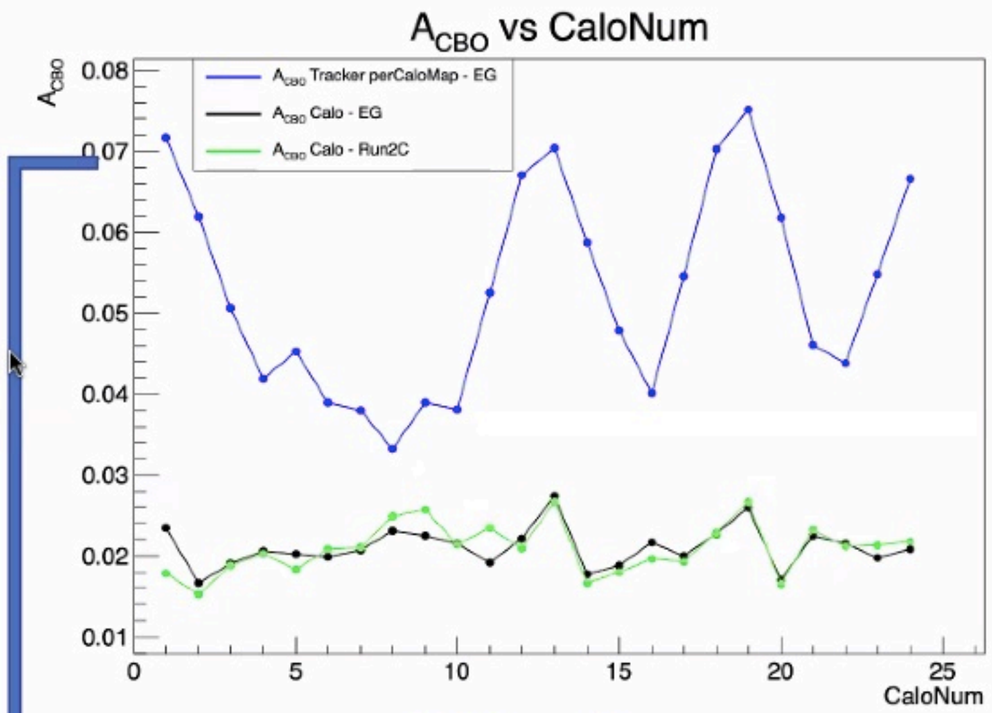
ω_a fit from Tracker

- During Run1 analysis we were not able to obtain the same parameters from tracker data (i.e. A_{CBO}) respect to calorimeter data.
- Blue points are from tracker (corrected by tracker acceptance)
- The green and black points are obtained by ω_a fit from calorimeter (Run1-2)



$$N_C(t) = \frac{N_T(x,y)}{\varepsilon_T(x,y)} \cdot \varepsilon_C(x,y)$$

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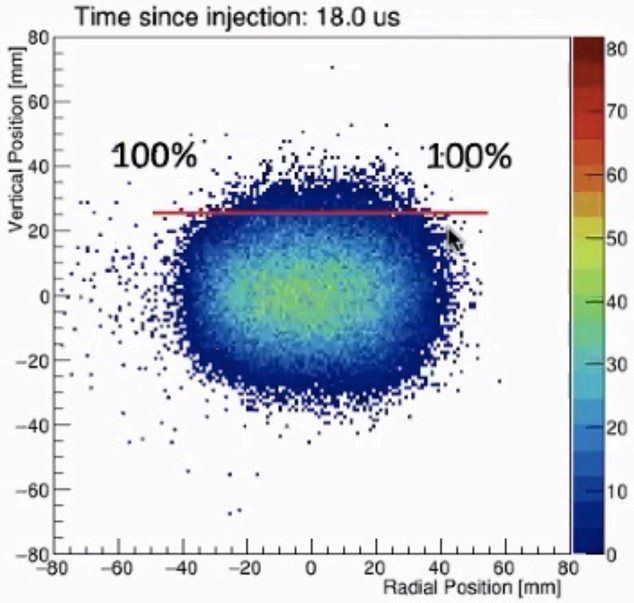
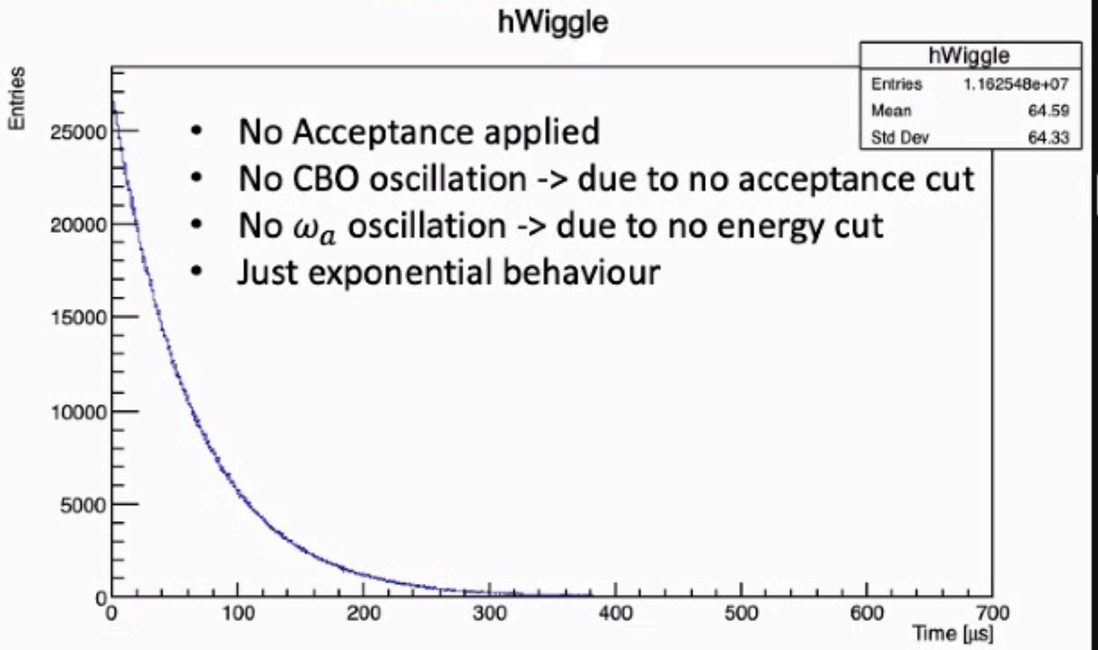
Tracker Acceptance – How does it work?

- Imaging to have a perfect detector around the beam pipe, which can detect every positron emitted.
- If you don't apply any cut on energy you get a simple exponential
- Applying the acceptance we obtain oscillations -> $A_{CBO} > 0$





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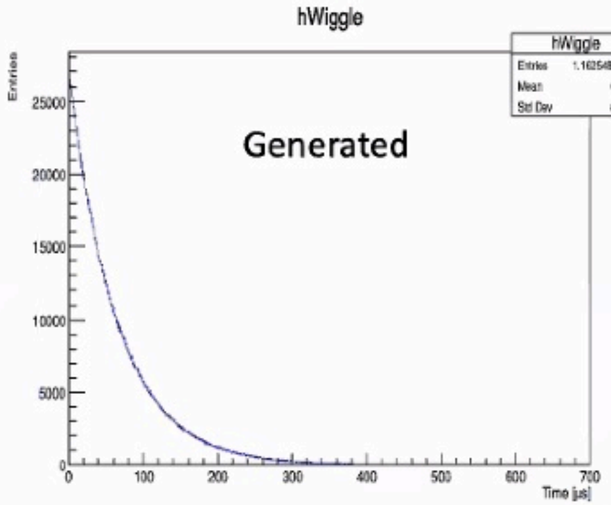
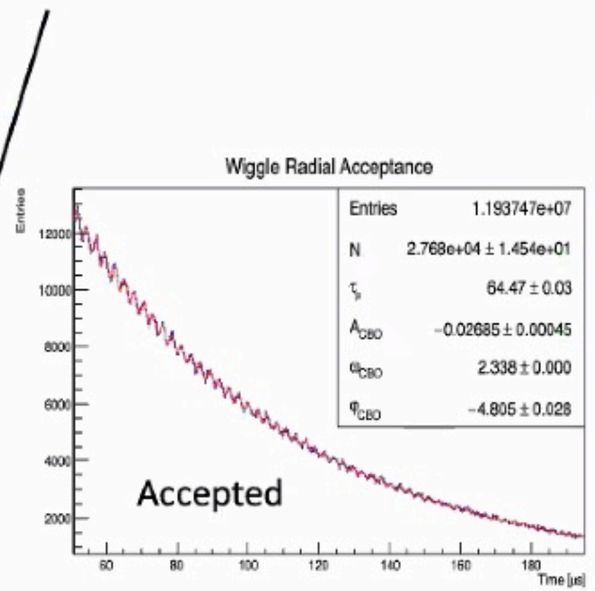
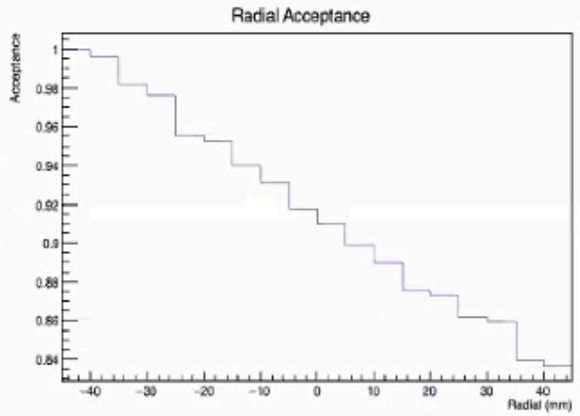
Tracker Acceptance – How does it work?

- The acceptance is calculated using a simulation sample, the GasGun.
- It is extracted as the ratio between the number of events generated by simulation, over the number of positron which hits the detector for a given decay position or momentum:







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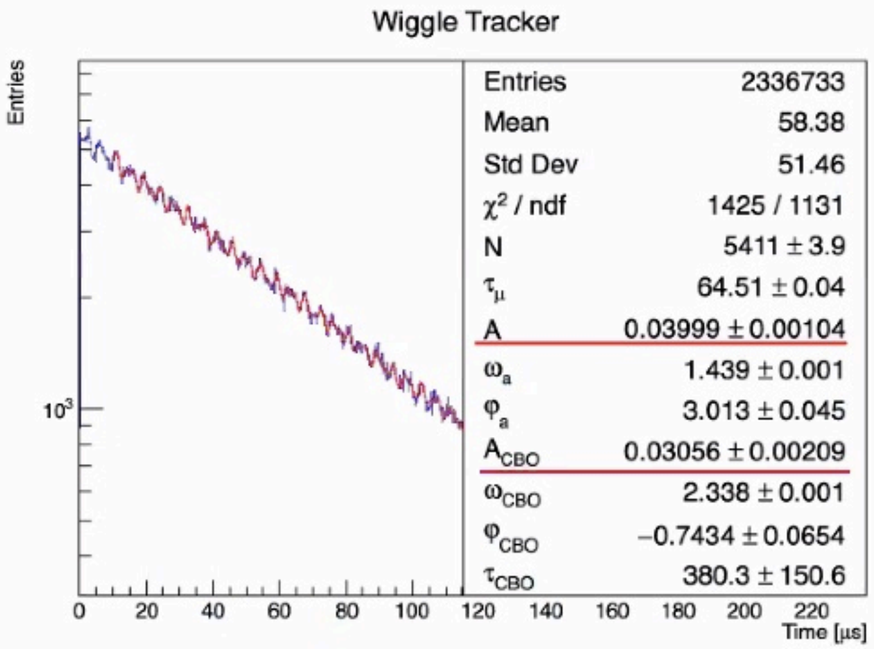
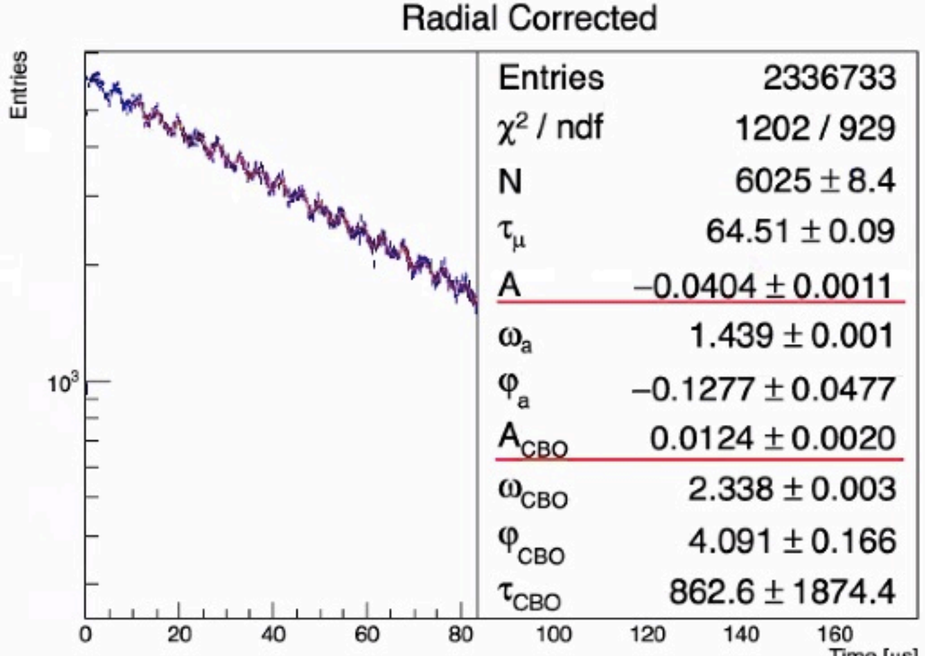
Tracker Acceptance – How does it work?

- Correcting for radial acceptance we obtain a reduction of 60% on A_{CBO}.
- While the ω_a amplitude remains constant.





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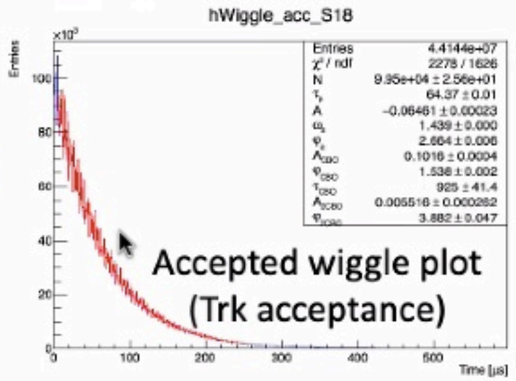
Closed Loop

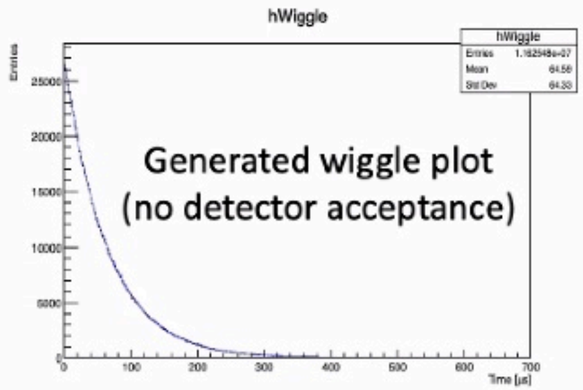
- As first step, we want to compute the tracker acceptance from simulation and use it on the same sample to get back to the generated distribution.

Including acceptance



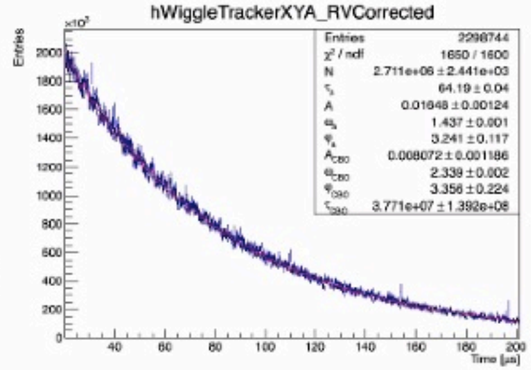
Accepted wiggle plot
(Trk acceptance)

Correcting for the acceptance



Generated wiggle plot
(no detector acceptance)

These plots should match if the acceptance is well computed and applied



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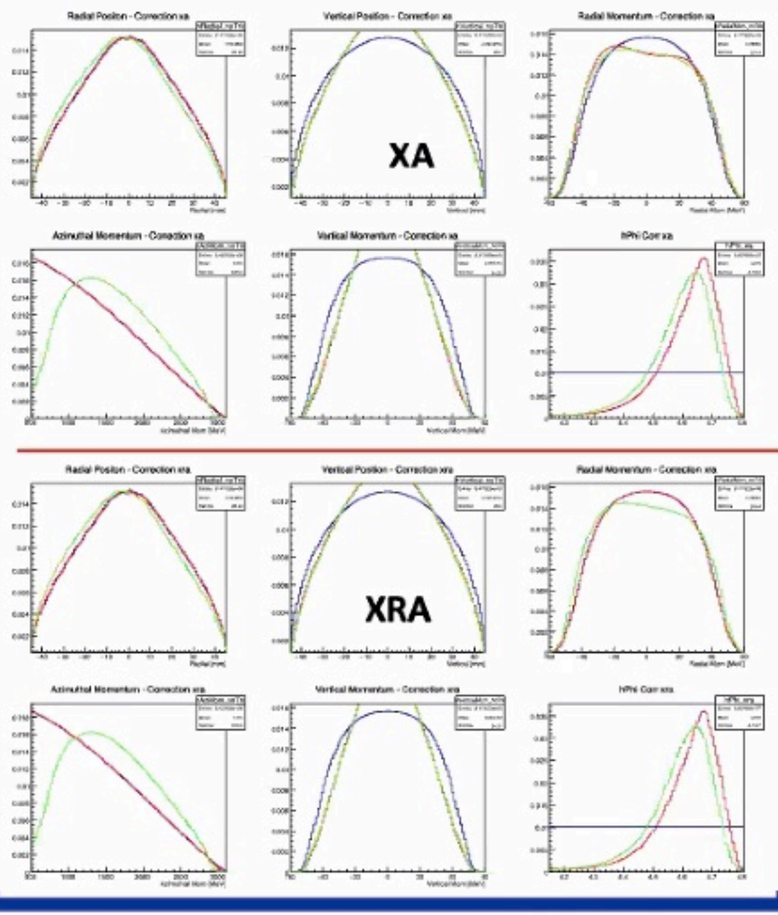
CBO from a large GasGun sample

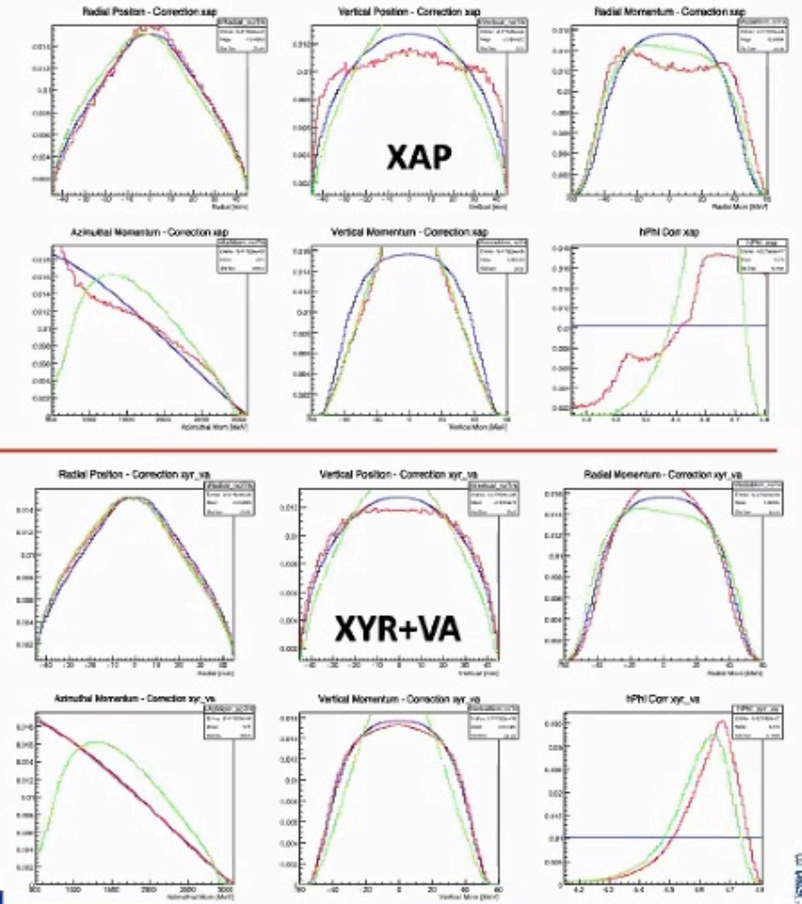
- These corrections should also affect the beam distribution.

-Gen Events

-Acc Events

-Corr Events





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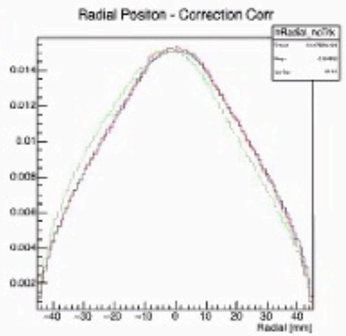
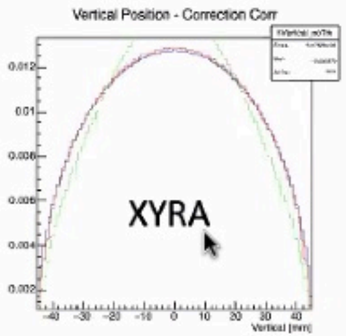
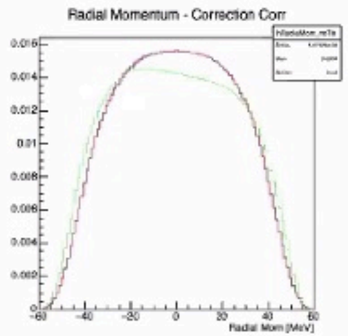
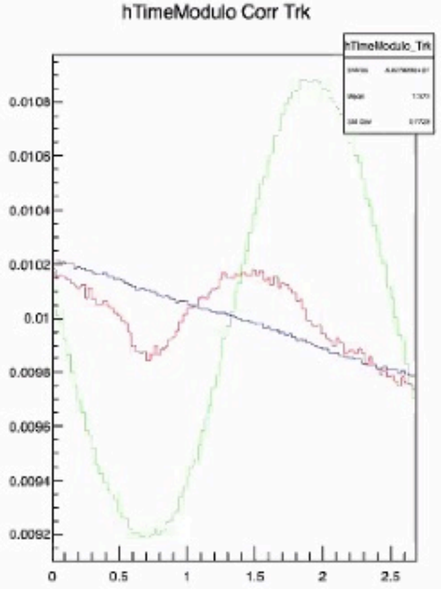
4D correction

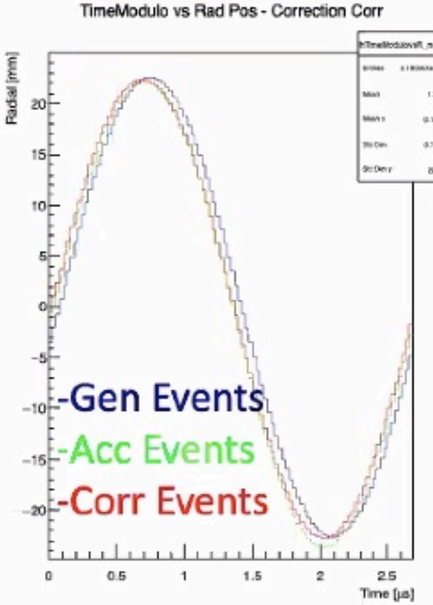
- From the previous slides is clear that the larger effect is given by correcting for radial/azimuthal position and radial/azimuthal momentum -> we also reduced the interval that worked for XRP correction, but in 4D we don't get the same result.

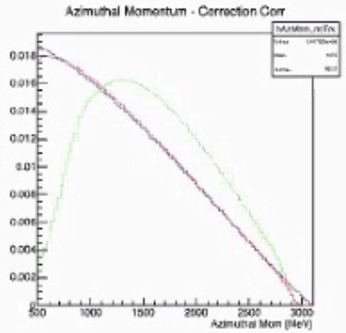


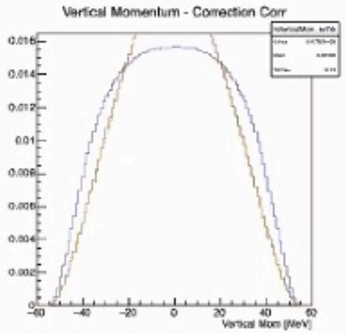


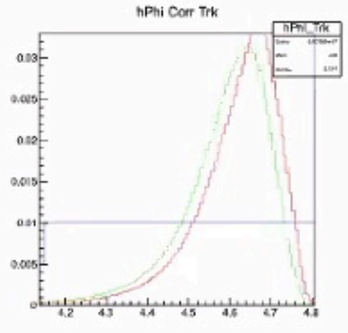












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Excluding the “bad bins”, solution?

- We found that reducing the binning we see an improvement of the acceptance correction.
- Instead of changing the range, we can simply remove all the bins that are labelled as “bad”.
- “bad bins” in acceptance (generated/accepted) can be defined as:
  - Zero bins in accepted events;
  - Weights with a large error $\sigma_{acc} = \sqrt{acc \cdot (1 - acc)/gen}$
- Excluding those bins also from the generated histograms we will introduce some oscillations, but this time we should expect that generated and corrected histograms should agree better, if this is the cause.

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Complete vs Minimal correction
Radial Mean/Azimuthal Momentum

- We found that the closed loop works and the way we compute the acceptance is correct.
- 4D solution would work perfectly if we had infinite statistics.
- Using real data though, we don't have radial momentum information or a good reconstruction of azimuthal position, so we need to find the minimal set which allows us to correct data.

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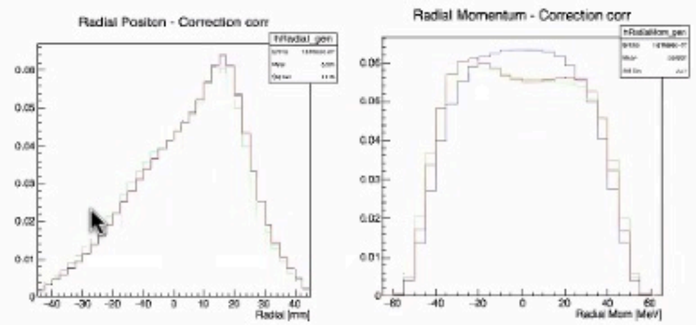
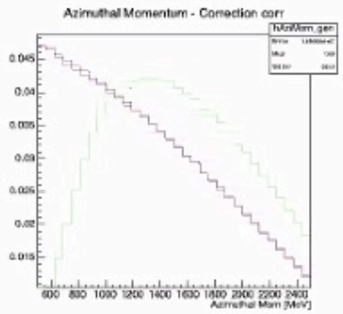
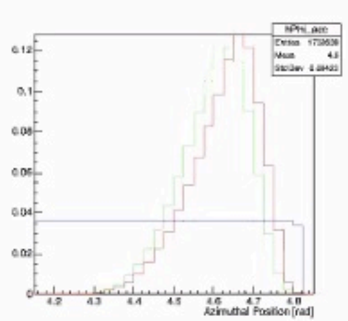
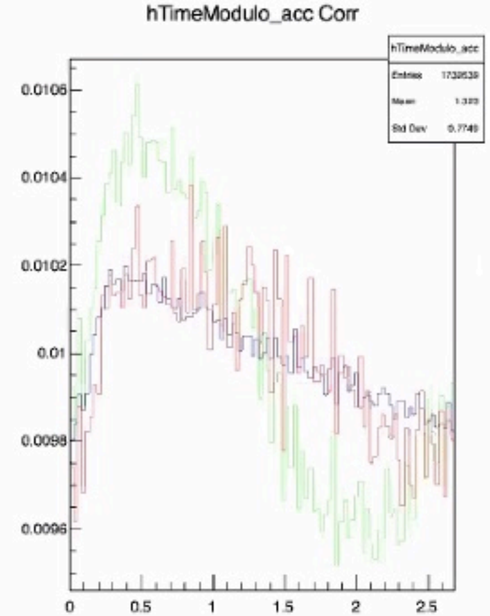
GasGun samples with CBO (cut over aziMom > 2500MeV)

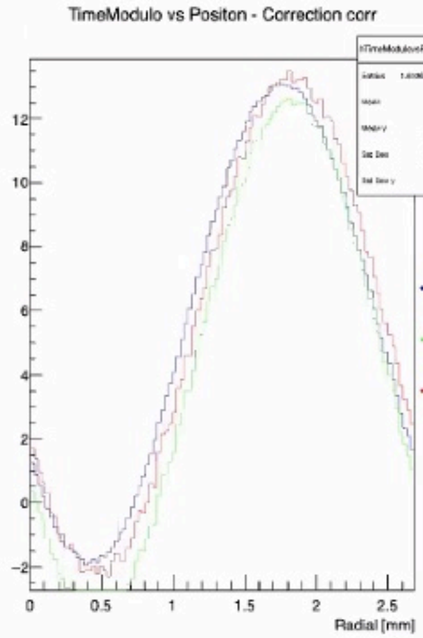
- Once found the better compromise using variables available from tracker data, we can do an independent study by looking at the smaller GasGun sample with CBO.











-Gen Events
-Acc Events
-Corr Events

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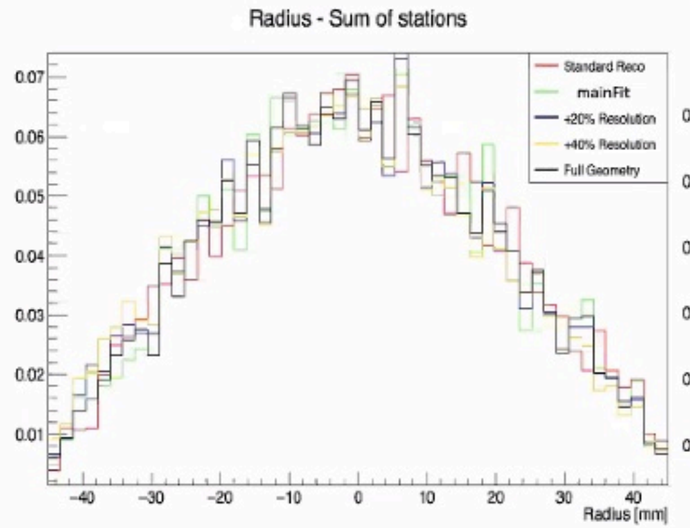
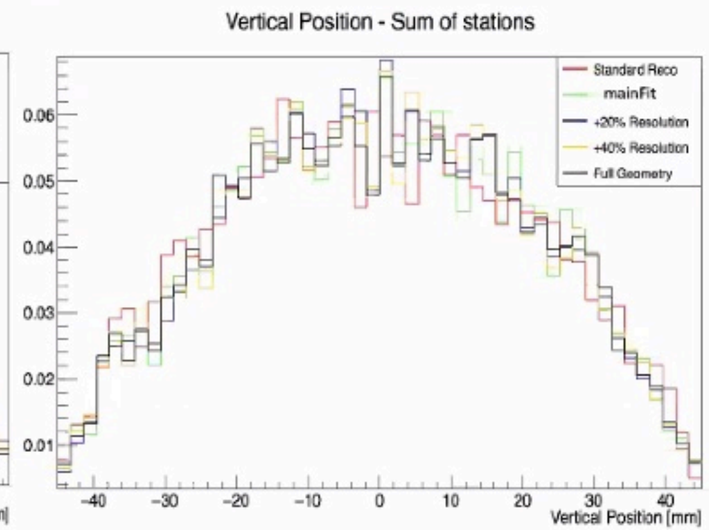
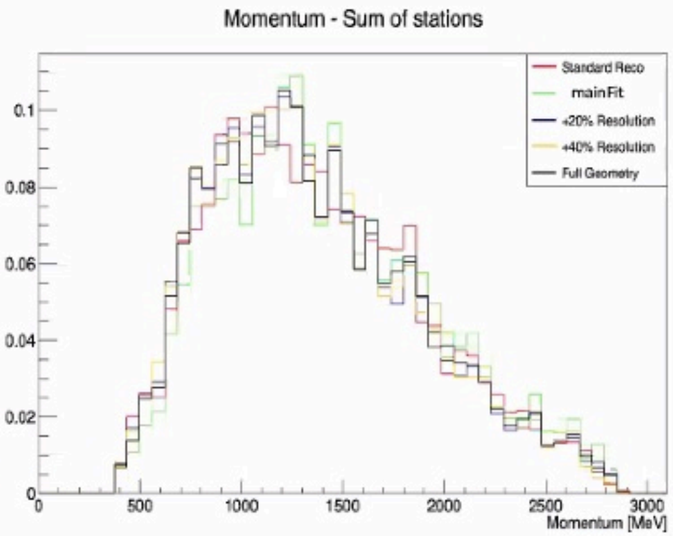
Changing Reconstruction Fit

- Here the comparison between different reconstruction fit.
- The larger difference is on momentum for the Main Fit option (Run-2/3 fitter)
- Resolution doesn't make difference.







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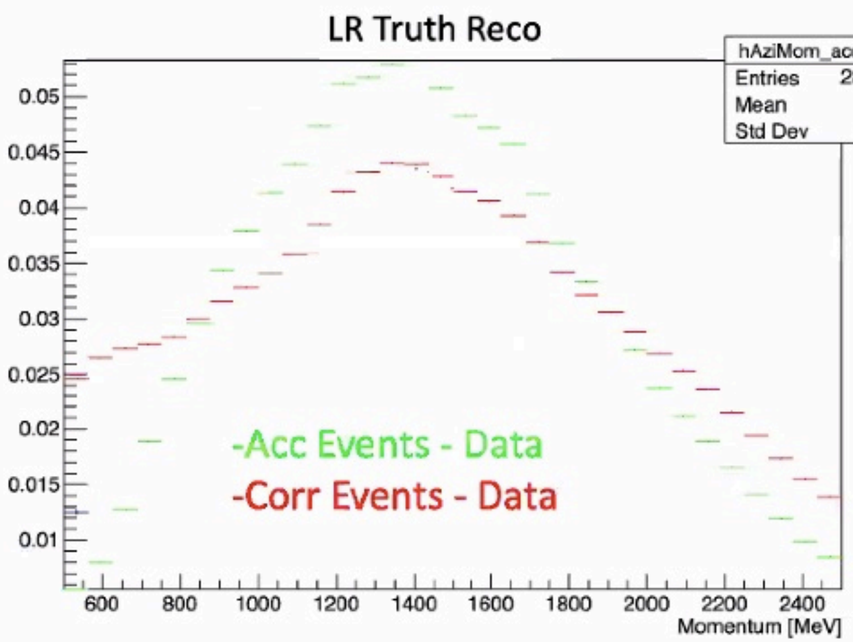
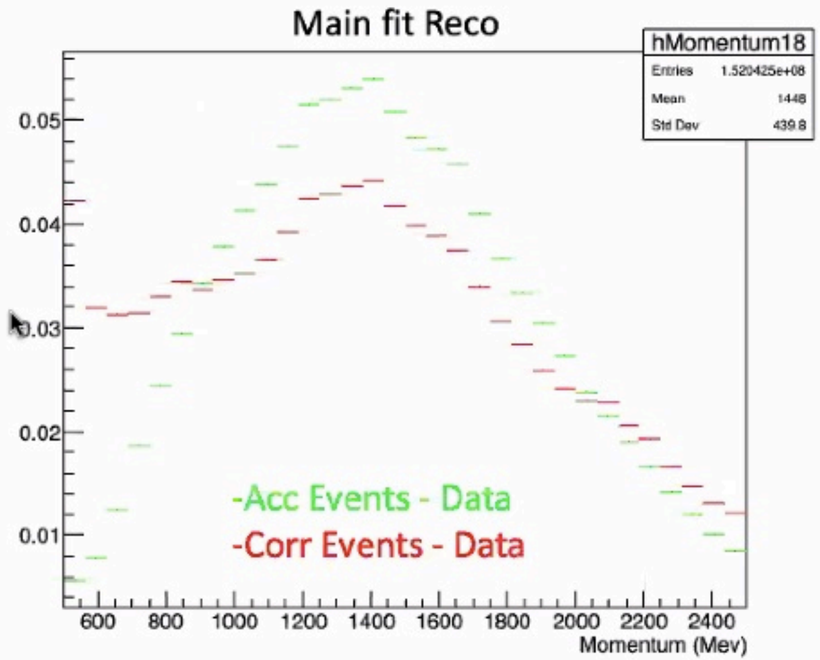
Changing Reconstruction Fit – Data comparison

- Here the corrected data using the mainFit option.
- Little improvement in the momentum distribution, no effect on ACBO.





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Conclusion

- From these results with full stats, it seems that our 2D correction works better on GasGun rather than BeamGun.
- It is not due to the maps, since GG and BG maps gave the same result
- In this condition a reduction of 50% is found on BeamGun, does it mean that managing correctly the reconstruction on data our best correction could be 50%?
- To summarize we have 2 problems:
  - The technique itself isn't perfect - we're always left with some residual oscillation which can be as large as 50% of the input oscillation.
  - The reconstruction doesn't match the data.
- At this point, it seems that we are not able to solve those problems shortly, so, could we go on with what we have now -> We cannot use unrandomized procedure for PA in Run2/3, we can think to apply a correction on randomized central values.

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