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Multidimensional Dependences of Nuclear Attenuation

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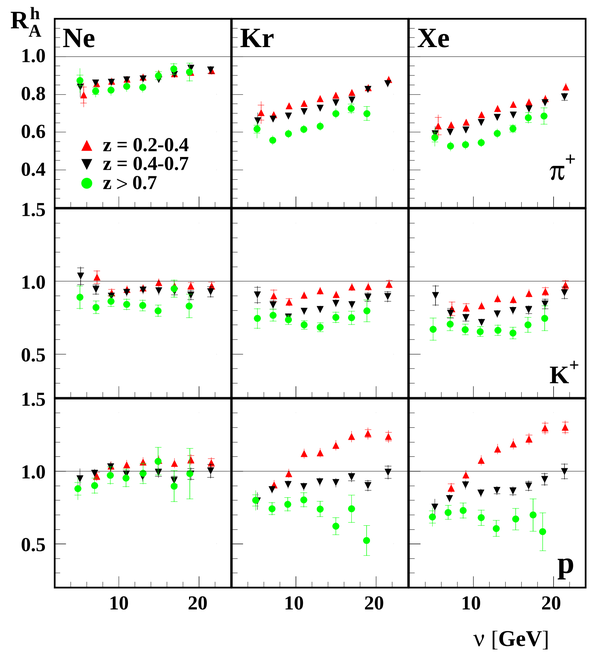
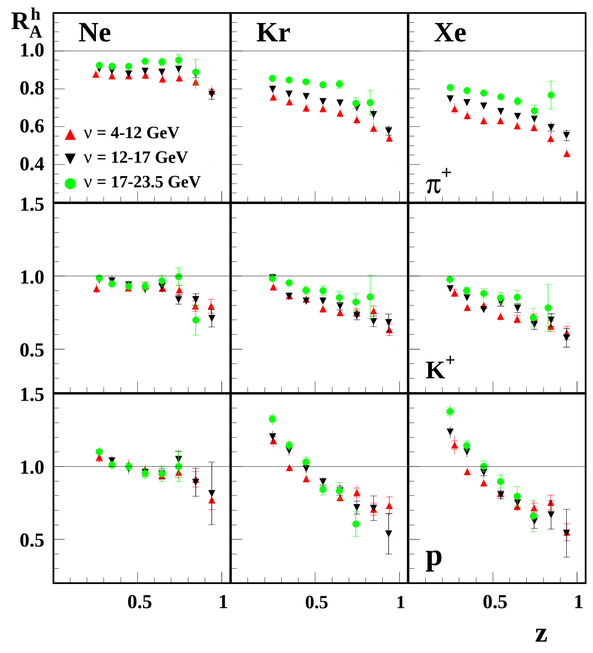
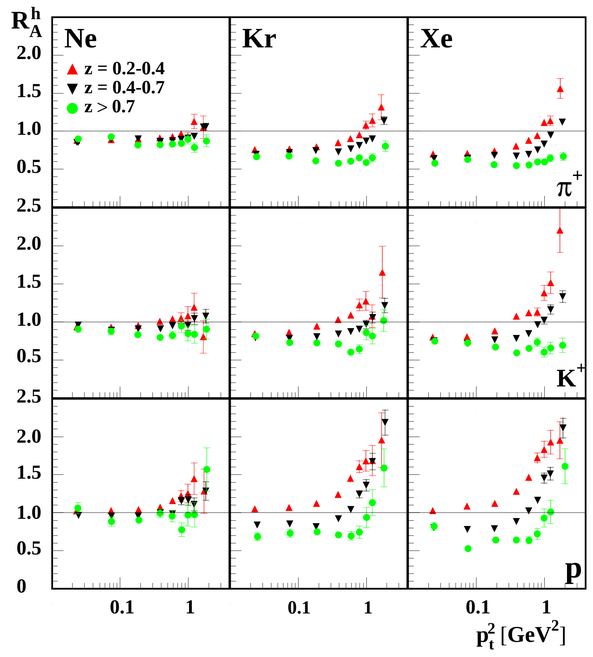


Dependence of R_A^h on ν for positively charged hadrons for three slices in z (scale uncertainties are 3%, 5% and 4% for pions, kaons and protons, respectively).



Dependence of R_A^h on z for positively charged hadrons for three slices in ν.



Dependence of R_A^h on p_t^2 for positively charged hadrons for three slices in z.

- **As a global trend, R_A^h increases (decreases) with increasing values of ν (z)**
- **R_A^h decreases with increasing value of the mass number A of the nucleon**
- **Protons behave very differently from the other hadrons (knock-out processes?)**

- **Semi-inclusive hadron production**
  - **$e + p \to e' + h + X$**

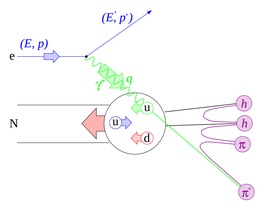
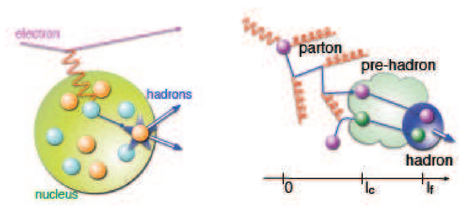


Diagram of Semi-Inclusive Deep-Inelastic Scattering.

- $\nu = E - E'$ **- energy of a virtual photon**
- $Q^2 = -q^2 = -(k - k')^2$ **- negative squared four momentum transfer**
- p_t^2 **- transverse momentum square of a hadron**
- $z = \frac{E_{had}}{\nu}$ **- energy fraction of a hadron**

- **$e + A \to e' + h + X$**

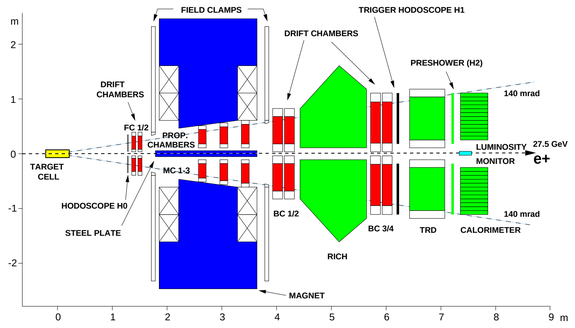


Schematic view of nuclear deep-inelastic scattering(left) and the hadronization process in the nucleus(right).

$$R_A^h(\nu, Q^2, z, p_t^2) = \frac{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_A}{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_D} \qquad (1)$$

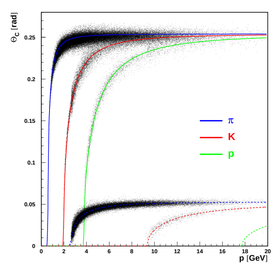
- $N^h(\nu, Q^2, z, p_t^2)$ **- number of semi-inclusive hadrons in a given (ν, Q^2, z, p_t^2) bin**
- $N^e(\nu, Q^2)$ **- number of inclusive deep inelastic scattered leptons in the same (ν, Q^2) bin**

- **Formation length by Lund model $L_c \sim \nu(1 - z)/k$ $k \sim 1 GeV/fm$**



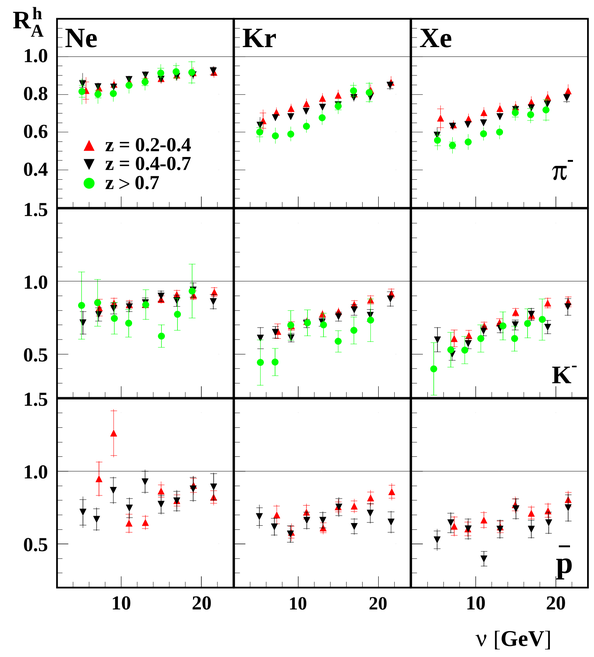
The **HERMES** spectrometer.

- **e^-/e^+ beam of energy $27.6\,GeV$**
- **Nuclear targets $^2D, ^{20}Ne, ^{84}Kr, ^{131}Xe$**
- **Particle Tracking System**
- **Good momentum resolution $\Delta p/p < 2\%$**
- **Particle Identification System**

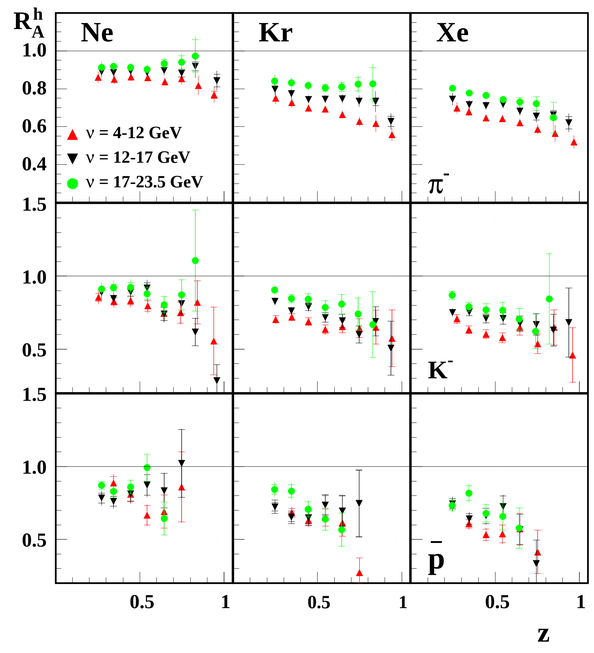


Momentum dependence of the Cherenkov angle for different hadron types and radiators. The upper band corresponds to the aerogel and the lower band to the C_4F_{10} gas respectively.

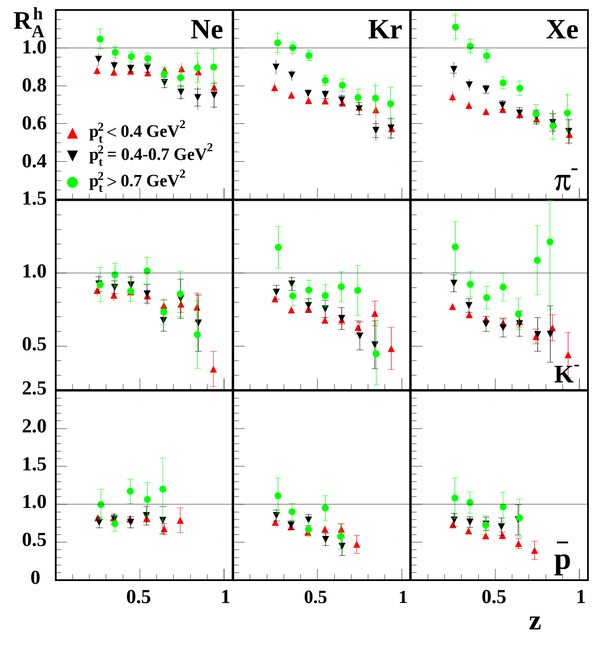
- **Excellent particle identification capabilities for $\pi^+, \pi^-, K^+, K^-, p, \bar{p}$**
- **Separation of charged particles in momentum range of $2 - 15\,GeV$**



Dependence of R_A^h on ν for negatively charged hadrons for three slices in z(scale uncertainties are 3%, 5% and 10% for pions, kaons and antiprotons, respectively).



Dependence of R_A^h on z for negatively charged hadrons for three slices in ν.



Dependence of R_A^h on z for negatively charged hadrons for three slices in p_t^2.

- **The dependences of π^- and K^- on ν and z are similar to π^+**
- **Cronin effect is suppressed for large z**
- **The 2D HERMES data will constrain theoretical models**