

Status report of the HARP-CDP group

Yu. Nefedov for the HARP-CDP group



SPSC 83, 4 October 2007

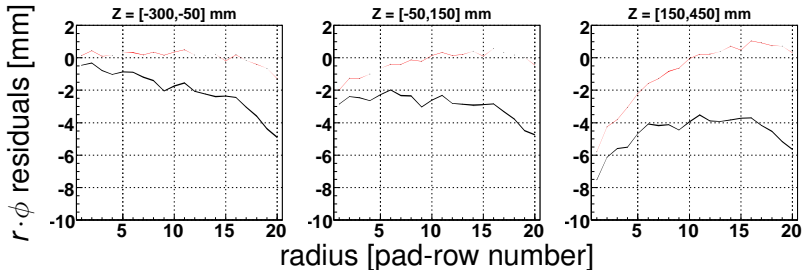
Outline

- 1 Calibration
 - Static track distortions
 - Dynamic track distortions
- 2 Physics performance
 - TPC performance (*published in CERN-PH-EP-2007-030*)
 - RPC performance (*published in NIM **A578** (2007) 119*)
 - Particle Identification
- 3 Results
 - Raw spectrum
 - Cross-sections

TPC calibration: Static track distortions

- Calibration with cosmic-muon tracks
- Barrel RPCs used as external reference system

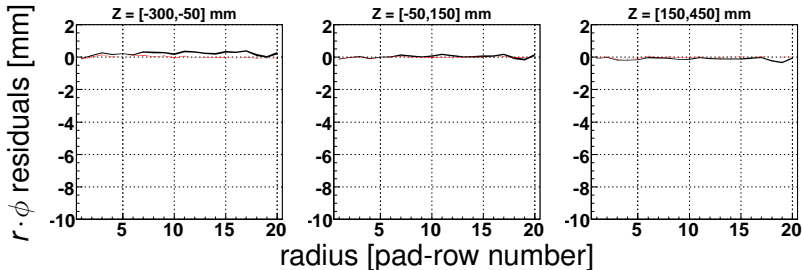
Before any distortion correction



TPC calibration: Static track distortions

After static distortions corrections:

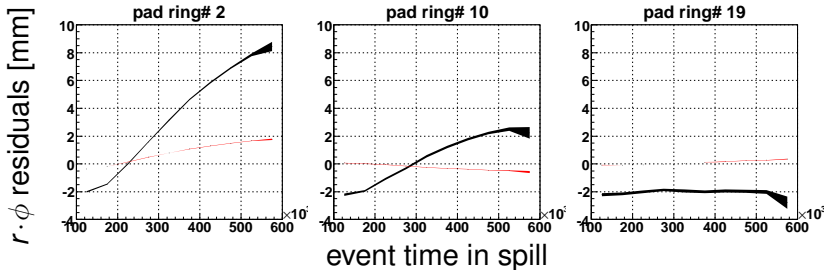
- magnetic field inhomogeneity
- high-voltage misalignment
- anode-wire 'durchgriff' effect
- static 'margaritka' effect



TPC calibration: Dynamic track distortions

- Calibration with physics tracks
- Barrel RPCs and the beam point used as external reference system

Thin Be +8.9 GeV/c after static distortion corrections

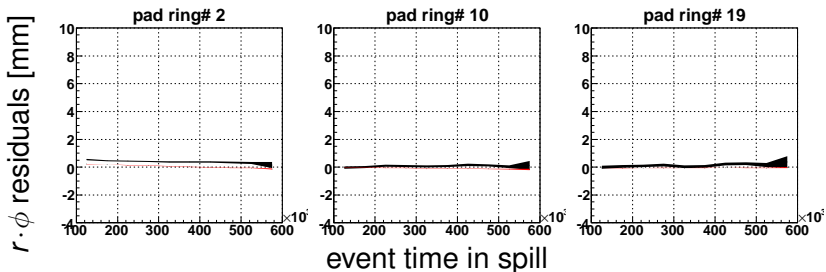


TPC calibration: Dynamic track distortions

Dynamic distortions corrections:

- ‘stalactite’ charge: build-up of Ar^+ ions in TPC volume
- dynamic ‘margaritka’ effect

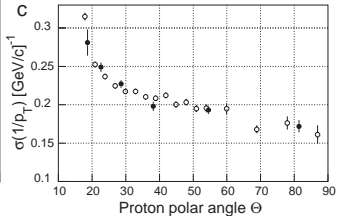
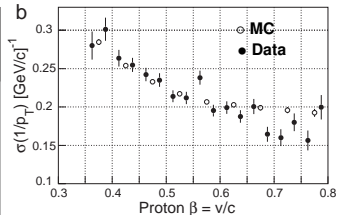
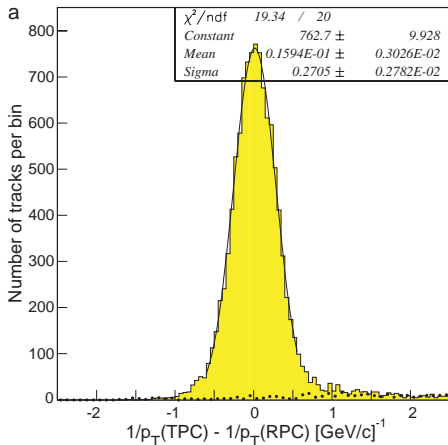
Thin Be +8.9 GeV/c after ALL distortions corrections



TPC performance: p_T resolution

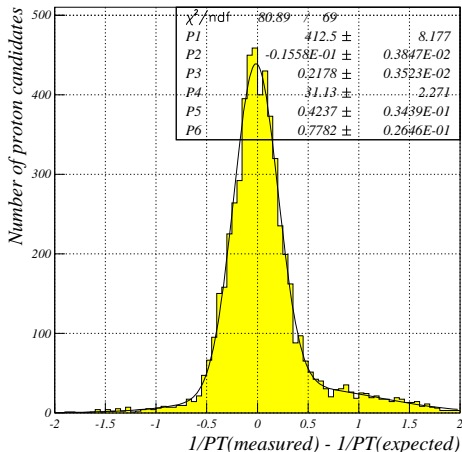
Difference of $1/p_T$ measured in TPC and from RPC time of flight

$$\sigma(1/p_T) = 0.20 \text{ (GeV/c)}^{-1}$$



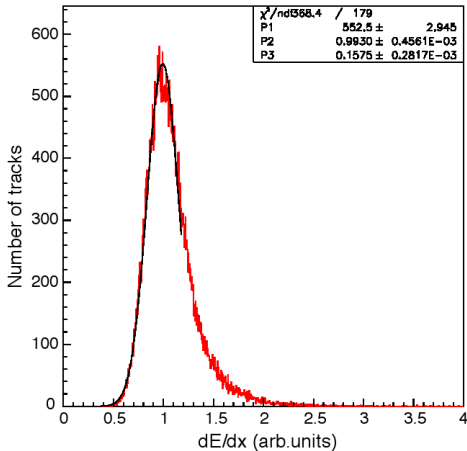
Cross-check from elastic scattering on hydrogen

+3 GeV/c beam (protons and π^+) on liquid H₂ target



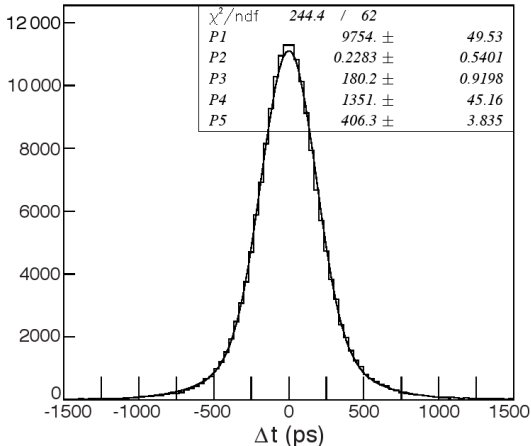
- calculate p_T (expected) of recoil protons from Θ of the track
- average $p_T \sim 0.5$ GeV/c
- momentum scale:
 $\Delta p_T/p_T = 0.8\%$
- resolution:
 $\sigma(1/p_T) = 0.19$ (GeV/c)⁻¹

TPC performance: dE/dx resolution



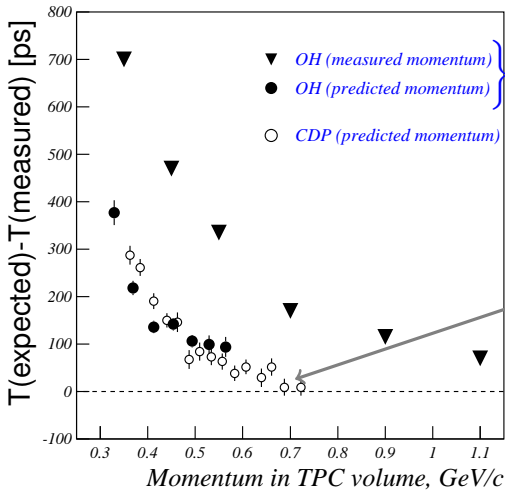
- Corrections on temperature and pressure
- $\sigma(dE/dx) = 16\%$

RPC timing resolution



- Intrinsic time resolution
 $\sigma(\Delta T) = 127 \text{ ps}$
- RPC system time resolution: 175 ps

RPC time response for protons



arXiv:0709.3756 (24 Sep 2007)

theory *NIM A578 (2007) 119*

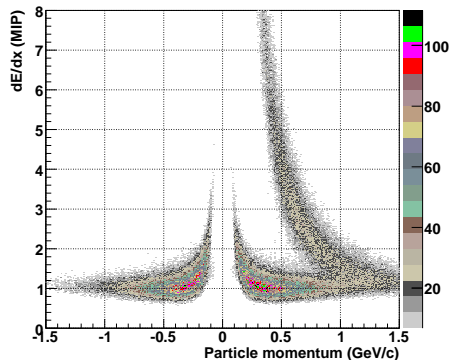
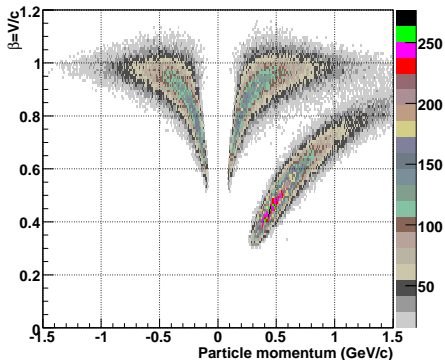
$$\Delta t = 45 \text{ ps} \cdot \ln \frac{dE/dx_{\text{proton}}}{dE/dx_{\text{pion}}}$$

Particle identification

Two independent methods for particle identification:

- time of flight in the RPCs

- dE/dx in TPC



Particle identification

For each track with measured p_T , Θ , β , dE/dx we calculate:

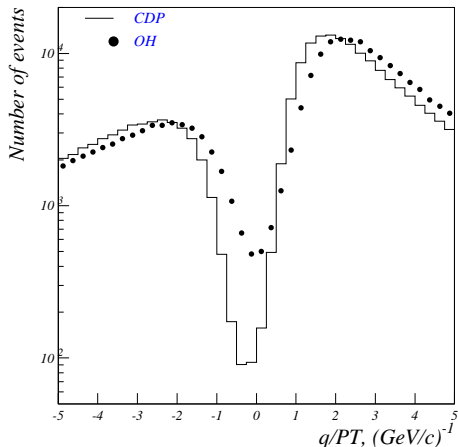
- Probability to be proton
- Probability to be pion
- Probability to be electron

These probabilities are used as weights

Raw spectrum

Spectrum of all secondaries from +8.9 GeV/c protons on thin Be

OH: [arXiv:0709.2806](https://arxiv.org/abs/0709.2806) (17 Sep 2007)

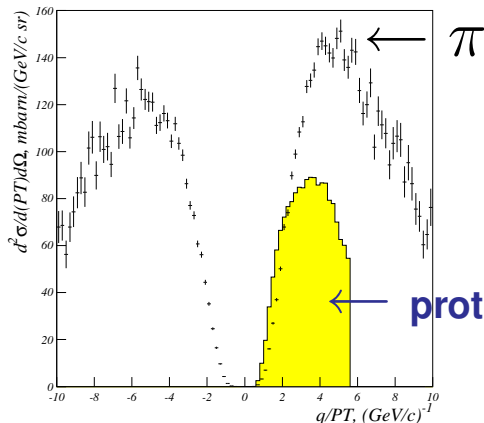


- dynamic distortions corrections applied for both analyzes
- different absolute momentum scale
- different resolution
- ... but same charge ratio

Double-differential inclusive cross-sections

HARP-CDP data from +8.9 GeV/c protons on thin Be
Preliminary. Statistic errors only

$0.35 < \Theta < 0.55$



cross-sections

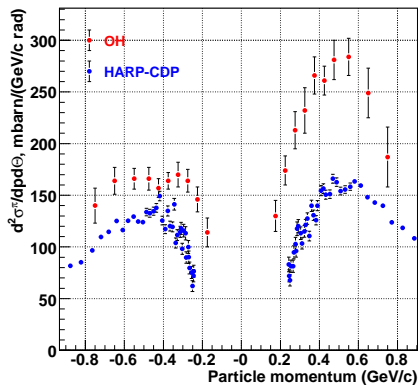
$$\frac{d^2 \sigma}{dp_T d\Omega} \left[\frac{\text{mb}}{\text{GeV}/c \cdot \text{sr}} \right]$$

Comparison

Preliminary HARP-CDP data. Statistic errors only

OH: arXiv:0709.3458 (21 Sep 2007)

$0.35 < \Theta < 0.55$



E910: Phys.Rev.C65(2002) 024904

$0.45 < \Theta < 0.64$

