Vertexing and Track Errors

Matt Solt
10/22/2018

Introduction
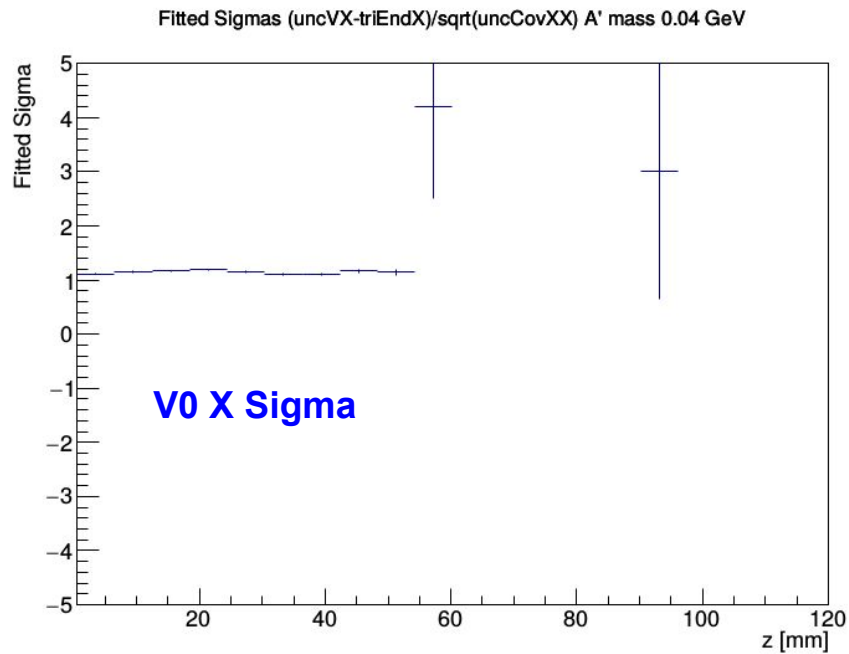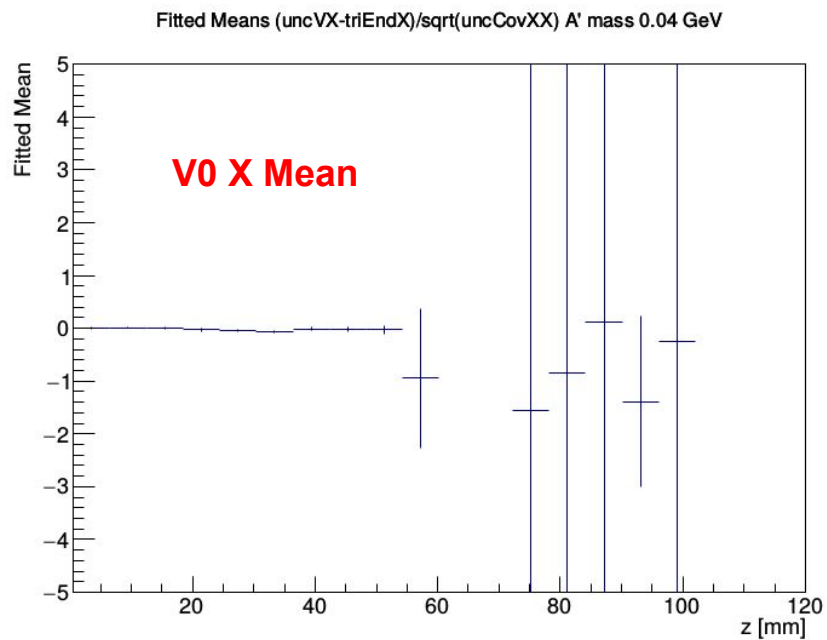
We have had recent issues with errors and pulls

I checked the pulls position components, momentum components, mass, extrapolation back to target position, and 5 track parameters

We have issues with the pulls of mass, target position, and Pz
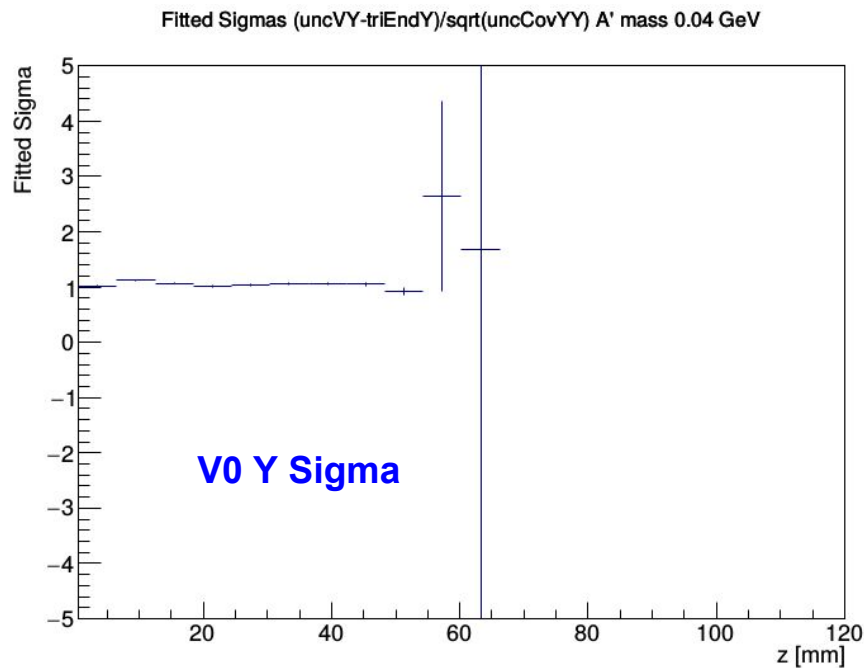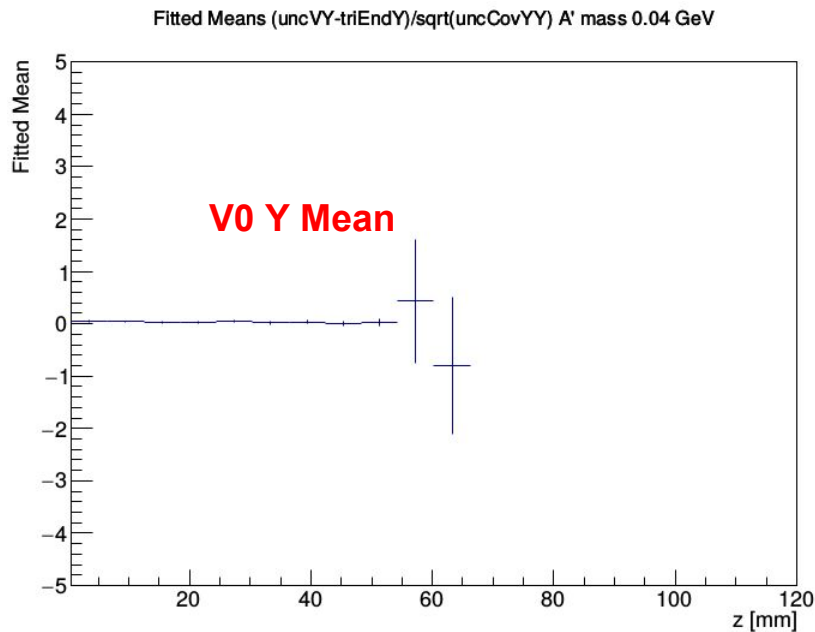
Discrepancy with Miriam on uncVY pulls has been resolved

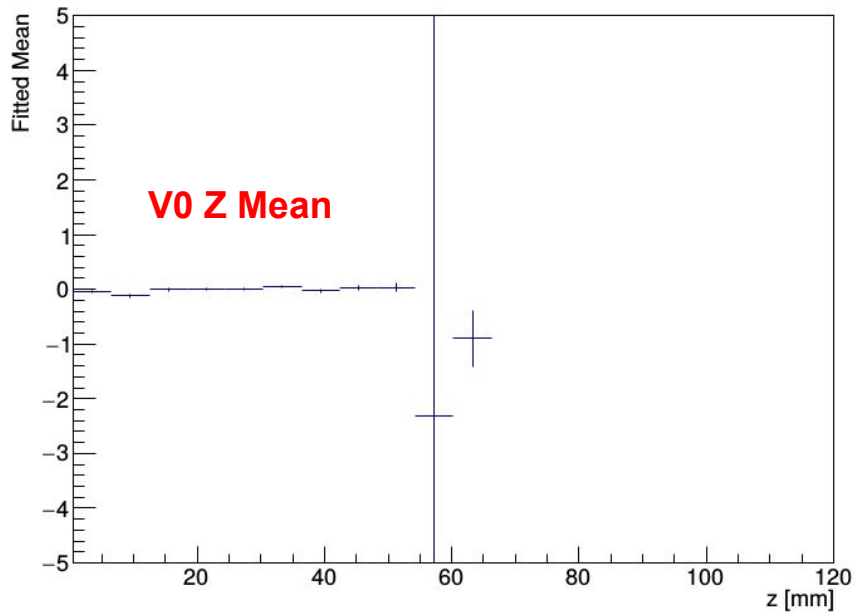All plots shown have iss-311 branch merged and the new fieldmap

V0 X Position Pulls

Fitted Means (uncVX-triEndX)/sqrt(uncCovXX) A' mass 0.04 GeV

V0 X Mean

Fitted Sigmas (uncVX-triEndX)/sqrt(uncCovXX) A' mass 0.04 GeV

V0 X Sigma

V0 Y Position Pulls

Matt G's fix in iss-311 fixed this pull (resolves discrepancy with Miriam)

Fitted Means (uncVY-triEndY)/sqrt(uncCovYY) A' mass 0.04 GeV

V0 Y Mean

Fitted Sigmas (uncVY-triEndY)/sqrt(uncCovYY) A' mass 0.04 GeV

V0 Y Sigma

V0 Z Position Pulls

Fitted Means (uncVZ-triEndZ)/sqrt(uncCovZZ) A' mass 0.04 GeV

V0 Z Mean

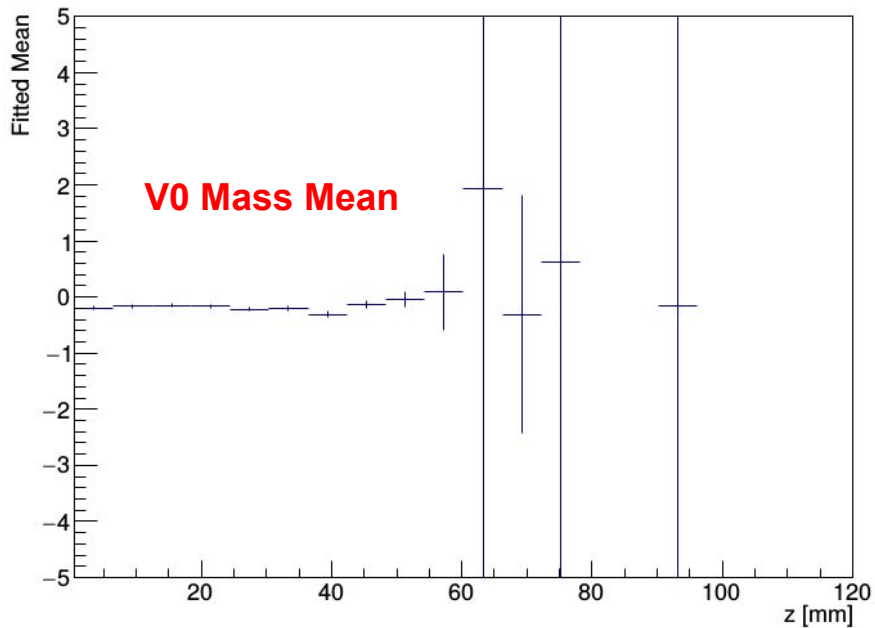Fitted Sigmas (uncVZ-triEndZ)/sqrt(uncCovZZ) A' mass 0.04 GeV

V0 Z Sigma
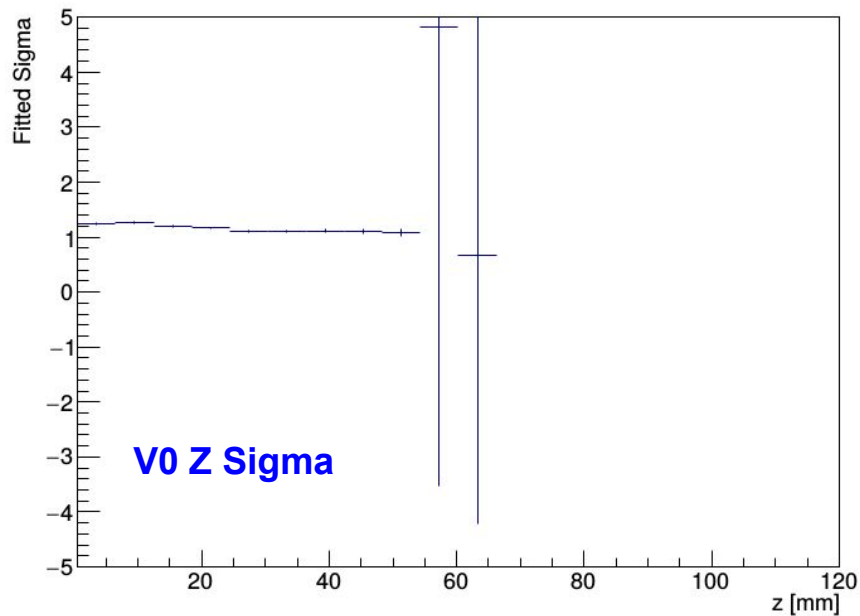
V0 Mass Pulls

Bad! With target projection pulls also bad, let's look at momentum pulls.
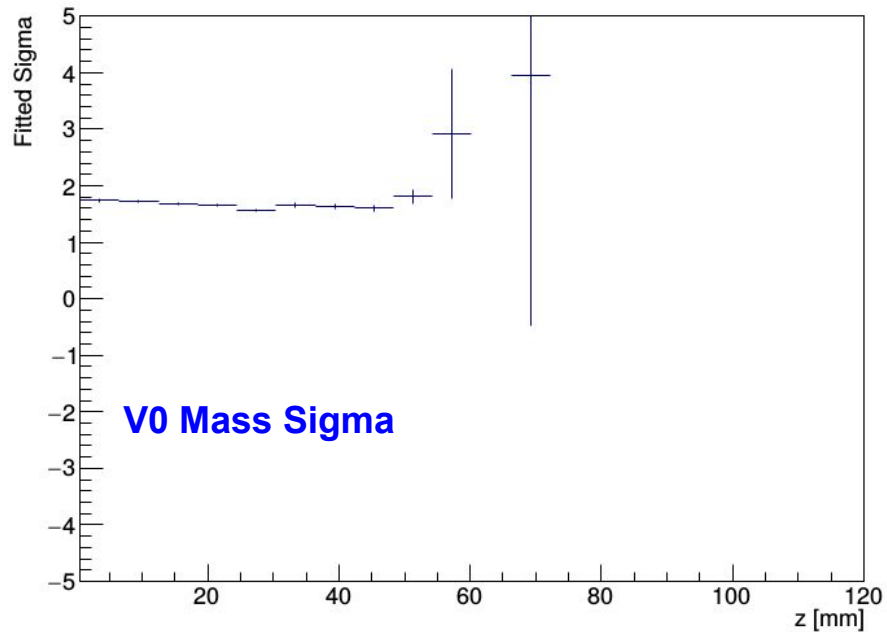
V0 Momentum X Pulls
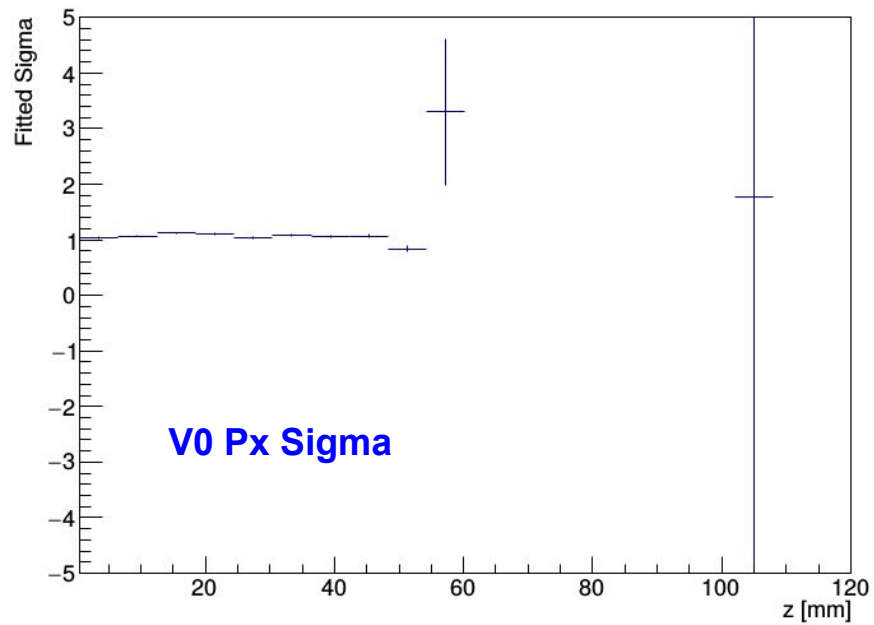

Fitted Means (uncPX-triPX)/uncMomXErr A' mass 0.04 GeV
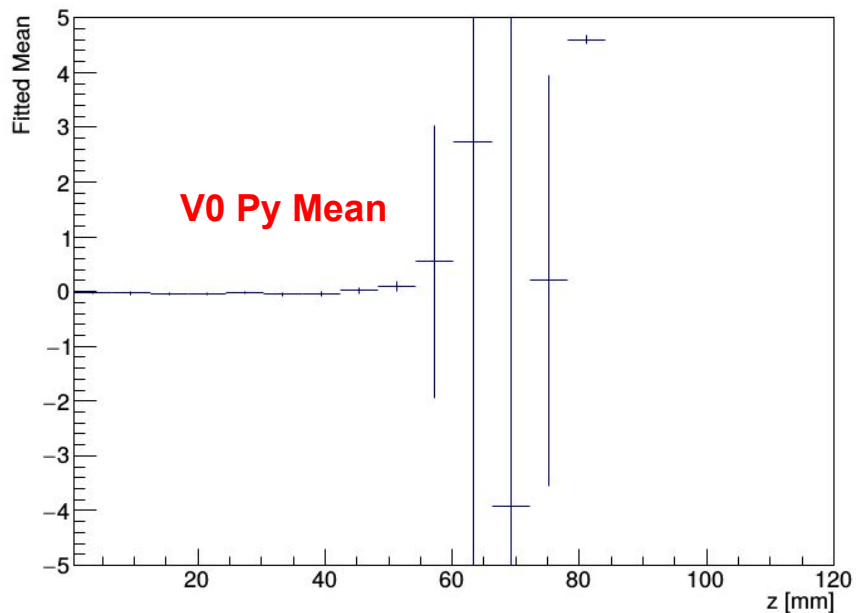
V0 Px Mean
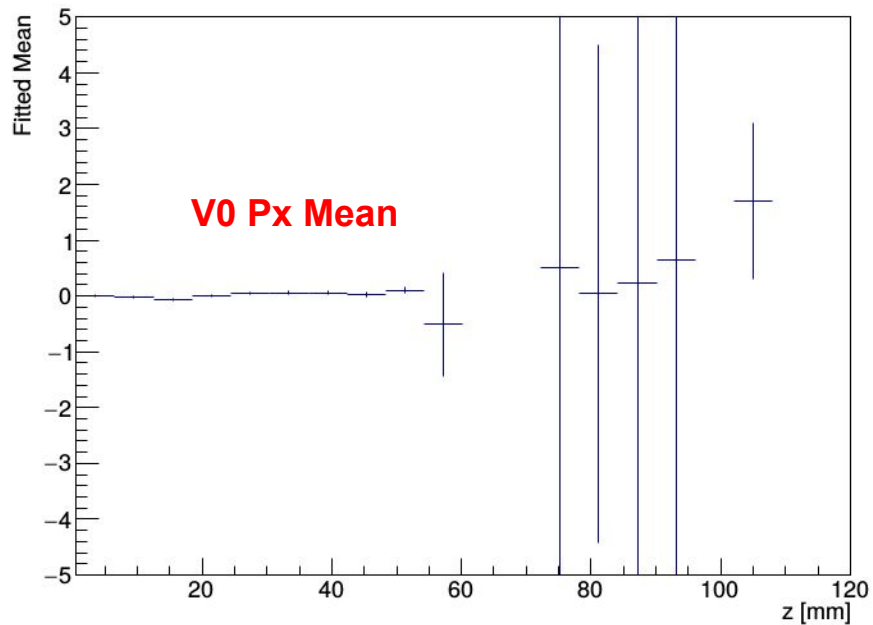
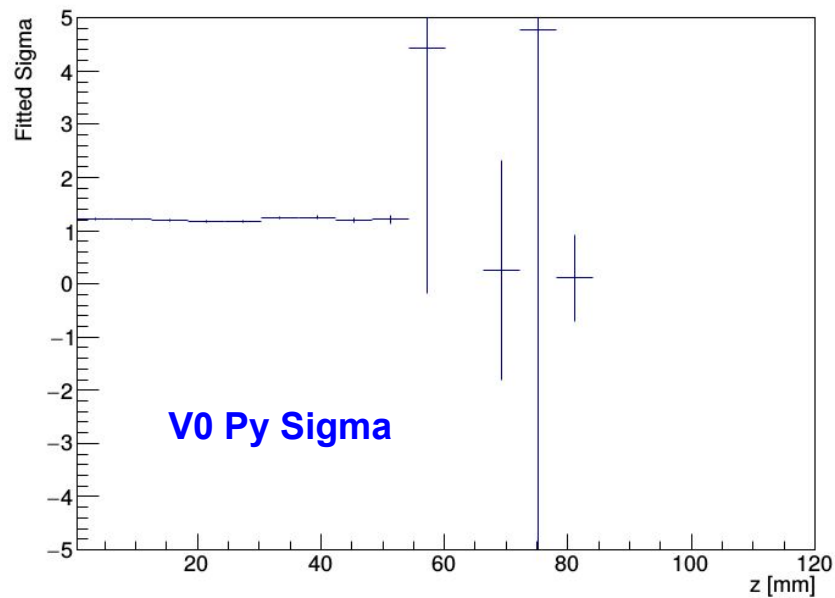Fitted Sigmas (uncPX-triPX)/uncMomXErr A' mass 0.04 GeV

V0 Px Sigma

V0 Momentum Y Pulls
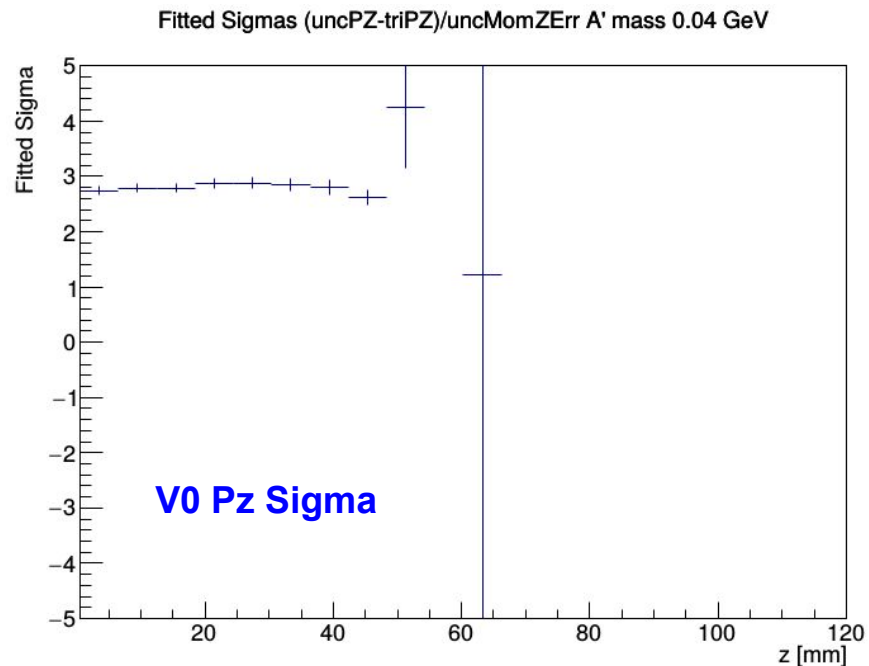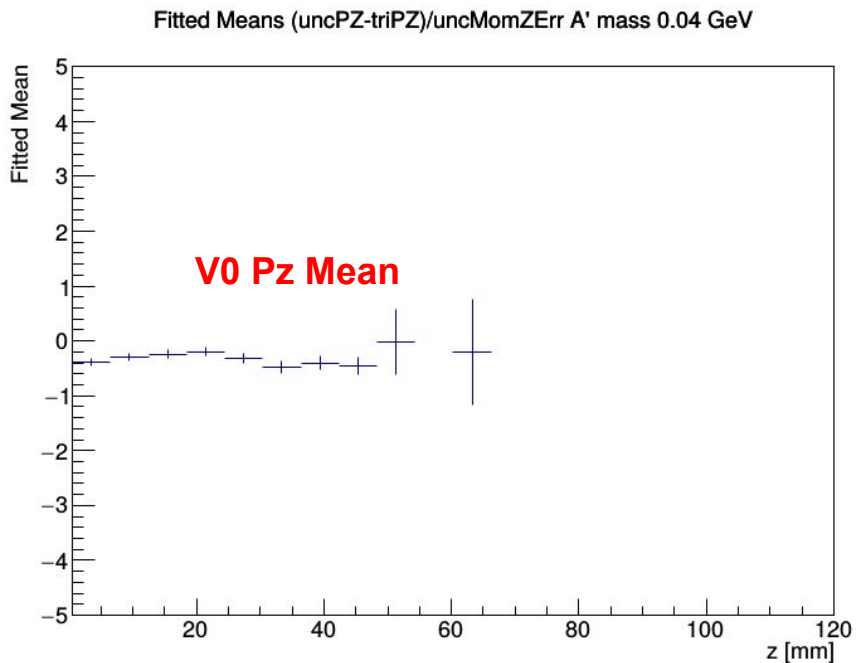

Fitted Means (uncPY-triPY)/uncMomYErr A' mass 0.04 GeV

V0 Py Mean

Fitted Sigmas (uncPY-triPY)/uncMomYErr A' mass 0.04 GeV
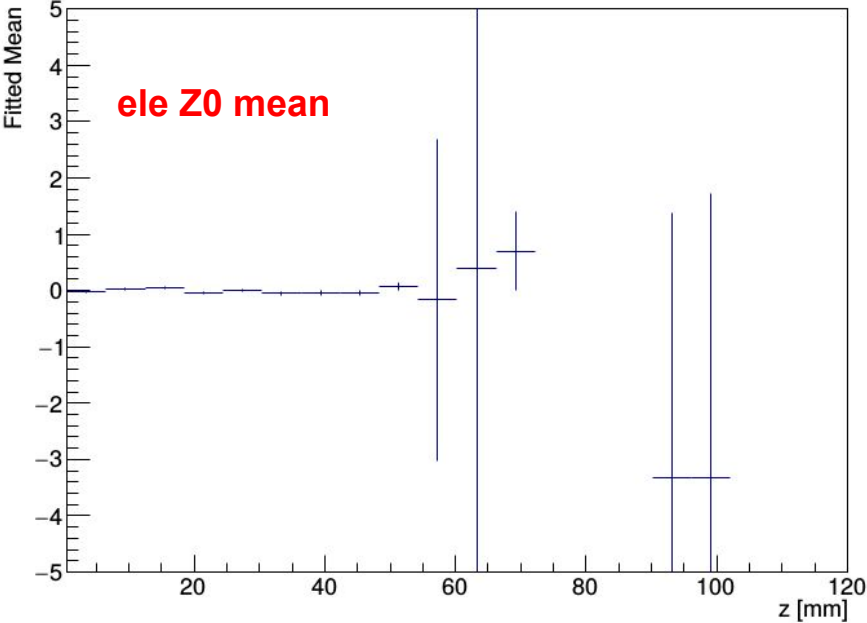
V0 Py Sigma

V0 Momentum Z Pulls
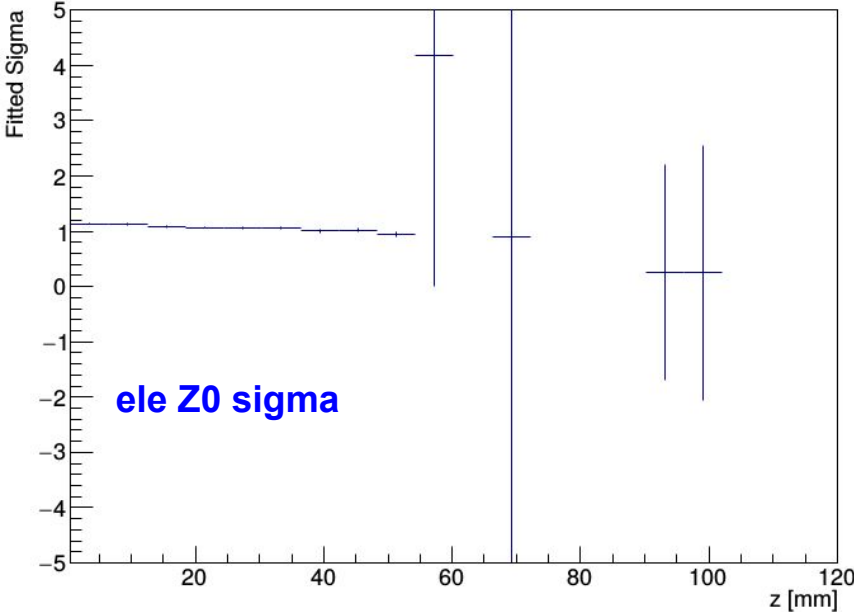
Yikes! Let's check the pulls of individual tracks

Fitted Means (uncPZ-triPZ)/uncMomZErr A' mass 0.04 GeV

V0 Pz Mean

Fitted Sigmas (uncPZ-triPZ)/uncMomZErr A' mass 0.04 GeV

V0 Pz Sigma

Electron Z0 at Target Pulls

Fitted Means (-triEle1PY/triEle1PZ*triEndZ+triEndY-eleTrkZ0)/eleTrkZ0Err A' mass 0.04 GeV

ele Z0 mean

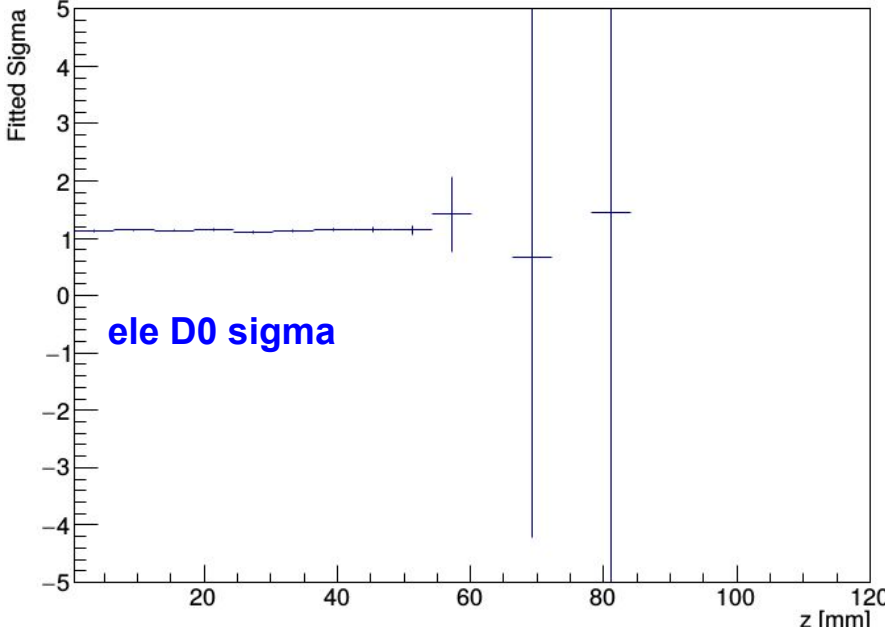Fitted Sigmas (-triEle1PY/triEle1PZ*triEndZ+triEndY-eleTrkZ0)/eleTrkZ0Err A' mass 0.04 GeV

ele Z0 sigma

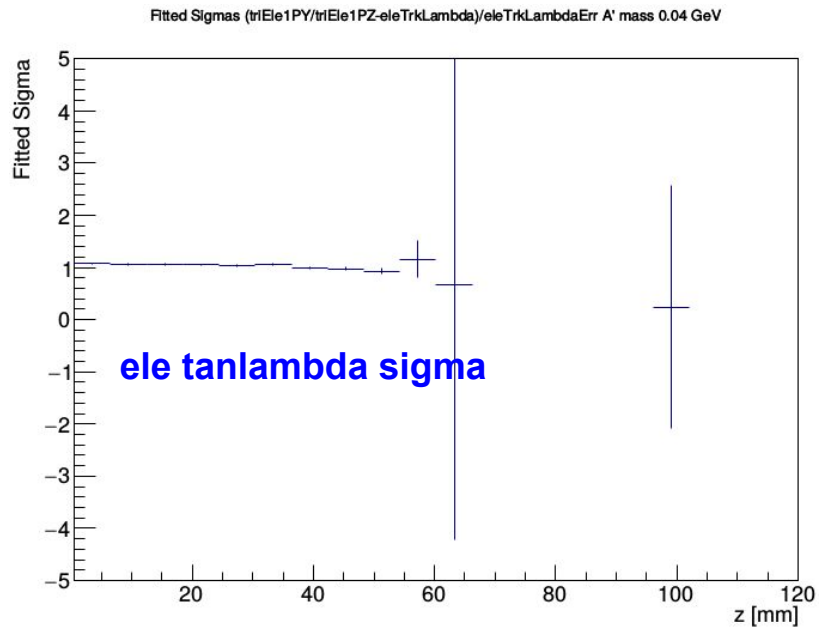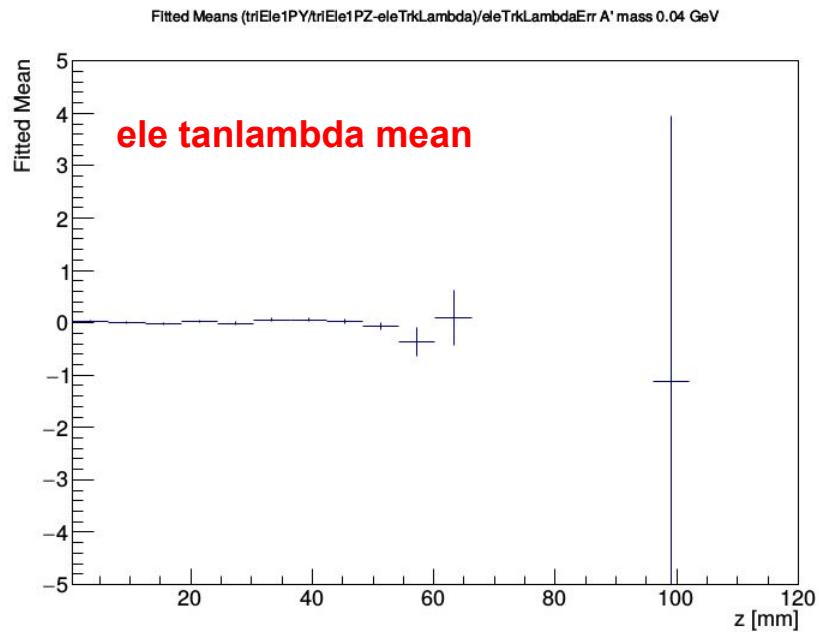# Electron D0 at Target Pulls

Fitted Means (-triEle1PX/triEle1PZ*triEndZ+triEndX-0.000075*triEndZ**2-eleTrkD0)/eleTrkD0Err A' mass 0.04 GeV

ele D0 mean

Fitted Sigmas (-triEle1PX/triEle1PZ*triEndZ+triEndX-0.000075*triEndZ**2-eleTrkD0)/eleTrkD0Err A' mass 0.04 GeV

ele D0 sigma
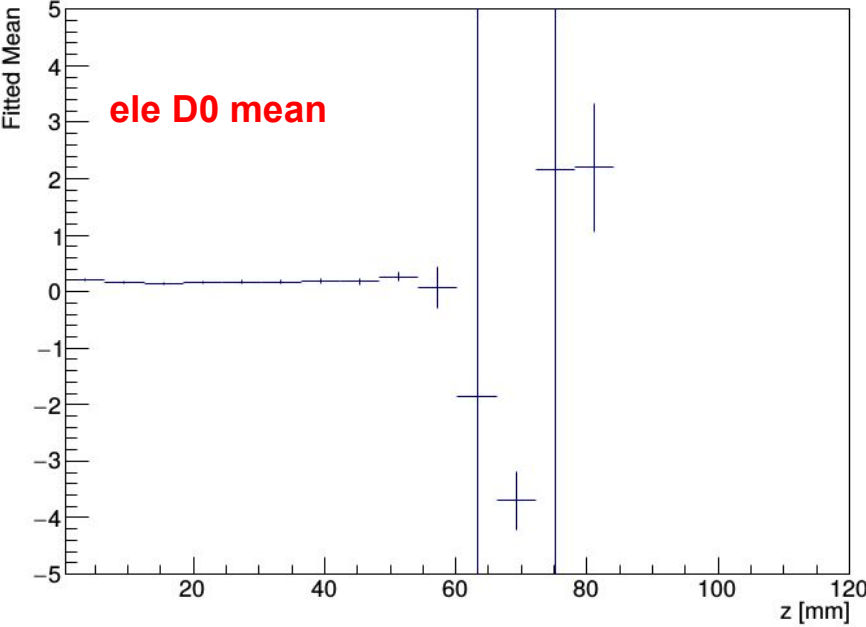
Electron TanLambda at Target Pulls

Fitted Means (triEle1PY/triEle1PZ-eleTrkLambda)/eleTrkLambdaErr A' mass 0.04 GeV

ele tanlambda mean

Fitted Sigmas (triEle1PY/triEle1PZ-eleTrkLambda)/eleTrkLambdaErr A' mass 0.04 GeV

ele tanlambda sigma

Electron Phi0 at Target Pulls

*The mean is extremely sensitive to the value of B, so I think it's fine

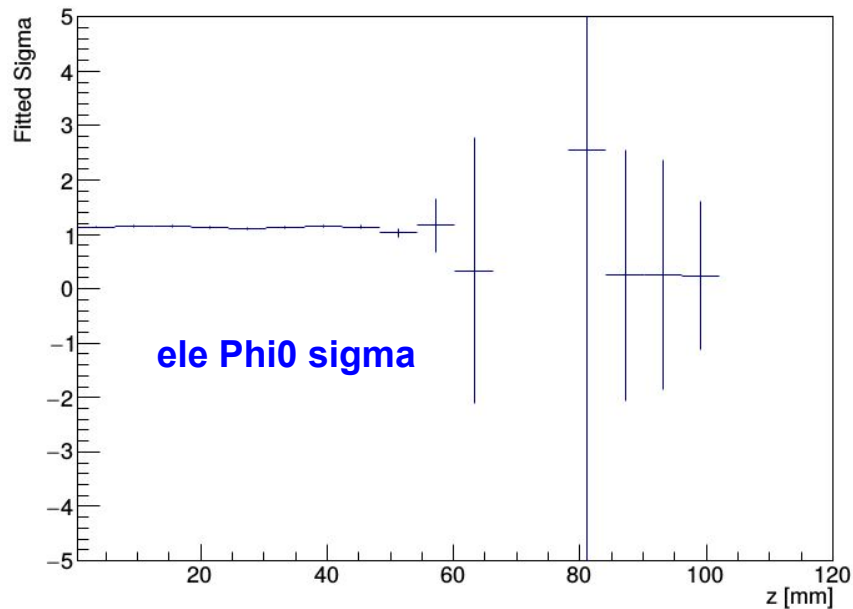# Electron Omega at Target Pulls

*The mean is extremely sensitive to the value of B, so I think it's fine

Fitted Means (0.000075/sqrt(triEle1PX**2+triEle1PZ**2)-eleTrkOmega)/eleTrkOmegaErr A' mass 0.04 GeV

ele omega mean

Fitted Sigmas (0.000075/sqrt(triEle1PX**2+triEle1PZ**2)-eleTrkOmega)/eleTrkOmegaErr A' mass 0.04 GeV
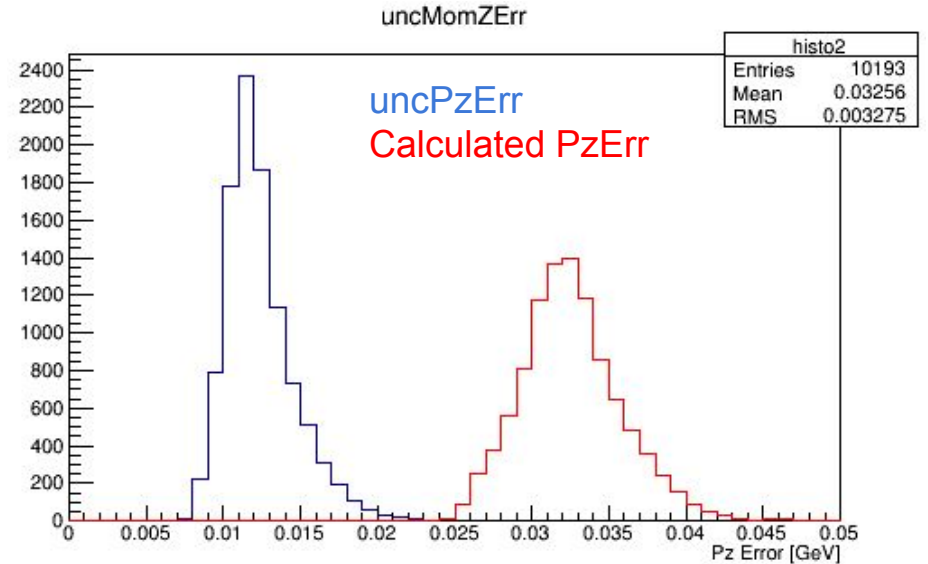
ele omega sigma
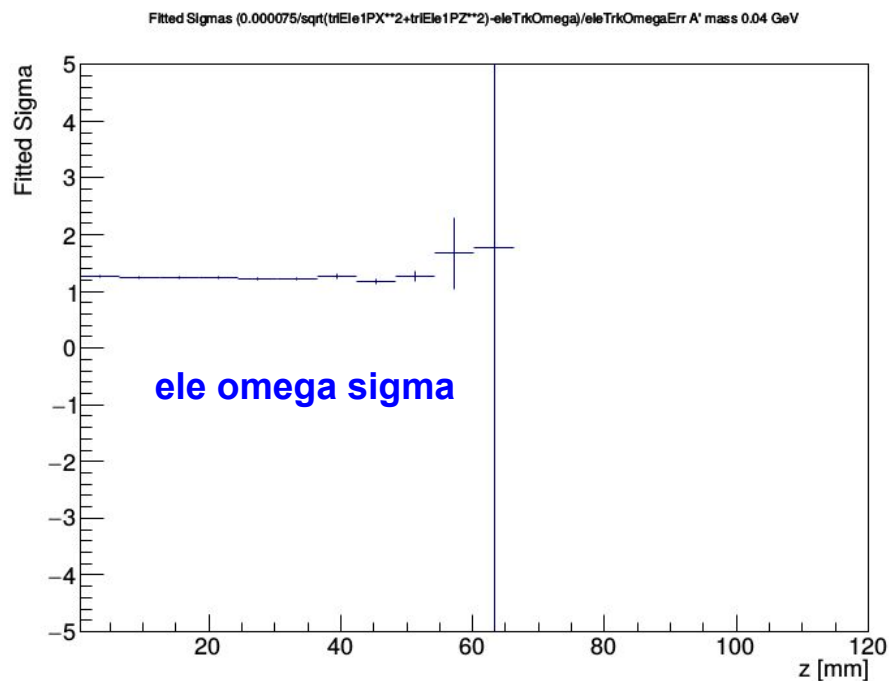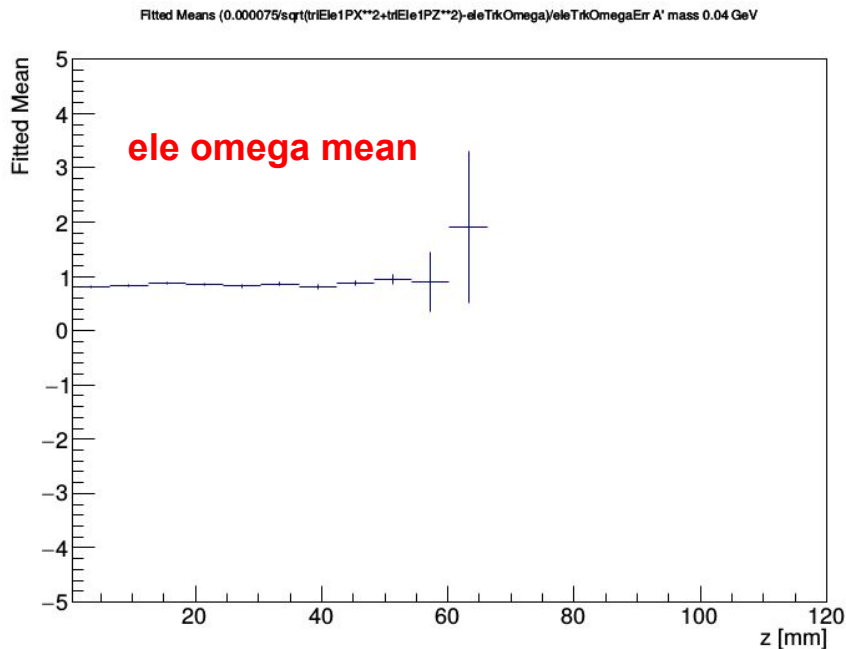
Calculate Momentum Error from Track Parameters

$$\Delta P_z = \sqrt{\Delta P_{z,ele}^2 + \Delta P_{z,pos}^2}$$

$$P_z = \frac{qB}{m\Omega} \qquad \Delta P_z = \frac{qB}{m}\frac{\Delta\Omega}{\Omega^2}$$

$$\Delta P_z = \frac{qB}{m}\sqrt{\left(\frac{\Delta\Omega_{ele}}{\Omega_{ele}^2}\right)^2 + \left(\frac{\Delta\Omega_{pos}}{\Omega_{pos}^2}\right)^2}$$

uncMomZErr

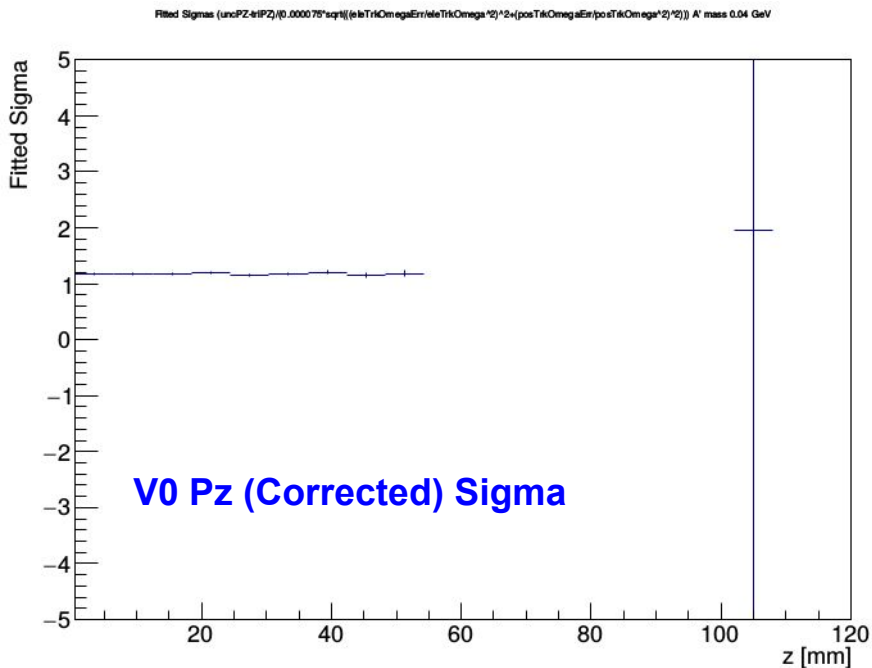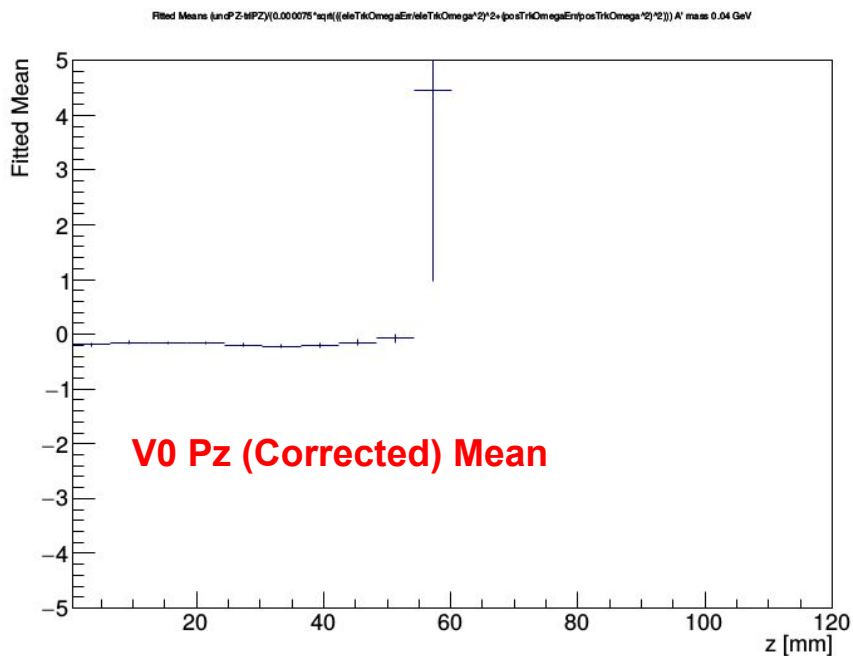| histo2	
Entries	10193
Mean	0.03256
RMS	0.003275

uncPzErr
Calculated PzErr

Pz Error [GeV]

Combining errors is hand-wavy (cross terms neglected), but is ~3 times greater than output of Billior Vertexer!!
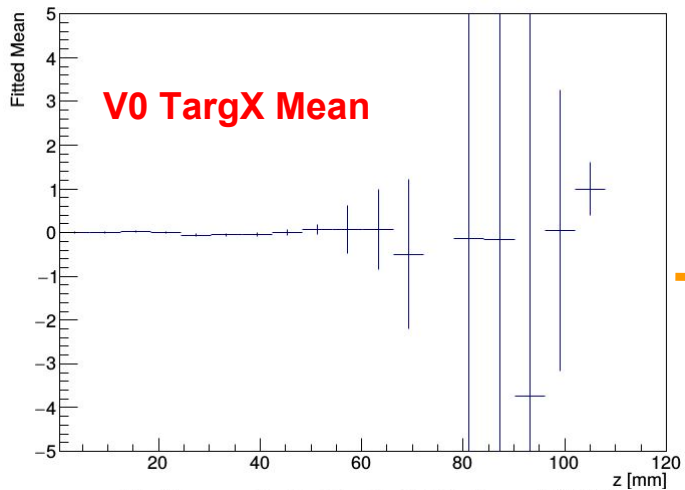
Apply this correction to other pulls and see if that fixes anything.

V0 Corrected Momentum Z Pulls

Using the corrected Pz errors; pulls look ok! (calculation is sensitive to B value)
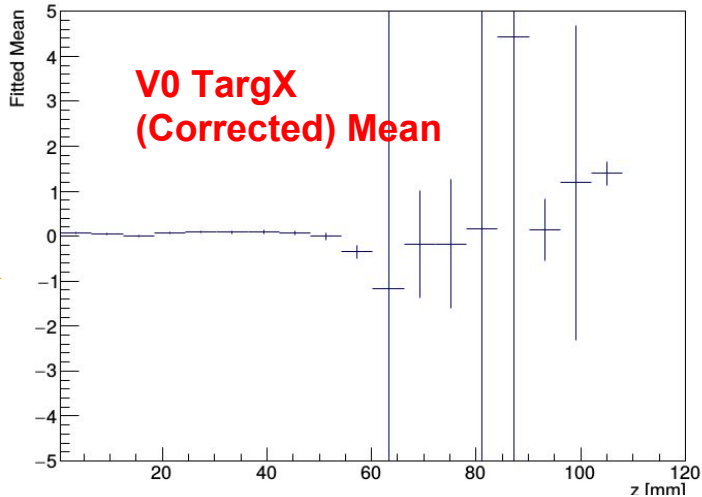

Fitted Means (uncPZ-trlPZ)/(0.000075*sqrt(((eleTrkOmegaErr/eleTrkOmega^2)^2+(posTrkOmegaErr/posTrkOmega^2)^2))) A' mass 0.04 GeV

Fitted Sigmas (uncPZ-trlPZ)/(0.000075*sqrt(((eleTrkOmegaErr/eleTrkOmega^2)^2+(posTrkOmegaErr/posTrkOmega^2)^2))) A' mass 0.04 GeV

V0 Pz (Corrected) Mean

V0 Pz (Corrected) Sigma

Fitted Means uncTargProjX/uncTargProjXErr A' mass 0.04 GeV

V0 TargX Mean

Corrected

V0 TargX
(Corrected) Mean

Fitted Sigmas uncTargProjX/uncTargProjXErr A' mass 0.04 GeV

V0 TargX Sigma

Corrected

V0 TargX
(Corrected) Sigma
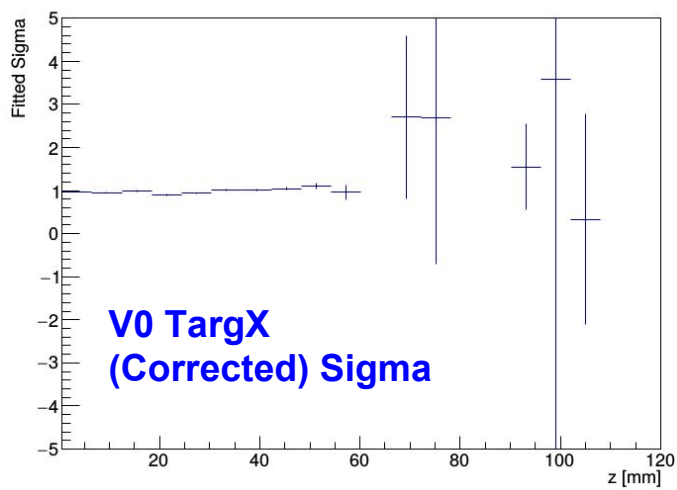
Fitted Means uncTargProjY/uncTargProjYErr A' mass 0.04 GeV

V0 TargY Mean

Corrected

V0 TargY (Corrected) Mean
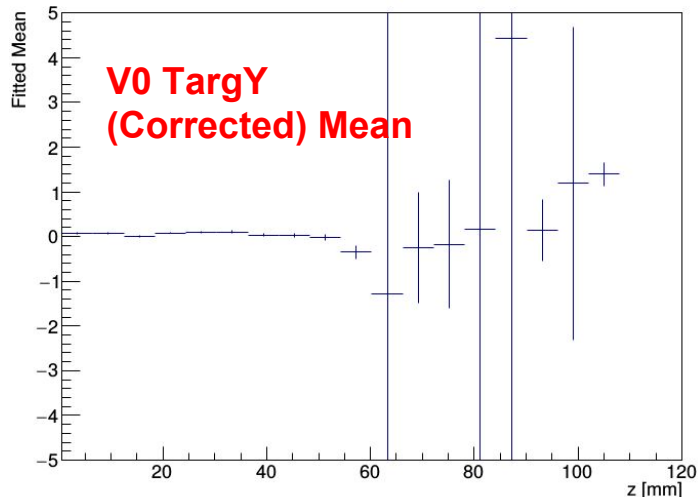
Fitted Sigmas uncTargProjY/uncTargProjYErr A' mass 0.04 GeV

V0 TargY Sigma
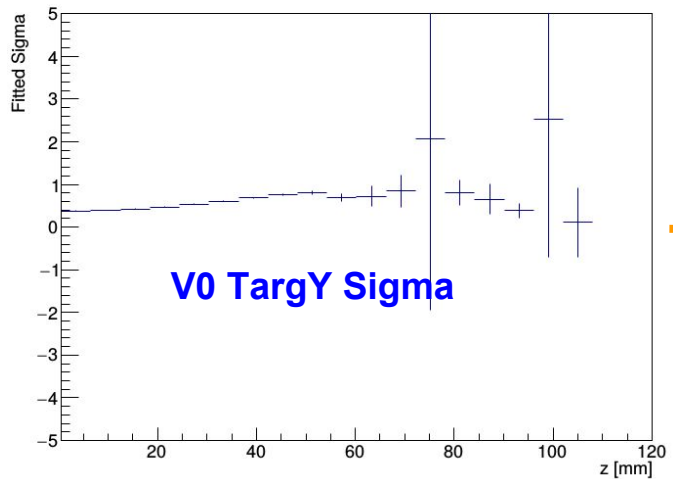
Corrected

V0 TargY (Corrected) Sigma
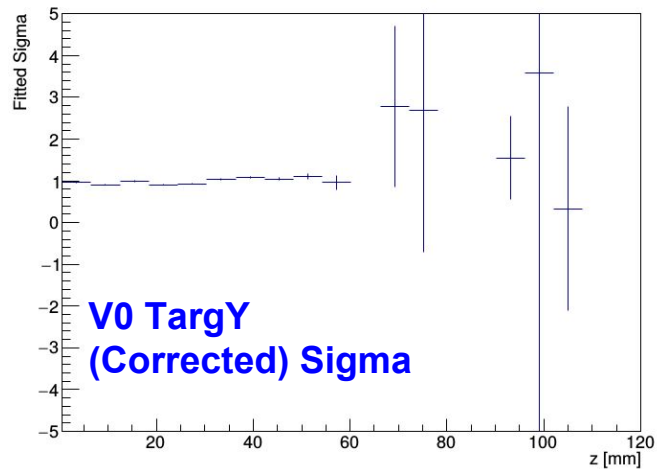
Conclusion

There is something wrong with the V0 unconstrained Pz errors

A hand wavy correction seems to work (assume mass pulls work with correction)

Check the same parameter pulls but in the beamspot constrained and target constrained collections?