Analysis Status Meet

November 20th, 2025

(d,p) excitation function

Total E* plot

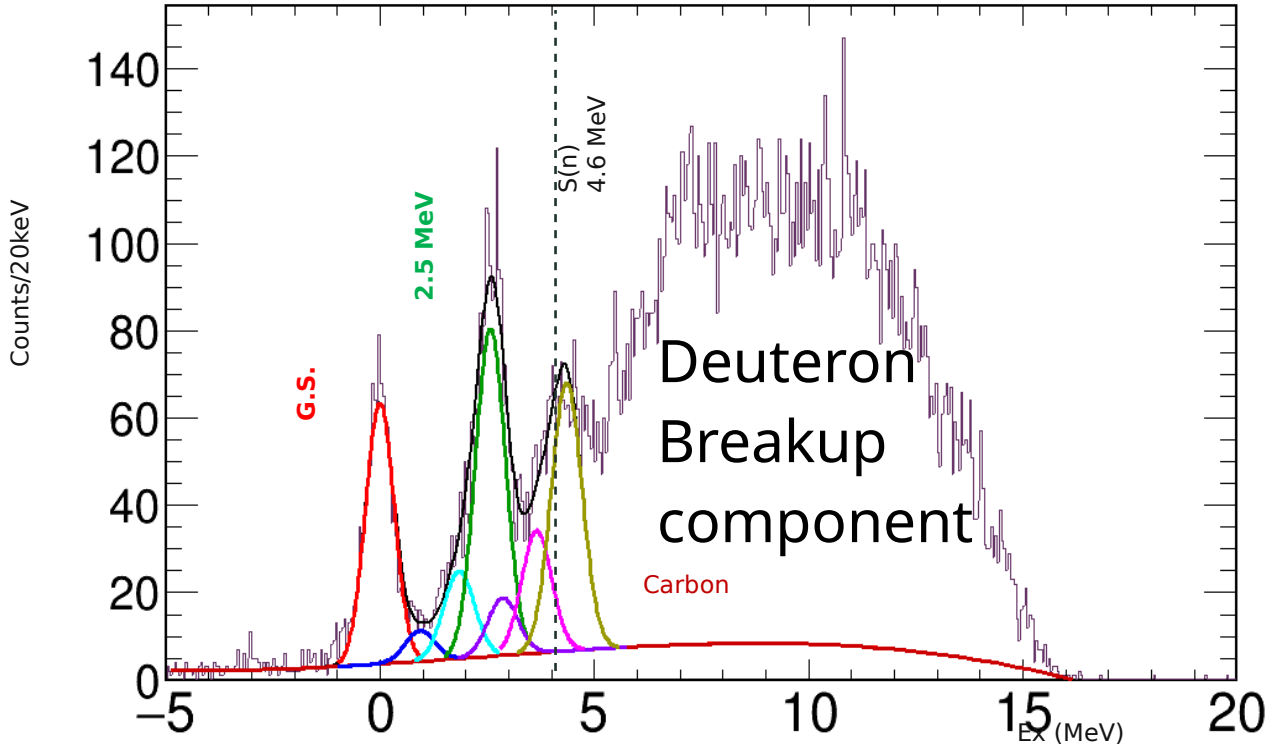
E* > S(n)

Drift Chamber

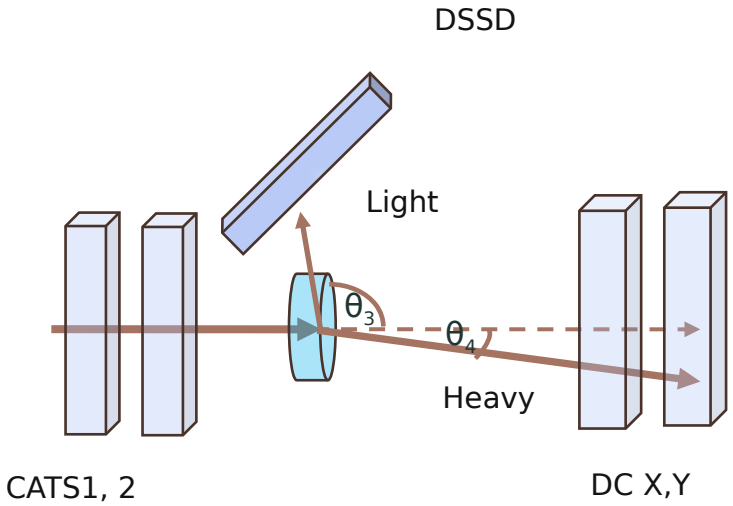
Trajectories: CATS

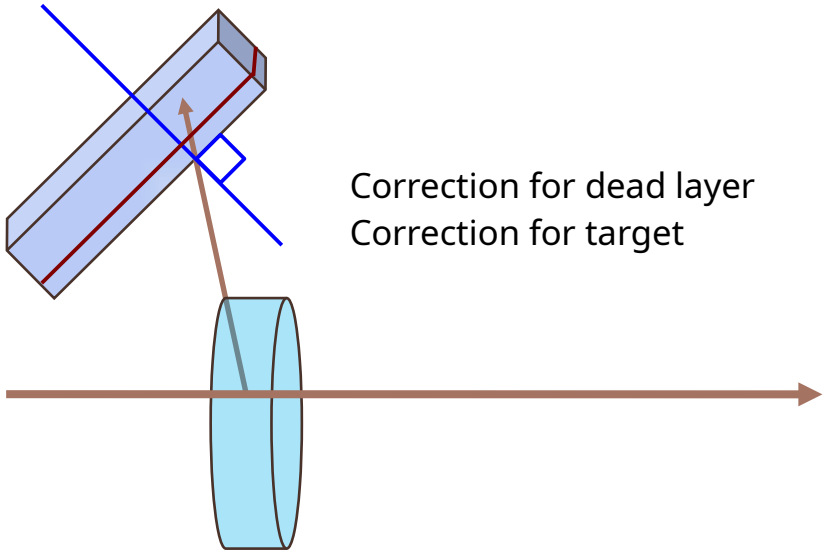
E* < S(n)

Exogam



The need for CATS

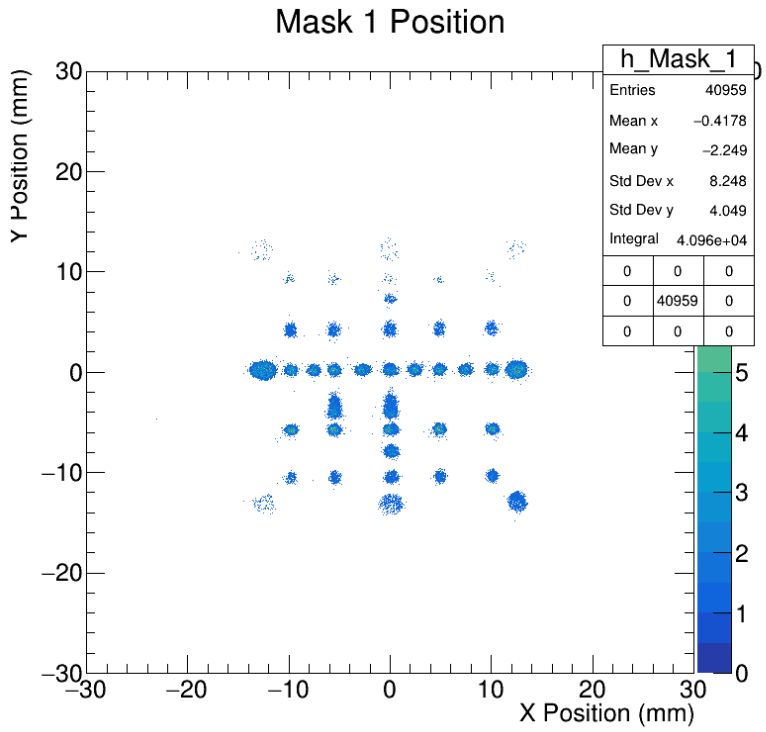


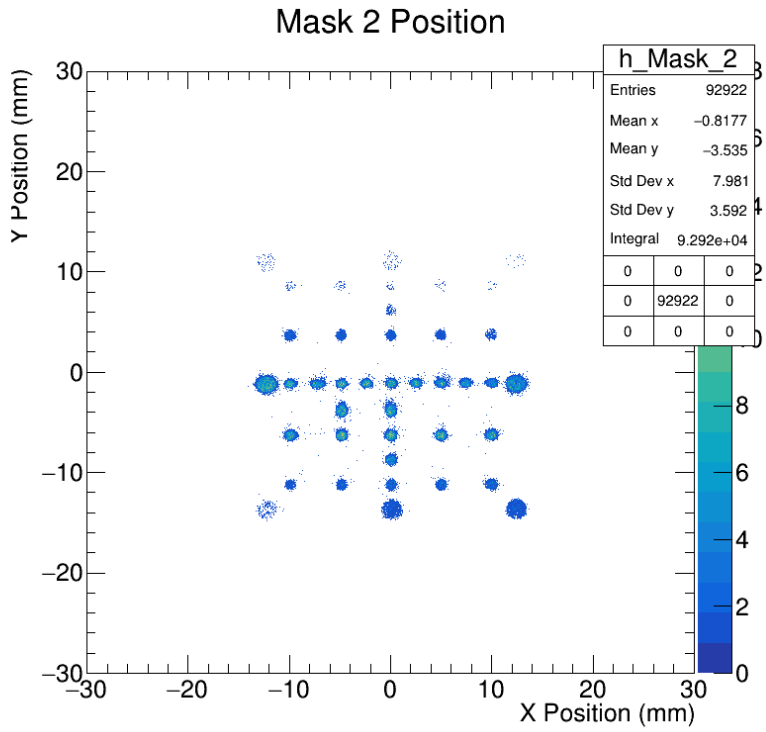


Ozge's method: Shift the target spot to minimize the resolution in E* plot

BeamImpact = TVector3(-(CATS->PositionOnTargetX)+1.7,-(CATS->PositionOnTargetY)+2.3,0);

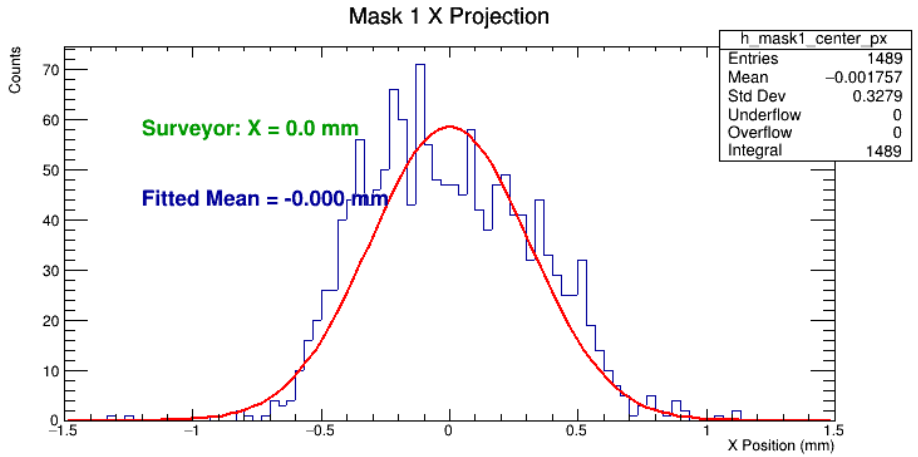
CATS calibration

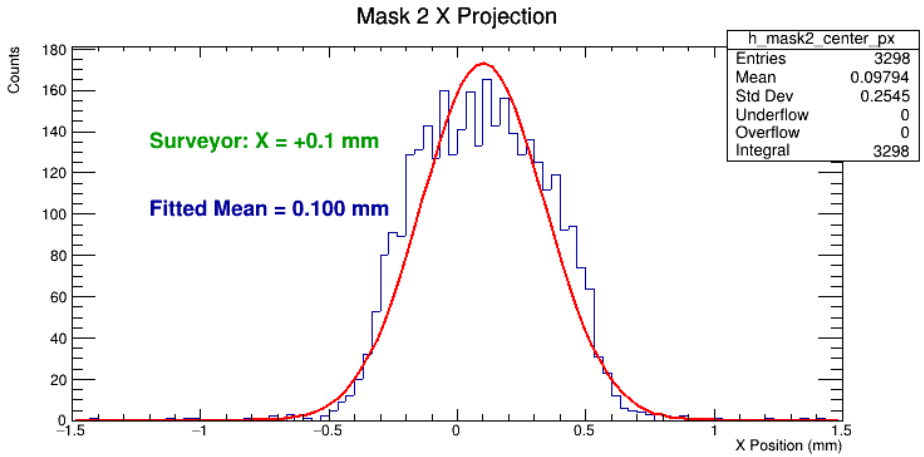


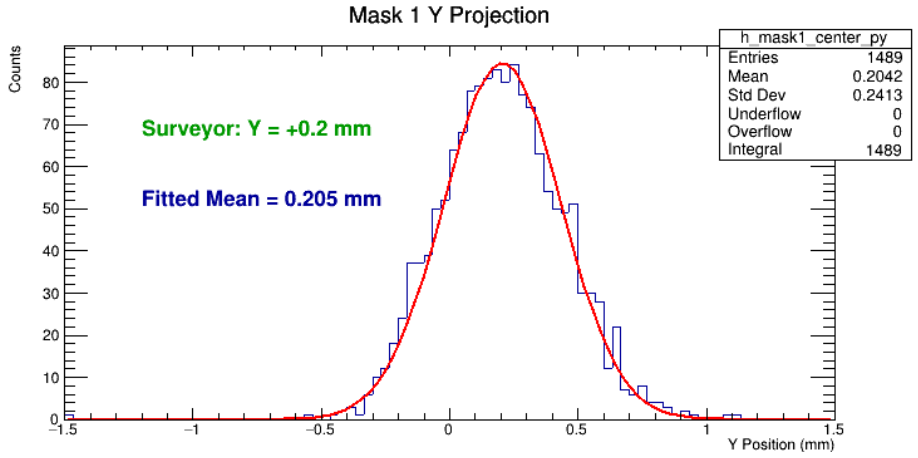


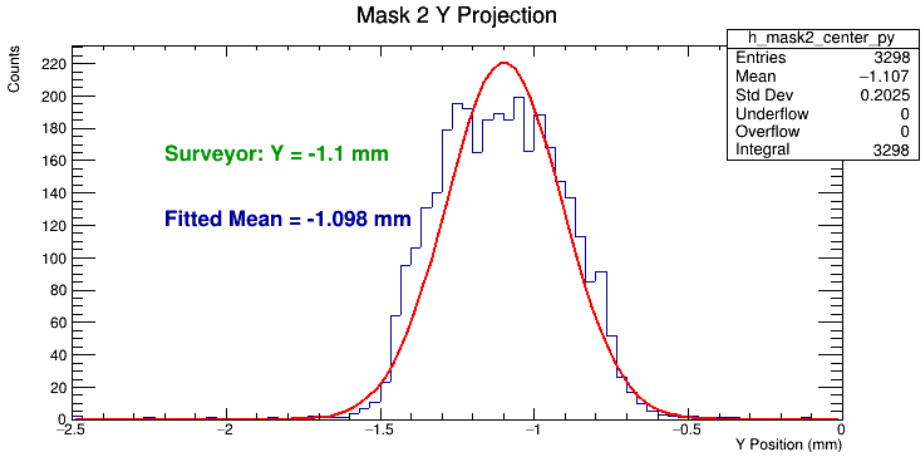
Known from surveyor:
the pos of central holes only

CATS calibration→ mask central holes (x,y)

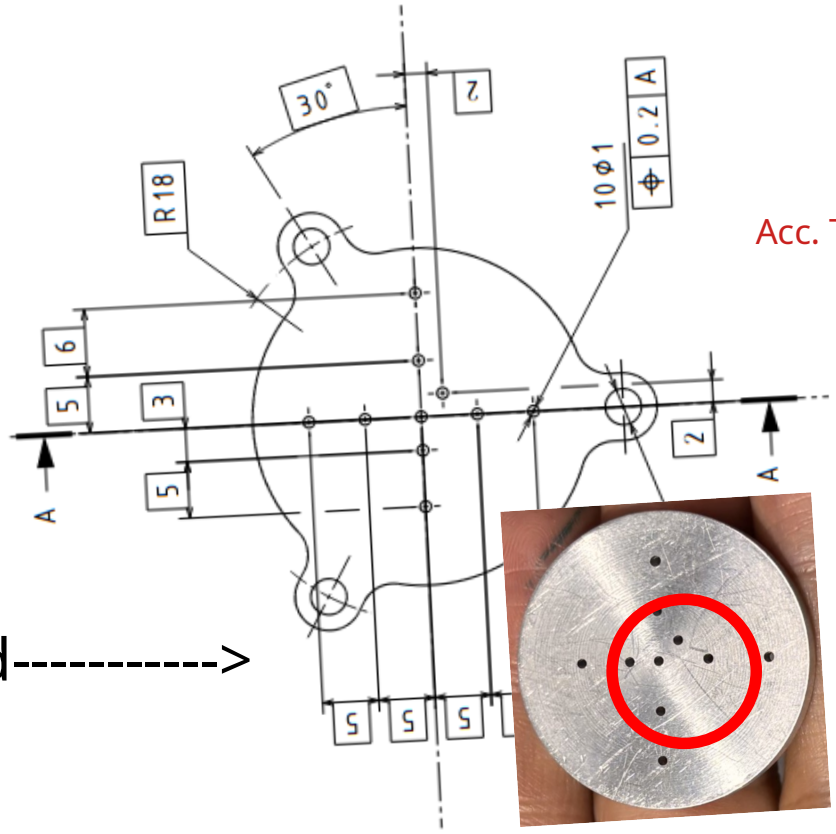




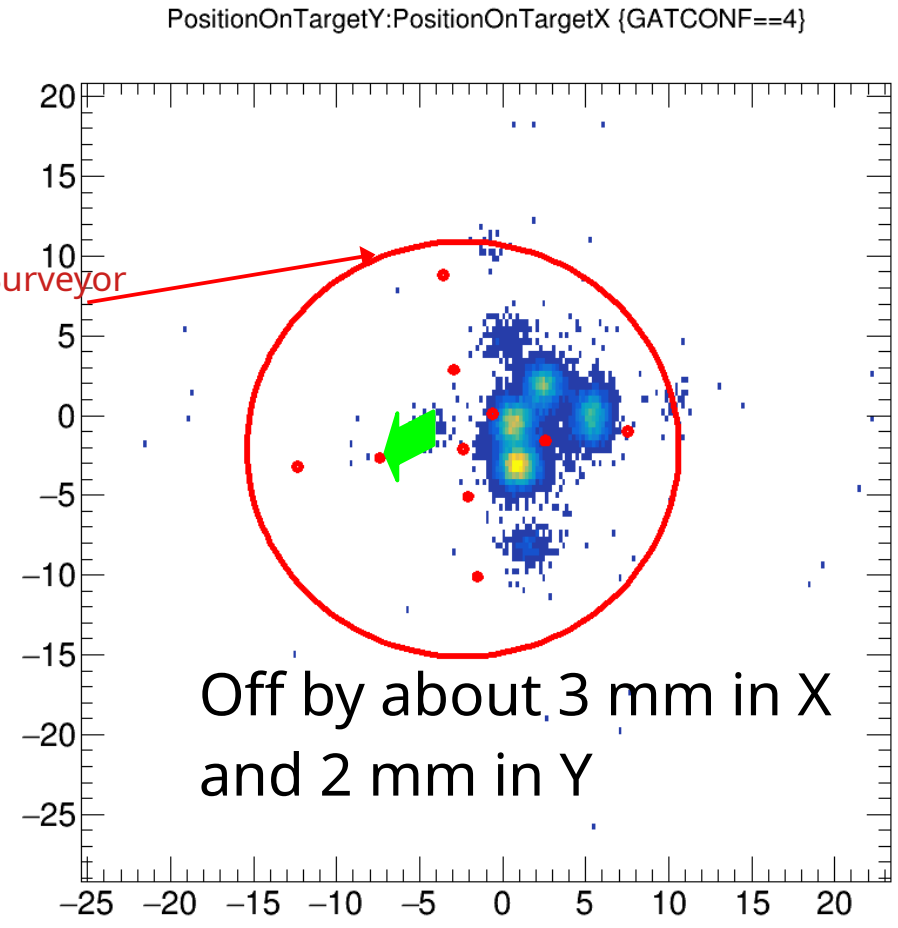




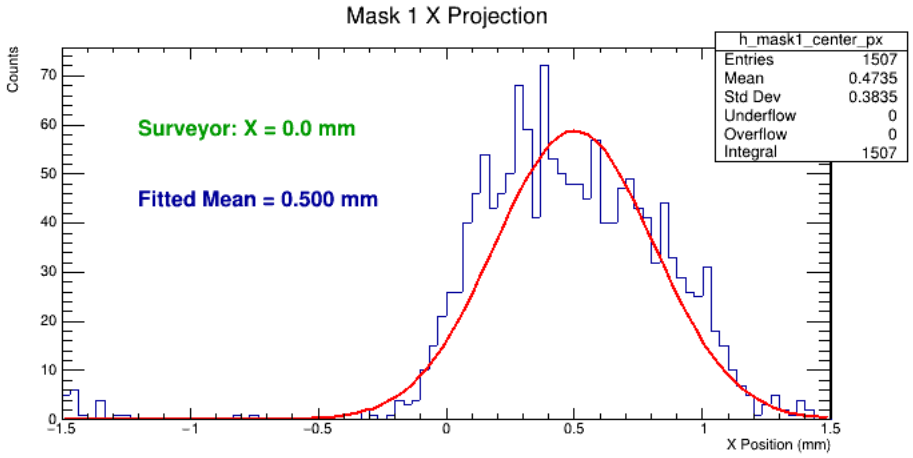
CATS calibration→ target mask holes (x,y)

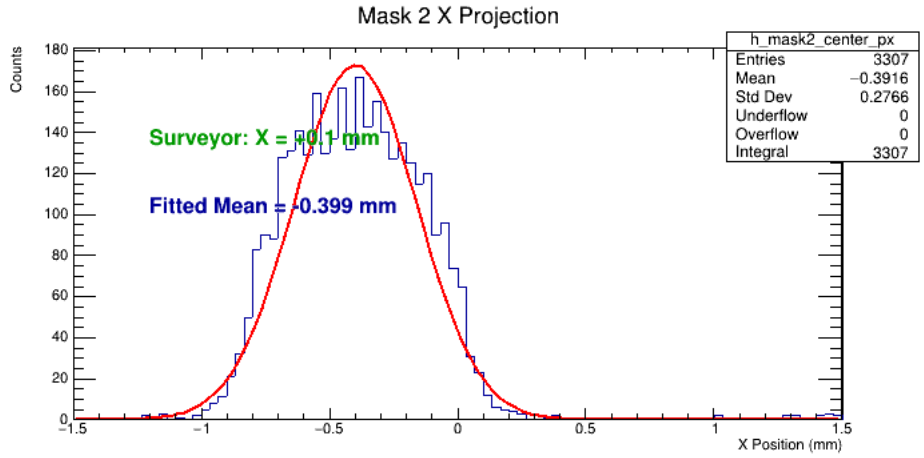


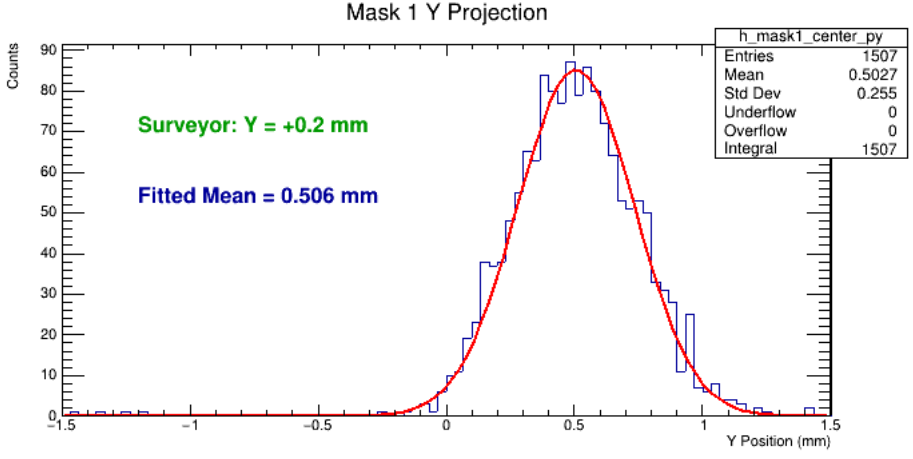
Rotated---------->

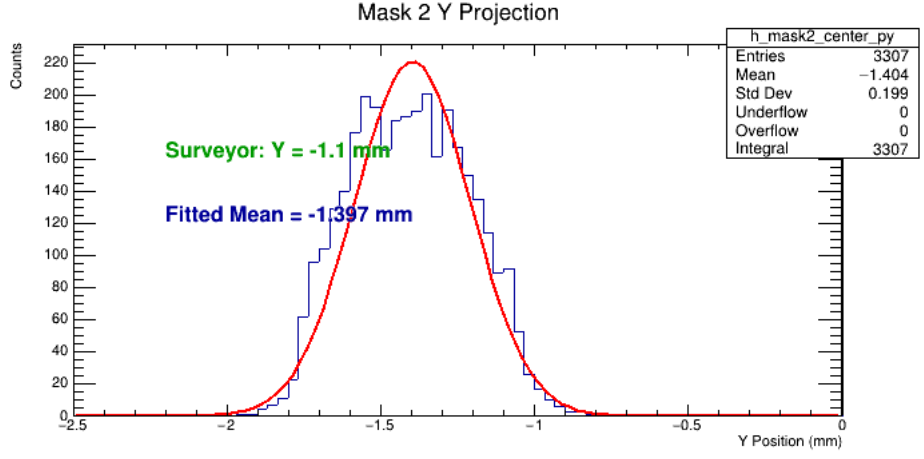


CATS calibration→ cats mask holes shift (x,y)









CATS calibration→ target mask holes shift (x,y)

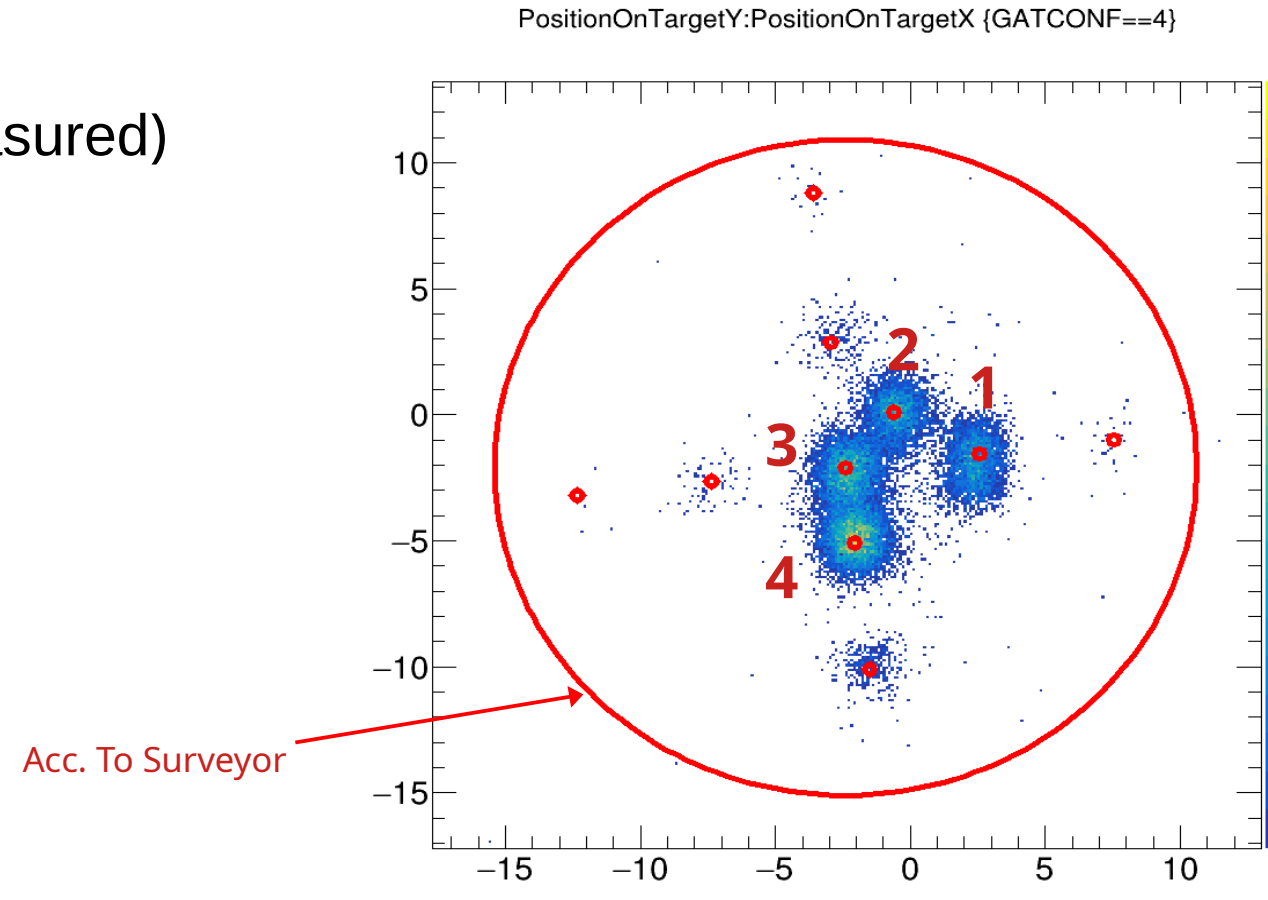
New shifts (Δ = surveyor - measured)

Hole 1 (X, Y): (0.18, 0.32)

Hole 2 (X,Y): (-0.15, 0.04)

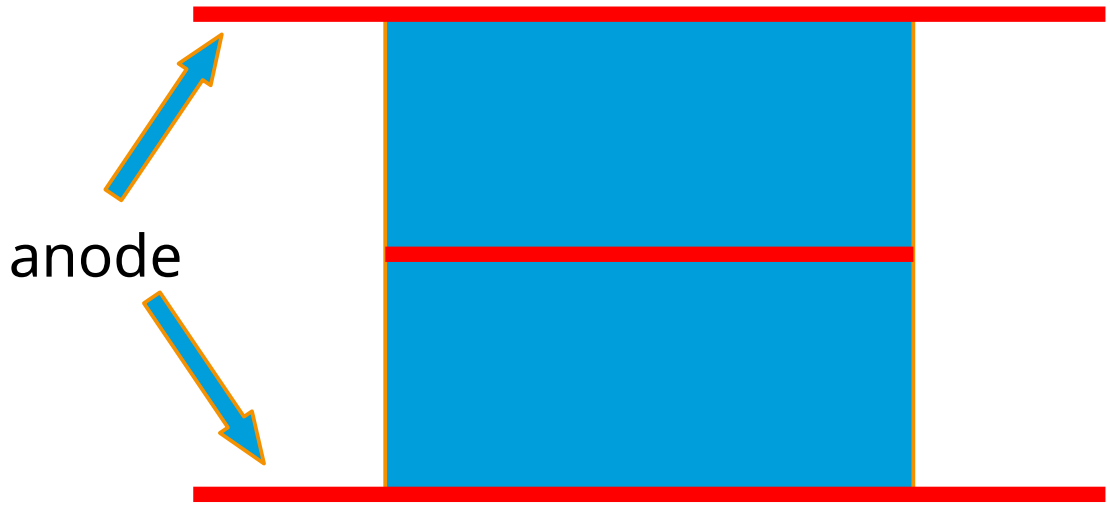
Hole 3 (X,Y): (-0.14, 0.06)

Hole 4 (X,Y): (-0.04, -0.21)

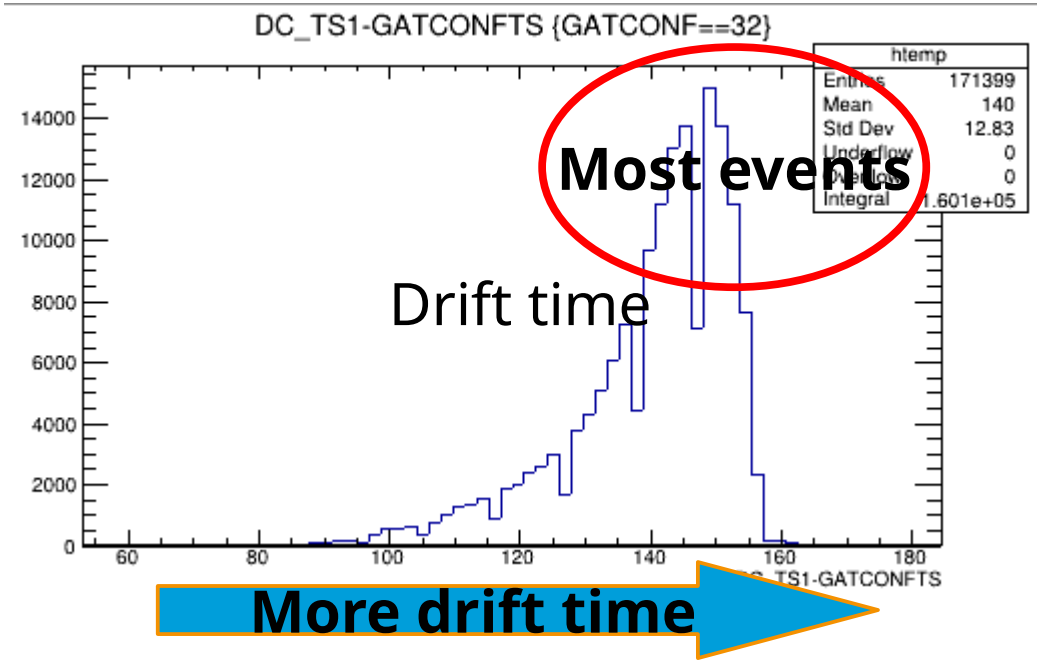


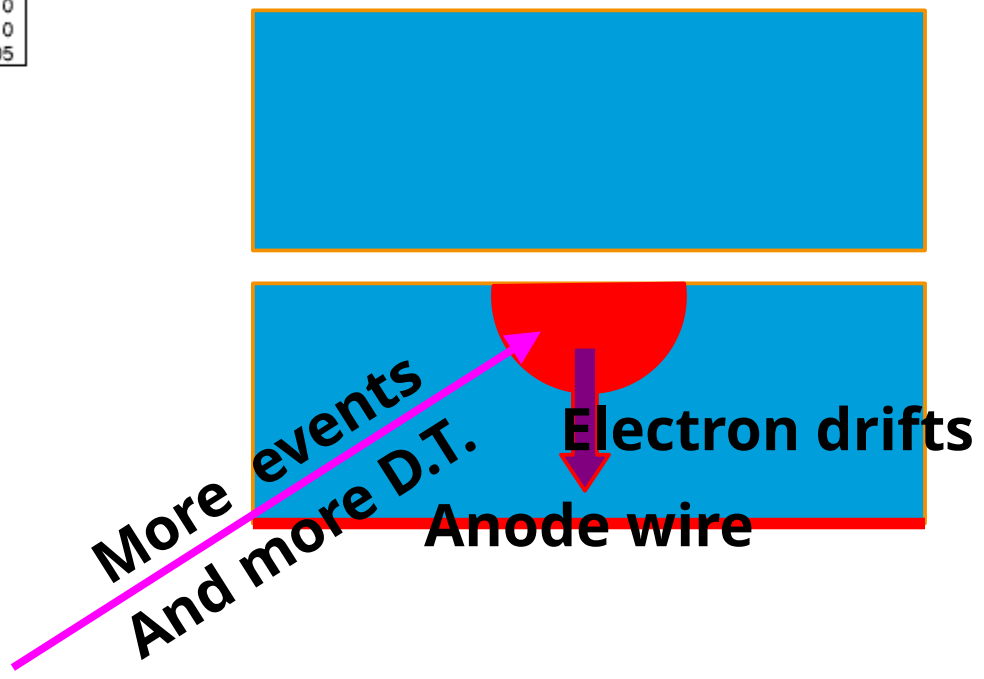
Drift Chamber : Construction

4 channels in total, 2 horizontal and 2 vertical

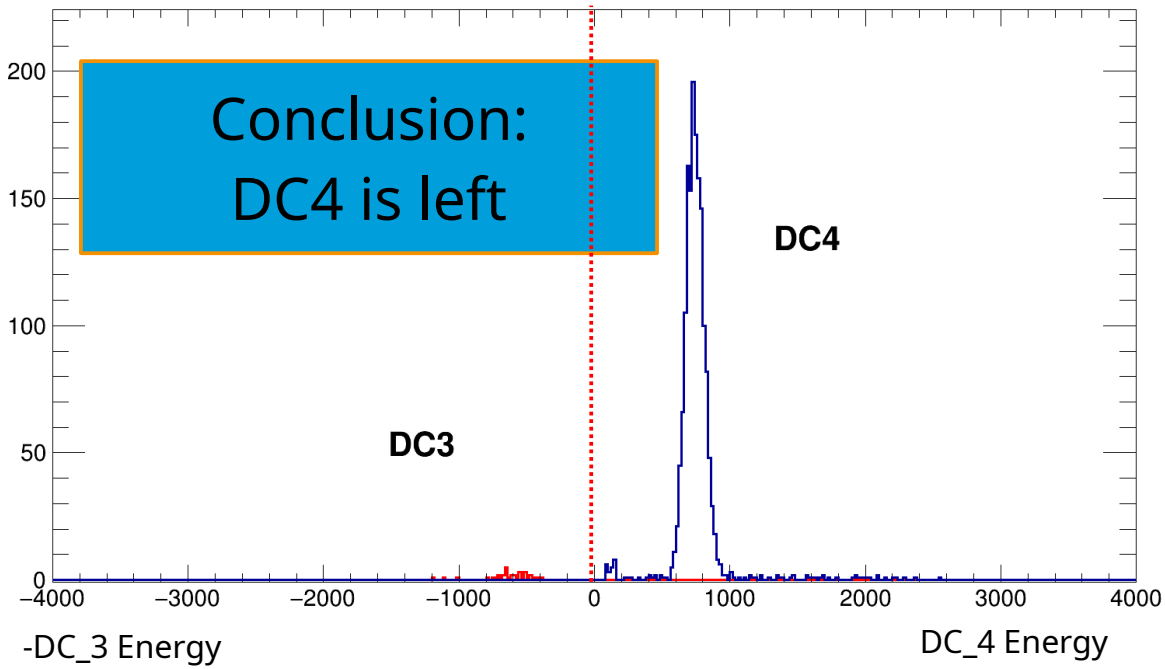


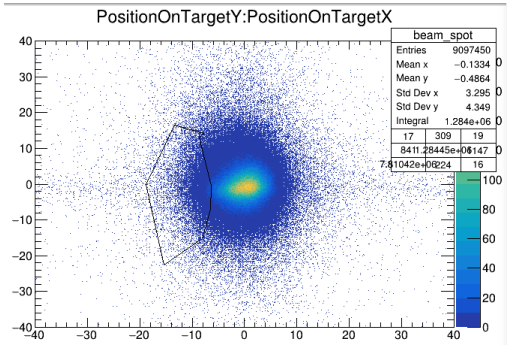
Drift Chamber: working

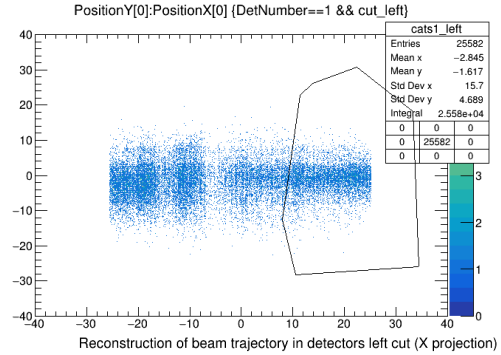


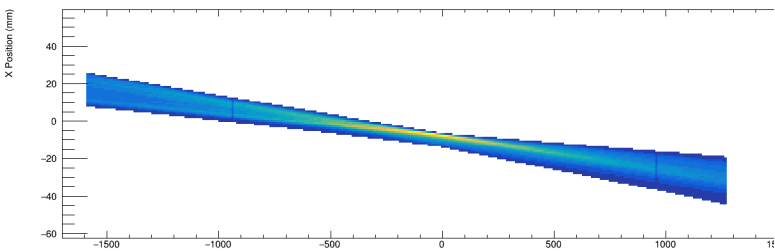


Drift Chamber: Channel identification

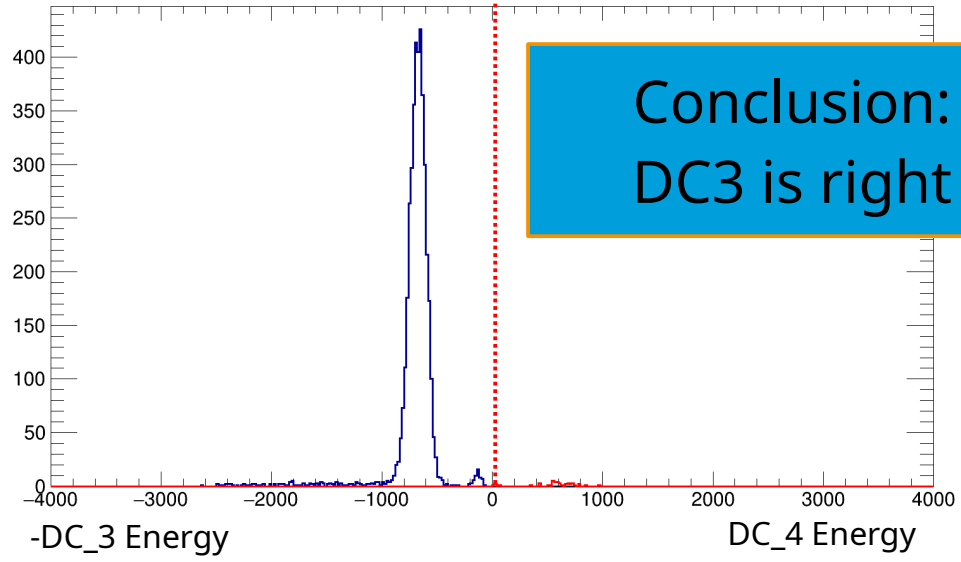




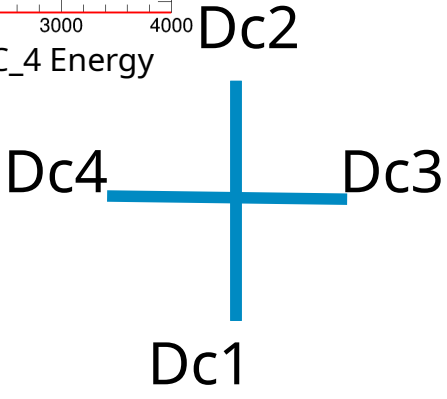


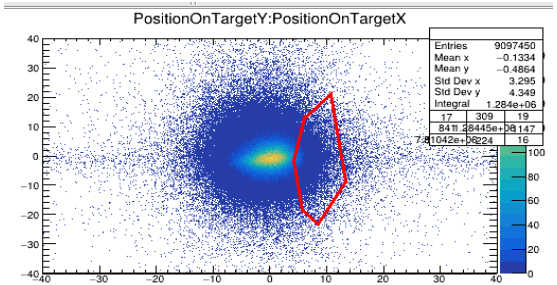


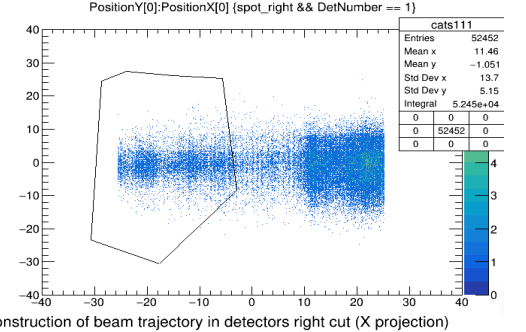
Drift Chamber: Channel identification



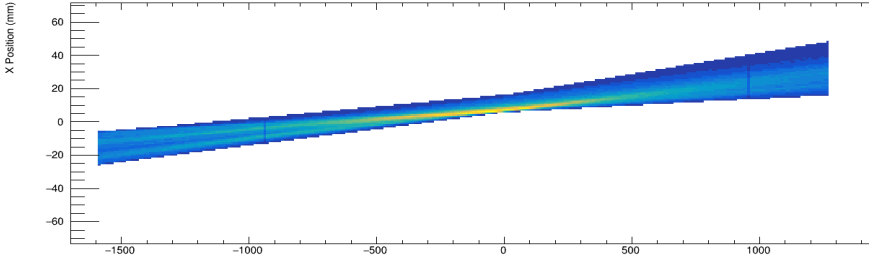
Conclusion:
DC3 is right





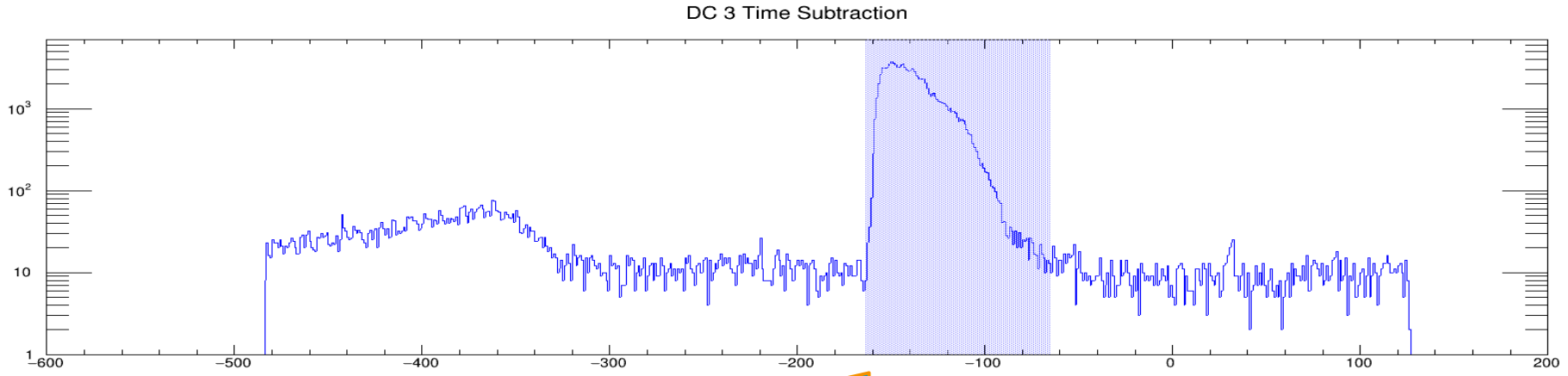


Reconstruction of beam trajectory in detectors right cut (X projection)

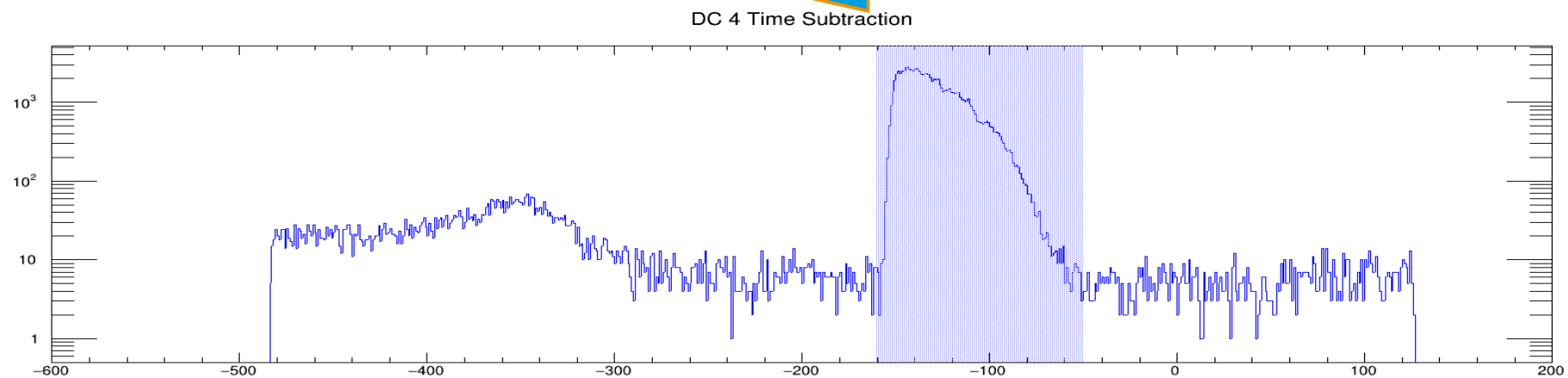


Drift Chamber: Channel identification

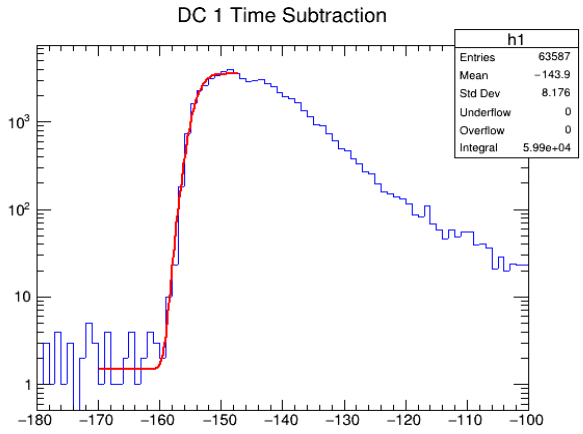
Counts in log scale

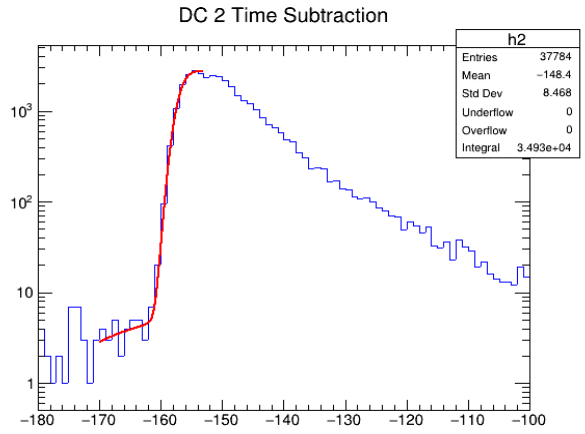


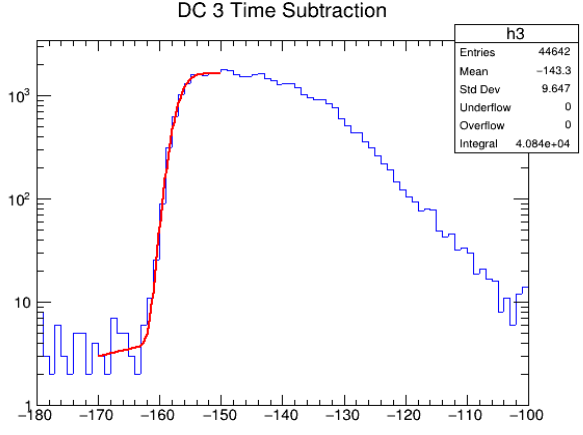
More drift time

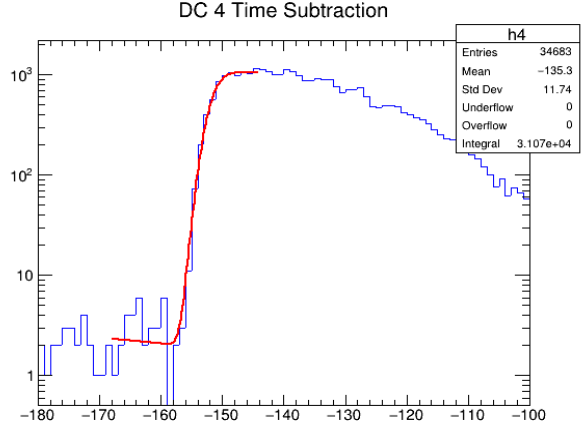


Drift Chamber: Drift time spectra



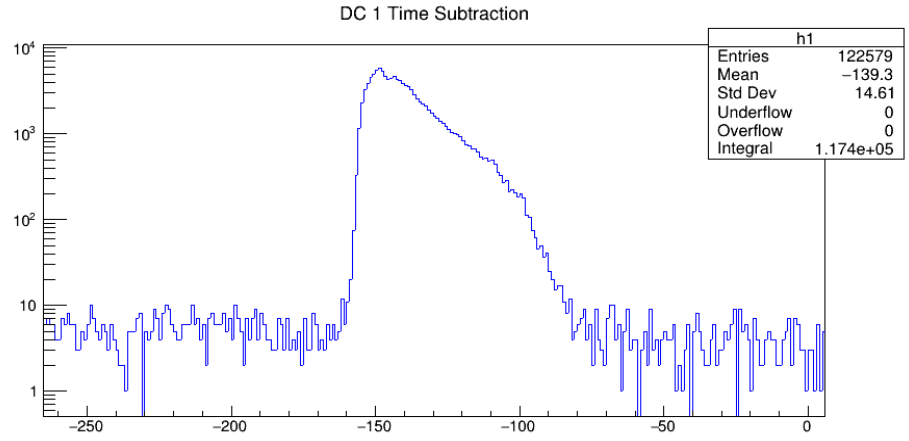


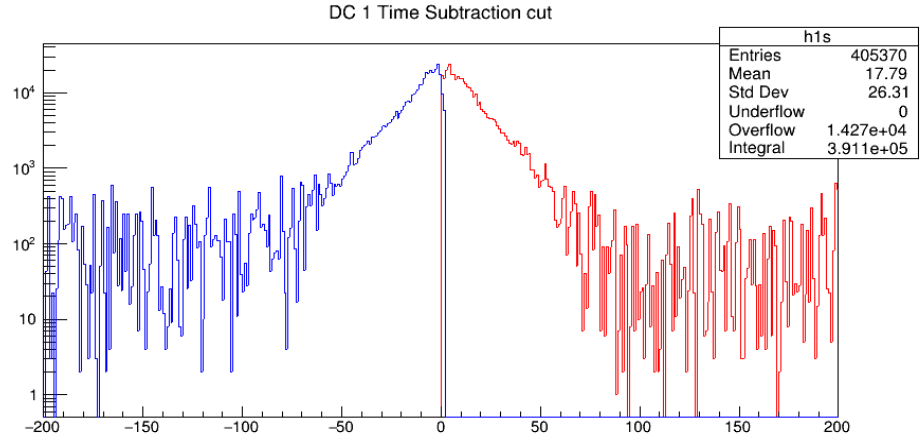


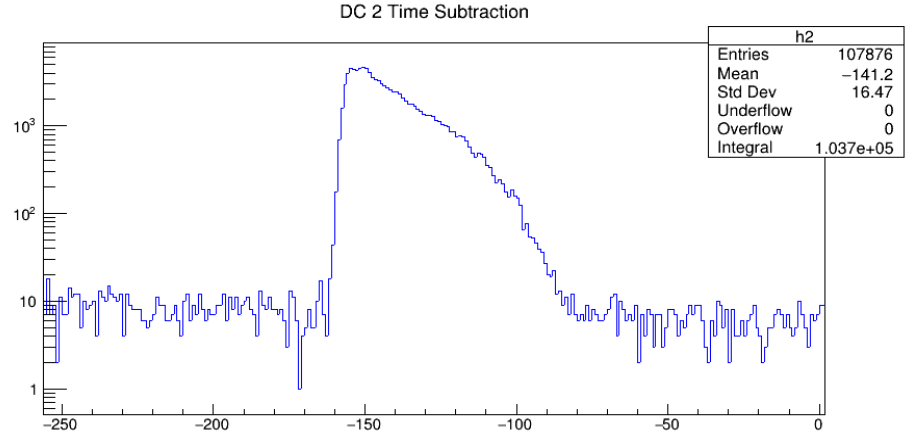


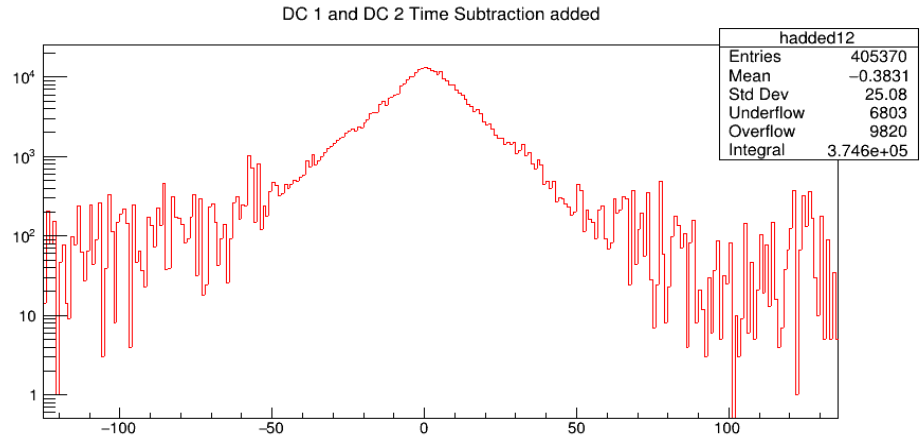

```
//////// Plugin: core    | Class : nptool::Application   | Mu
enable
Total Entries: 9097450
Processing entry: 0%
Processing entry: 10.9921%
Processing entry: 21.9842%
****************************************
Minimizer is Minuit2 / Migrad
Chi2                      =      222.539
NDf                       =           18
Edm                       =  2.24485e-06
NCalls                    =          226
C0                        =       1766.1   +/-   15.4834
mu                        =      -154.077   +/-   0.042109
sigma                     =       1.53627   +/-   0.0287905
a0                        =       1.63778   +/-   20.6047
a1                        =   0.000921442   +/-   0.124708
****************************************
Minimizer is Minuit2 / Migrad
Chi2                      =       15.3219
NDf                       =           12
Edm                       =  8.08805e-06
NCalls                    =          301
C0                        =       1368.17   +/-   18.3581
mu                        =      -157.186   +/-   0.0393256
sigma                     =       1.25713   +/-   0.0324009
a0                        =       39.3337   +/-   42.9911
a1                        =      0.214571   +/-   0.259325
****************************************
Minimizer is Minuit2 / Migrad
Chi2                      =       20.0765
NDf                       =           15
Edm                       =  1.31777e-08
NCalls                    =          371
C0                        =       811.875   +/-   10.139
mu                        =      -157.019   +/-   0.0535315
sigma                     =       1.59132   +/-   0.0459175
a0                        =       21.0022   +/-   43.1257
a1                        =      0.105948   +/-   0.259756
****************************************
Minimizer is Minuit2 / Migrad
Chi2                      =       41.4959
NDf                       =           18
Edm                       =  2.32093e-06
NCalls                    =          300
C0                        =       525.426   +/-   7.48684
mu                        =       -151.89   +/-   0.0667052
sigma                     =       1.66474   +/-   0.05221
a0                        =      -2.53316   +/-   21.6299
a1                        =   -0.0288823   +/-   0.132456
root [1]
```

Drift Chamber: Drift time spectra

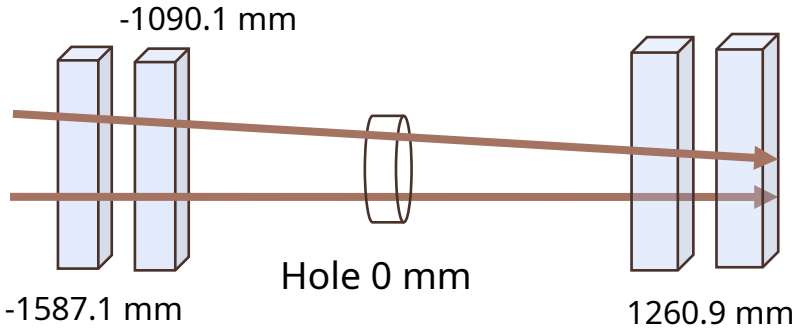


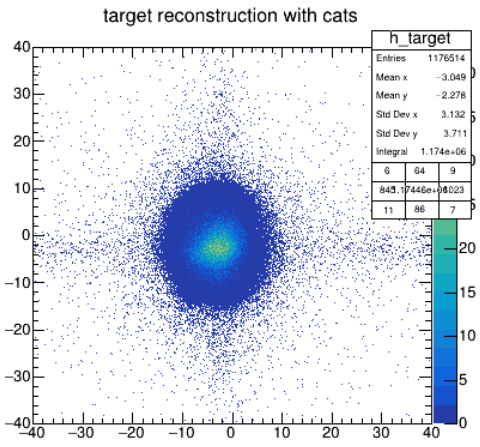


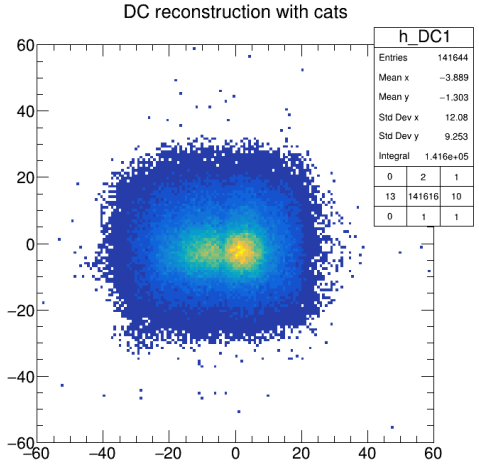


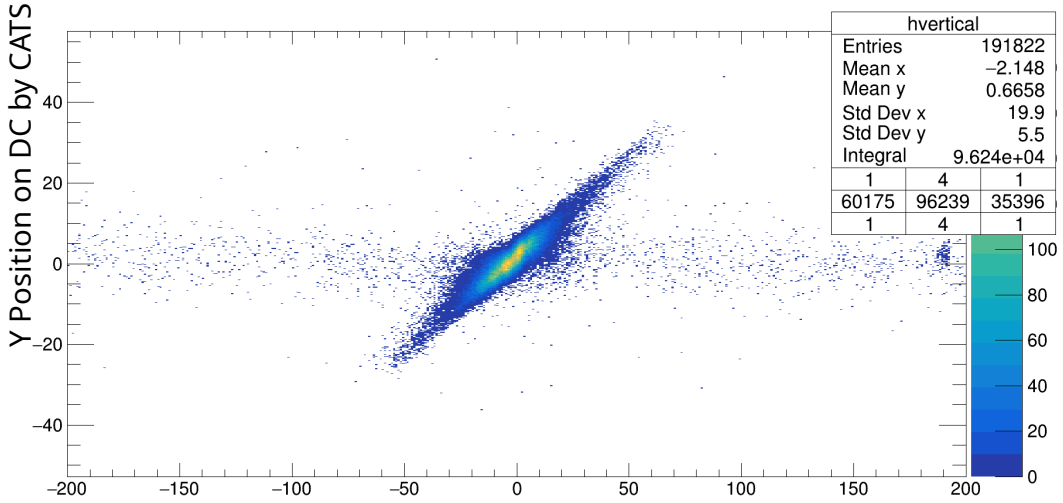


Drift Chamber: Trajectory by CATS

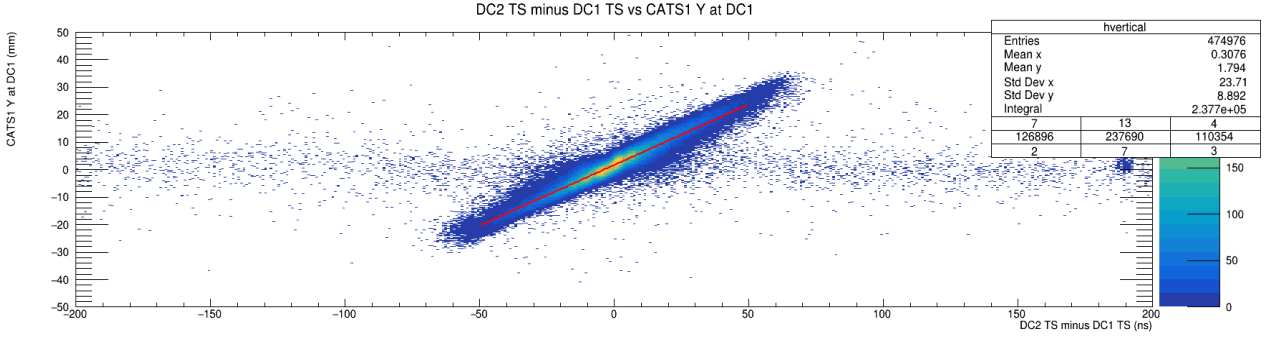


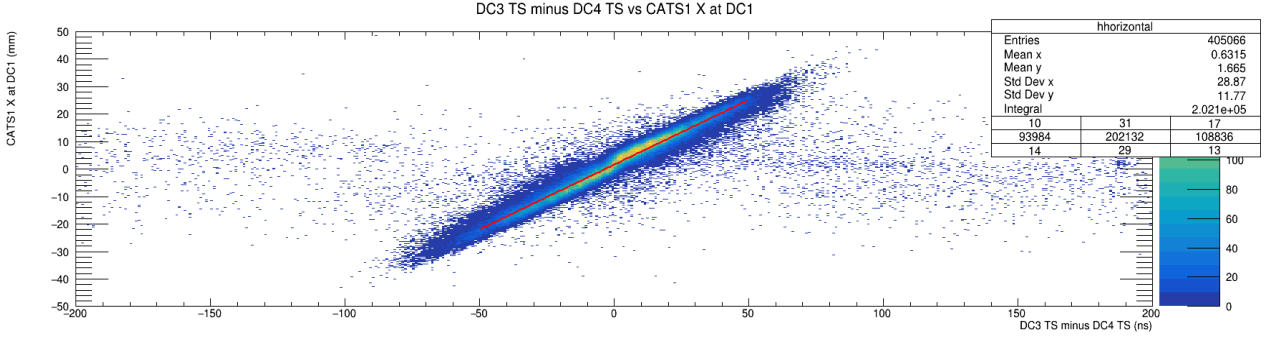


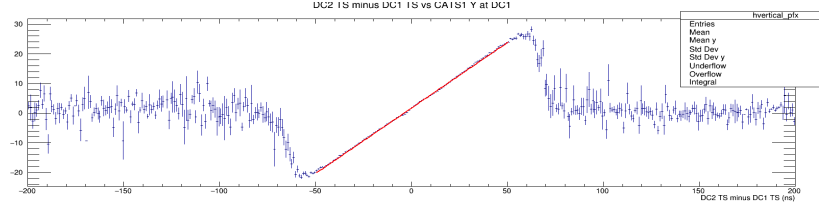


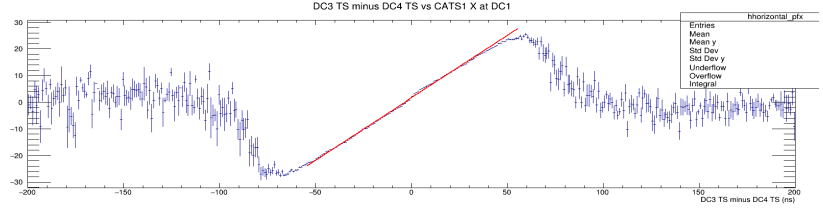


Drift Chamber: CATS cons. vs Drift time

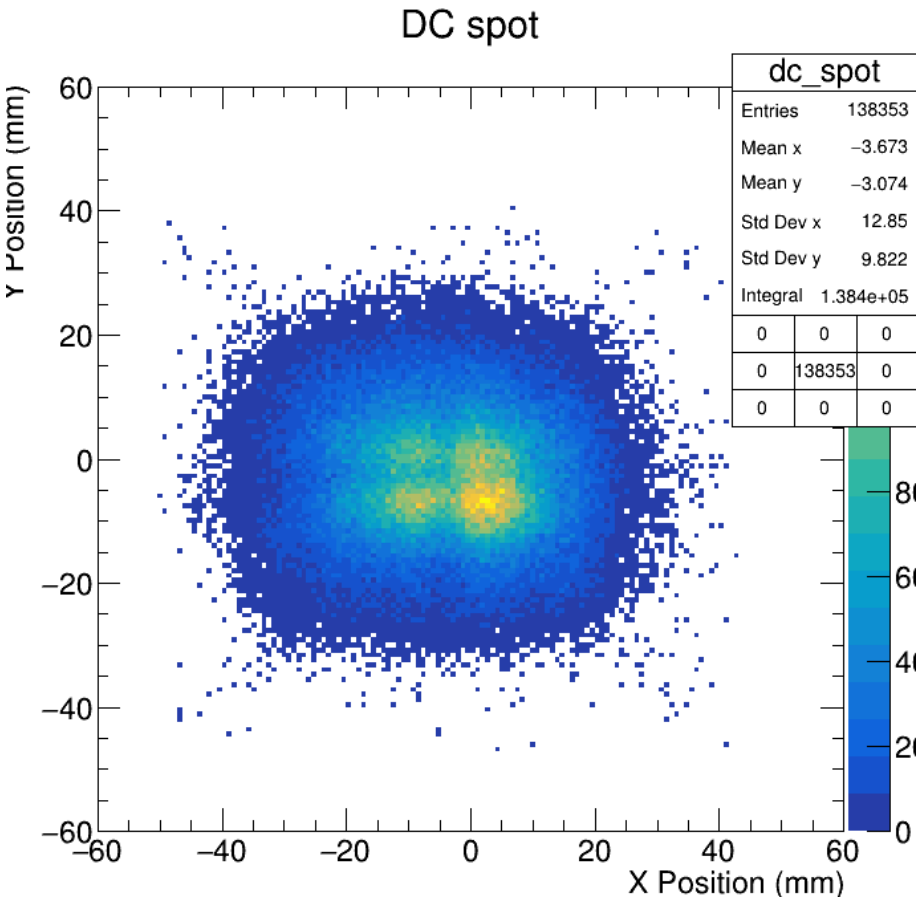


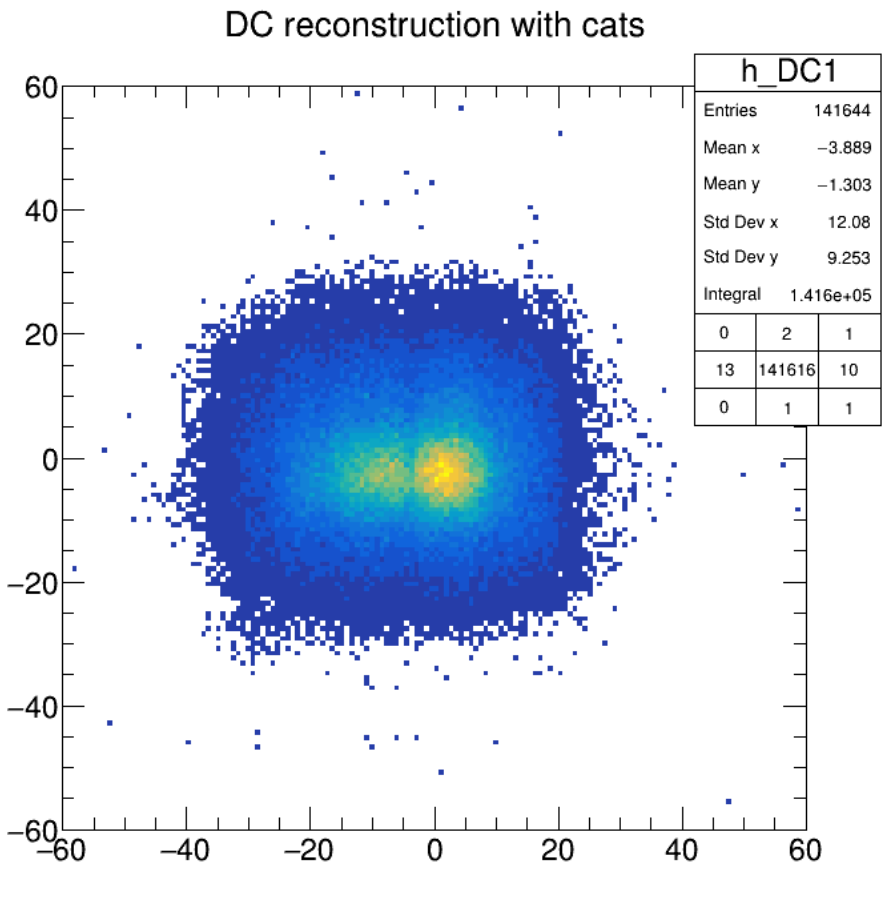




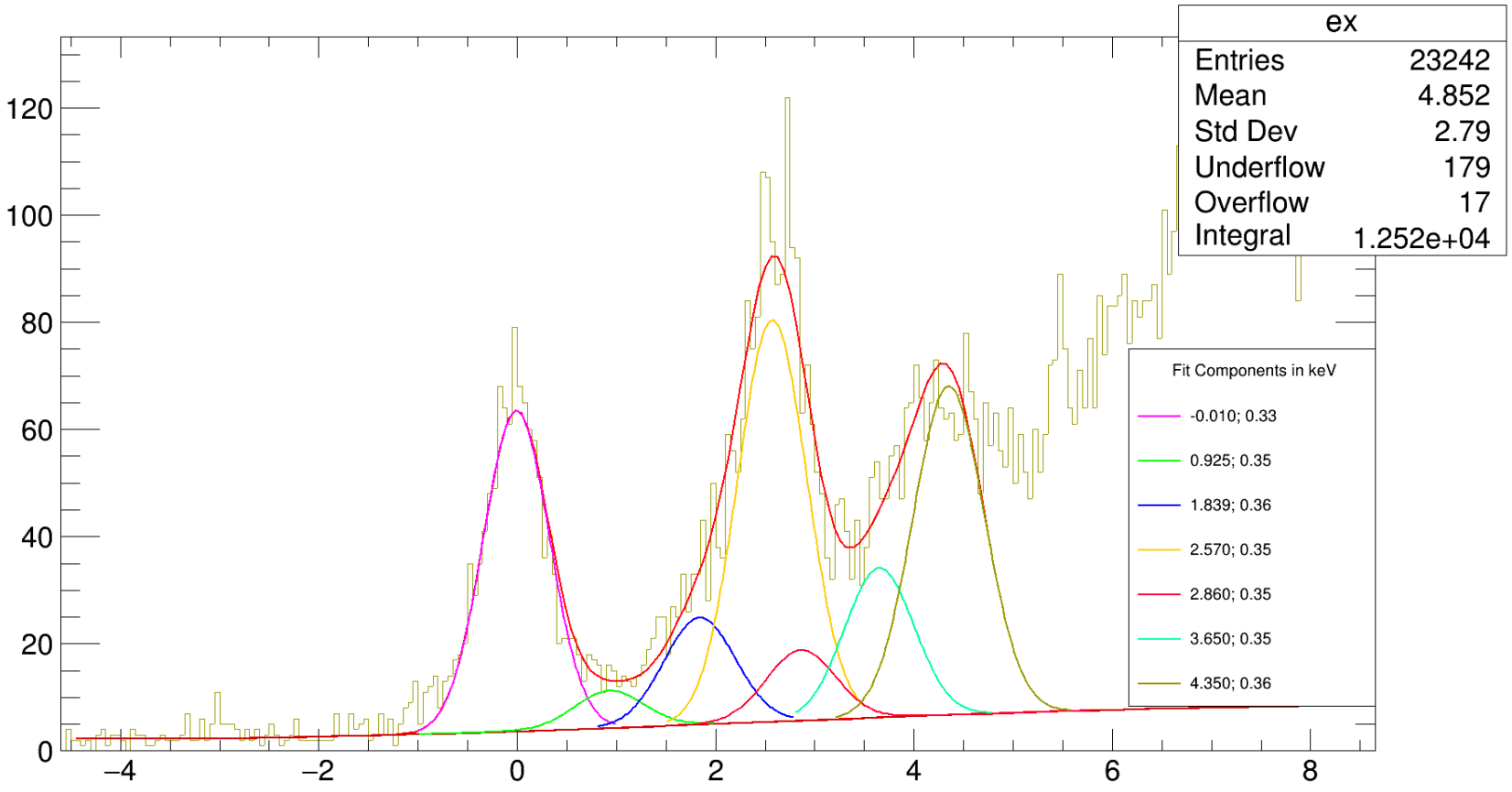


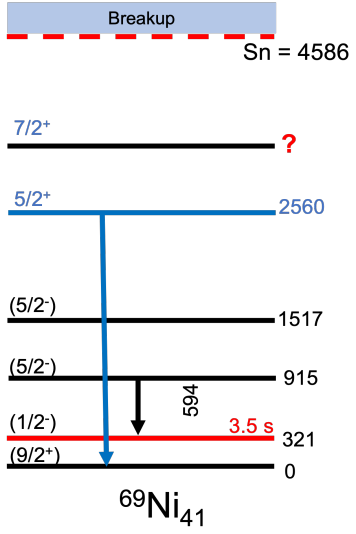
Drift Chamber: Spot on DC1



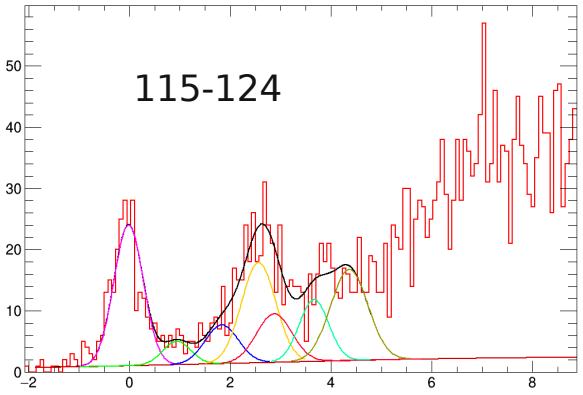


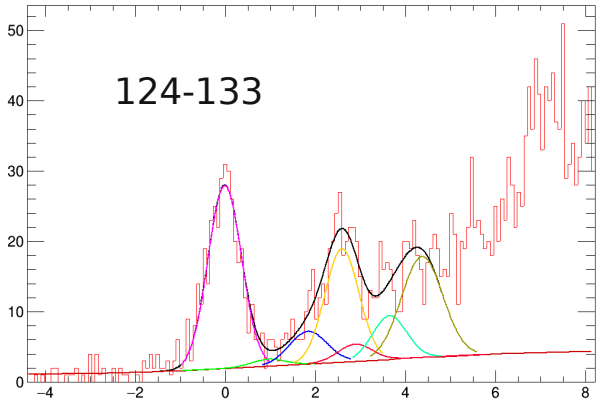
E* < S(n)

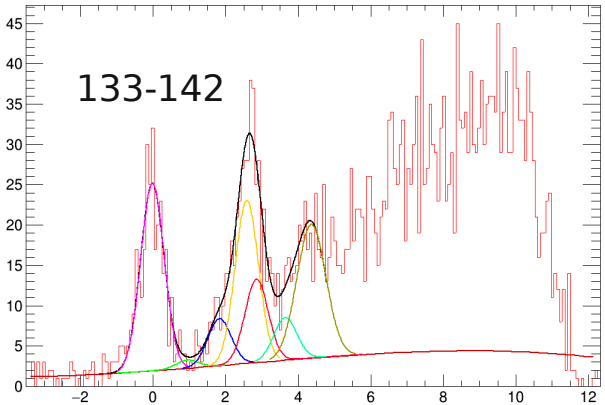

ex
Entries 23242
Mean 4.852
Std Dev 2.79
Underflow 179
Overflow 17
Integral 1.252e+04
Fit Components in keV
-0.010; 0.33
0.925; 0.35
1.839; 0.36
2.570; 0.35
2.860; 0.35
3.650; 0.35
4.350; 0.36
120
100
80
60
40
20
0
−4
−2
0
2
4
6
8

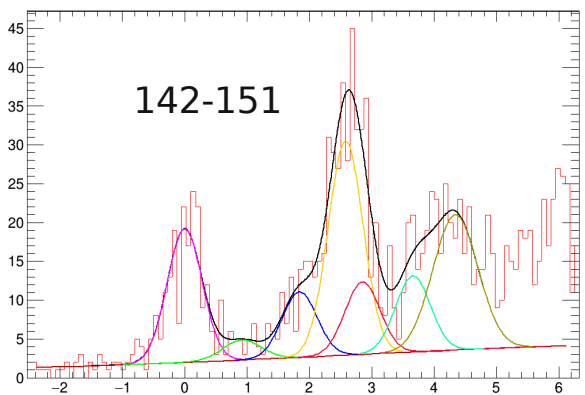

Breakup
Sn = 4586
7/2+
?
5/2+
2560
(5/2-)
1517
(5/2-)
915
594
(1/2-)
3.5 s
321
(9/2+)
0
69Ni41

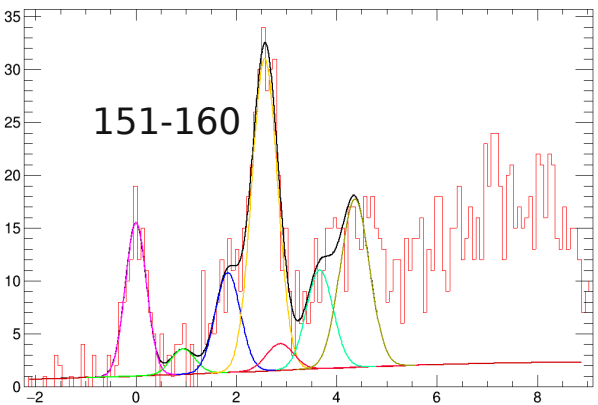
E* < S(n)











E* < S(n): Resolution

- Gamma rays can help identify and constrain states.
- For that, we gate on a definite value of Ex and see the gamma rays.
- The resolution of EXOGAM will depend on 3 factors:
  - The intrinsic resolution.
  - The angle uncertainty
  - Beta spread of the beam

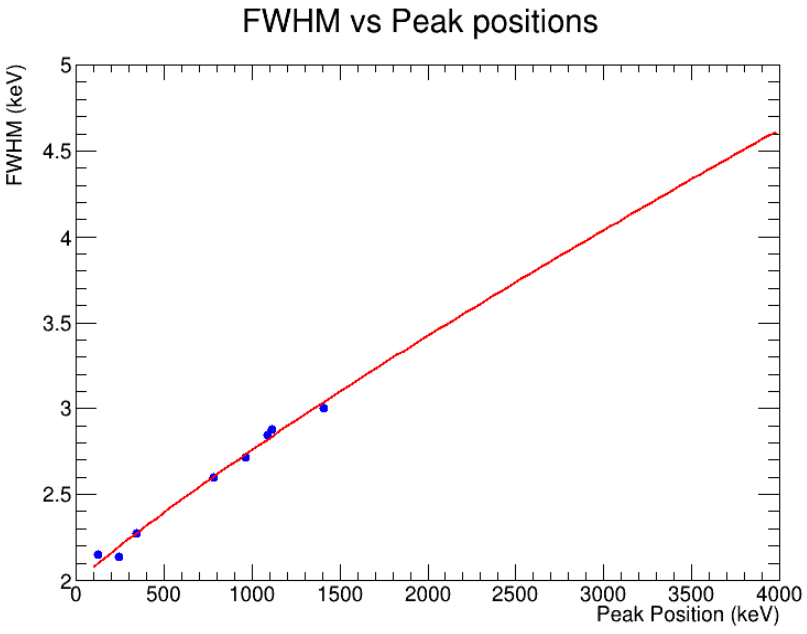
$$\frac{\Delta E_\theta}{E} = \frac{|\beta \sin\theta|}{(1-\beta\cos\theta)}\Delta\theta$$

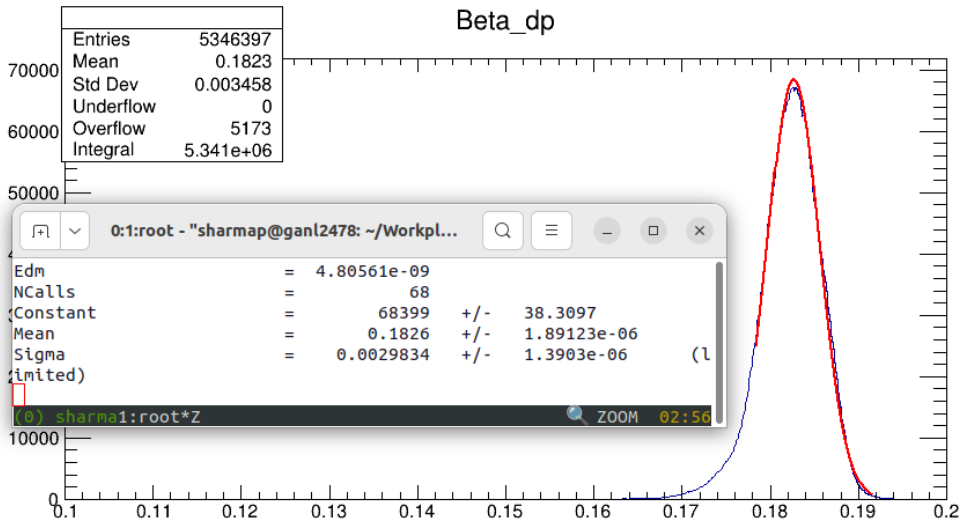
$$\frac{\Delta E_\beta}{E} = \frac{|-\beta+\cos\theta|}{(1-\beta^2)(1-\beta\cos\theta)}\Delta\beta$$

$$\left(\frac{\Delta E}{E}\right)^2 = \left(\frac{\Delta E_\theta}{E}\right)^2 + \left(\frac{\Delta E_\beta}{E}\right)^2 + \left(\frac{\Delta E_{int}}{E}\right)^2$$

Thesis: Stephane Leenhardt (2000)

Exogam: Resolution



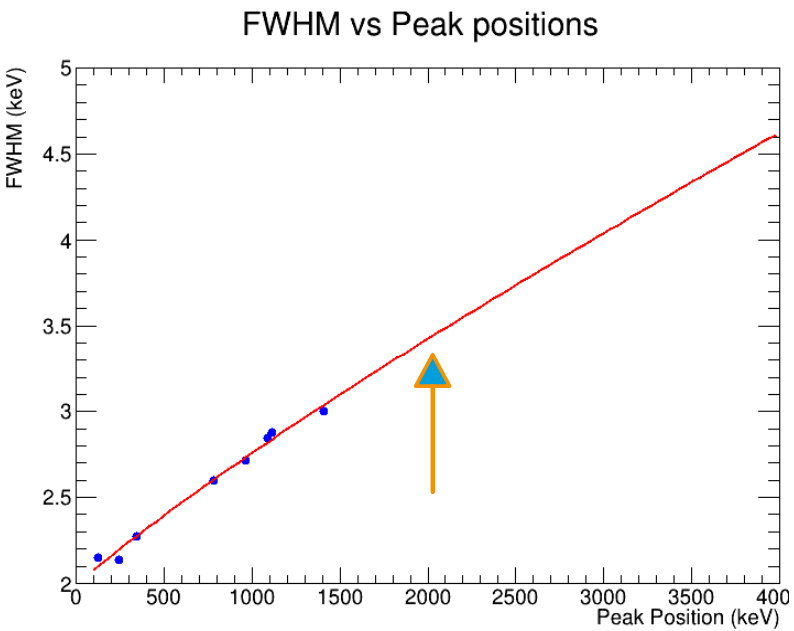


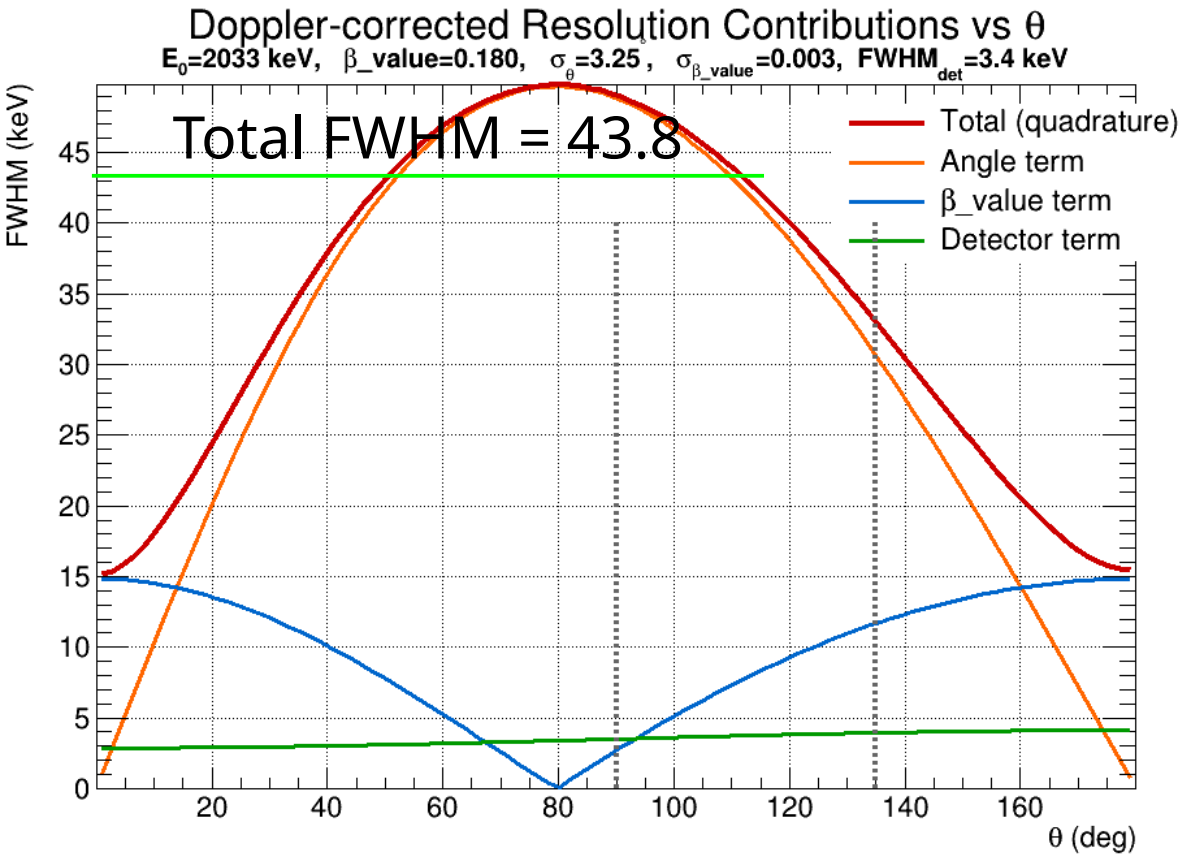
Beta = 0.18, sigma(beta) = 0.003

Angles = 90, 135 degrees
Sigma (angles): taken 27.5 mm pitch with 140 mm target to crystal distance

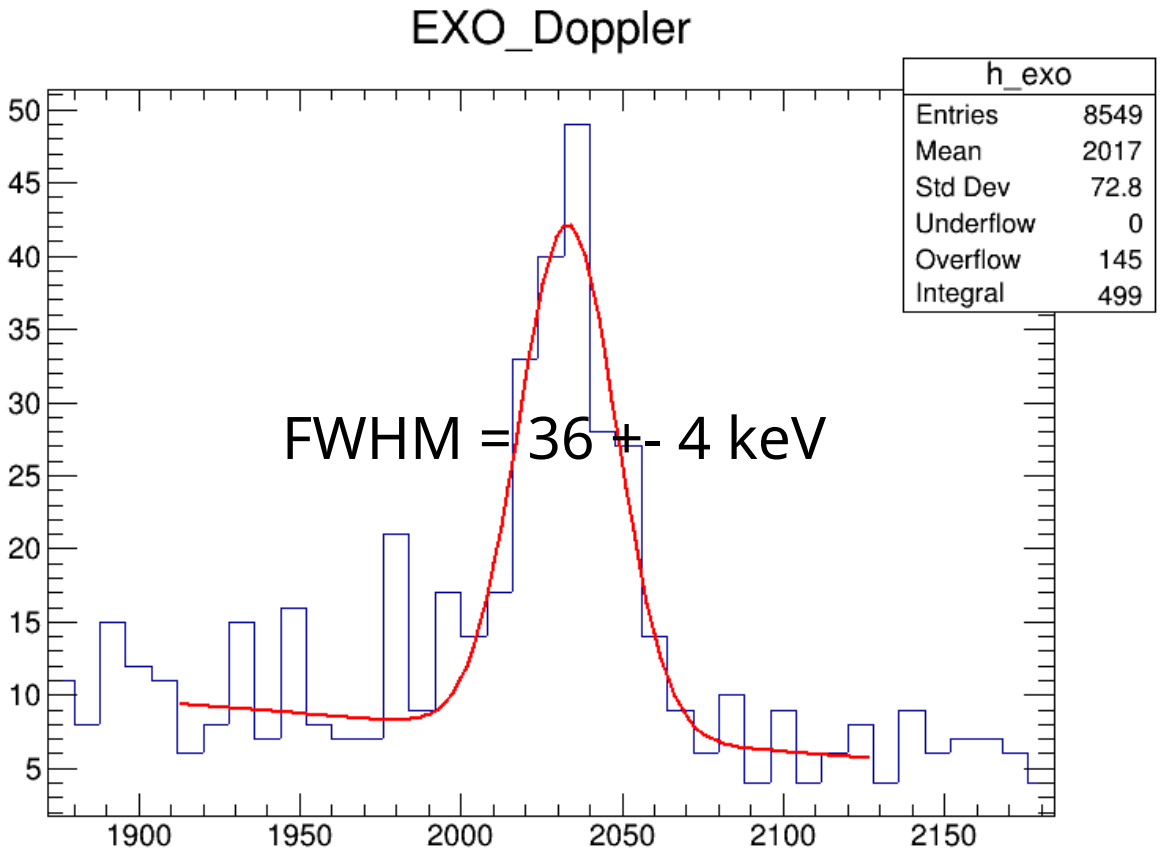
Exogam: Resolution

For example: @ 2033 keV
from ^{68}Ni, $FWHM_{int}$ = 3.44





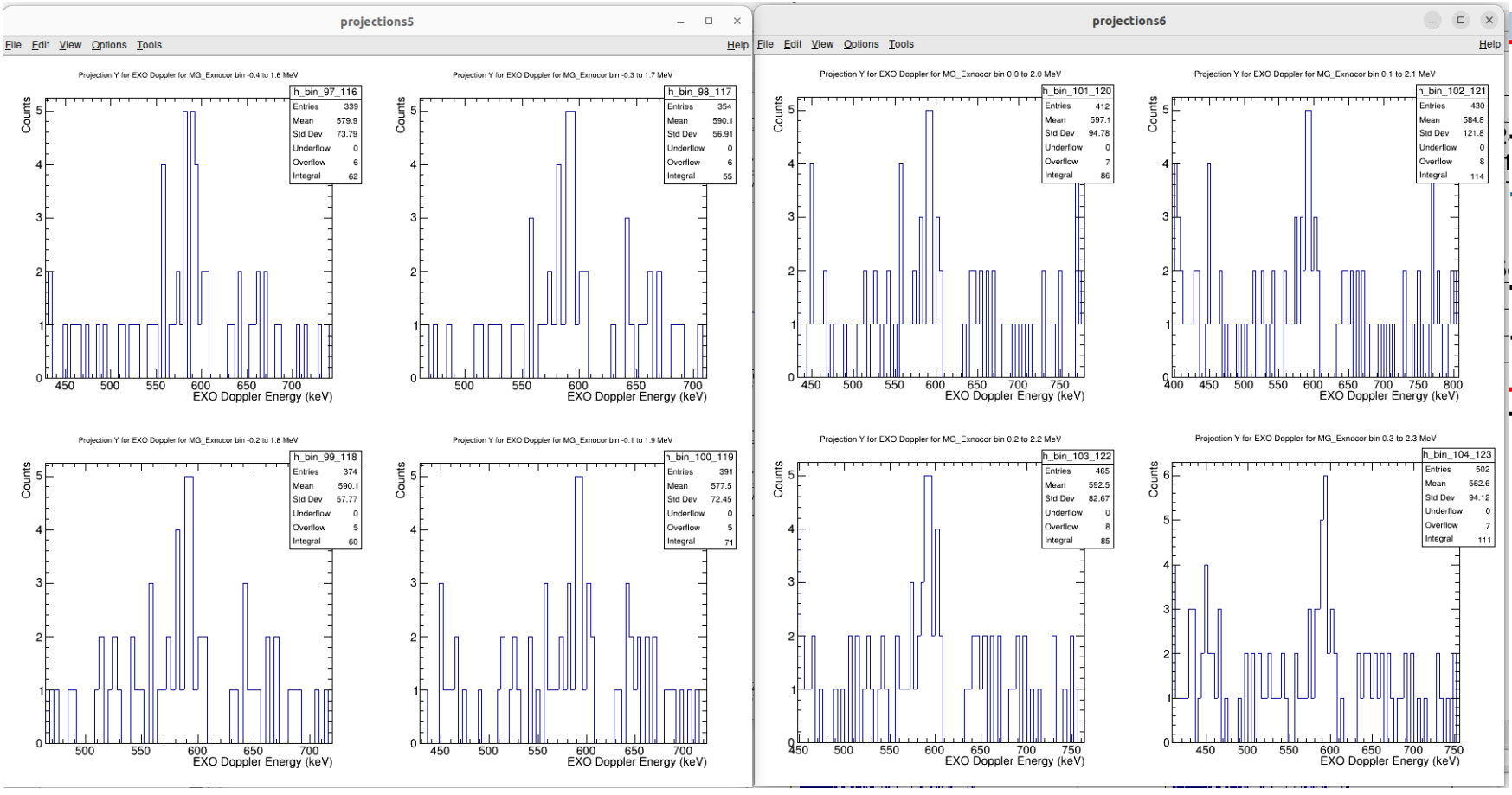
Exogam: Resolution

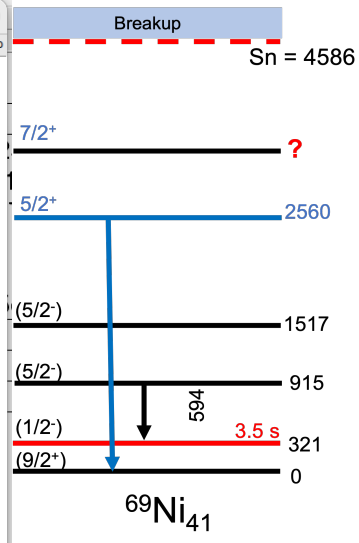


To-do/Ongoing Work:

- Implementing this Drift Chamber with multiplicity > 0 with preference given to events predicted by CATS.
- Build the angular correlation of light and heavy.
- Building the excitation plot with new positions of CATS.
- Then move on to the gamma vs E*.

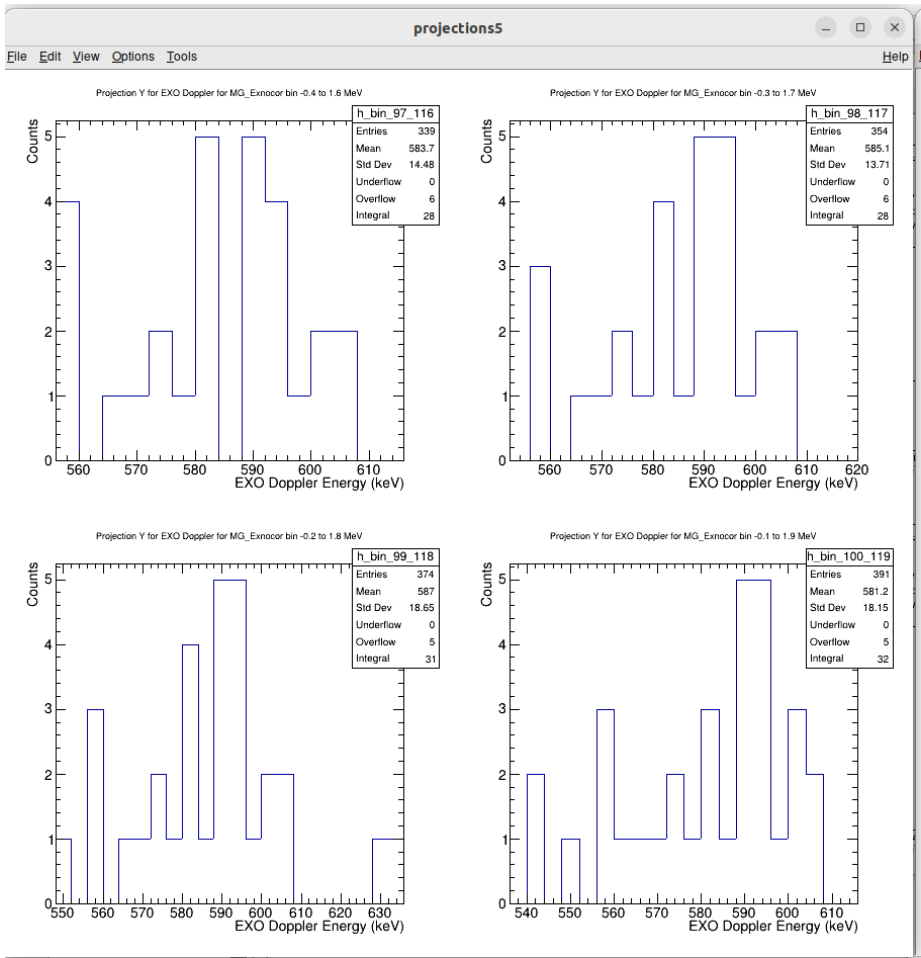
The 594 keV transition: whether to include in the fit

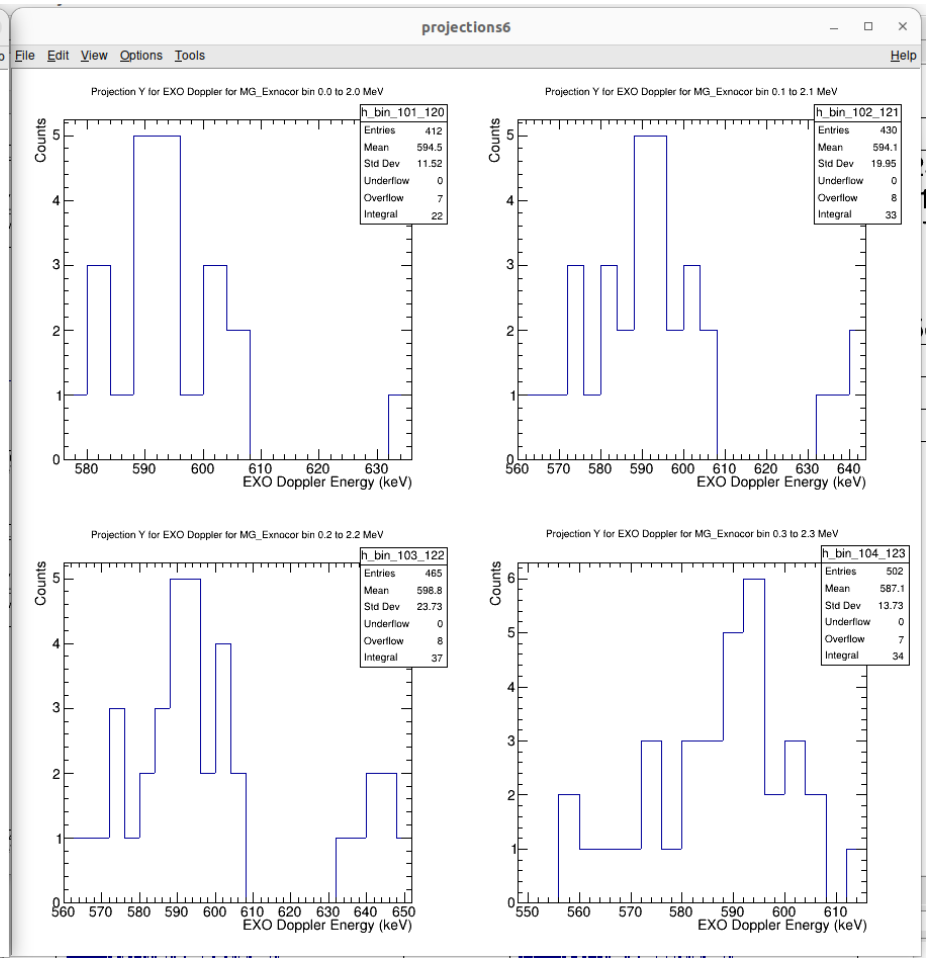




Should have sigma ~ 5.5 keV

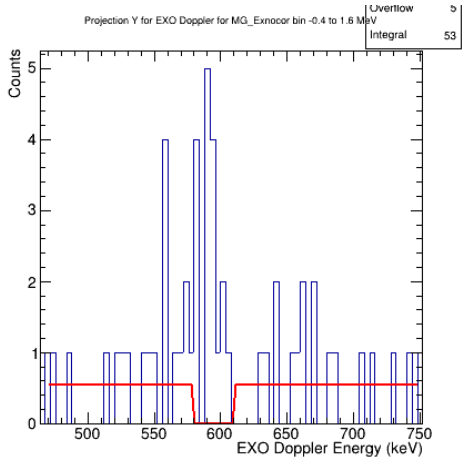
594: zoomed in

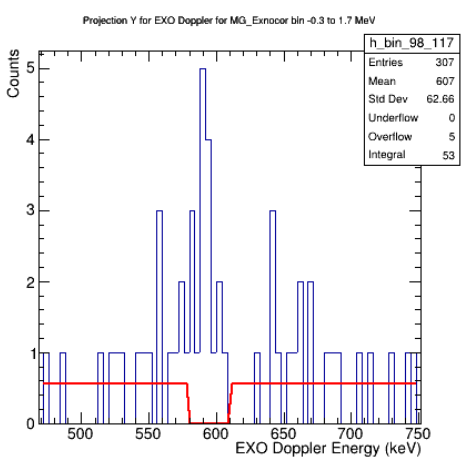


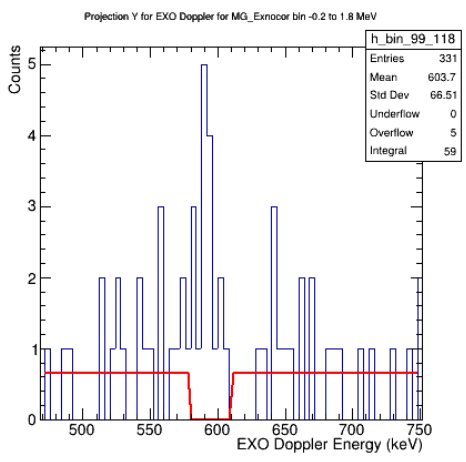


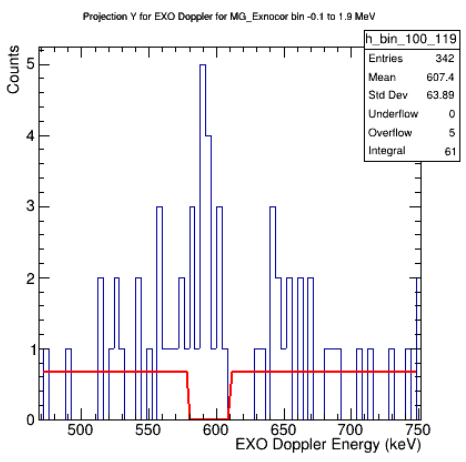
CATS calibration→ cats mask holes shift (x,y)

If this is 594, with the sigma value of 5.5keV I count the yeild for 594 +- 16 With gates on slices of E* spectrum.

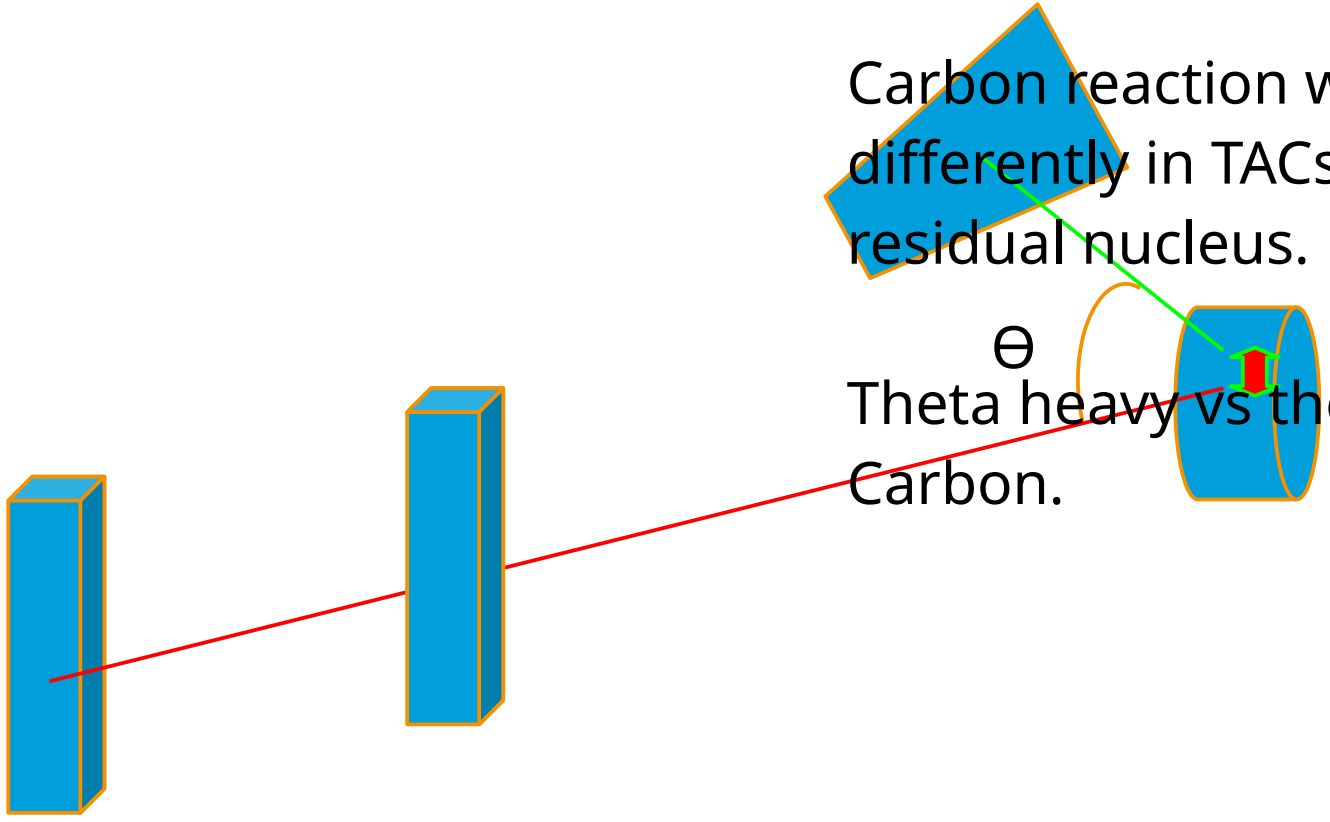








Drift Chamber: Channel identification



Carbon reaction with 68Ni will appear differently in TACs because of heavier residual nucleus.

Θ

Theta heavy vs theta light and effect of Carbon.

Backup

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

CATS calibration→ cats mask holes shift (x,y)

Drift Chamber: Channel identification