

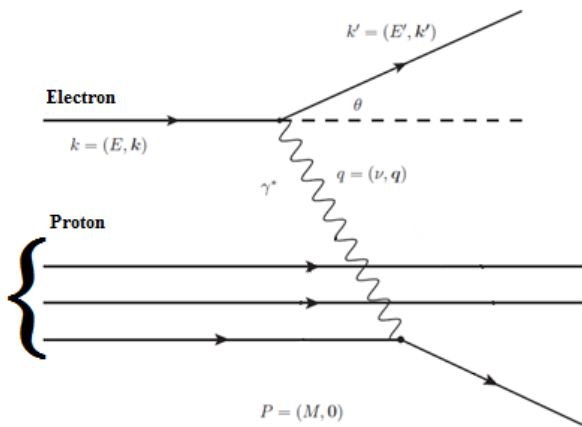
Aerogel RICH for HERMES at DESY, Hamburg, Germany

Introduction

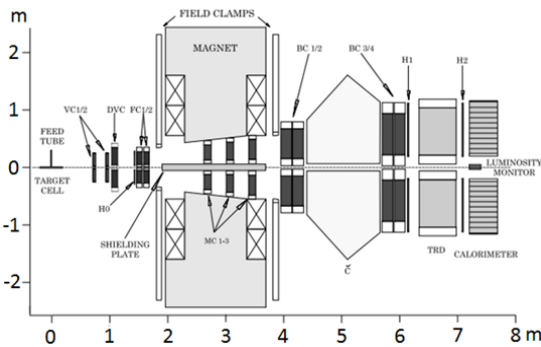
The HERMES experiment is the first application of aerogels as a RICH (Ring Imaging Cerenkov Detector) radiator material. This material was produced in Japan.



The collision studied is an electron – proton deep inelastic scattering using a beam energy of 27.5 GeV. Shown below is the Feynman diagram.



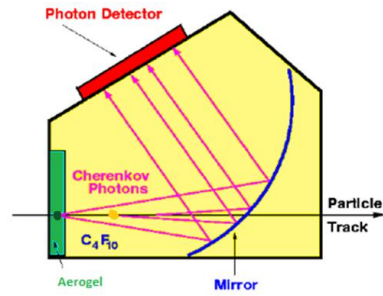
The goal of the experiment is to study the spin structure of the proton through measurement of the dependence of the quark flavor on the structure function of the proton. Below is the set up of the spectrometer used in HERMES.



Components of the RICH Detector

Two radiators are: aerogel (SiO_2) with index of refraction $n=1.0304$, and gas (C_4F_{10}) with $n=1.0037$.

One common mirror and one common photon detector are used in as shown below.



Particle Identification for Hadrons (π, K, p)

Particle velocity is determined via Cerenkov radiation angle. The momentum is determined from the magnet and drift chambers. The total energy is calculate with,

$$E = \frac{mc^2}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

and then the mass is calculated from Einstein's relation.

$$E^2 = (pc)^2 + (mc^2)^2$$

Efficiency

The efficiency of the detector was determined using these four decay processes and are shown below.

Decay	Efficiency
$\rho^0 \rightarrow \pi^+\pi^-$	$\varepsilon_\pi = 0.915 \pm 0.024$
$K_s \rightarrow \pi^+\pi^-$	$\varepsilon_\pi = 0.900 \pm 0.005$
$\phi \rightarrow K^+K^-$	$\varepsilon_K = 0.750 \pm 0.007$
$\Lambda \rightarrow p\pi^-$	$\varepsilon_p = 0.726 \pm 0.010$ $\varepsilon_\pi = 0.890 \pm 0.011$

Conclusion

The detector allows for pion and kaon identification at 2-10GeV/c which is almost the entire momentum range of the HERMES experiment.

References

[1] N.Akopov et al., Nucl. Instrum. Meth. A479 (2002) 511