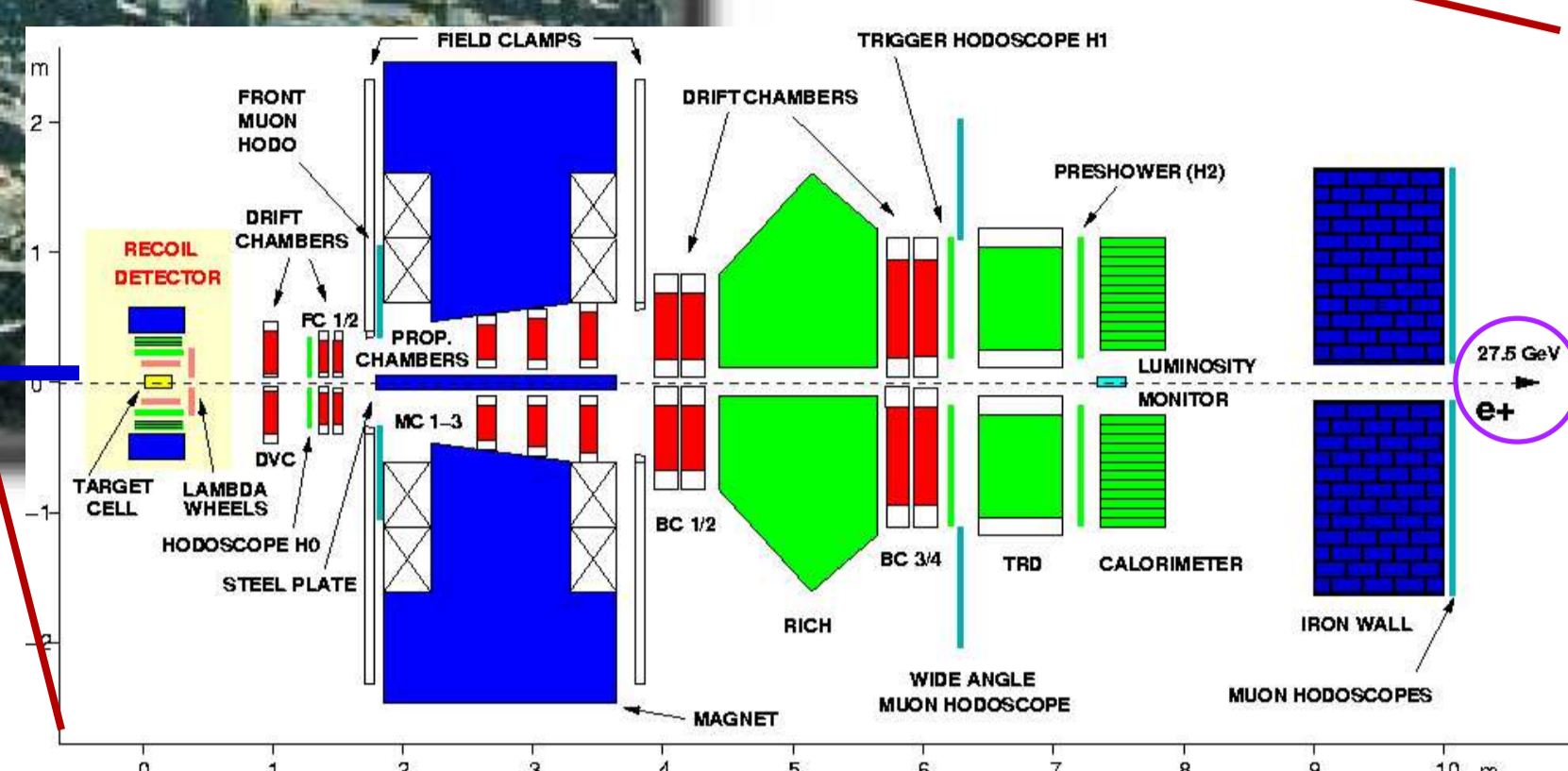
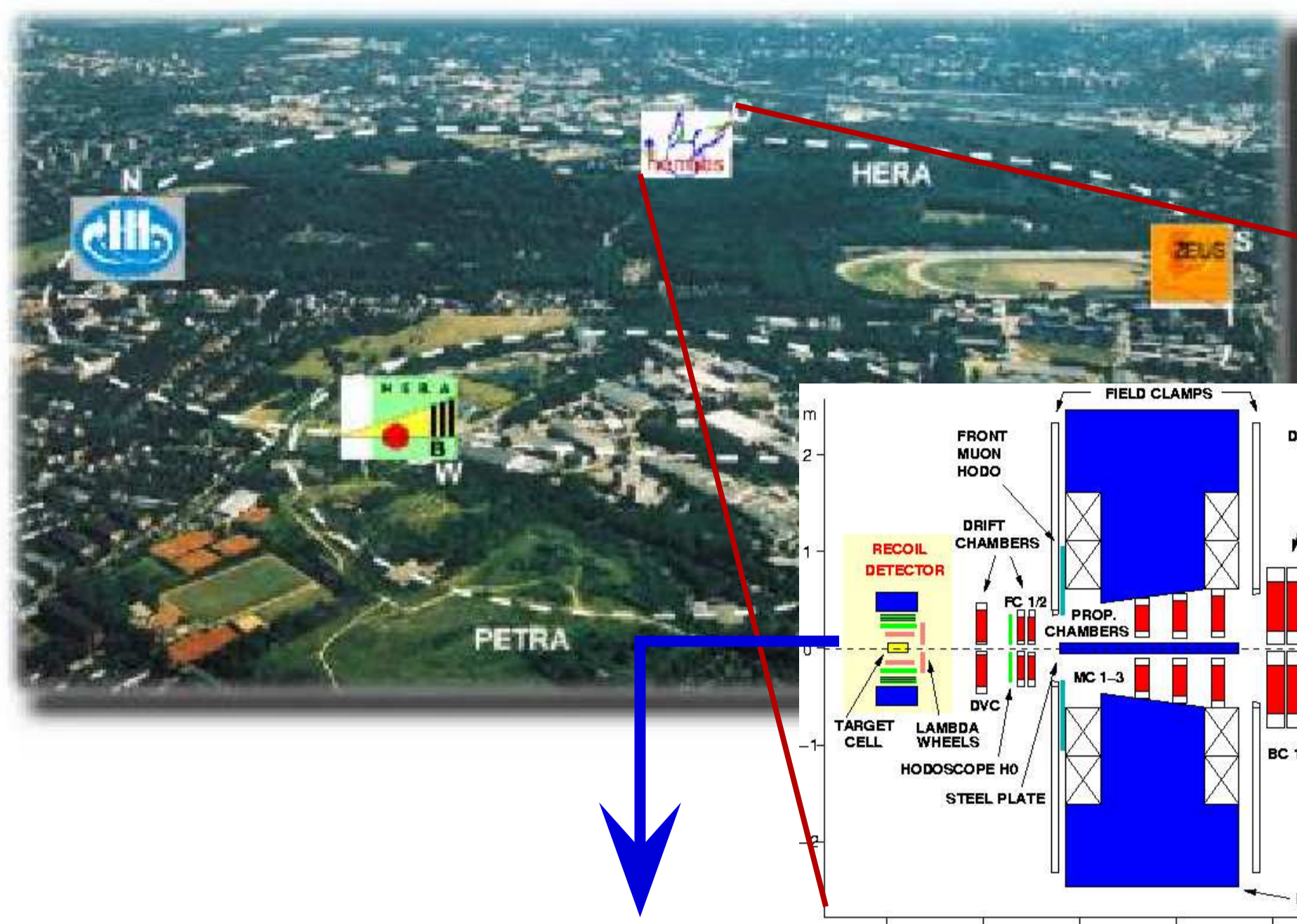


HERA MEasurement of Spin @ DESY Hamburg

27.5 GeV e^+/e^- beam with fixed target (p-gas)

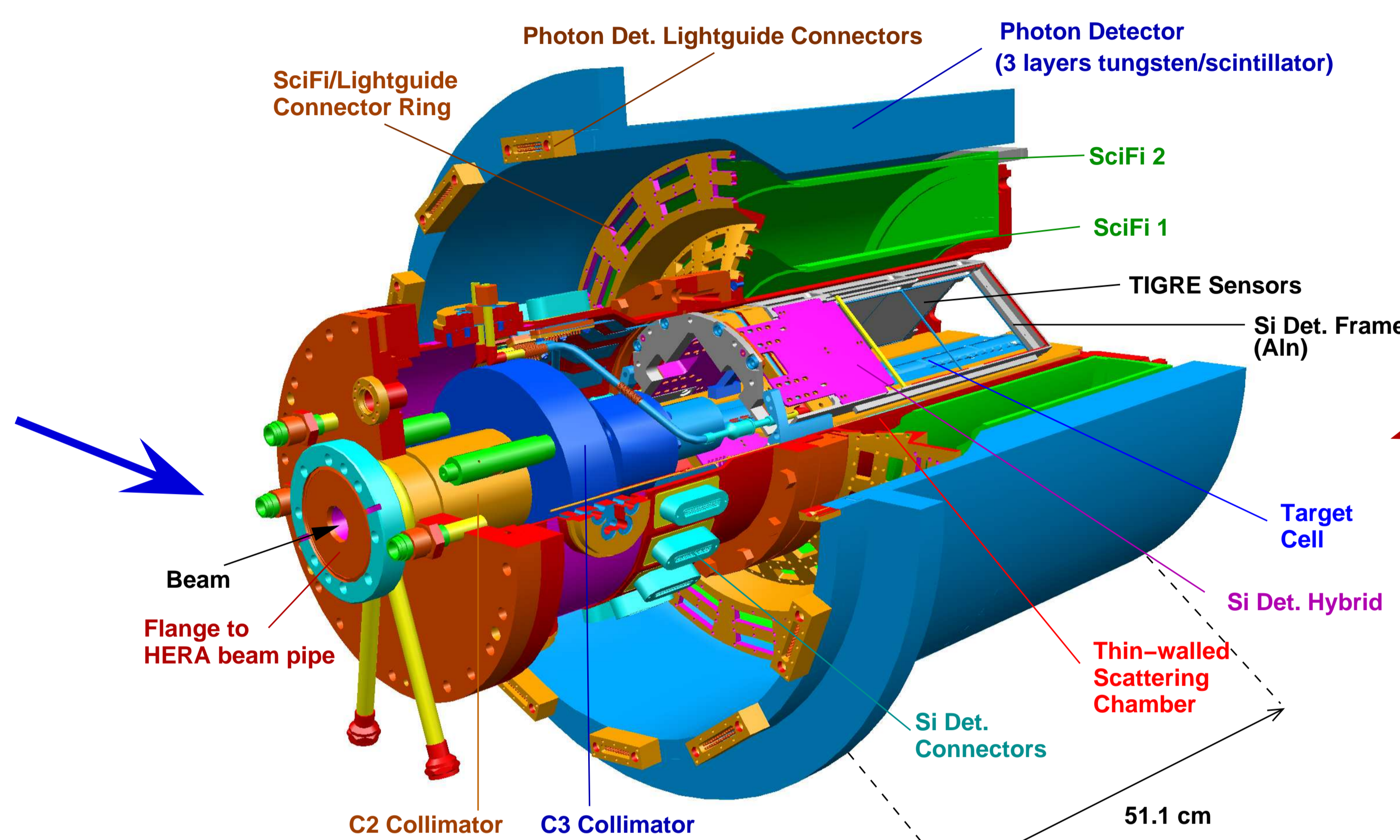


Forward Spectrometer:

- Tracking
- PID
- Energy/momentum measurement

2005 – To study exclusive Deep Inelastic Scattering (DIS):

- Establish **exclusivity** at event level
- **Cut** in non-exclusive **background** < 1%:
– Main source: intermediate Δ -resonance production
– Higher resonances removed by invariant mass cut

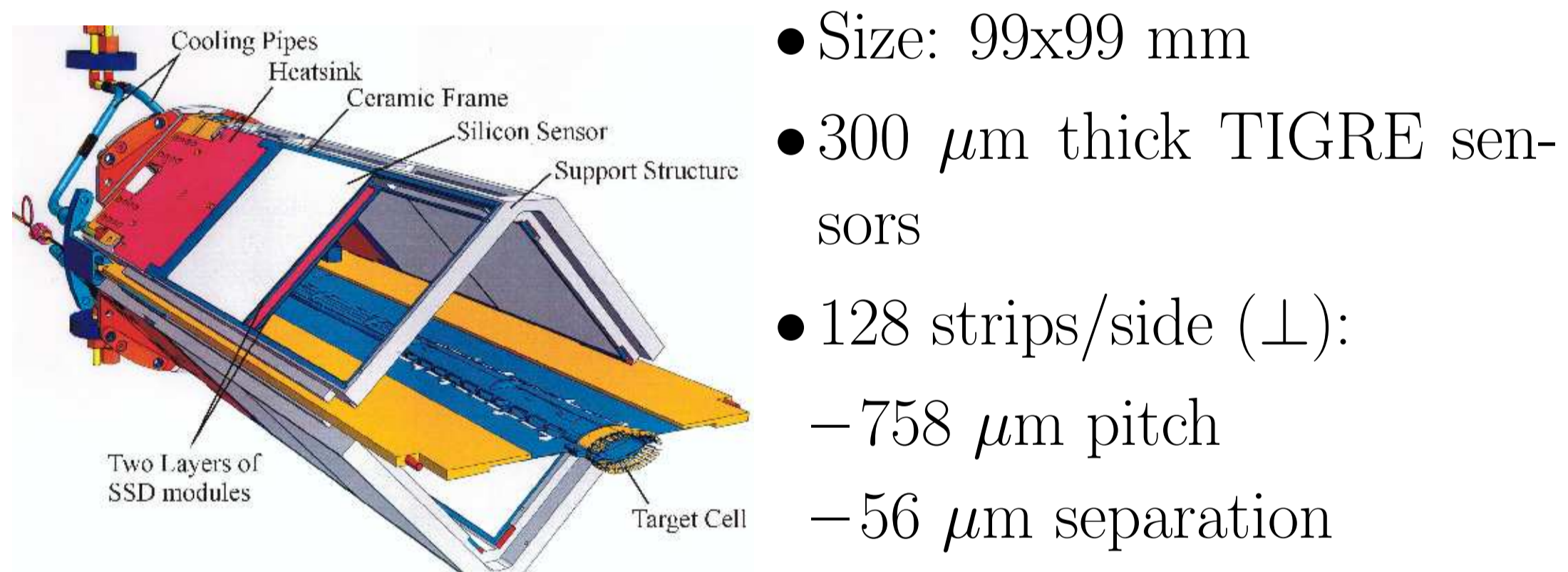


Need to design & build a Recoil Detector able to detect:

- **Protons:**
– Recoil protons (50-600 MeV/c)
– Protons from Δ -resonances (< 1.4 GeV/c)
- **Pions** (< 800 MeV/c)
- **Photons** (from π^0 decay)
(Momentum ranges containing most statistics)

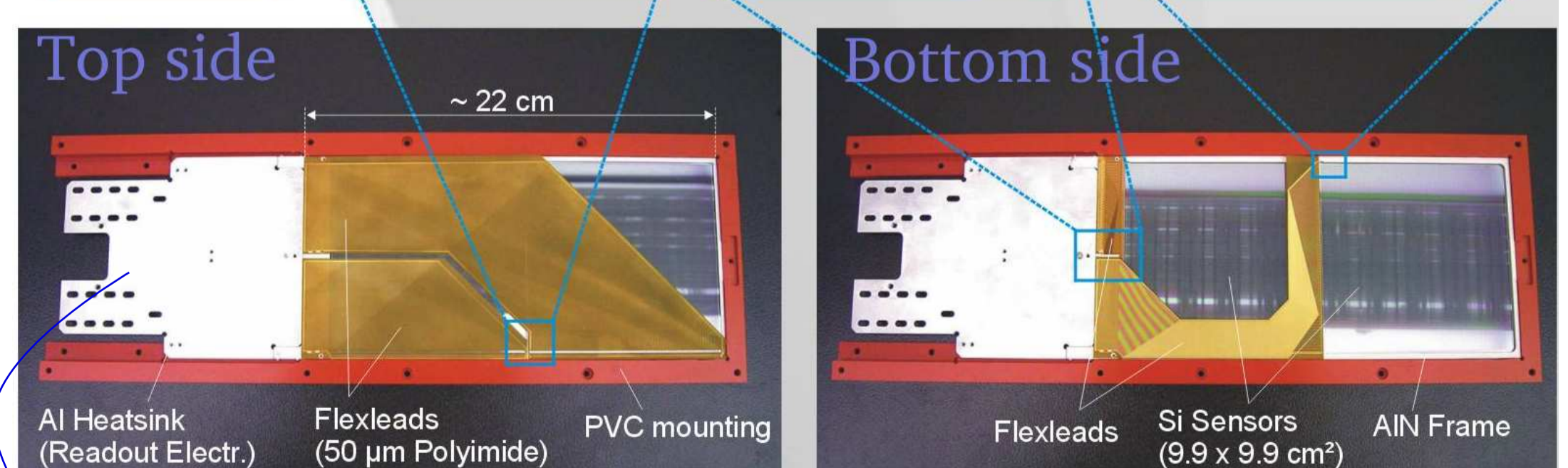
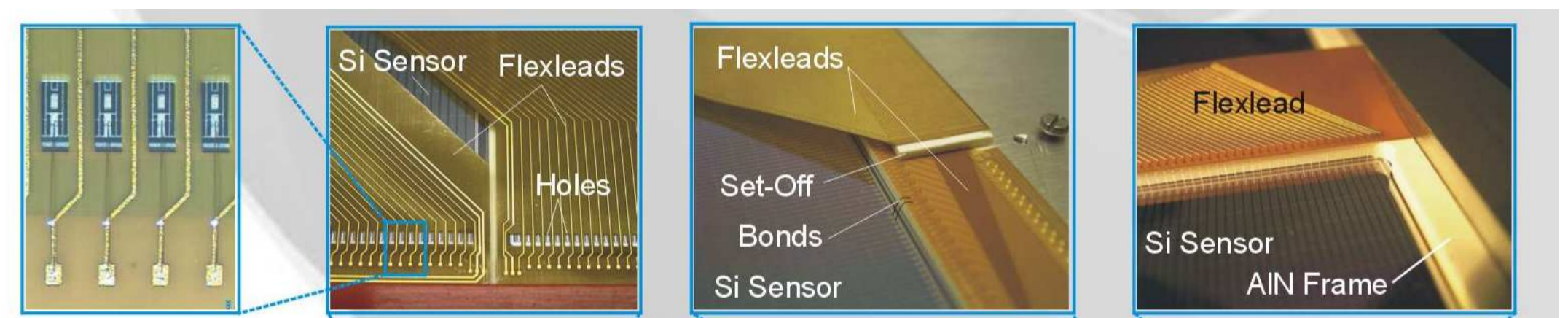
Silicon Detector

- Detect low momentum protons up to 0.5 GeV/c
- Polar acceptance $0.4 < \theta < 1.35$ 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:

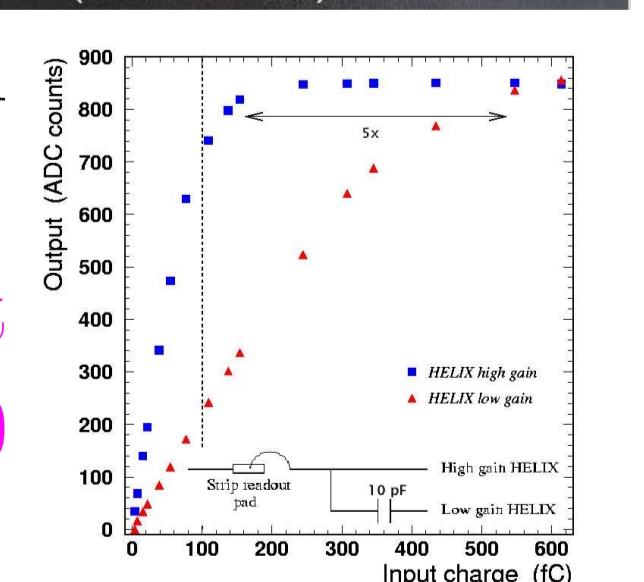
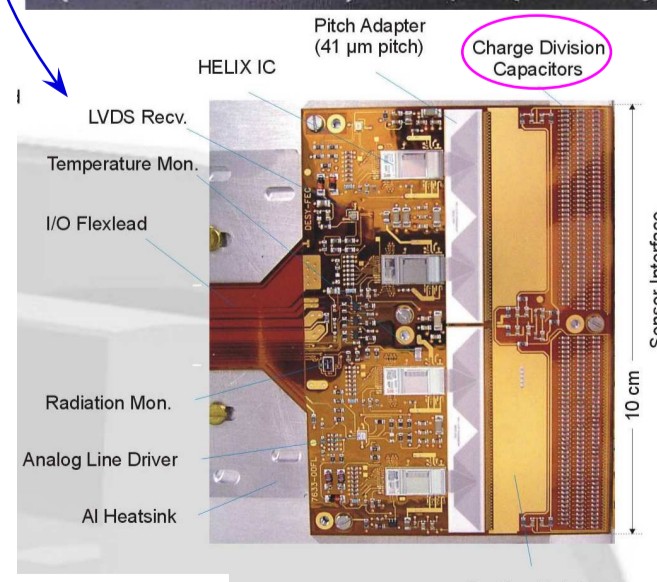


- Size: 99x99 mm
- 300 μ m thick TIGRE sensors
- 128 strips/side (\perp):
– 758 μ m pitch
– 56 μ m separation

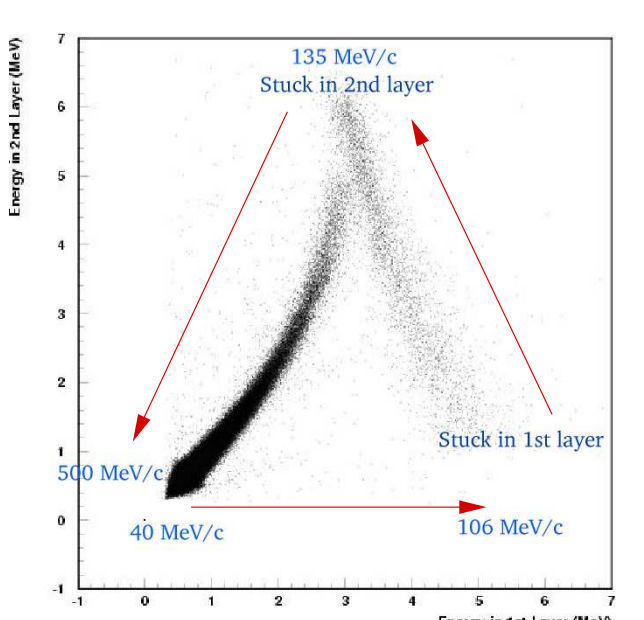
⇒ Particle tracking with 222 μ m resolution up to two spacepoints



• Charge division setup:
⇒ Dynamic input range from 8 to 270 fC

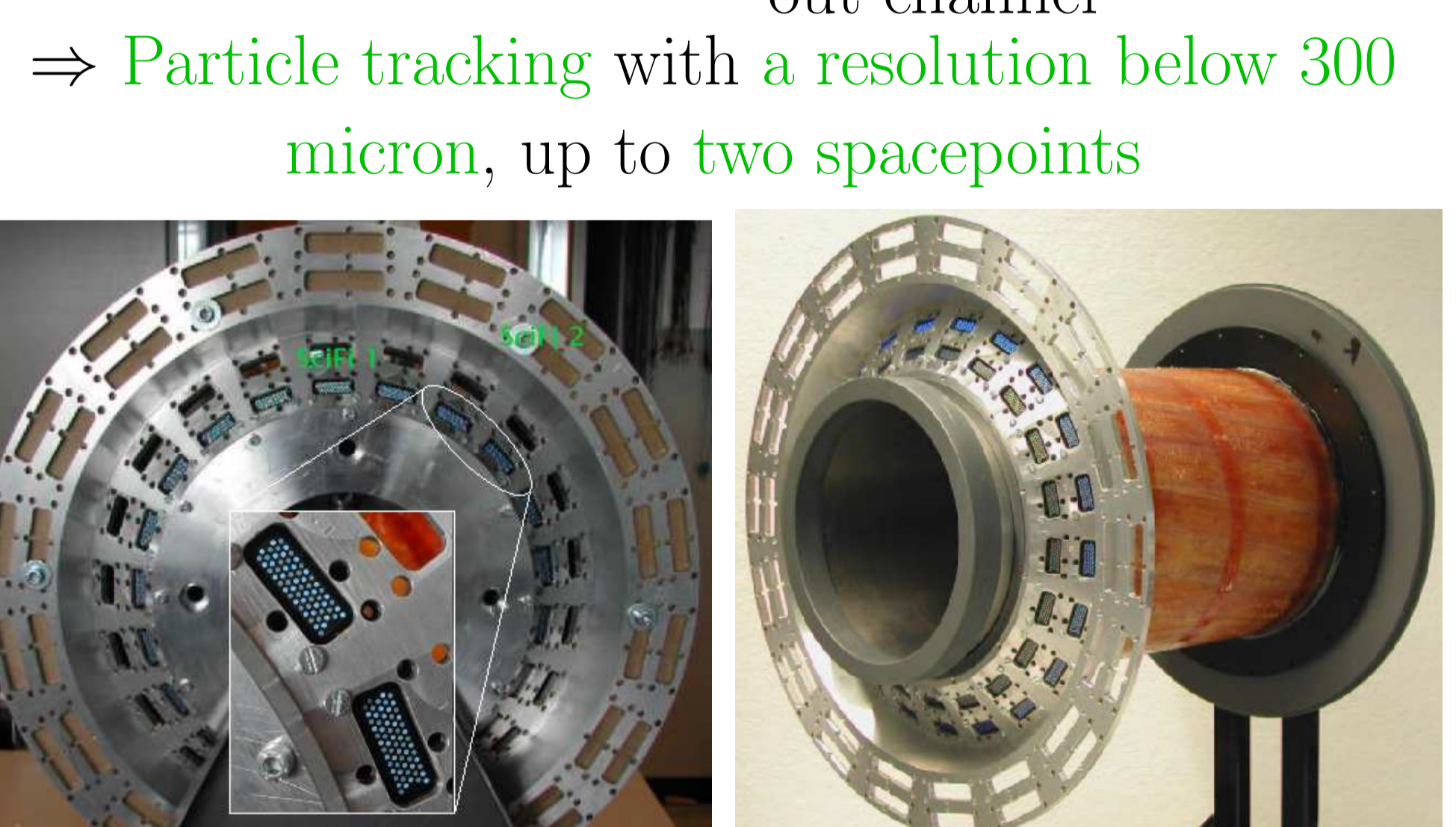
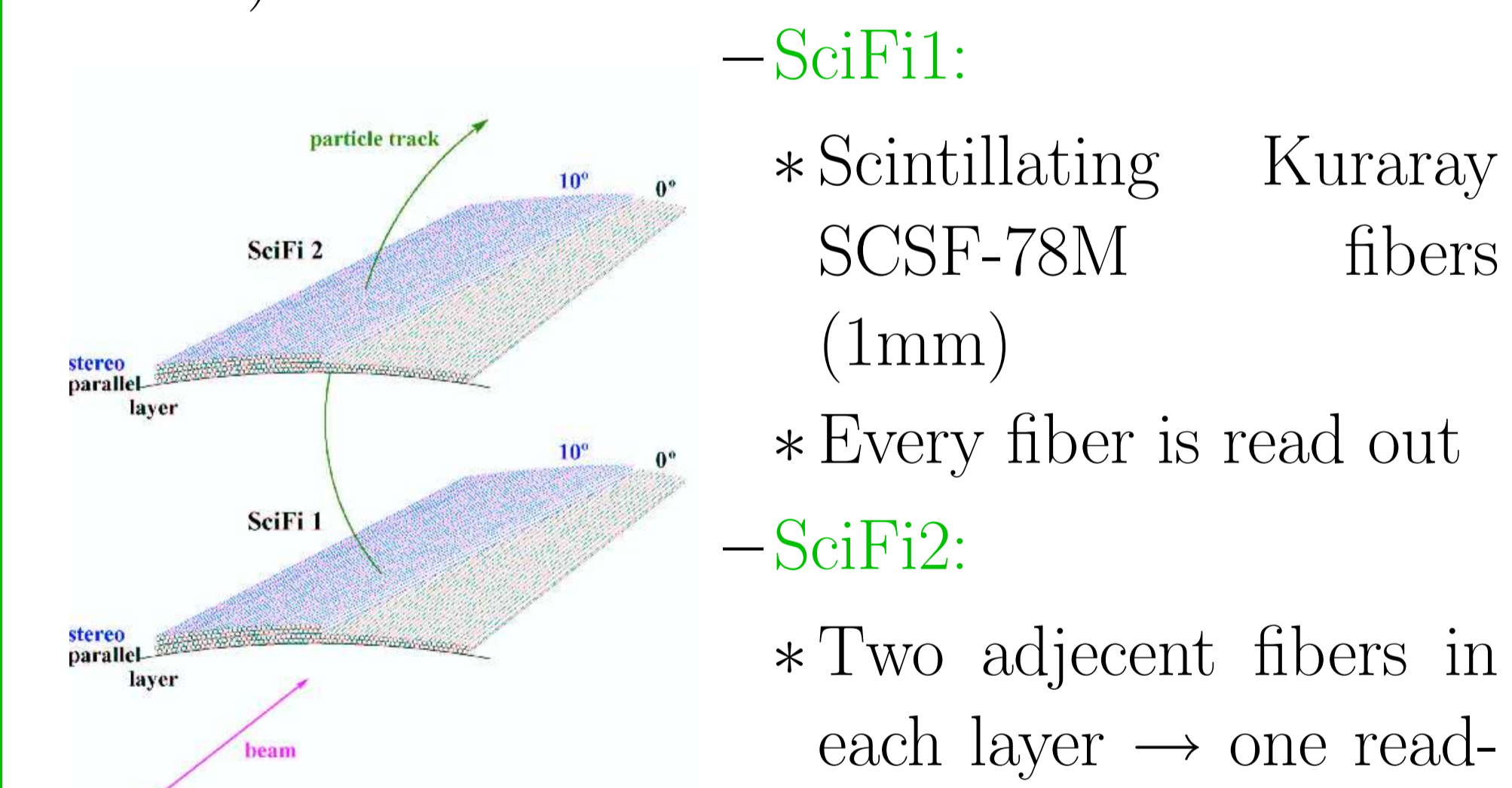


• Deposited energy is a step function of momentum (Bethe Bloch $1/\beta^2$ area)
⇒ Momentum measurement



Scintillating Fiber Detector

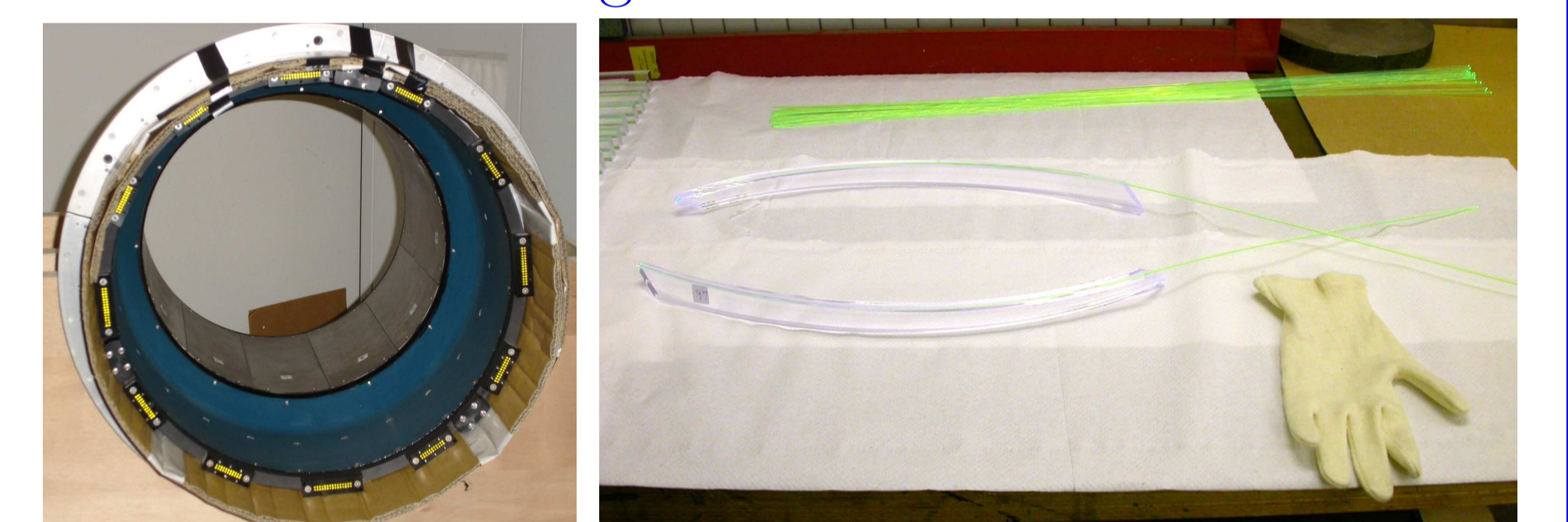
- Detect recoil protons ranging from 0.25 to 1.6 GeV/c
- Polar acceptance $0.7 < \theta < 1.35$
- ϕ resolution is 0.008 rad
- Consist of two 26 cm long barrels (SciFi1 and SciFi2):



- Read out of (combined) fibers with 64 Channel PMTs (H7546B)
- Total 7036 densely packed fibers and 4836 PMT channels
- Digitalisation using frontend electronics with GASSIPLEX chips
- Mean MIP signal is 7.5 photo electrons
- Magnetic field causes deflection of charged particles
⇒ Momentum measurement

Photon Detector

- Detect photons coming from $\Delta^+ \rightarrow p\pi^0$
- 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

