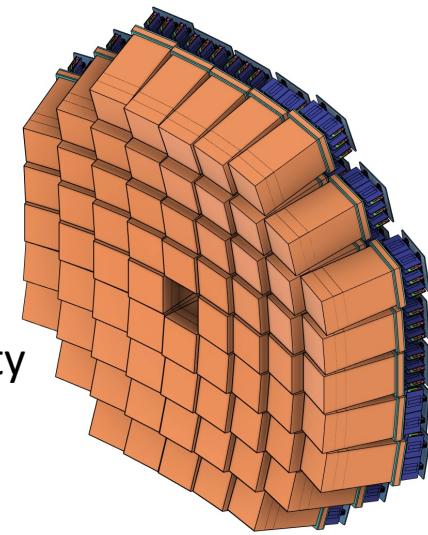


# Backwards RICH Review: mRICH



Murad Sarsour  
Georgia State University

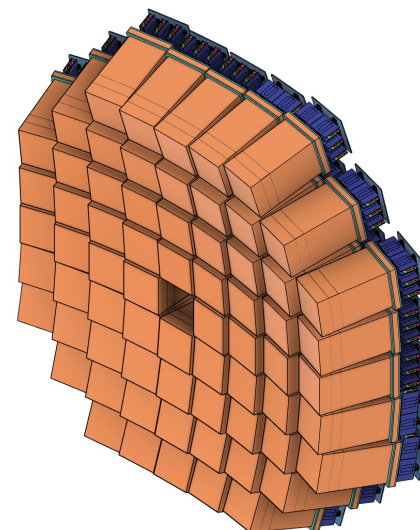
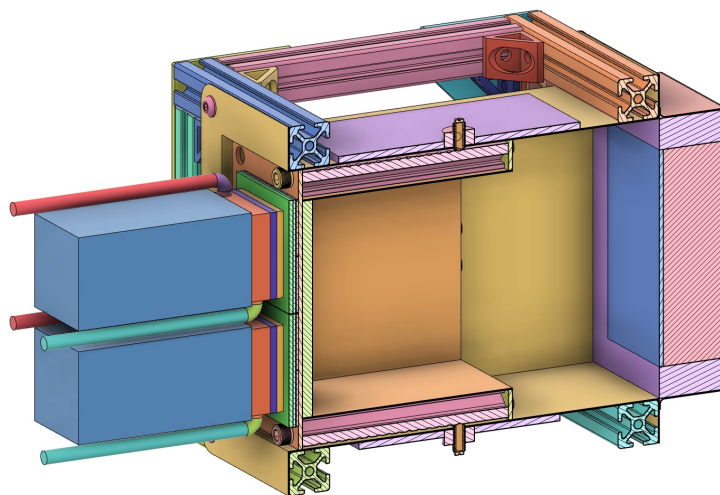
The review should address the following questions:

1. Reminder of the proposed **detector configuration** for the use in the ePIC detector.
2. **Input information:**
  - a. **Pertinent information on similar technology/design** that is used by other experiments or R&D efforts (example references could be literature or conference talks).
  - b. **Prototypes and their tests:** done so far, ongoing effort, future planning (with timelines); results from prototypes and their tests
  - c. **Simulation studies:** already performed, ongoing and planned (with timelines); results from the simulations; particular care in (i) showing how realistic the parameters used in simulations are and (ii) reporting what is missing for a fully realistic simulation (backgrounds, specific event categories, ...) (iii) Does the simulation take into account the **realistic response of the selected photosensors and related FEE?**
3. **Performances:**
  - a. Comparison of the **present assessment of the Cherenkov PID detector performance compared with the YR requirements?**
  - b. Performance perspectives **beyond the YR requirements (if any) ?**
  - c. **Efficiency figures:** single particle  $P(\text{Kaon/Proton})$  identified as  $P(\text{Pi/Kaon/Proton})$  as a function of the truth momentum in a 3x3-panel figure?
  - d. **Please quantify the performance for electron/hadron separation**
  - e. **Active area or /dead area** as 2D function of eta and phi; and comment on the edge effects?
  - f. **Performance or potential as ToF detector, providing both timing resolution and acceptance coverage in eta and phi.**
  - g. **Under the coordination of the SIDIS working group, provide Kaon Purity in the kinematic region of ( $x \dots Q_2 \dots$ ) via parameterized hadron PID performance.**
4. **Radiator**
  - a. **Status of radiator selection**
  - b. **Status of the radiator development and related potential issues?**
  - c. **Perspectives of radiator mass production and timelines for the production period?**
5. **Sensors and FEE:**
  - a. **Status of photosensor selection** (a single consolidated option, more options under consideration); please provide photo sensor and pixel segmentation characteristics?
  - b. **Status of the sensor development and related potential issues?**
  - c. **Perspectives of sensor mass production and timelines for the production period?**
  - d. **Status of FEE selection** (a single consolidated option, more options under consideration)?
  - e. **Characteristics of the ASIC and FEEs considered?**
  - f. **Status of the FEE development and related potential issues?**
  - g. **Perspectives of FEE mass production and timelines for the production period?**
6. **Integration:**
  - a. **Status of the proposed detector integration** into the current baseline detector?
    - i. **z-space and effect to tracking:** in coordination with the tracking DWG, produce backward momentum resolution for the tracker that fit into the z-spaced allowed by the proposed RICH detector
    - ii. **Material effect to backward EMCal:** in coordination with the calorimeter DWG, produces electron lineshape in the backward EMCal with the proposed RICH detector in front.
  - b. **Status of the design of the electrical/electronic infrastructure** (channels, power supplies, heat, rate)?
  - c. **Cooling strategies?**
7. **Workforce:**
  - a. **List of groups** engaged in the proposed detectors and of other groups potentially interested;
  - b. **Workforce needed with timelines and qualification of the required professional profiles;** please, include also physicists needed for dedicated simulation studies;
  - c. **Available workforce** (specifying: granted, expected, possible) by the groups proposing the detector;
8. **Cost and scheduling:**
  - a. **up-to-date cost estimate** for the different components and expenditure categories;
  - b. **In-kind contributions** (specifying: granted, expected, possible).
  - c. **Envisioned schedule** for full scale production
9. **Envisioned risk and risk mitigation strategy**

# Backwards RICH Review: mRICH

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2. **Input information:**
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[eRD14 & eRD101. NIMA 871, 13 \(2017\)](#)
  - b. **Prototypes and their tests:** done so far, ongoing effort, future planning (with timelines); results from prototypes and their tests
    - Fermi Lab 1&2 + JLab test (finish data analysis + publish) .. Expect to be done for review!
    - Future beam test: Optimizing the focal plane location and Aerogel thickness (New mRICH Prototype Design)

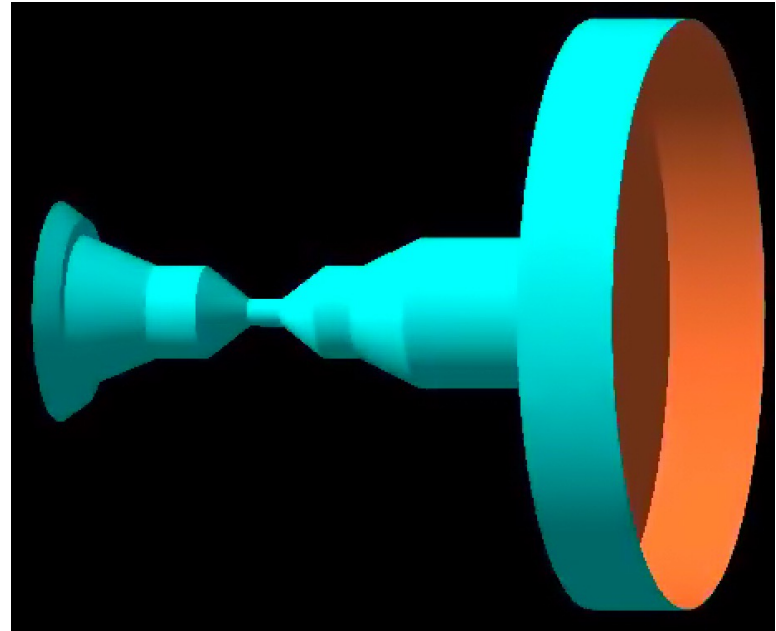
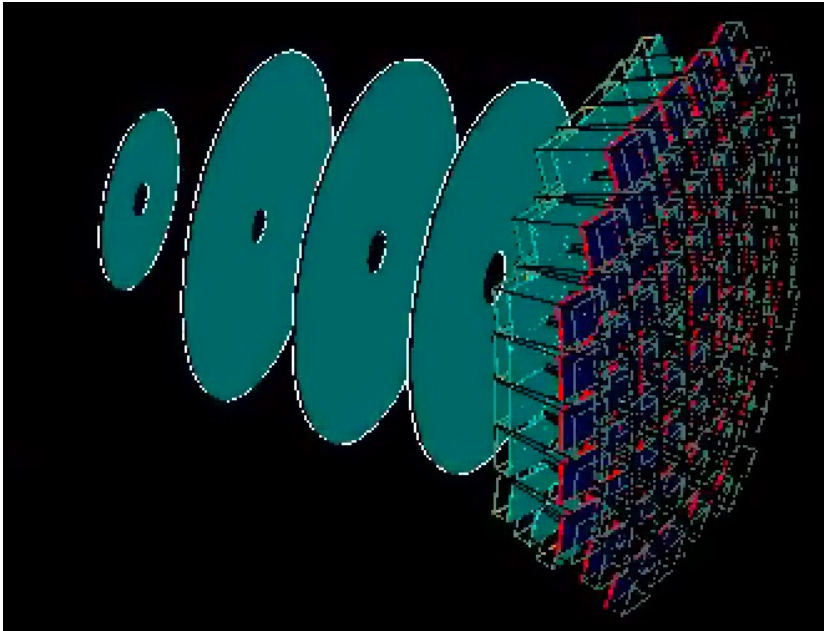
JLab:  
Alex Eslinger



# Backwards RICH Review: mRICH

- c. Simulation studies: already performed, ongoing and planned (with timelines); results from the simulations; particular care in (i) showing how realistic the parameters used in simulations are and (ii) reporting what is missing for a fully realistic simulation (backgrounds, specific event categories, ...) (iii) Does the simulation take into account the **realistic response of the selected photosensors and related FEE?**

❖ Using fun4all framework: mRICH + tracking&services & scaled magnetic field (1.7/1.5)



❖ 3mm pixelization + 2 photons as noise for photosensor + FEE

# Backwards RICH Review: mRICH

## 3. Performance:

- a. Comparison of the **present assessment of the Cherenkov PID detector performance compared with the YR requirements?**
- b. Performance perspectives **beyond the YR requirements (if any) ?**
- c. **Efficiency** figures: single particle Pi/Kaon/Proton identified as Pi/Kaon/Proton as a function of the truth momentum in a 3x3-panel figure?
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- f. **Performance or potential as timing detector, providing both timing resolution and acceptance coverage in eta and phi.**

Glasgow University (Rachel Montgomery and Bjoern Seitz)

- g. **Under the coordination of the SIDIS working group, provide Kaon Purity in the kinematic region of (x. ..  $Q^2$ ... ) via parameterized hadron PID performance.**

# Backwards RICH Review: mRICH

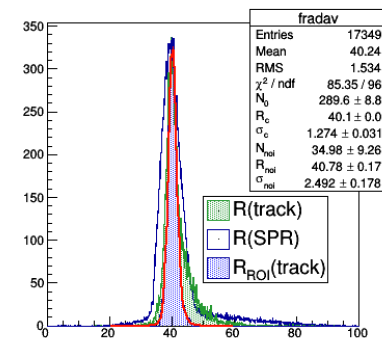
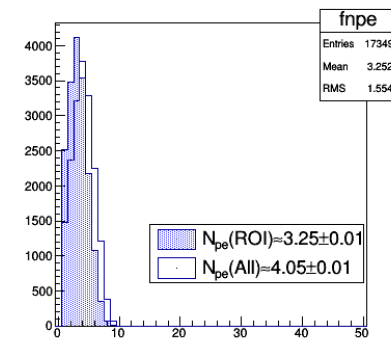
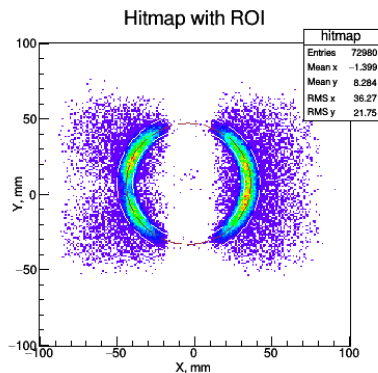
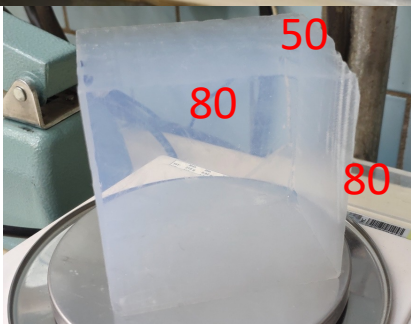
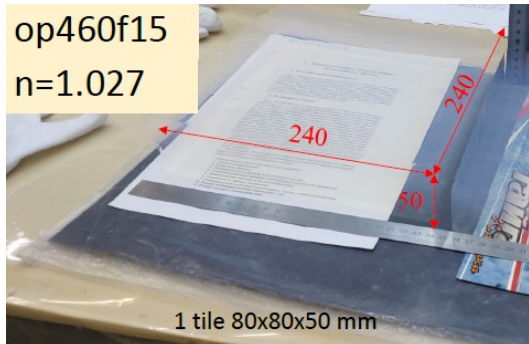
## 4. Radiator

- Status of radiator selection  $n=1.03$  at 4 cm?
- Status of the radiator development and related potential issues?
- Perspectives of radiator mass production and timelines for the production period?

Risk mitigation & prototyping)

New Aerogel Development: Russian & Chinese collaborators  
(Alexander Barnyakov & Zhihong Ye)

*Beam test results for aerogel tile with 30 mm thick*



- ❖ Future beam test to confirm no emission point effect with 4 cm compared to 3 cm

# Backwards RICH Review: mRICH

## 5. Sensors and FEE:

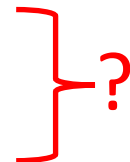
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- f. Status of the **FEE development** and related potential issues?
- g. Perspectives of **FEE mass production** and timelines for the production period?

eRD109&110 + Glasgow collaborators. Rachel. et al.

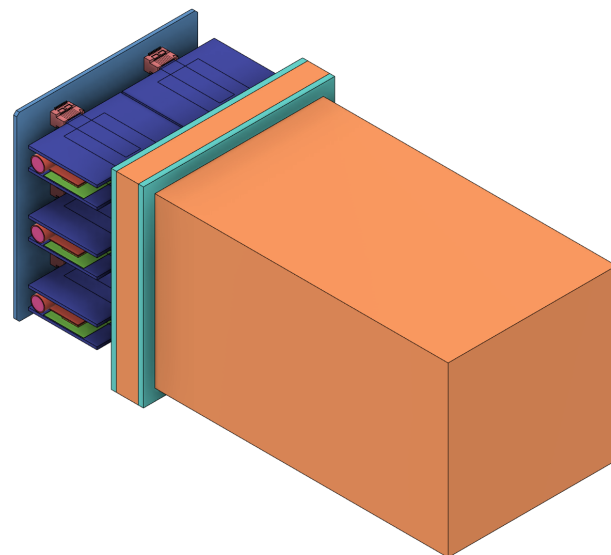
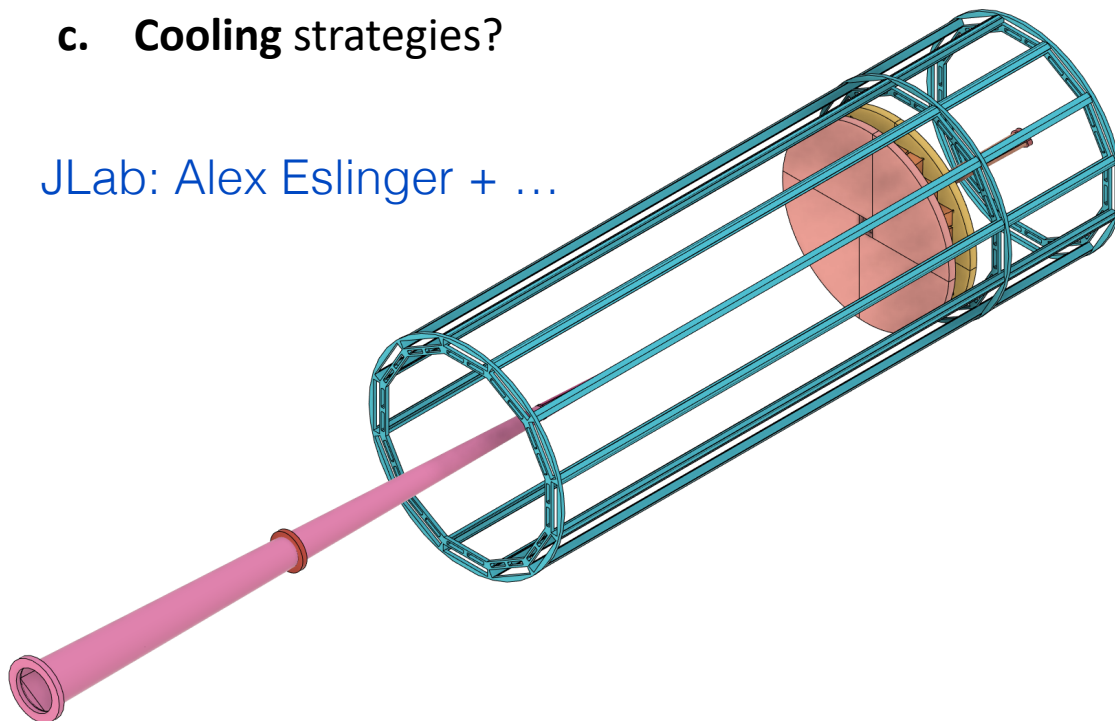
# Backwards RICH Review: mRICH

## 6. Integration:

- a. **Status of the proposed detector integration** into the current baseline detector?
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JLab: Alex Eslinger + ...



# Backwards RICH Review: mRICH

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- c. **Available workforce** (specifying: granted, expected, possible) by the groups proposing the detector

ANL (Junqi Xie), BINP (Alexander Barnyakov), BNL (Edward Kistenev and Alexander Kieslev), Duke University (Zhiwen Zhao), Glasgow University (Rachel Montgomery and Bjoern Seitz), Georgia State University (Xiaochun He, Murad Sarsour and Deepali Sharma), INFN/Ferarra (Marco Contalbrigo), JLab (Alex Eslinger and Benedikt Zihlmann), Tsinghua University (Zhihong Ye) and University of South Carolina (Yordanka Ilieva).

- Need software help – Eicrecon /JANA2 experience – for migrating mRICH PID reconstruction to ePIC reconstruction framework



# Backwards RICH Review: mRICH

## 8. **Cost and scheduling:**

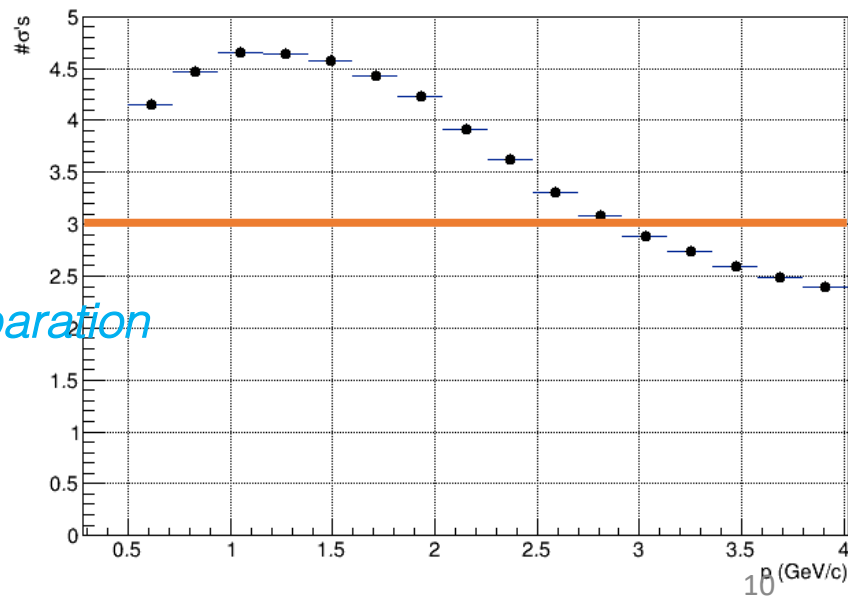
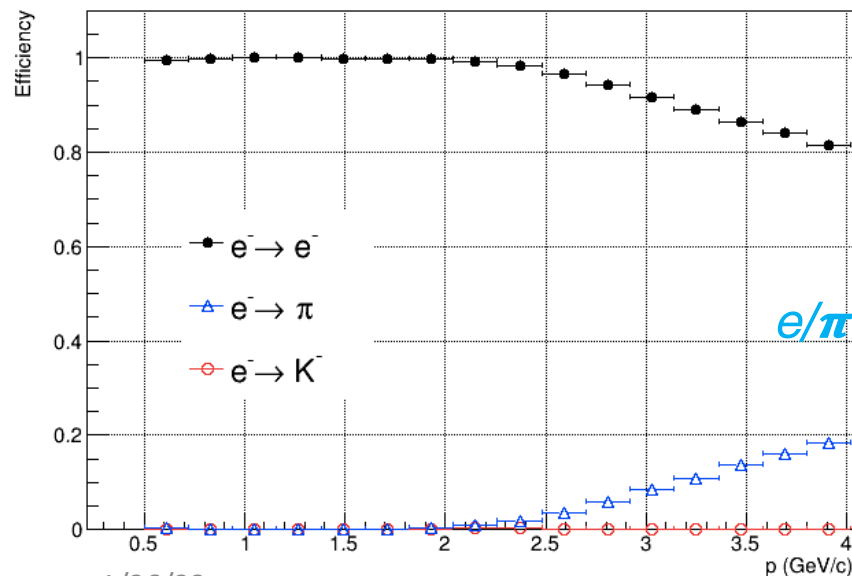
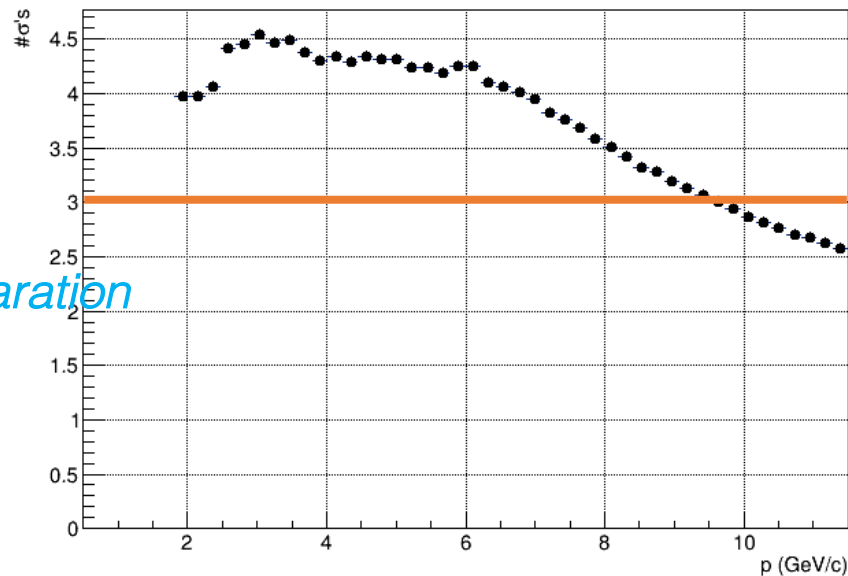
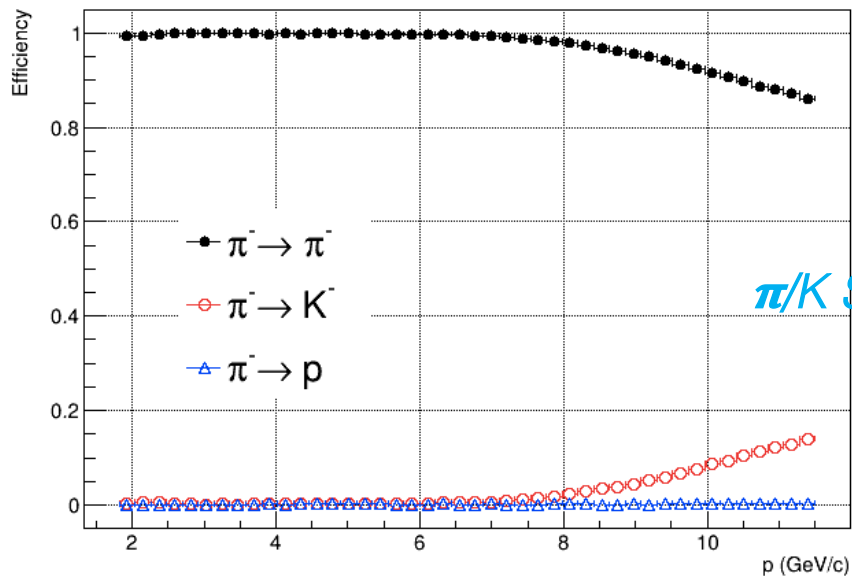
- a. up-to-date cost estimate for the different components and expenditure
- b. categories;
- c. In-kind contributions (specifying granted, expected, possible).
- d. Envisioned schedule for full scale production

## 9. **Envisioned risk and risk mitigation strategy**

# mRICH PID Performance

- 3 cm Aerogel @  $n = 1.02$
- SiPM Q.E.

$\Delta\theta = 1.75$  mrad



# Tracking Resolution

At  $\eta = -2.1$

