

Integrating FastDIRC into GlueX framework

- Last time:
 - FastDIRC vs. HDGeant4: agreement in geometry seems good; other features/discrepancies (timing, “additional/missing” hits etc.) are under investigation.
- Update:
 - A framework is set up to read data/MC trees and perform KDE-based reconstruction with FastDIRC
 - First pi/K delta log likelihood (DLL) plots from FastDIRC reconstruction using commissioning data

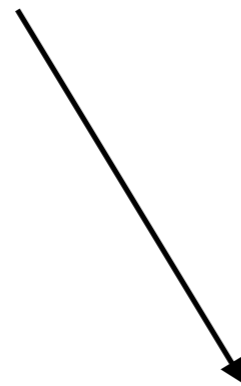
Workflow

Data in REST/raw format



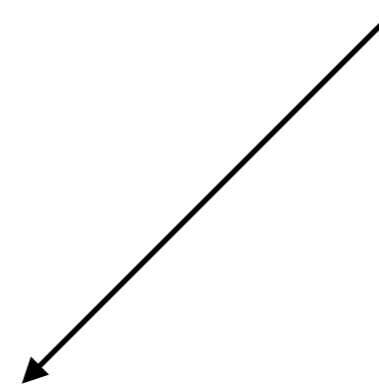
a plugin: some variant of dirc_tree
recon. and selection of events and tracks

a ROOT tree of "DIRC events"
(track + measured hits)



standalone "HDFastDIRC":
recon., alignment etc.

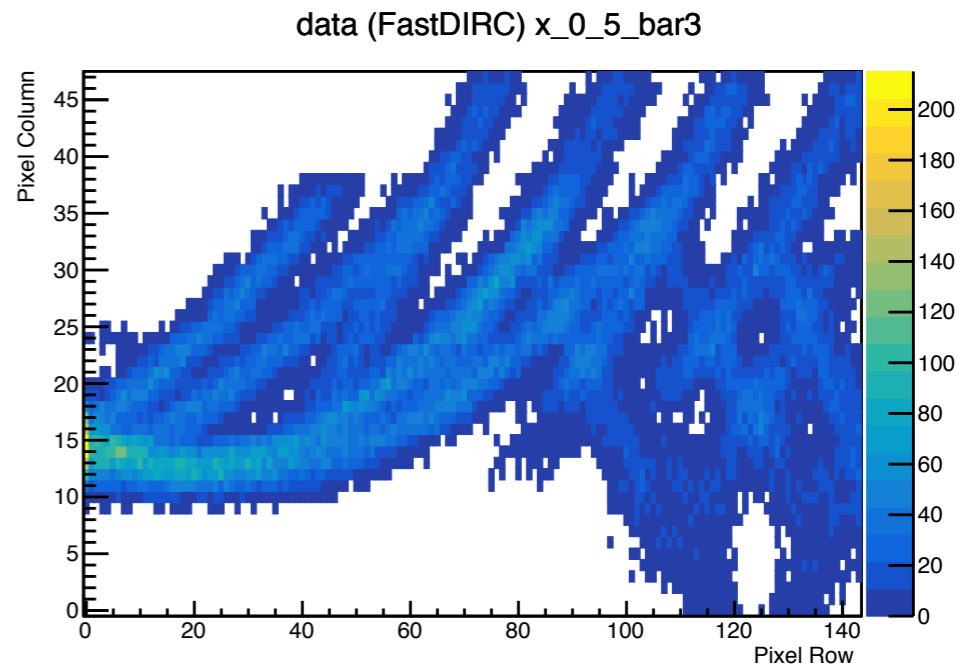
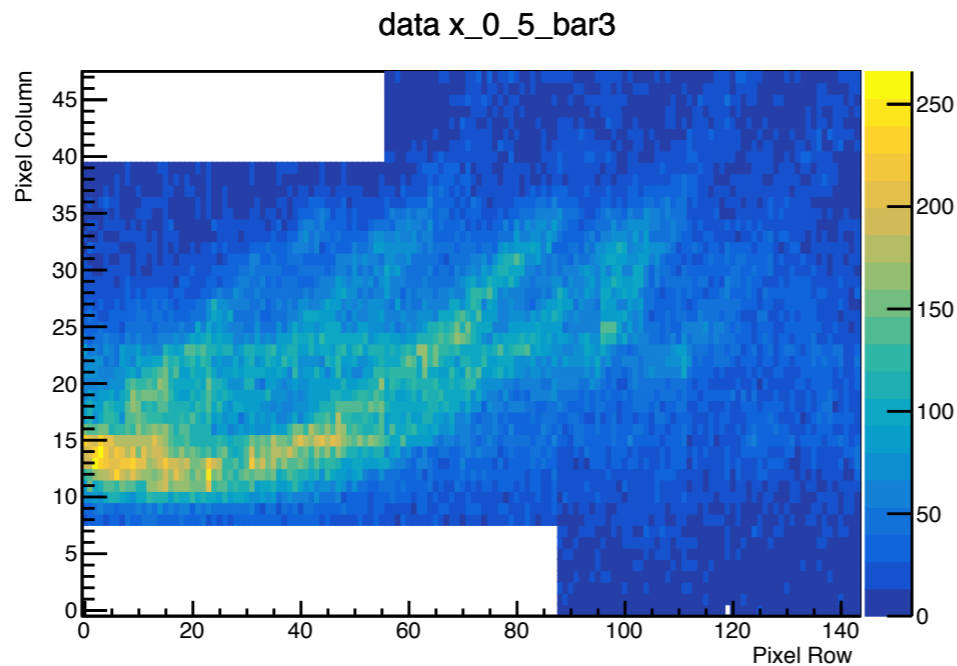
DIRC geometry in xml



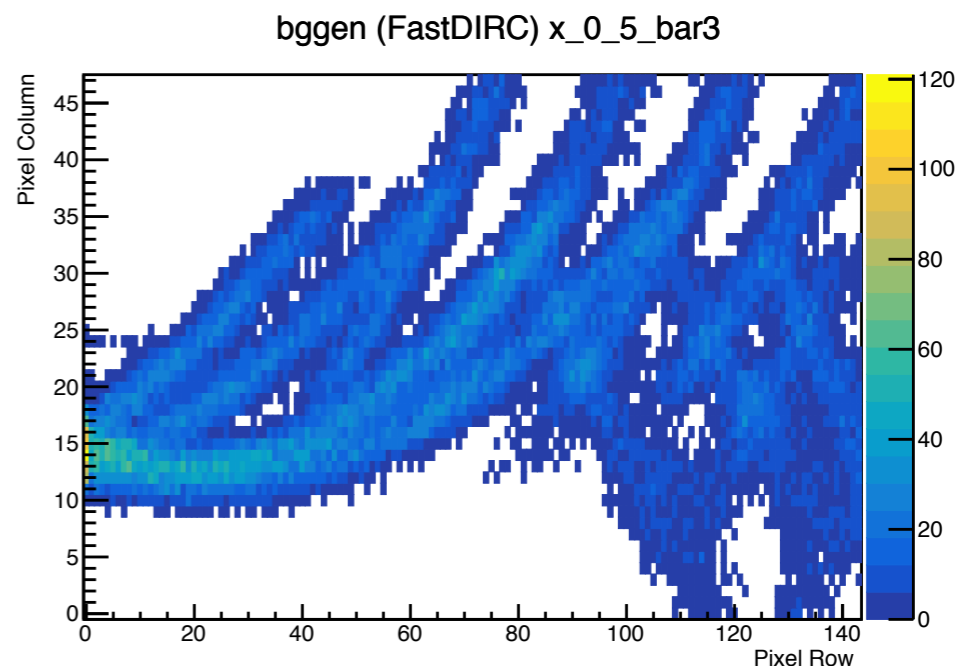
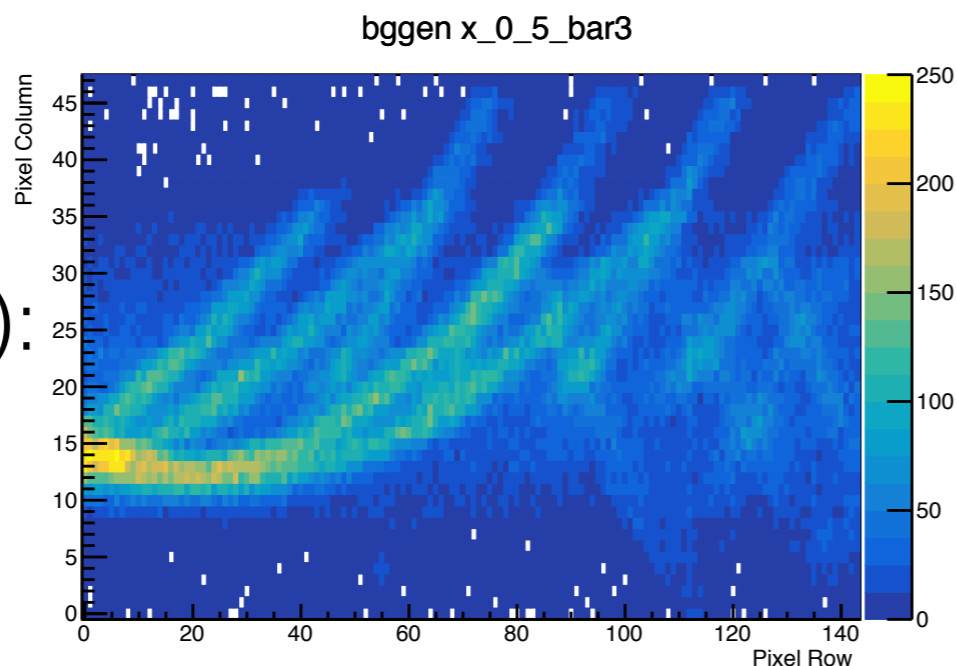
For pi/K tracks hitting bar #3 and x in [0, 5] cm:

FastDIRC prediction
given track

data:

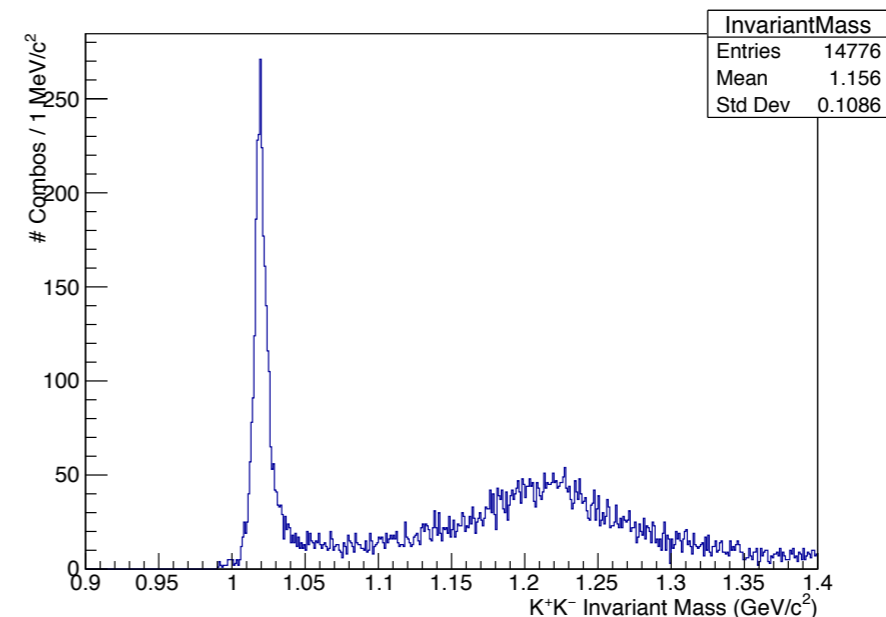
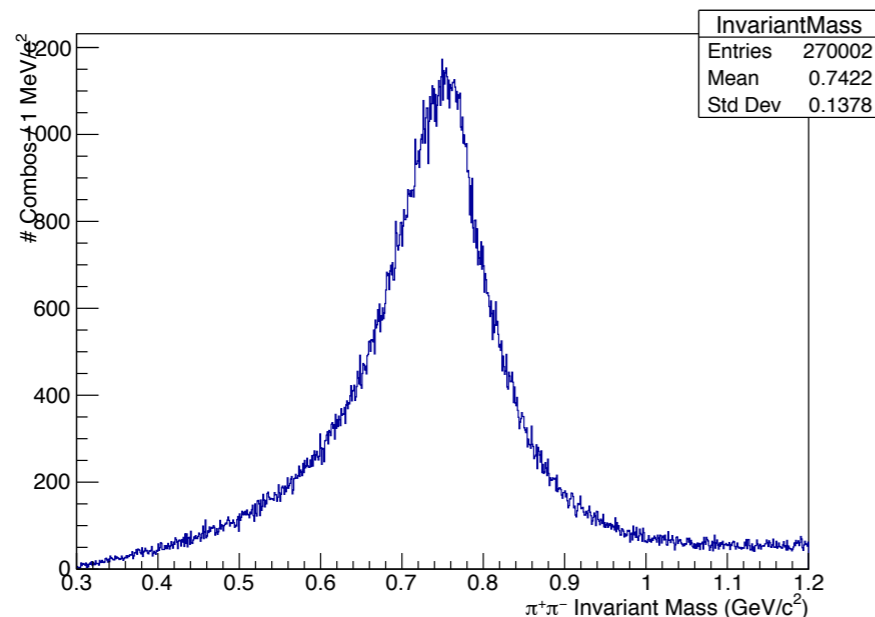


bggen (MC):

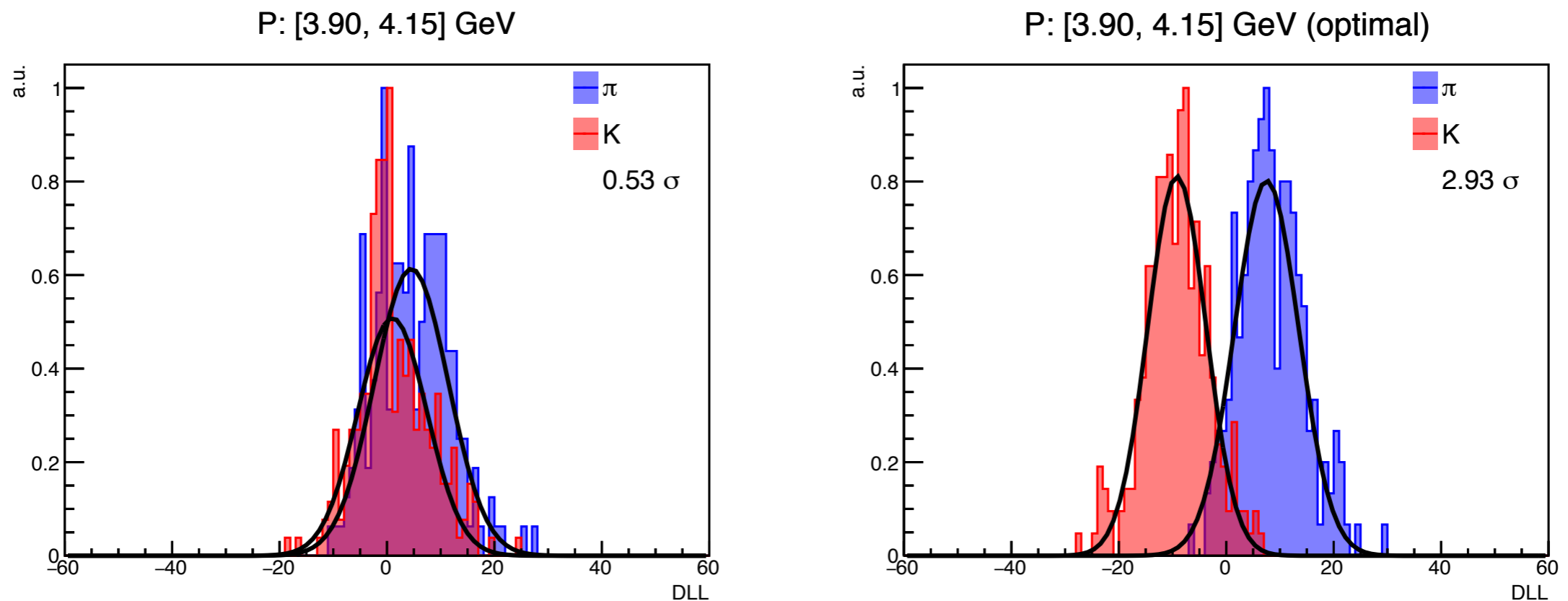


Selection (data sample prepared by Roman):

- Event: $\rho \rightarrow \pi^+ \pi^-$ and $\phi \rightarrow K^+ K^-$ reactions with a KinFit cut (plots below show the inv. mass spectra after selection)
- Track: some track quality cut (same as in dirc_reactions plugin)
- Require the project track hit positions on the DIRC wall to be on bar 4 and x in (0., 10.) cm
- Track momentum: [3.9, 4.15] GeV

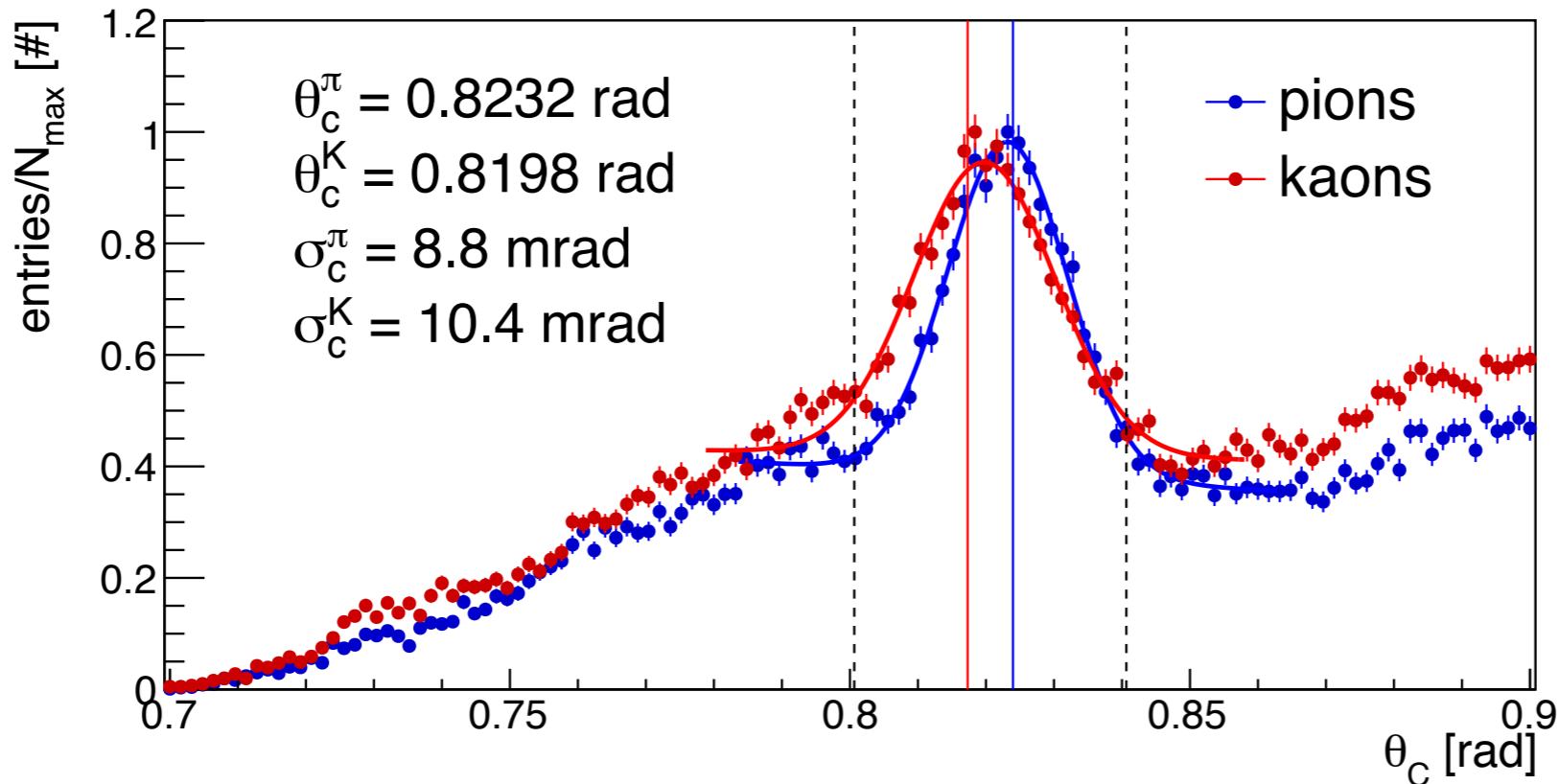
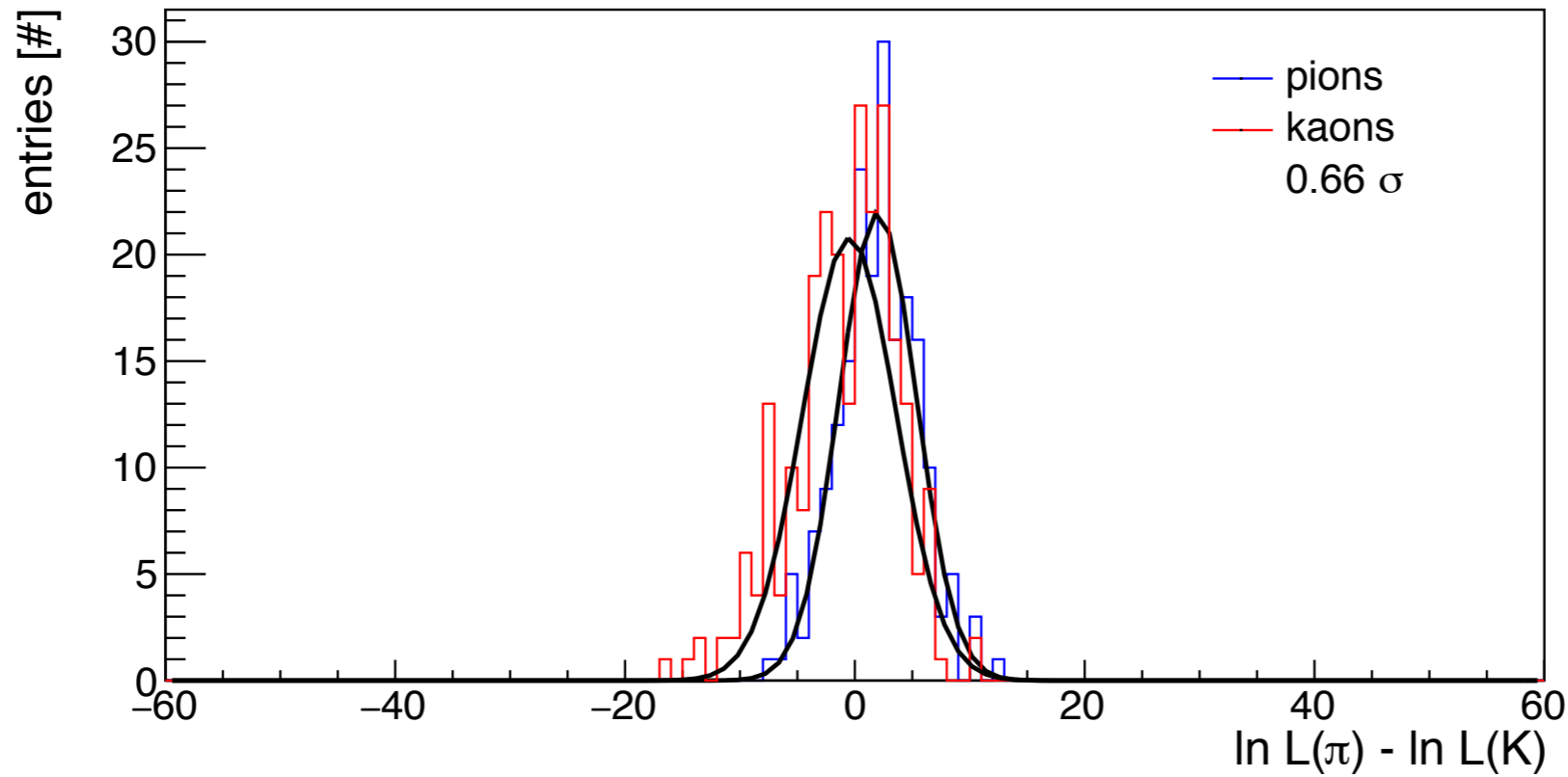


DLL from FastDIRC KDE-based reconstruction



- Nominal geometry (designed positions) is used
- No cut on PMT hits (but we know there are non-signal hits)
- Plot on the right: take the track's kinematics and use FastDIRC to generate hits (i.e. assuming FastDIRC models the geometry and hits perfectly)
- Certainly not a statement for the final performance

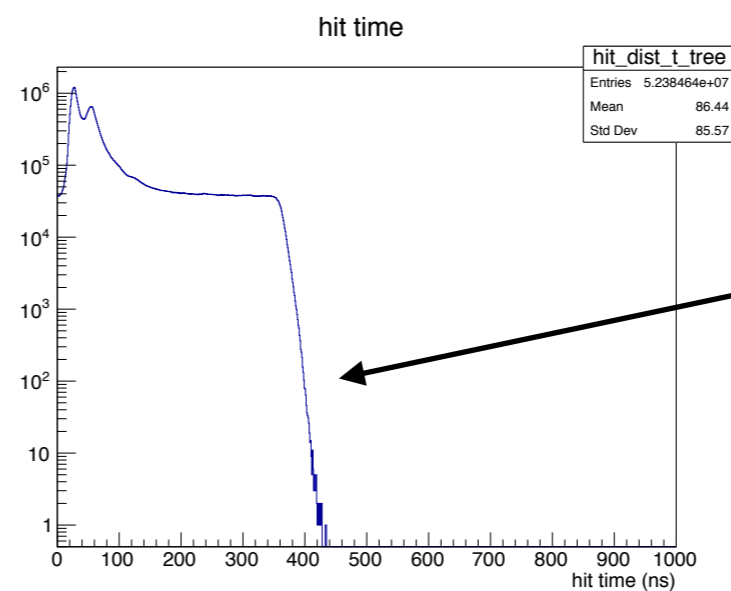
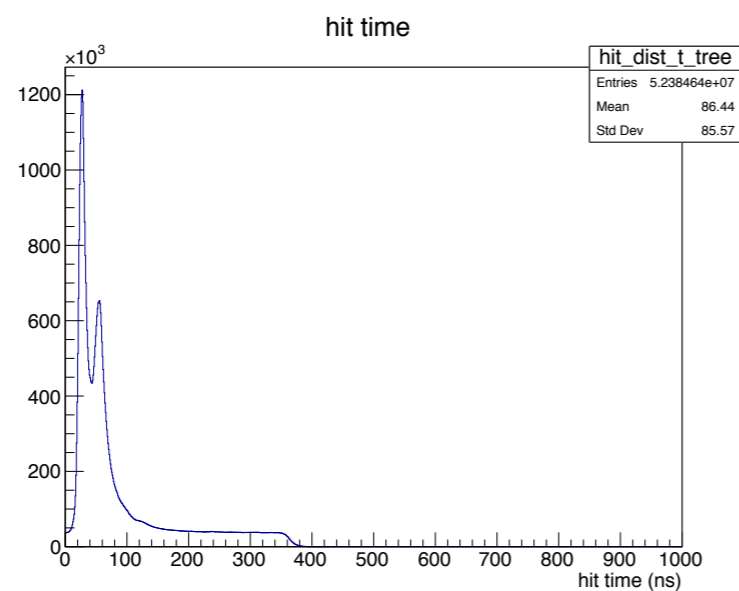
DLL from LUT reconstruction



- Exact same sample and selection as for FastDIRC
- Used a LUT corresponding to the same nominal geometry as fed to FastDIRC
- DeltaT timing cut on hits

Known unknowns:

- geometry and alignment (in active progress)
- non-signal hits: beam-induced other Cherenkov photons, electronic noise etc.



~20% of all hits

Aside: photon yield per ~4 GeV track

- Data: Nhits(raw) peak at ~40 (see Maria's studies) => ~32 photons
- FastDIRC: predicted ~28 (by scaling SuperB prototype) + ~10-15% gain from cookies => ~31 photons

Unknown unknowns:

- ideas/suggestions welcome!