ITALIA-SIDIS-GROUP UPDATE

Lorenzo Polizzi – University of Ferrara

FIRST MEASUREMENTS

π^+ distributions, reconstruction efficiencies and contaminations for SIDIS analyses

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DATA ANALIZED

This analysis is the first step of the **italian sidis group** in the studies of the simulations produced by the ePIC collaboration.

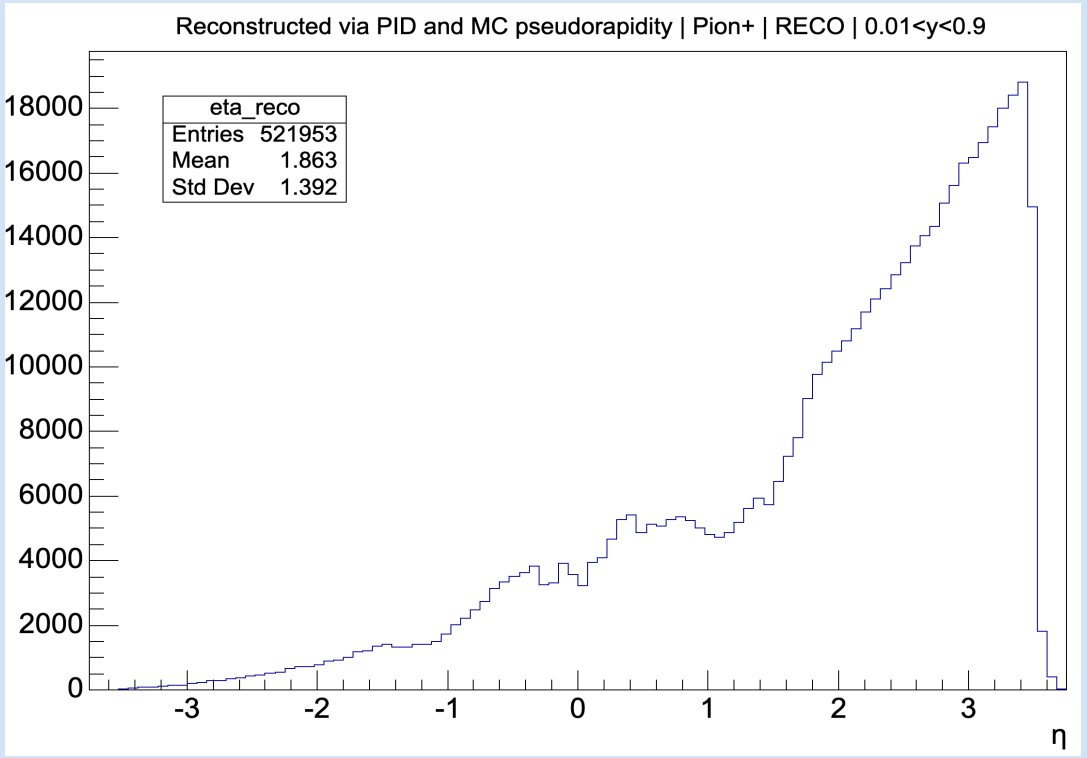
The dataset chosen for this first analysis is the DIS.25.04, more precisely:

/volatile/eic/EPIC/RECO/25.04.1/epic_craterlake/DIS/NC/10x100/minQ2=1/

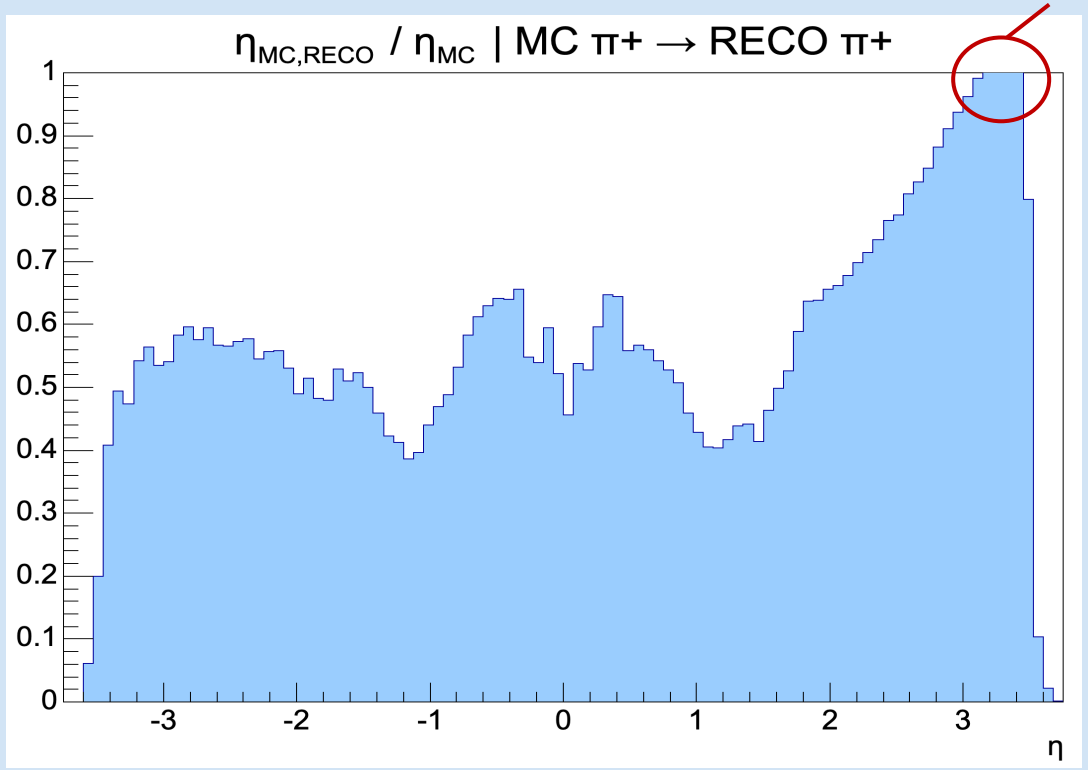
We observe the π^+ production in **SIDIS** processes, performing an initial analysis of the **distributions of the main kinematic variables**, with a focus on the **current performance** of the **reconstruction system**. The goal is to extend these analyses to π^- and **Kaons**, to observe the possible impact for the future **TMDs extrapolation**.

PSEUDORAPIDITY EFFICIENCY

Pseudorapidity (η) provides important information about the spatial distribution of the process and highlights the performance of the different types of ePIC detectors.



Pseudorapidity distribution

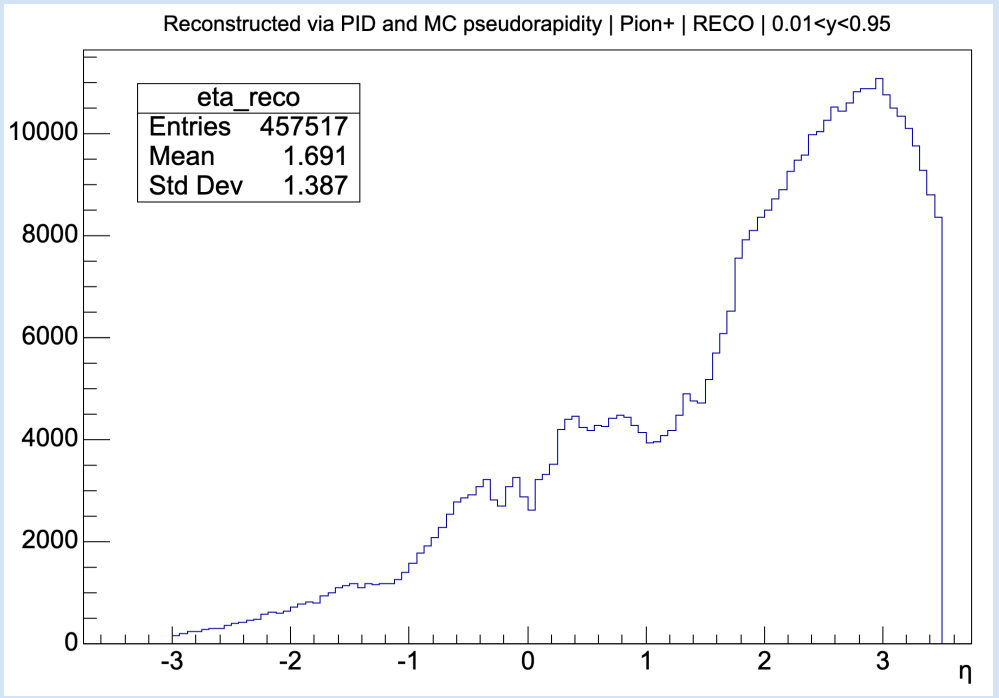


Efficiecy

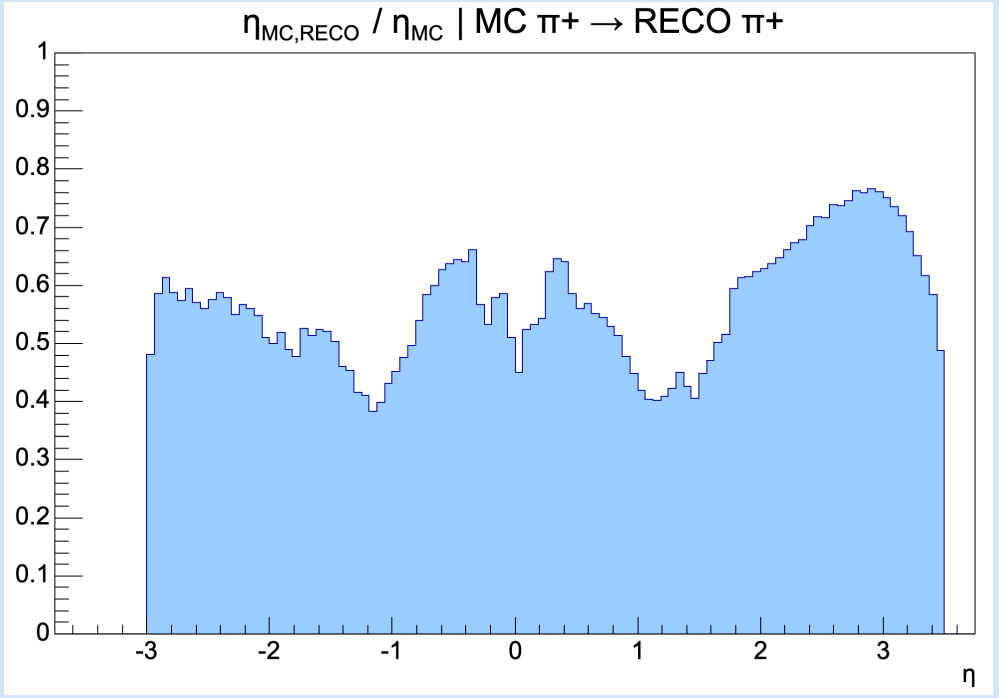
PID QUALITY CUT

We saw that some MC particles had a **double RECO trace**, which is why the efficiency had unreasonable values. Inside the TTree 'ReconstructedChargedRealPIDParticles', we use '**goodnessOfPID**' info to perform a cut in the reconstruction.

Seems to have worked, moreover, **contaminations have decreased by a factor of 7**.



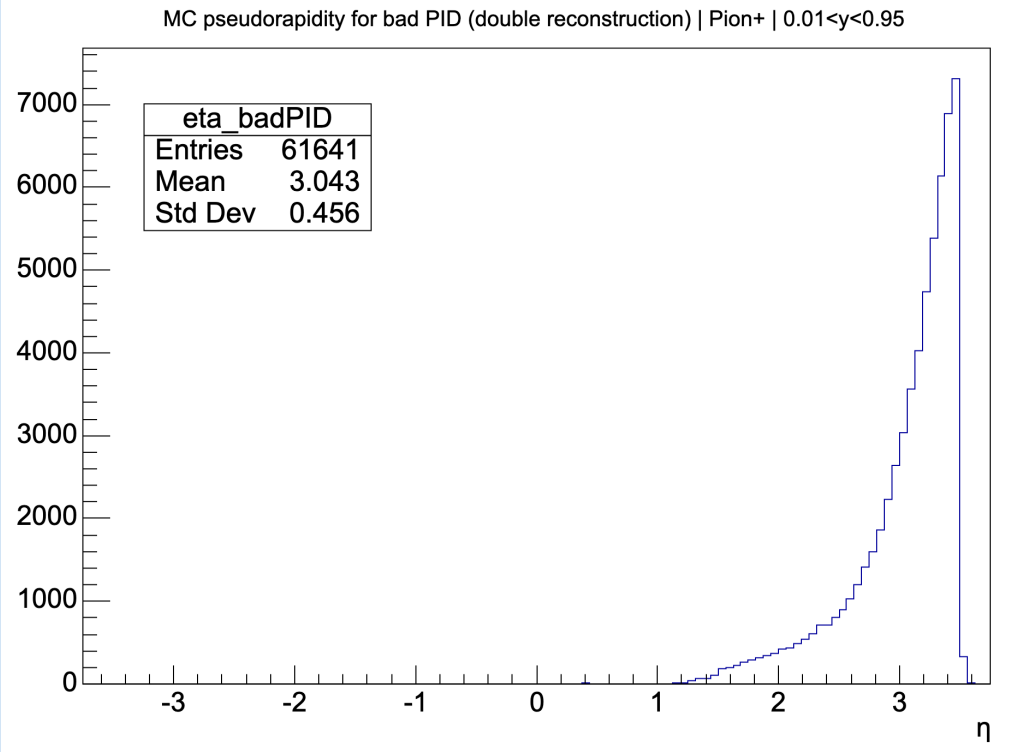
Pseudorapidity distribution



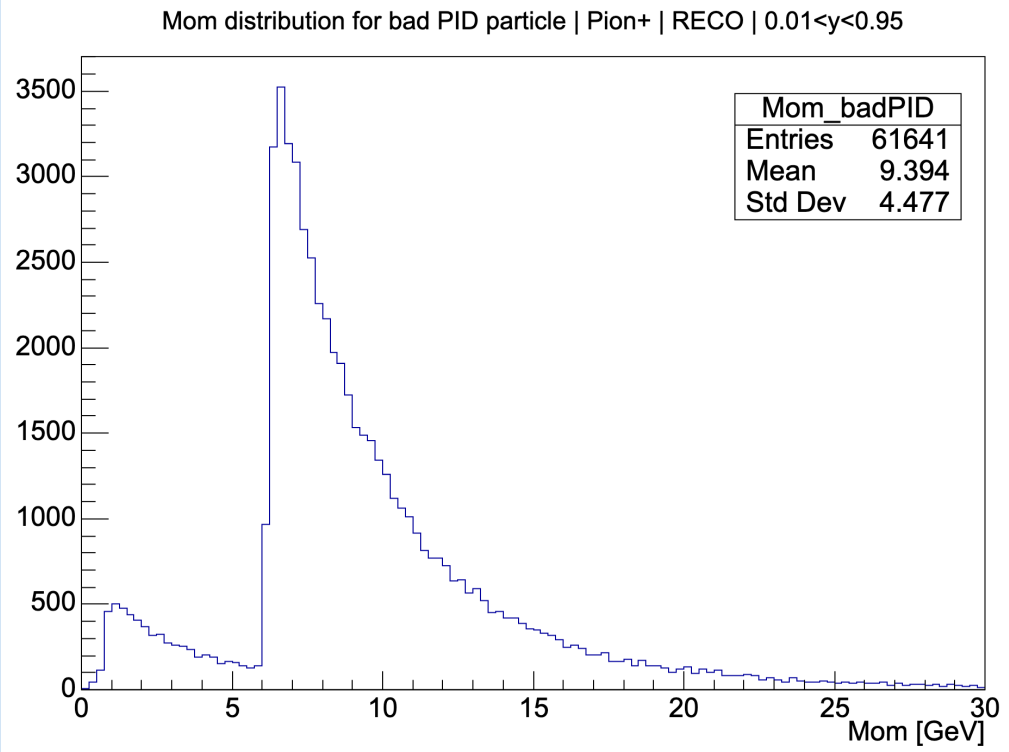
Efficiecy

PID QUALITY CUT

The particles removed are all **high-energy** traces and populate the forward region of the detector. This cut has been applied very recently and is still under study, so this information should be taken with caution.



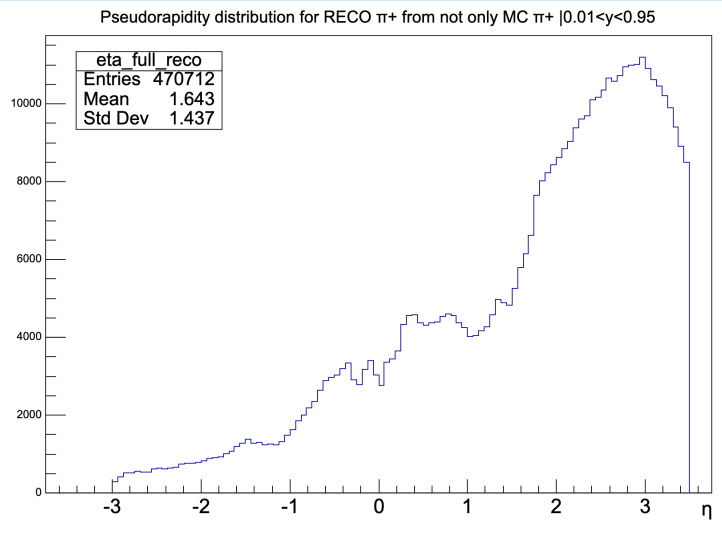
Pseudorapidity distribution



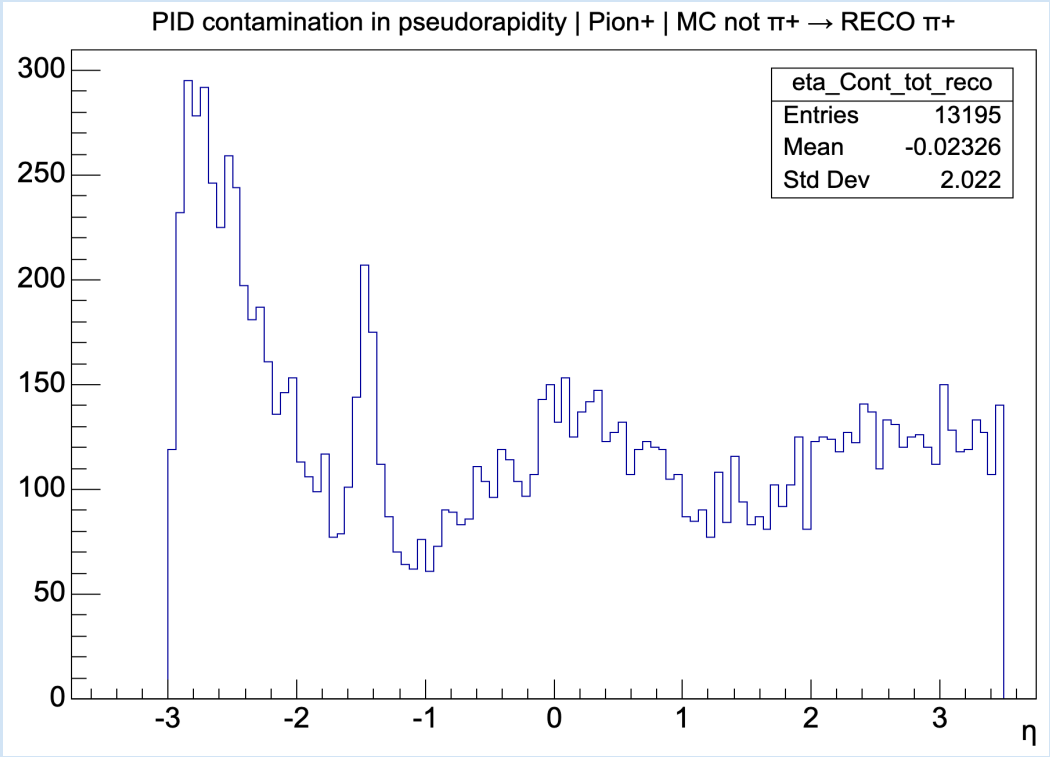
Efficiecy

PSEUDORAPIDITY CONTAMINATION

Observing the π^+ reconstruction, only **2.8%** of the identifications are source of data contaminations.

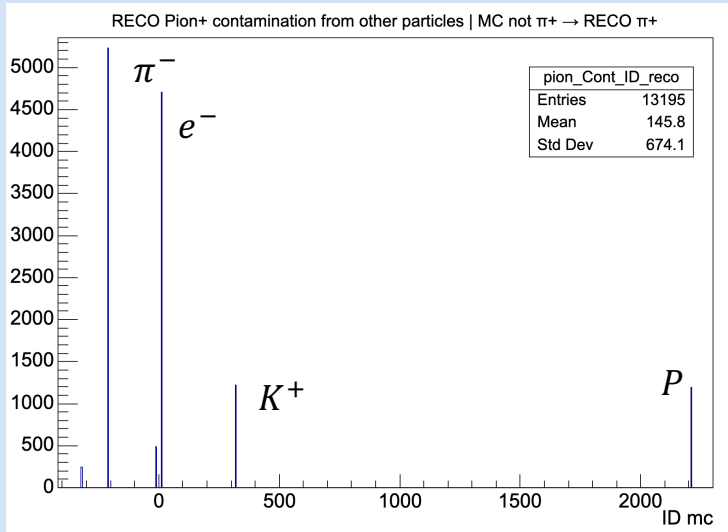


Pseudorapidity distribution



η distribution of reconstructed contaminated data

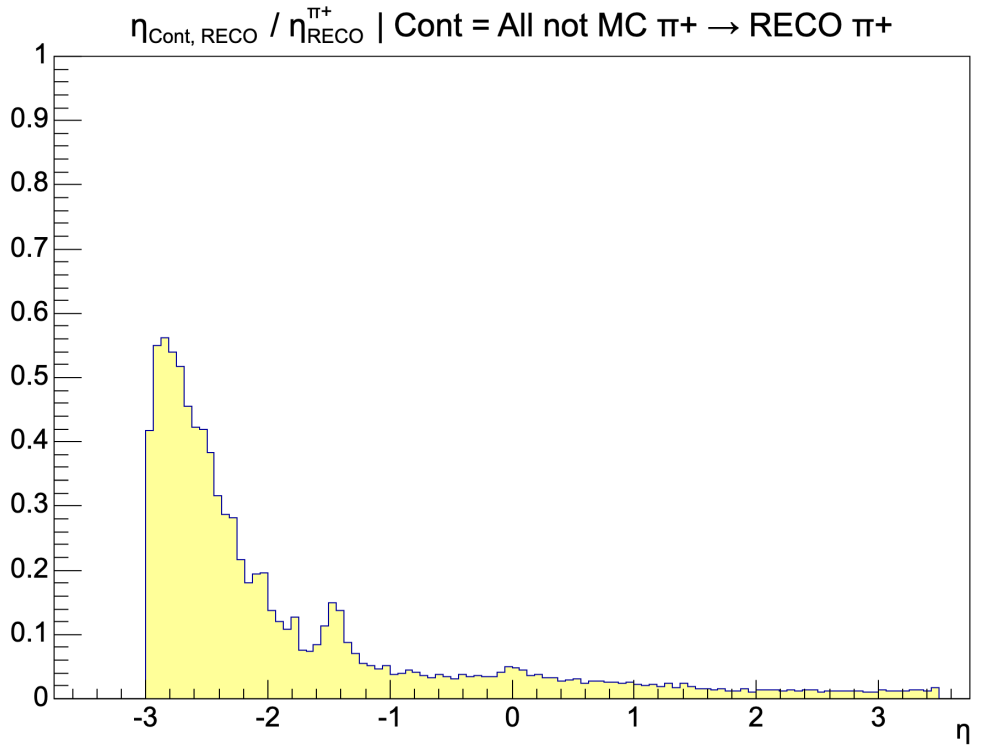
π^- 39.7% e^- 35.7%
K^+ 9.23% P 9.07%



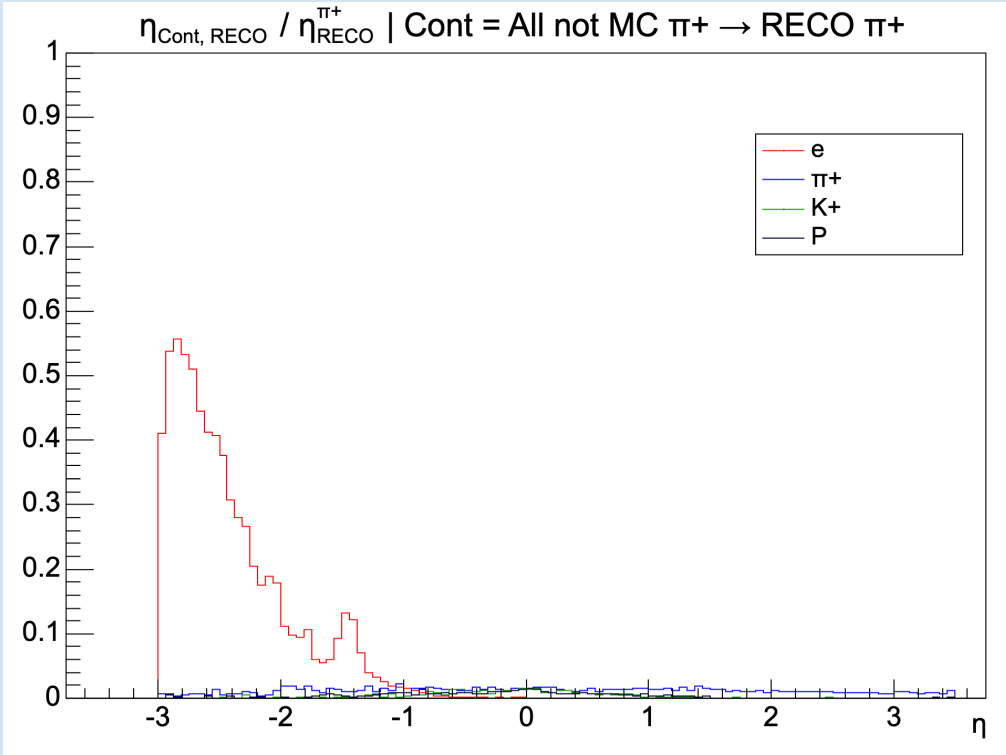
Contamination sources

PSEUDORAPIDITY CONTAMINATION

Strong contamination of e^- in backward sector (Pf-RICH, Hp-DIRC) up to 55%
Background contamination of π^-, K^+, **P** lesser than **2%** in the all kinematic range.



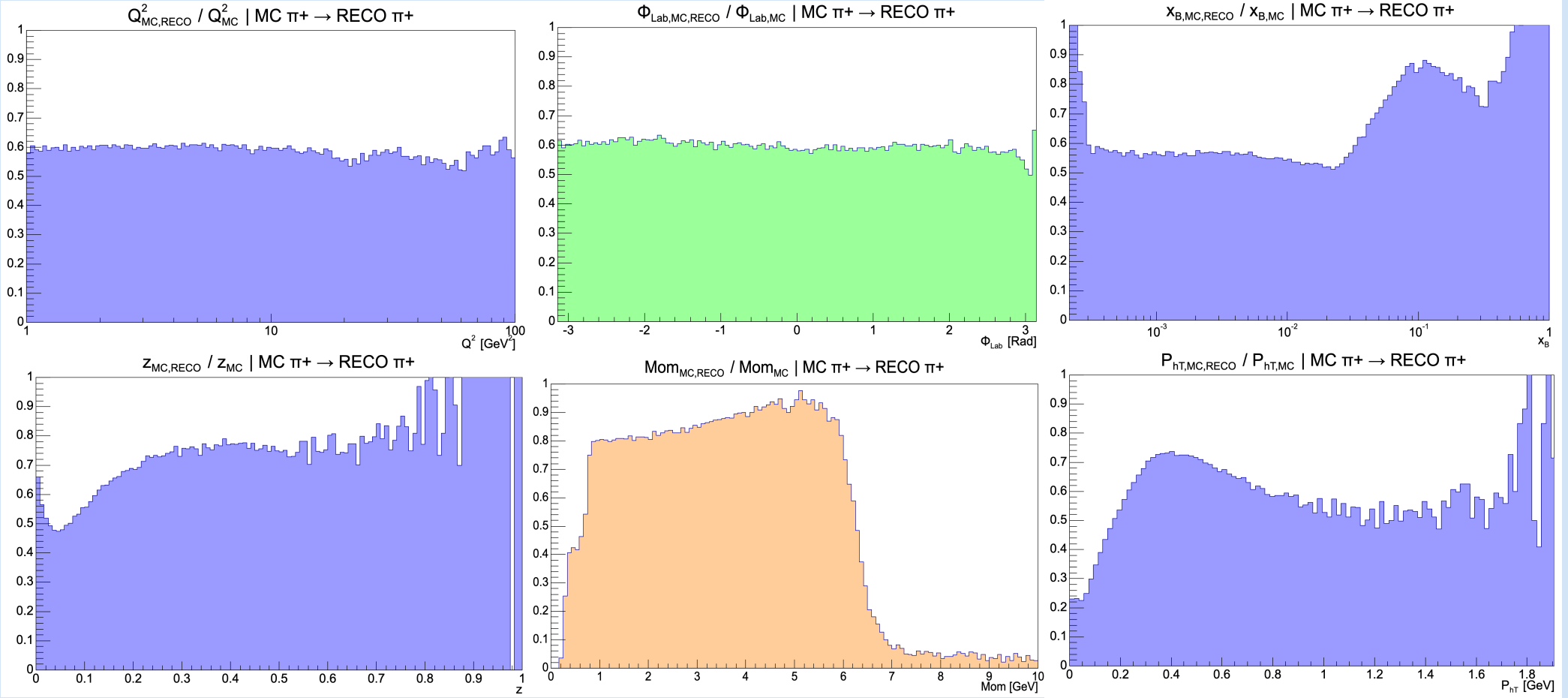
Contaminated fraction



Contaminated contributions

KINEMATIC VARIABLE EFFICIENCIES

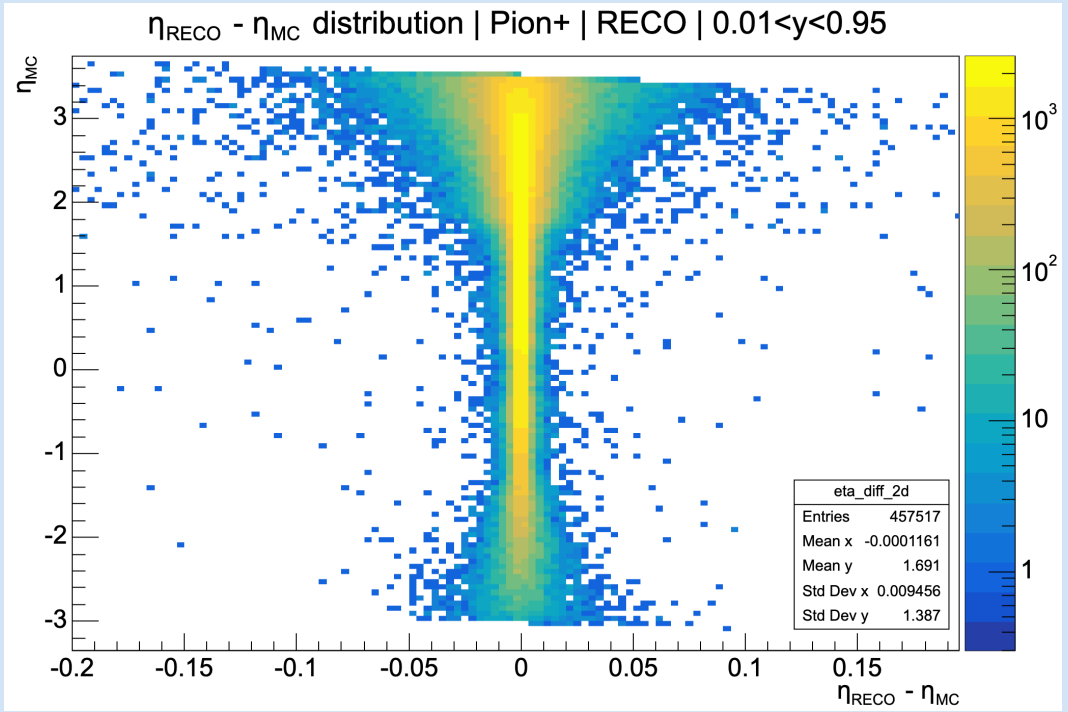
From MC and RECO production we observe that the total efficiecy of MC π^+ correctly reconstructed as π^+ is about to $\mathbf{59.65\%}$.



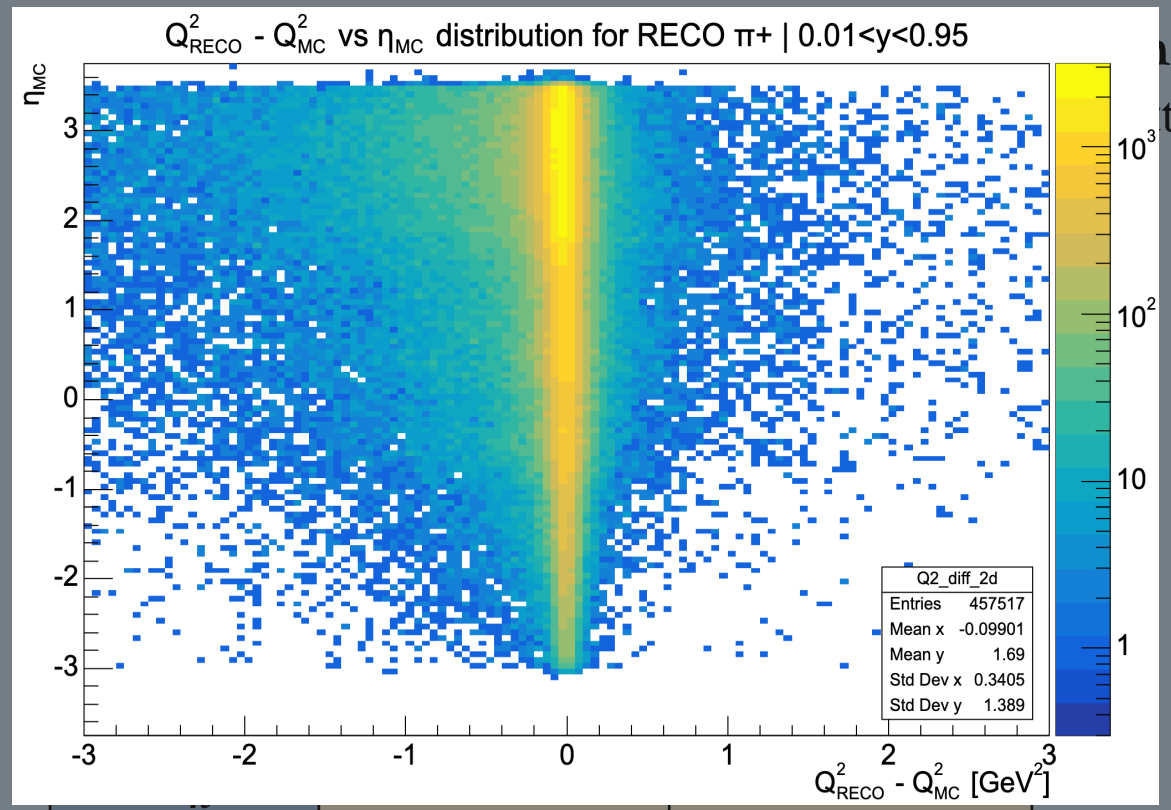
RECONSTRUCTION PRECISION

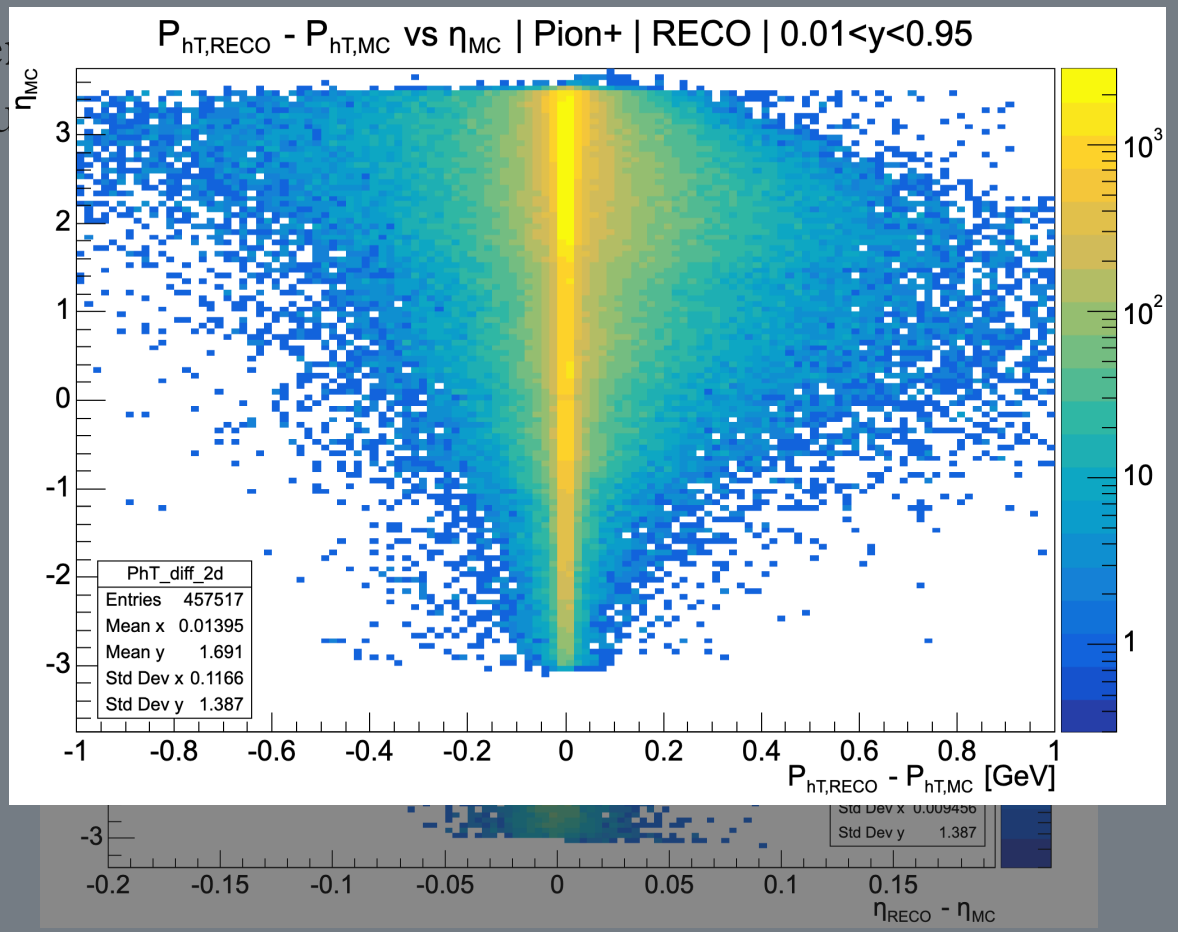
The **reconstruction** performance shows **slight underestimation** behavior of the main variables such as: $\boldsymbol{x_B, Q^2, z}$, while it shows an **overestimation** attitude for $\boldsymbol{P_h}$, $\boldsymbol{P_{hT}}$. The tracking system provides a **nearly perfect** reconstruction of $\boldsymbol{\eta}$.

	$\Delta_{mean}(RECO - MC)$	σ_{STD}
$\boldsymbol{\eta}$	-1.2×10^{-4}	9.5×10^{-3}
$\boldsymbol{x_B}$	-0.0116	0.0355
$\boldsymbol{Q^2}$	-0.0990	0.3405
$\boldsymbol{z}$	-0.0253	0.0695
$\boldsymbol{P_h}$	$+0.0016$	0.1190
$\boldsymbol{P_{hT}}$	$+0.0139$	0.1166



RECONSTRUCTION PRECISION





P_{hT}	+0.0139	0.1166

CONCLUSION & NEXT STEPS

- Become more confident with the models and divide the work in order to expand the analysis for other **types of particles**.

- Decide a well-functioning data **binning grid** and related **kinematic cuts** to remove data outside the **TMD regions** ⟶ Probably **more stastistics** will be necessary!

- Ready to **inject a spin asymmetry** in the Monte Carlo (simple version) in order to extract important parameters for the **cross-section** and **TMDs** (like Sivers, Collins, and so on…), following the **HERMES** solution to polarize a MC dataset.

- Study the **contamination** effect reconstructions and the detector performance in the reconstructions with some hand-made manipulation of those contributions ⟶ **Susanna presentation**!

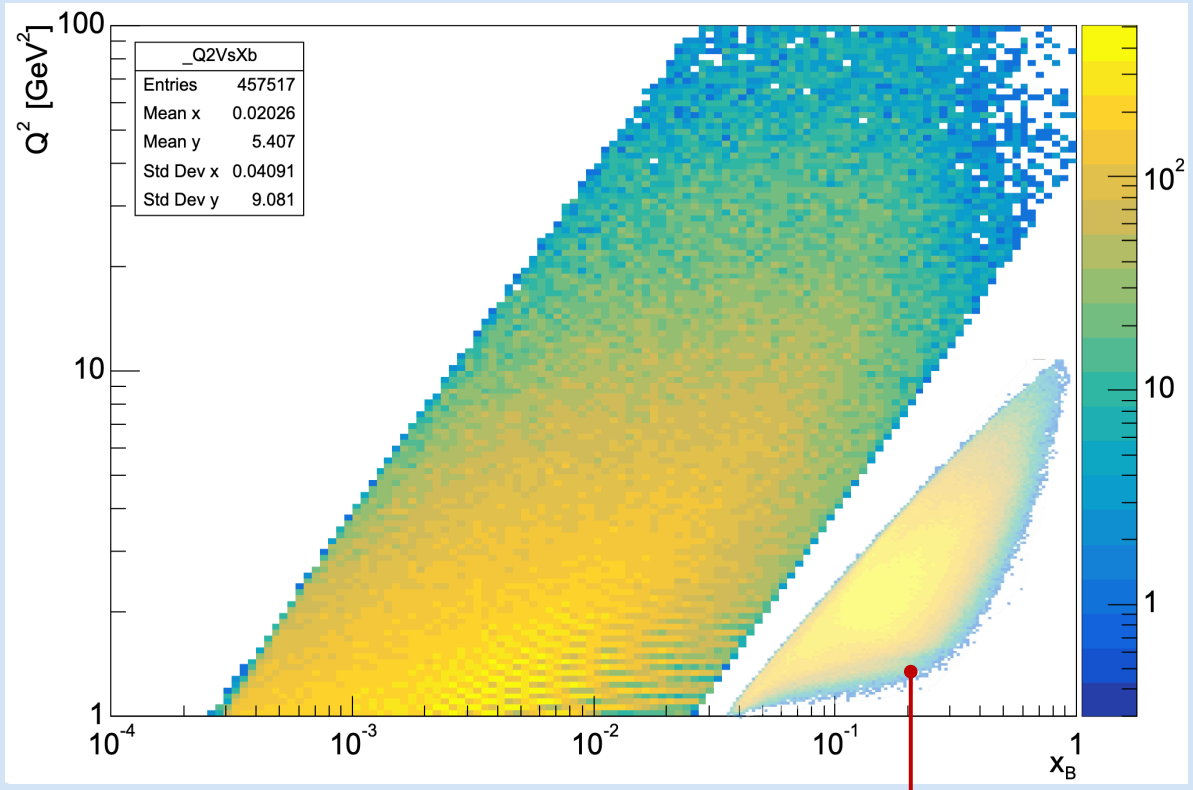
THANKS FOR YOUR ATTENTION

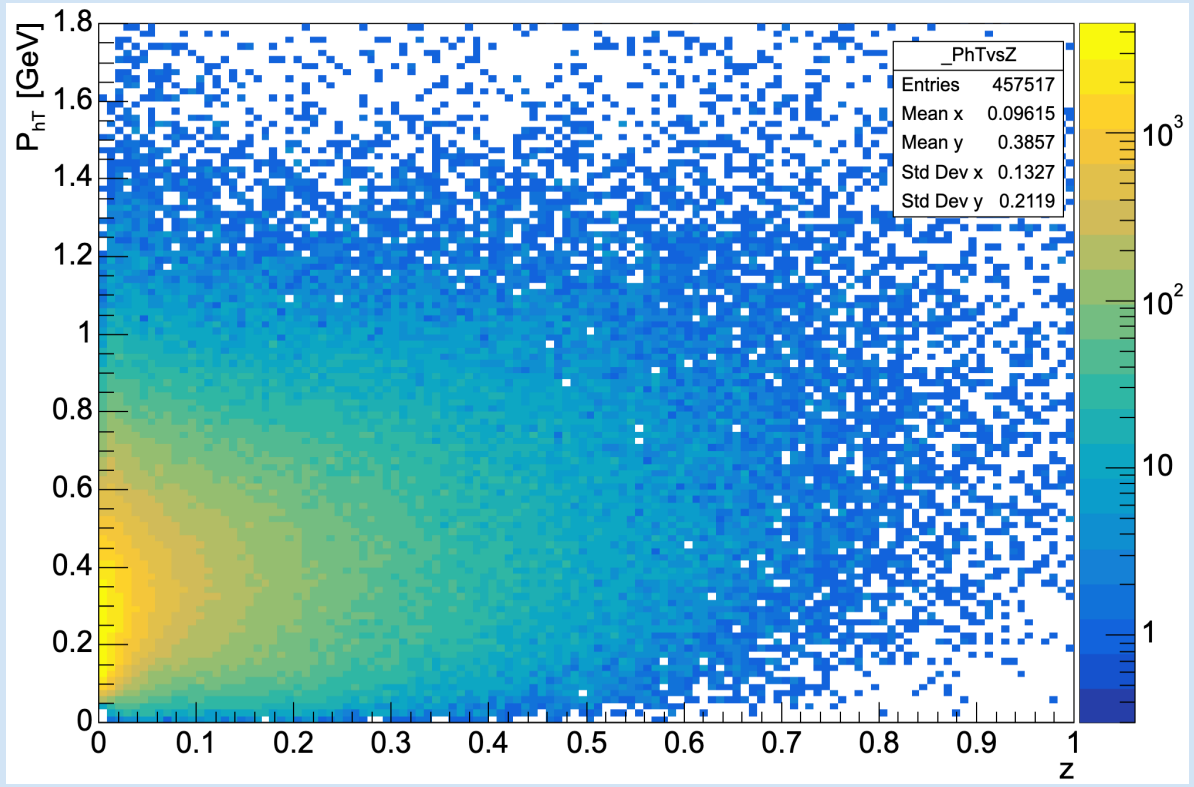
PHASE SPACE COVERED AT EIC (MAIN SIDIS VARIABLE)

x_B *vs* Q^2

The only cut here is $0.01 < y < 0.95$

z *vs* P_{hT}





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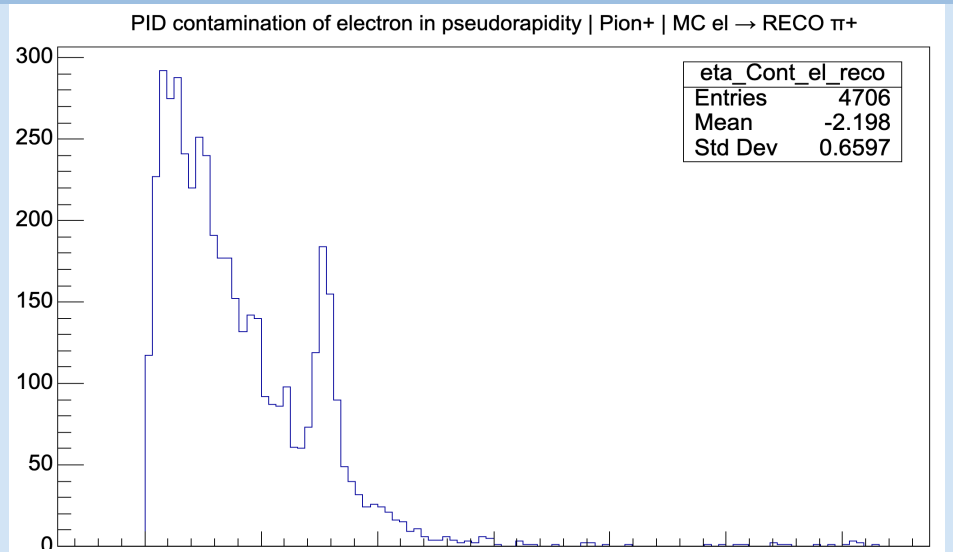
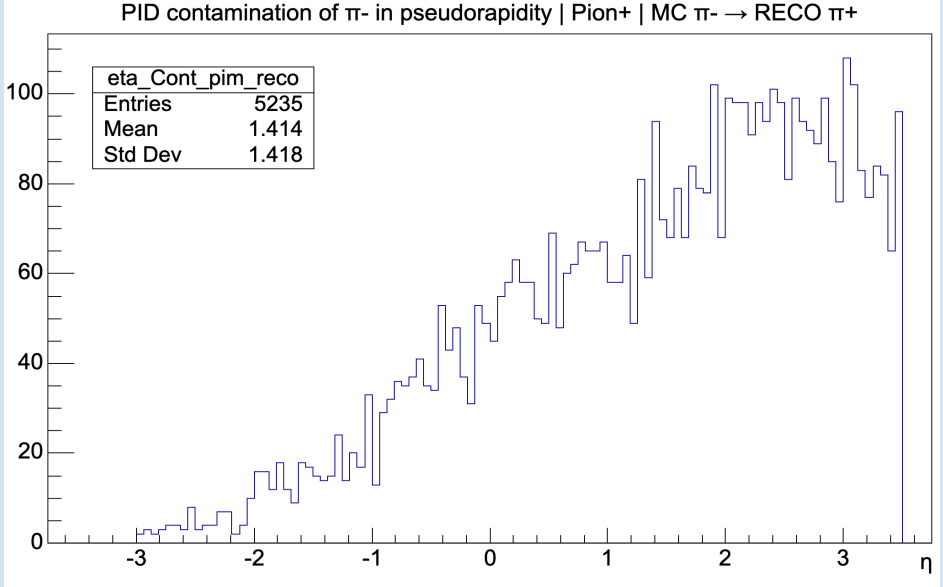
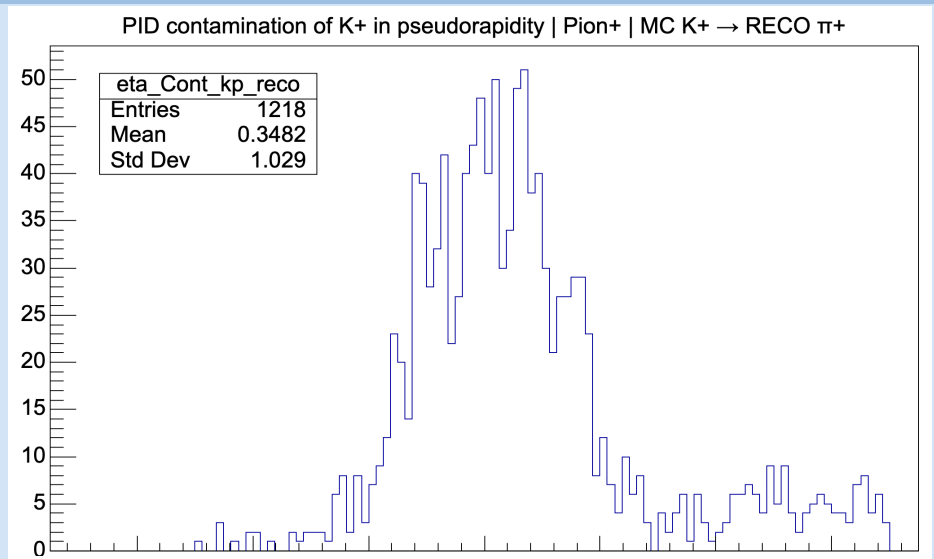
η CONTAMINATION DISTRIBUTION



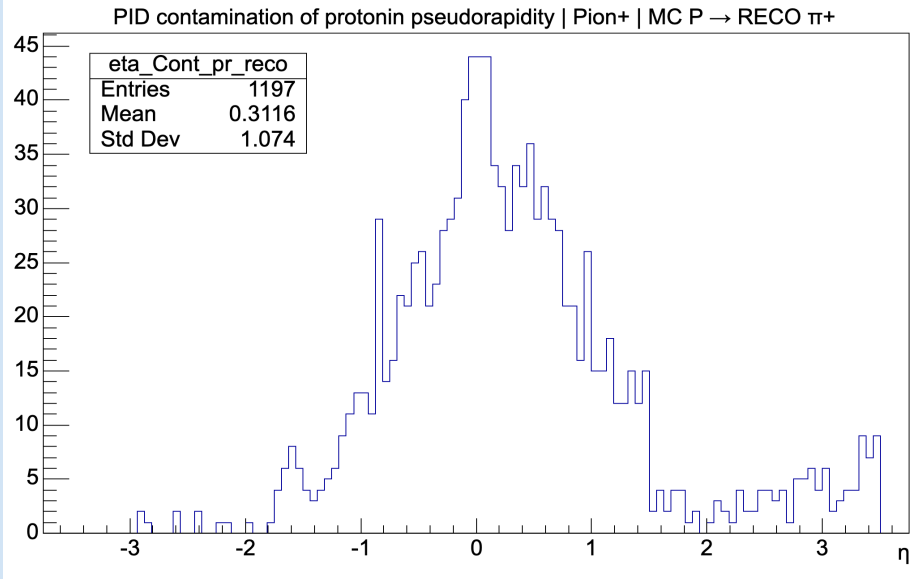
e^-



π^-



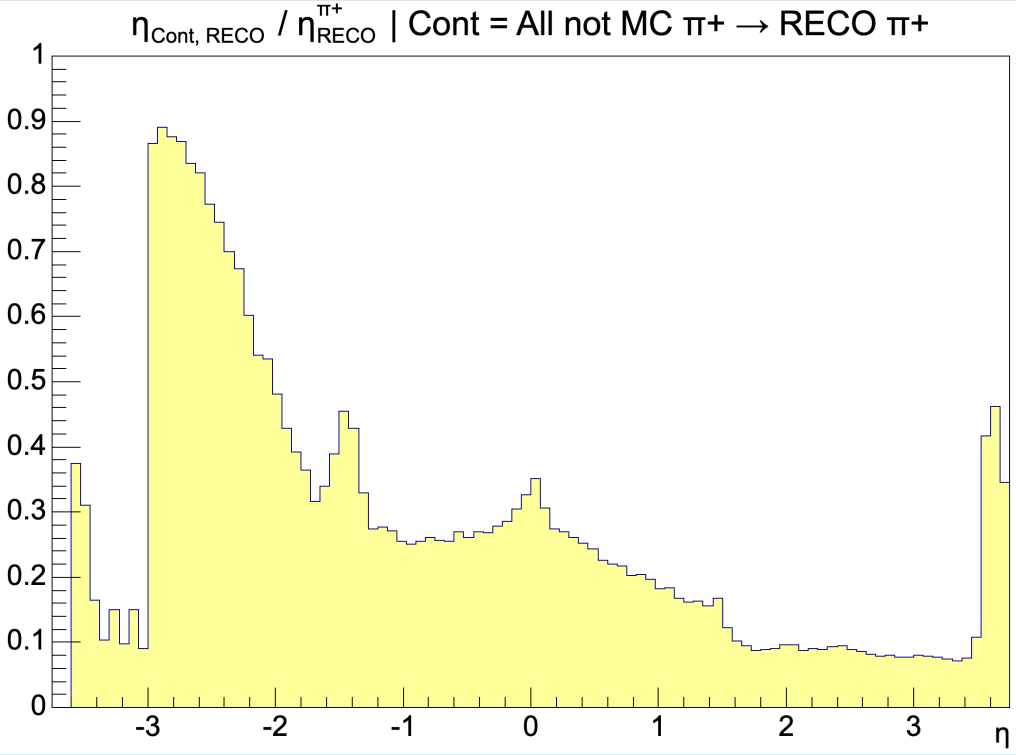
K^+



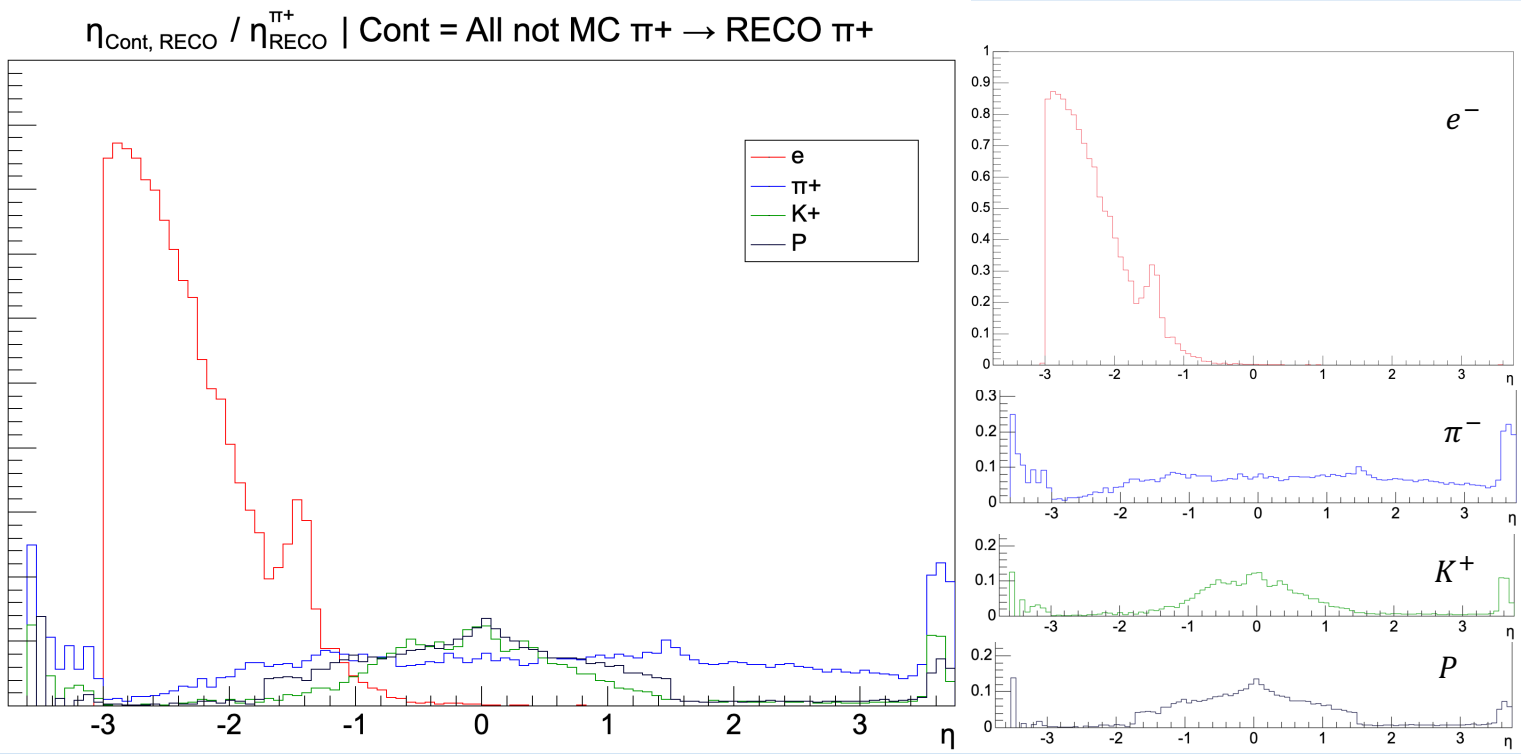
P

CONTAMINATION BEFORE THE PID CUT

Strong contamination of e^- in backward sector (Pf-RICH, Hp-DIRC) up to 90%!
Background contamination of π^- lesser than 10% in the all kinematic range. The central sector highlights some mis-identidication (10%) among $K^+ - \pi^+$ and $P - \pi^+$.



Contaminated fraction



Contaminated contributions

KINEMATIC EFFICIENCIES

HERE THE DISTRIBUTIONS ARE COMPLETELY OUT OF SCALE. USED OLNY TO DISPLAY THE DISTRIBUTION OF THE DATA!

From MC and RECO production we observe that the total efficiecy of MC π^+ correctly reconstructed as π^+ is about to $\mathbf{59.65\%}$.