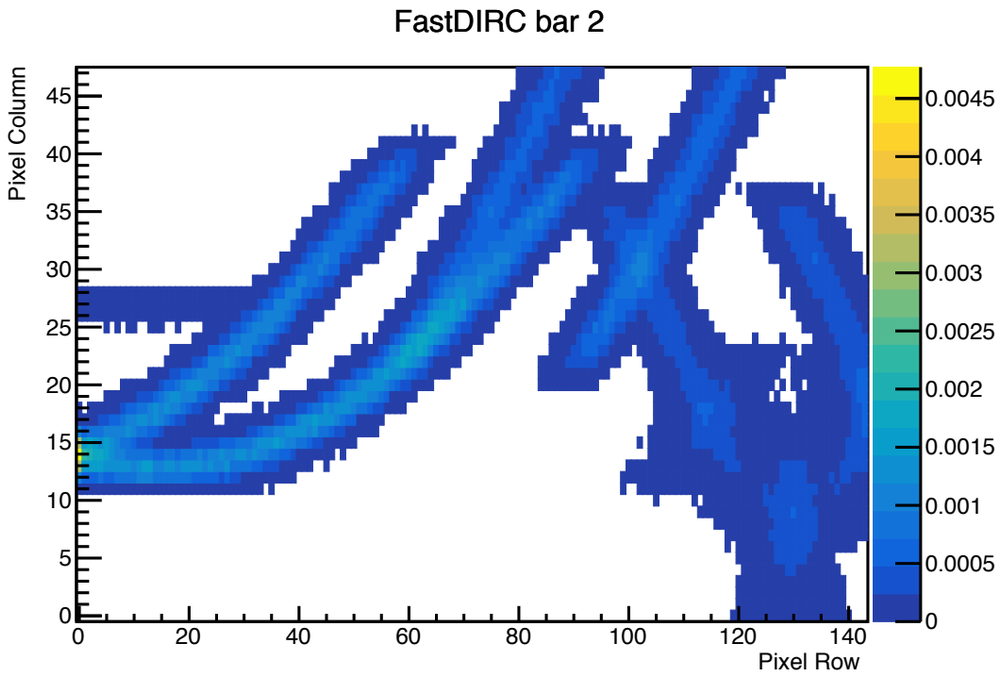
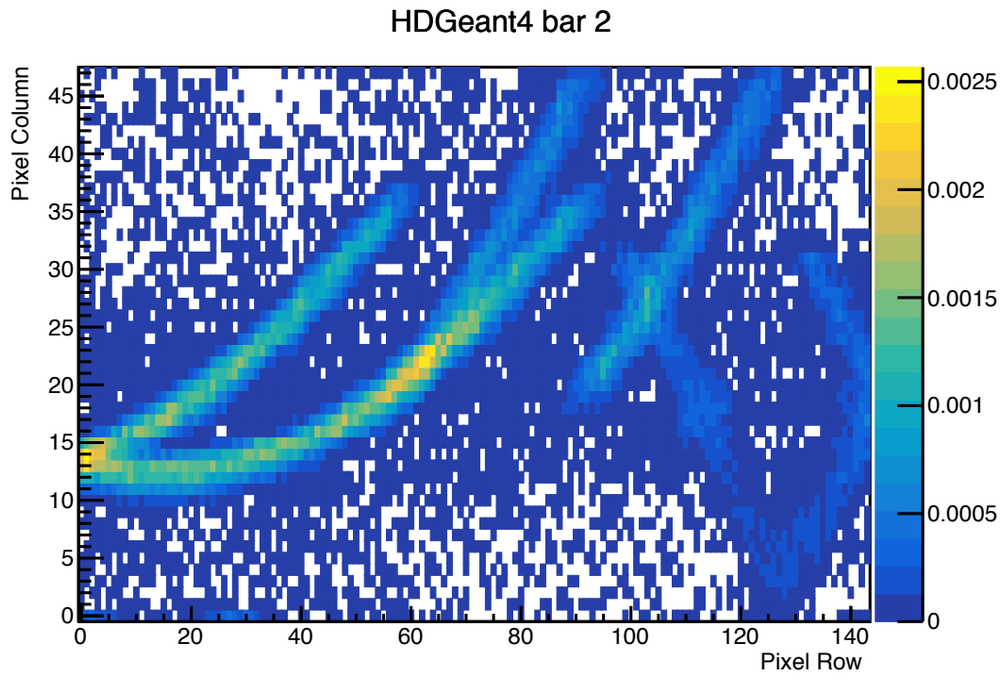
Integrating FastDIRC into GlueX framework

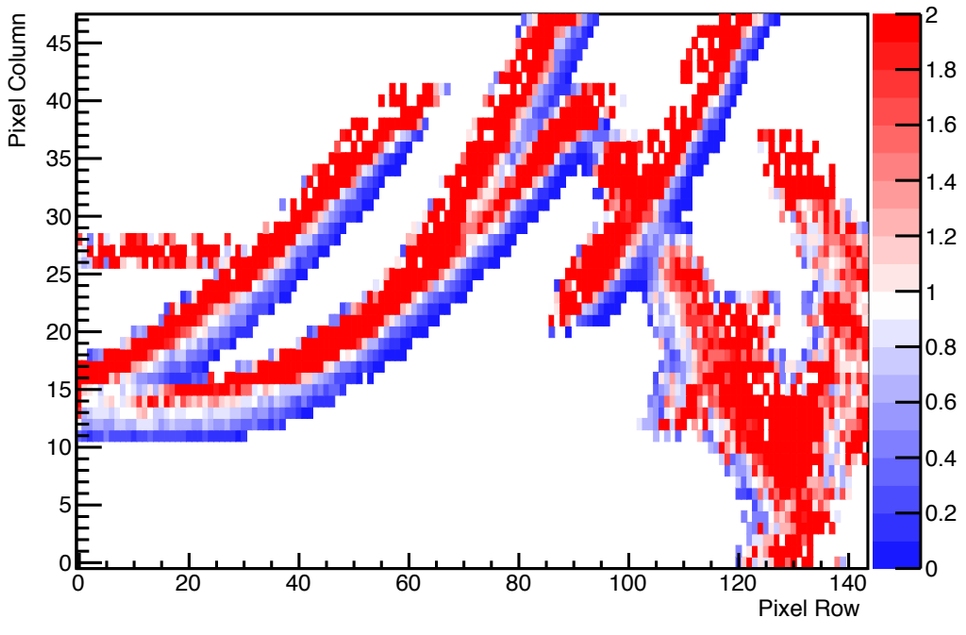
- Last time:
  - Hit pattern comparison between out-of-the-box FastDIRC (hard-coded geometry) with HDGeant4 (nominal xml geometry)
  - First-look seems good, but discrepancies are present
- Update:
  - FastDIRC's internal geometry is now defined by xml file (nominal).
  - Conversion of incident charged particle kinematics from hall coordinates to FastDIRC coordinates is taken care of.
  - Timing now included in comparisons.

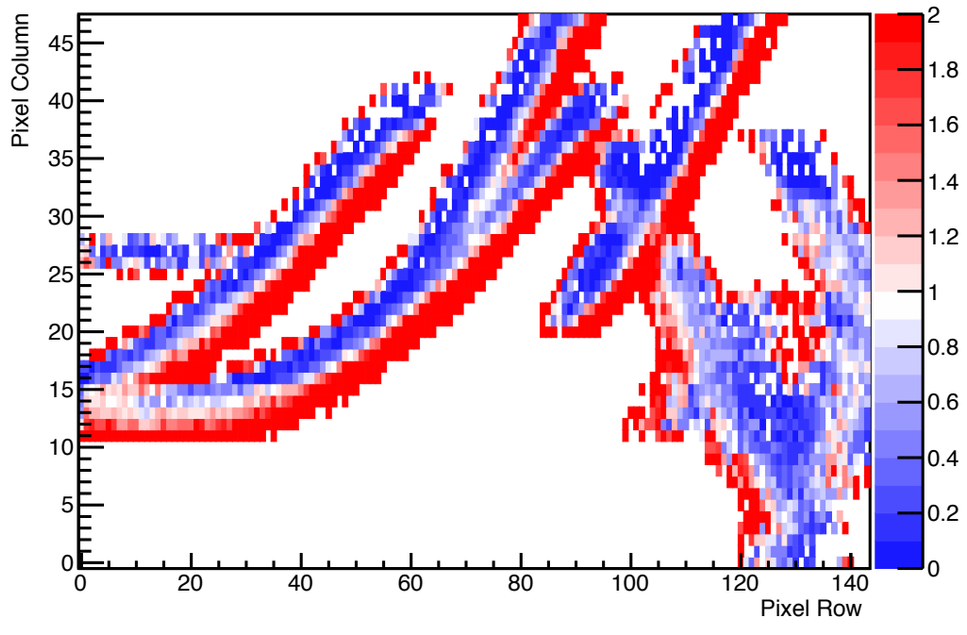
Last time:
FastDIRC (out-of-the-box) vs. HDGeant4 (nominal xml)





Ratios:

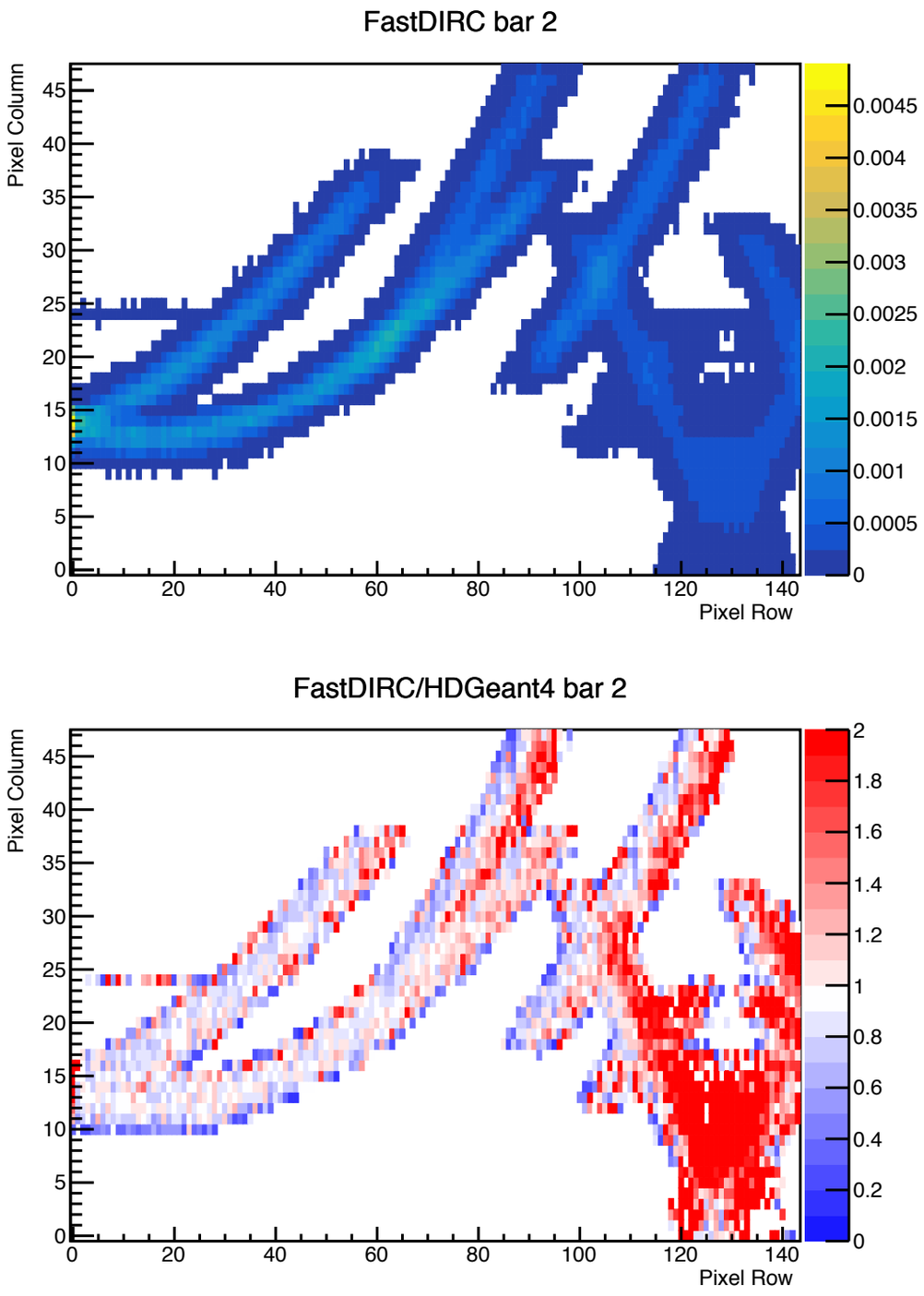


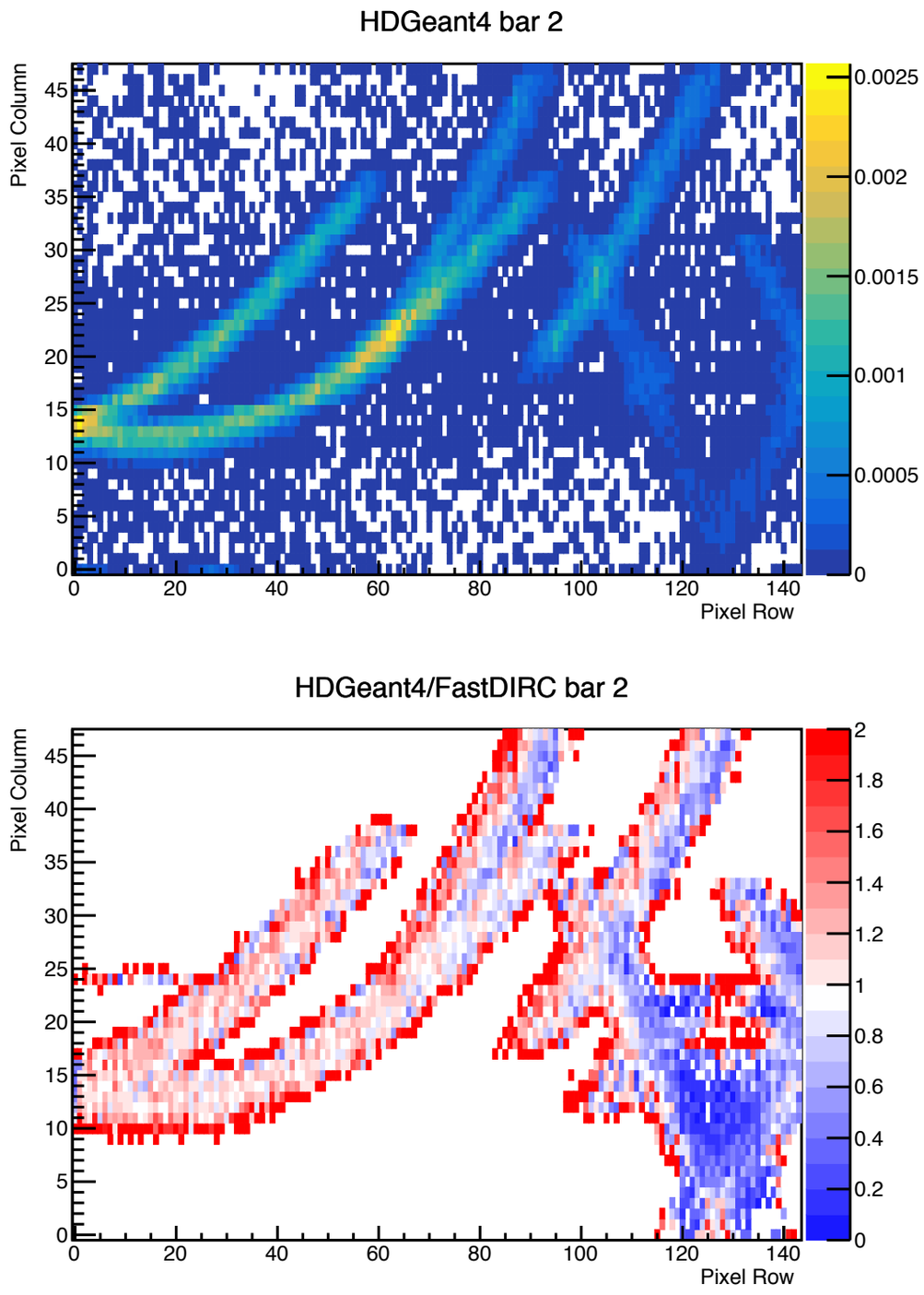


5 GeV pions impinging perpendicularly into bar 2

Same xml file as input: FastDIRC vs. HDGeant4

Ratios:



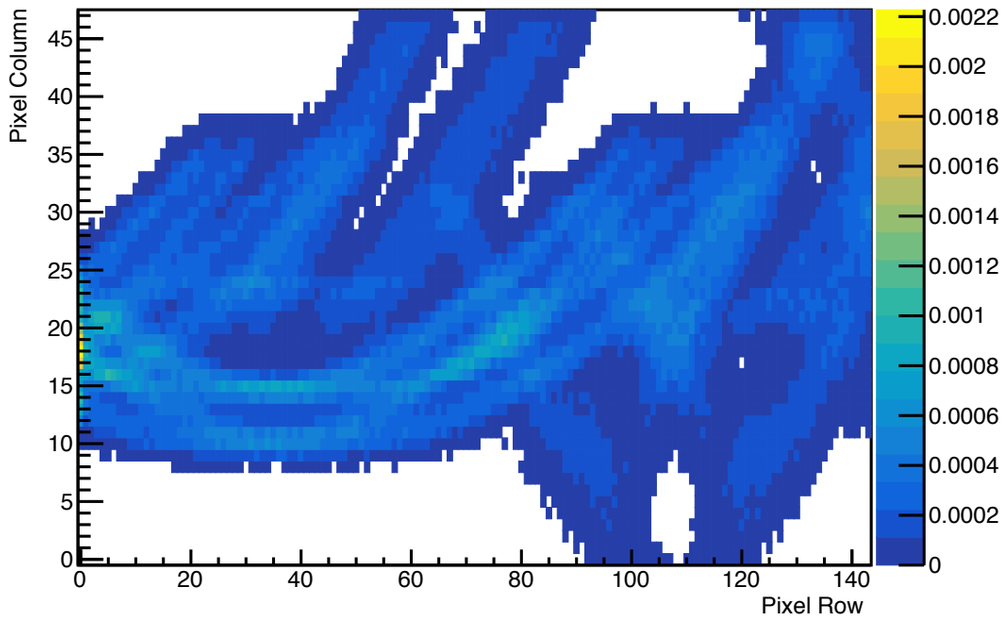


5 GeV pions impinging perpendicularly into bar 2

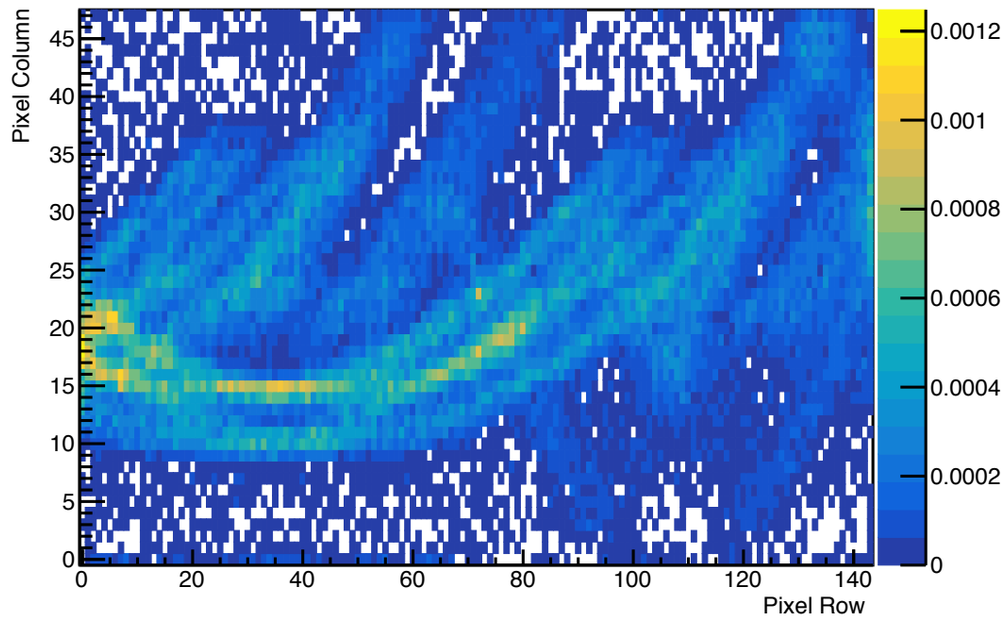
Hit pattern comparison for:

pion kinematics: E = 5 GeV, theta = 2.5 degree, phi = 68.4
hit position on DIRC wall: x = 120.8 cm, y = -32.9 cm

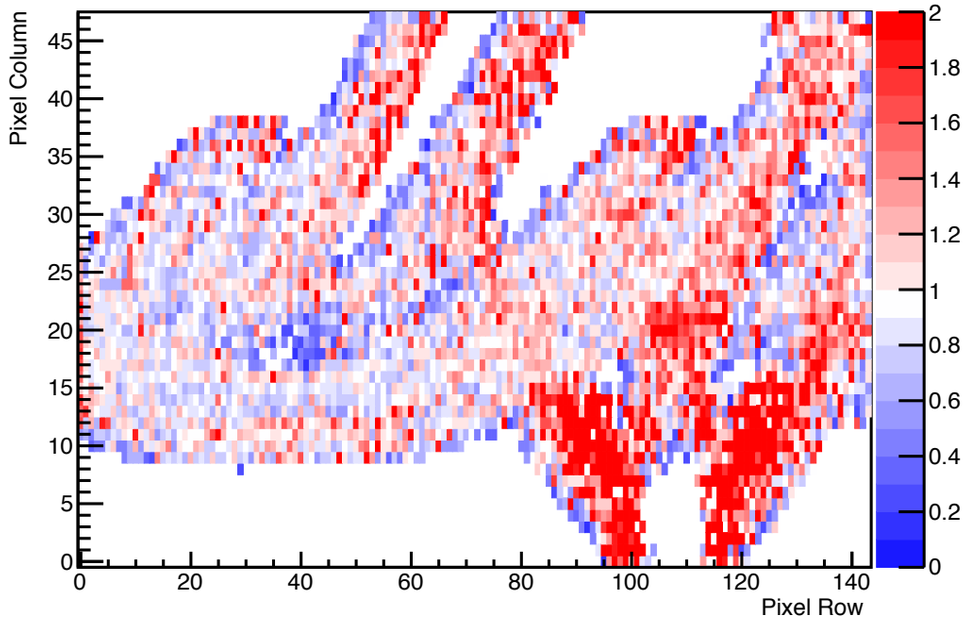
FastDIRC bar_2_3_68_121_-33



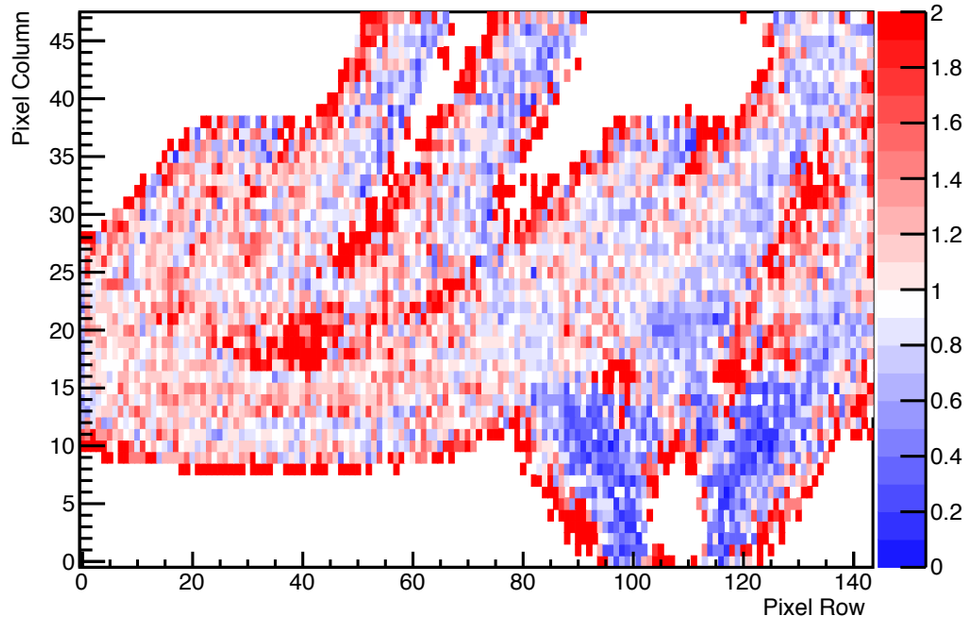
HDGeant4 bar_2_3_68_121_-33



FastDIRC/HDGeant4 bar_2_3_68_121_-33

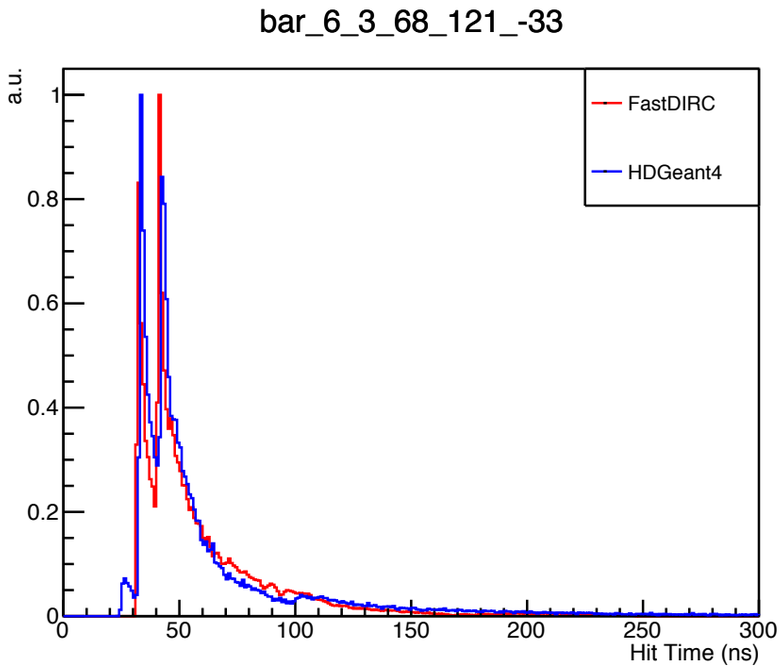


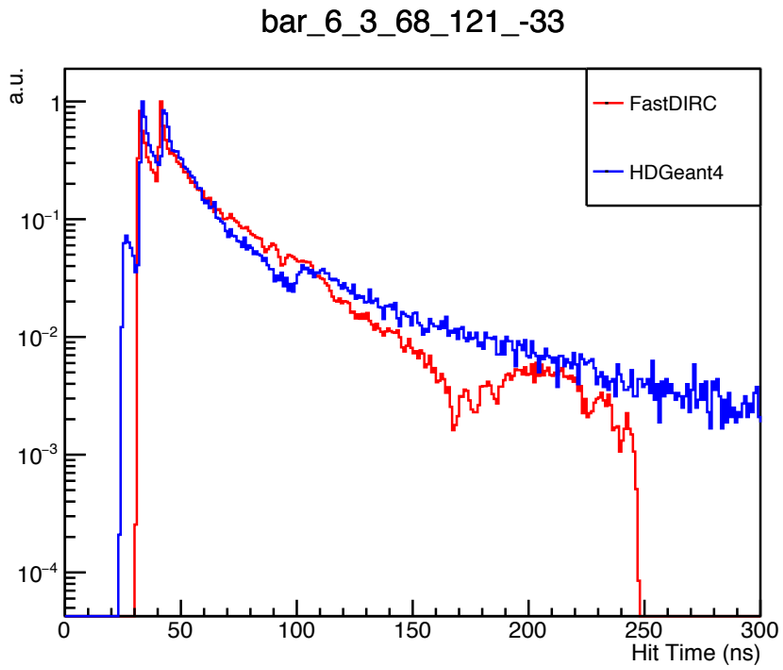
HDGeant4/FastDIRC bar_2_3_68_121_-33



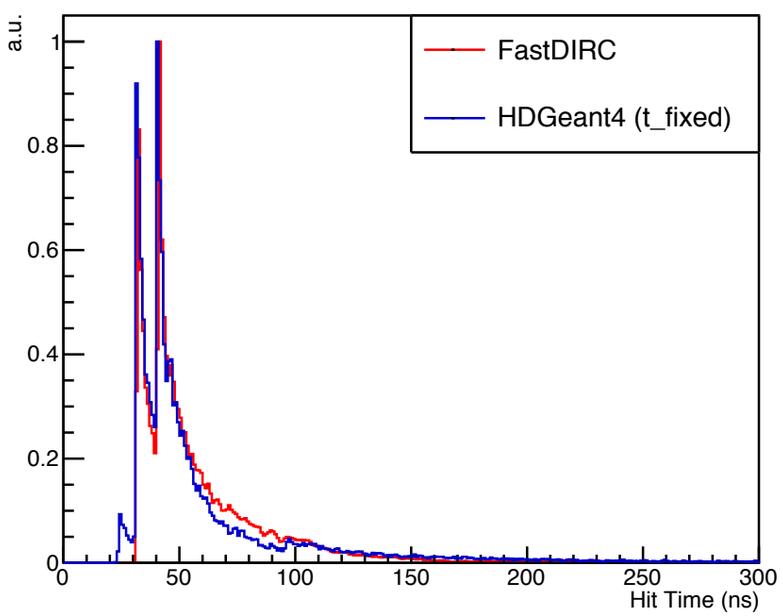
Hit timing comparison for:

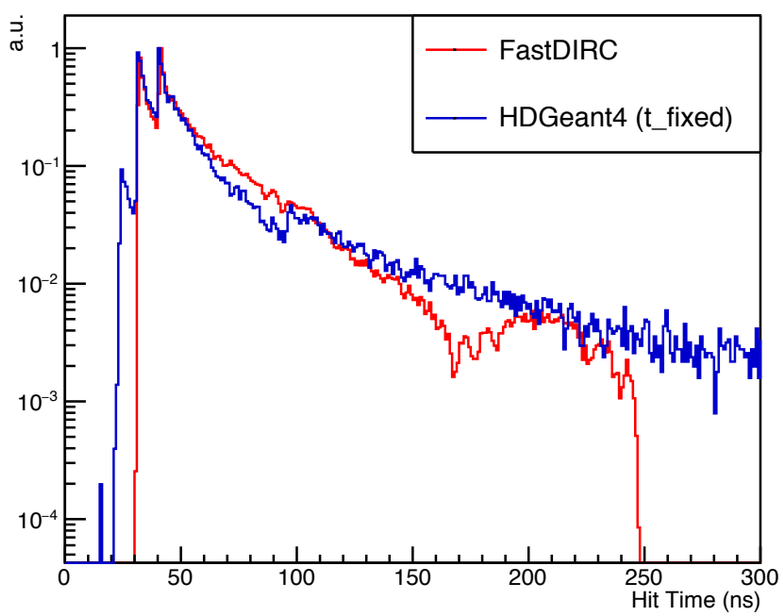
pion kinematics: E = 5 GeV, theta = 2.5 degree, phi = 68.4
hit position on DIRC wall: x = 120.8 cm, y = -32.9 cm





DDIRCTruthPmtHit.t





DDIRCTruthPmtHit.t_fixed

Summary:

- FastDIRC vs. HDGeant4 comparison:
  - Agreement in geometry seems good.
  - Other features (timing, “additional/missing” hits etc.) are to be understood.
- Studies are done in standalone “HDFastDIRC”:
  - input: xml + particle kinematics
  - output: hit channel number + time
  - easy interface to Cris’s alignment framework

Next:

- Read trees produced by Roman's dirc_tree plugin as inputs to FastDIRC (both data and Geant), then make comparisons of data vs. FastDIRC vs. HDGeant4
- Adapt the reconstruction part of FastDIRC for data (setting up the stage for alignment)
- Understand differences between FastDIRC outputs and Geant outputs

FYI: GAN for DIRC [1903.11788]

- Fast simulation of DIRC response using a Generative Adversarial Network (GAN): from incident particle kinematics to DLL directly