

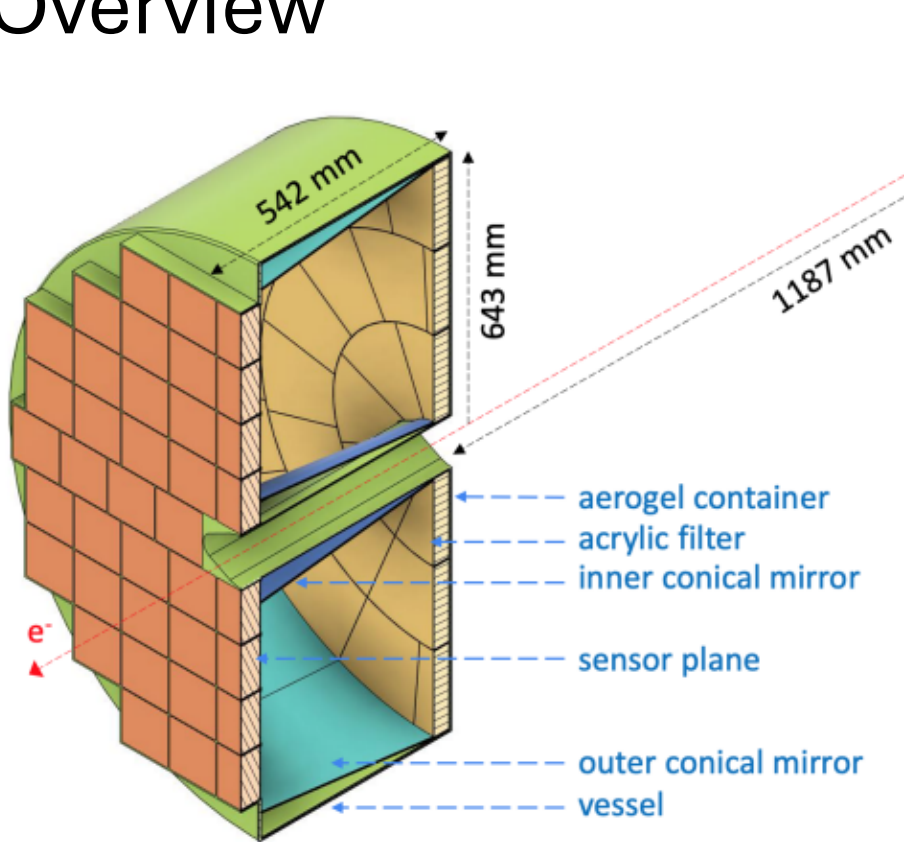
pfRICH LUT spot checks with new magnetic field map

ePIC physics and detector simulation meeting

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6/18/24

Overview



pfRICH (proximity-focusing Ring Imaging Cherenkov)

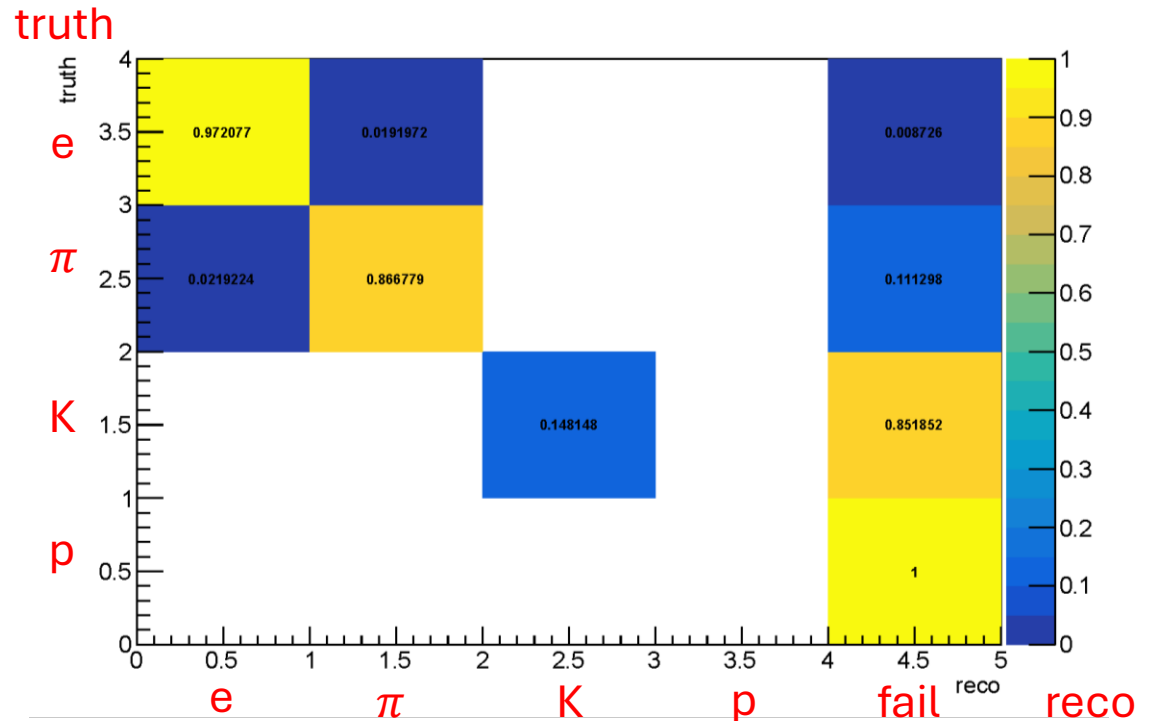
- Crucial for PID in the e-going direction in $-3.5 < \eta < -1.5$
- Expected momentum reach:

competing particle species	separation range (GeV/c)
e vs $\pi/K/p$	$\sim 0.2 \div \sim 2.5$
K vs π/p	$\sim 2.0 \div \sim 9.0$

- **New set of LUTs** uploaded to epic-data repository (<https://github.com/eic/epic-data>) on May 6, for May simulation campaign
 - Simulations run with standalone software (<https://github.com/eic/pfRICH>)
 - Updated vertex smearing, geometry changes...
 - Higher statistics and finer binnings: 100M events in total per species; $37 \times 20 \times 120$ bins in $p \times \theta \times \phi$
- **New magnetic field map**
 - MARCO_v.6.4.1.1.3_1.7T \rightarrow MARCO_v.7.6.2.2.11_1.7T
 - Did spot checks to see if performance is impacted

Setup

- May campaign: 400M particles thrown (100M e, π , K, p each), flat in:
 - $p \in (0.1, 15)$ GeV, $\theta \in (2.65, 3.1)$, $\phi \in (-\pi, \pi)$
- Spot check: half statistics so far
- Kinematics selection 1:
 - $p \in (1.6, 2.0)$ GeV \rightarrow focus on a low momentum bin, where any change in B field would impact performance more. **Expect good e/hadron separation** in this range.
 - $\theta \in (2.875, 2.8975) \rightarrow \eta \in (-2.10, -2.01)$
 - $\phi \in (0, 3)$ degree
- Note: 5th column (fail) is for number of reconstructed photons < 3

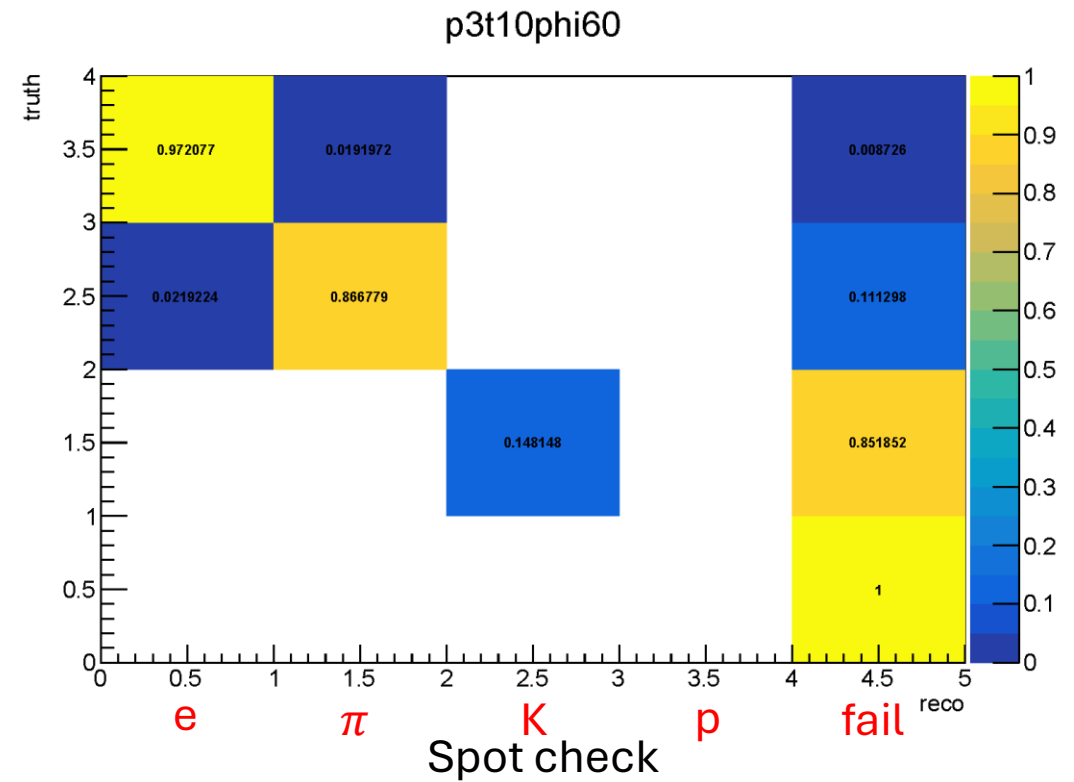
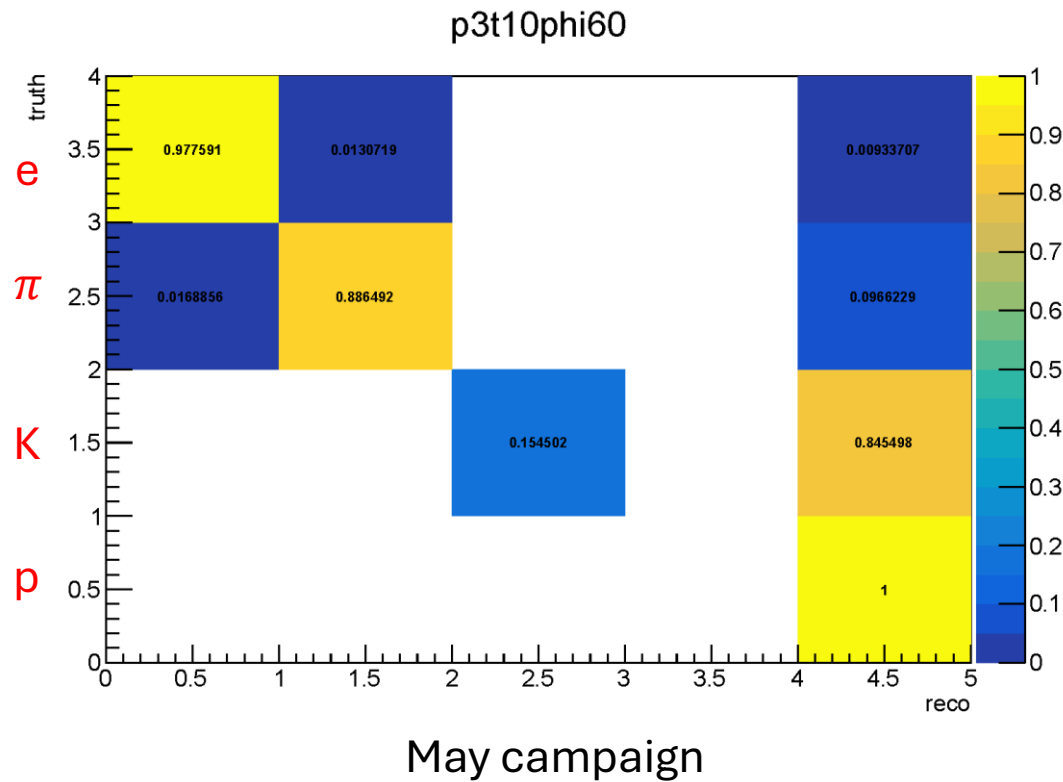


Selection 1

- Kinematics selection 1:

- $p \in (1.6, 2.0)$ GeV
- $\theta \in (2.875, 2.8975) \rightarrow \eta \in (-2.10, -2.01)$
- $\phi \in (0, 3)$ degree

- Spot check result consistent with May campaign

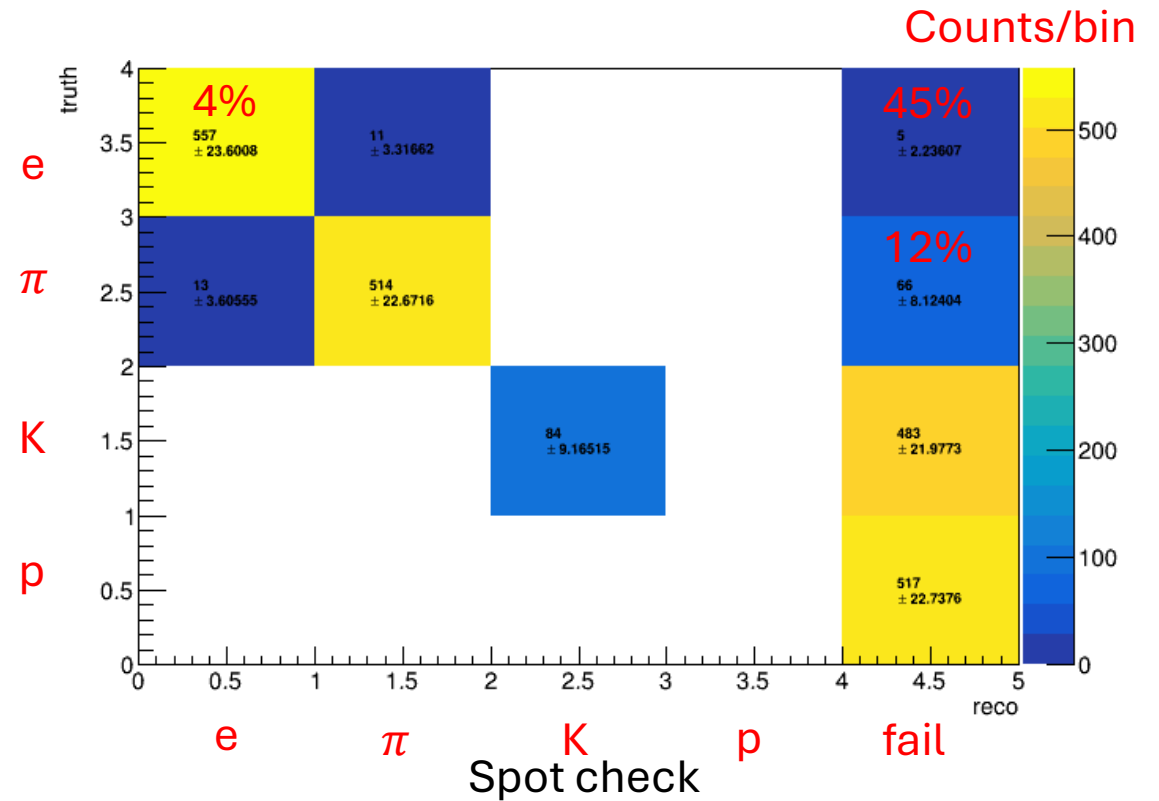


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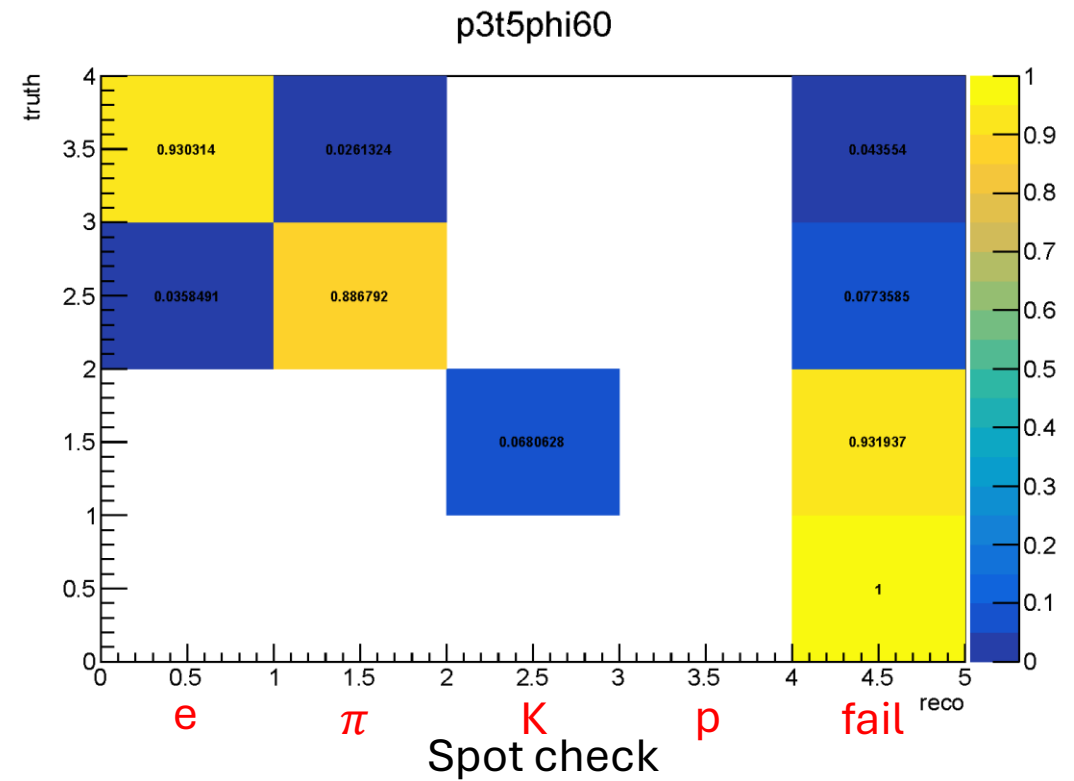
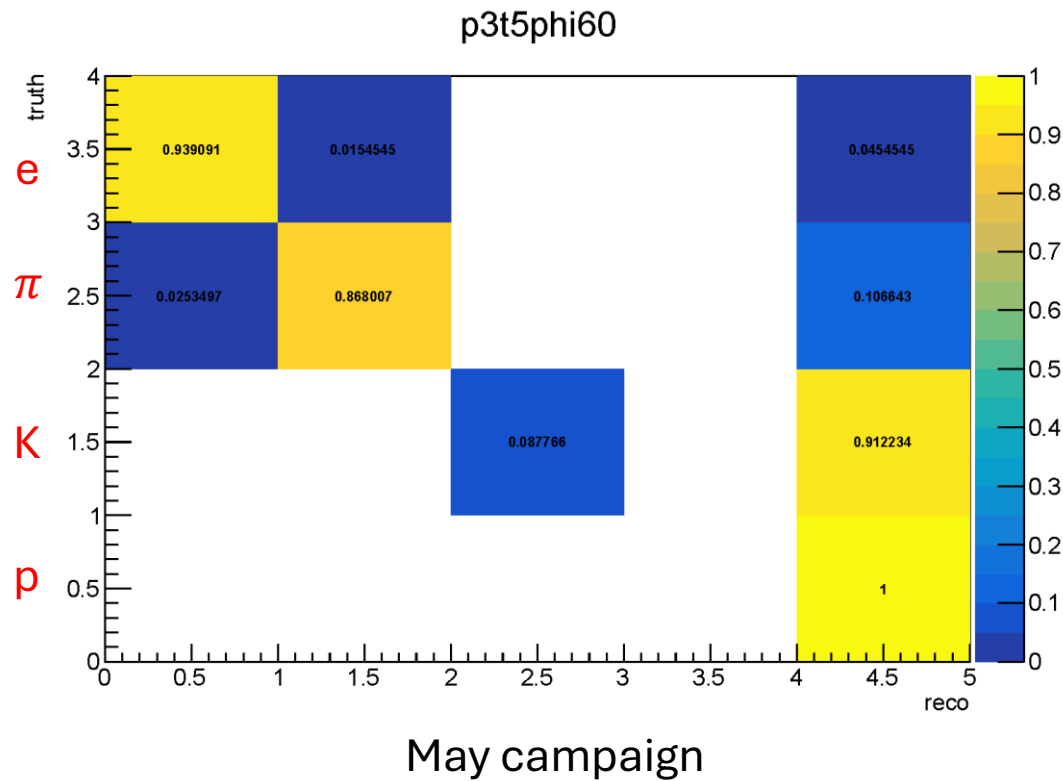
- Estimate roughly relative uncertainty using Poisson statistics

- Spot check result consistent with May campaign



Selection 2

- Kinematics selection 2:
 - $p \in (1.6, 2.0)$ GeV
 - $\theta \in (2.7625, 2.785) \rightarrow \eta \in (-1.71, -1.65)$: Expecting higher fraction of “fail” in this η range (see backup)
 - $\phi \in (0, 3)$ degree



Selection 2

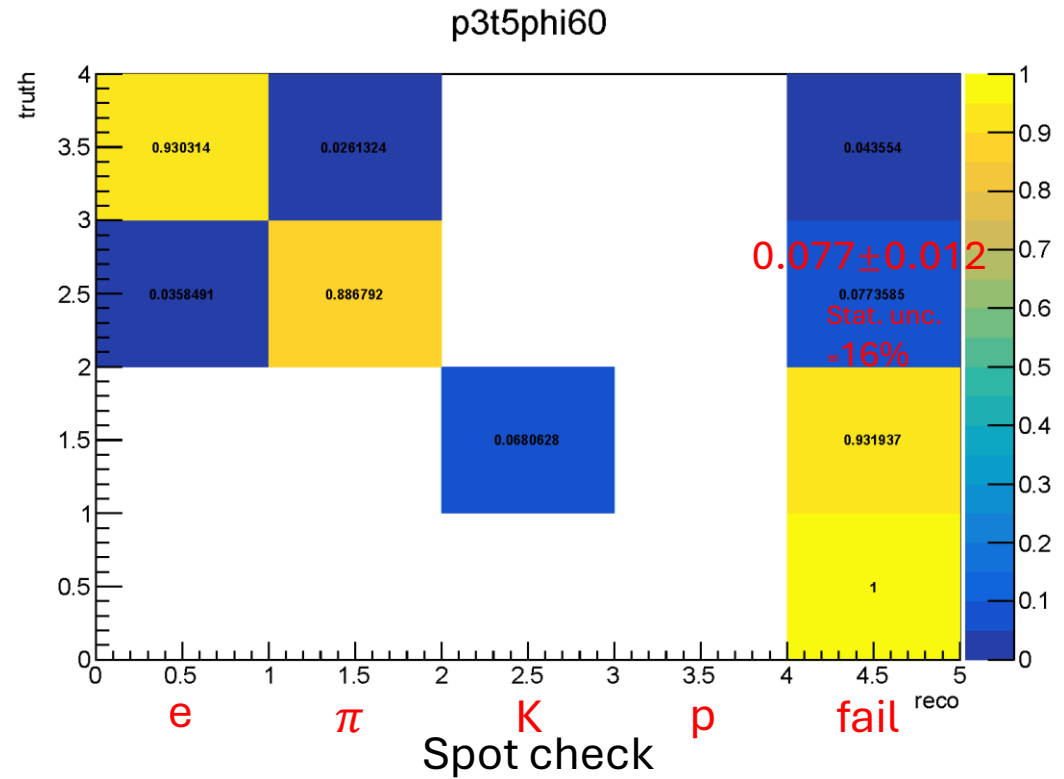
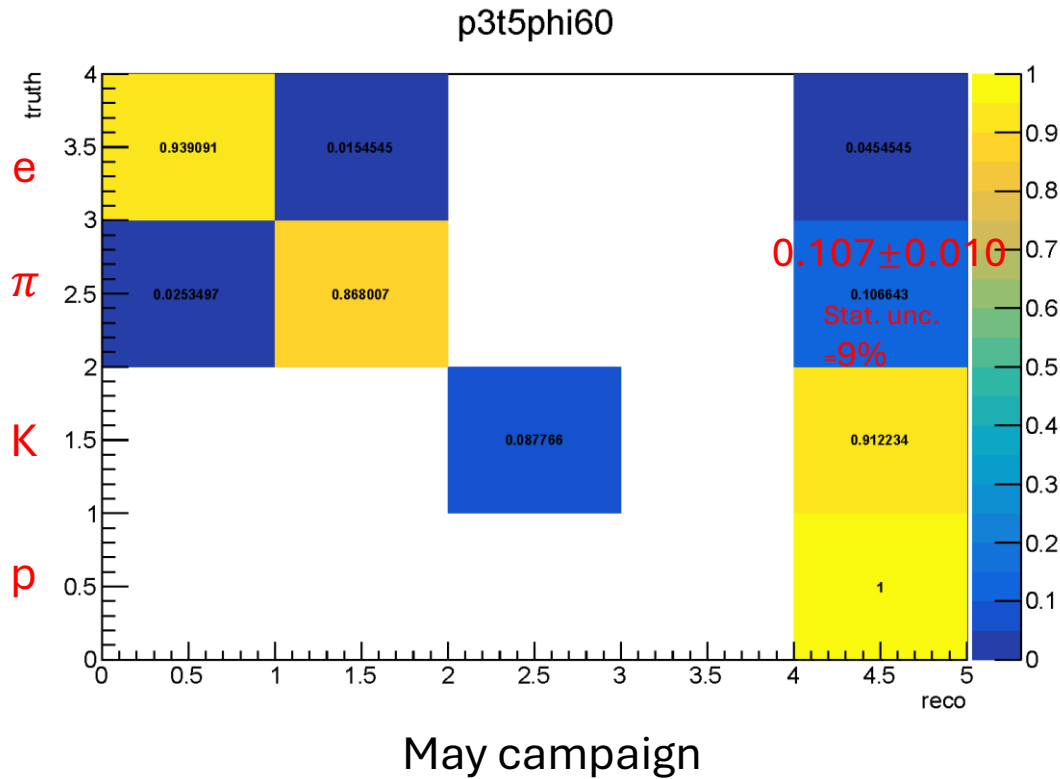
- Kinematics selection 2:

- $p \in (1.6, 2.0)$ GeV

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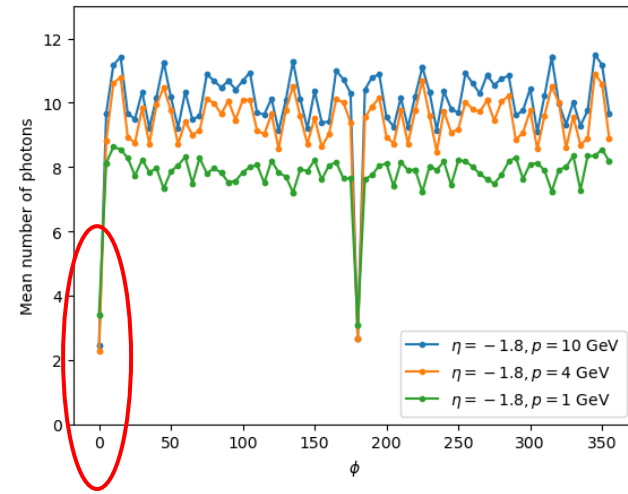
- $\phi \in (0, 3)$ degree

- Spot check result consistent with May campaign?
Perhaps higher statistics is needed to confirm

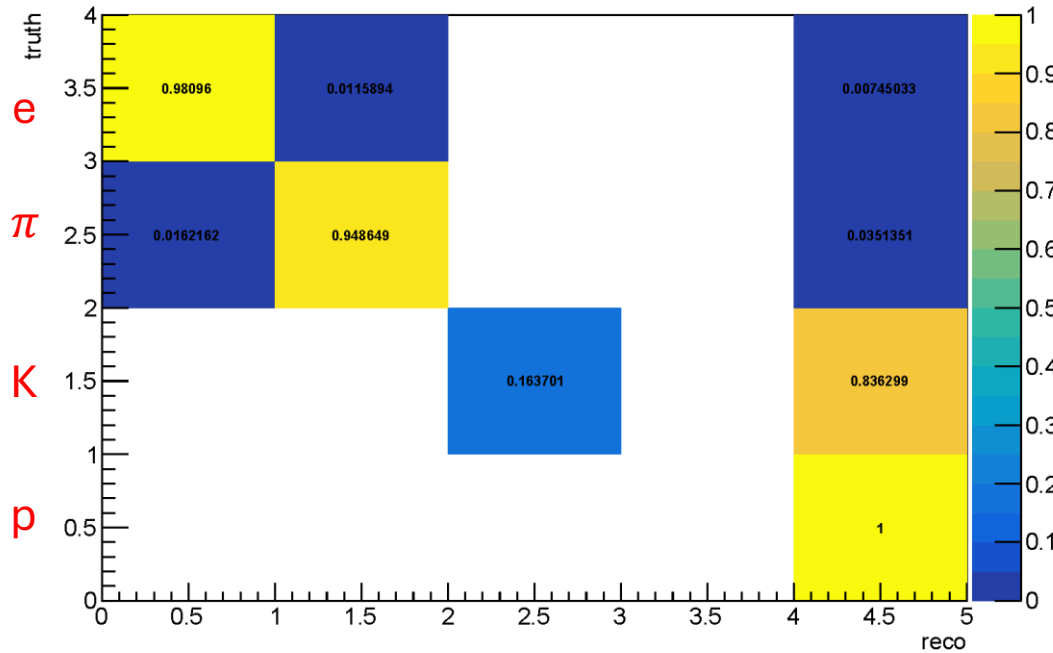


Selection 3

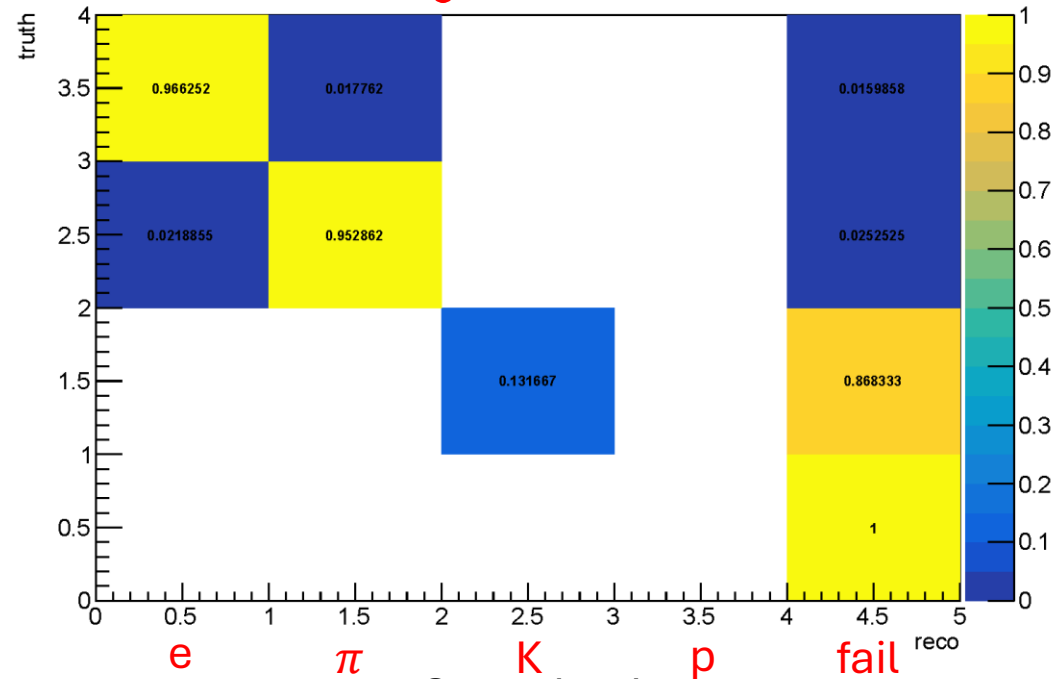
- Kinematics selection 3:
 - $p \in (1.6, 2.0)$ GeV
 - $\theta \in (2.875, 2.8975) \rightarrow \eta \in (-2.10, -2.01)$
 - $\phi \in (9, 12)$ degree: Avoiding inefficiency at 0 (compared to 1)



p3t10phi63



May campaign



Spot check

- Spot check result consistent with May campaign for this kinematic selection

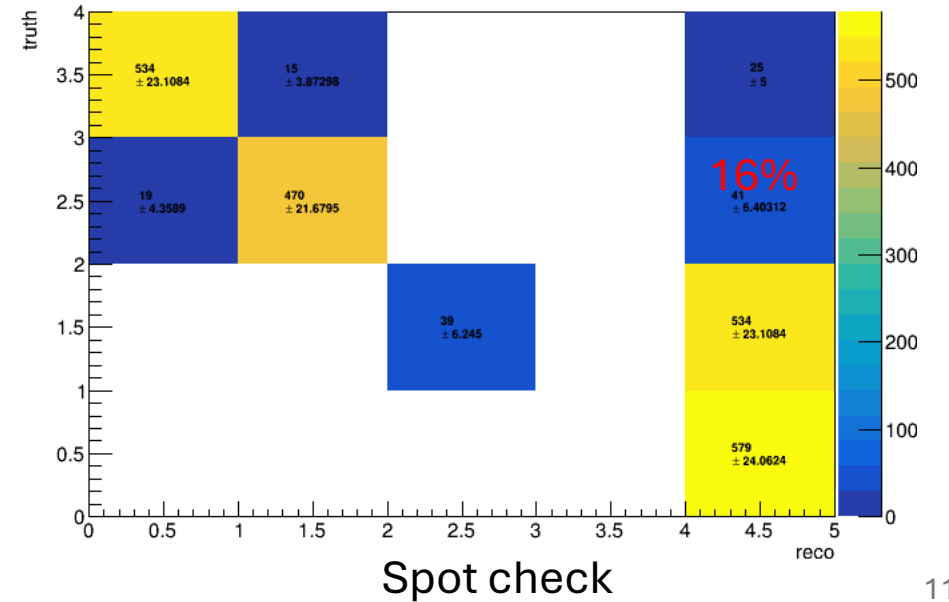
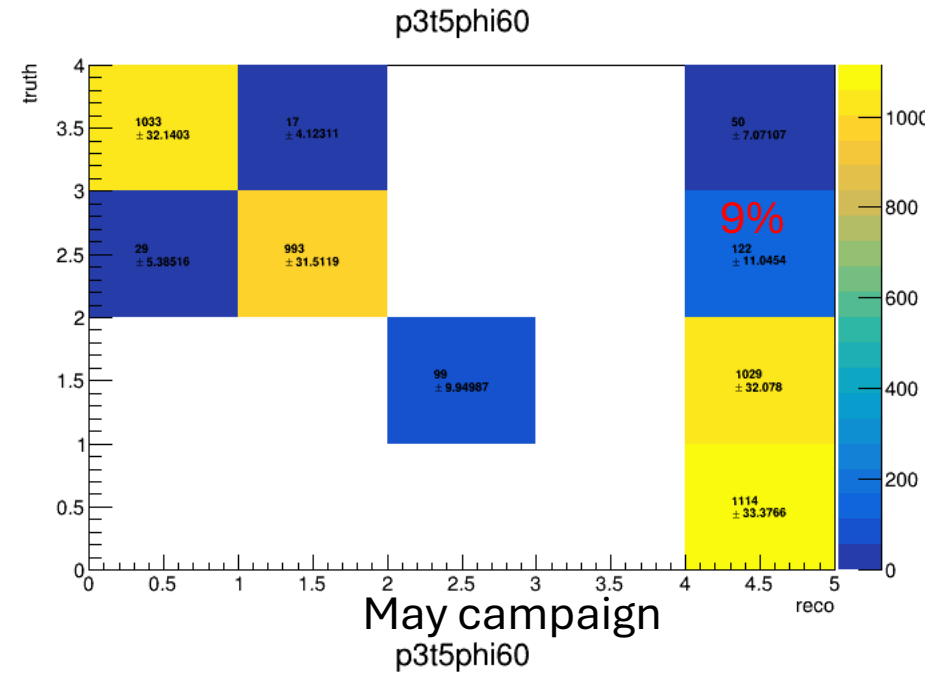
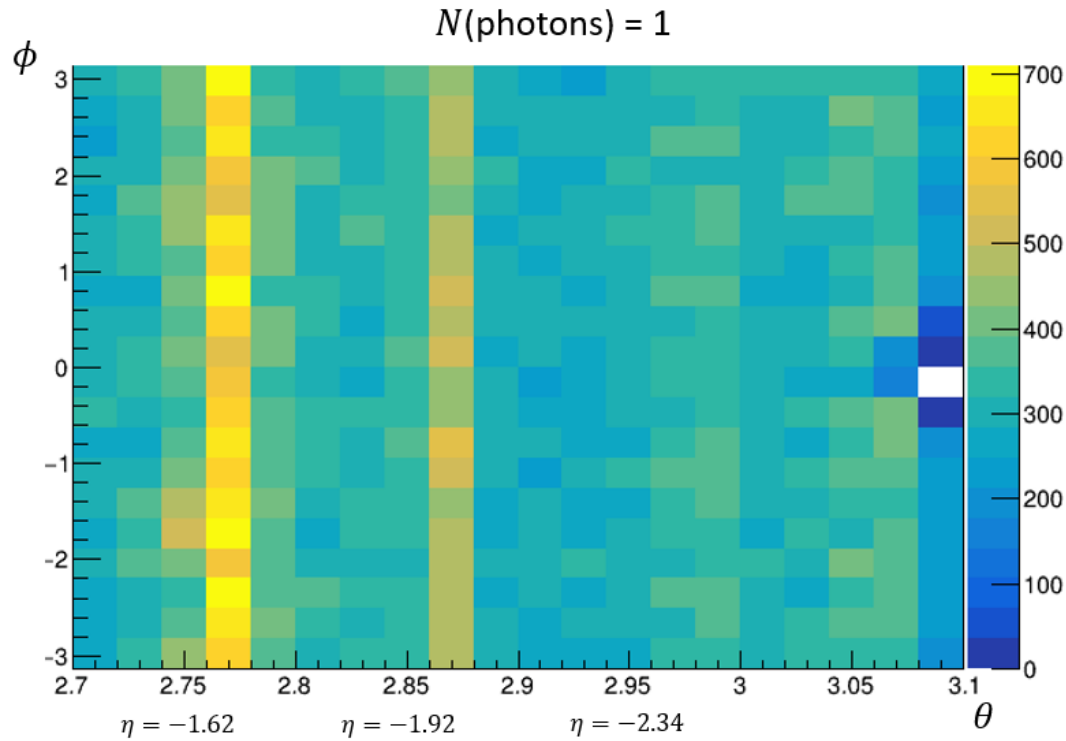
Conclusions

- We compared pfRICH PID LUT before and after magnetic field update
- Overall, the effect is insignificant

Backup

Selection 2

- Kinematics selection 2:
 - $p \in (1.6, 2.0)$ GeV
 - $\theta \in (2.7625, 2.785) \rightarrow \eta \in (-1.71, -1.65)$:
Expecting higher fraction of “fail” in this η range
 - $\phi \in (0, 3)$ degree



Selection 3

- Kinematics selection 3:
 - $p \in (1.6, 2.0)$ GeV
 - $\theta \in (2.875, 2.8975) \rightarrow \eta \in (-2.10, -2.01)$
 - $\phi \in (9, 12)$ degree: Avoiding inefficiency at 0

