Stability Test of ProtoDUNE ARAPUCA PDS channels Performed with PDS Calibration System

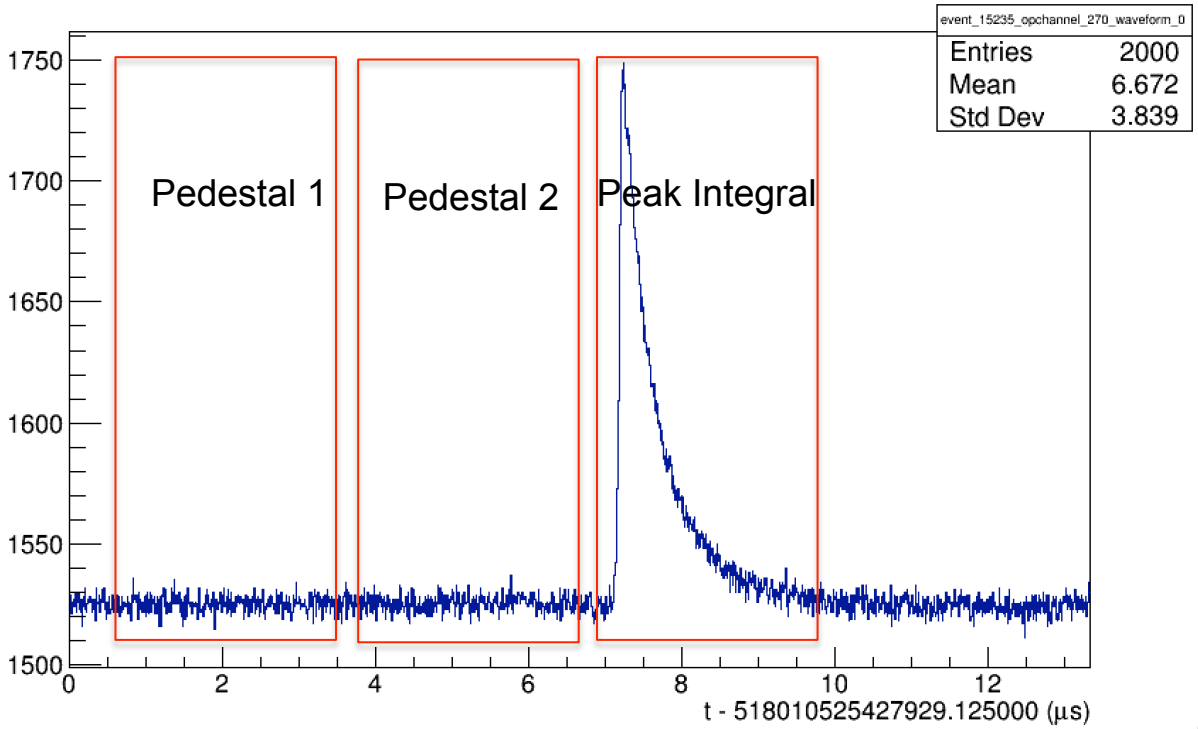
Zelimir Djurcic

Argonne National Laboratory

Stability Test Info

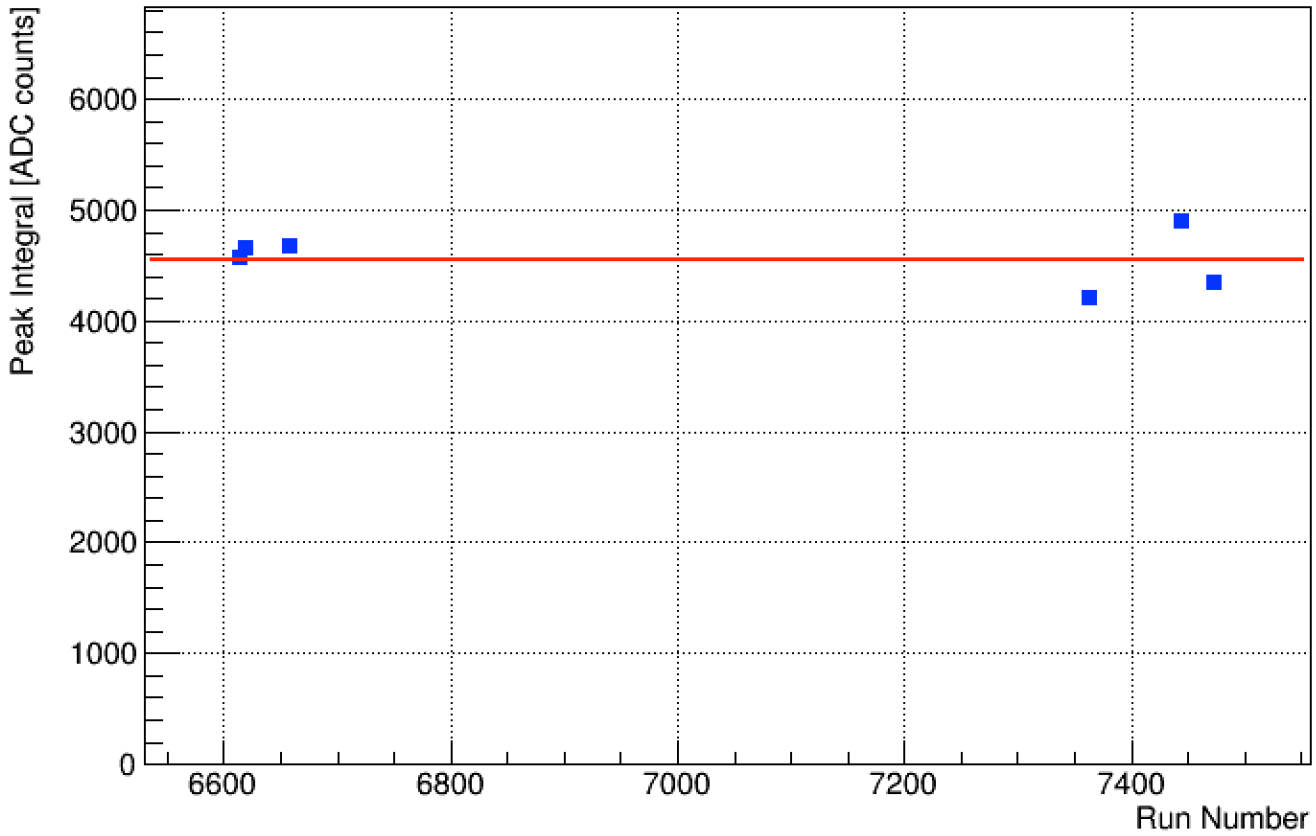
- Used DCM Runs:
  -Jan/Feb: 6015 (double pulses), 6620 (single pulses), 6659 (single pulses)
  -Mar/Apr: 7363, 7445, 7473 (all single pulse runs)
  -Pulse amplitude: UV LED bias = 30V -> "0x00040FFF" for all runs
  -Pulse width: 30 ns -> "0x9" for all runs

- Integrate the waveform peak area for each channel

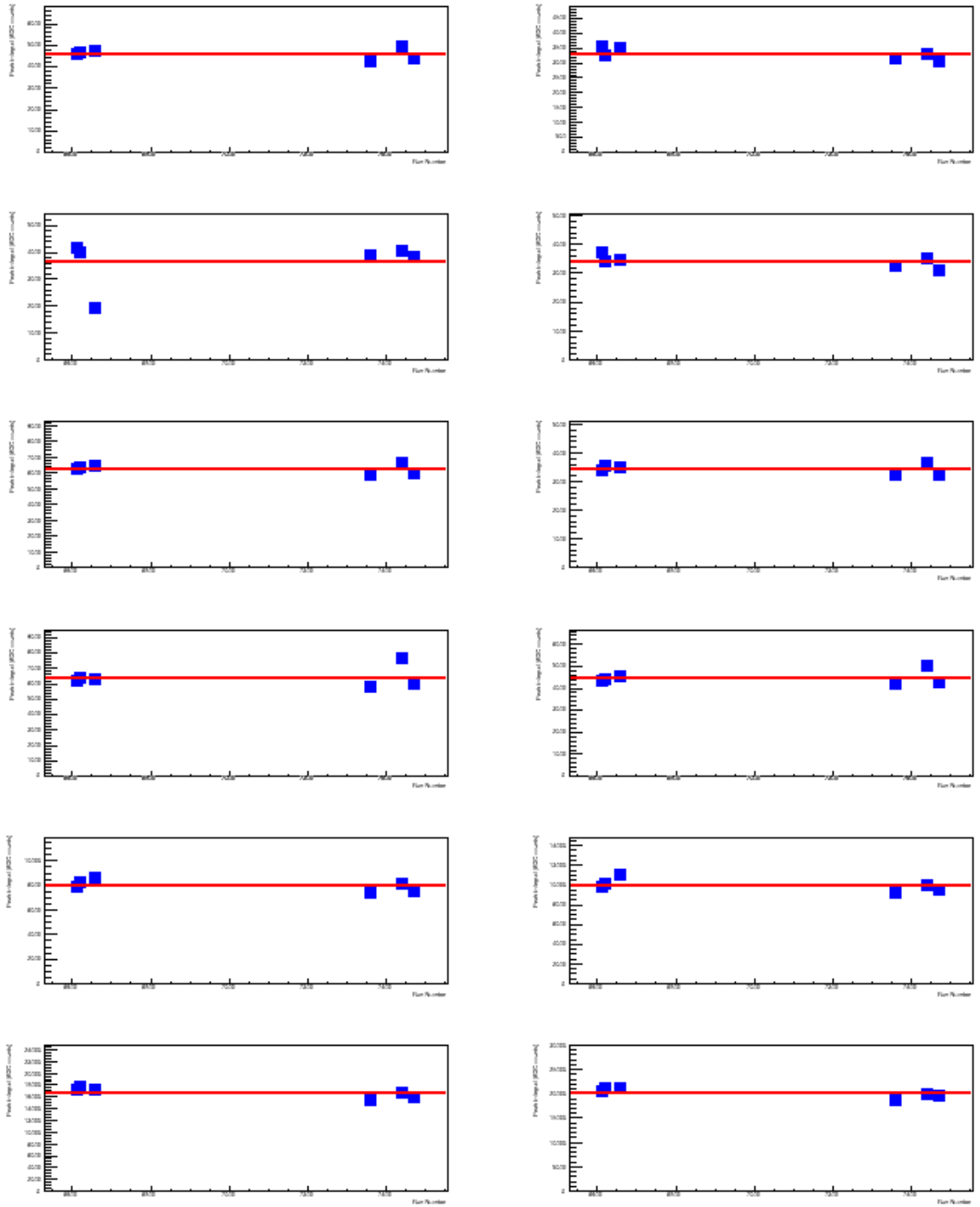


Stability Test Results

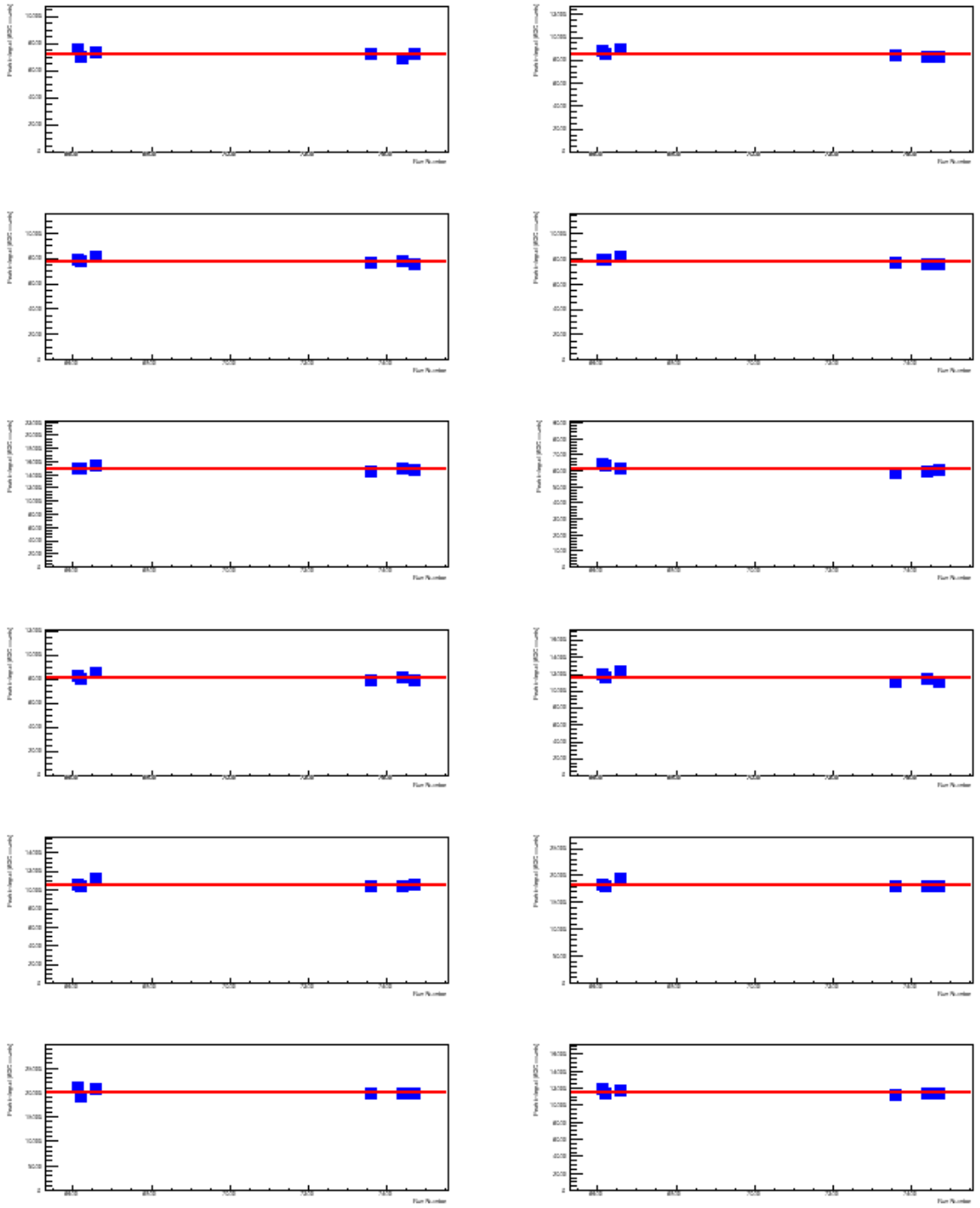
- Make the following plot for each channel, fit the line and check the spread



ARAPUCA 1 (ch 132-143)



ARAPUCA 2 (ch 262-275)



Stability Test Results

- Stability per channel in terms of numbers

Fit value, Fit error, Graph RMS, RMS/Mean(fit):

4556.39, 101.351 , 226.628 , 0.0497384
3274.03, 77.4935 , 173.281 , 0.0529258
3630, 346.524 , 774.852 , 0.213458
3383.23, 85.7338 , 191.707 , 0.0566638
6193.84, 117.655 , 263.085 , 0.0424753
3417.12, 73.5075 , 164.368 , 0.0481013
6339.34, 265.096 , 592.773 , 0.0935071
4438.6, 121.671 , 272.065 , 0.0612952
7946.54, 181.607 , 406.085 , 0.0511021
9884.82, 244.131 , 545.893 , 0.0552254
16552.9, 360.8 , 806.773 , 0.0487391
20040.2, 382.33 , 854.916 , 0.0426601

ARAPUCA 1 (ch 132-143)

Apart from an outlier (third raw) stability to within 6-9%

7197.97, 103.061 , 230.452 , 0.0320163
8497.38, 103.653 , 231.775 , 0.027276
7725.31, 75.8013 , 169.497 , 0.0219405
7764.59, 91.2865 , 204.123 , 0.0262889
14812.3, 112.205 , 250.897 , 0.0169384
6087.47, 83.0056 , 185.606 , 0.0304899
8108.05, 90.8726 , 203.197 , 0.0250612
11545.4, 210.737 , 471.222 , 0.0408148
10496.1, 126.45 , 282.751 , 0.0269386
18130.8, 214.947 , 480.635 , 0.0265093
19912.2, 263.503 , 589.21 , 0.0295904
11440.8, 122.688 , 274.338 , 0.023979

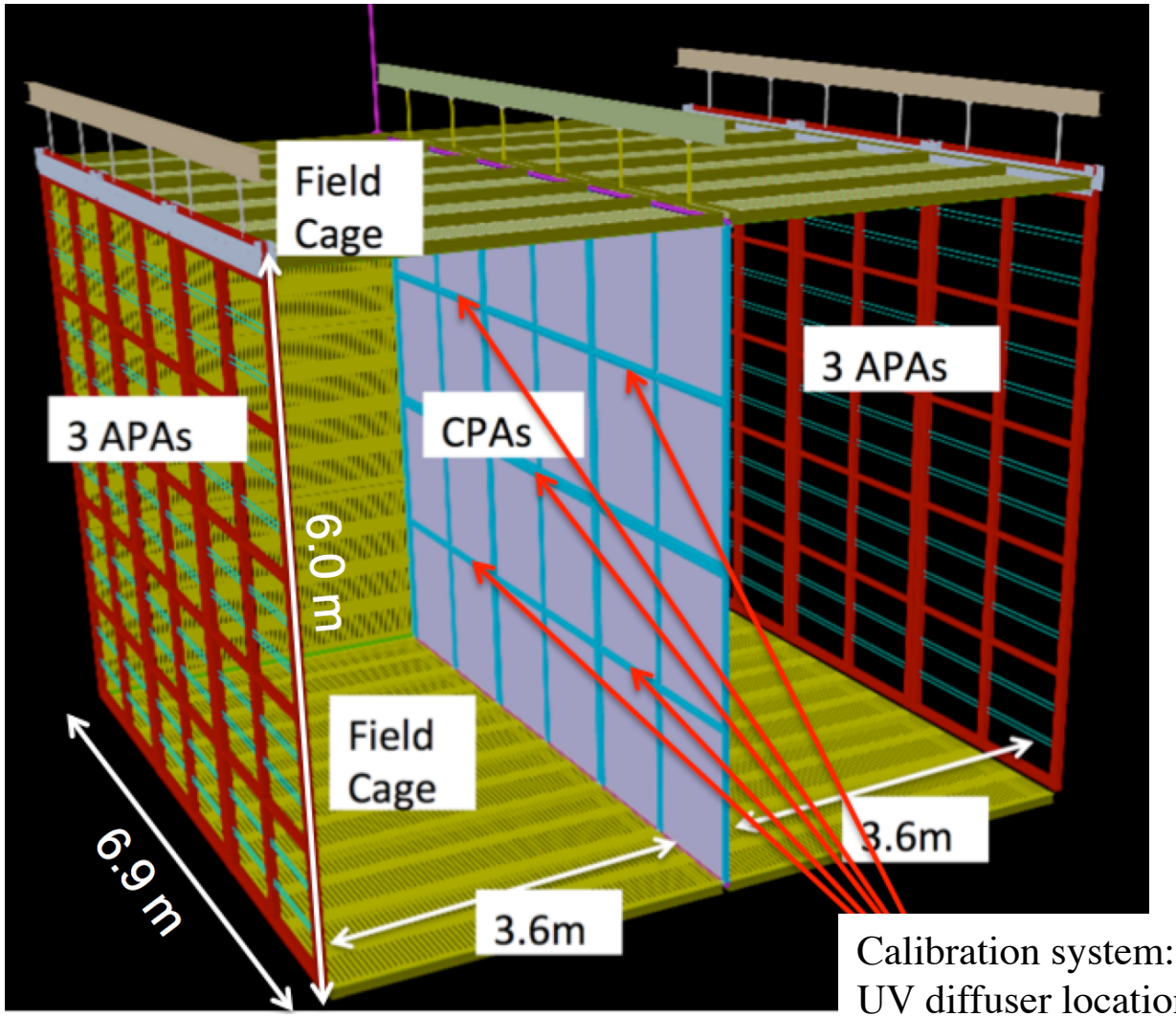
ARAPUCA 2 (ch 262-275)

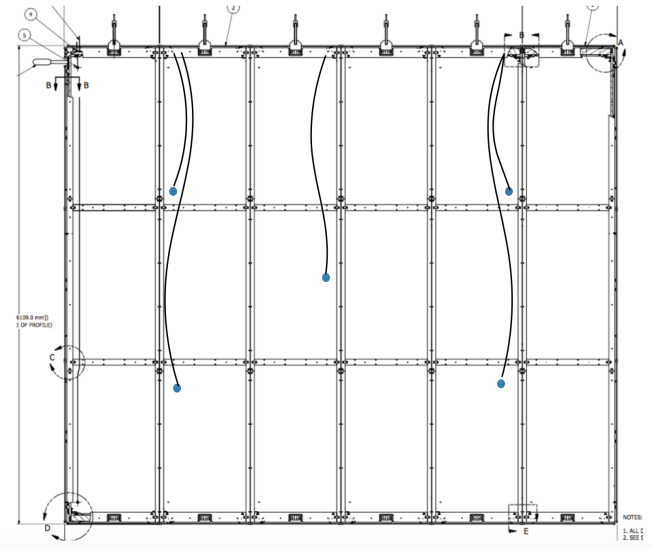
Stability to within 4%

Backup

ProtoDUNE Calibration System Design

- Photon-Detector Calibration system with light emitted from CPA to APAs

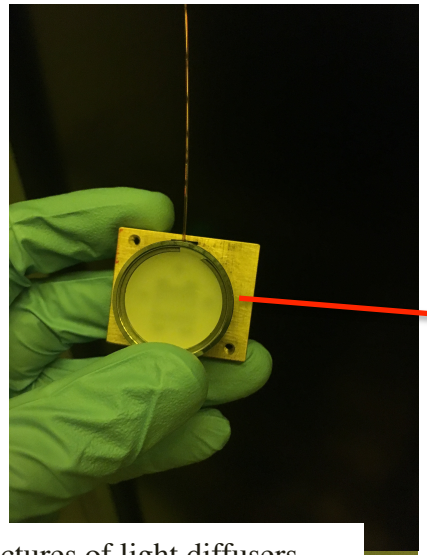


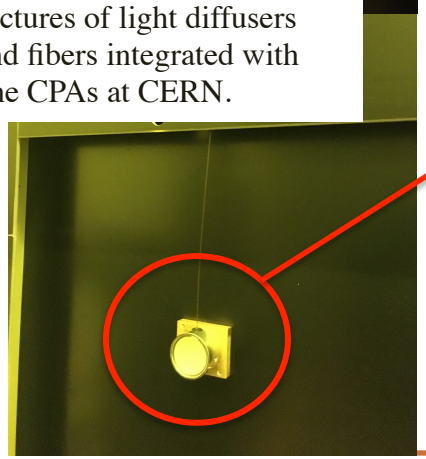


Calibration system:
UV diffuser locations
at ProtoDUNE-SP CPA

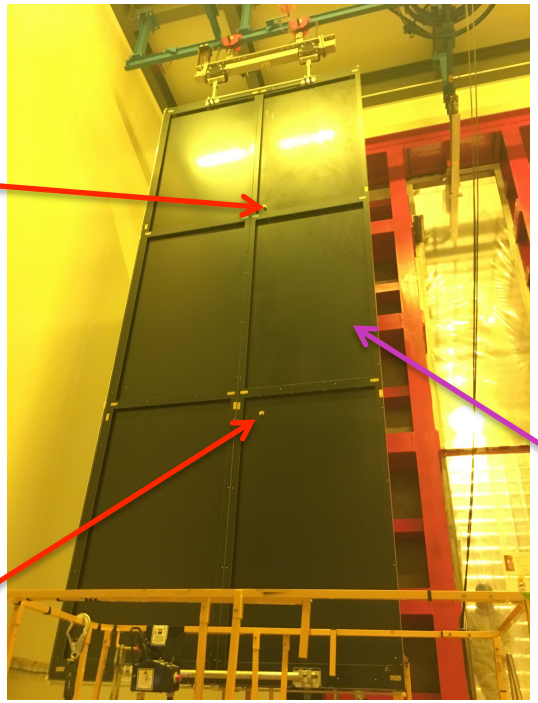
ProtoDUNE Calibration System Design

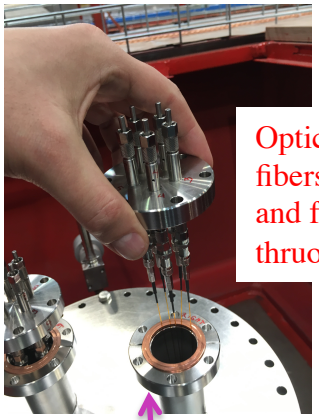
- ProtoDUNE system components illustrated here in the single page



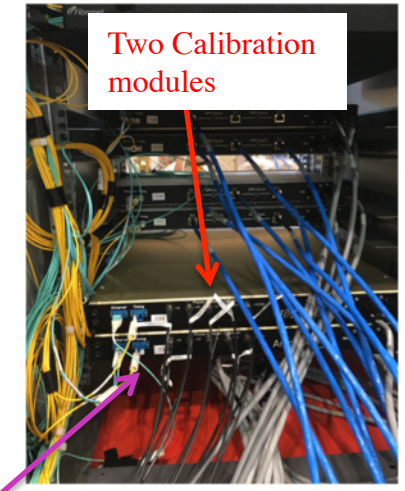


Pictures of light diffusers and fibers integrated with one CPAs at CERN.

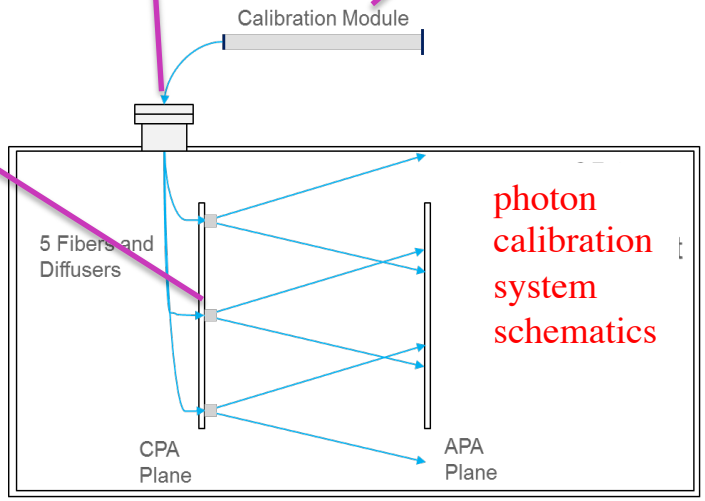




Optical fibers and feed-thruough

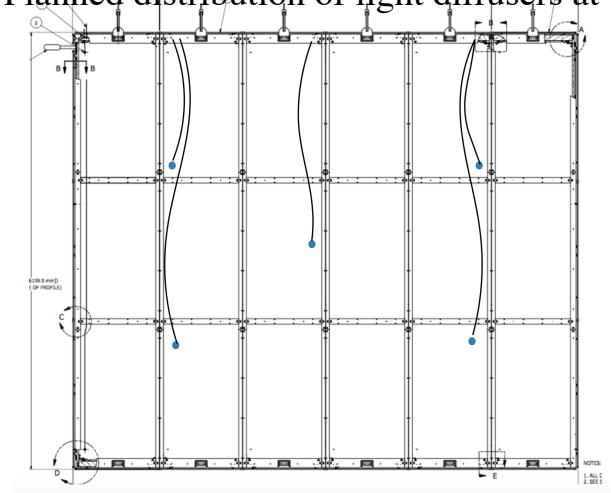


Two Calibration modules

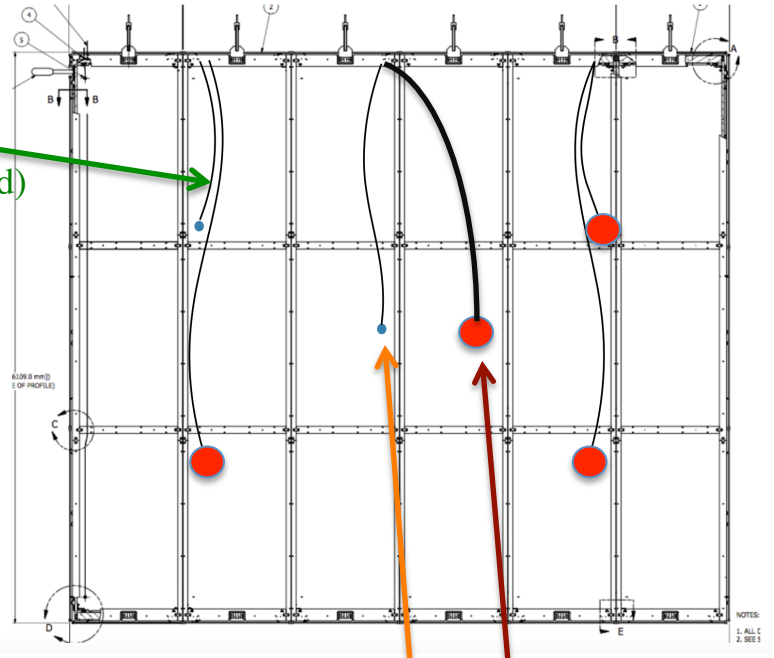


photon calibration system schematics

- Planned distribution of light diffusers at CPA

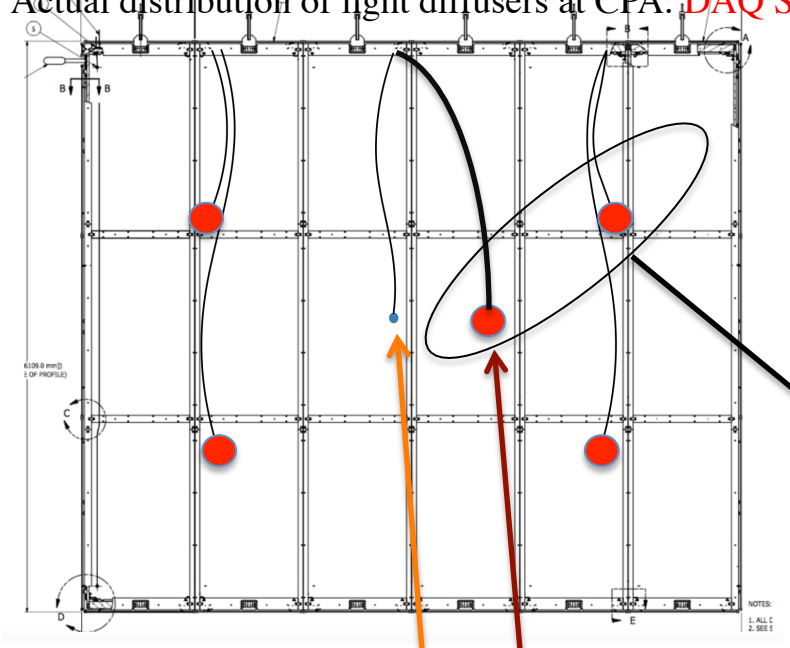


- Actual distribution of light diffusers at CPA: Rack Side



Fiber/diffuser moved from here to there (at CPA installation time)

- Actual distribution of light diffusers at CPA: DAQ Side



These two optical paths never connected
(from day 1…)

Fiber/diffuser moved from here to there (at CPA installation time)

Therefore, what worked from day 1 (and stayed working) is the the following Calibration channels:
-DAQ side: UL, LL, LR
-Rack side: Center, LL, LR, UR