B field impact on forward RICH performance

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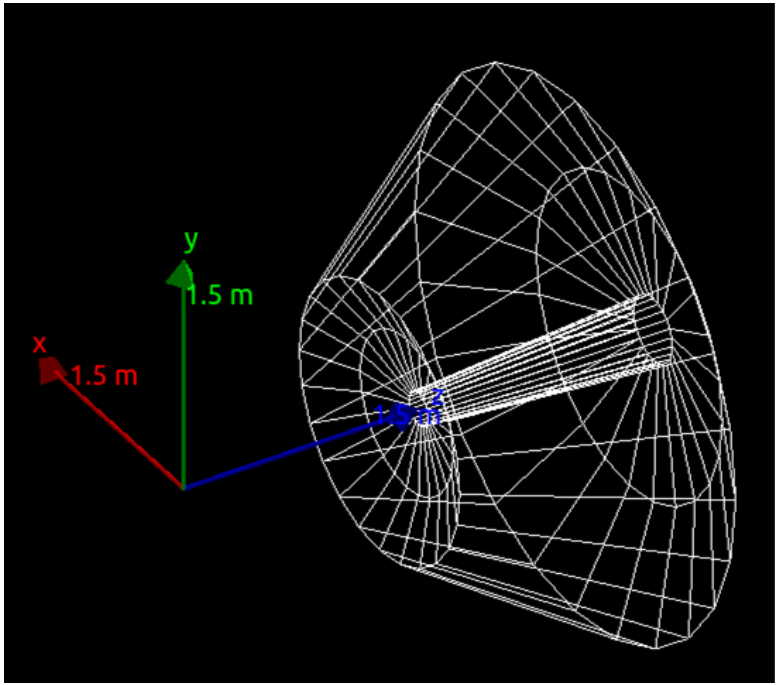
24 May 2021

Previous presentations

- First look at IP6 field maps with a simple Geant4 model (17 May 2021)
  - https://indico.bnl.gov/event/11795/contributions/49746/attachments/34575/56085/chchatte_IP6_17052021.pdf

Updates to the model

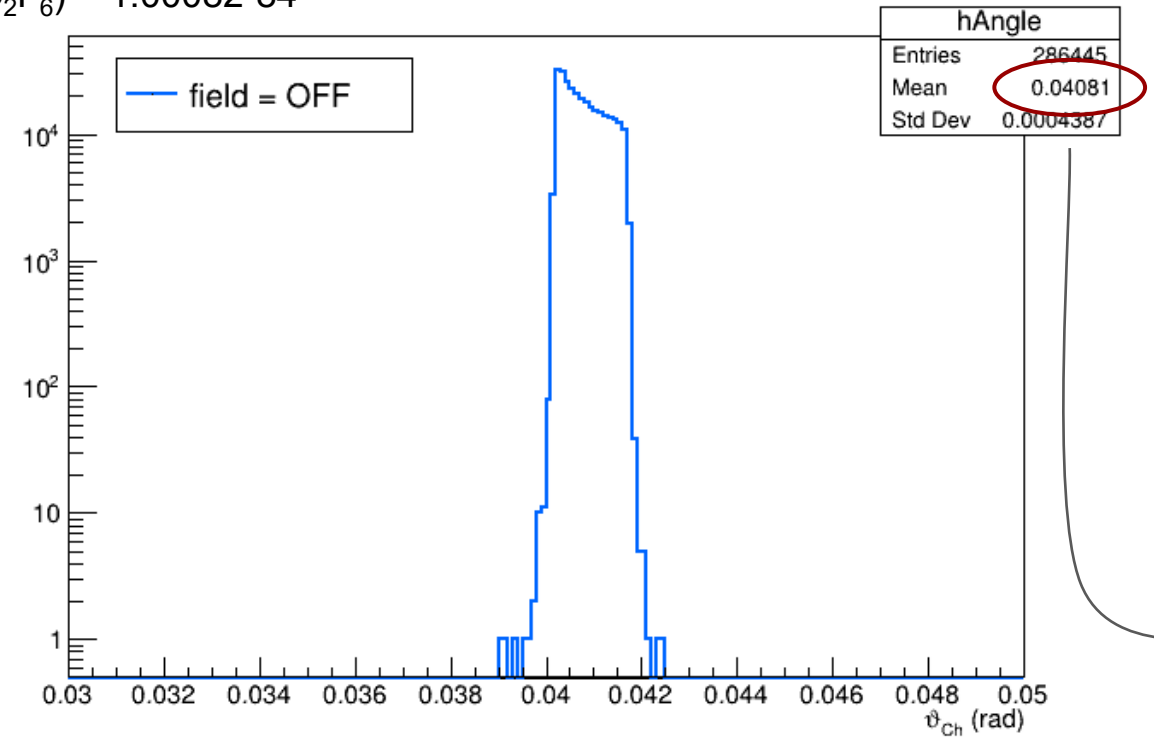


- **C2F6 refractive index for the radiator**
  - with chromatic dispersion
  - realistic C_2F_6 material
- **spherical mirror with perfect reflection**
  - R = 300 cm
- **spherical sensor surface**
  - R = 150 cm
- **basically an ideal RICH detector**
- **inverse ray-tracing reconstruction**
  - from HERMES papers
  - fix emission at mid-point of the radiator
  - assumes perfect tracking information
    - namely the actual track position / direction at the emission point

Preliminary results

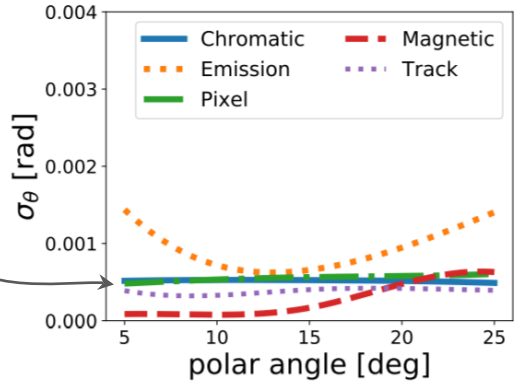
fixed particle direction / energy
η = 1.5 (ϑ = 25 deg)
E = 30 GeV
muons

reconstructed Cherenkov angle looks correct
n(C_2F_6) ~ 1.00082-84



single-photon Cherenkov angle distribution measured via inverse ray-tracing algorithm

spread is due to chromaticity in line with dRICH simulations ~ 0.5 mrad



Preliminary results

fixed particle direction / energy
η = 1.5 (ϑ = 25 deg)
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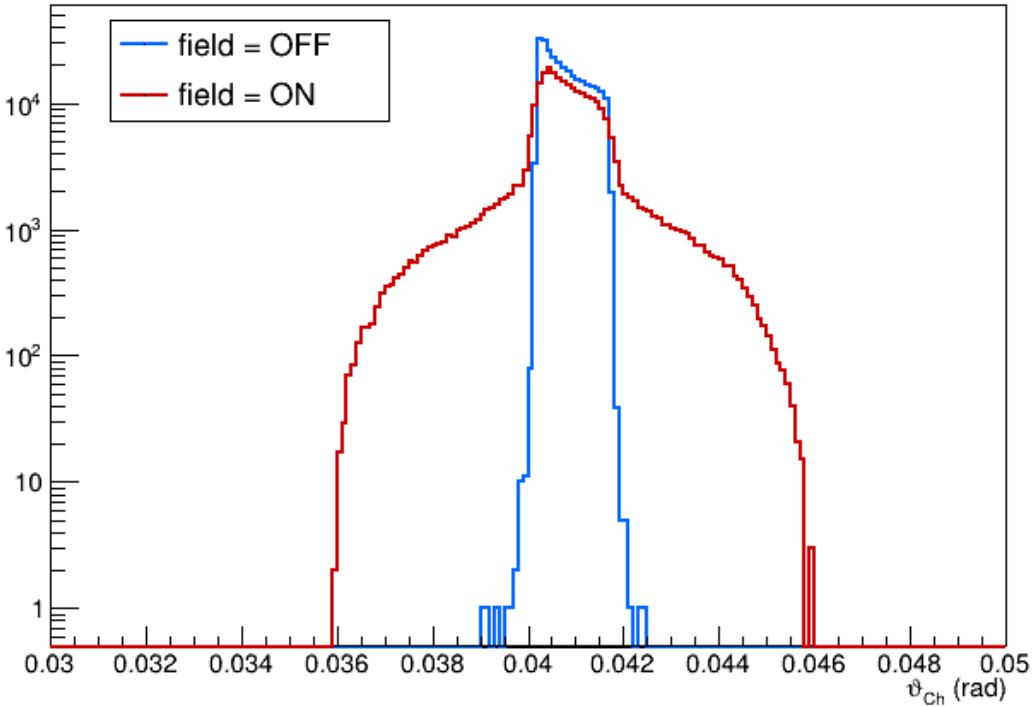
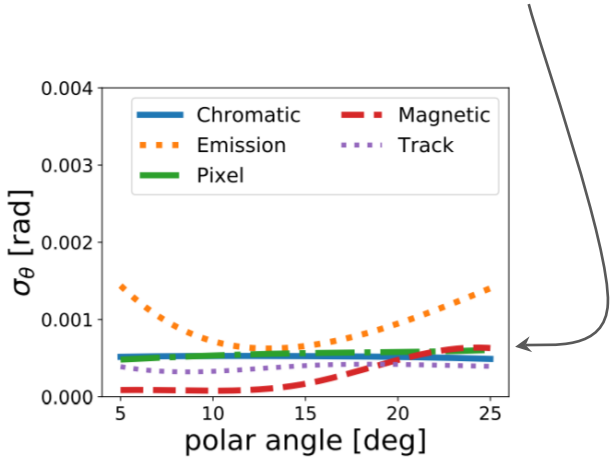
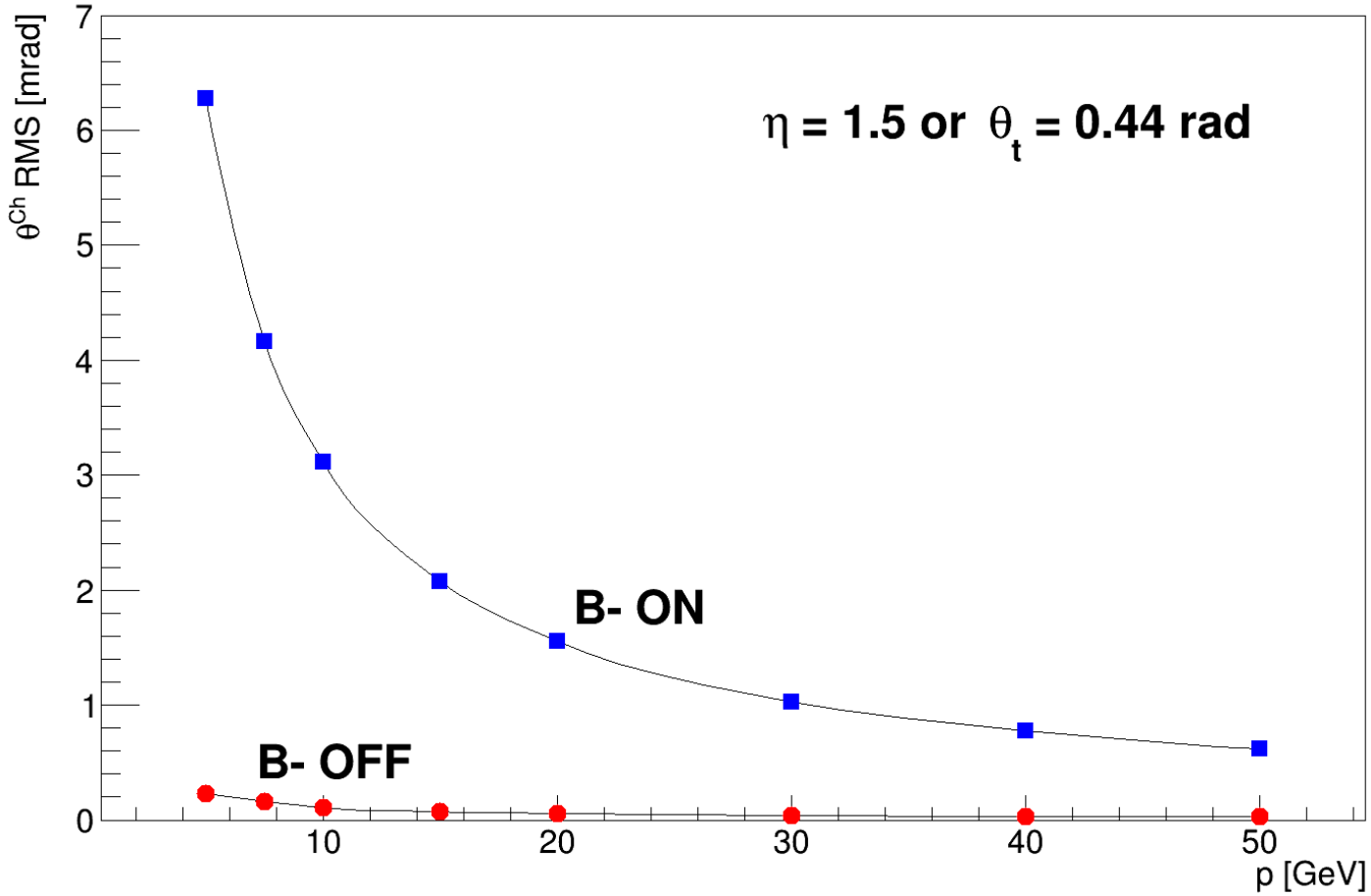
muons

single-photon Cherenkov angle distribution measured via inverse ray-tracing algorithm

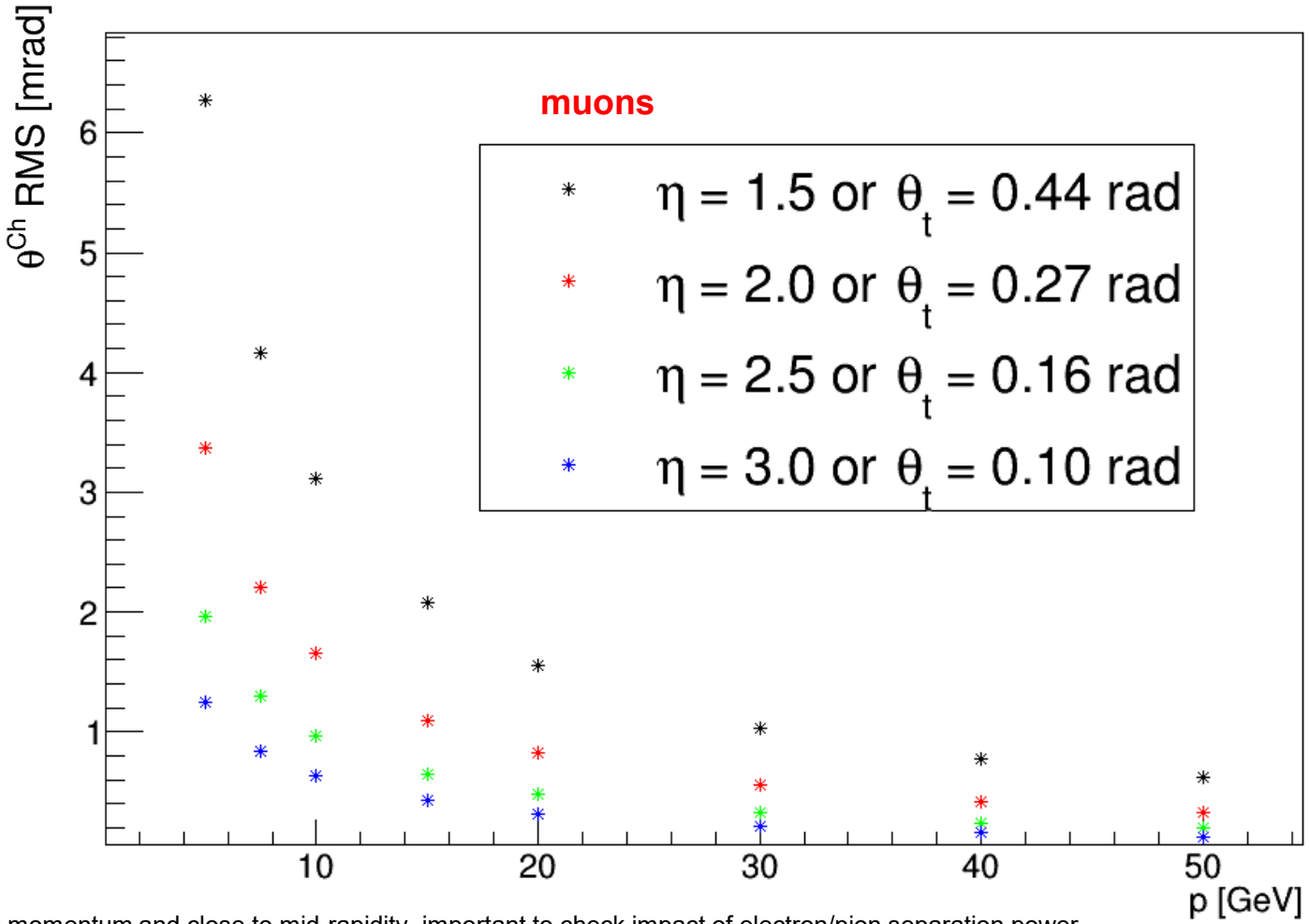
B field increases StdDev
to 1.1 mrad
~ 1 mrad contribution



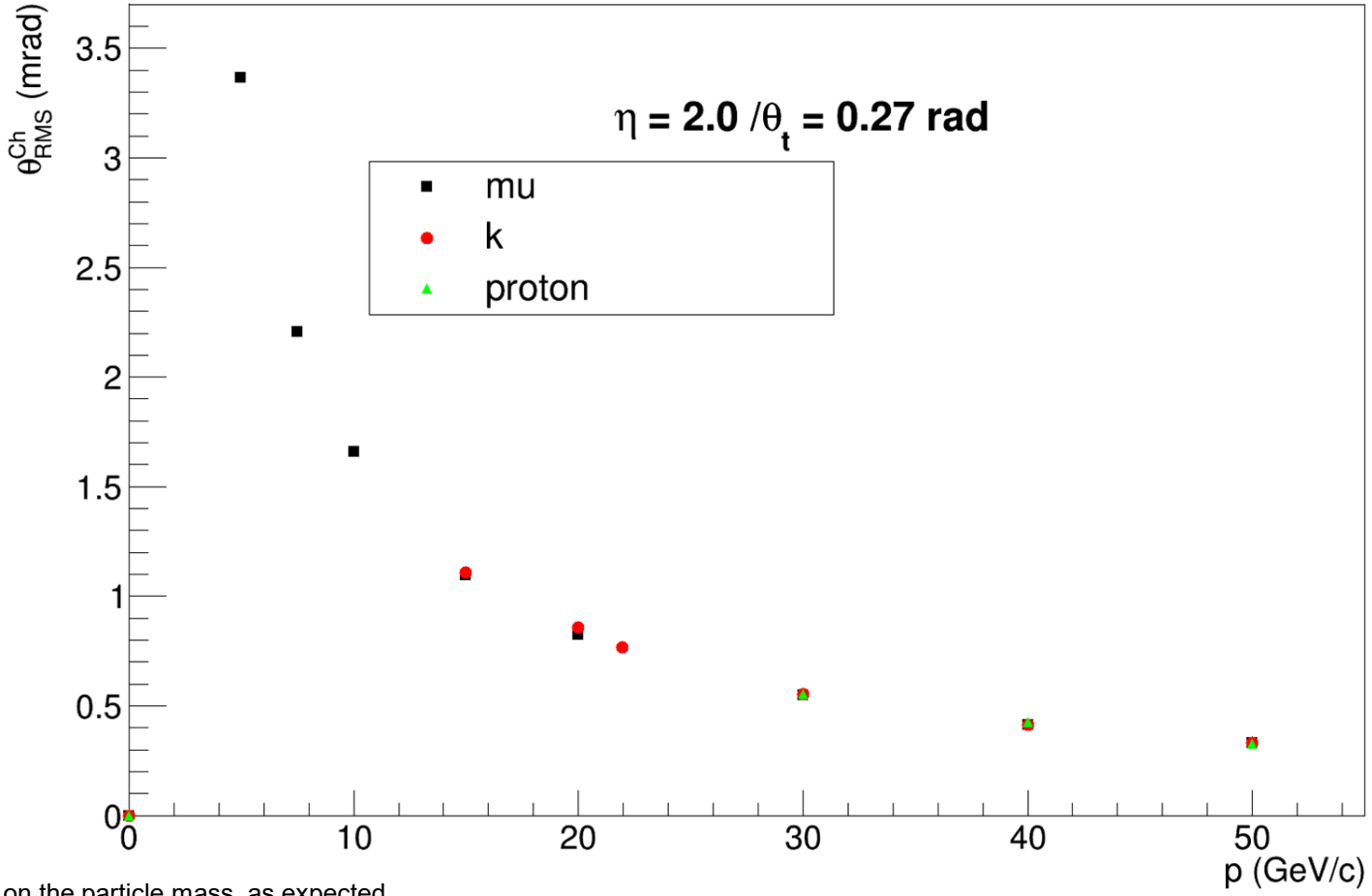




B-field broadens the rms of the reconstructed single photon Cherenkov theta.



large effect at low momentum and close to mid-rapidity, important to check impact of electron/pion separation power



No dependence on the particle mass, as expected.

Separation between different particles as a function of momentum will be studied.

Started playing with the actual dRICH geometry