

Hadroproduction on nuclei: inclusive cross-sections and parametrizations

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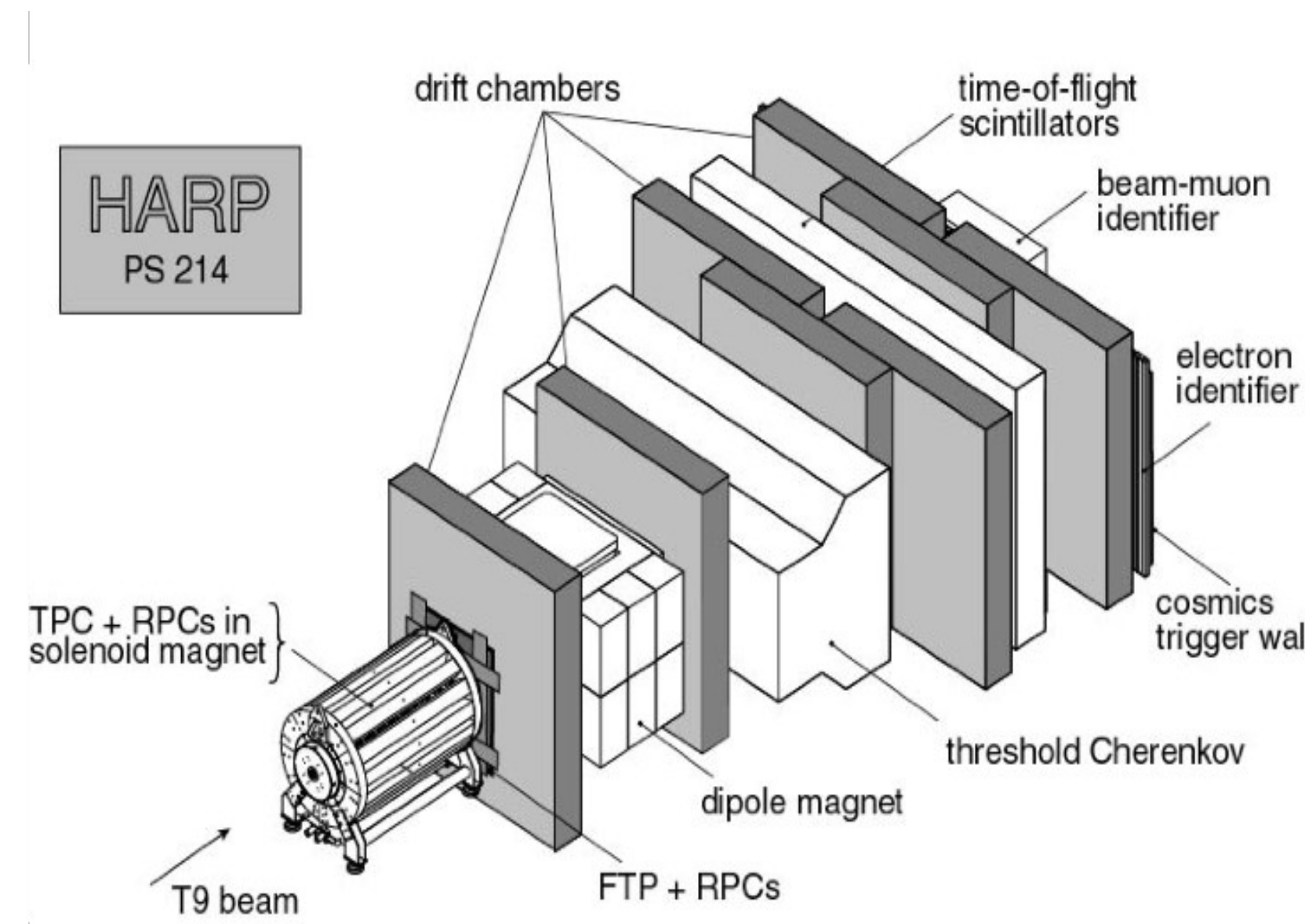
The HARP experiment at CERN was carried out to measure inclusive cross-sections of the production of p , π^+ and π^- , by p , π^+ and π^- beams with momenta between 1.5 and 15 GeV/c, on target nuclei ranging from hydrogen to lead.

Its goal was the improvement of cross-section data as input for the optimization of proton drivers of future neutrino factories, for the design of conventional neutrino beams, for calculations of the atmospheric neutrino flux, and for the tuning of Monte-Carlo generators.

The HARP-CDP group published so far inclusive cross-sections of p , π^+ and π^- production on Be, C, Cu, Ta, and Pb nuclei Refs. [3–8].

Our results are in good agreement with results from earlier experiments (E802 [9] and E910 [10]) at Brookhaven but disagree with the results published by the HARP Collaboration [11,12] who analyzed the same data as us.

The HARP detector and its performance



TPC

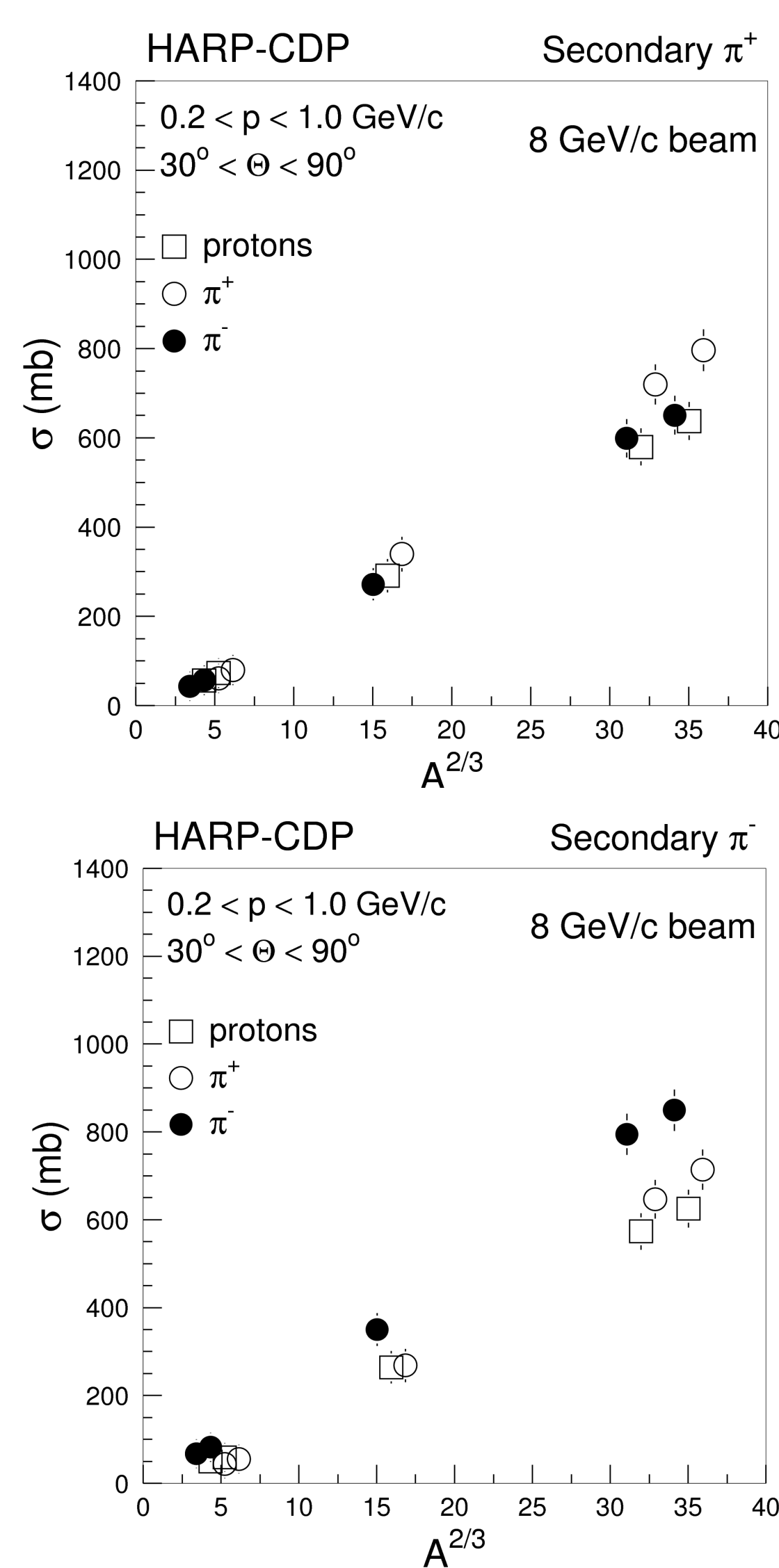
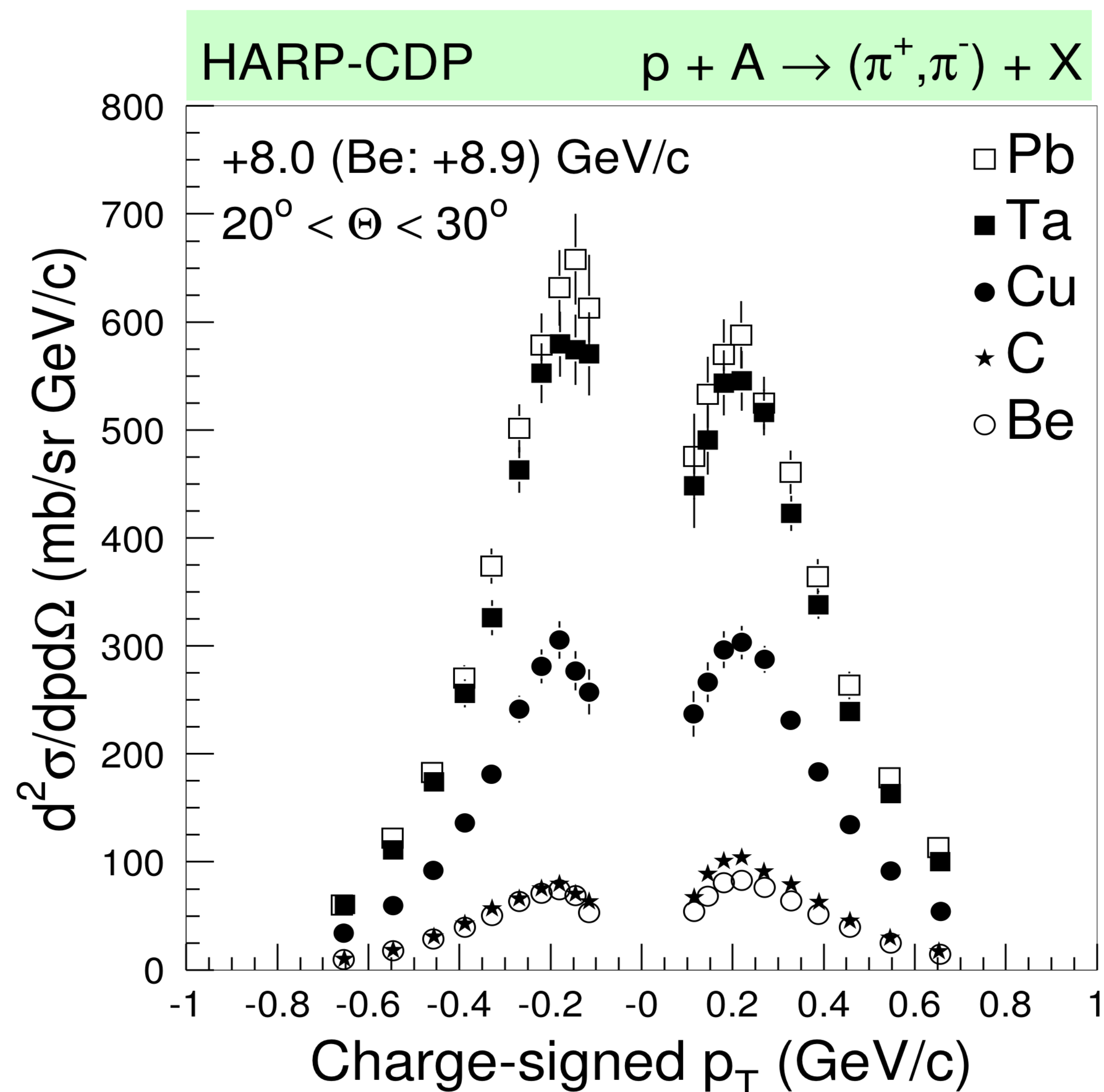
- $\sigma(1/p_T) \approx 0.20 \text{ (GeV/c)}^{-1}$
- $\sigma(\Theta) \approx 9 \text{ mrad}$
- $\sigma(dE/dx)/(dE/dx) \approx 0.16$

RPCs

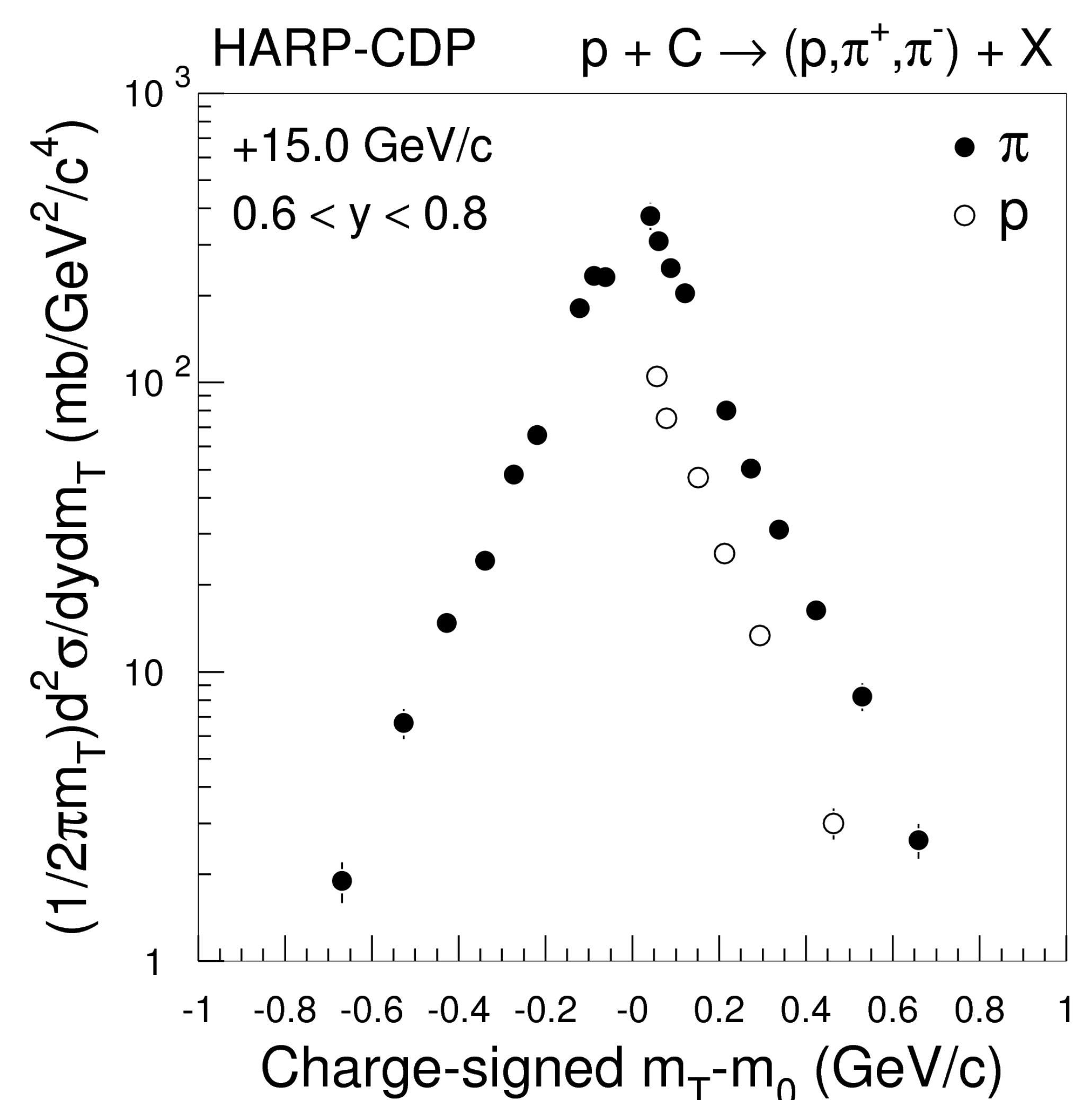
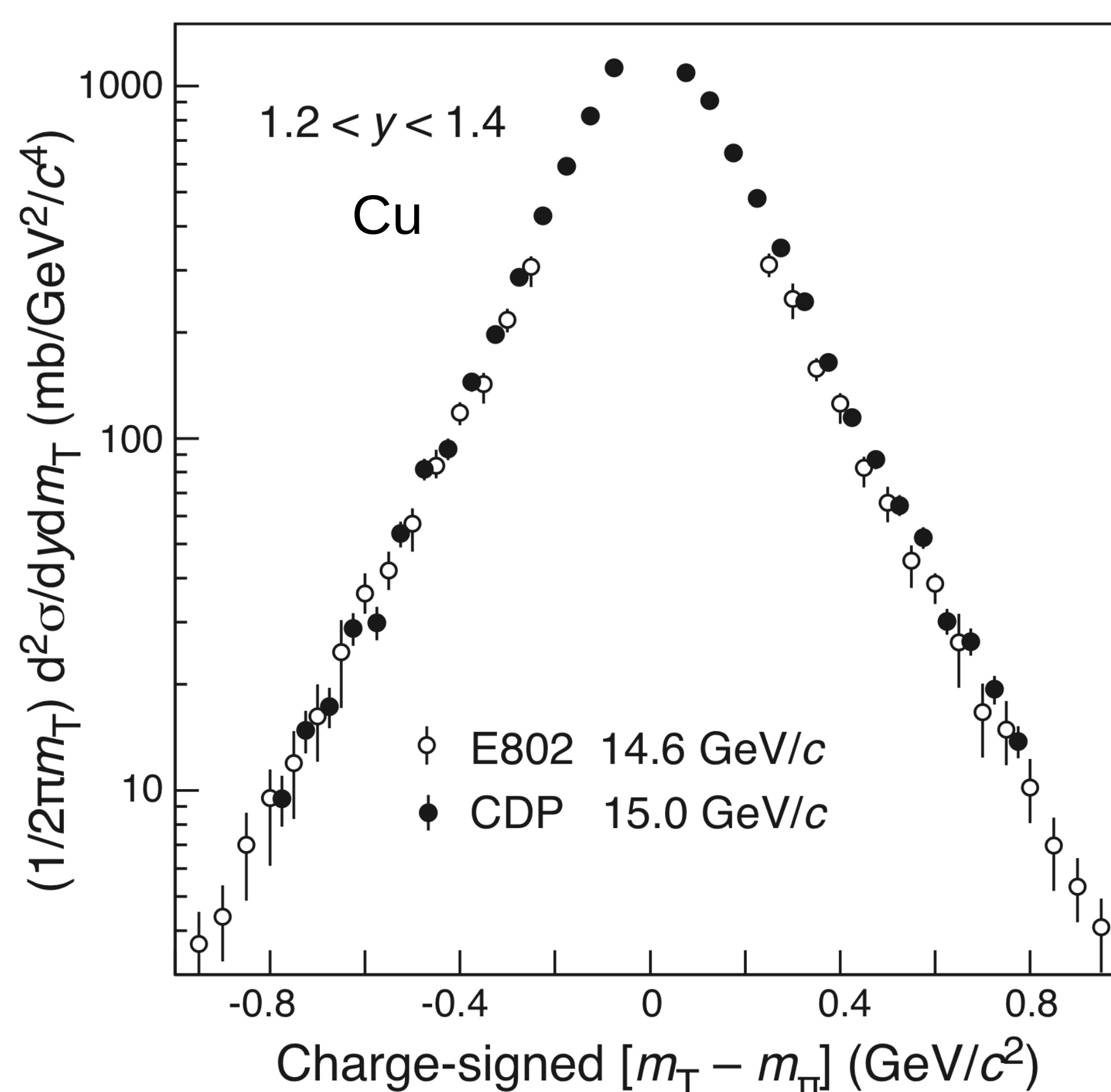
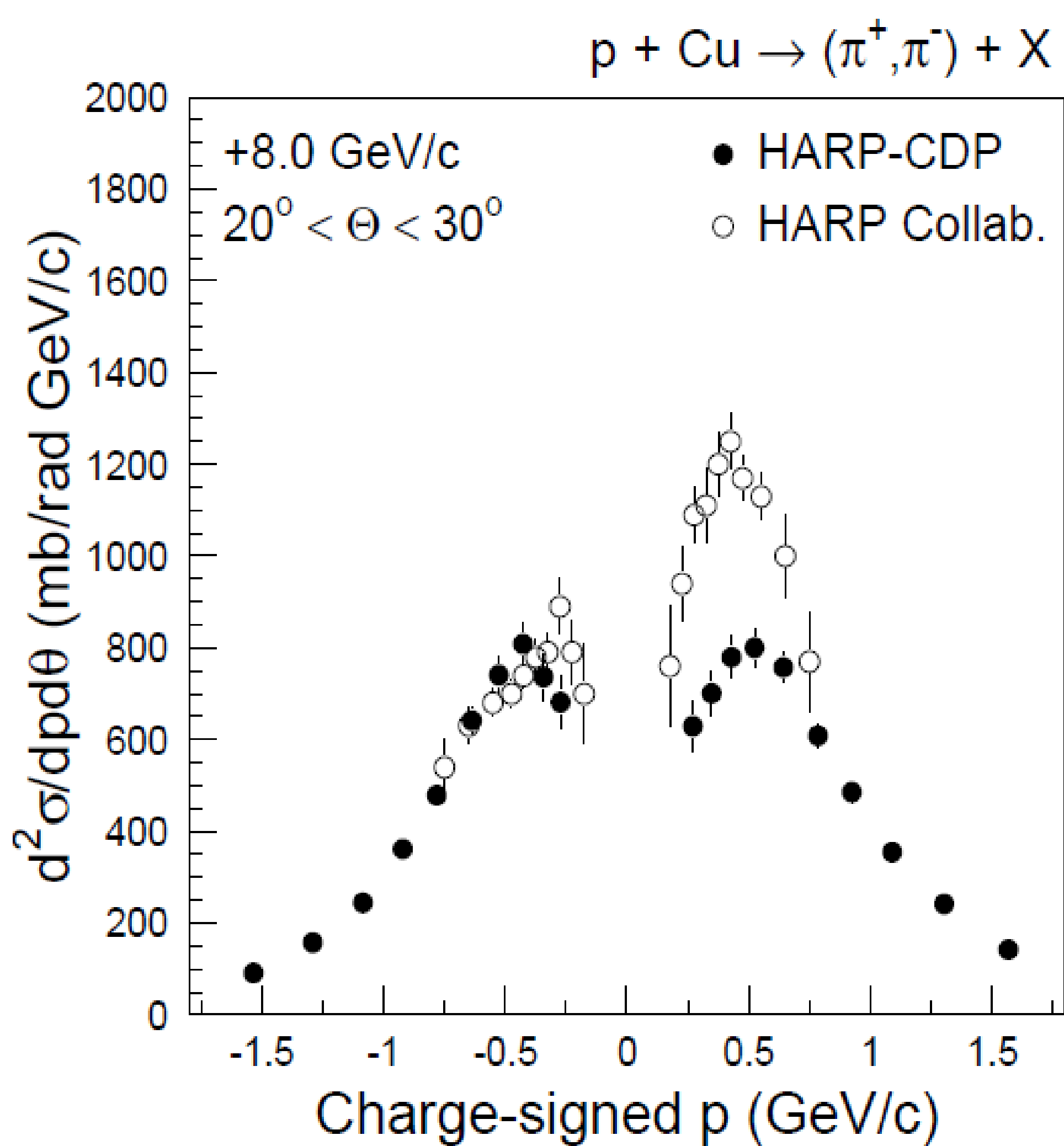
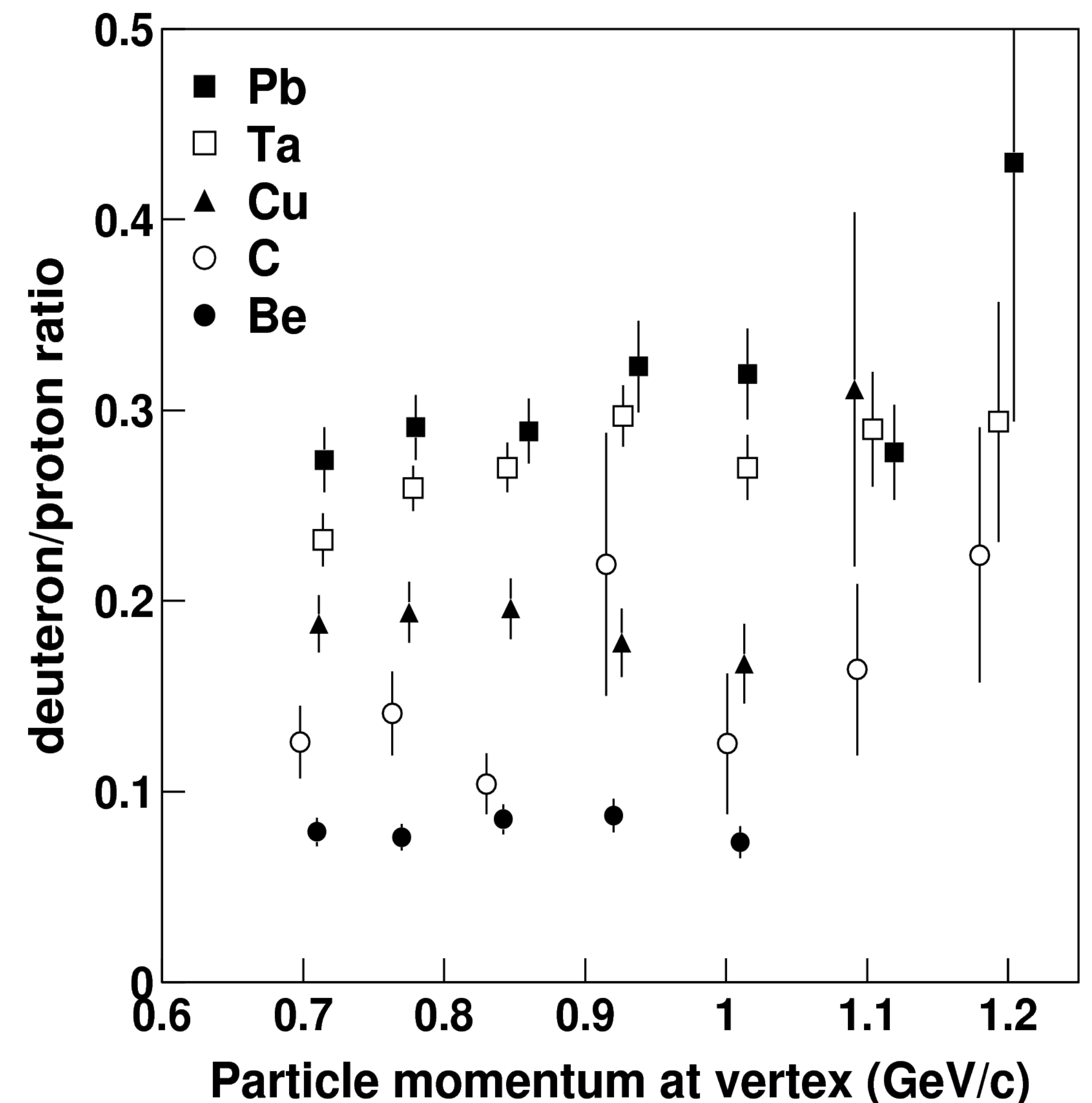
- Efficiency $\approx 98\%$
- $\sigma(\text{TOF}) \approx 175 \text{ ps}$

Good particle identification by combining dE/dx from TPC and TOF from RPCs (Refs. [1-2]).

Cross-sections and parametrization



Deuteron production



Gross disagreement for all target nuclei with the cross-sections published by the HARP Collaboration. Here shown for the Cu target.

Good agreement of our cross-sections with those measured by E802 at Brookhaven National Laboratory

The measured cross-sections lend themselves to an easy parametrization as a function of the transverse mass. In this parametrization pions and protons show the same slope.

[1] V. Ammosov et al., NIM A588 (2008) 294
[2] V. Ammosov et al., NIM A578 (2007) 119
[3] A. Bolshakova et al., EPJ C62 (2009) 293

[4] A. Bolshakova et al., EPJ C62 (2009) 697
[5] A. Bolshakova et al., EPJ C63 (2009) 549
[6] A. Bolshakova et al., EPJ C64 (2009) 181

[7] A. Bolshakova et al., EPJ C66 (2010) 57
[8] A. Bolshakova et al., to appear
[9] T. Abbot et al., PR D45 (1992) 3906

[10] I. Chemakin et al., PR C65 (2002) 024904
[11] M.G. Catanesi et al., PR C77 (2008) 055207
[12] M. Apollonio et al. PR C80 (2009) 055207