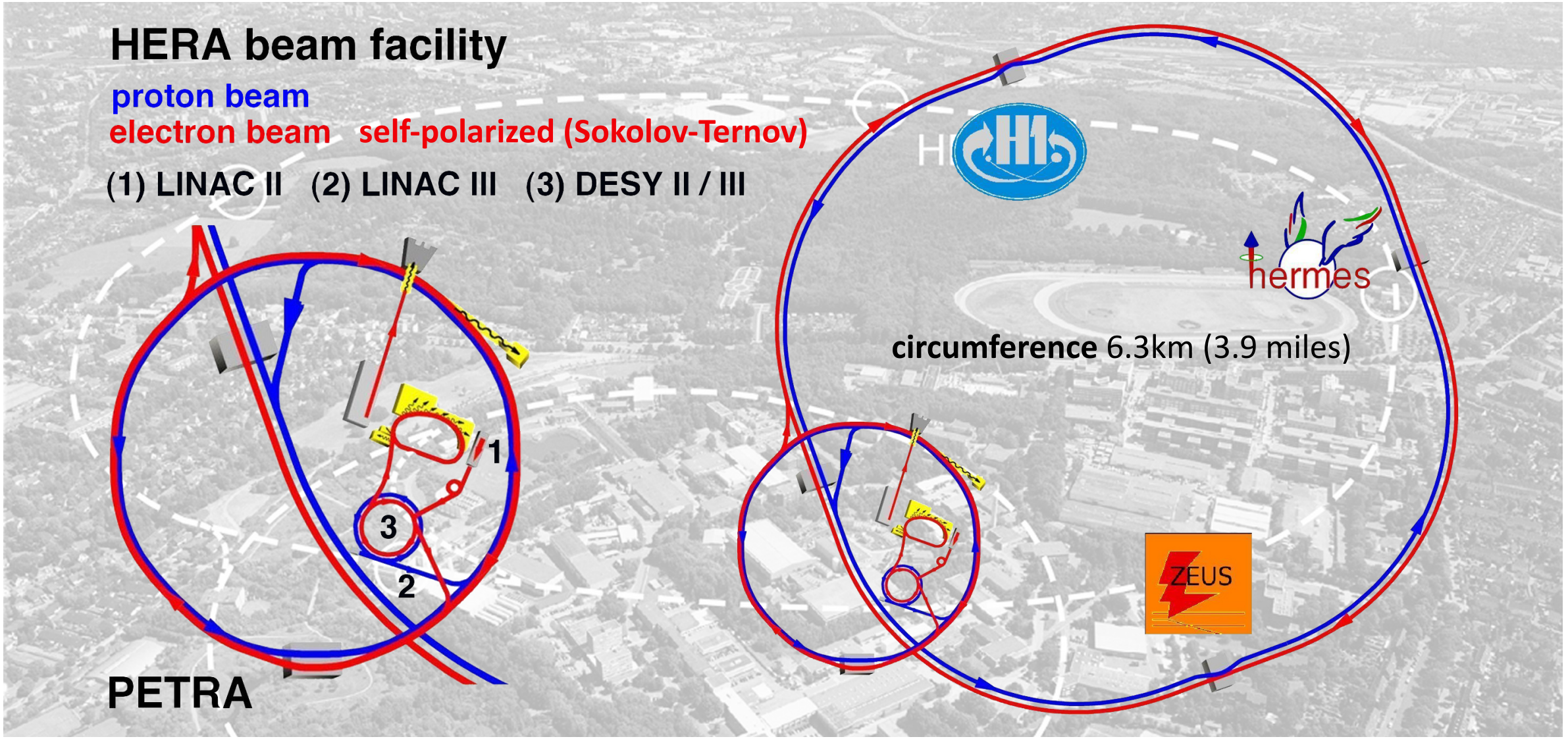
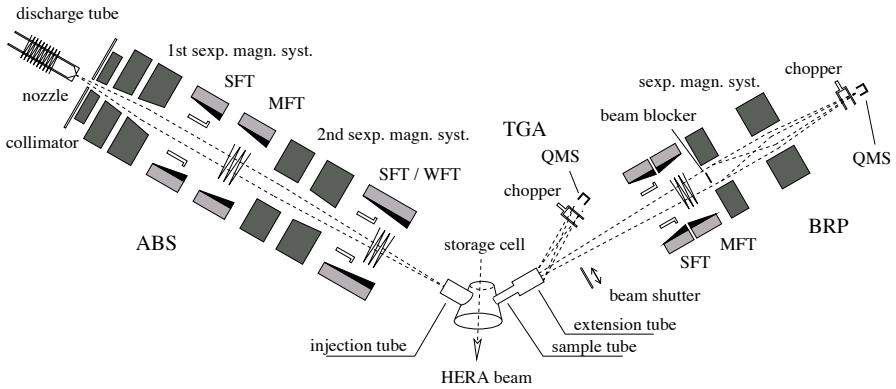
# Electron-Proton Collider: HERA (1992 – 2007)

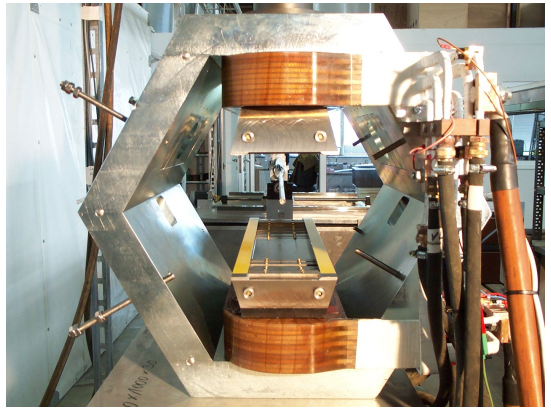


# HERMES experiment

## Internal gas target

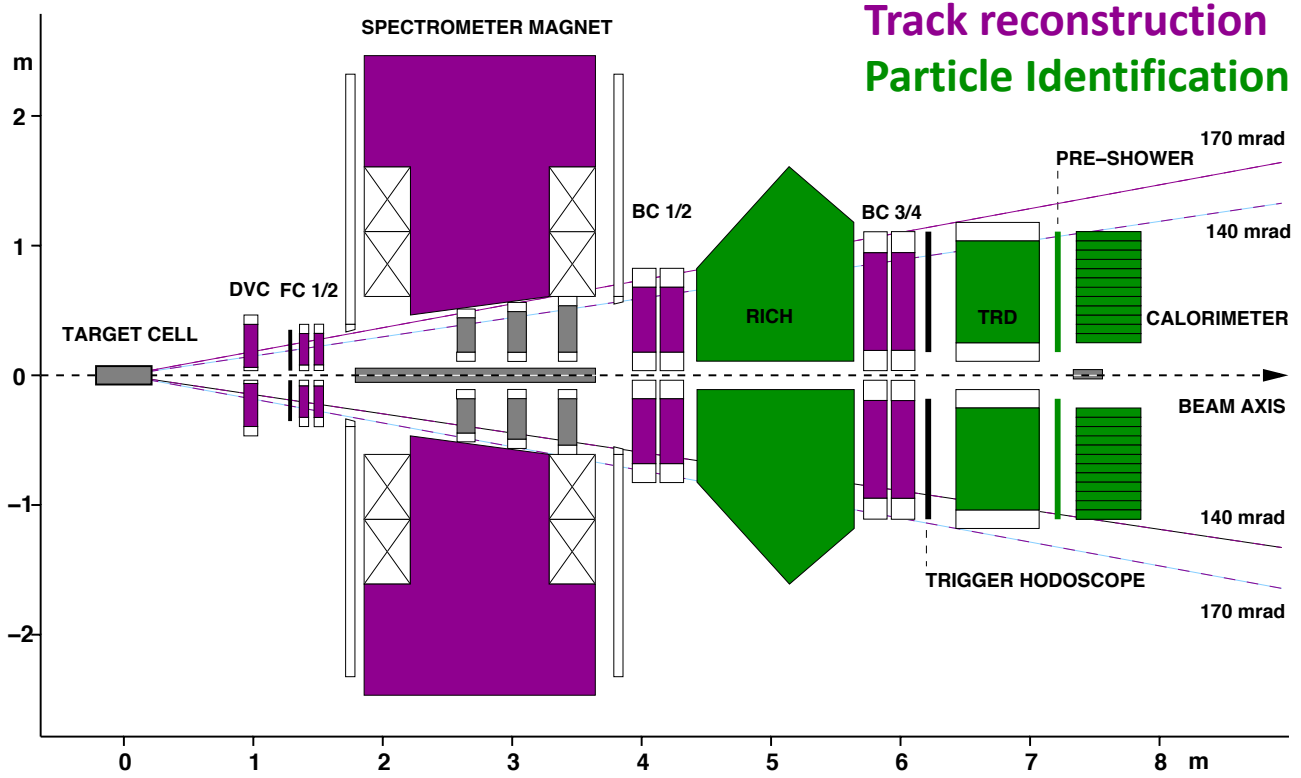



## Transverse target magnet

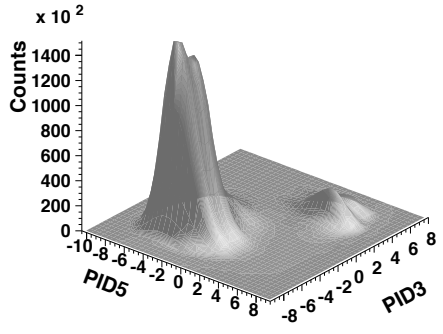


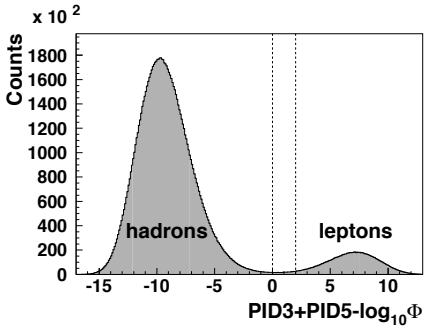
## Spectrometer

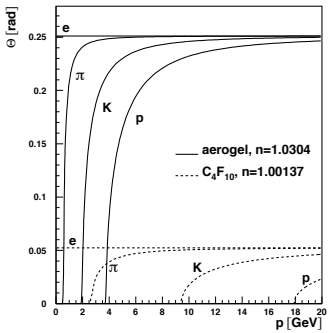
Track reconstruction
Particle Identification




## PID

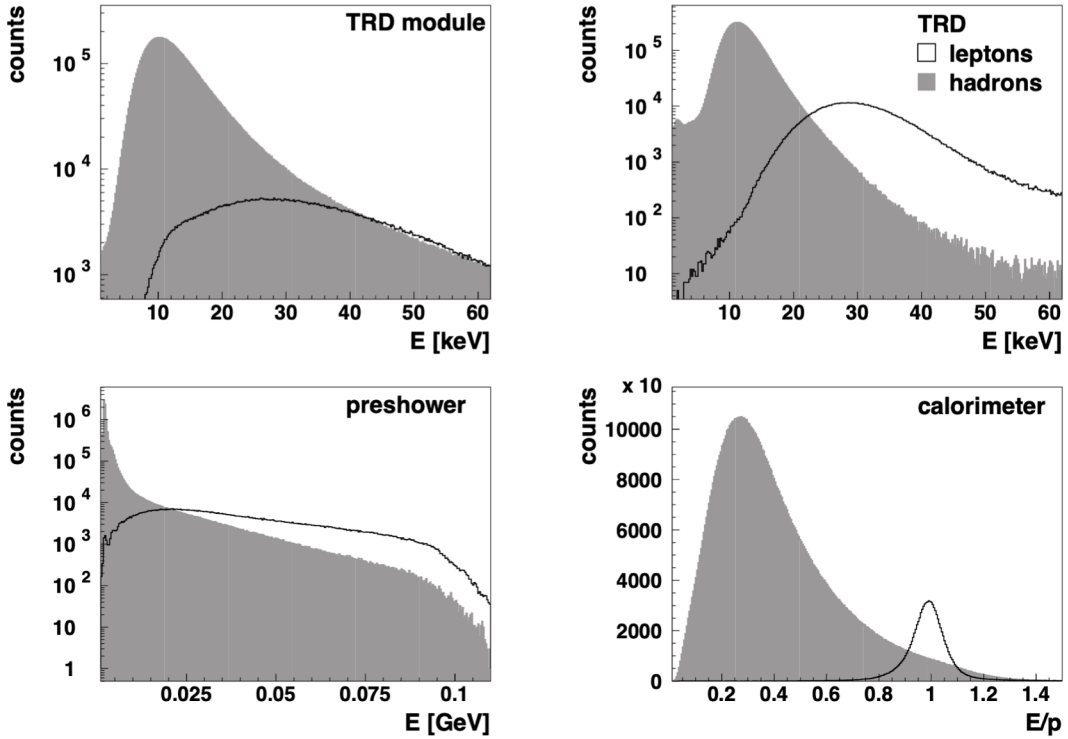


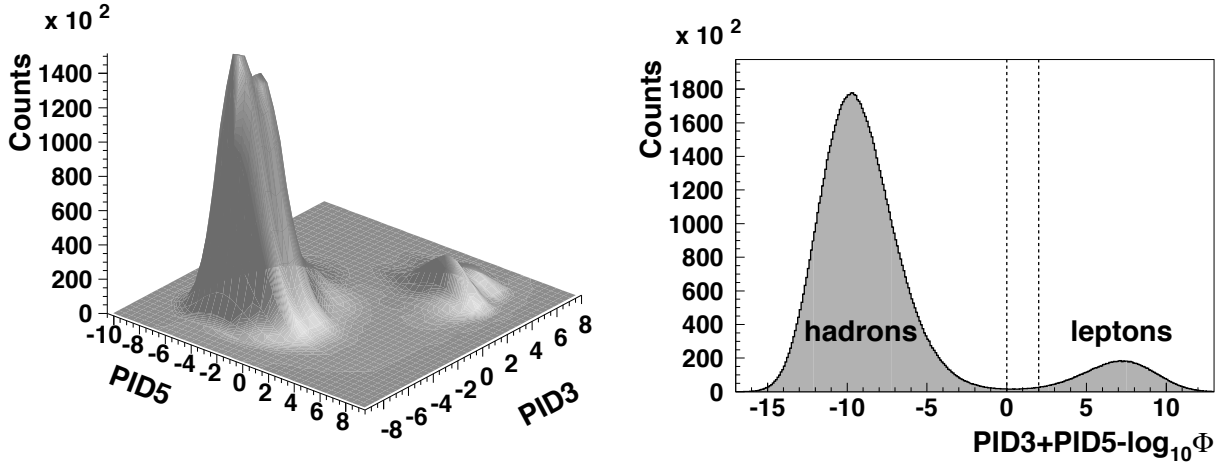



# Lepton-Hadron Separation

**Typical responses of the HERMES PID system:**




**Lepton identification with efficiency up to 99% and a hadron contamination of less then 1% using combined information:**




**Bayesian Approach:**

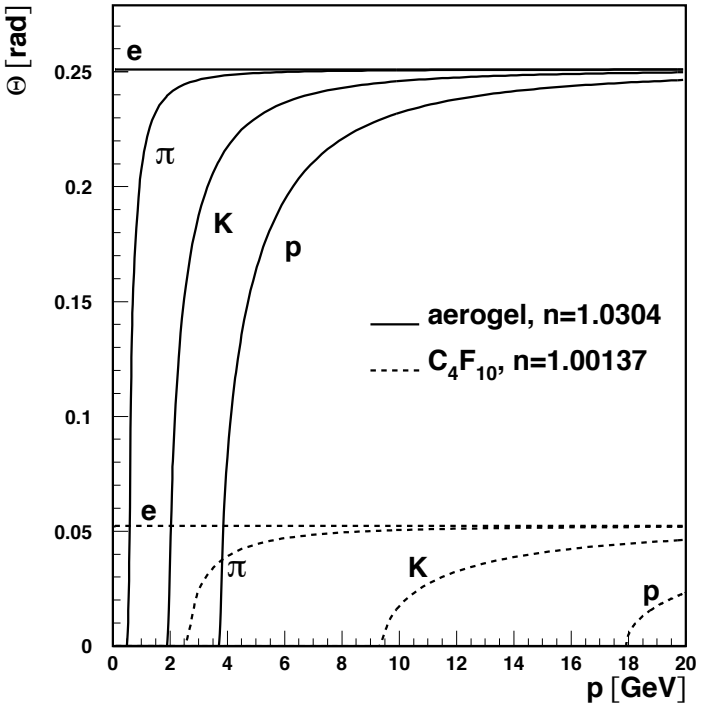
1. $$P_{E,p,\theta}\left(L(H)\right) = \frac{P_{p,\theta}\left(L(H)\right) P_{L(H),p}\left(E\right)}{P_{p,\theta}\left(L\right) P_{L,p}\left(E\right) + P_{p,\theta}\left(H\right) P_{H,p}\left(E\right)}$$

2. $$\log_{10}\frac{P_{E,p,\theta}\left(L\right)}{P_{p,E}\left(H\right)} = \log_{10}\frac{P_{L,p}\left(E\right)}{P_{H,p}\left(E\right)} + \log_{10}\frac{P_{p,\theta}\left(L\right)}{P_{p,\theta}\left(H\right)} = \mathrm{PID}_{\mathrm{detector}} + \log_{10}\Phi.$$

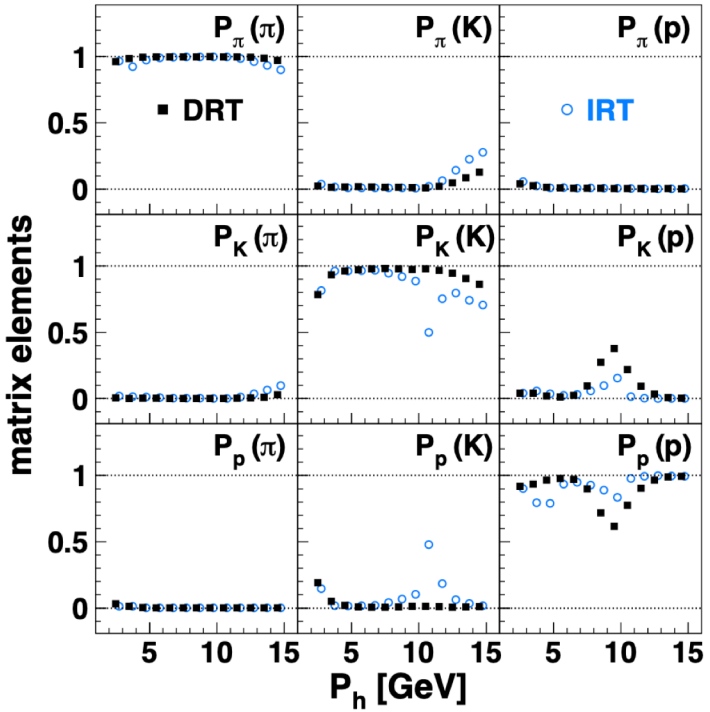
3. | | |
|---|---|
| **leptons:** | $\mathrm{PID3} + \mathrm{PID5} - \log_{10}\Phi > 2$ |
| **hadrons:** | $\mathrm{PID3} + \mathrm{PID5} - \log_{10}\Phi < 0$ |

**PID3**: TRD
**PID5**: preshower, calorimeter, and RICH

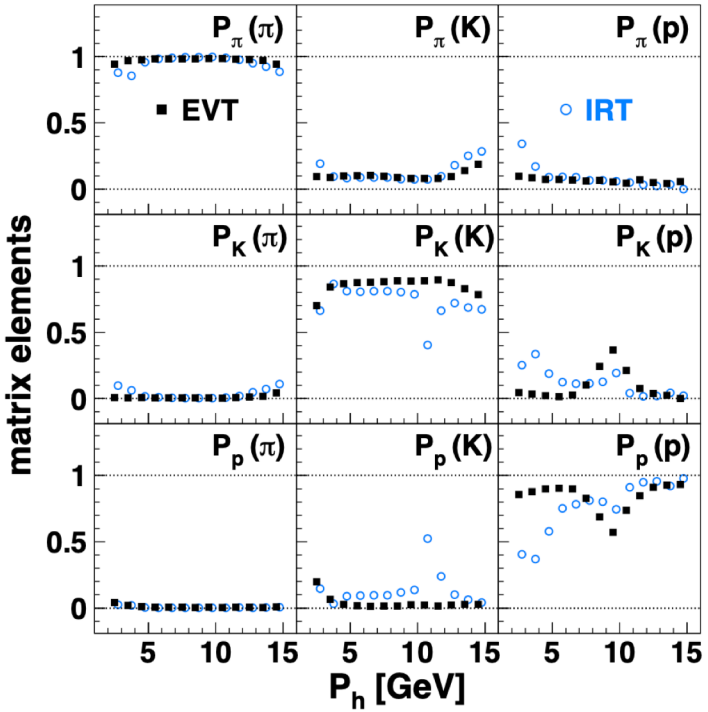
# Hadron Identification in HERMES RICH Detector




**One hadron track in RICH half**
(58% of all SIDIS events):




**More than one track**
(42% of all SIDIS event):




**EVT method for multiple track events**: *"These* [SIDIS] *measurement would not have been possible without an improved hadron-type identification algorithm for the Ring Imaging Cherenkov (RICH) detector. The EVT event-level algorithm is presented and now is the primary method used at Hermes"*