The HERMES Recoil Detector

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Silicon Detector
- Detect low momentum protons up to 0.5 GeV/c
- Polar acceptance 0.4 < θ < 1.35 rad
- φ resolution is 0.031 rad
  ⇒ Placed inside beam vacuum (10^-9 mbar) close to the IP
  ⇒ Lowest proton momentum detectable is 135 MeV/c
- 16 double sided silicon sensors:
  - Size: 99x99 mm
  - 300 μm thick TIGRE sensors
  - 128 strips/side (⊥):
    - 758 μm pitch
    - 56 μm separation
  ⇒ Particle tracking with 222 μm resolution up to two spacepoints

Scintillating Fiber Detector
- Detect recoil protons ranging from 0.25 to 1.6 GeV/c
- Polar acceptance 0.7 < θ < 1.35
- φ resolution is 0.008 rad
- Consist of two 26 cm long barrels (SciFi1 and SciFi2):
  - SciFi1:
    - Scintillating Kuraray SCSF-78M fibers (1mm)
    - Every fiber is read out
  - SciFi2:
    - Two adjacent fibers in each layer → one read-out channel
  ⇒ Particle tracking with a resolution below 300 micron, up to two spacepoints

Photon Detector
- Detect photons coming from Δ⁺ → pγ^0
- From inside out (302 mm long):
  - 1st layer: 60 bars || with beam
  - 2nd layer: +45° with beam (44 bars)
  - 3rd layer: -45° with beam (44 bars)
  ⇒ Enables tracking
- Provides cosmic trigger
- Each strip is connected with a scintillating fiber on each side (2)
- Every fiber is read out by 64 channel PMTs (H7546)
- Two signals from same strip are summed and signal is digitized by commercial CAEN QDC

Detector Performance / MC

Protons only detected by Silicon

Improved by Photon Detector

Need to design & build a Recoil Detector able to detect:
- Protons:
  - Recoil protons (50-600 MeV/c)
  - Protons from Δ-resonances (< 1.4 GeV/c)
- Pions ( < 800 MeV/c)
- Photons (from π⁰ decay)
(Momentum ranges containing most statistics)