

Light hadrons from $Xe+W$ @ 2.5 GeV (fixed target)

Natalia Kolomojets

LHEP, JINR

11.03.2024

Production 36: Xe+W, fixed target, $E_{\text{kin}} = 2.5$ GeV, UrQMD [500k events is presented here]

$$\sqrt{s_{NN}} = m_N \sqrt{2 \left(1 + \frac{E_{\text{Lab}}}{m_N} \right)}, \quad E_{\text{Lab}} = E_{\text{kin}} + m_N - \text{energy of projectile nucleon}$$

$$y_{\text{CM}} = y_{\text{Lab}} - \Delta y, \quad \Delta y = \frac{1}{2} \ln \frac{1 + \beta}{1 - \beta}; \quad \gamma = \frac{\sqrt{s_{NN}}}{2m_N} \Rightarrow \beta$$

$$E_{\text{kin}} = 2.5 \text{ GeV} \Rightarrow \sqrt{s_{NN}} = 2.87 \text{ GeV}; \quad \gamma = 1.53; \quad \beta = 0.76; \quad \Delta y = 0.986$$

MPDRoot setup

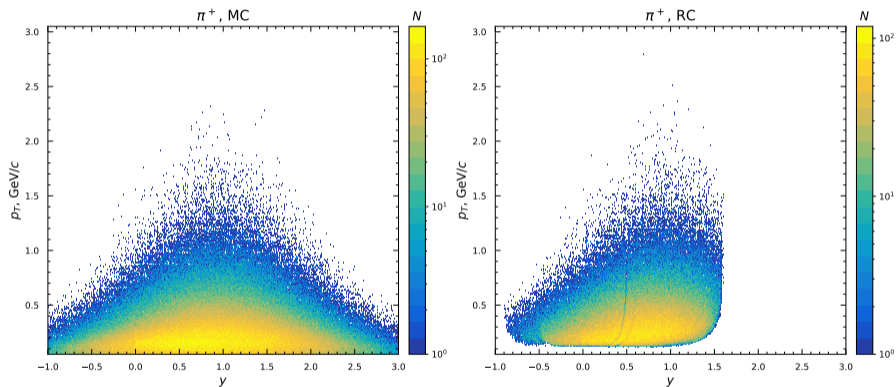
```
$ ls mpdroot/physics/pairKK/macros_FXT/  
DCAs_FXT.root          pPID.txt  
nTr_Centr_Req35-UrQMD.root  TrackRecEff_FXT.root  
pCentr.txt
```

```
MpdVertex *vertex //=  
    = (MpdVertex*)event.fVertex->First();  
if (vertex->GetZ() > mParams.mZvtxCut)  
    return;
```

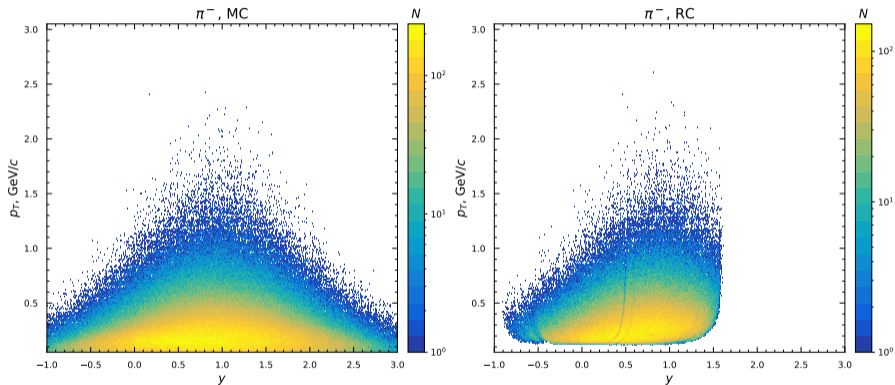
pHS.txt

```
#-----Parameters used for analysis-----  
# Abs[pdg] for considered particles:  
mAbsPDGs      211 321 2212  
# |sqrt{s_{NN}}|  
mSqrtSNN      2.8652 // [GeV]  
mGeneratorForPID  URQMD  
# Event selection:  
mZvtxCut      86 // cut on vertex z coordinate  
# Centrality binning  
mCentMin      0 10 20 30 40  
mCentMax      10 20 30 40 80  
# Track cuts:  
mNofHitsCut   27 // minimal number of hits for a track  
mDCAMax       1.0 // maximal |DCA|  
#  
mUseELC       true  
# Pt for histos  
mPtMin        0.05 // minimal pt for a track  
mPtMax        3.05 // maximal pt for a track  
mPtWidth      0.01 // GeV  
# Rapidity for histos  
mRapMin       -1.0  
mRapMax       3.0  
mRapWidth     0.01  
# PID cuts:  
mSigE         3.0 // nSigmas for dE/dx  
mSigB         3.0 // nSigmas for the average beta
```

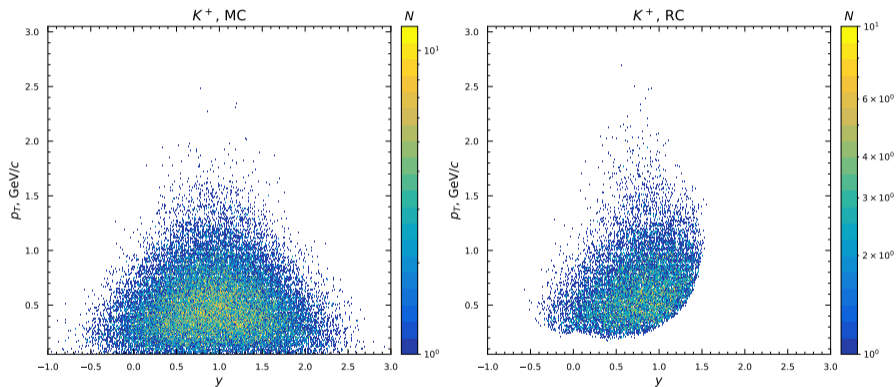
Phase Spaces: π^+



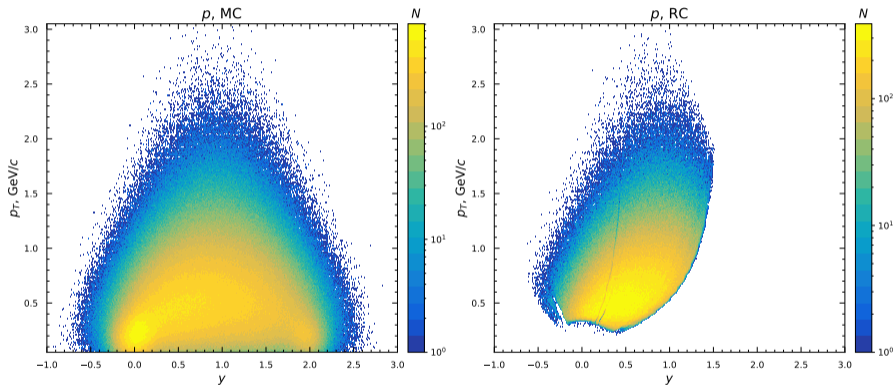
Phase Spaces: π^-



Phase Spaces: K^+



Phase Spaces: p



(y-pt) distribution, efficiency and δp_T (Xe+W)

$$\text{eff} = \frac{\frac{dN}{dydp_T}(\text{reco})}{\frac{dN}{dydp_T}(\text{sim})}$$

$$\Delta p_T = \frac{|p_T^{\text{reco}} - p_T^{\text{mc}}|}{p_T^{\text{mc}}}$$

protons

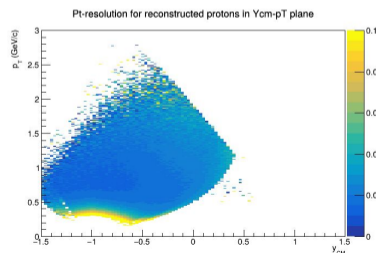
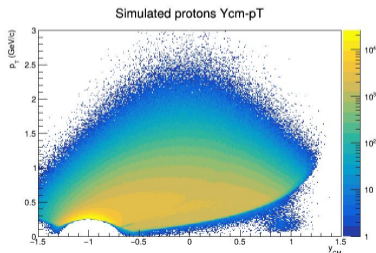
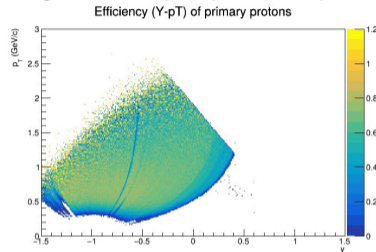
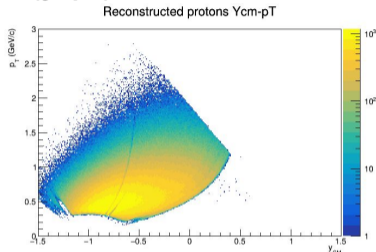
Xe+W T=2.5A GeV

Cuts for reco tracks:

- Nhits>27
- DCA< 1 cm
- PID (dEdx+TOF)

Cuts for sim particles:

- PID (pdg code)
- Primary (motherId)



Efficiencies & Contaminations

Total correction:

$$W = \frac{\prod_i \text{Eff}_i}{\prod_j (1 - \text{Cont}_j)}$$

$$W = W[\text{TPC}, \text{TOF}, \text{PRIM}, \text{PID}, \text{CELL}] = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLRC}]}{N_{\text{MC}}[\text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{TPC}_{\text{eff}} = \frac{N_{\text{RC}}[\text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}{N_{\text{MC}}[\text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{TOFMC}_{\text{eff}} = \frac{N_{\text{RC}}[\text{TOFMC}, \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{TOF}_{\text{eff}} = \frac{N_{\text{RC}}[\text{TOFRC} \& \text{TOFMC}, \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFMC}, \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{TOF}_{\text{cont}} = \frac{N_{\text{RC}}[\text{TOFRC} \& (!\text{TOFMC}), \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{Sec}_{\text{eff}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC} \& \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMMC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{Sec}_{\text{cont}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC} \& (!\text{PRIMMC}), \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{PID}_{\text{eff}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC} = \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDMC}, \text{CELLMC}]}$$

$$\text{PID}_{\text{cont}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC} \neq \text{PIDMC}, \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLMC}]}$$

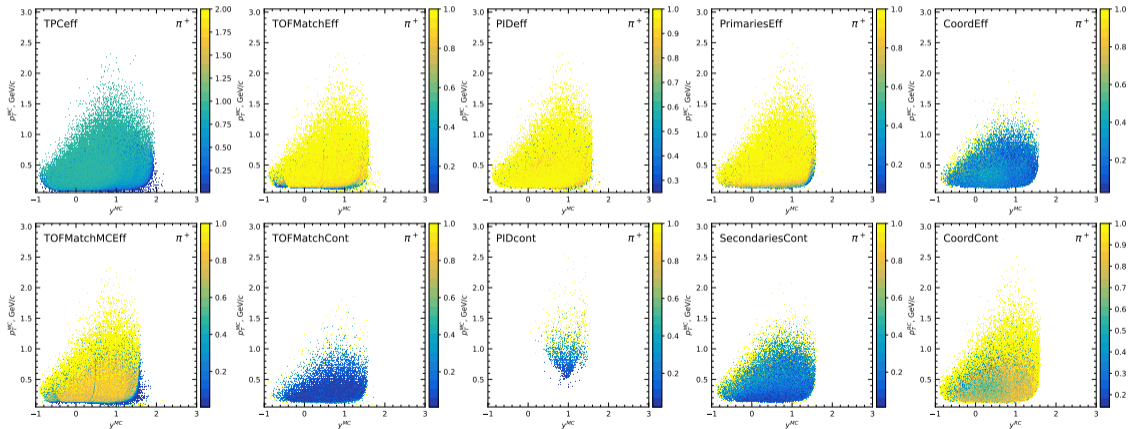
$$\text{CELL}_{\text{eff}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLRC} = \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLMC}]}$$

$$\text{CELL}_{\text{cont}} = \frac{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLRC} \neq \text{CELLMC}]}{N_{\text{RC}}[\text{TOFRC}, \text{PRIMRC}, \text{PIDRC}, \text{CELLRC}]}$$

$A \cdot \varepsilon$, Purity



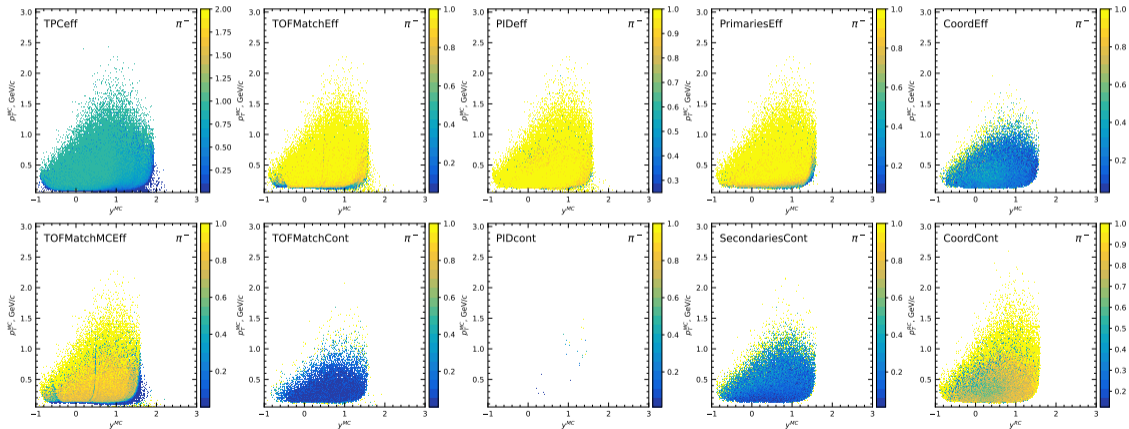
Additional corrections



$A \cdot \varepsilon$, Purity



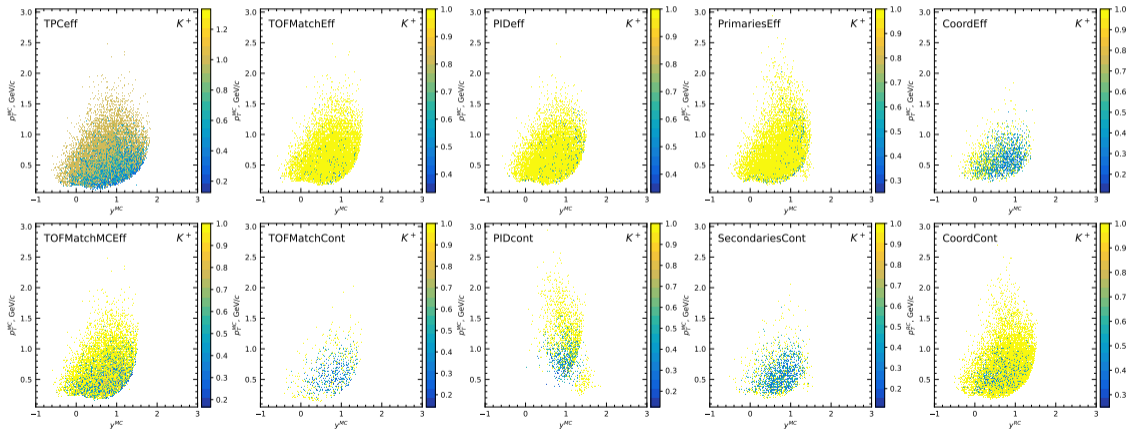
Additional corrections



$A \cdot \epsilon$, Purity



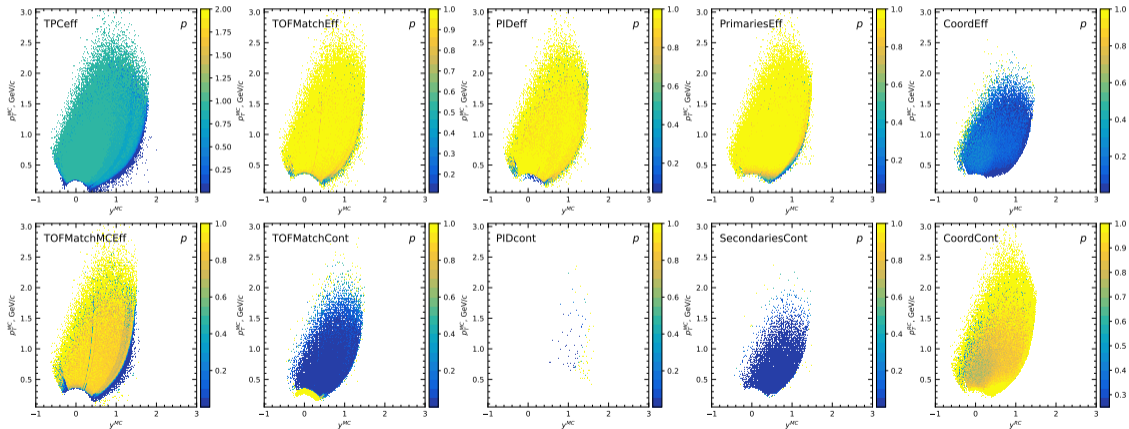
Additional corrections



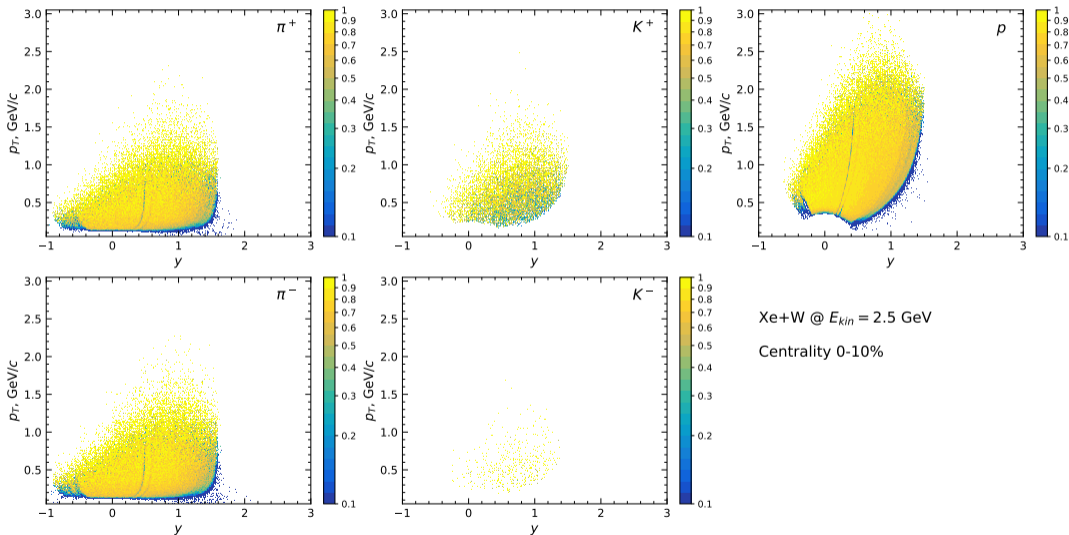
$A \cdot \epsilon$, Purity



Additional corrections



PID efficiency



Amount of events in centrality bins

Centrality bins: 0-10%, 10-20%, 20-30%, 30-40%, 40-80%

Bi+Bi @ 9.2 GeV [18k events]:

Before ZvtxCut: $3272 + 2619 + 2846 + 2584 + 6438 = 17759 \sim 18k$

After ZvtxCut: $3217 + 2568 + 2790 + 2544 + 6324 = 17443$

Xe+W @ 2.5 GeV [500k events]:

Before ZvtxCut: $41249 + 37081 + 34428 + 34731 + 147189 = 294678 < 500k$

After ZvtxCut: the same as before ZvtxCut

Is it OK?

