WILLIAM & MARY

CHARTERED 1693

GRINCH Report

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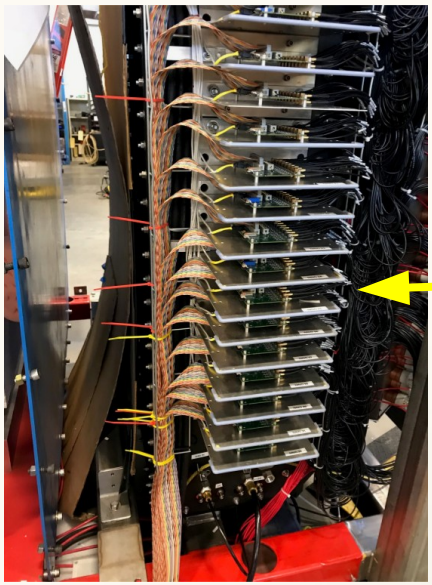
The College of William and Mary

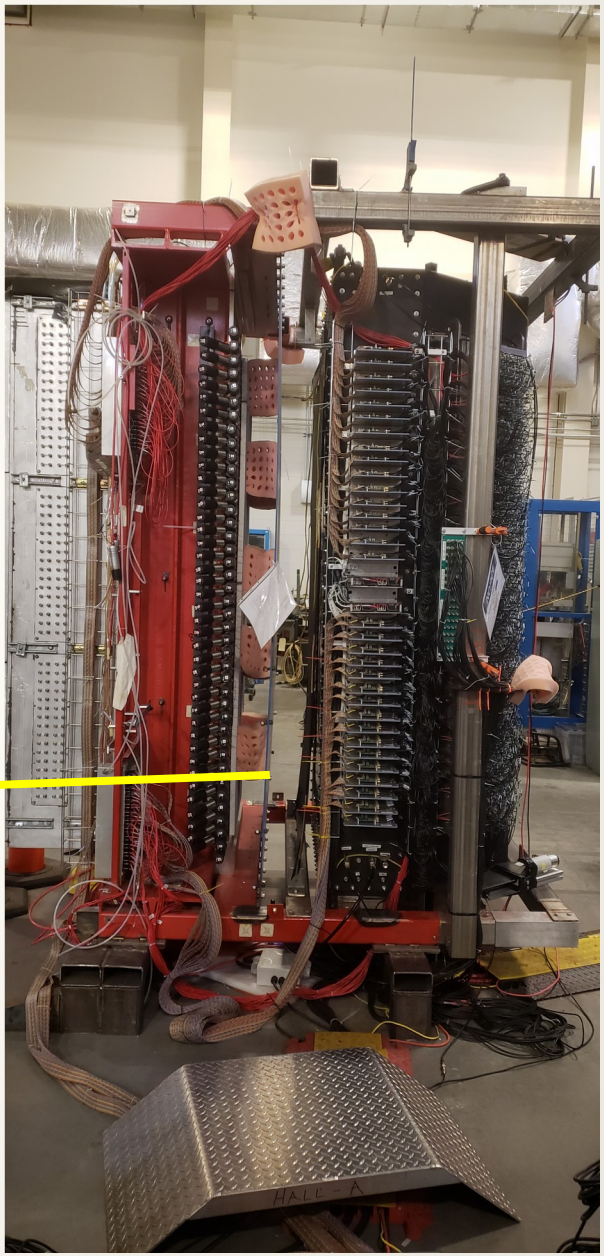
SBS Collaboration Meeting, Feb 27, 2019

Reminder

Gas **RIN**g **CH**erenkov: BigBite Gas Cherenkov for 10^{-2} π/e separation

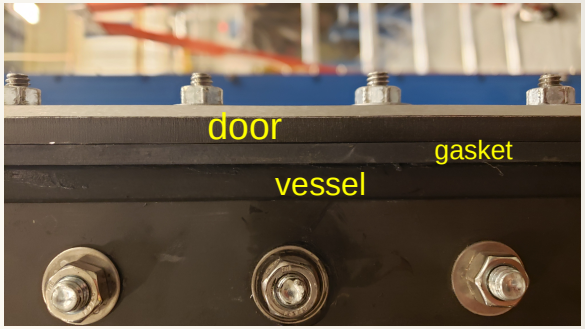
- Array of 510 PMTs of 1” diameter
- 32 discriminator NINO cards (16 channels/card)
- 4x VETROC modules (128 channels/module)
- C_4F_{10} gas at 1 atm → π threshold 2.7 GeV/c (under discussion)





Gas Leaks (aka the door)

- Past November, Jessie Butler's team purchased and prepare a 3/16" thickness gasket (EPDM 60A Durometer)
- We flip the door outside-inside to offer a larger surface for compression.



- After some tests, we found that regardless how hard we tight the door, in order to adjust it to the “curvature” of the frame, the corners were not well tight.
  - **Simple observation of the marks of the entrance frame on the gasket show a well defined mark, except in the corners**
- Also, we vacuum tested each bolt for possible leaks.

Gas Leaks (the solution)

- We cut rubber shims of ~1/16” thick to introduce more compression.
  - x4 L-shape piece just placed over the gasket on each corner

Not a real picture

Only test done until the date shown a leak rate comparable with the old BB Cerenkov detector.

The case for the gas

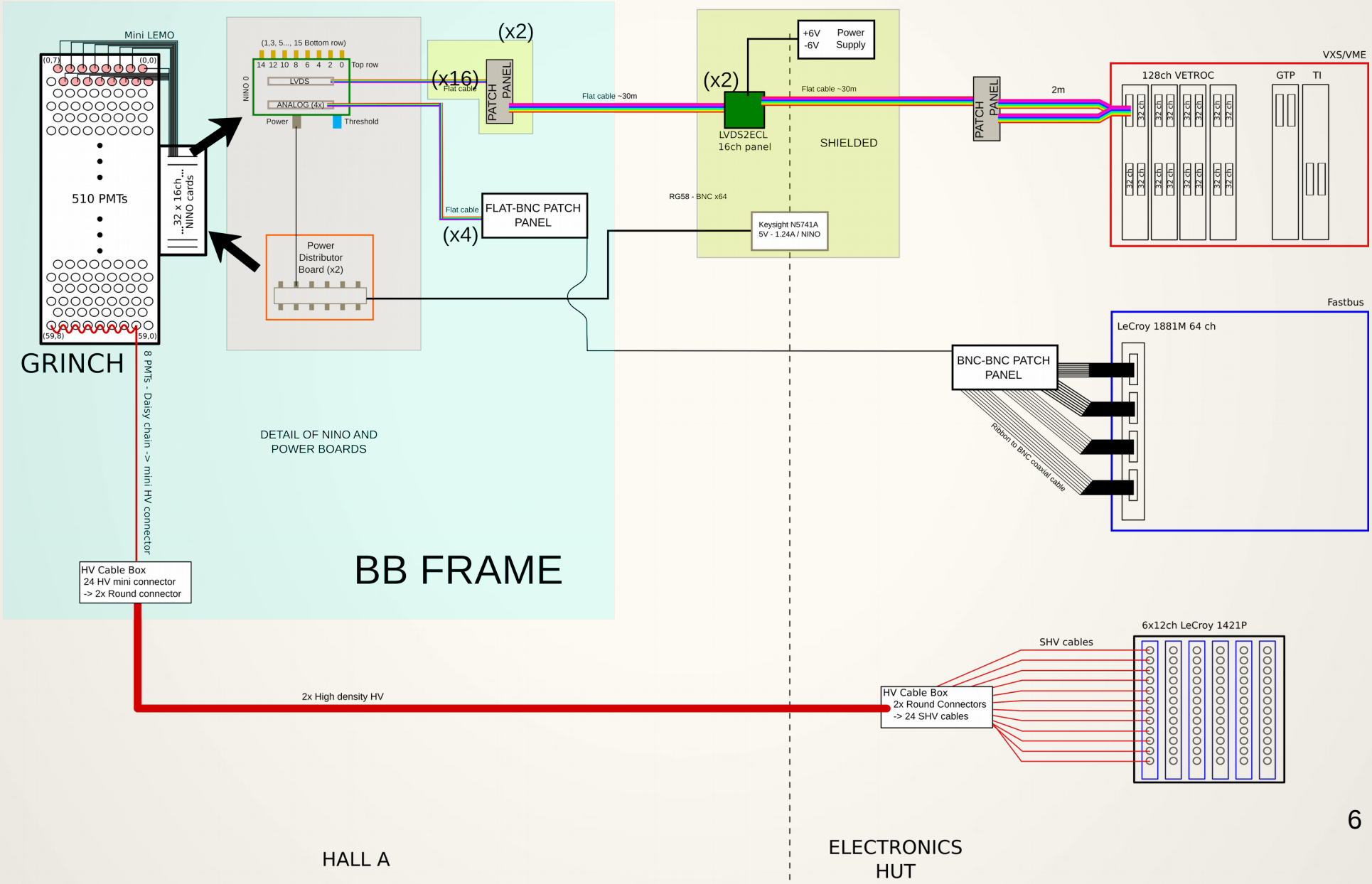
Although the leak issue was solved, the gas to be used is under discussion due to the high cost C_4F_{10} is the desired option, but we tested other options making C_4F_8 a good candidate.

Gas Name	Gas	(n-1) at 1 atm	Rel Photon Yield	Company AirGas (bulk) ($/kg)	Company Synquestlabs (20 kg) ($/kg)	Company F2Chemical (bulk) ($/kg)
Decafluorobutane	C_4F_{10}	0.0015	1.0	-	550 (7-10 weeks)	300
Heptafluorobutyryl fluoride	C_4F_80	-	-	-	2650 (10-12 weeks)	-
Octafluorocyclobutane	C_4F_8	0.00132	0.88	60	195 (in stock)	-
Octafluoropropane	C_3F_8	0.00111	0.74	140	-	-
Sulfur hexafluoride	SF_6	0.000783	0.52	10	-	-
Carbon Dioxide	CO_2	0.000450	0.3	4	-	-
Air	-	0.000290	0.19	-	-	-

- Simulations have shown that each hit cluster will produced 1-2 phe on ~9 tubes making use of C4F10.→ A photon yield reduction will affect the π/e rejection goal.
- In principle, GMn could use lighter gas since it only requires a 10:1 rejection ratio.

Todd has been in contact with F2chemical and maybe it is possible to get a good price on C_4F_{10}, maybe comparable to C_4F_8.

DAQ

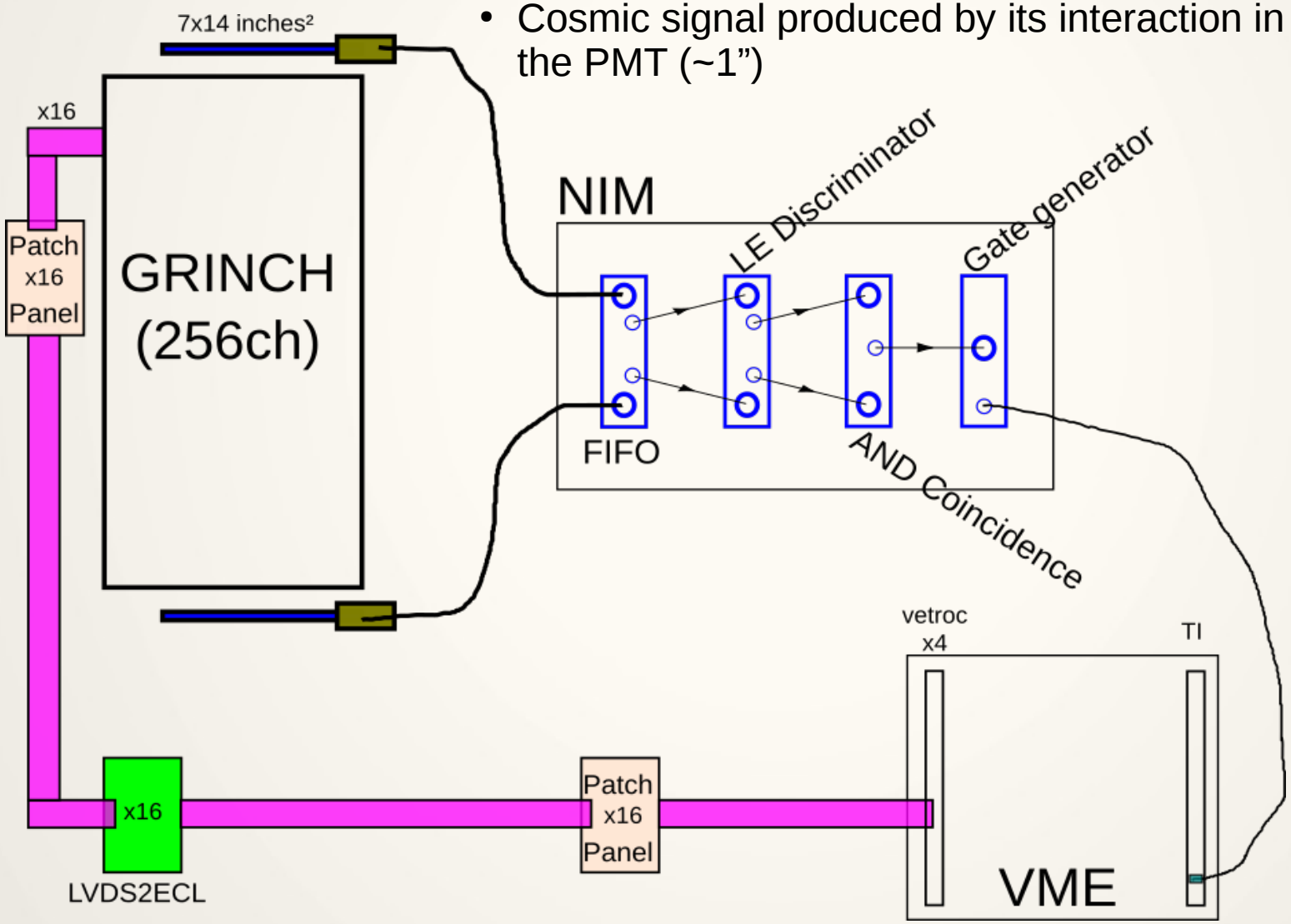

Mini LEMO
(0,7)
(0,0)
510 PMTs
(59,8)
(59,0)
GRINCH
32 x 16ch... NINO cards
8 PMTs - Daisy chain -> mini HV connector
HV Cable Box
24 HV mini connector
-> 2x Round connector
(1,3, 5..., 15 Bottom row)
14 12 10 8 6 4 2 0
Top row
NINO 0
LVDS
ANALOG (4x)
Power
Threshold
Power Distributor Board (x2)
DETAIL OF NINO AND POWER BOARDS
(x2)
(x16)
Flat cable
PATCH PANEL
Flat cable
(x4)
FLAT-BNC PATCH PANEL
BB FRAME
Flat cable ~30m
(x2)
LVDS2ECL 16ch panel
+6V Power Supply
-6V
Flat cable ~30m
SHIELDED
RG58 - BNC x64
Keysight N5741A
5V - 1.24A / NINO
PATCH PANEL
2m
VXS/VME
128ch VETROC
GTP
TI
32 ch
Fastbus
LeCroy 1881M 64 ch
BNC-BNC PATCH PANEL
Ribbon to BNC coaxial cable
2x High density HV
HV Cable Box
2x Round Connectors
-> 24 SHV cables
SHV cables
6x12ch LeCroy 1421P
HALL A
ELECTRONICS HUT

Update from last report

- Cables built at Jlab:
  - 7 cables were found to be defective → new ones under construction.
  - Alternative cables from Brad in hand → x16 from Brad + x2 from Bogdan.
- Defective channel in VETROC (found during the cable test):
  - Solved by W. Gu → mezzanine card loose attached.
- Noisy channels coming from the level translator (also found during the cable test):
  - Level translator wrongly ground → just bridge the ground plug in the power supply to real ground.
- A VETROC module showed a strange output (again, during the cable test):
  - Give it to Ben Raydo → He offered to change for a new one.

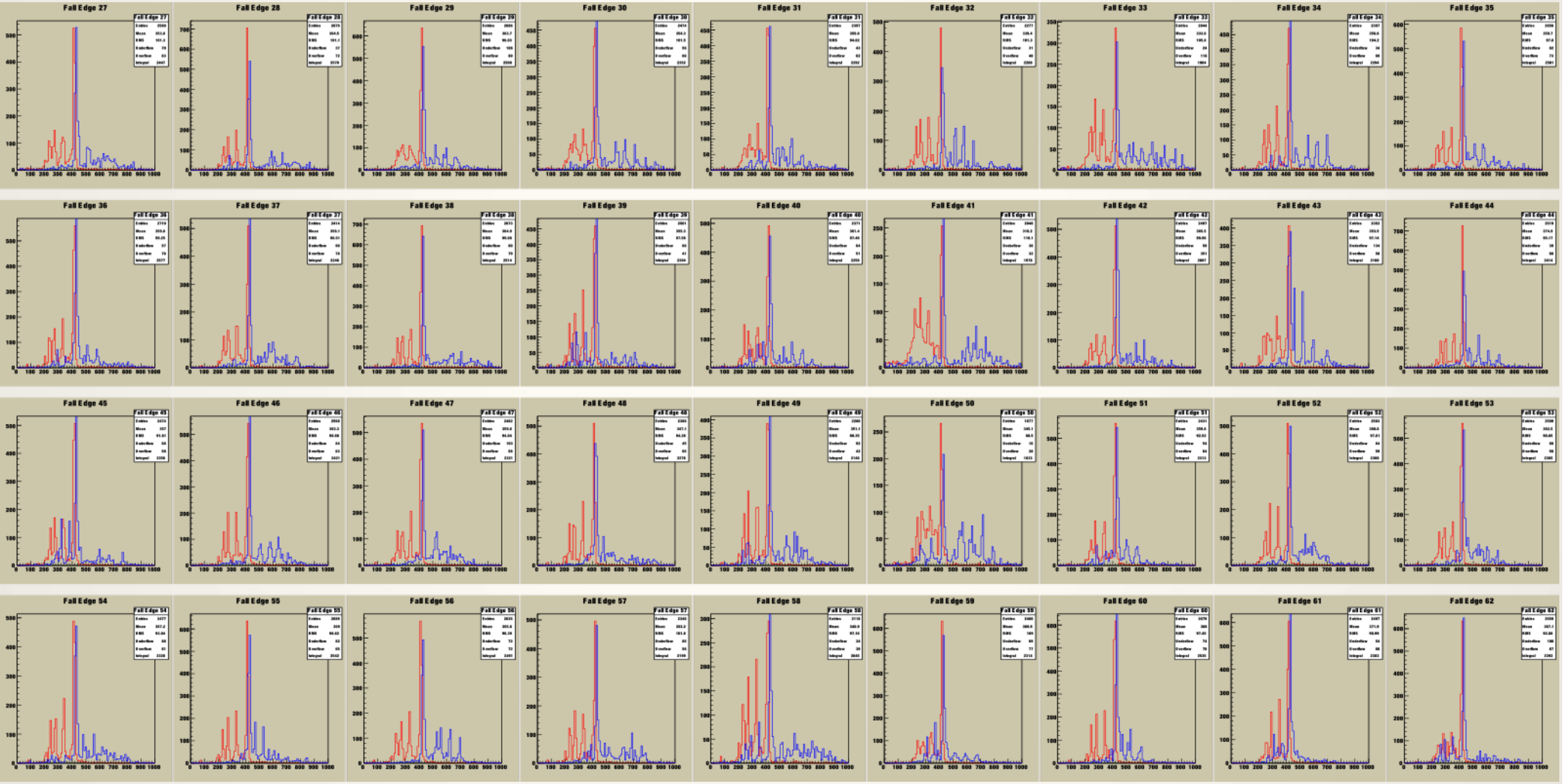
Cosmic data

- Standard set-up to create the trigger.
  - Two 7x14” scintillator paddles sandwich the PMT array
- Cosmic signal produced by its interaction in the head of the PMT (~1”)



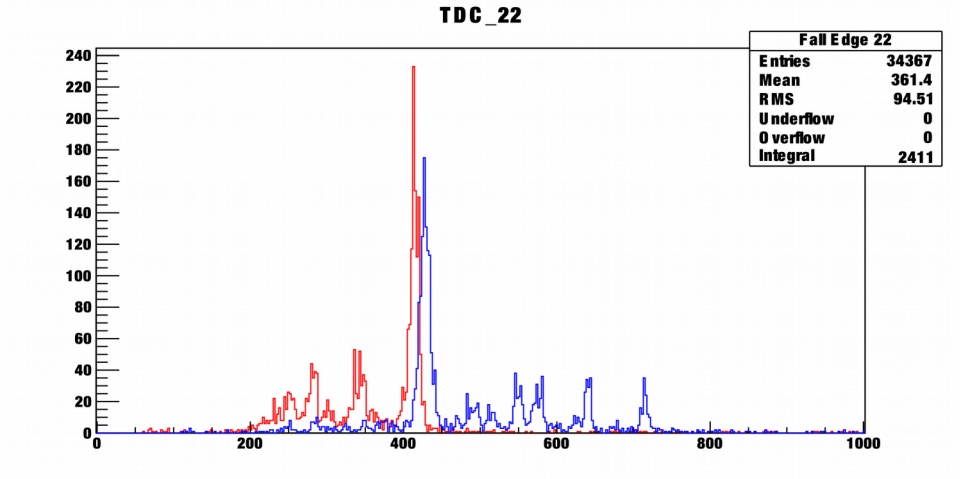
Cosmic data

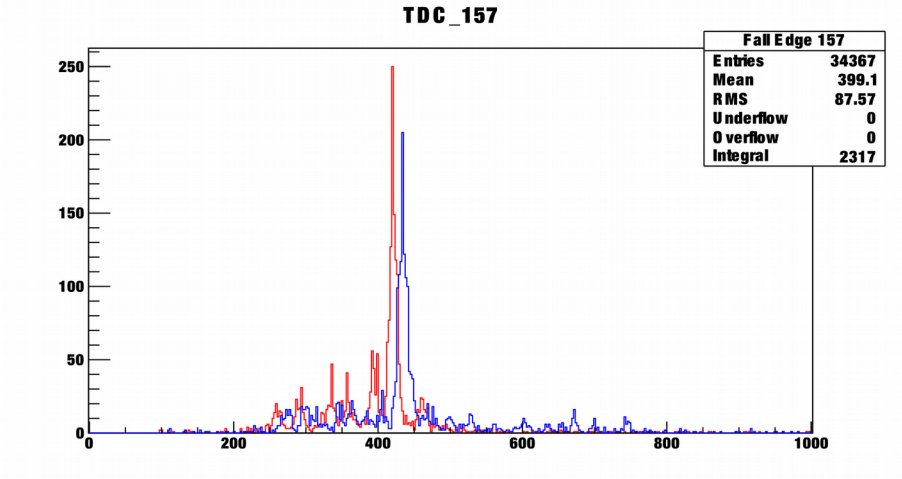
Raw TDC histogram (PMTs 27-62) (Feb 24, 2019, 5 days running)

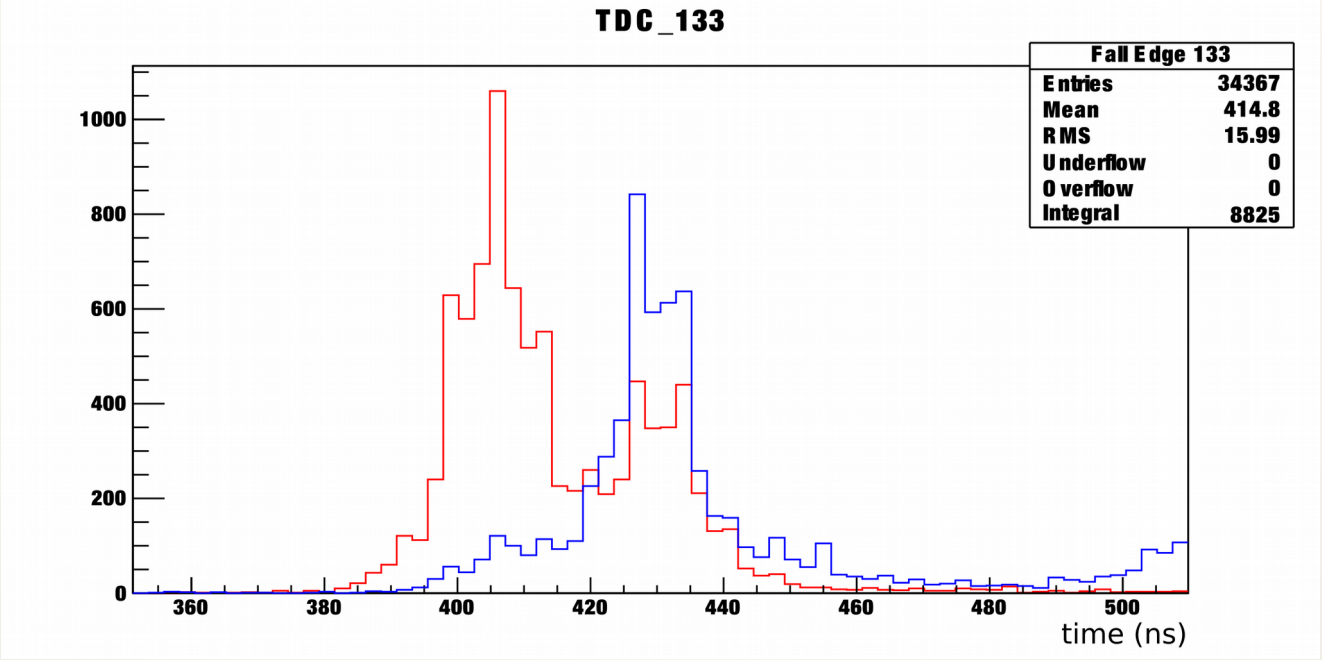


VETROC parameters:Window: 2500ns Latency: 3500 ns

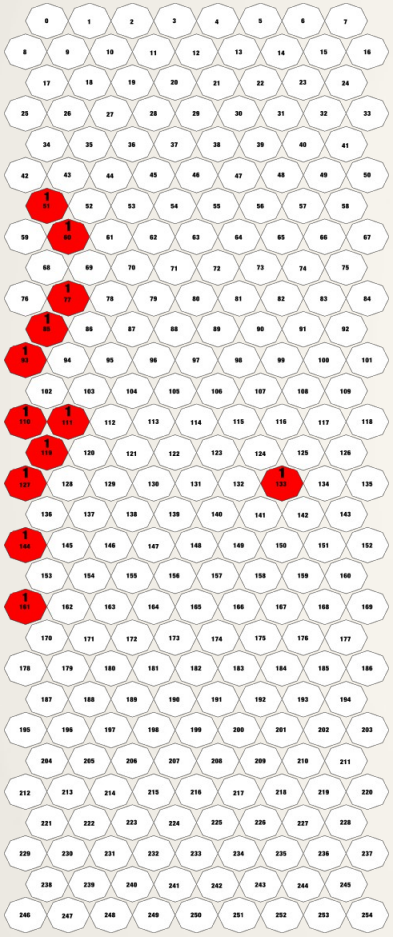
Cosmic data

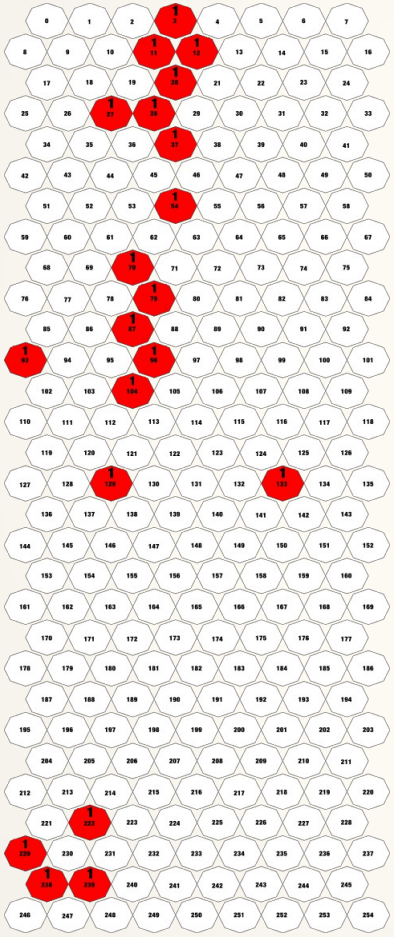

TDC_22
Fall Edge 22
Entries 34367
Mean 361.4
RMS 94.51
Underflow 0
Overflow 0
Integral 2411

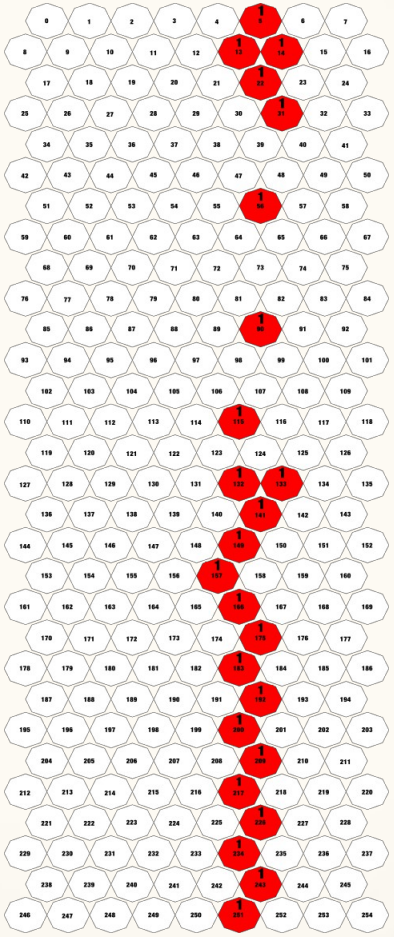

TDC_157
Fall Edge 157
Entries 34367
Mean 399.1
RMS 87.57
Underflow 0
Overflow 0
Integral 2317

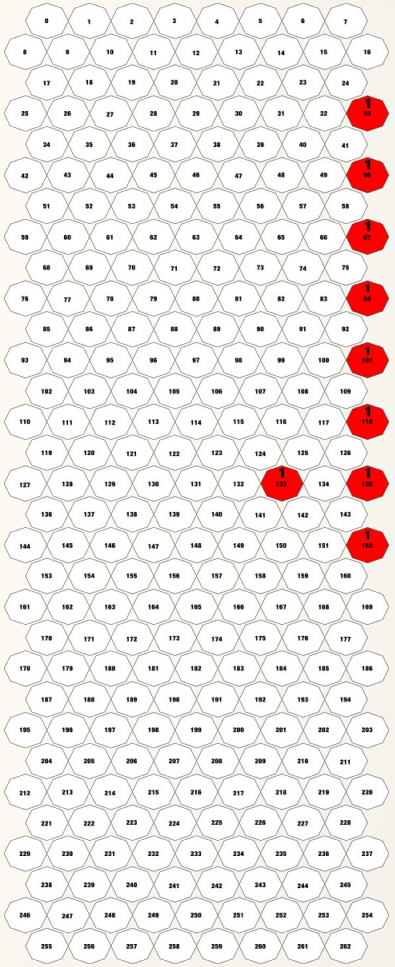

TDC_133
Fall Edge 133
Entries 34367
Mean 414.8
RMS 15.99
Underflow 0
Overflow 0
Integral 8825
time (ns)

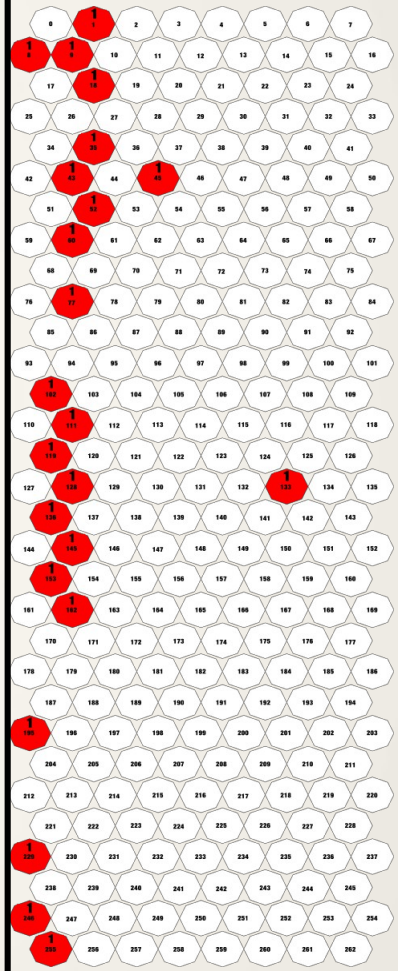
Cosmic tracks



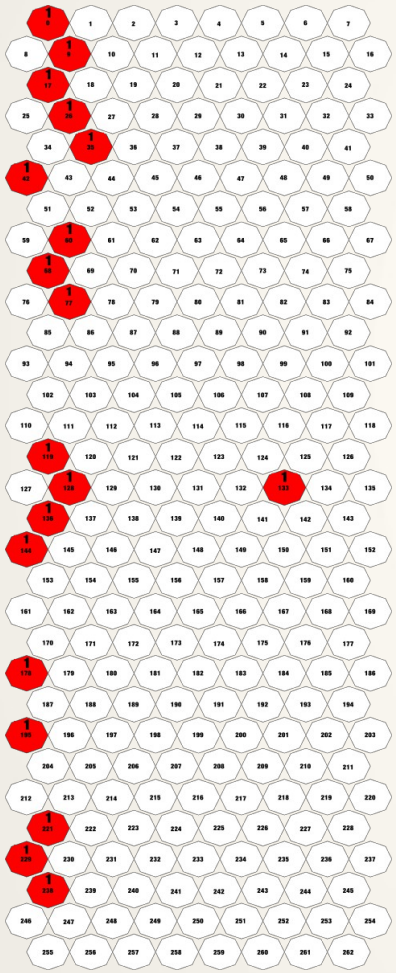


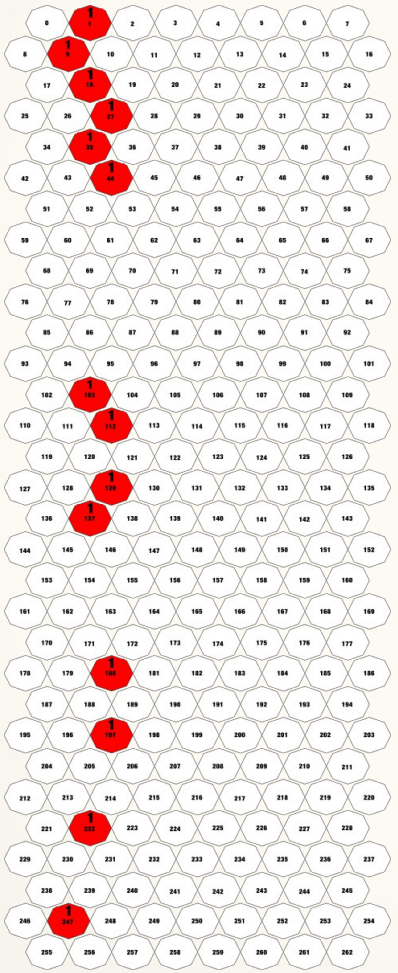


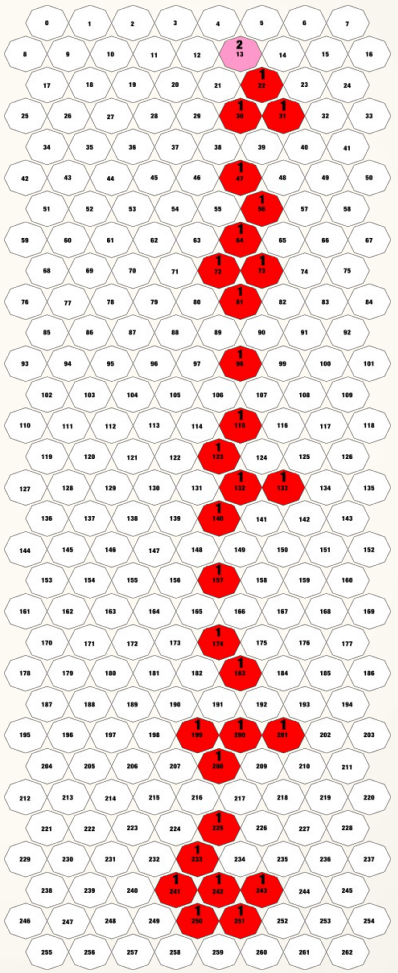


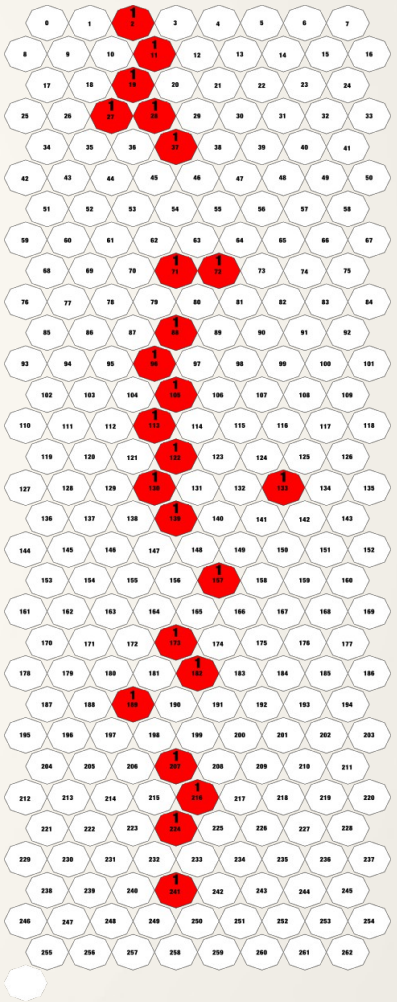


Cosmic tracks





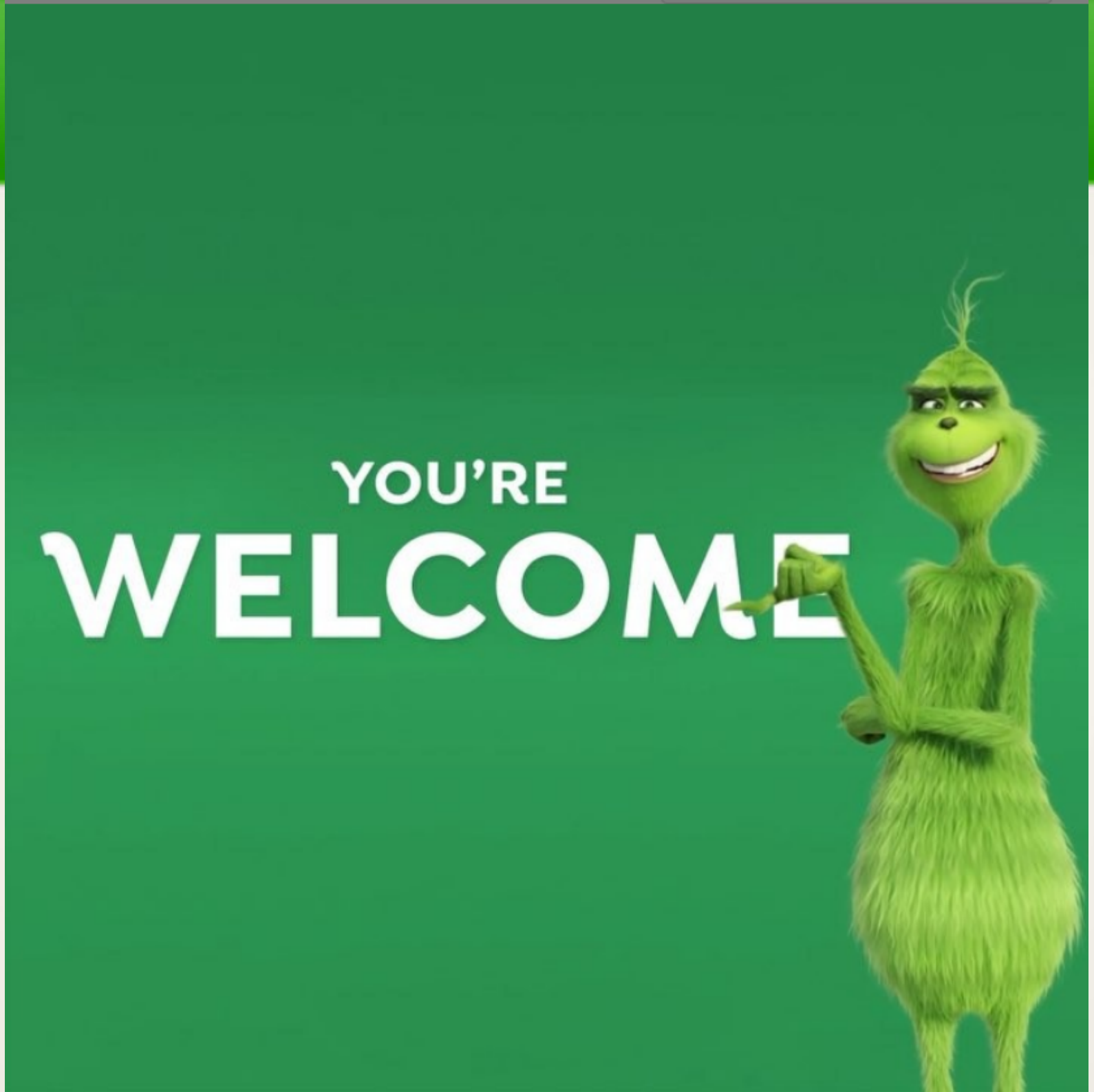




Summary and Outlook

- The gas leak issue of the door has been solved
- The heavy gas to be used is under discussion (final stage)
  - Two candidates, but cost still high
- Electronic issues reported last January, solved
- Cosmic data
  - Better VETROC timing configuration (window and latency) will allow clean data
  - Introduce the trigger timing info into the data to remove the jitter.

- Understand the TDC spectra
  - We plan to bring a set-up from W&M (3x2 PMT array and 2 small scintillator paddles) and connect it to the GRINCH system
  - Light leaks?
  - Change the gain of the PMT array → Write a script to change the voltage according change ont the gain.
- Cable the whole detector (TED high bay new arrangement)
- ...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