COMPASS

Weekly Meeting

Proton Radius Measurement
Test Beam 2018

Friday, 20. April 2018

Christian Dreisbach
Proton Radius Measurement

- elastic scattering of muons off a proton target
- measure $Q^2$ spectrum over wide range: $10^{-4}$ to $10^0$ GeV$^2$/c$^2$
  - extract Radius from its shape
- muon scattering angle between 100 μrad and 10 mrad
- proton recoil energy between 100 keV and 500 MeV

$Q^2 = -q^2$

[Diagram of muon scattering process]
Test Beam Goals

• performance of TPC as active target in muon beam
• beam rate studies - background and readout
• possibility to identify candidates for recoil protons
• correlate events in silicon detectors with TPC events
• possibility of using time stamps and tracking
• collect experience for the future measurement
Test Beam Setup

- S101
- S102
- TPC
- S104
- S105

COMPASS DAQ

TDCs

TPC trigger

time stamp

TPC DAQ

beam trigger
Test Beam Properties

Simulations of beam at the test experiment position (J. Bernhard)

- beam distribution at 190 GeV/c: $\sigma_x \times \sigma_y = 81 \text{ mm} \times 84 \text{ mm}$
- beam momentum at 190 GeV/c: $p = 186.8 \text{ GeV/c}$ with $\sigma = 6.2 \text{ GeV/c}$
Test Beam Setup
Test Beam Trigger

- active area: 6.4 cm x 4.8 cm (~Silicon)
- three trigger elements:
  - one segmented trigger elements (movable)
  - two normal scintillator elements (fixed)

estimate for beam rate
Trigger and Silicons
Trigger and Silicons

Trigger Area

Generator + no beam

no Beam

Generator + 100 kHz beam

100 kHz

Generator + 200 kHz beam

200 kHz

Generator + 400 kHz beam

400 kHz

Generator energy resolution

A66 std. dev., AU

A66 rate, kHz

Entries 11407
Mean 21.7
Std Dev 3.912

Entries 2877
Mean 21.72
Std Dev 1.045

Entries 12476
Mean 21.73
Std Dev 1.194

Entries 2216
Mean 21.62
Std Dev 1.281
Data Taken

Since Monday Evening:

5000 Spills - 750 Million Events

(Combined data taking)
First Tracking Results
First Tracking Results

Preliminary

vertex position

Window

cable/tube

S104X1_

4) unbiased Residual
- 5x better in general
  (Alignment + Reconstruction)

< 150x Events
Thank you all for your work!

Thank you for your attention!