Medium-induced modification of kaons spectra measured in semi-inclusive DIS at HERMES

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(on behalf of the HERMES collaboration)

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Outline

- ✓ Theoretical motivation
- ✓ Data selection
- ✓ Results
- ✓ Summary

Theoretical motivation

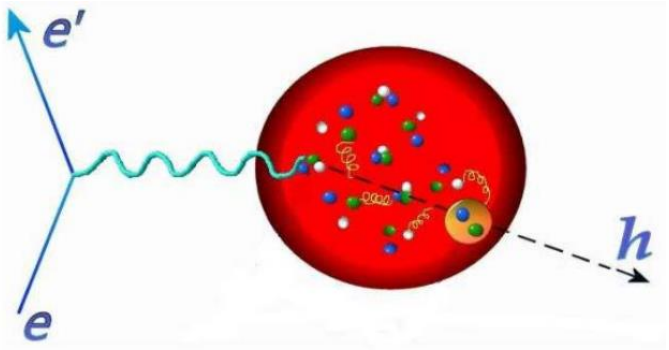
How K^- can form ?

$K^-(\bar{u}s)$ ⟶

a. Valence quark (u, d) shower evolution

b. Sea quarks ($\bar{u}s$)

How K^- spectra can enhance ?



Medium-induced flavor conversion (large x_{Bj} & z)!

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Introduction & Theoretical motivation

Nuclear Modification Factor

The nuclear modification factor for a hadron spectra is defined in term of ratio of hadron yields per DIS event for a nuclear target A to this for a deuterium target D.

$$R^h_{A/D}(x_{Bj}, z, p_t^2, \dots) = \frac{\left(\frac{N^h(x_{Bj}, z, p_t^2, \dots)}{N^e(x_{Bj}, z, p_t^2, \dots)}\right)_A}{\left(\frac{N^h(x_{Bj}, z, p_t^2, \dots)}{N^e(x_{Bj}, z, p_t^2, \dots)}\right)_D}$$

x_{Bj}: fraction of the nucleon's momentum carried by the struck quark (Bjorken variable)

z : hadron fractional energy

p_t : transverse momentum of produced hadrons

N^e: number of DIS electrons

N^h: number of SIDIS (Semi Inclusive Deep Inelastic Scattering) hadrons

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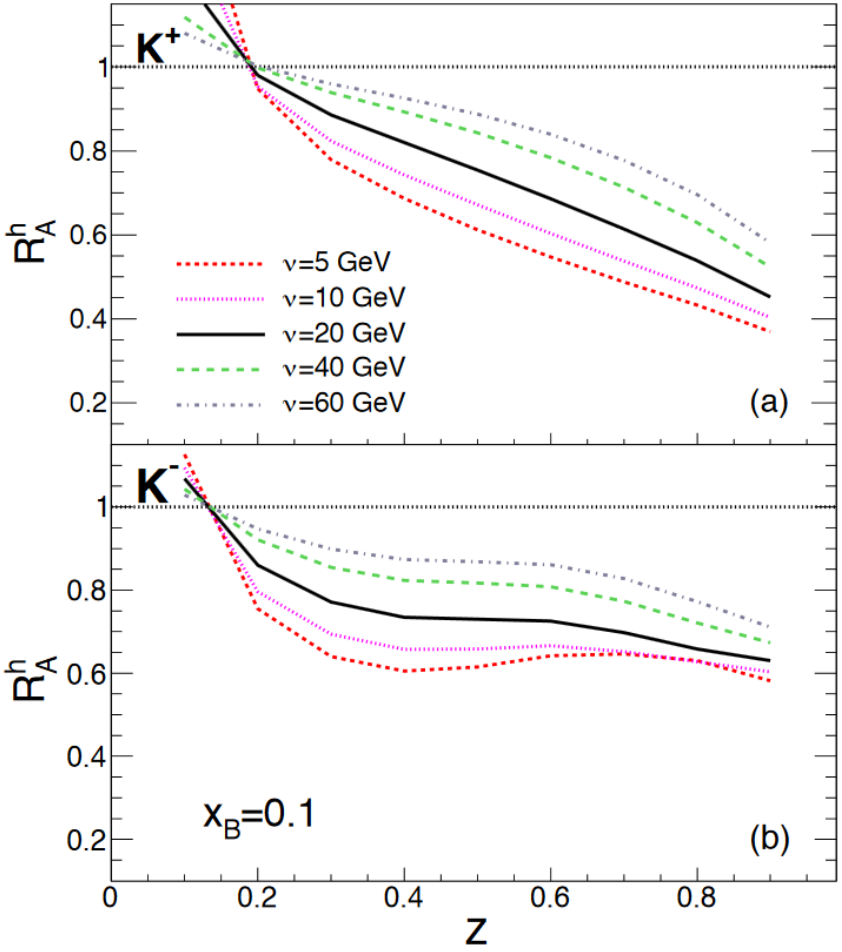
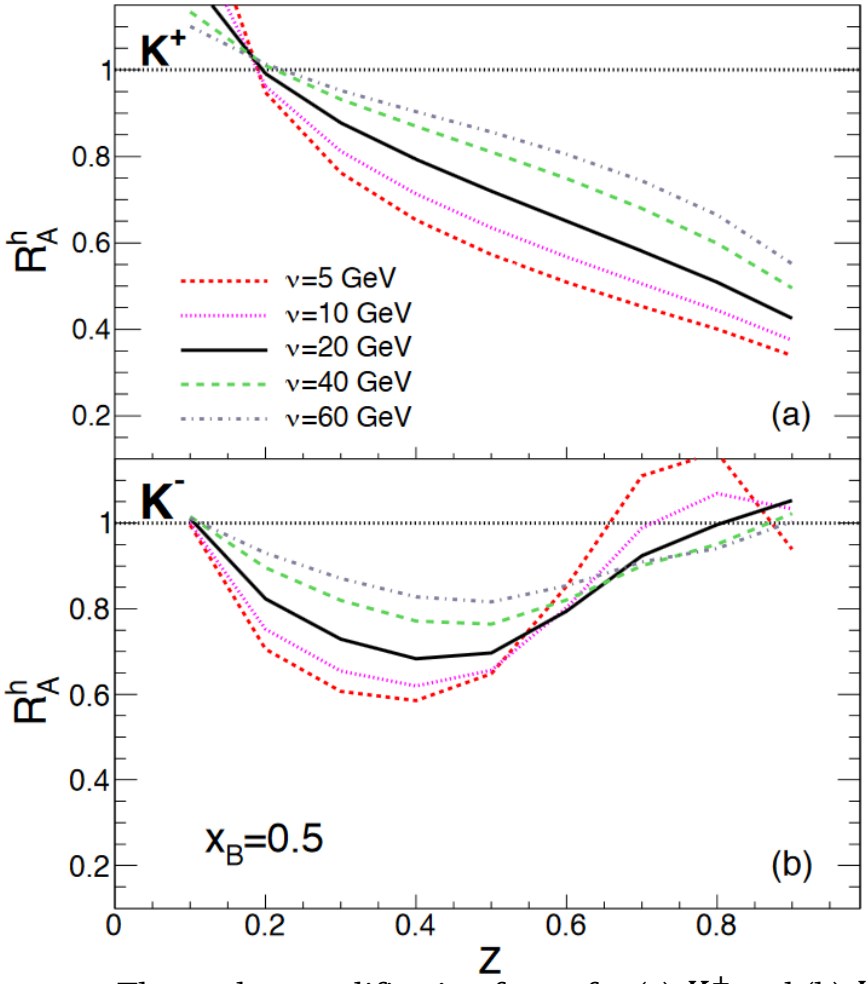
Theoretical prediction

Medium-induced flavor conversion and kaon spectra in electron-ion collisions Ning-Bo Chang, Wei-Tian Deng and Xin-Nian Wang, Nov. 25, 2014; Phys. Rev. **C92** (2015) no.5, 055207

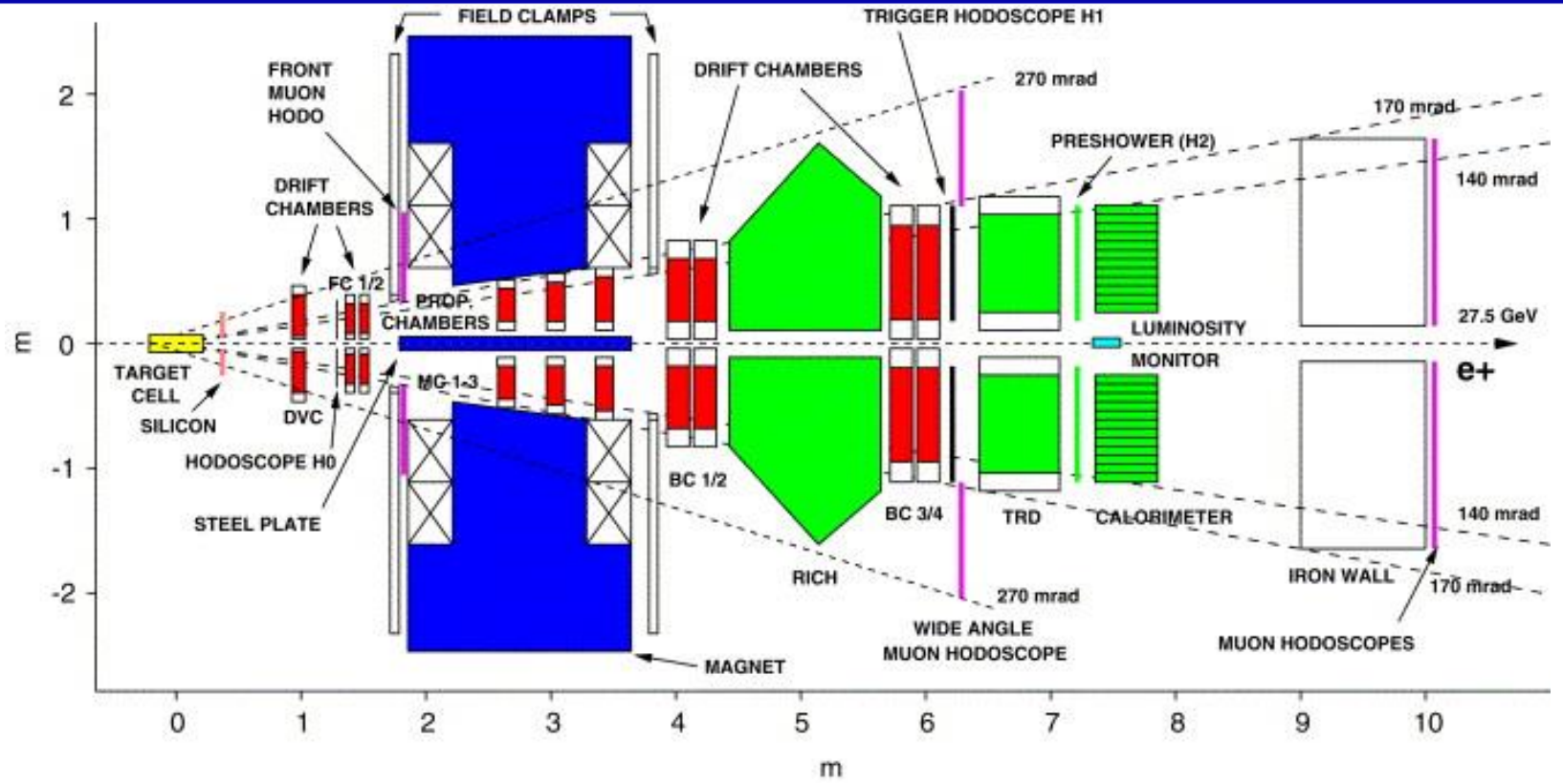


The nuclear modification factor for (a) K^+ and (b) K^- for different initial quark energy in SIDIS at x_{Bj}= 0.1



The nuclear modification factor for (a) K^+ and (b) K^- for different initial quark energy in SIDIS at x_{Bj}= 0.5

HERMES spectrometer



Beam energy (e^+, e^-) 27.5$[GeV]$

Geometric acceptance: ± 170 mrad horizontal plane and 40-140 mrad vertical plane

Momentum resolution: $\Delta p/p \sim 0.7\text{-}1.7\%$

Angular resolution: $\Delta\theta/\theta \sim 0.5\%$

Targets (pure gaseous): H, D, Ne, Kr, Xe

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Data Selection

Targets: D, Ne, Kr and Xe

Data selection

- ✓ $Q^2 > 1[GeV^2]$; $W^2 > 10[GeV^2]$
- ✓ $2 < p_h < 15\ [GeV]$
- ✓ x_{Bj}: $0.023 < 0.1$; $0.1 - 0.15$; $0.15 - 0.25$; $0.25 - 0.35$; $0.35 - 0.41$
- ✓ z : $0.2 - 0.3$; $0.3 - 0.4$; $0.4 - 0.55$; $0.55 - 1.2$

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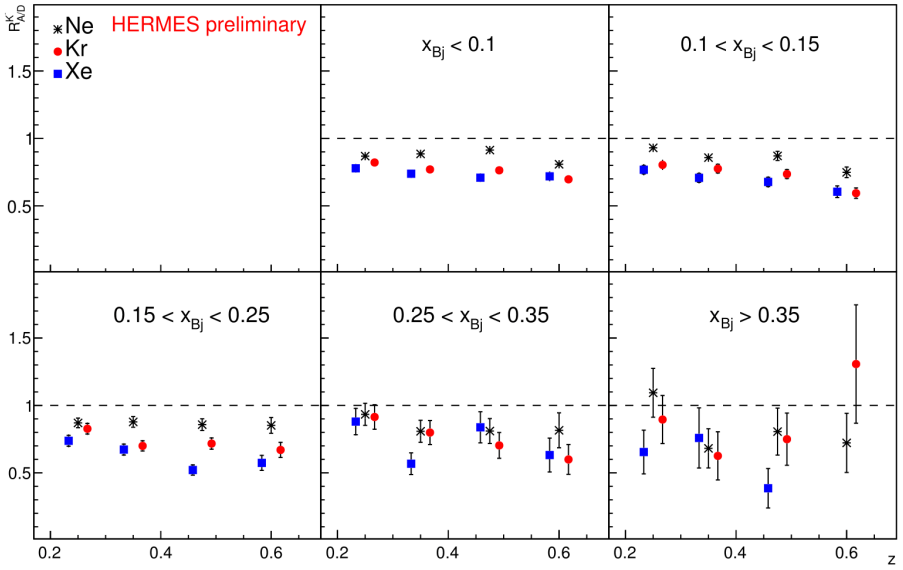
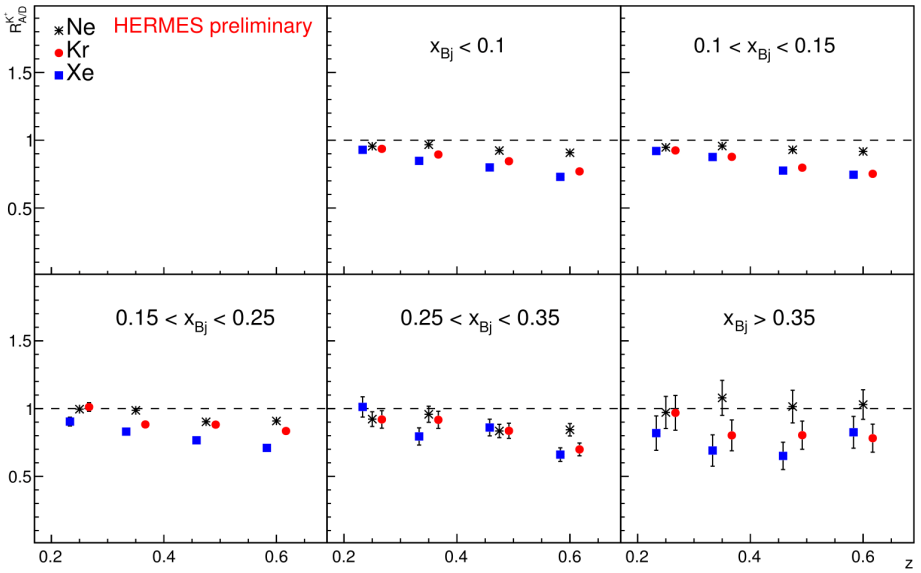
Results



The $R_{A/D}^{K^-}(z)$ ratios at five x_{Bj} slices for negatively charged kaons



The $R_{A/D}^{K^+}(z)$ ratios at five x_{Bj} slices for positively charged kaons

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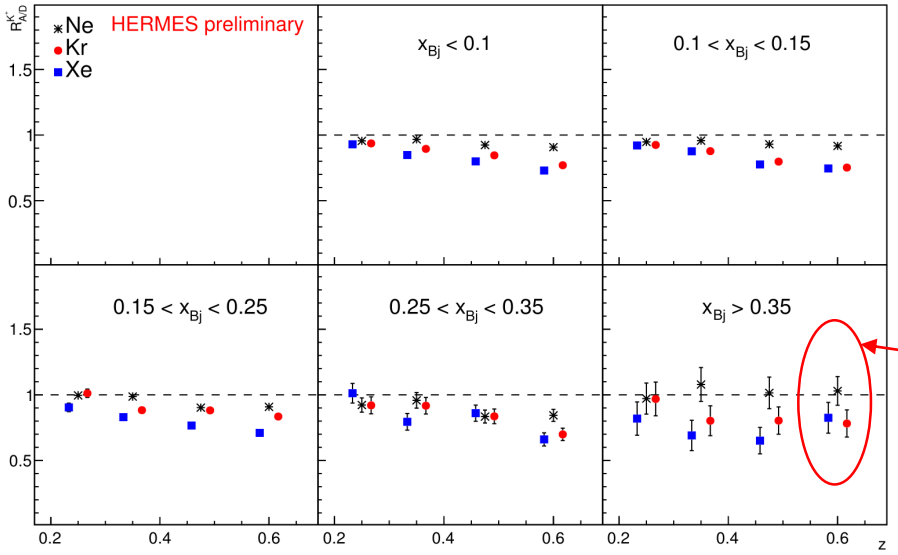
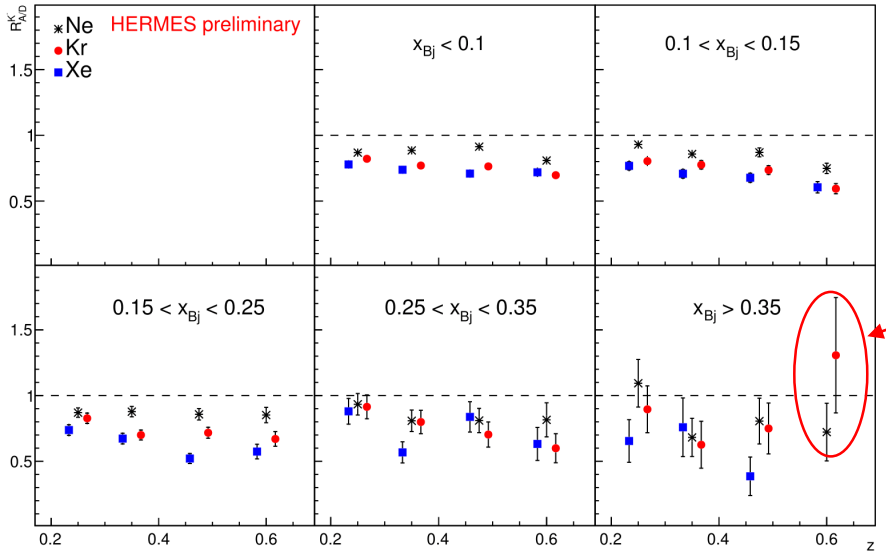
Results


Ne
Kr
Xe
HERMES preliminary
$x_{Bj} < 0.1$
$0.1 < x_{Bj} < 0.15$
$0.15 < x_{Bj} < 0.25$
$0.25 < x_{Bj} < 0.35$
$x_{Bj} > 0.35$
z


Ne
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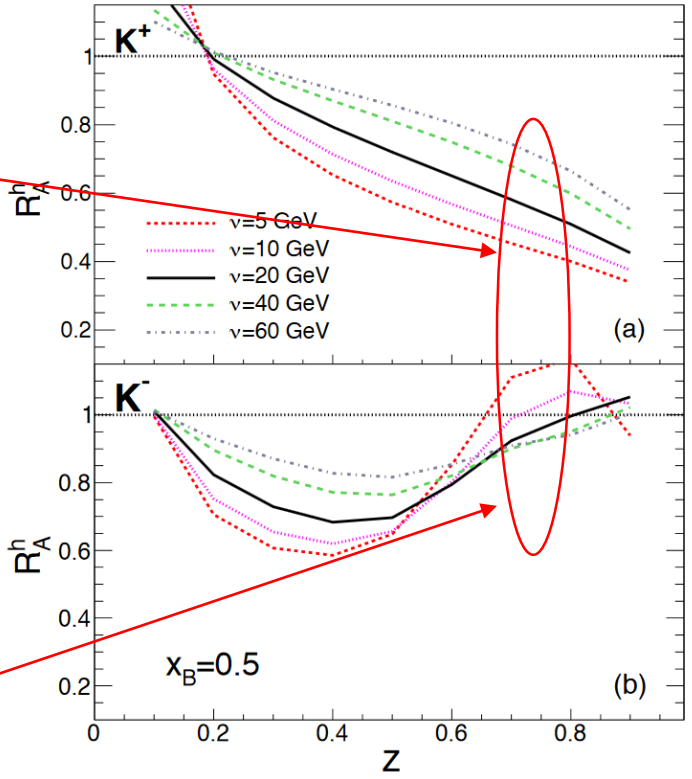
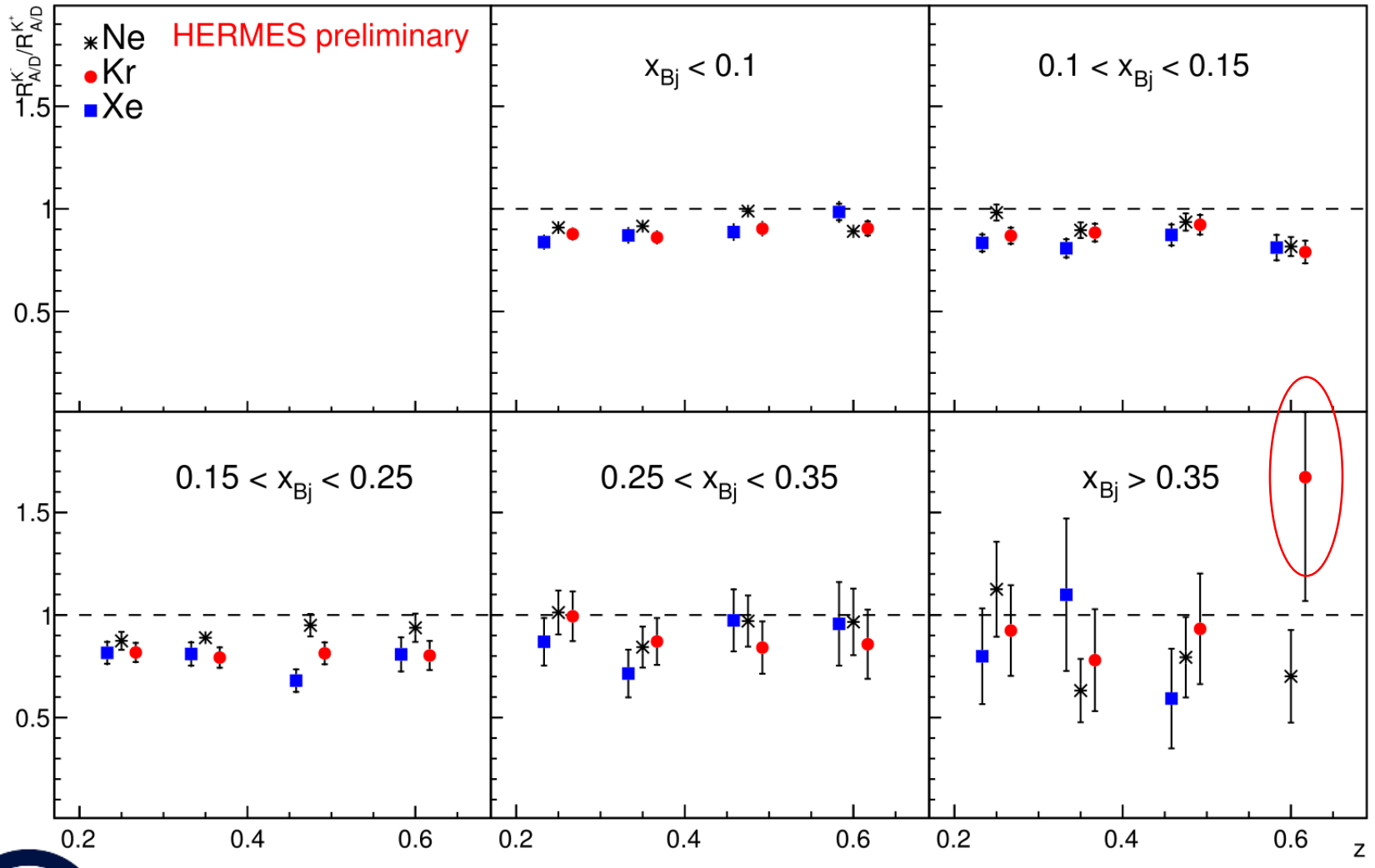
$0.25 < x_{Bj} < 0.35$
$x_{Bj} > 0.35$
z


K^+
K^-
R_A^h
ν=5 GeV
ν=10 GeV
ν=20 GeV
ν=40 GeV
ν=60 GeV
(a)
(b)
x_B=0.5
z

Results



$R^{K^-}_{A/D} \Big/ R^{K^+}_{A/D}$ (z) ratio for chrged kaons

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Summary

- ✓ For K^- in case of Kr target at x_{Bj} greater than 0.35 certain indication of enhancement of the $R_{A/D}^{K^-}(z)$ with the increasing of z is observed.

- ✓ Super ratio $R_{A/D}^{K^-} \Big/ R_{A/D}^{K^+}$ at highest z and x_{Bj} becomes even greater than unity for Kr.

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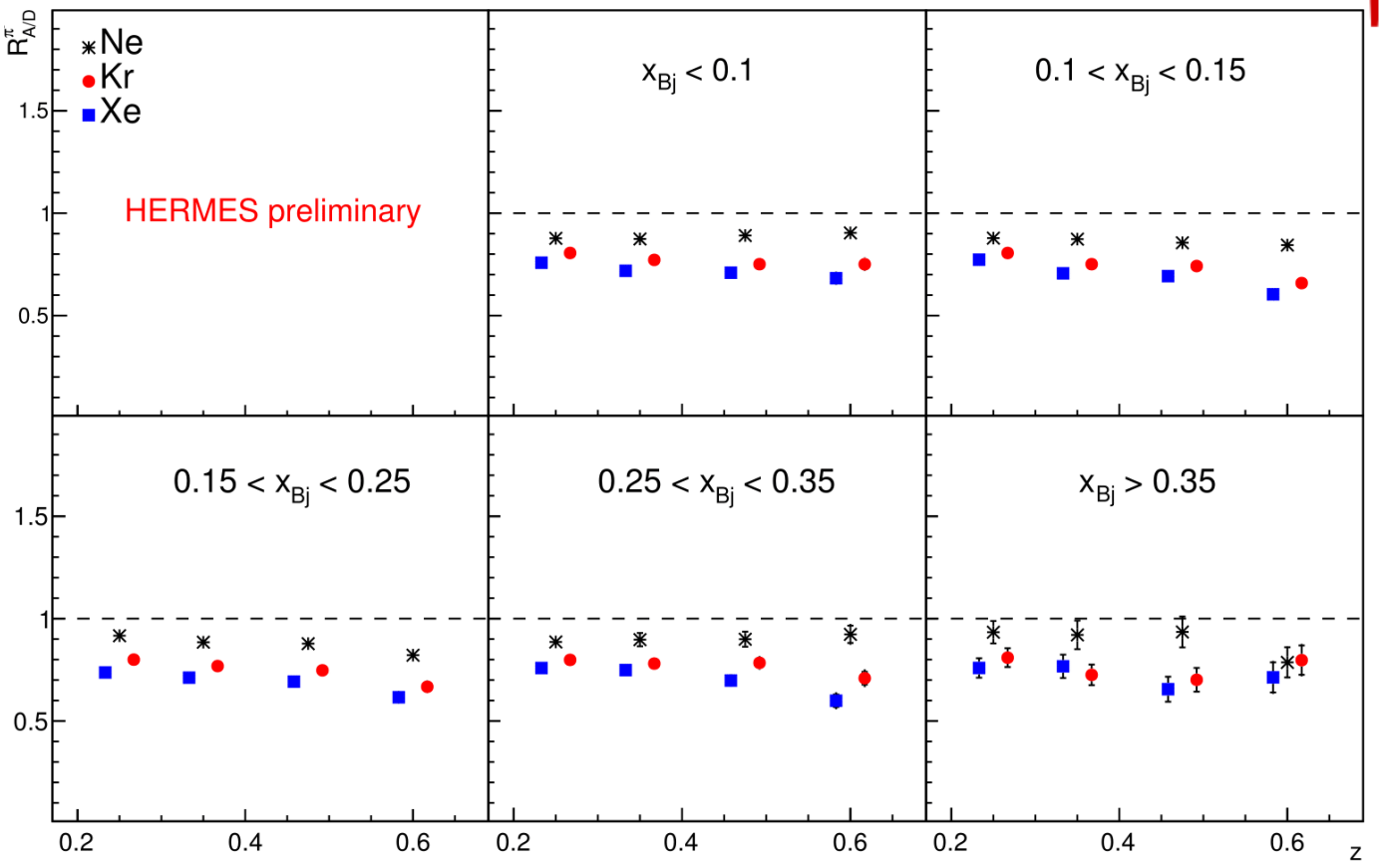
Thank you for your attention !

$R_{A/D}^{\pi^-}$



The $R_{A/D}^{\pi^-}(z)$ ratios at five x_{Bj} slices for negativly charged pions

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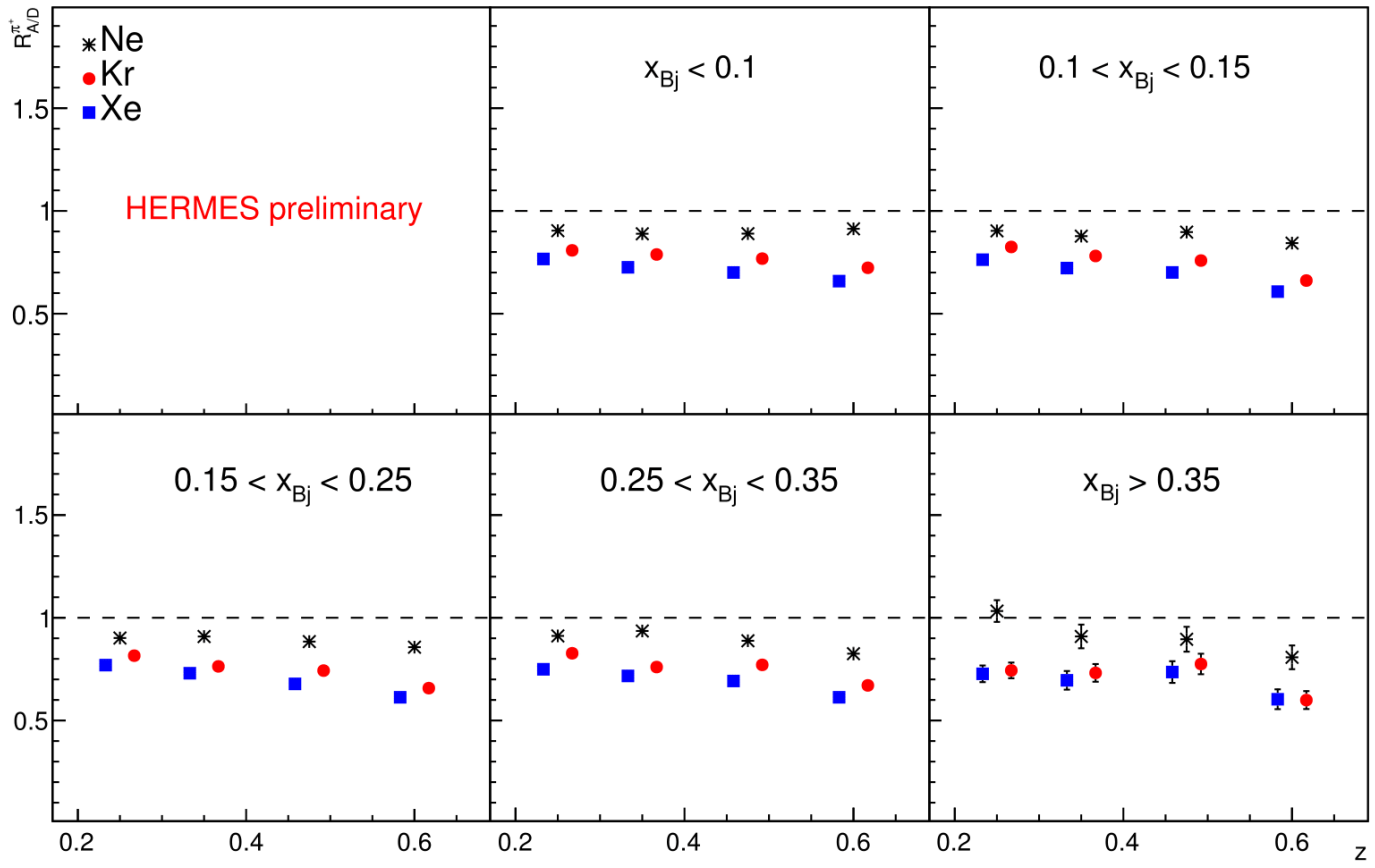

The $R_{A/D}^{\pi^+}(z)$ ratios at five x_{Bj} slices for positively charged pions

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