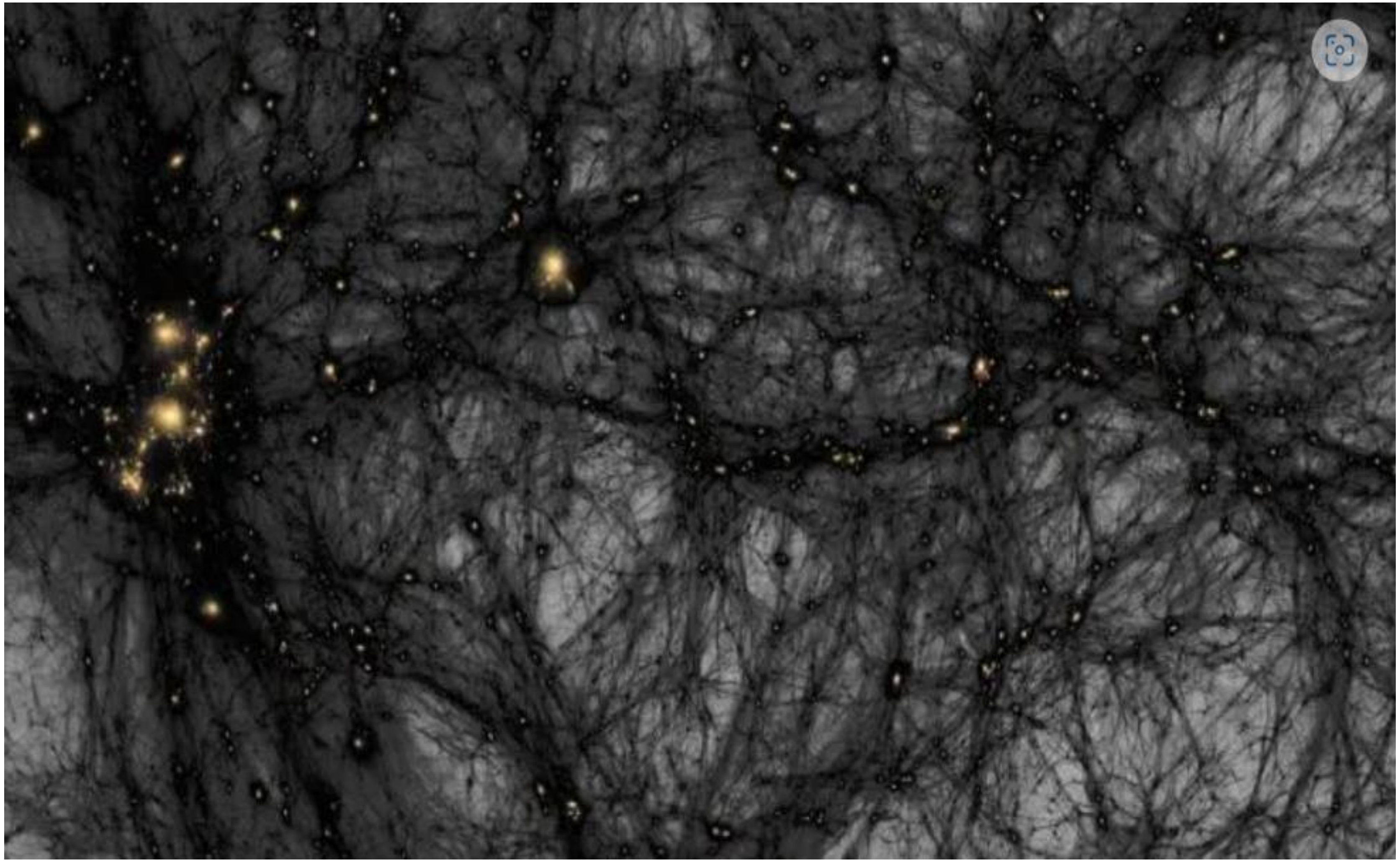
DEAP-3600

HARDWARE UPGRADES AND 'FLASHER' EVENTS

Aarchi Shah

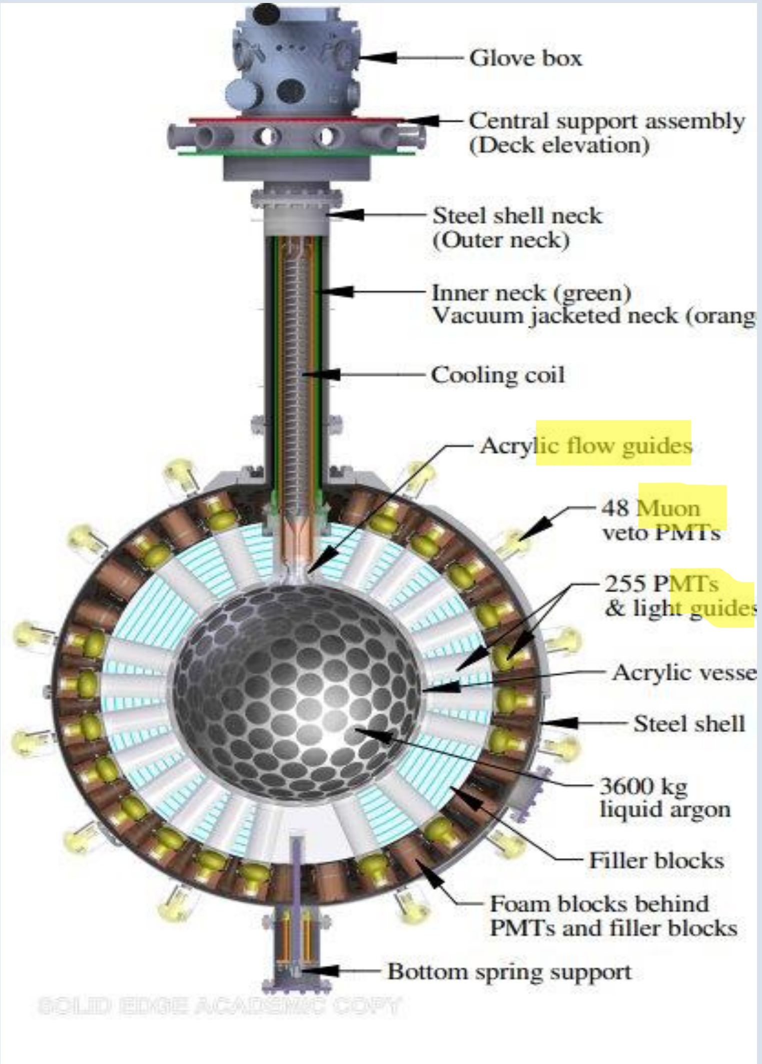
Queen's University

Dark Matter and W.I.M.Ps



W- WEAKLY
I - INTERACTING
M - MASSLESS
P- PARTICLES

About DEAP-3600



- DEAP-3600 gets its name because it uses about 3,600 kg of liquid argon

- The spherical acrylic vessel had to be brought into the lab in orange-slice shaped pieces

- Argon is kept in liquid form because if it became gaseous, it would take up almost 600 times as much volume.

Queen's UNIVERSITY

Content of the presentation

UNDERGROUND

- Worked on hardware upgrades
- Got the opportunity to go in the glove box!
- Assisted with and understood the procedures and Software

SURFACE

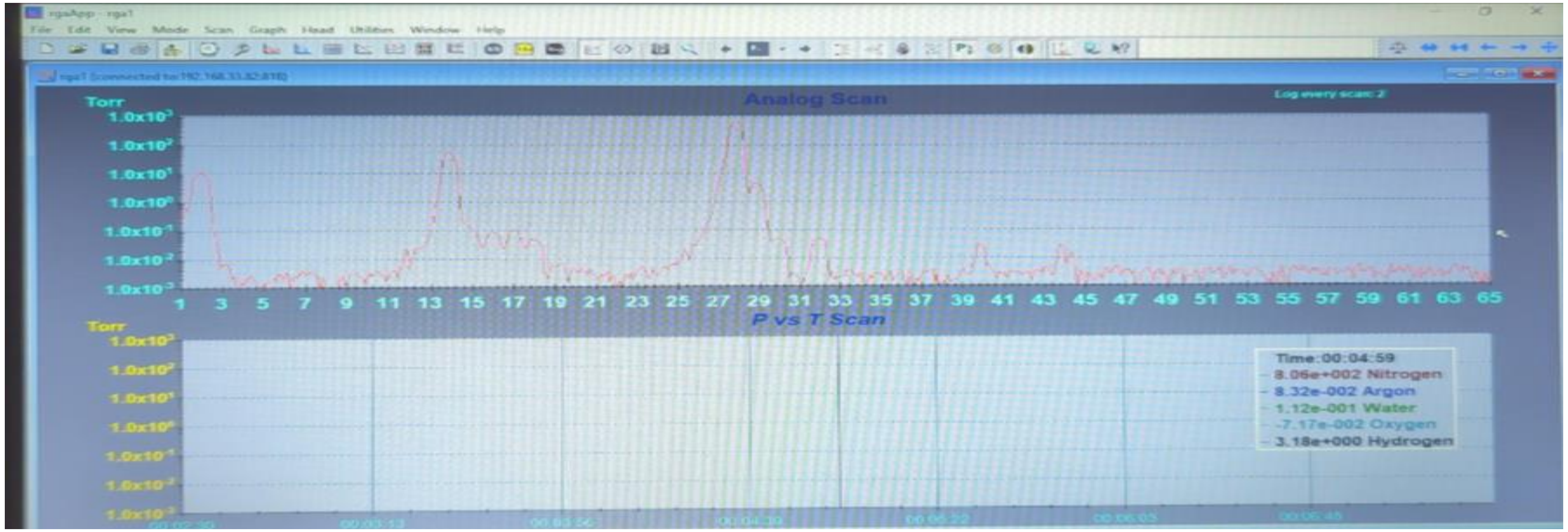
- Used ROOT to analyze data and make plots
- Categorize different events found in the root files
- Indulge deeper into one of the categories of events (Flashers)

ANALYSIS

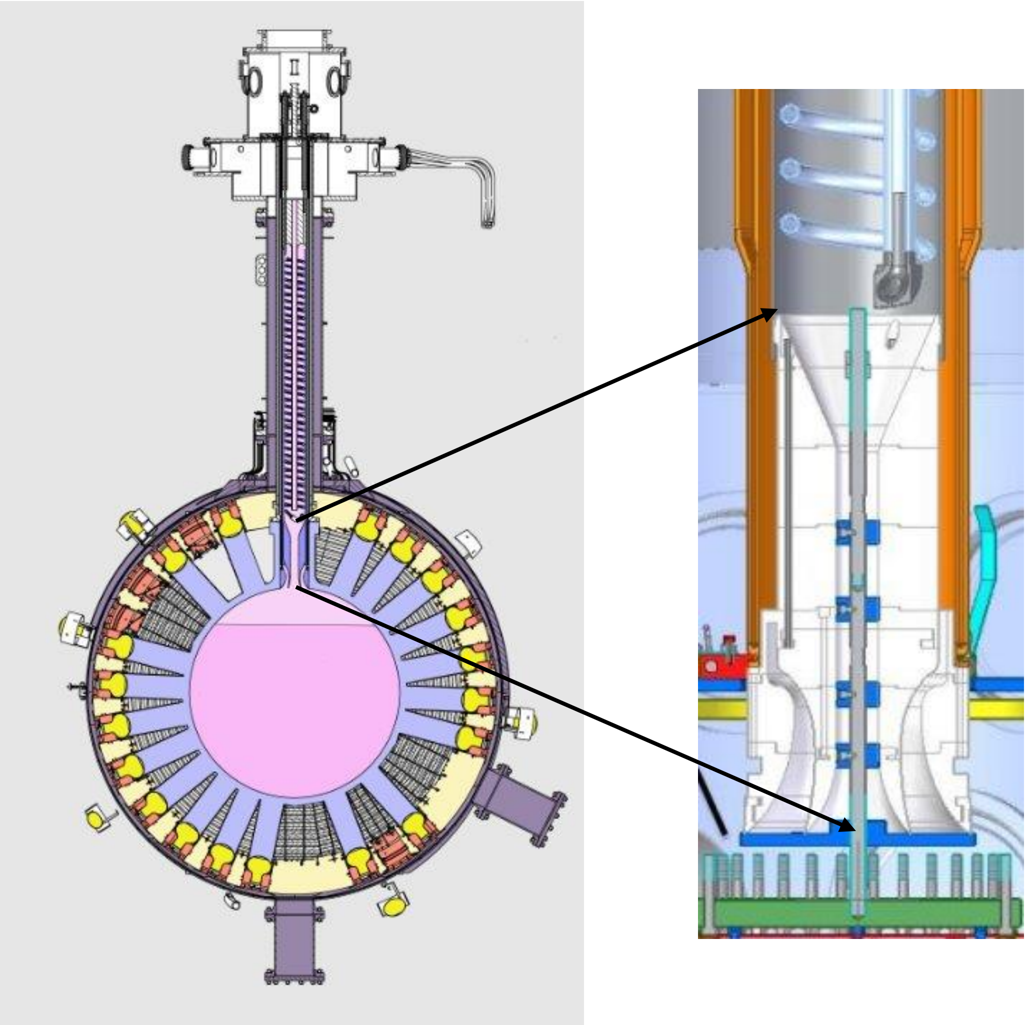
- Started with extracting data
- Made 1D, 2D histograms
- Made scatter plots

UNDERGROUND: Pump Purge Procedure

- Ensure the glovebox is not contaminated with anything but nitrogen
- Understood valves, gas flow to and from the gloves/antechamber and glovebox
- Check and set up RGA (Residual Gas analyser) to monitor gas levels and bubbling

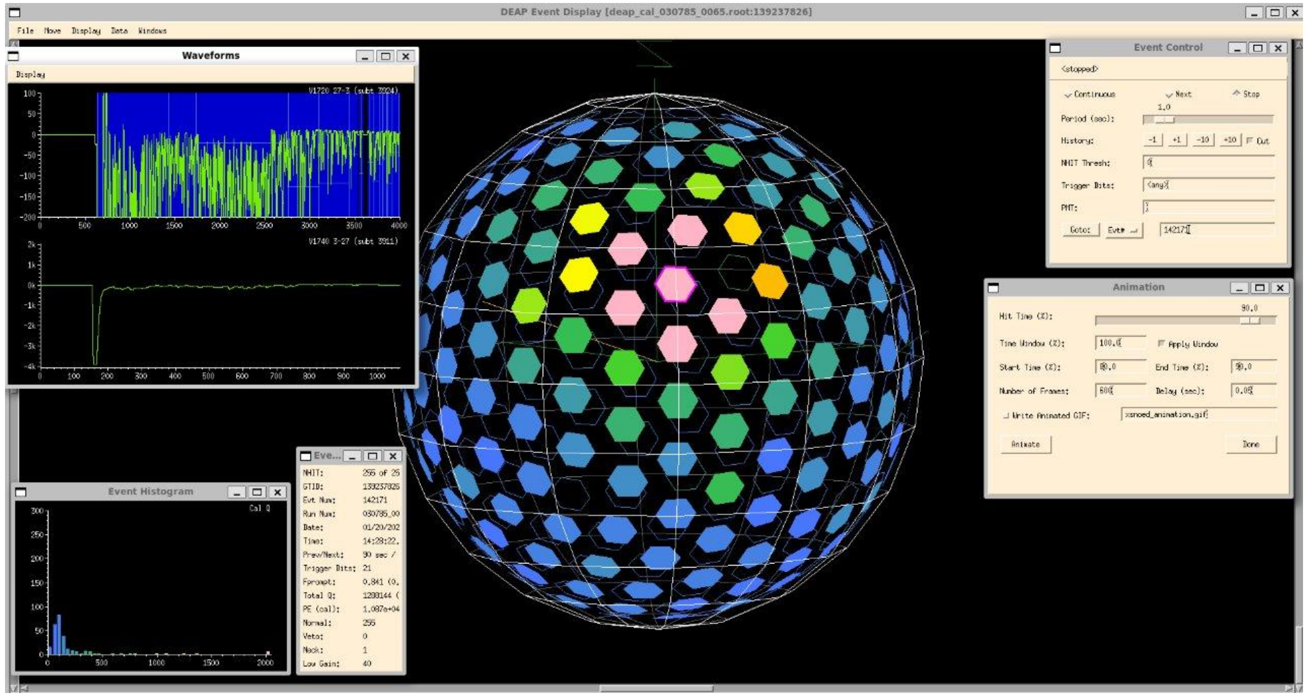


UNDERGROUND: Hardware upgrades



- Neck was lifted and citric acid washed
- Install Flow Guides into the Neck
- one person in the glovebox should guide the neck to keep it centered as it lowers
- Verify the 3 holes are clear
- Tighten the three bolts on the neck centering ring
- Raise the bottom plate to the maximum achievable height

SURFACE: Flasher Events



- Events occurred not from particle interaction
- Observed in DEAP & SNO
- One PMT flashes brightly and the others light up sequentially with lower charges, less bright
- There is the 'correct' color scheme ignition sequence seen
- Essential because the lower energy flashers may fall within WIMP ROI
- Looked into vaccuum data to separate and understand the flasher events better, made appropriate cuts (qPE>2000)

SURFACE: Individual PMT analysis

- Started with making 1D, 2D histograms to look for any clear correlations

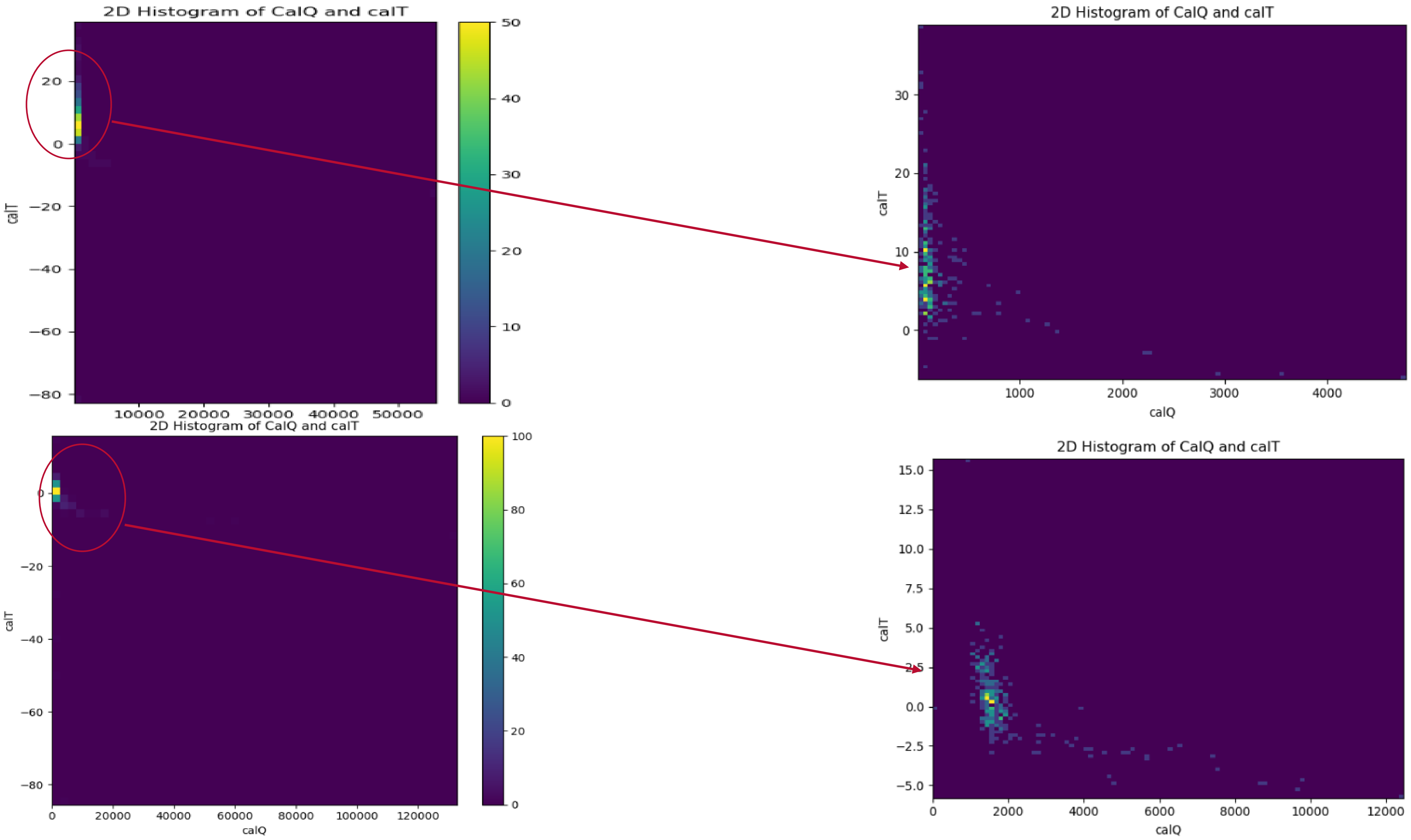
- Looked out for the pattern between PMTs

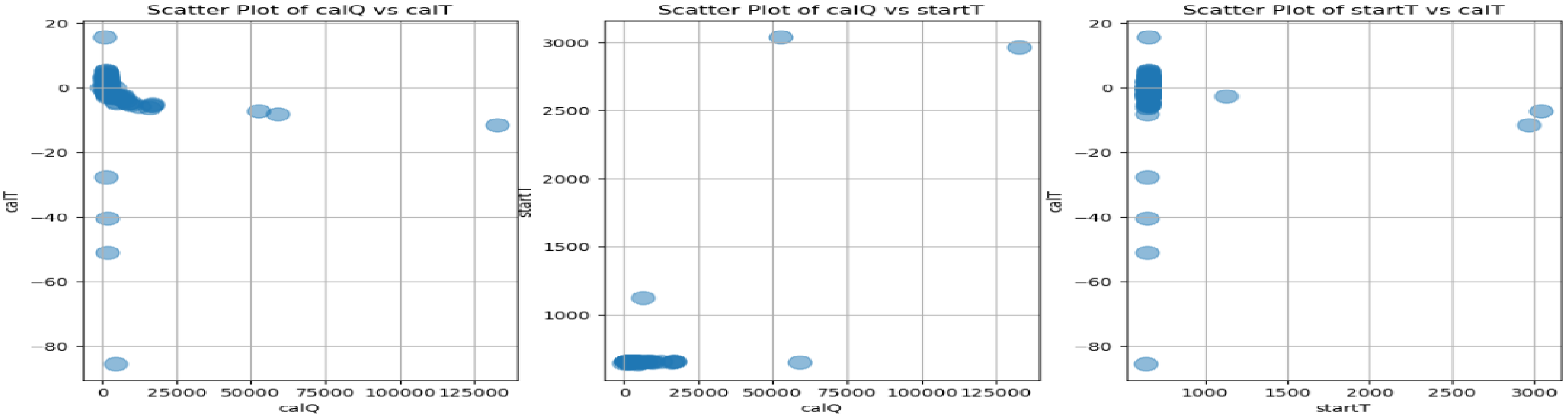
- Extracted 4 major variables

  i. **StartT** : Starting time for the digitizer
  ii. **CalT** : Calibrated time
  iii. **CalQ** : Calibrated charge
  iv. **TotalQ** : The total charge in all waveforms

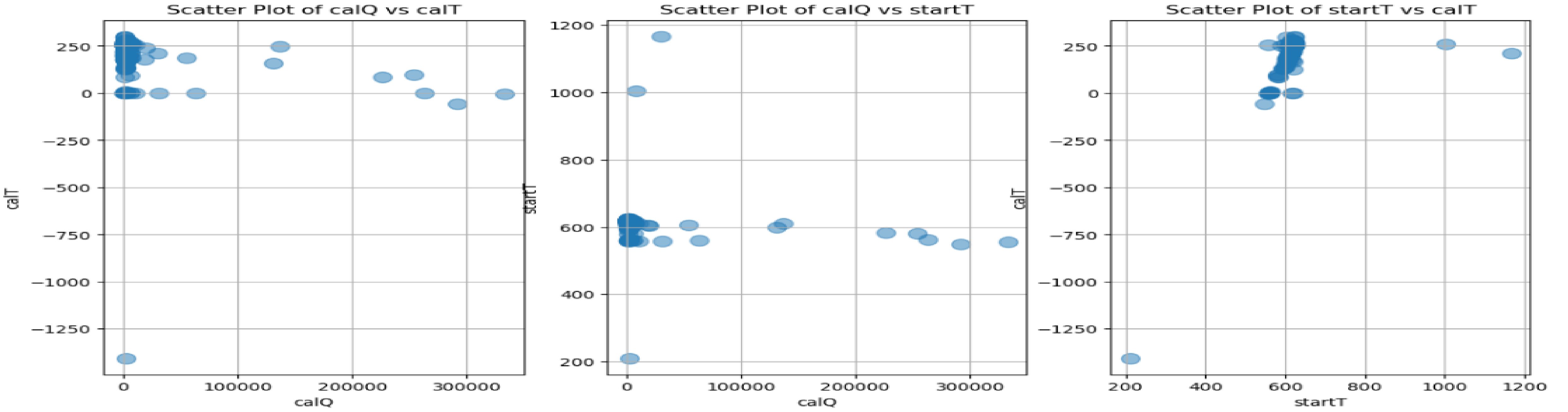
- Made multiple plots to look out for patterns (no relevant patterns)

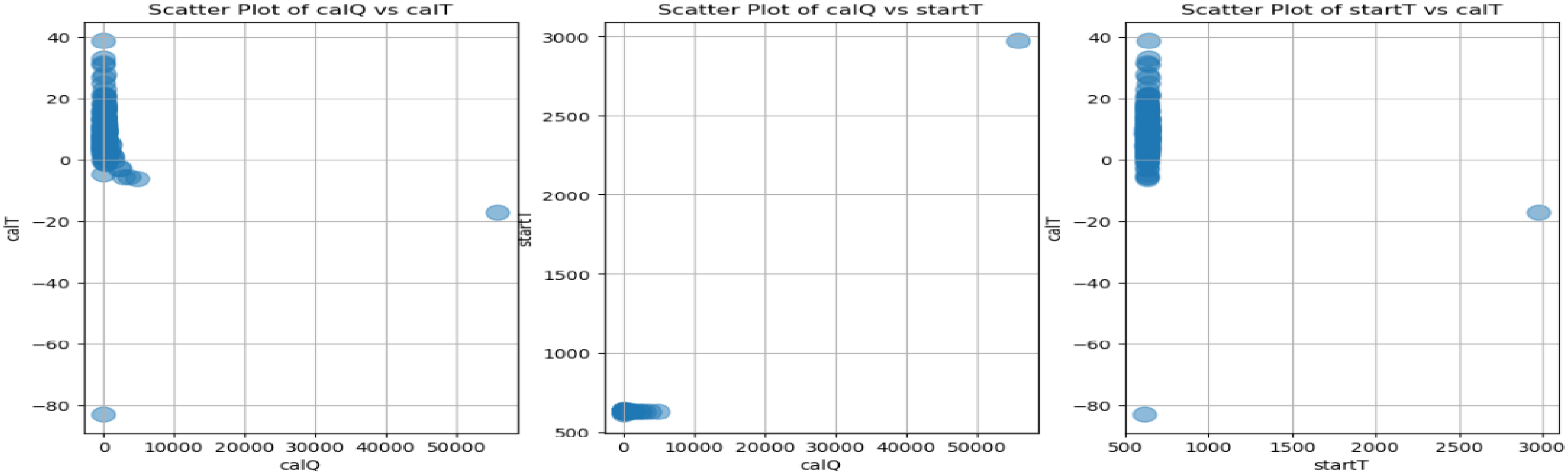
- Looked into other variables to make plots in (no relevant patterns as of now)


2D Histogram of CalQ and calT
calT
calQ
2D Histogram of CalQ and calT
calT
calQ
2D Histogram of CalQ and calT
calT
calQ
2D Histogram of CalQ and calT
calT
calQ

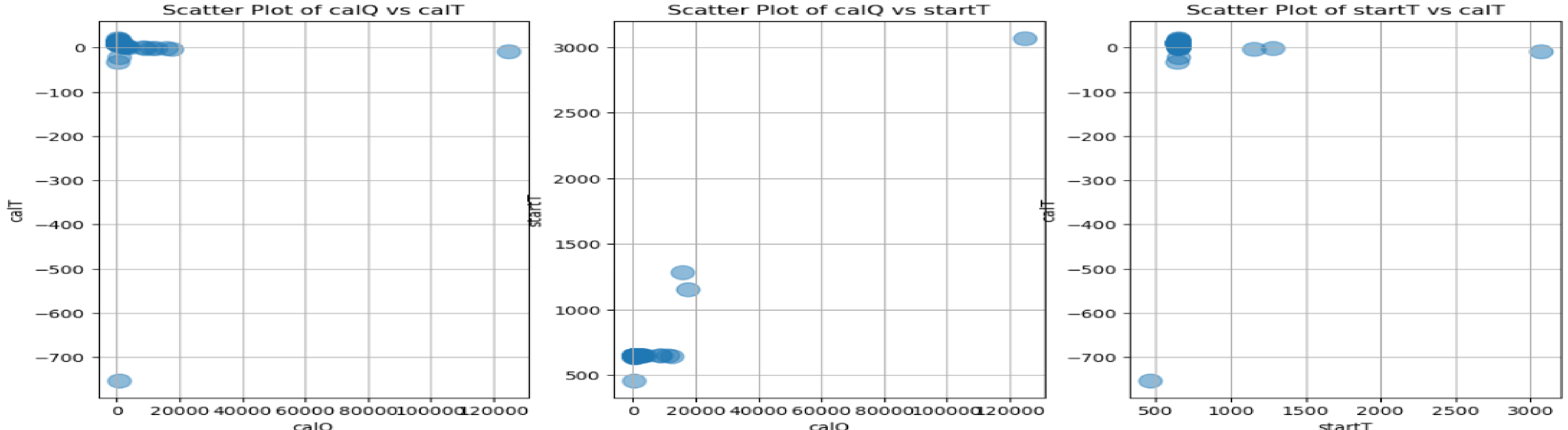


Two different flasher event plots with different variables but no correlation





Other two different flasher event plots with different variables but no correlation correlation



Flasher: MuonVeto PMTs

		TIME:			
dateyyyymmdd		timehhmmss		timeNanoSec	
FLASHER	PRIOR	FLASHER	PRIOR	FLASHER	PRIOR
		192822	192822	627556816	627111536
		92018	92018	985638000	979395072
20220320	20220320	150353	150353	666728672	666724144
20200728	20200728	185815	185815	894923264	889215536
20200810	20200810	40538	40538	15255440	1393184
20200810	20200810	40545	40545	130172480	128832160
20200816	20200816	71634	71634	50629888	48719904
20200903	20200903	82928	82928	740676144	668577984
20201011	20201011	122807	122807	201879168	160337280
20200729	20200729	141846	141846	353360288	353327216
20220406	20220406	61949	61949	795843680	784595120
20220105	20220105	4835	4835	44950128	39550928
20220113	20220113	55016	55016	296874032	293704352
20211227	20211227	70424	70424	526226192	507127600
20211227	20211227	190613	190613	633424000	601140544

- PMT ignition sequences prior and post the flasher event were investigated

- Almost all (15 out of 16) had muon veto PMTs ignited at most **26** eventIDs prior

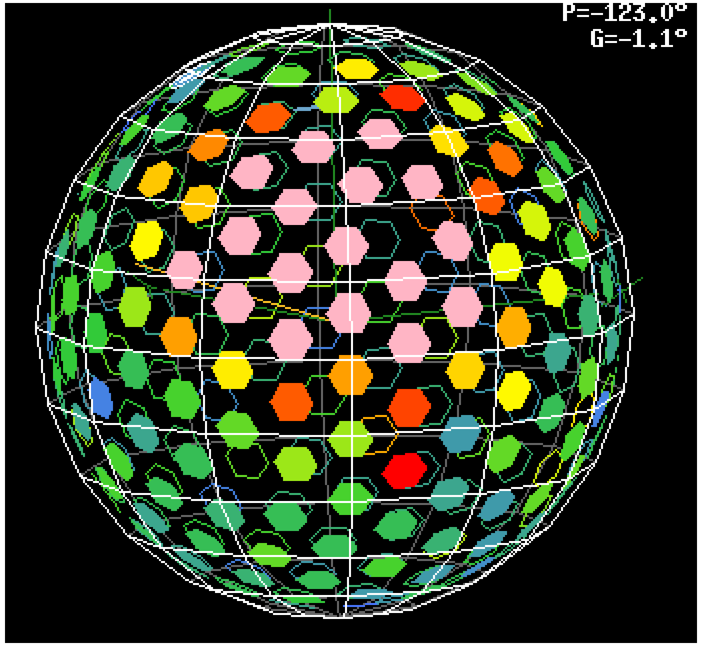
- Hypothesis: muons light up a couple of ns before an event

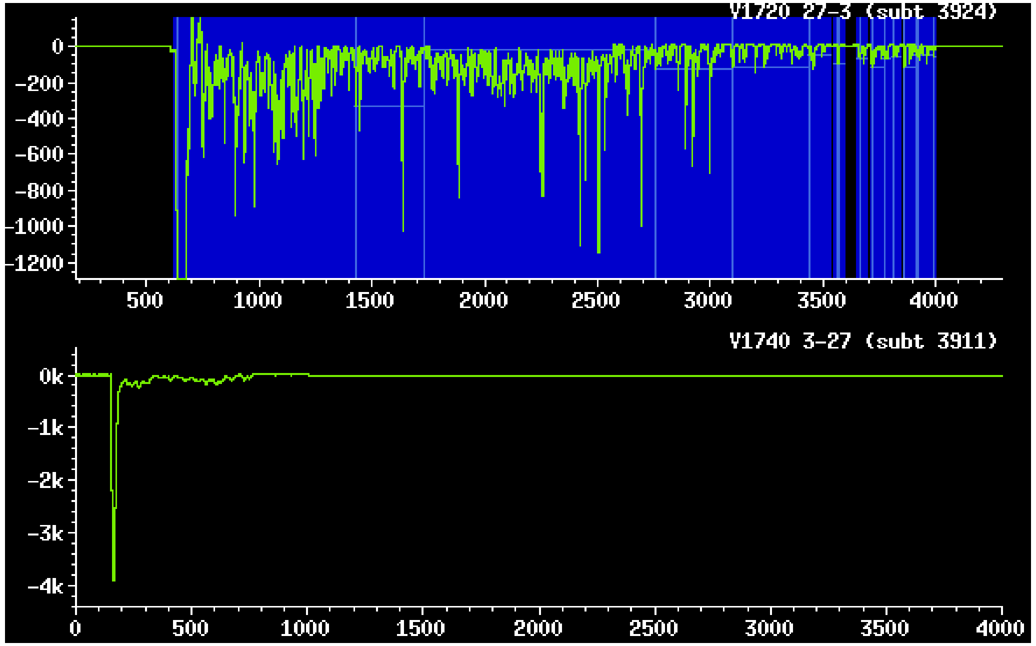
- The **time difference** was calculated *and* **waveforms** from the MuonVeto to the Flasher compared. (14/16 had no waveforms and get a spike during the Flasher event)

- Compared non flasher events to check when the Muon Veto PMTs ignite. (14/17 non-flasher events had an eventID difference of at least 35)

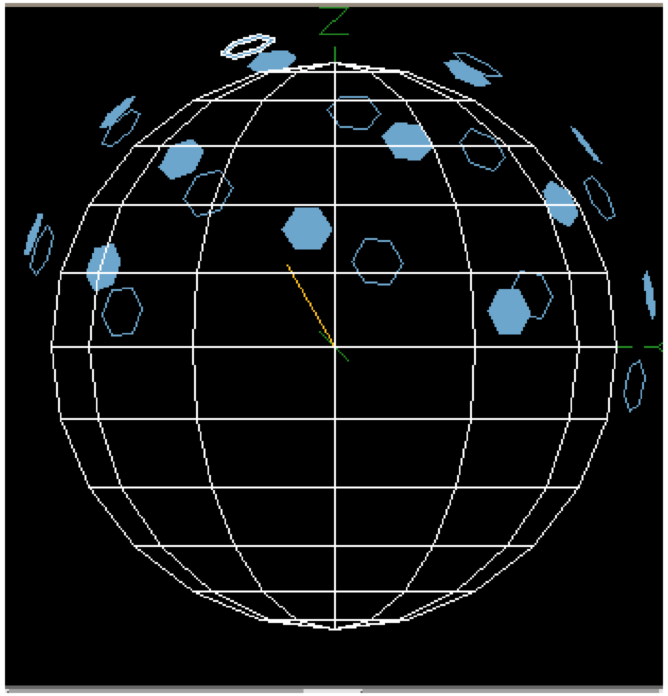
- It took relatively longer for the veto PMTs to ignite. Will make comparisons with more datasets to conclude

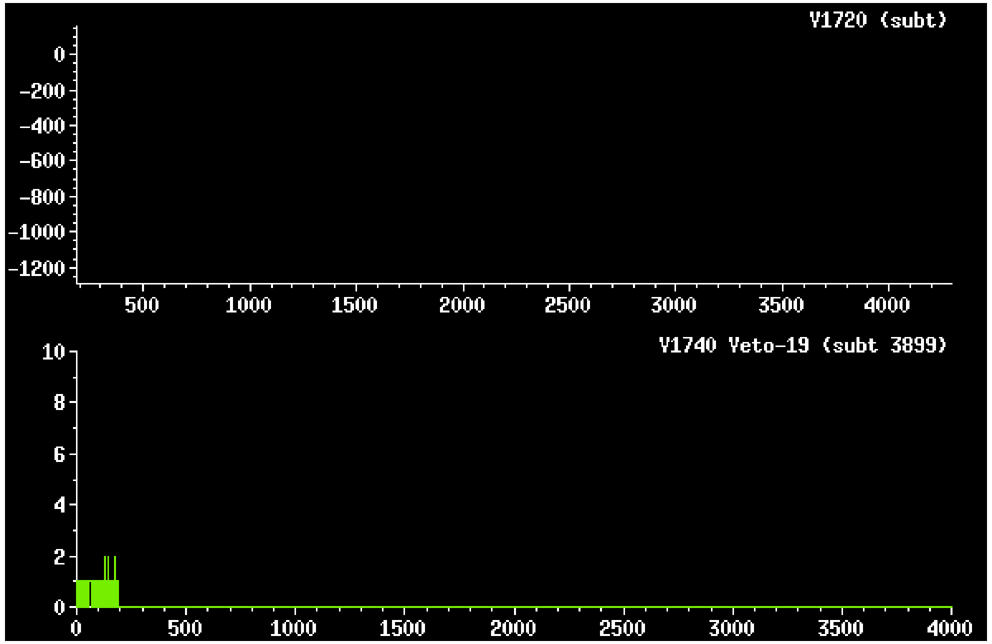
FLASHER EVENT





MUONVETO PMT EVENT PRIOR





THANK YOU!

A special thanks to Phillipe Di Stephano, Fredrick Schuckman, Peter Skensved, Chris Jillings, Pierre Gorel, Sean Daugherty & the rest of the DEAP Crew!

Queen's
UNIVERSITY