Update on Quartz Window Study

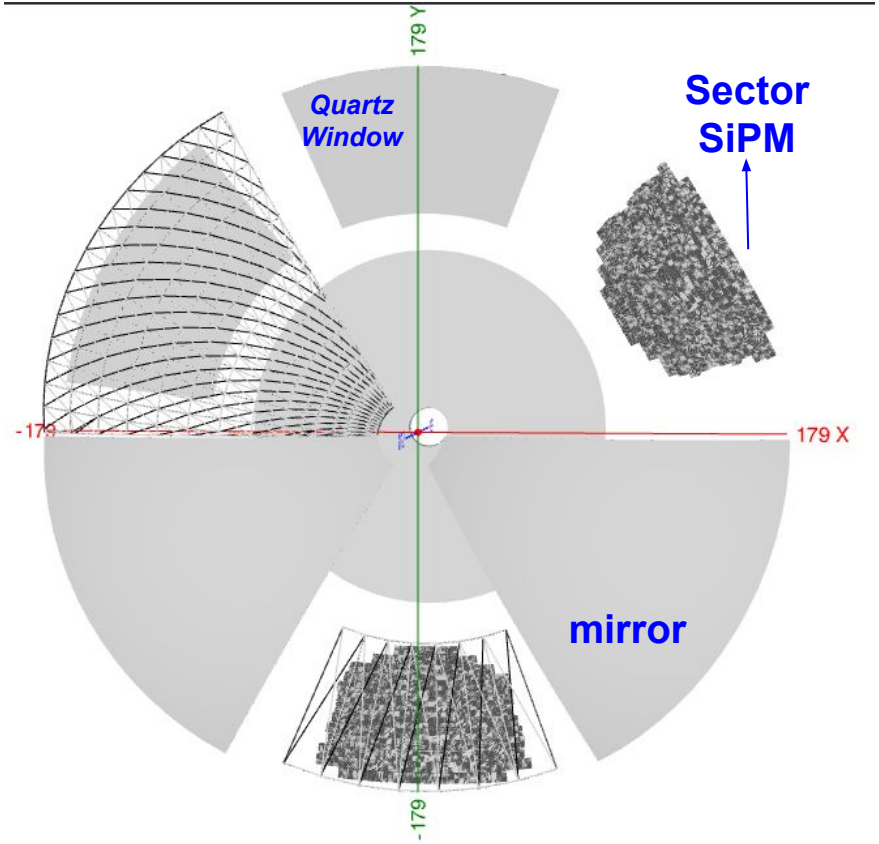
Chandradoy Chatterjee, **Nebin George**, **Rohit Jangid**, Girdish Laishram,

Ramandeep Kumar, Deepak Samuel, Tanya Tanvi, Meenu Thakur

dRICH Simulation Meeting

17 April 2025

Quartz Window Geometry



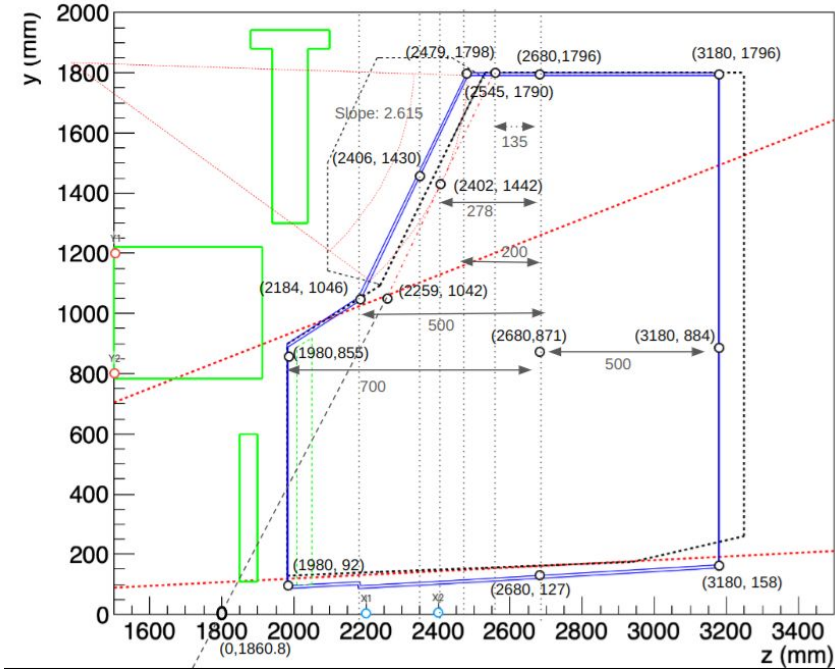
Why window is important for dRICH?

1. It prevents any contamination or mixing between the gas (C_2F_6, n = 1.00076) and nitrogen (N_2)

- Provide an friendly environment to SiPM's so they can be maintain at low temperature (Because SiPM's will be exposed to high radiation count so cooling temperature is important for them)

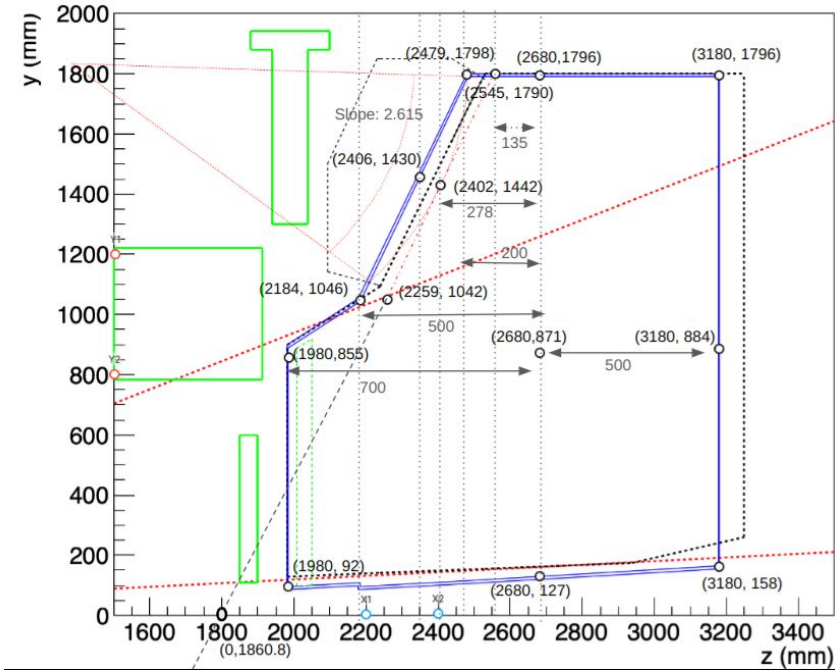
- Code can be cloned from drich-dev
  - https://github.com/deepaksamuel/epic

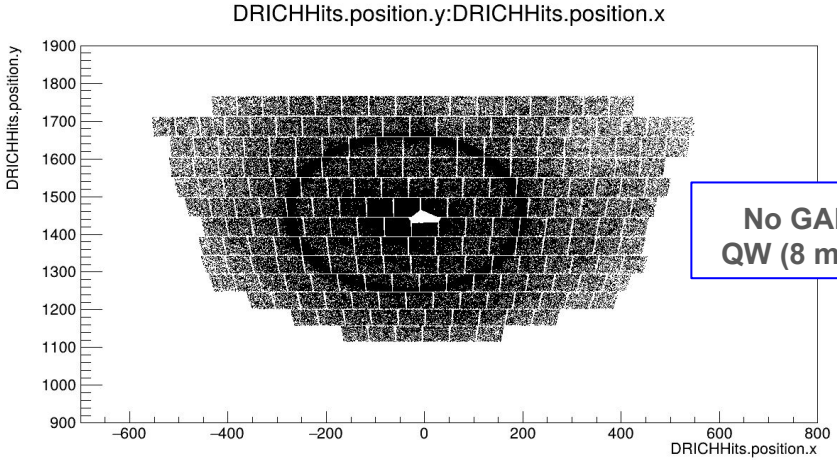
Coordinate Map of dRICH



Coordinate Map of dRICH

Pions (5000), p = 10 GeV/s, η = 1.7 (Target: Sector 1)

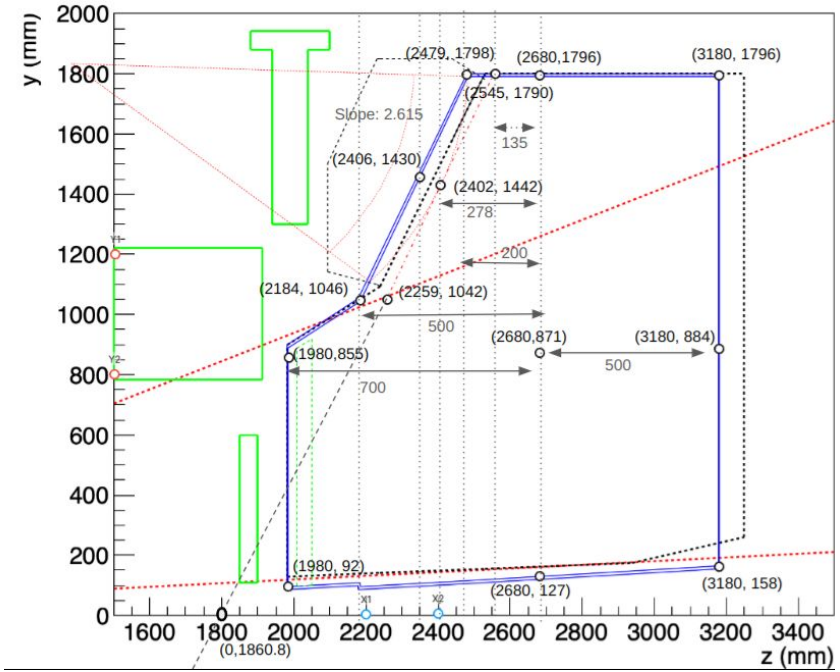


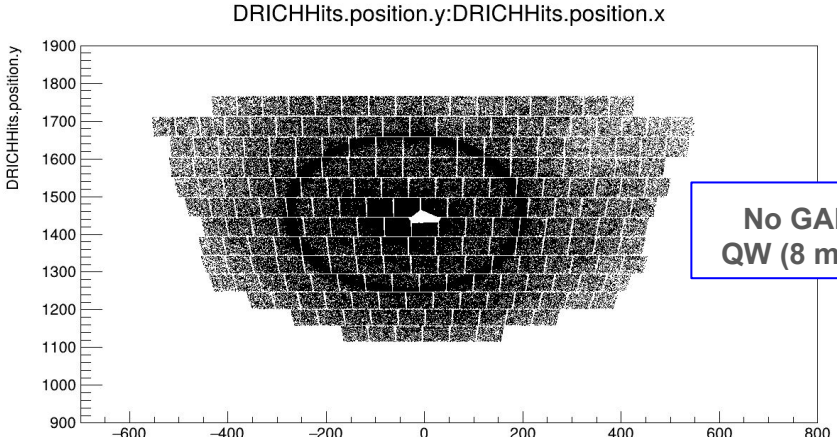


No GAP
QW (8 mm)

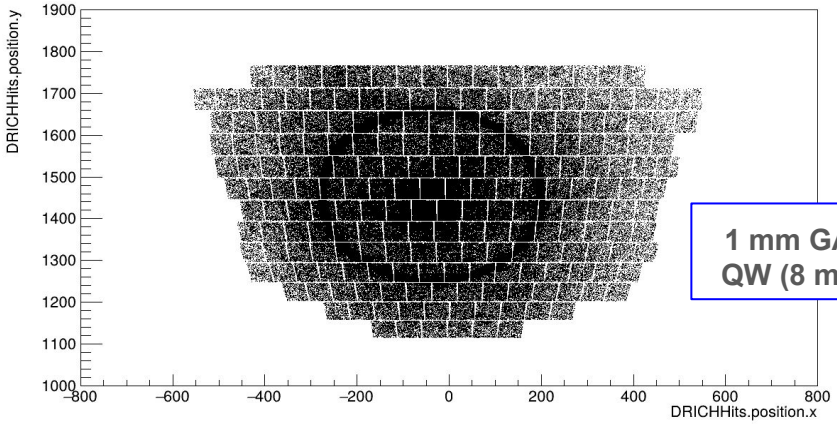
Coordinate Map of dRICH

Pions (5000), p = 10 GeV/s, η = 1.7 (Target: Sector 1)





No GAP
QW (8 mm)

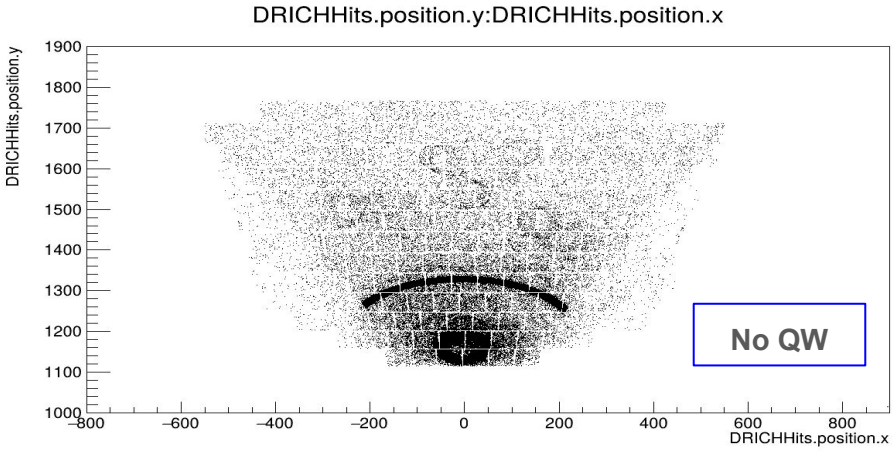


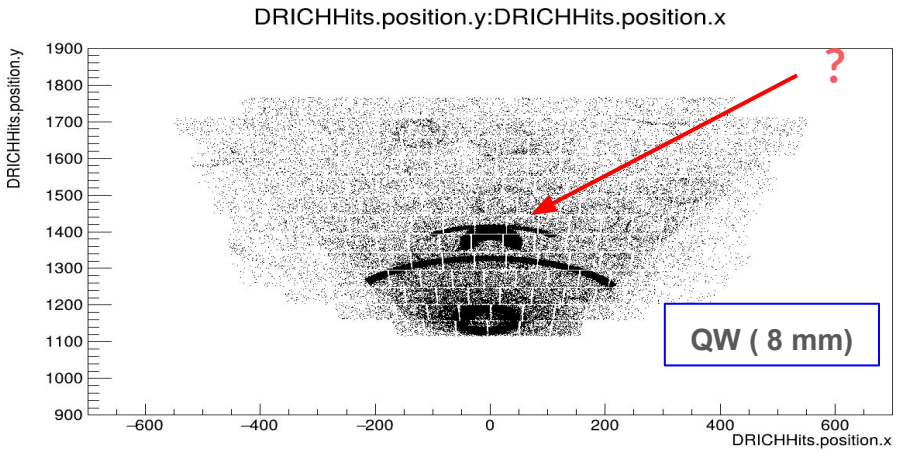
1 mm GAP
QW (8 mm)

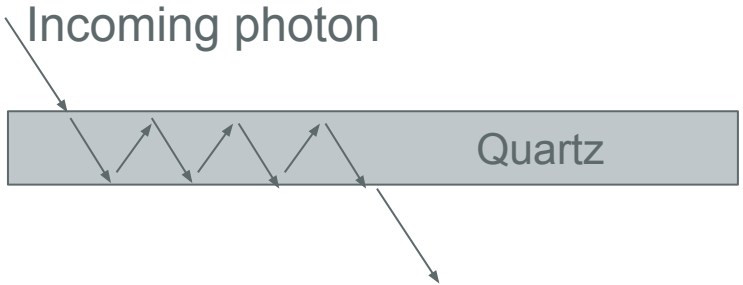
Shadow disappears by putting 1 mm (relative) gap between window and sector

Effect of inserting QW

Pions (5000), p = 10 GeV/s, η = 3.5 (Target: Sector 1)



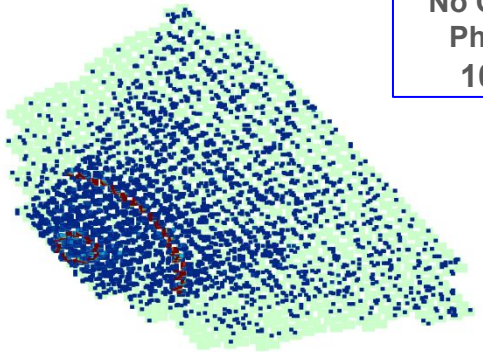




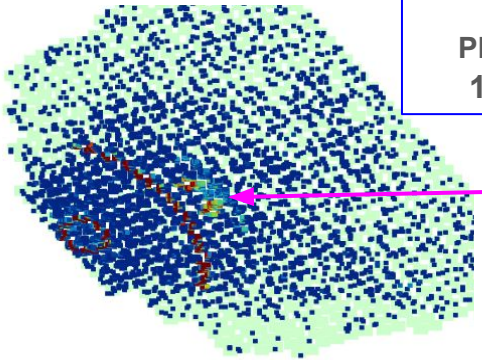
- **Possible trapping of photons inside the Quartz Window. Such photons may get escaped parallely at different locations (?)**

With digitized photons

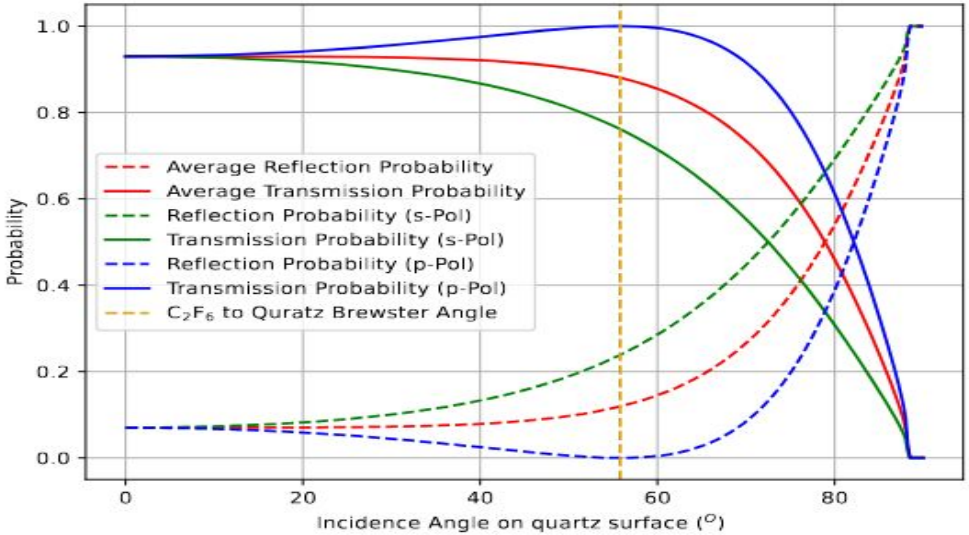
Pions (5000), p = 10 GeV/s, η = 3.5 (Target: Sector 1)



No Quartz Window
Photon Count =
103068 ± 321



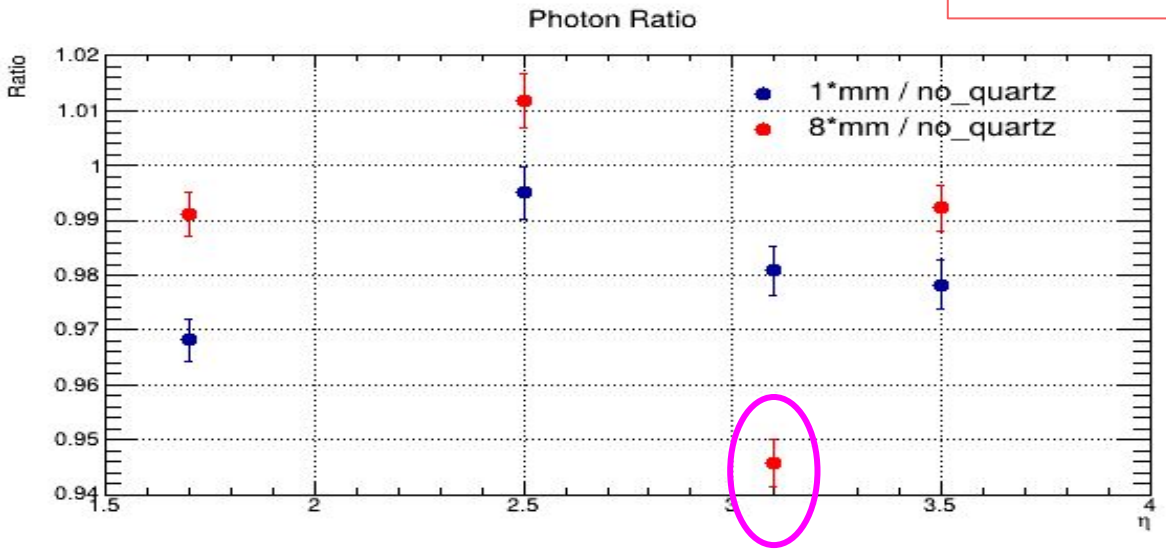
Quartz Window
(8 mm)
Photon Count =
102261 ± 320



- ~99.22 % photons passing through quartz window, which is a Good sign :)

Effect of QW width

Pions (5000), p = 10 GeV/s (Target: Sector 1)
η = 1.7, 2.5, 3.1, 3.5



Ambiguous (?) values at η = 3.1 (< 95% transmission)
Dominance of s-polarized photons over p-polarized ones at η = 3.1
OR any other reason (matter of investigation)

Number of digitized photons for 5000 π+ at 10 GeV/c for different η values and window types:

Window Thickness/η	1.7	2.5	3.1	3.5
No quartz window	152332	103183	110791	103068
1 mm quartz window	147498	102650	108668	100830
8 mm quartz window	150978	104387	104770	102261

Summary & Future Plans

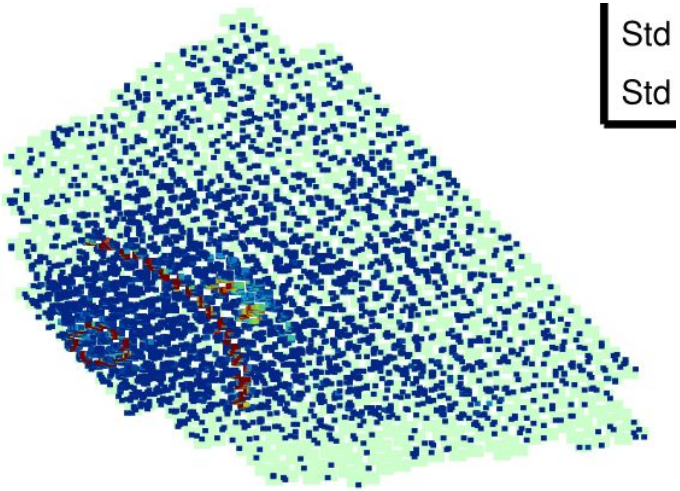
- **The gap between window and sector mandatory**
- **By implementing quartz window in dRICH, minor change in photon multiplicity is observed**
- **Resolution of Cherenkov angles need to be checked (N_σ-separation)**
- **Overlaps are to be removed**

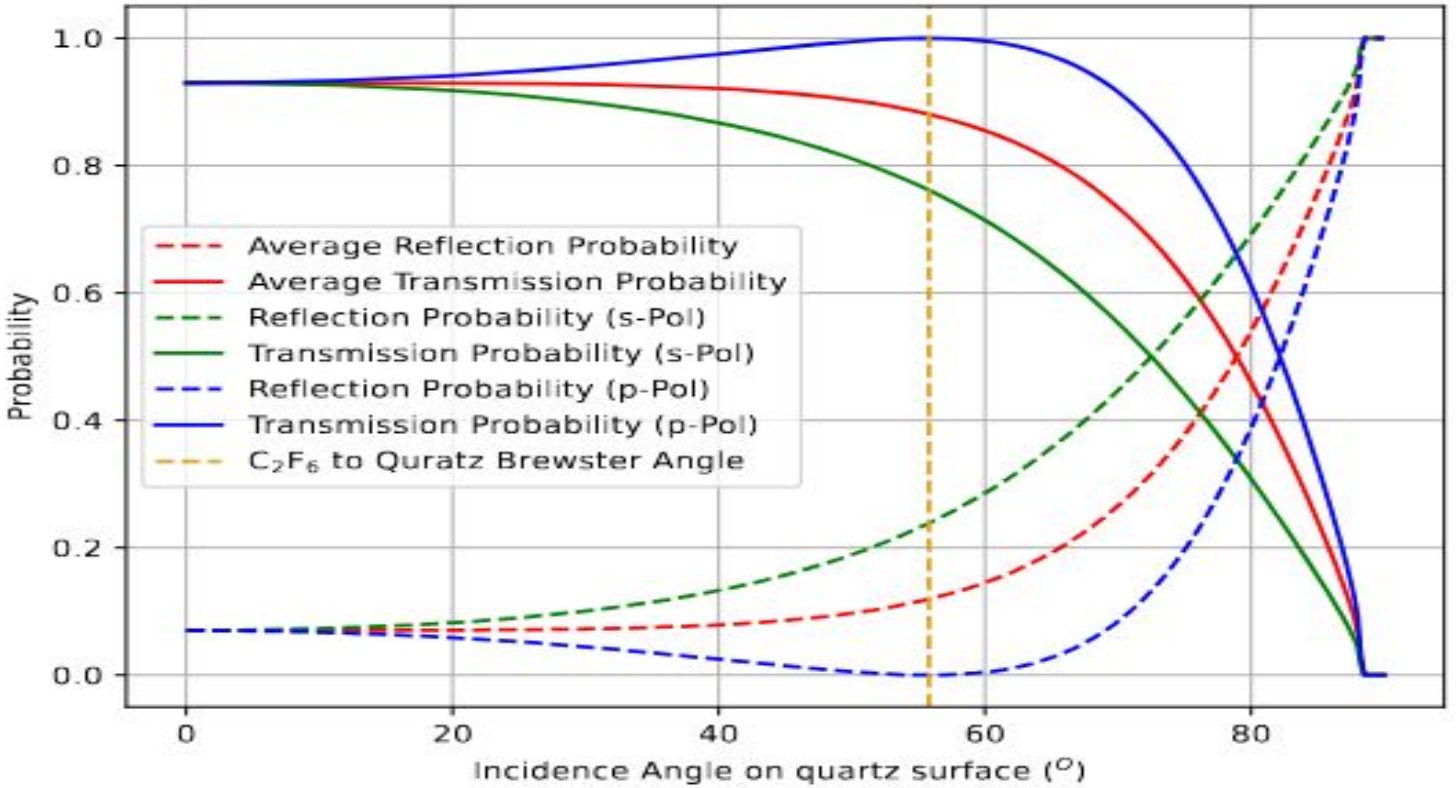
THANK YOU

Looking forward to feedback & comments

BACKUP

Other…





Caption : Reflection and Transmission probability as a function of incidence angle for photons traveling from C2F6 to Nitrogen through a quartz window.

If you are interested in numbers….
eta {1p7,2p5,3p1,3p5} at momentum 10 Gev/c , 5000 pion+

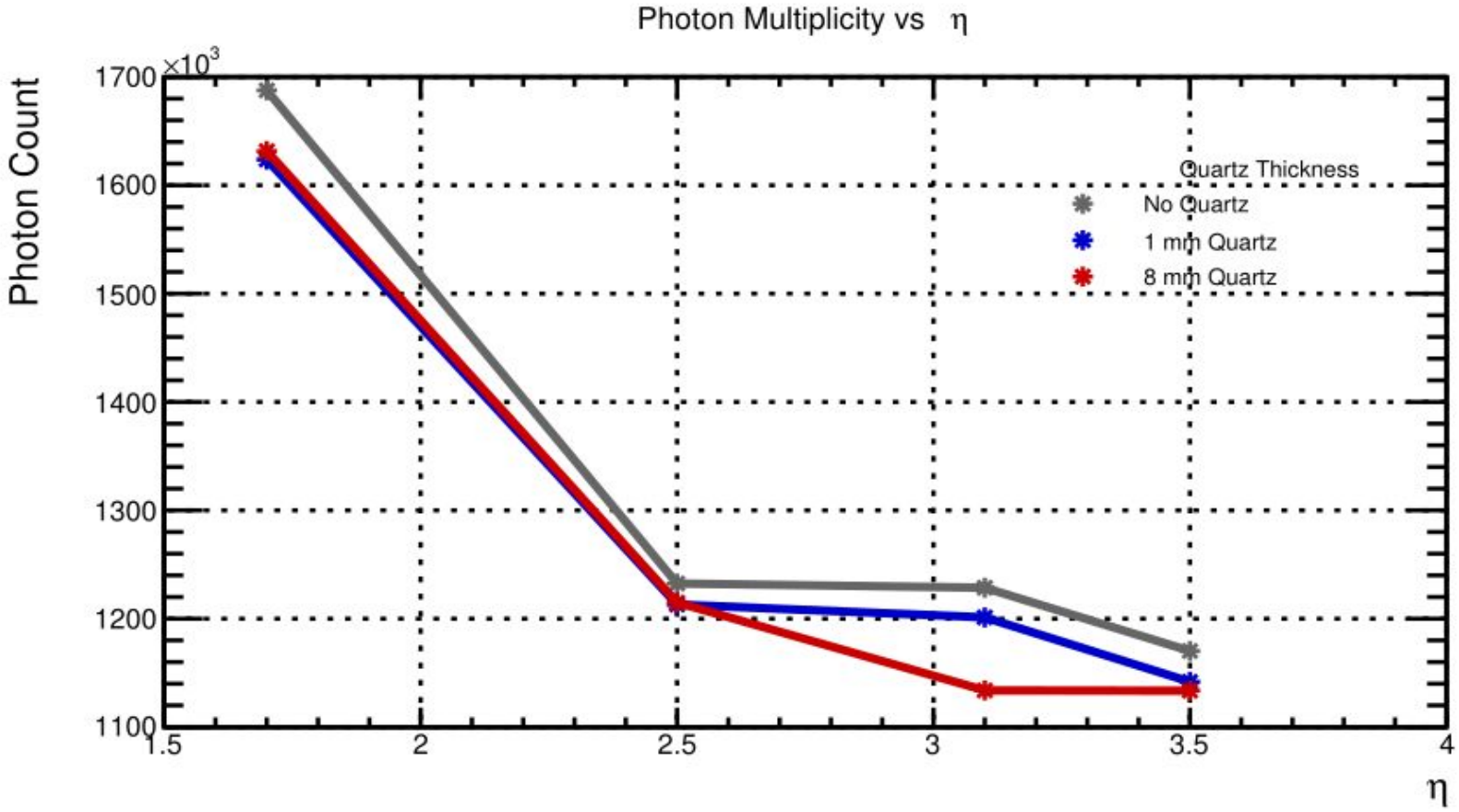
Number of digitized photons:-

1*mm window :
{147498+/-383.97 , 102650+/-320.39 , 108668 +/-329.60 , 100830+/-317.54}

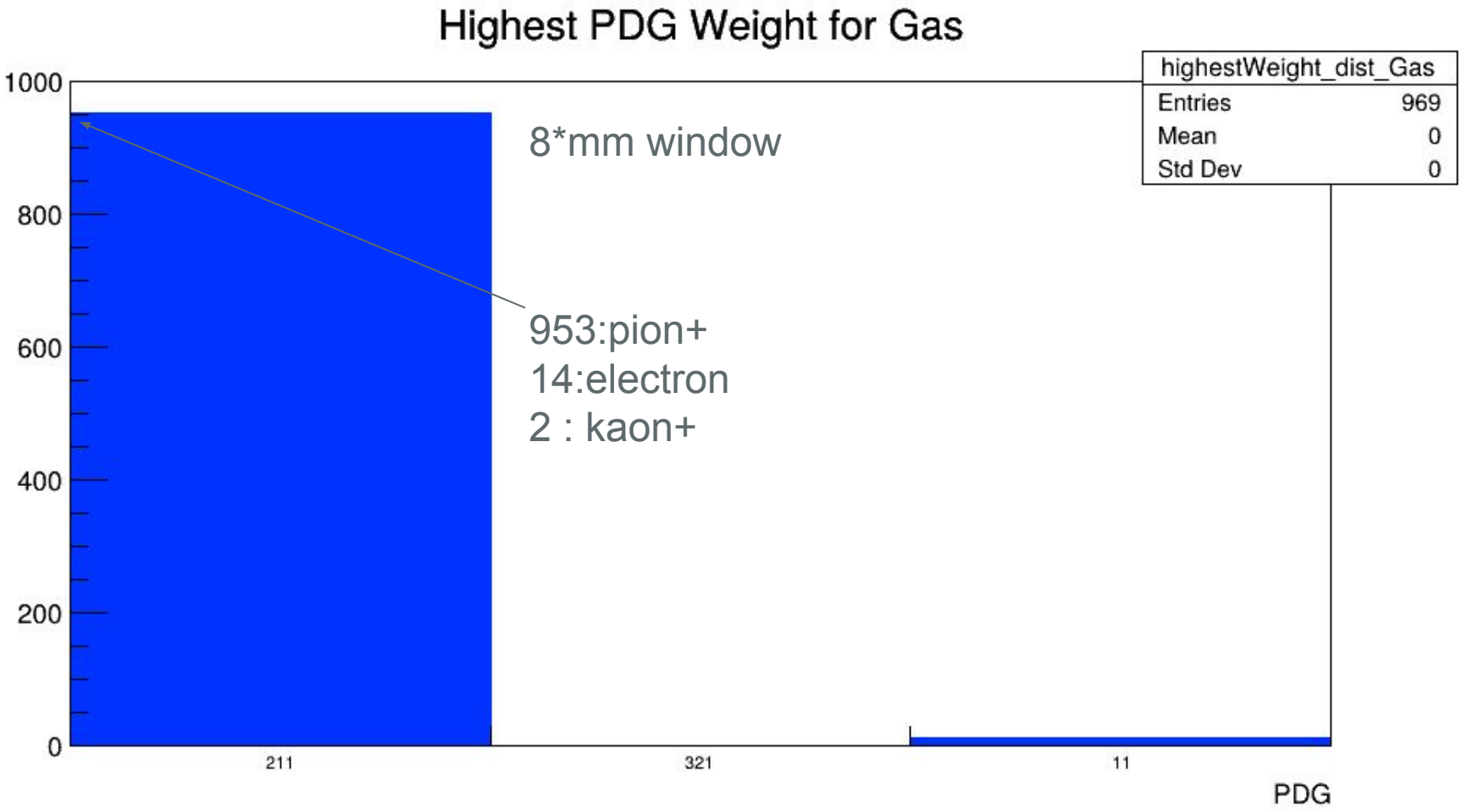
8*mm window :
{150978+/-388.51, 104387+/-323.16, 104770 +/-323.69 , 102261+/- 319.71}

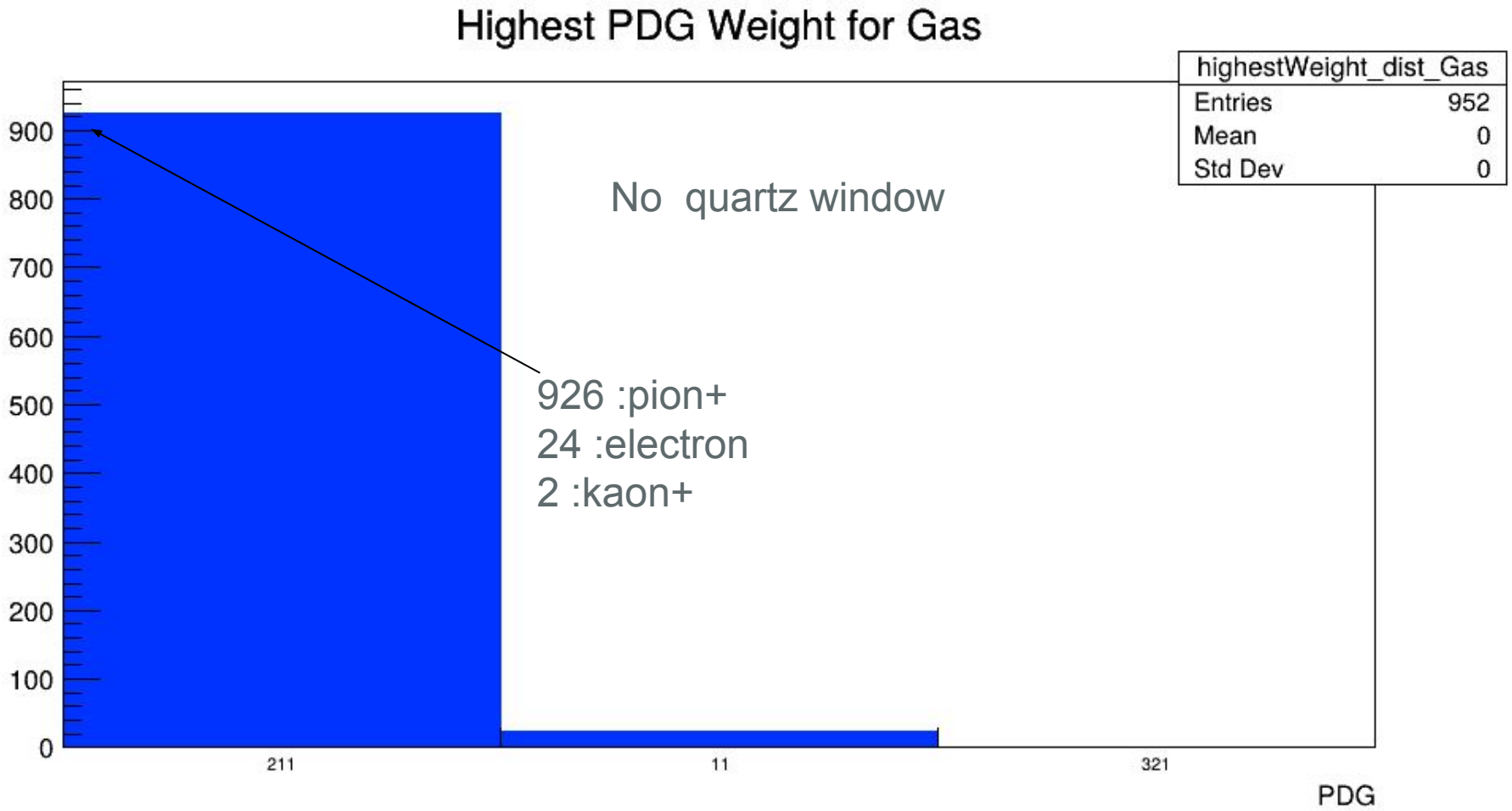
No quartz window :
{152332+/-390.26, 103183+/- 321.19, 110791+/-332.87, 103068+/- 321.04}

7.

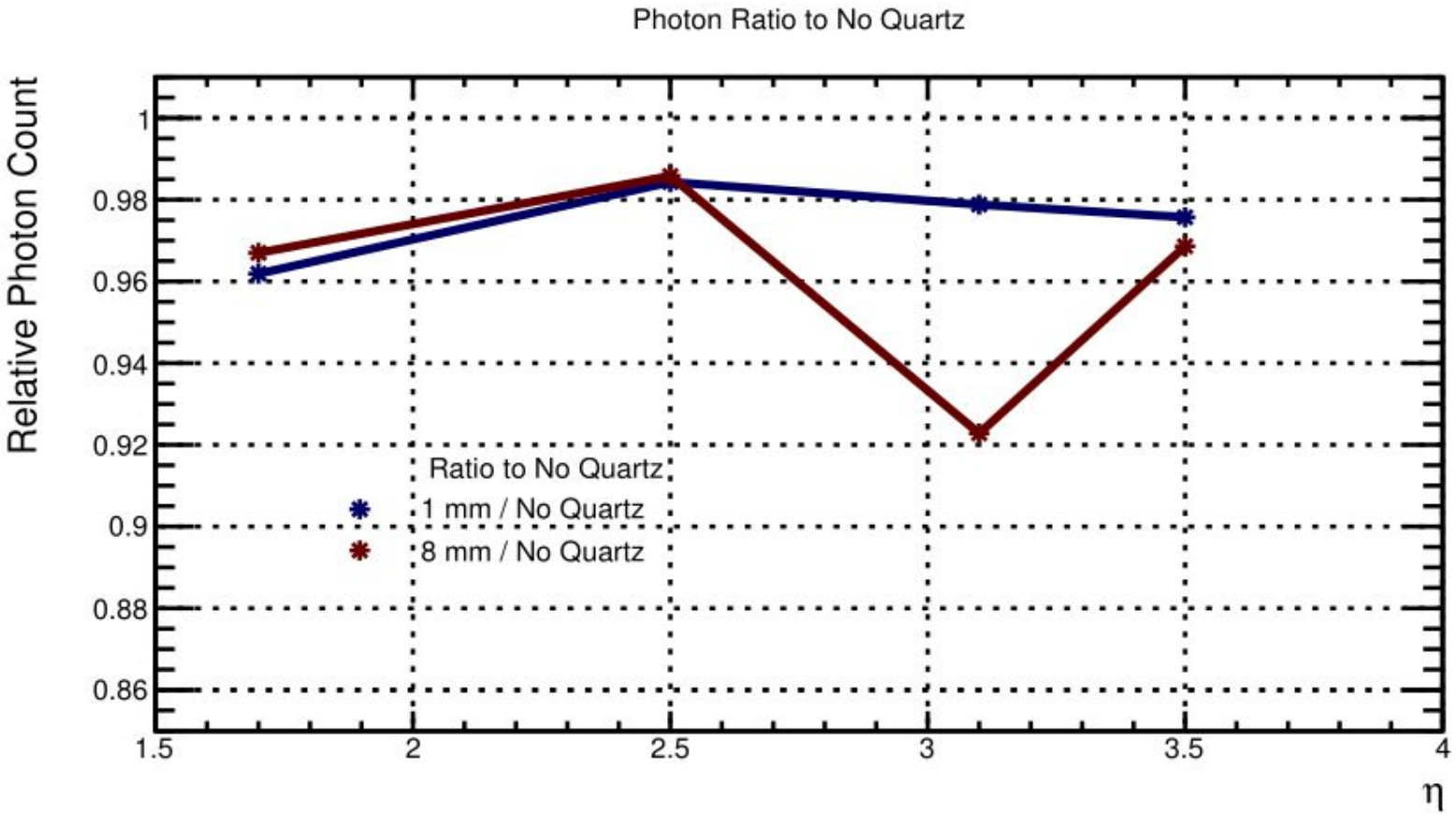


Data set: 5000 pion+ with momentum 10Gev/c


Highest PDG Weight for Gas
highestWeight_dist_Gas
Entries 969
Mean 0
Std Dev 0
8*mm window
953:pion+
14:electron
2 : kaon+
1000
800
600
400
200
0
211
321
11
PDG



Pion+ 1000 , momentum 10 Gev/c eta 3p5(near beam pipe line)


Photon Ratio to No Quartz
Relative Photon Count
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
1.5
2
2.5
3
3.5
4
η
Ratio to No Quartz
1 mm / No Quartz
8 mm / No Quartz