

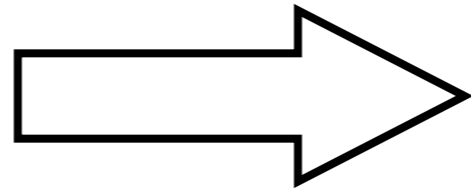
FastDRIC update: low-level observables

Yunjie Yang
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Dataset: ver01

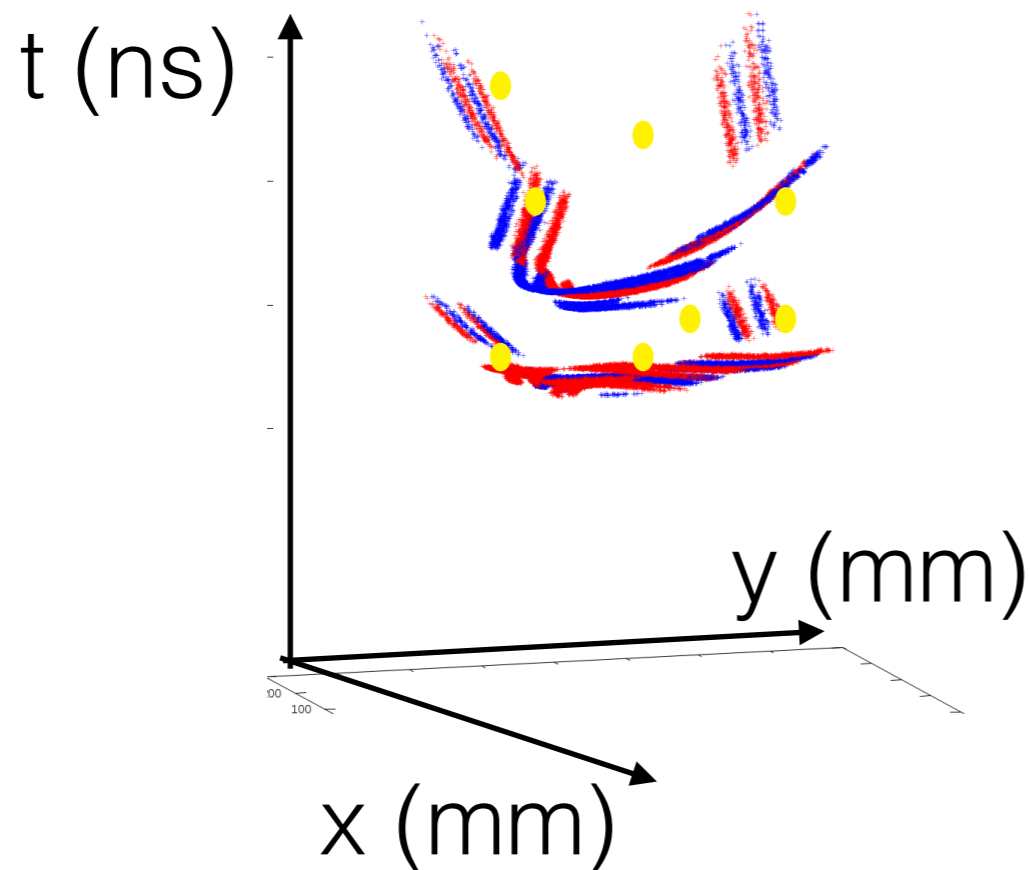
- /volatile/halld/home/gxproj7/RunPeriod-2019-11/dirc_monitoring/ver01/hists/merged/
- Produced with dirc_tree plugin: ρ, ϕ + track selection
- Using partially of runs 71028 — 71228
- Better calibration from both DIRC and other detectors compared to ver00
- Track selection: [2.9, 3.1] GeV (+ ρ, ϕ mass and track quality selection)

Input:
track kinematics,
mass hypothesis



Model:
geometry + propagation

$O(1M)$ Cherenkov
photons in (x, y, t)



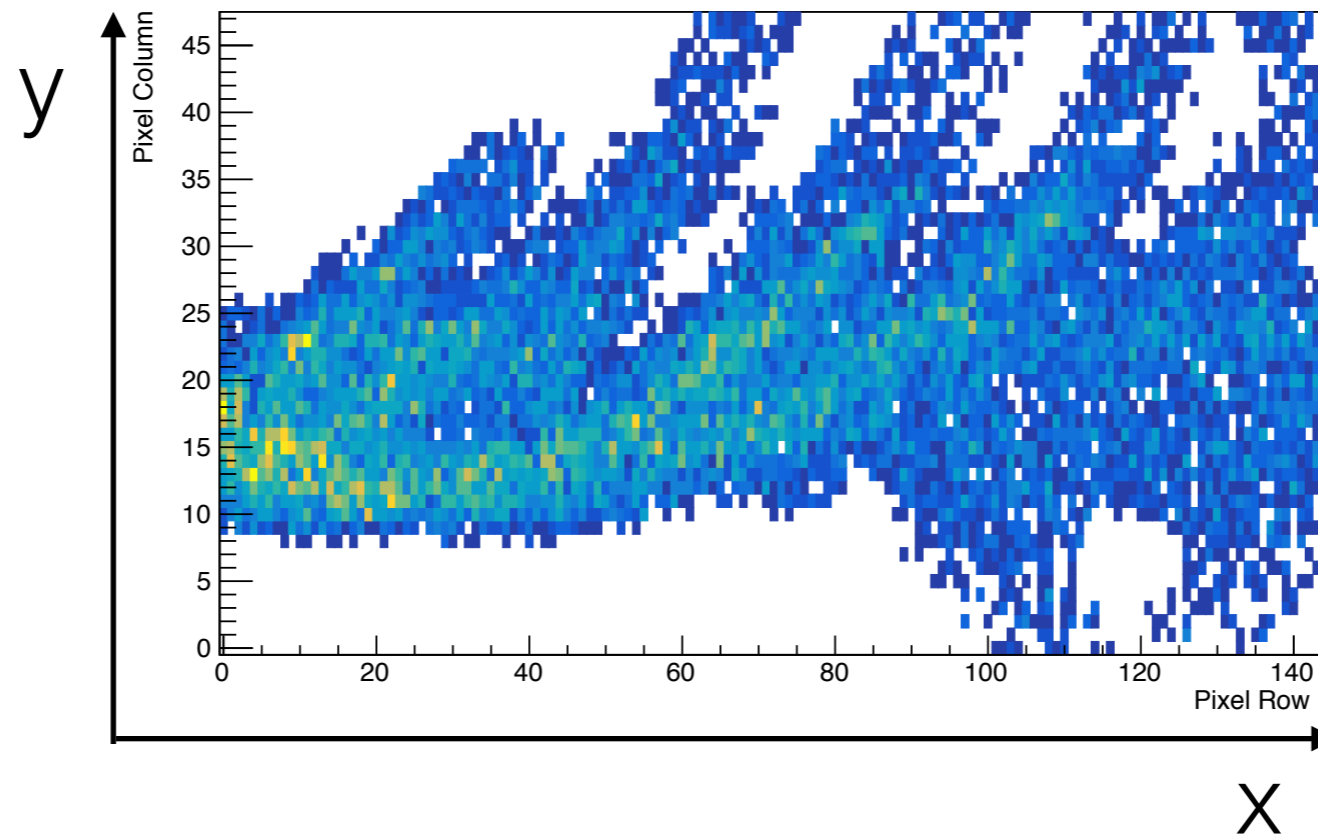
red and blue bands:
support points from
two mass hypos

● observed hit

Figure from John Hardin thesis

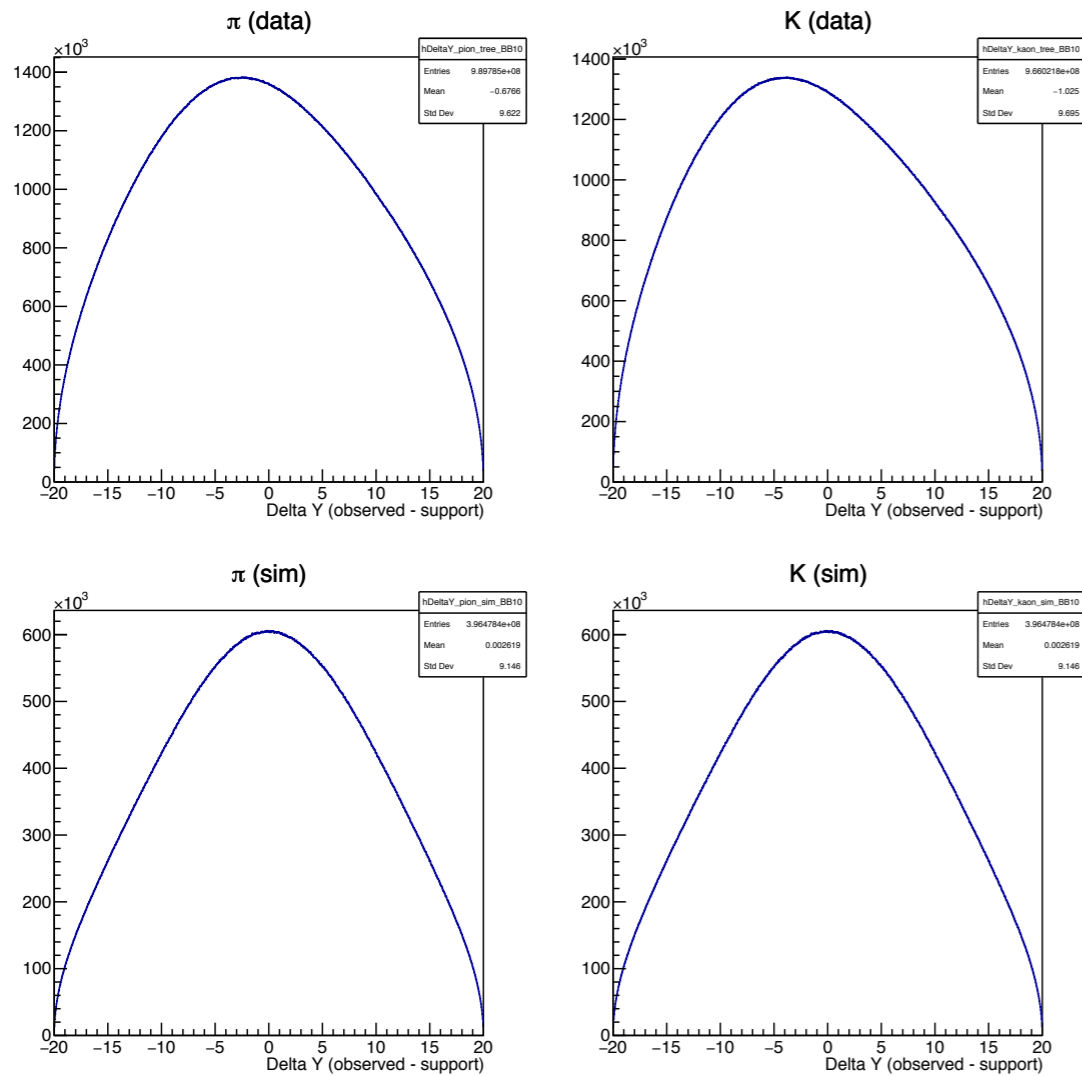
Delta observables

- For each observed hit, look within **8.5 mm** and **± 5 ns** (i.e. a 3D cylinder)
- compute Delta observables as $O_{\text{hit}} - O_{\text{support}_i}$ for all the support points within that “3D cylinder”

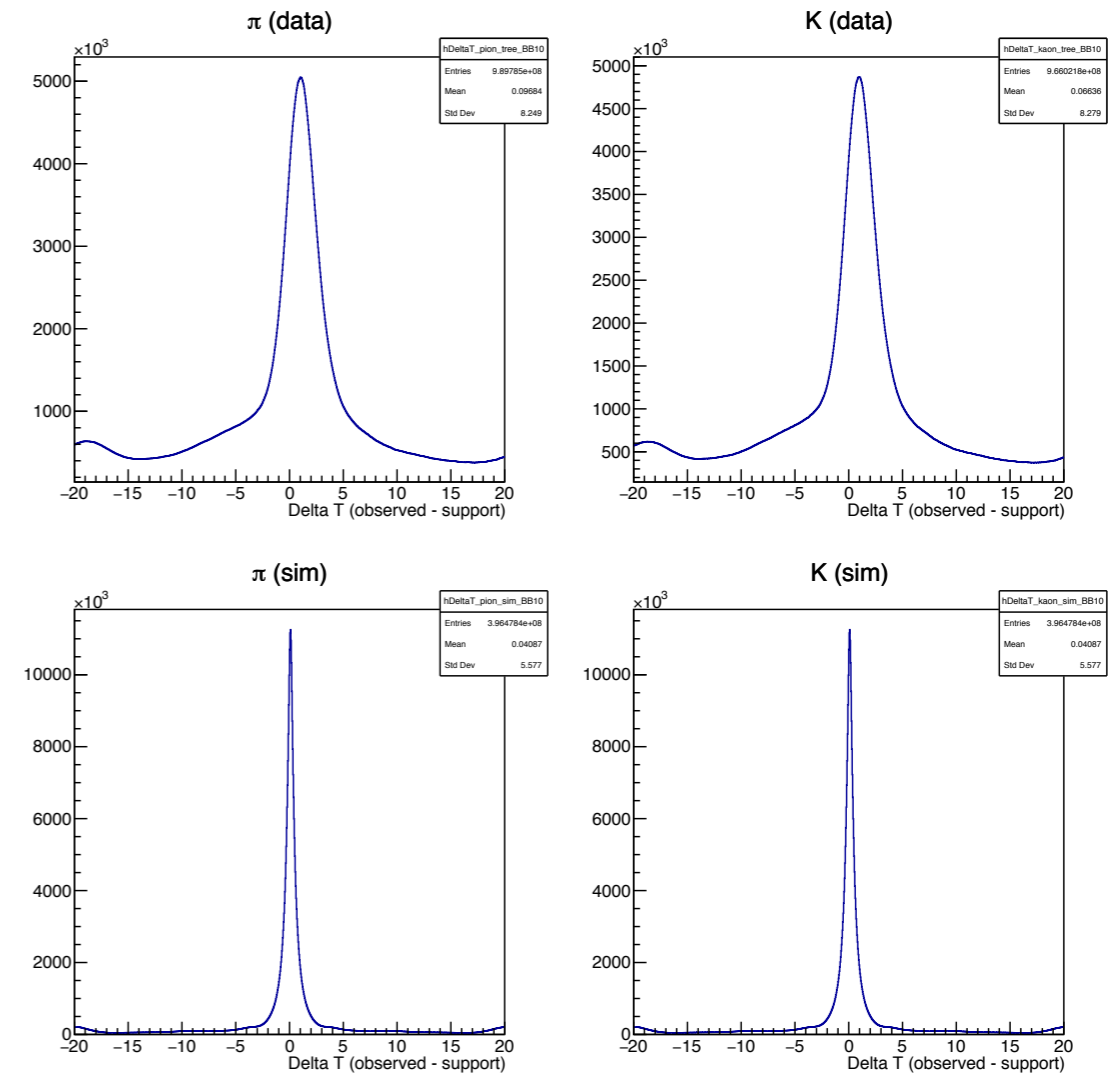


Reminder

DeltaY



DeltaT



offset from 0 in data

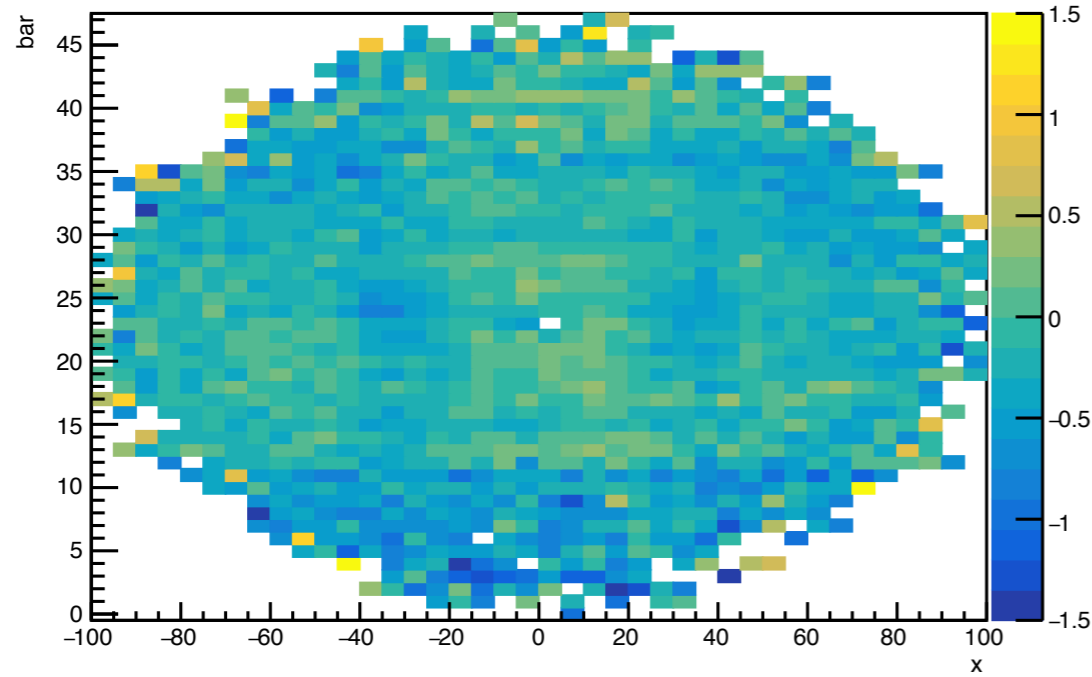
- offset from 0 in data
- wider width

Study: per Bar per Xbin

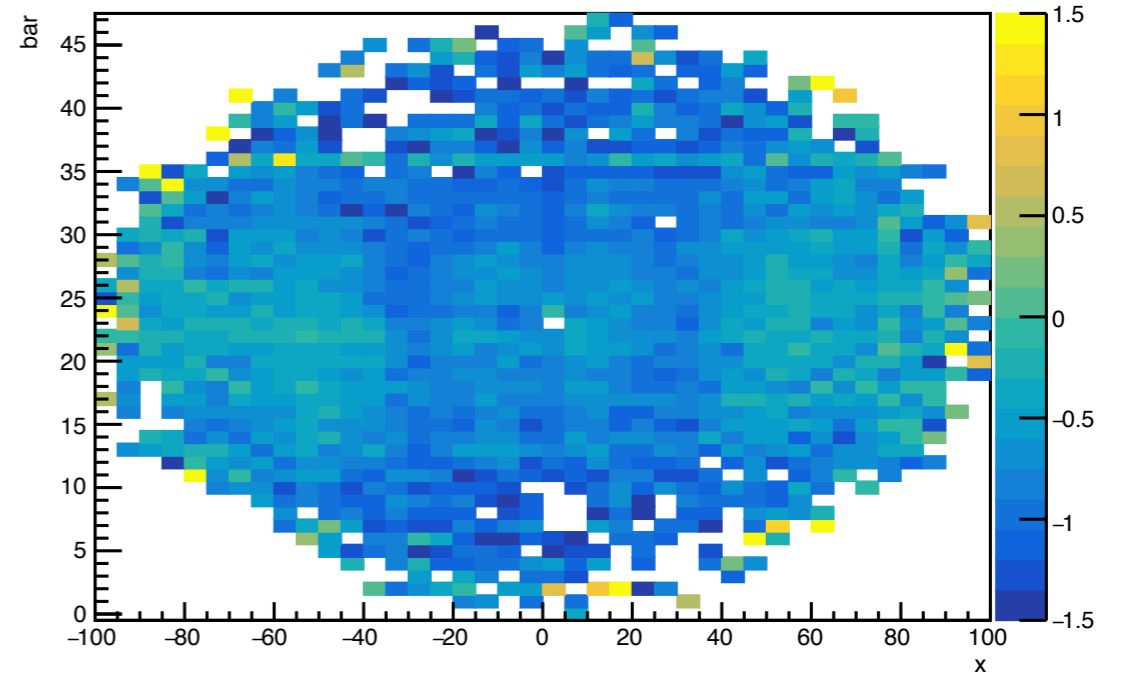
- Divide tracks according to where they hit on the DIRC wall
- Fit the Delta distributions in each bin to get the offset location (for both Y and T) and width (T only)
- Plot them in 2D; compare pion vs. kaon tracks and data hits vs. simulated hits
- Notes on simulated hits:
 - a “simulated hit” means to use the internal geometry+propagation model to simulate a hit, and digitize it (i.e. assign it a pixel location and a 1 ns time smearing). Then take the center of the pixel as the hit position in (x, y) when calculating likelihoods
 - the simulated hits and support points come from the exact same probability distribution function, except for the digitization

DeltaY: peak position

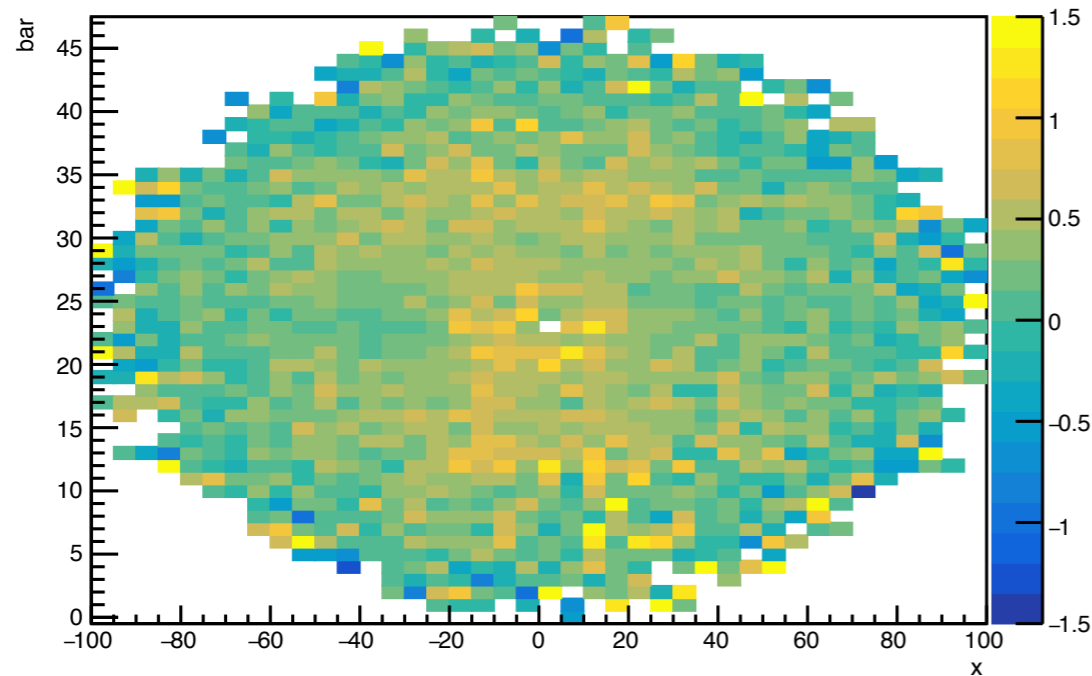
DeltaY π (data)



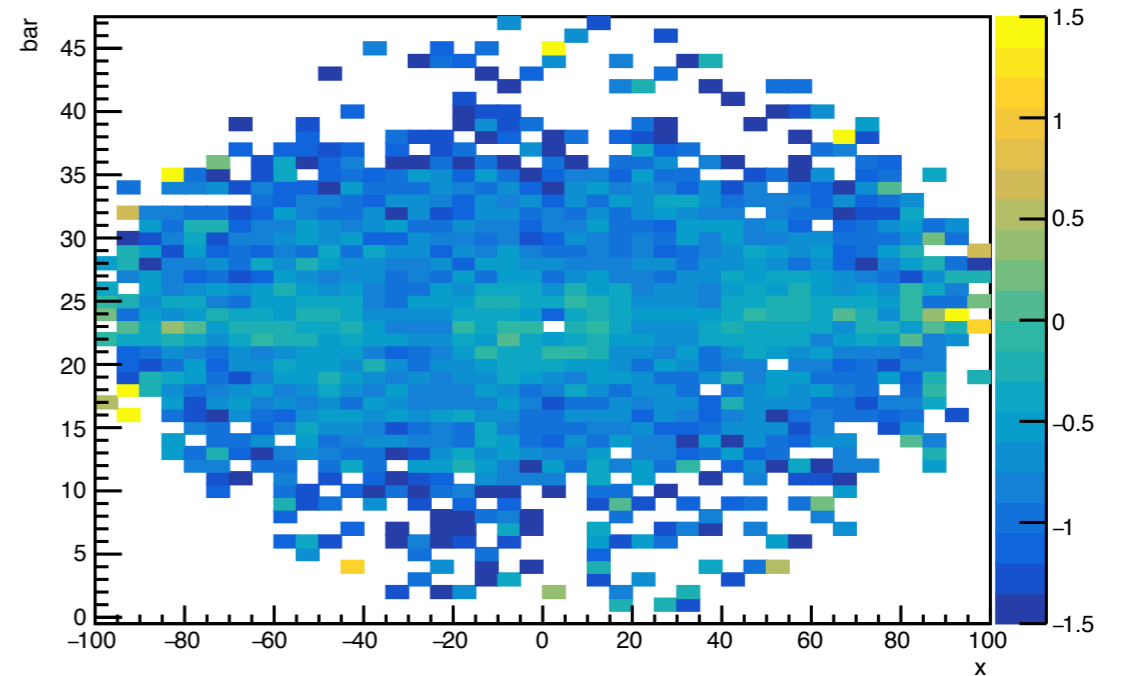
DeltaY K (data)



DeltaY π (sim hits)



DeltaY K (sim hits)



DeltaY: peak position

Observations and my interpretation:

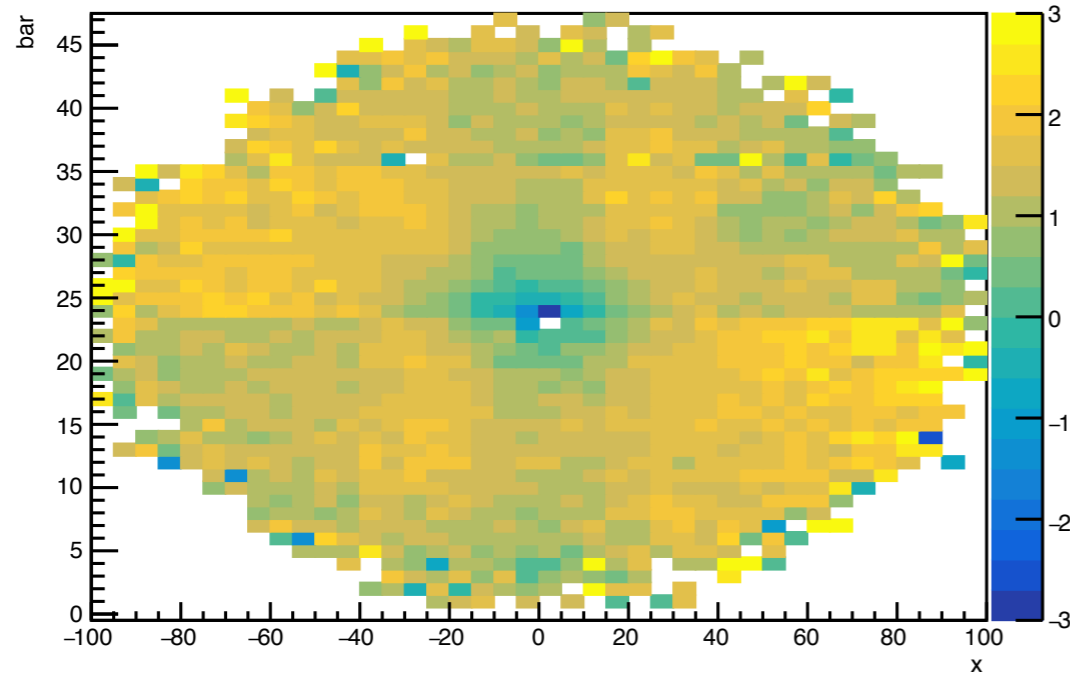
- Simulated hits don't have peak position at 0
 - digitization effect? i.e. pixel size
- Data hits and simulated hits show gross similarity
 - despite why sim. hits not at 0, this observable probably doesn't have the sensitivity to look at the disagreement between data and model? (or a positive way to say this is, the model is good to within a pixel size?)

Next steps:

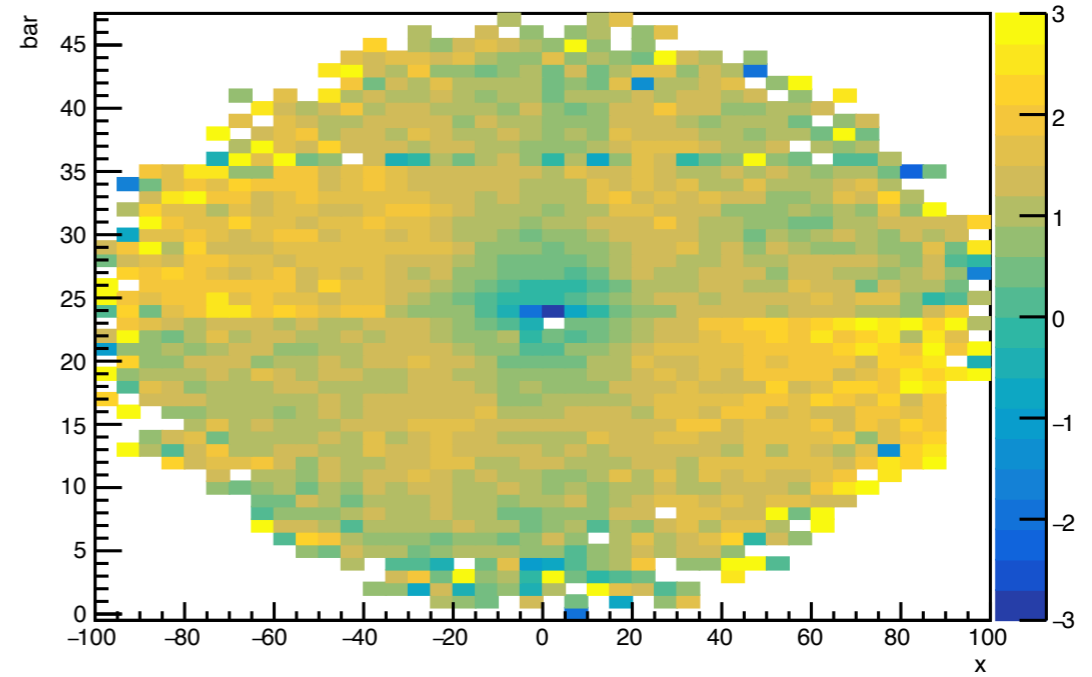
- Turn to simulation, try to disentangle the effects
 - check if digitization done properly
 - perturb the optics and see if there's any effect in those observables

DeltaT: peak position

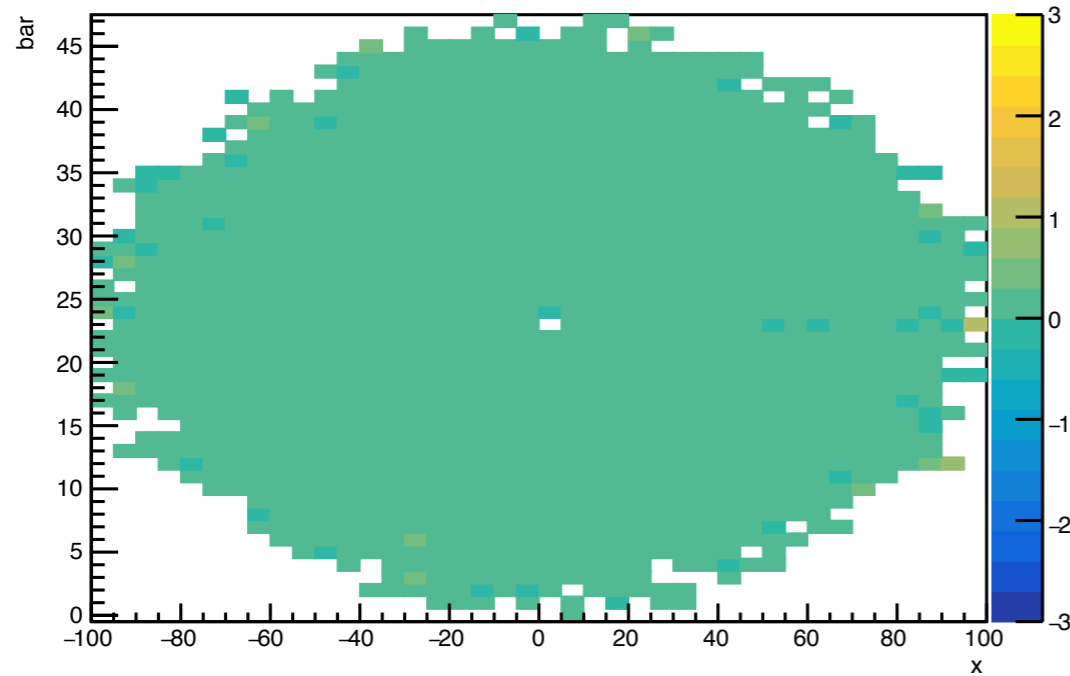
DeltaT π (data)



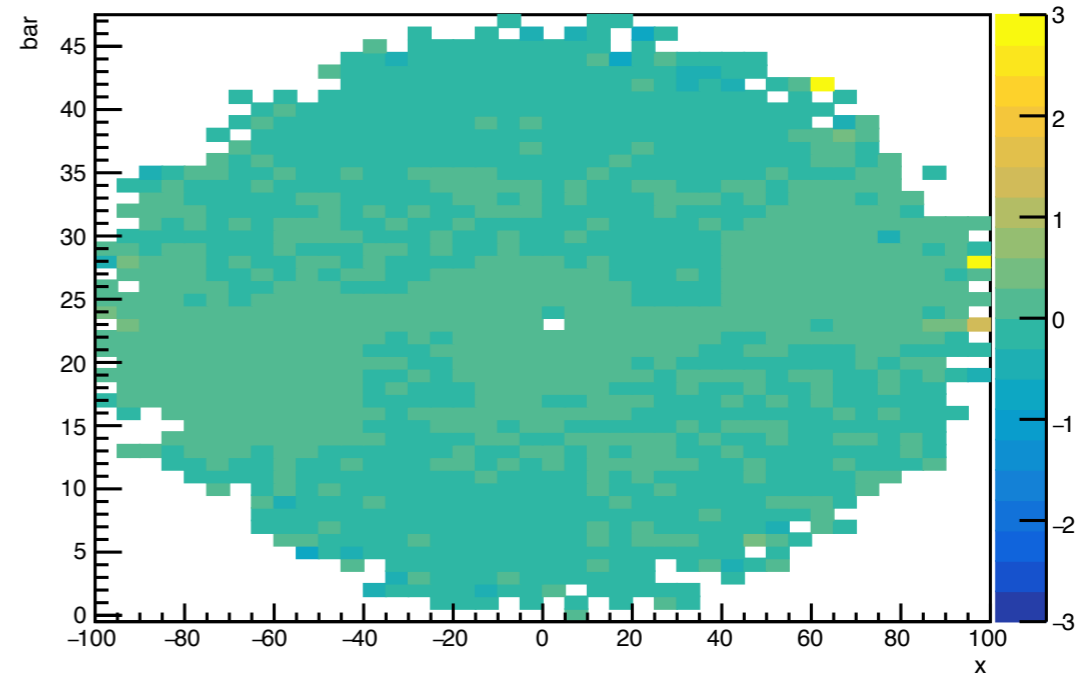
DeltaT K (data)



DeltaT π (sim hits)

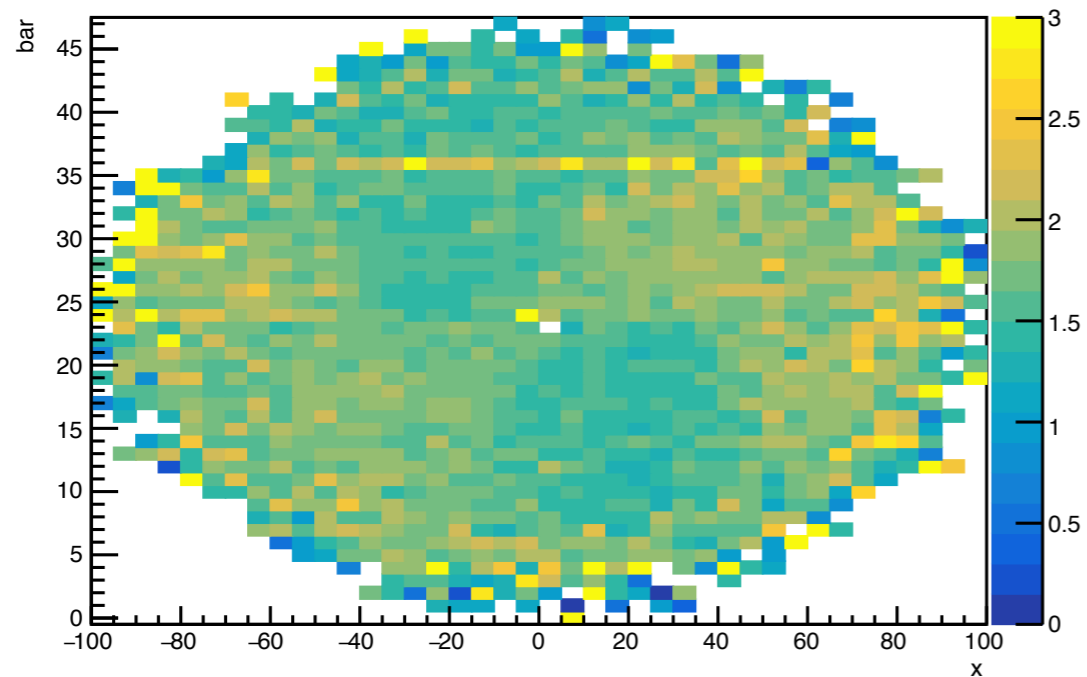


DeltaT K (sim hits)

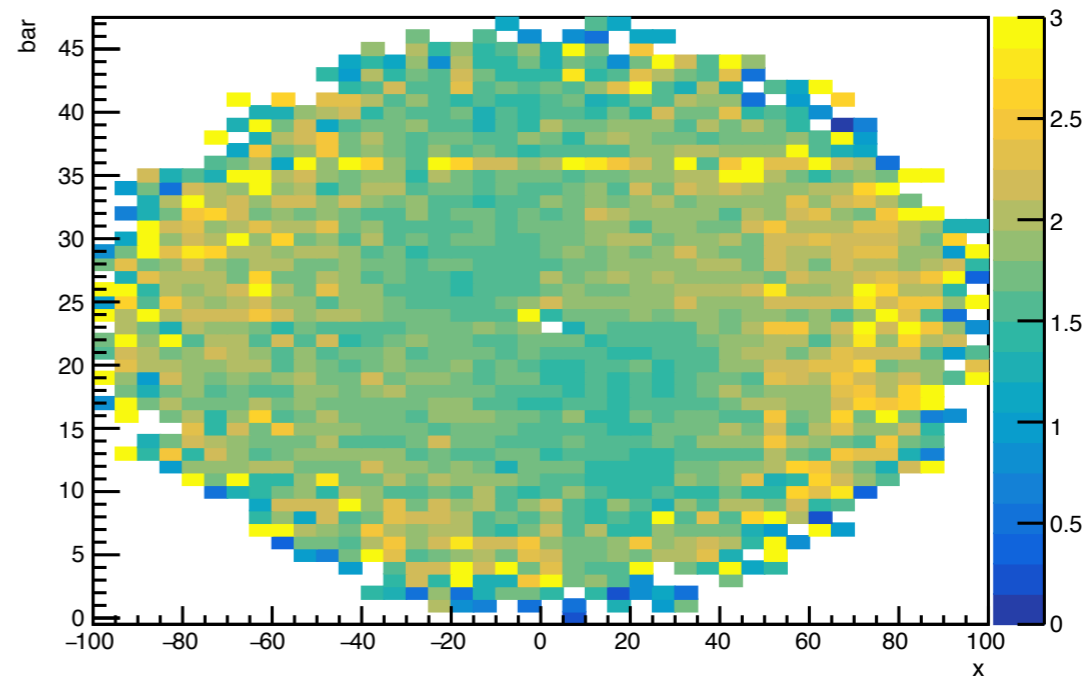


DeltaT: width

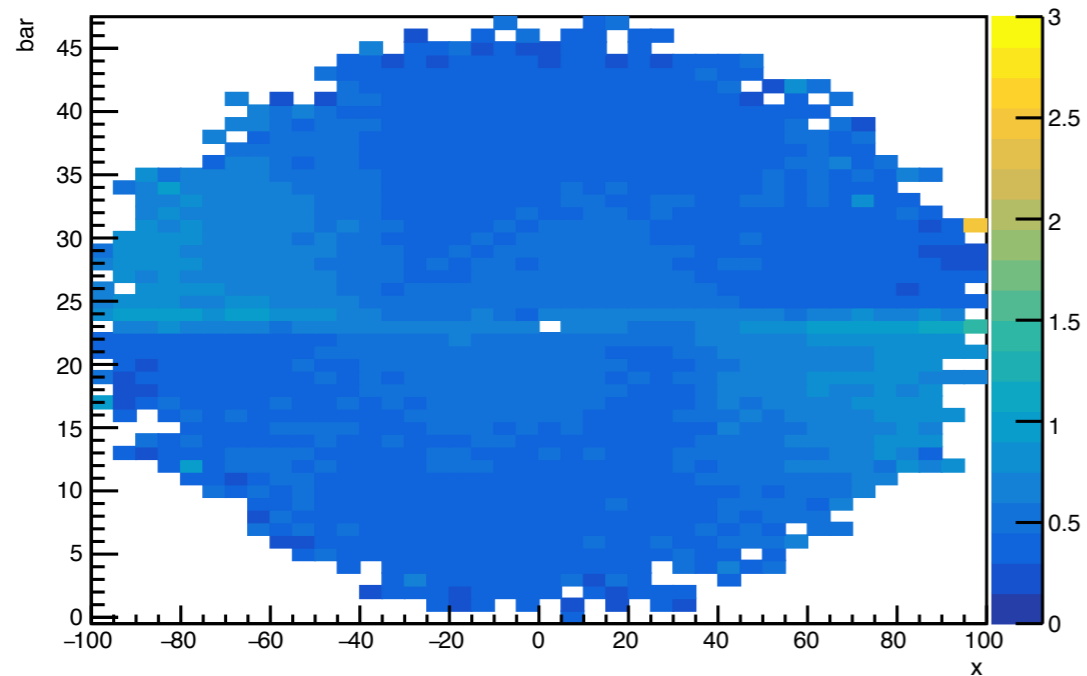
DeltaT π (data)



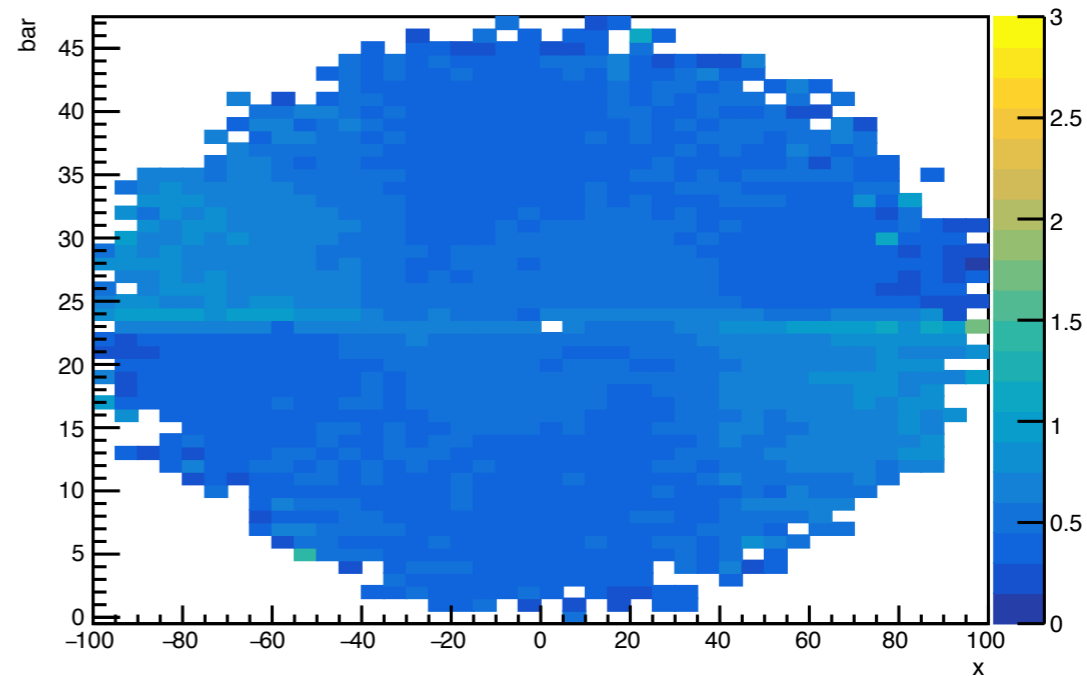
DeltaT K (data)



DeltaT π (sim hits)



DeltaT K (sim hits)



DeltaT: peak position and width

Observations and my interpretation:

- Simulated hits *do* have peak position at 0!
 - makes sense, because it's purely smearing around the truth time
- Both peak position and widths show upper-lower symmetry
 - probably not some overall shift
 - path length effect? index of refraction not modeled properly?
- Data hits show wider widths
 - track hit time or propagation model?

Next steps:

- Turn to simulation, try to disentangle the effects:
 - change index of refraction and see if it can produce similar structure
 - add angular/position smearing in track hit location and see what effects they produce

Next Steps

- Turn to simulation and try to disentangle different effects on those observables
- Resurrect the alignment work, start from closure check in simulation