Multidimensional hadron attenuation

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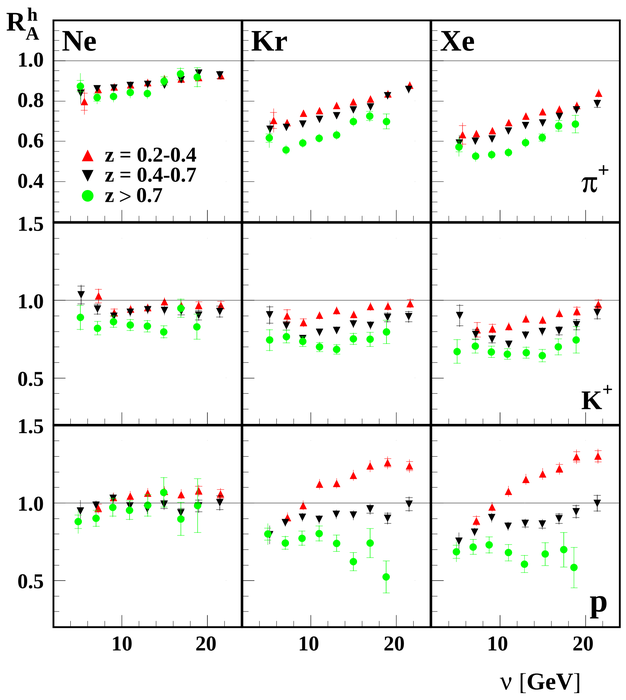
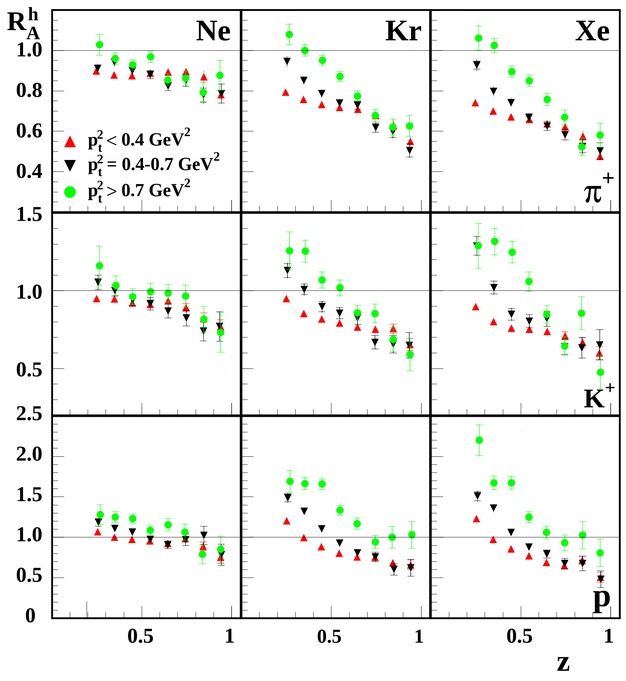
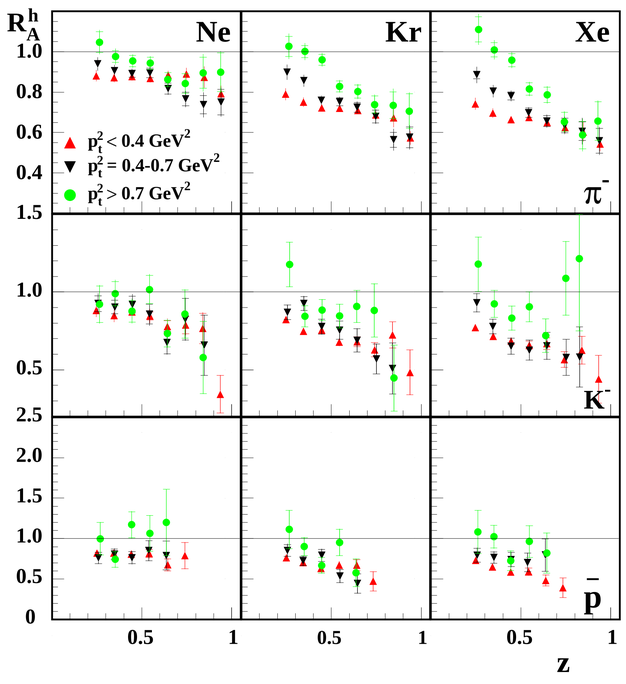


Dependence of R_A^h on ν for positively charged hadrons for three slices in z (scale uncertainties are 3%, 5%, 4%, and 10% for π, K, p, and $\bar{p}$ respectively).



Dependence of R_A^h on z for positively charged hadrons for three slices in the hadron's transverse momentum.



Dependence of R_A^h on z for negatively charged hadrons for three slices in the hadron's transverse momentum.

- **Attenuation is larger for heavy nuclei**
- **Protons behave very differently from the other hadrons**

- **Semi-inclusive hadron electroproduction process**

$$\mathbf{e + N \rightarrow e' + h + X}$$

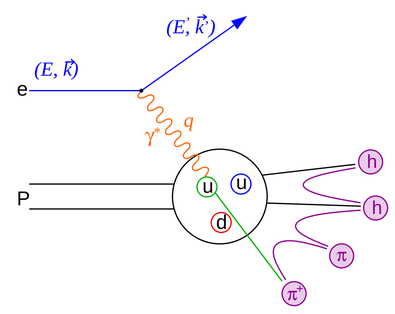
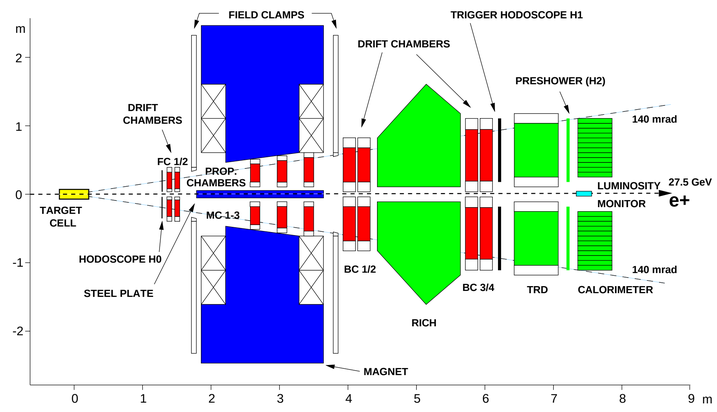


Diagram of semi-inclusive deep inelastic scattering.

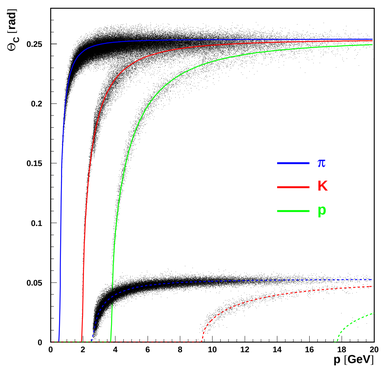
$$\mathbf{R_A^h(\nu, Q^2, z, p_t^2) = \frac{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_A}{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_D}} \qquad (1)$$

- $\mathbf{N^h(\nu, Q^2, z, p_t^2)}$ - number of semi-inclusive hadrons in a given (ν, Q^2, z, p_t^2) bin
- $\mathbf{N^e(\nu, Q^2)}$ - number of inclusive deep inelastic scattered leptons in the same (ν, Q^2) bin
- $\nu = \mathbf{E - E'}$ - energy of a virtual photon
- $\mathbf{Q^2 = -q^2 = -(k - k')^2}$ - negative squared four momentum transfer
- $\mathbf{p_t^2}$ - transverse momentum square of a hadron
- $\mathbf{z = \frac{E_{had}}{\nu}}$ - energy fraction of a hadron
- $\mathbf{e^-/e^+}$ **beam of** $\mathbf{27.6\,GeV}$ **energy**
- **Nuclear targets** ^{2}D,^{20}Ne,^{84}Kr,^{131}Xe
- **Good momentum resolution(** $\Delta p/p < 2\%$ **)**
- **Excellent particle identification capabilities**



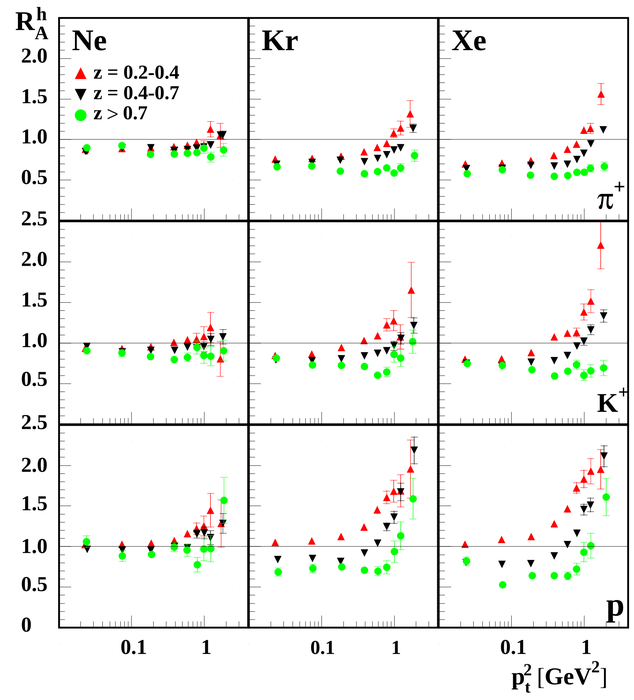
The **HERMES** spectrometer.

- **Particle Tracking System**
- **Particle Identification System**

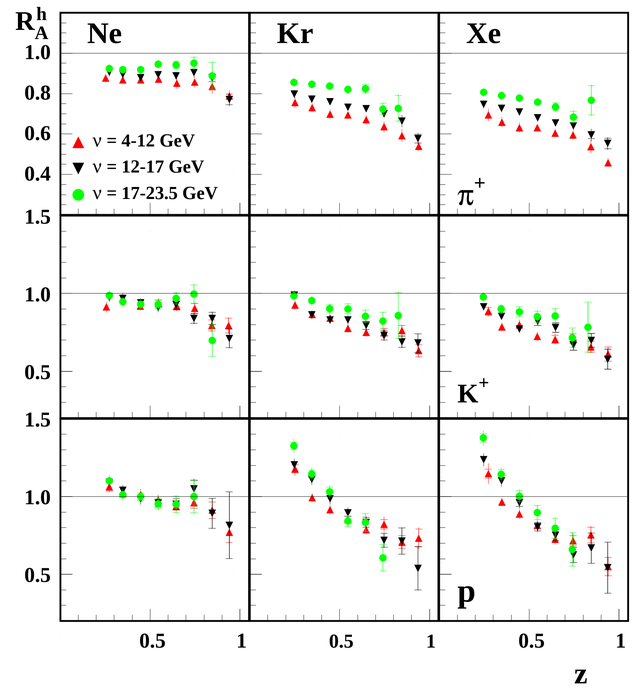


Momentum dependence of the Cherenkov angle for different hadron types and radiators. The upper band corresponds to aerogel and the lower band to C_4F_{10} gas respectively.

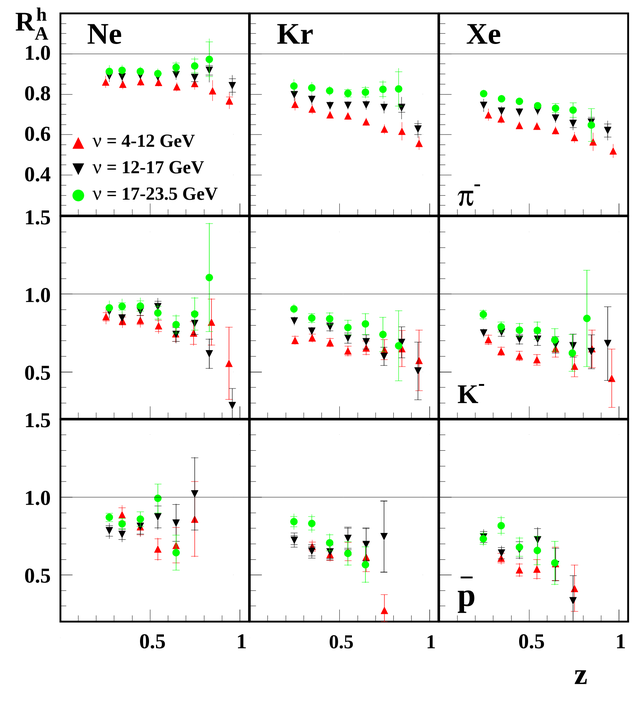
- **Charge-separated** $\pi, \mathbf{K}, \mathbf{p}$
- **Separation of** $\pi, \mathbf{K}$ **and** $\mathbf{p}$ **in momentum range of** $\mathbf{2 - 15\,GeV}$



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



Dependence of R_A^h on z for positively charged hadrons for three slices in the energy of the virtual photon.



Dependence of R_A^h on z for negatively charged hadrons for three slices in the energy of the virtual photon.

- **Cronin effect suppressed at large** z
- **Less attenuation with larger** ν **and small** z