External Tracker

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DESY

Momentum Resolution Measurement

- 100 µm point resolution

  → Gluckstern formula with B=1 T, lever arm of 50 cm and 84 hit points

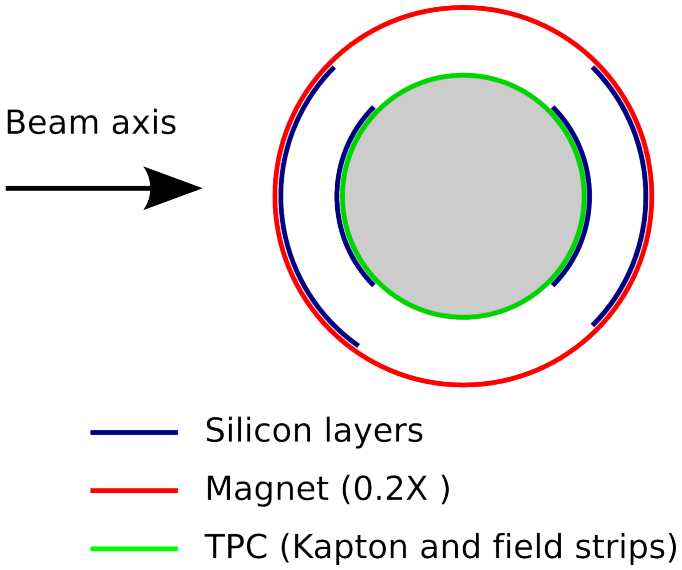
  $\sigma_p/p^2 \sim 4 \times 10^{-3}/\text{GeV}$

- Beam spread already too much
  - E=5 GeV, ΔE=167 MeV → $\sigma_p/p^2 = 6.7 \times 10^{-3}/\text{GeV}$
- Energy loss in the magnet makes it even worse
- Two possibilities:
  - Go into a hadron beam of E~100 GeV and and ΔE<40 GeV

    → CERN SPS beam spread ~2 % and energy loss in magnet negligible
  - Use an external reference inside the magnet

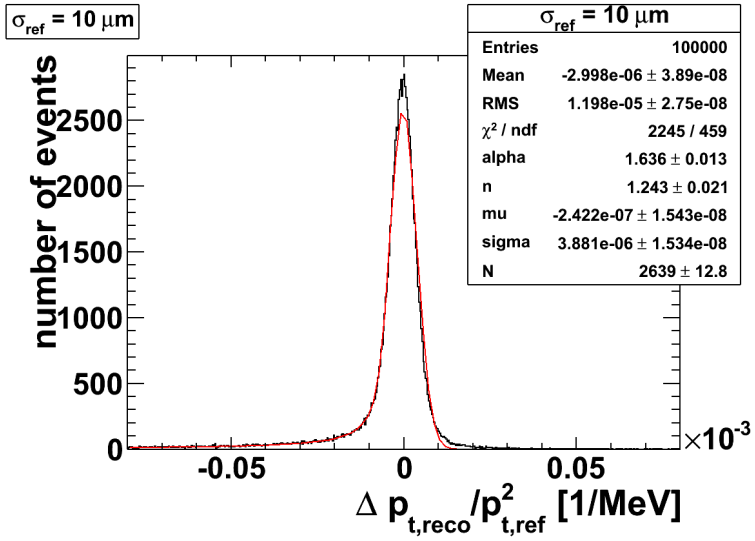
Geant4 Simulation

- Simple Geant4 Simulation
- Magnet is modeled by corresponding radiation length
- TPC made from Kapton and field strips
- Four silicon layers as external tracker
  - Next to the magnet inner wall and the outside of the field cage



External Reference

- ~10 µm resolution of the reference detector
- Jan also calculated the needed resolution
  - 4 layers → 10 µm should be sufficient
  - 3 layers → 5 µm or less (hard for alignment)
  - More than 4 layers → not much is gained, but possible easier alignment



Other Reasons for an External Tracker

- True point resolution
  - Our determination of the resolution uses assumptions:
    - Correct hit errors (more difficult than expected)
    - Independent measurements (charge can spread over two rows)
- Alignment
  - Performing alignment should get more precise
  - Test more complex alignment procedures
- Distortion correction
  - Decoupling distortions and alignment easier?

Funding the Project

- Project for AIDA 2 WP 15 “Facility Upgrades”
- Enough money for hardware and ~1 year postdoc
- Project description not very specific
- Should use existing hardware and DAQ (cost, time, performance)
- Strips (50 µm) with ~10-15 µm resolution are favored but pixel also possible
- Better resolution hard to reach without very precise and stiff holding structures (alignment)
- Size ~ 10 x 10 cm^2
- Use DESY in-house expertise (EUDET telescopes and silicon tracker groups)