

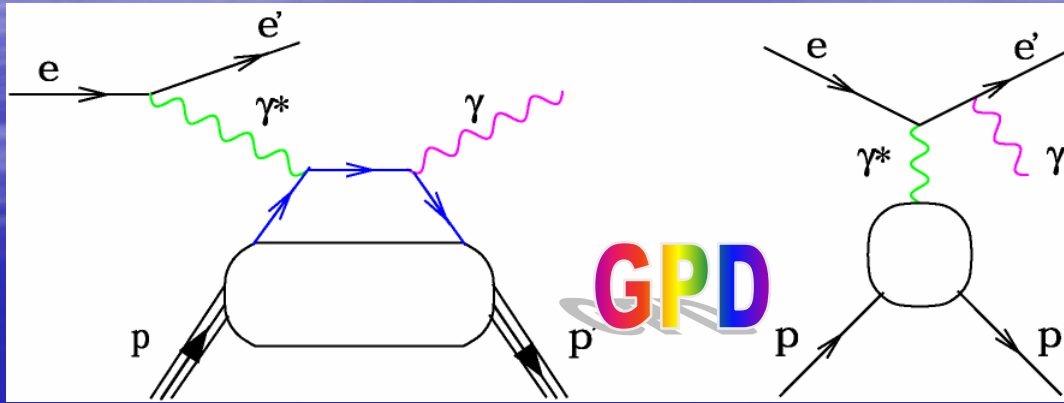
# The HERMES Recoil Detector Project

J Stewart

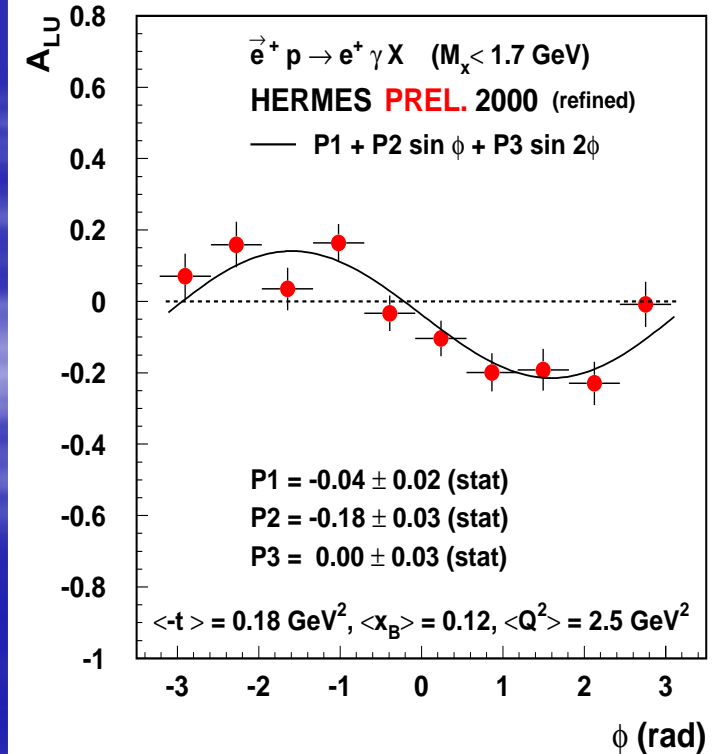
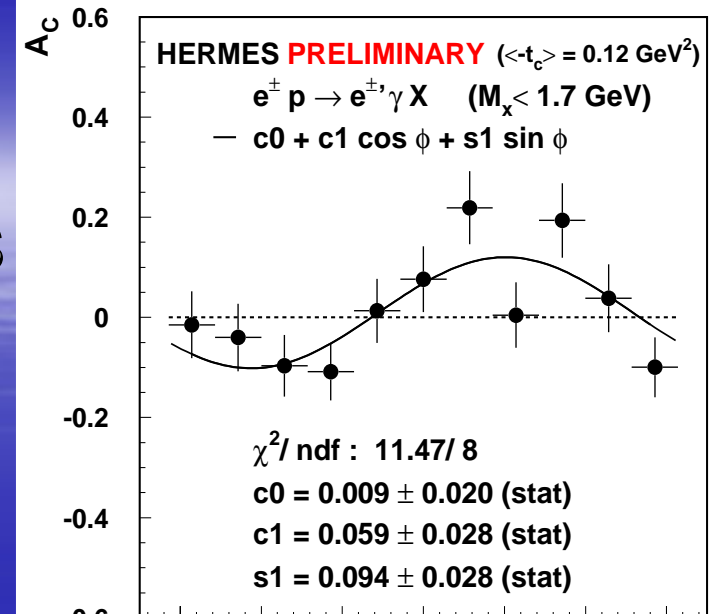
October 2004

# DVCS

- Cleanest way to access GPDs is DVCS

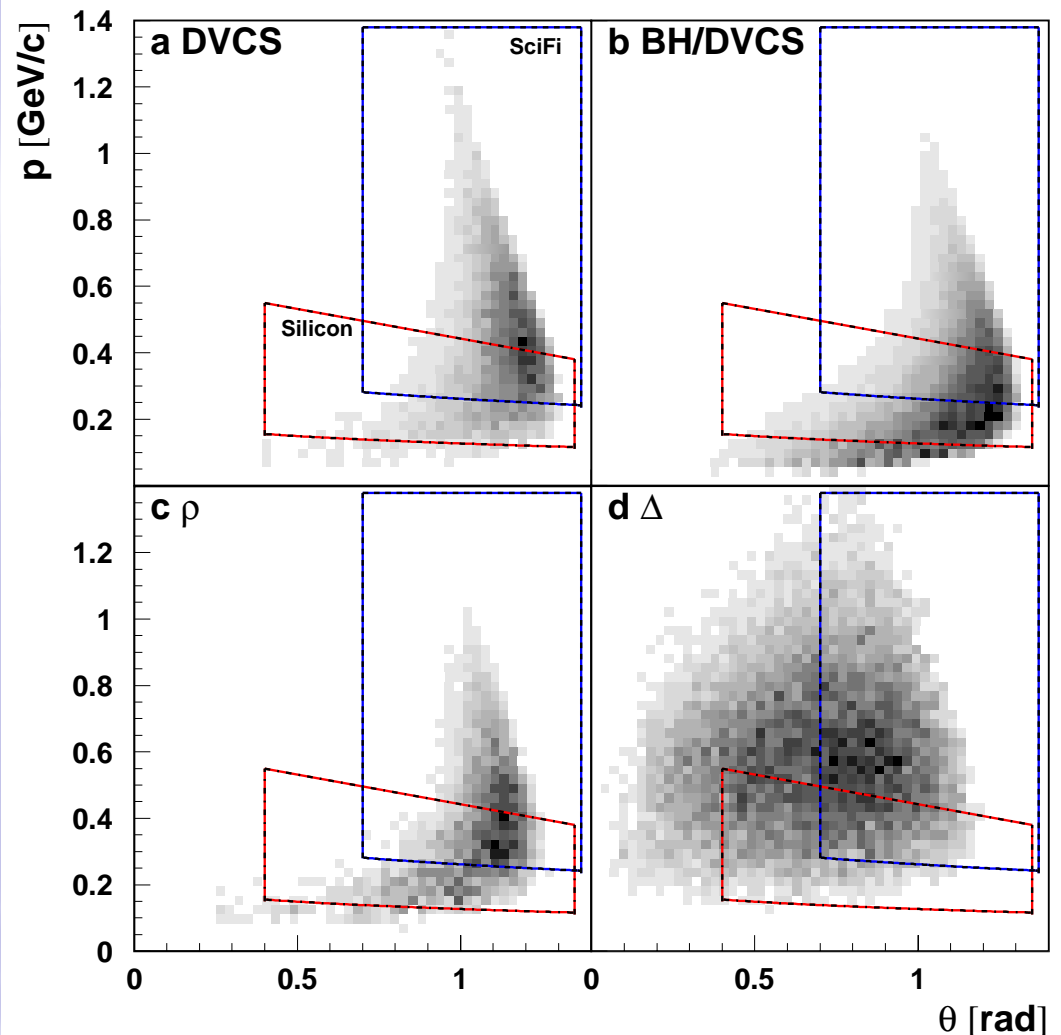


- Interference of DVCS amplitudes and Bethe-Heitler amplitudes.
- DVCS and BH have same final state --> amplitudes add up coherently.
- The interference terms can be used to extract the real and imaginary part of the DVCS amplitudes.
- Measurements of exclusive photon production is the best way to determine the GPDs.



# Needed for a major improvement ...

- Large increase in statistics.
  - HERMES will run 2005-2007 with unpolarized target and high density
  - $2\text{fb}^{-1}$  expected! (x8)
- Improved  $t$  resolution.
- Improved background rejection.
- Recoil proton detection!

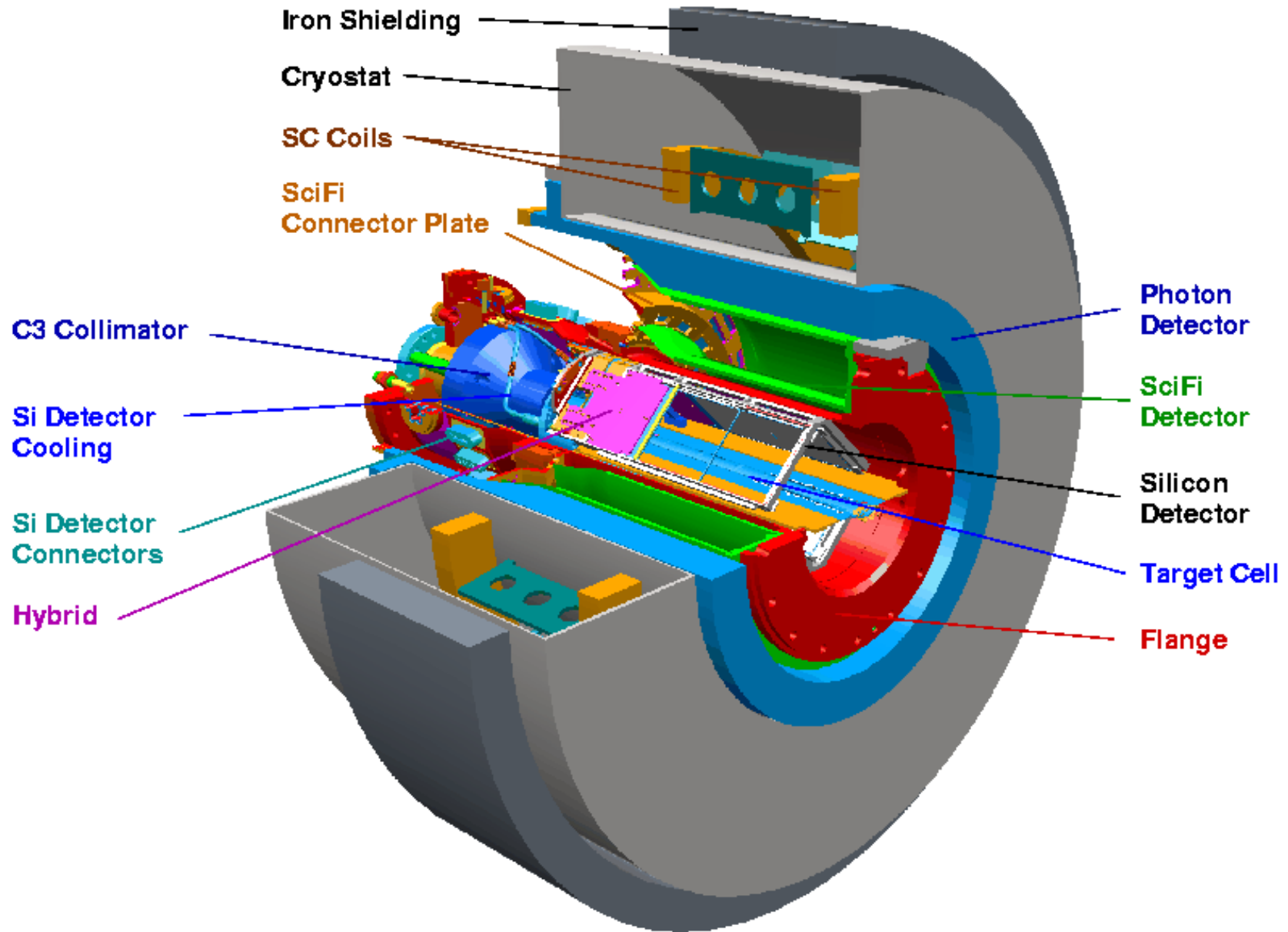


Must detect slow protons:

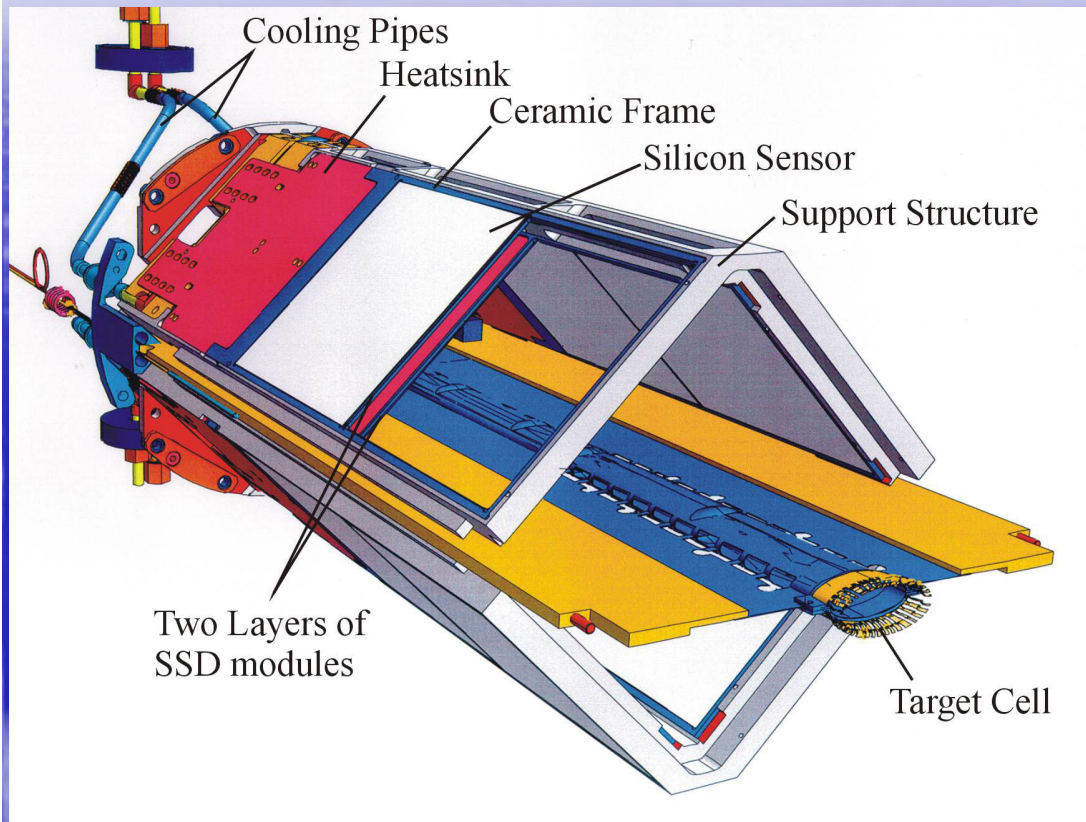
$$0.1 < \theta < 1.35 \text{ rad and } 50 < p < 1400 \text{ MeV/c}$$

Must detect background minimum ionizing particles and photons

# Recoil Detector Major Components



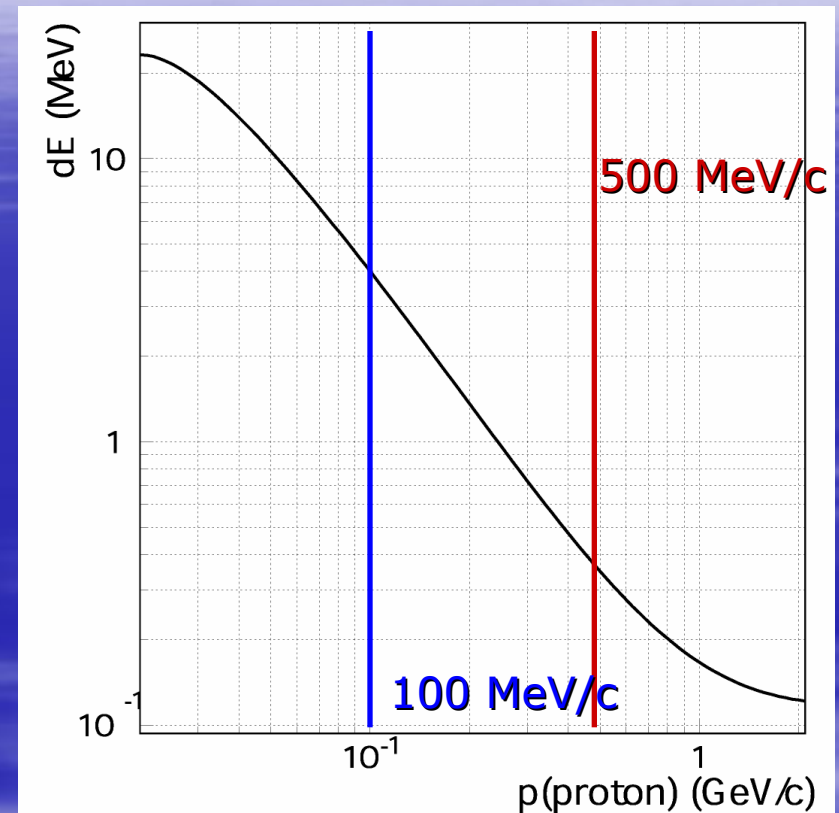
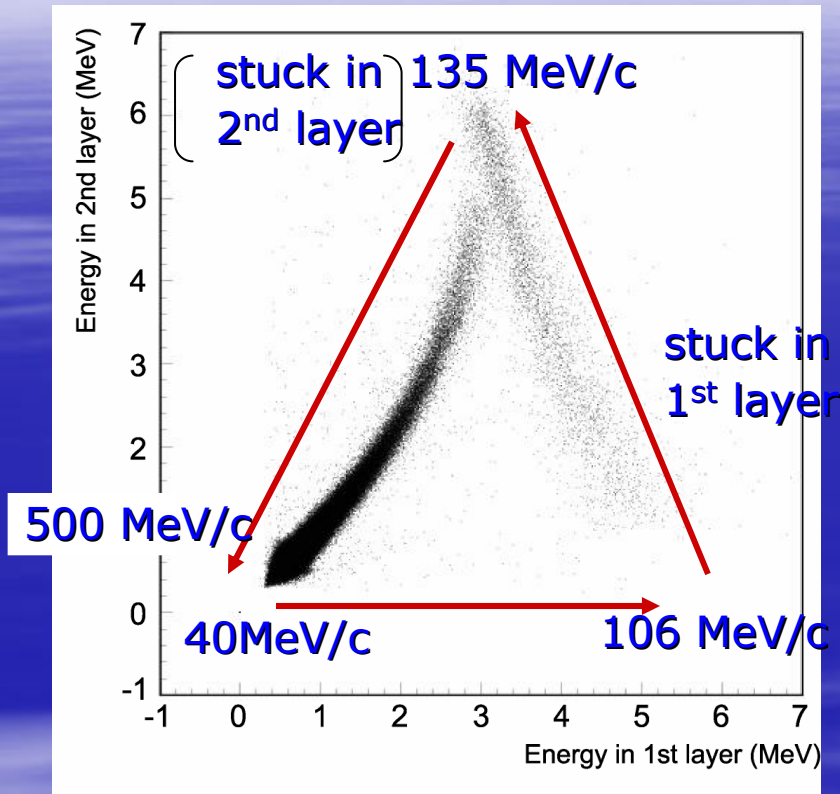
# Silicon Detector



- $p = 135$  to  $500$  MeV/c
- $0.1 < \theta < 1.35$  rad
- 2 silicon layers
- 16 double sided Si sensors
- Size  $99 \times 99$  mm<sup>2</sup>
- $300$   $\mu$ m thickness
- $758$   $\mu$ m strip pitch
- X-Y orientation
- HELIX3.0 -128 readout
  - Charge division

- Momentum determination by energy deposition
- Tracking information
- Running within vacuum and a few cm from the beam pipe

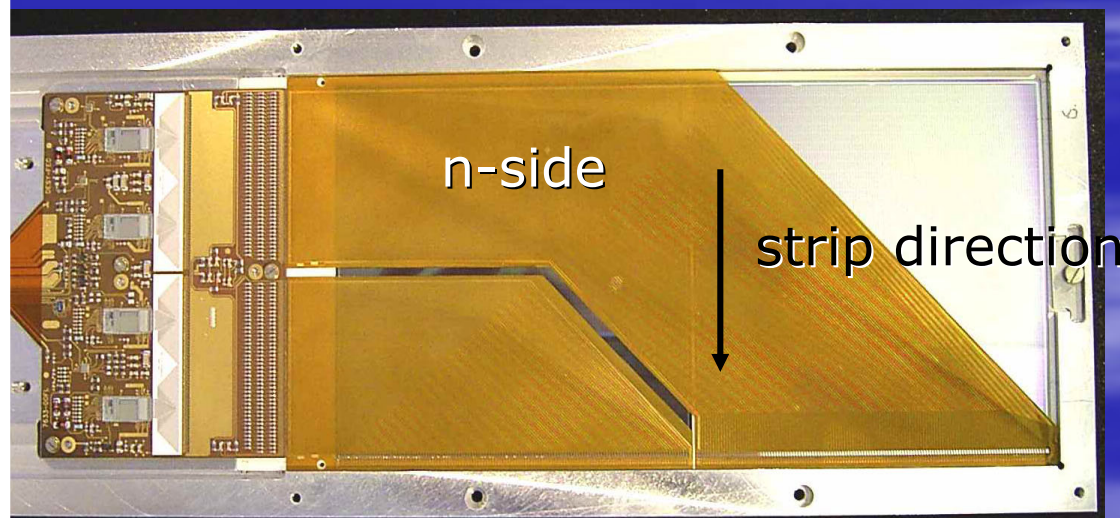
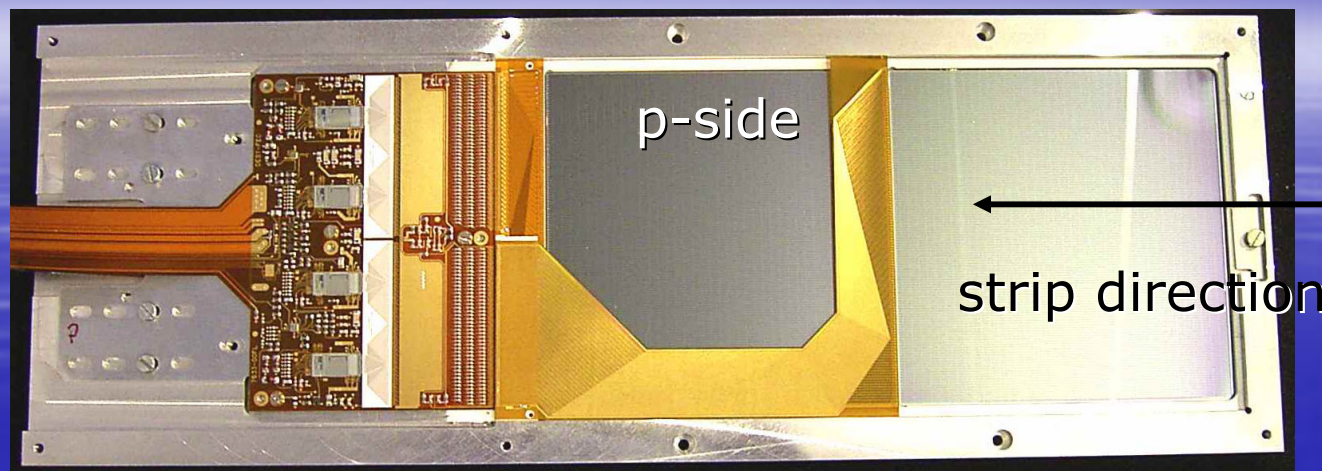
# Momentum Measurement



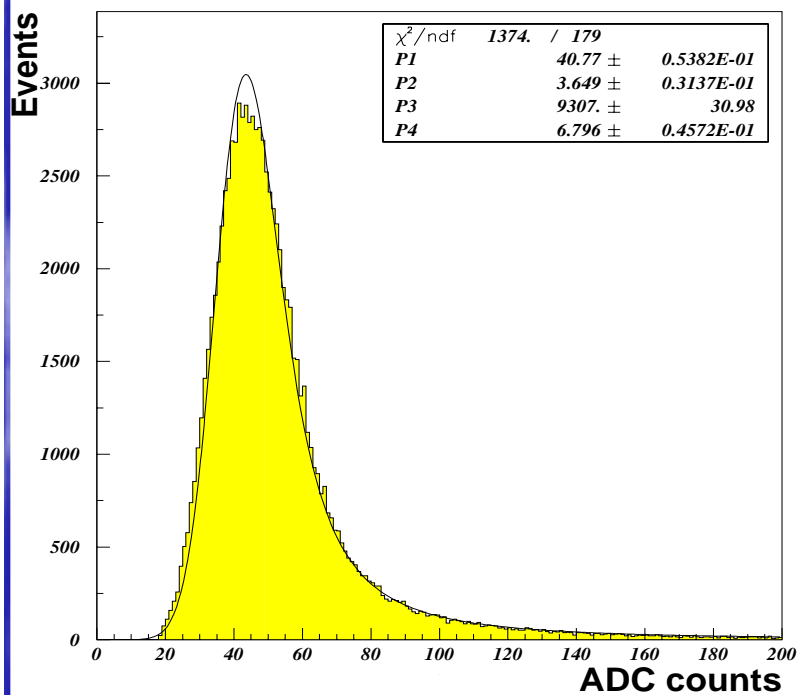
- proton energy deposited in the two silicon layers
- energy deposition can be parameterized with Bethe-Bloch formalism
- Readout needs dynamic range  $\sim 70$

# Silicon Detector Modules

- Detector Construction Finished.
- Test beam with slow protons started.
- Test beam data with 3 GeV positrons taken.



Landau+Gauss conv. fit P-side



S/N: min ionizing = 5-6  
slow protons = huge

# Scintillating Fiber (SciFi) Detector

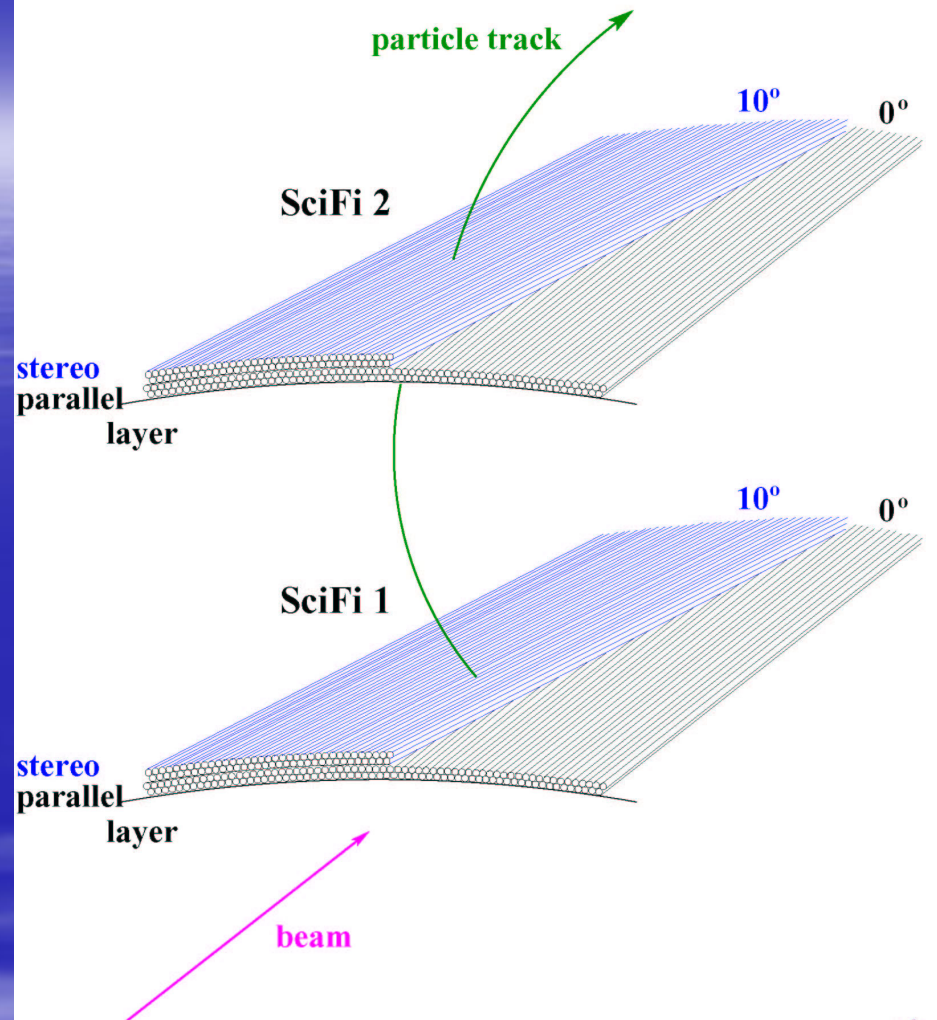
- Measure bending radius in 1T field.
- $p = 0.3$  to  $1.6$  GeV
- $\phi$  resolution  $8\text{mrad}$
- 2 layers of SciFi

## SciFi 1:

216 mm diameter cylinder  
4 layers of 1mm fibers  
2 parallel 2 at  $10^0$  stereo

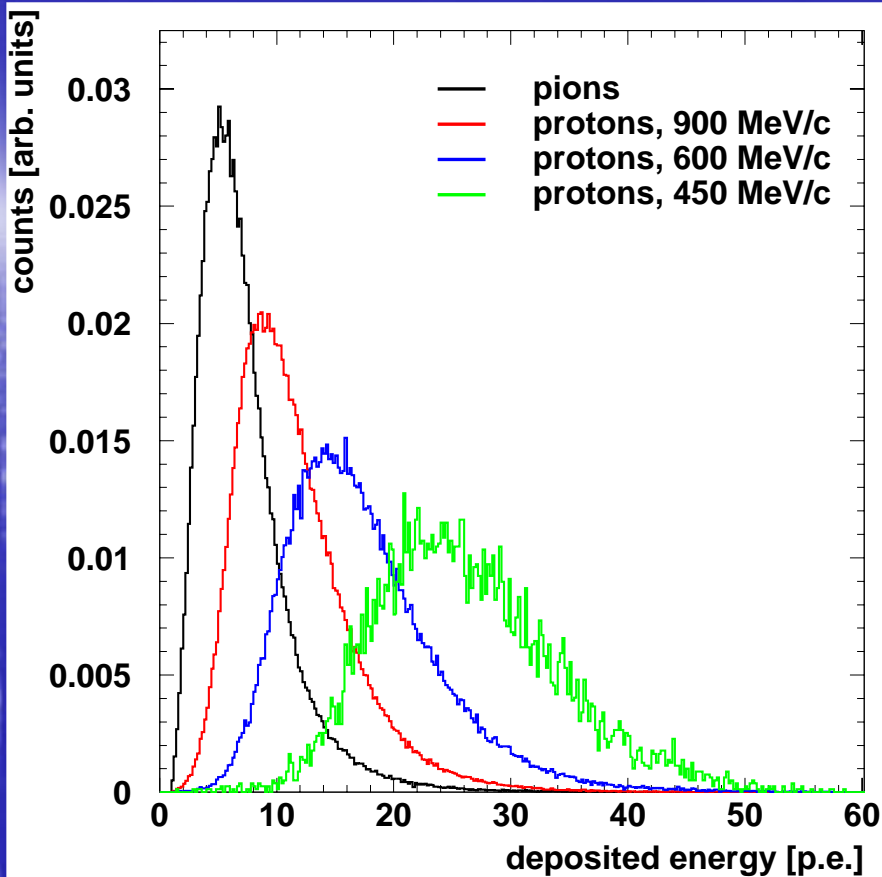
## SciFi 2:

366 mm diameter cylinder



7036 fibers mapped on 4836 PMT channels  
64 channel PMTs (H7546B)  
Gassiplex based readout

# Test experiment GSI



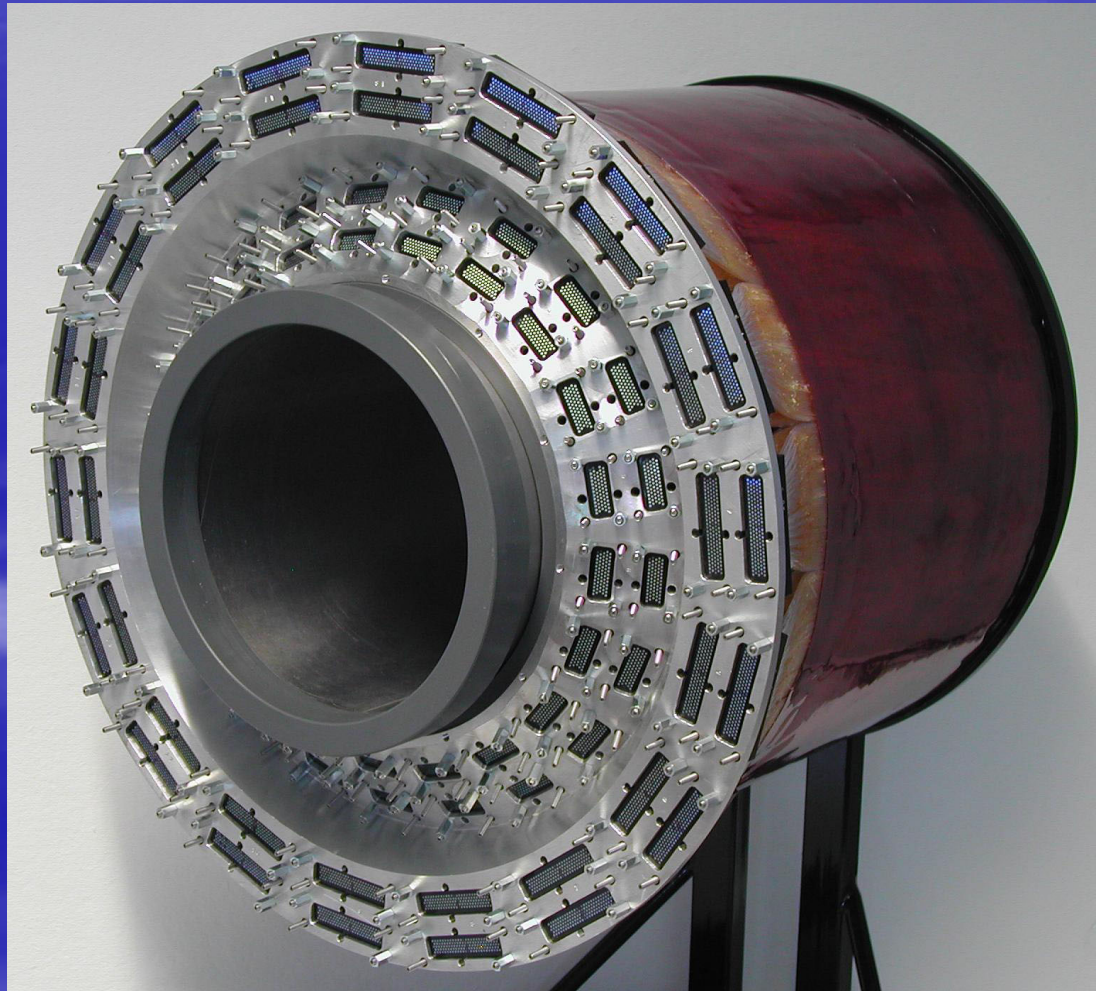
- 4 final SciFi modules
  - 2 parallel layers and 2 stereo layers
- 300 – 900 MeV protons and pions
- PID from time of flight

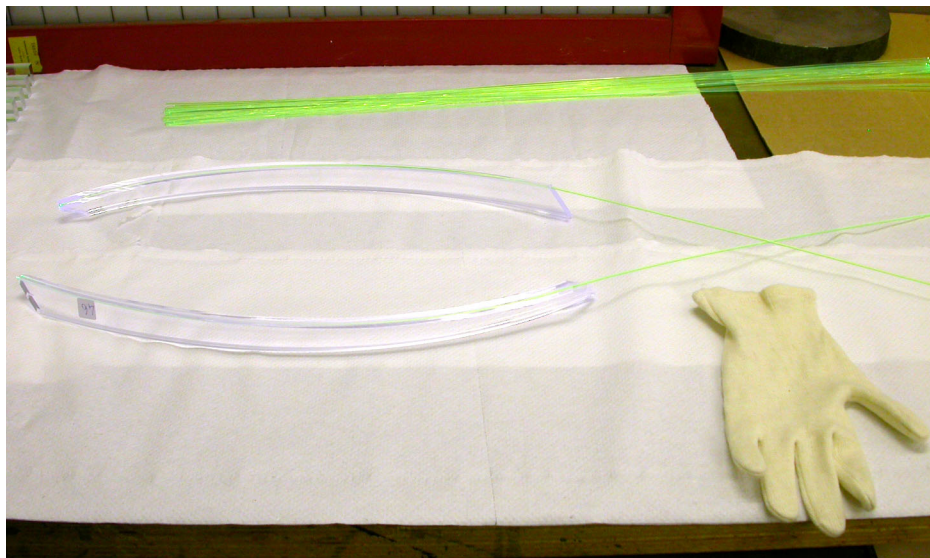
- Cluster multiplicity and cluster size as a function of threshold cut studied for pions and protons.
- Efficiency as function of threshold studied.
- Expected efficiency for pions is 98.5 to 99%



# SciFi Detector Status

Detector construction is finished.  
Full detector is now in test beam.





# Photon Detector

Detect Photons  $\Delta^+ \rightarrow p\pi^0$

Three layer preshower detector.

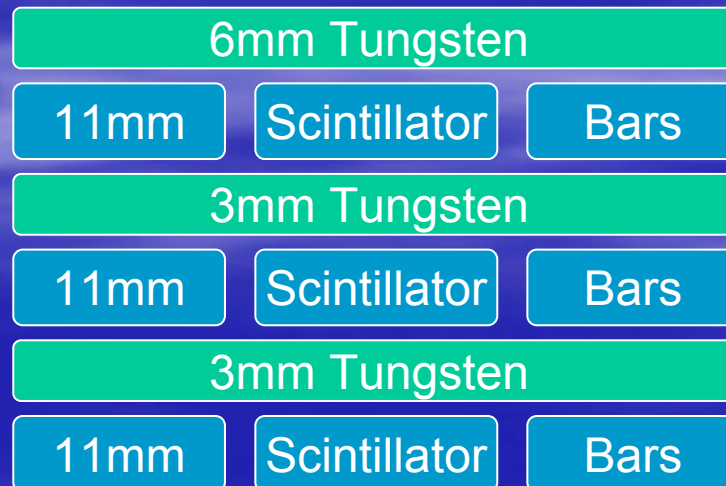
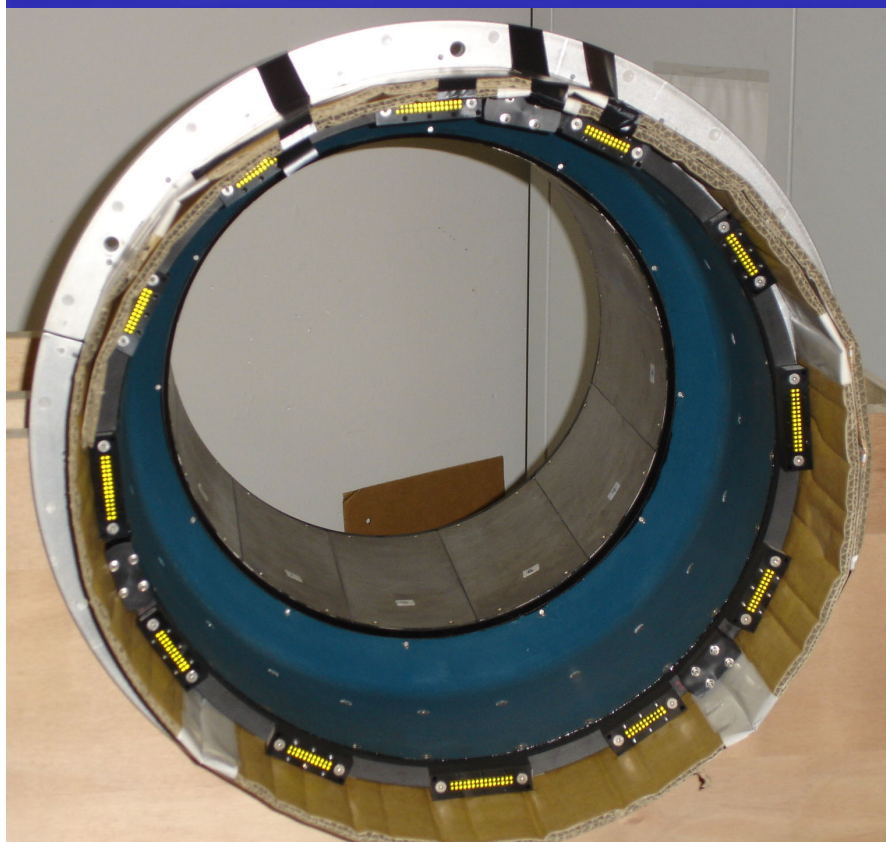
Tungsten radiator and scintillator detector.

- Read out with Wavelength shifter.
- H7546 64 channel PMTs.
- CAEN QDCs

Layer 1: 60 strips || beam

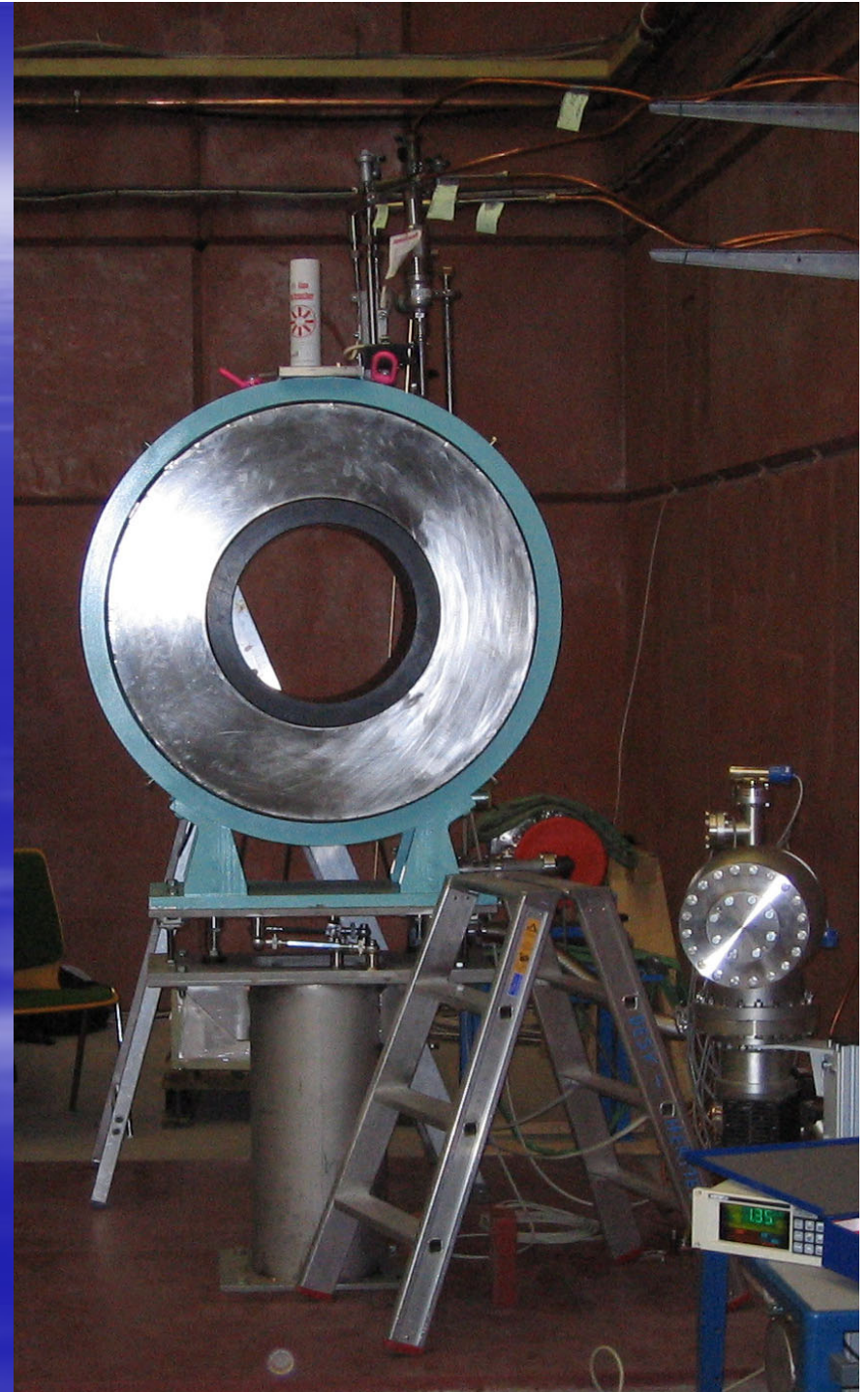
Layer 2: 44 strips +45° stereo

Layer 3: 44 strips - 45° stereo

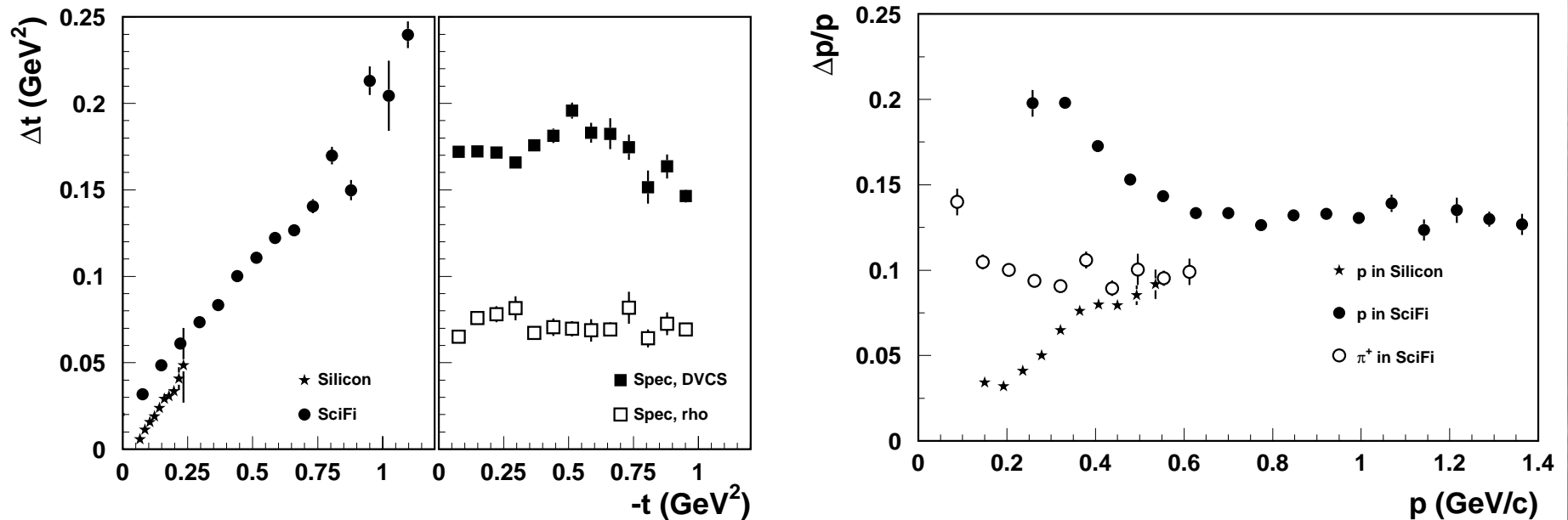


# Superconducting Magnet

- 1Tesla Field
- Helmholtz coil construction
- Bath cryostat 40 l volume
- 166A operating current
- Constructed by Efremov Institute
  
- Status
  - Installed at DESY
  - Ramped to full current
  - Preparing for field mapping



# Summary



- Good  $t$  resolution especially at small  $t$
- Factor of 10 suppression in background

Detector Construction is finished!  
Testing of the complete detectors has started.  
Scheduled installation in Summer 2005.