International Conference on High Energy Physics, Paris, France, 22-28 July, 2010

Hadroproduction in FLUKA and Geant4: agreement with data?

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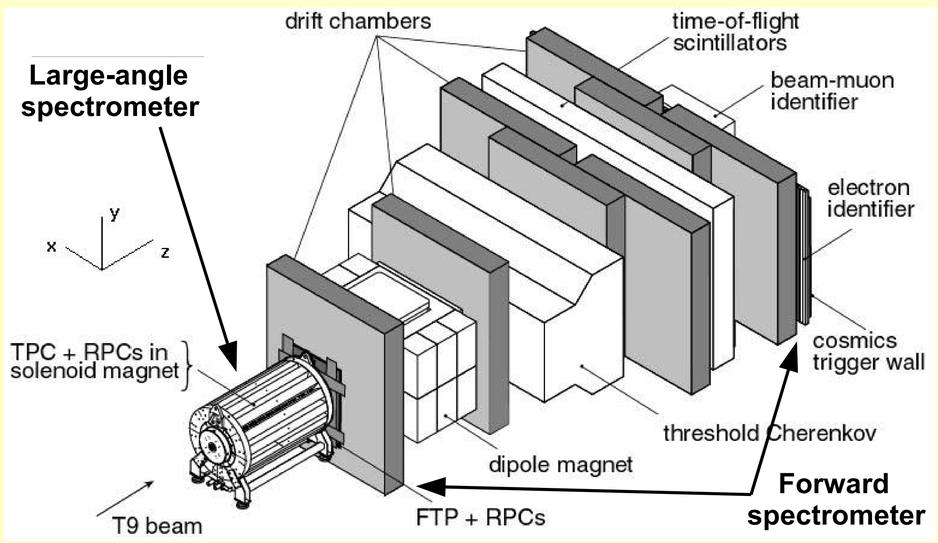
We report on the comparison of production cross-sections of secondary protons and charged pions in the interactions of protons and charged pions with momentum between 3 GeV/*c* and 15 GeV/*c* with 5% λ_{int} beryllium, copper, and tantalum nuclei, with simulations by the FLUKA and Geant4 Monte Carlo tool kits.

HARP detector



The objective of the **HARP** experiment is a systematic study of secondary hadron production for proton and pion beam momenta from 1,5 GeV*c* to 15 GeV/*c* for target nuclei ranging from hydrogen to lead.

The **HARP detector** combined a **large-angle spectrometer** with a **forward spectrometer**. The **large-angle spectrometer** comprised a cylindrical **Time Projection Chamber (TPC)** and an array of **Resistive Plate Chambers (RPCs)** around the TPC.

For the comparison with simulations, cross-sections are integrated over two regions:

- the `intermediate-angle' region: $20° < \theta < 50°$;
  $0.10 < p_T < 0.72$ GeV/*c* for pions;
  $0.30 < p_T < 0.72$ GeV/*c* for protons;
- and the `large-angle' region: $50° < \theta < 125°$;
  $0.16 < p_T < 1.25$ GeV/*c* for pions;

Cross-sections of protons are given only in the intermediate-angle region because the minimum p_T of protons in the large-angle region is about twice the one in the intermediate-angle region and therefore statistics are scarce.

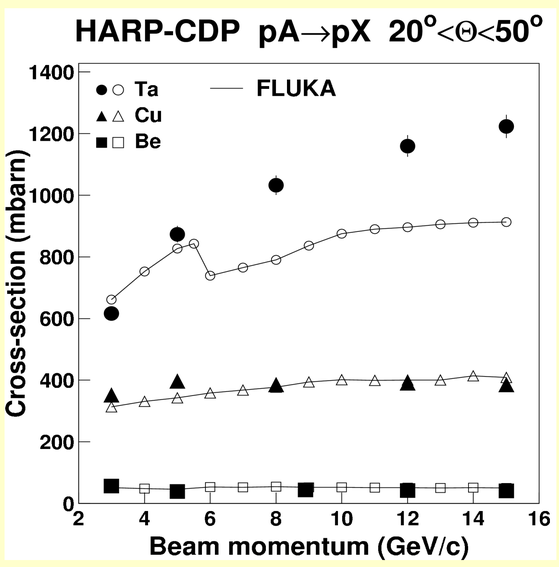
The data have been published in:

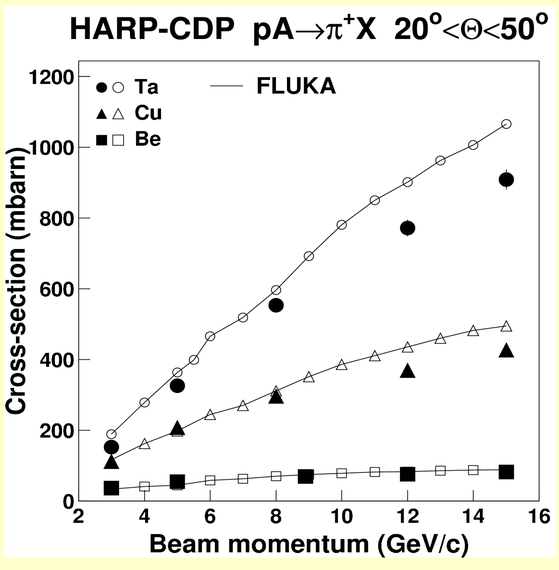
1) V. *Ammosov et al., Nucl.Instrum.Methods Phys. Res. A**588,** (2008) 294*
*2) V. Ammosov et al., Nucl. Instrum. Methods Phys. Res. A**578** (2007) 119*
*3) A. Bolshakova et al., Eur. Phys. J. **C62** (2009) 293*
*4) A. Bolshakova et al., Eur. Phys. J. **C62** (2009) 697*
*5) A. Bolshakova et al., Eur. Phys. J. **C63** (2009) 549*
*6) A. Bolshakova et al., Eur. Phys. J. **C64** (2009) 181*
*7) A. Bolshakova et al., Eur. Phys. J. **C66** (2010) 57*
8) A.Bolshakova et al., HARP-CDP hadroproduction data: Comparison with FLUKA and GEANT4 simulations, arXiv:1006.3429

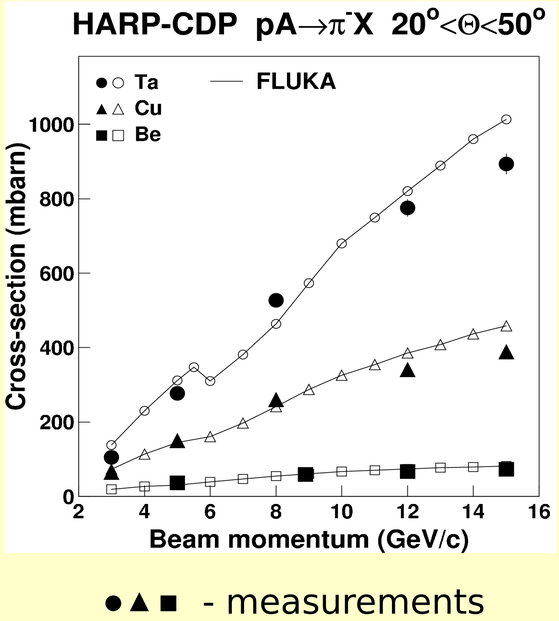
We used the program version FLUKA 2008.3c with default settings and the program version Geant 4.9.3., the QGSP_BERT `physics list' which was selected for being the preferred choice of the LHC Collaborations ATLAS and CMS.

$20° < \theta < 50°$

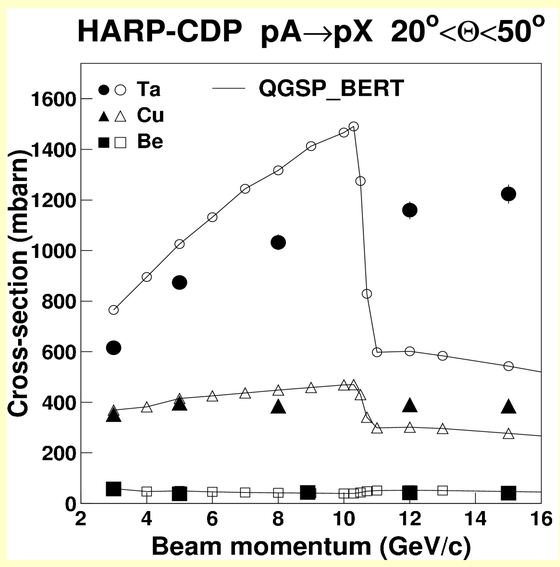
FLUKA

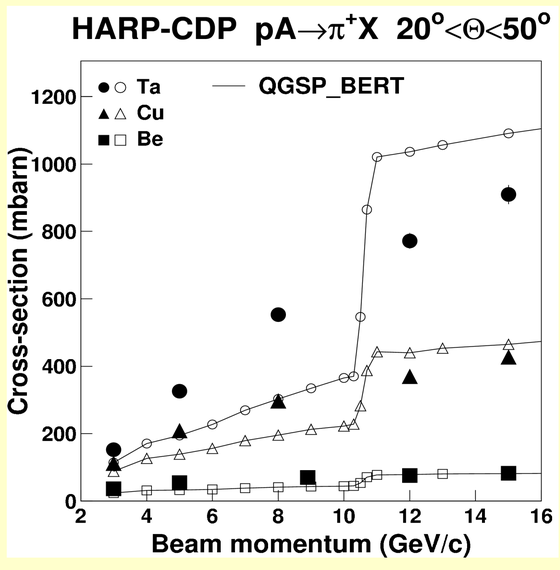


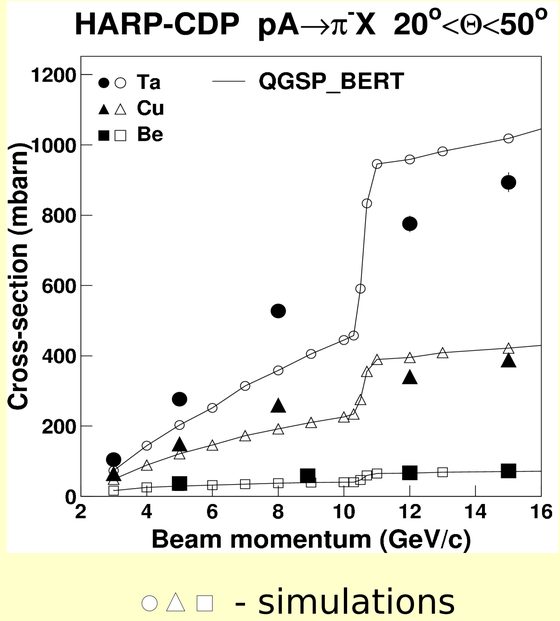




Geant4

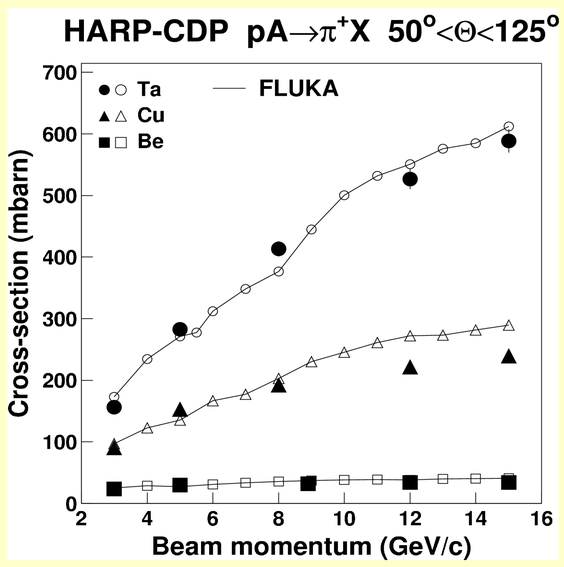


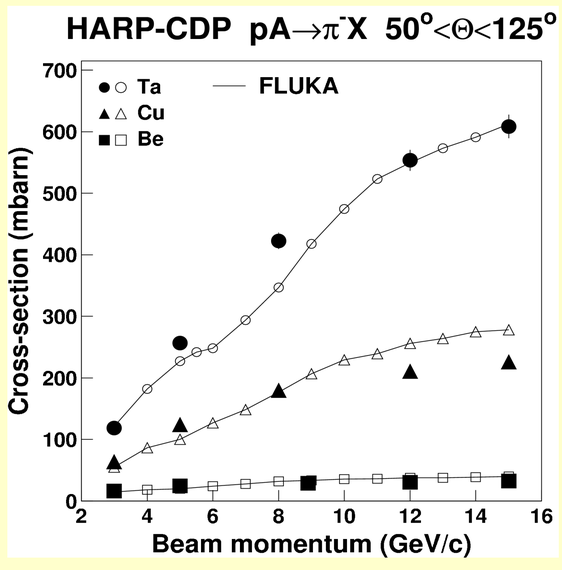




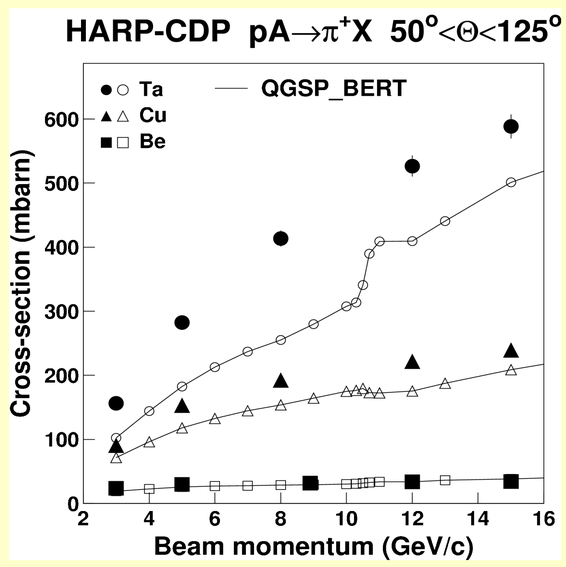
$50° < \theta < 125°$

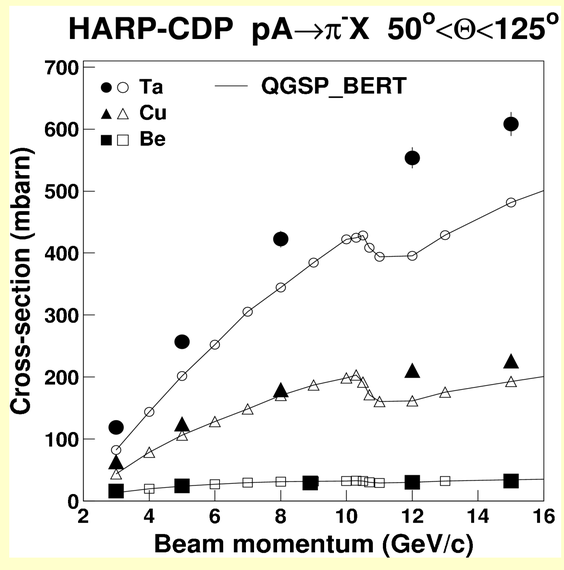
FLUKA



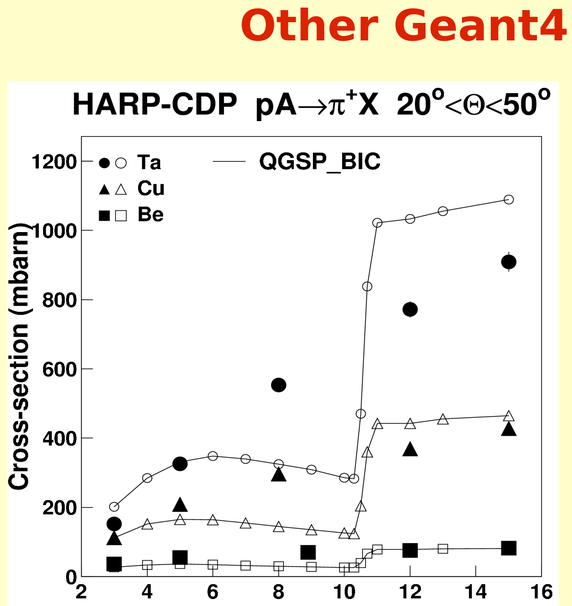


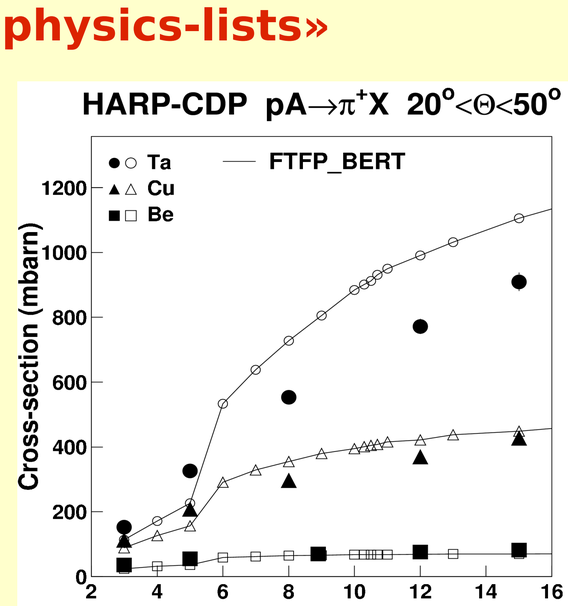
Geant4





Other Geant4 «physics-lists»





●▲■ - measurements

○△□ - simulations