

Hadroproduction on nuclei: inclusive cross-sections and parametrizations.

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Inclusive hadron production cross-sections of the interactions of few GeV/c protons and charged pions with nuclei are of interest for the understanding of the underlying physics, the modeling of Monte Carlo generators of hadron-nucleus collisions, and the design of neutrino beams. Precise and comprehensive double-differential inclusive hadron production cross-sections from *Be*, *C*, *Cu*, *Ta* and *Pb* target nuclei are presented and their characteristics discussed, with emphasis on their dependence on the nuclear mass number.

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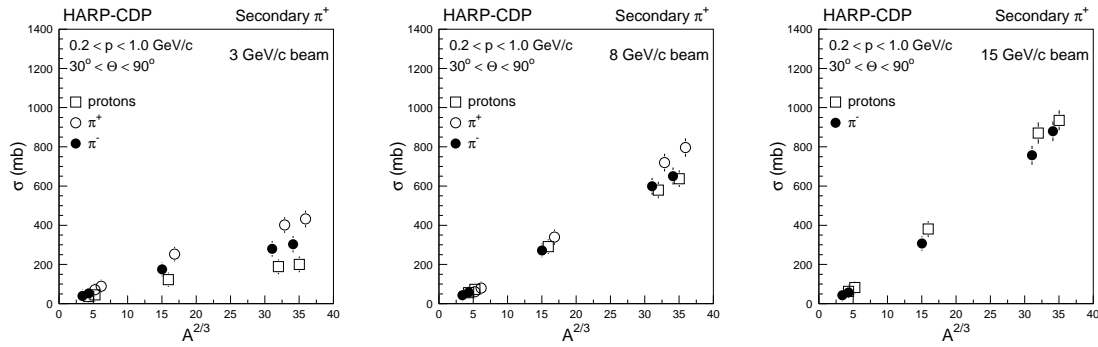


Figure 1: Inclusive cross-sections of π^+ production by protons (open squares), π^+ (open circles), and π^- (black circles), as a function of $A^{2/3}$ for, from left to right, *Be*, *C*, *Cu*, *Ta*, and *Pb* nuclei.

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. 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. [1, 2, 3, 4, 5, 6]).

Figure 1 presents a comparison between the inclusive cross-sections of π^+ production, integrated over the secondaries' momentum range $0.2 < p < 1.0$ GeV/ c and polar-angle range $30^\circ < \theta < 90^\circ$, in the interactions of p , π^+ and π^- with *Be*, *C*, *Cu*, *Ta* and *Pb* nuclei, for beam momenta of 3, 8 and 15 GeV/ c . The comparison employs the scaling variable $A^{2/3}$ where A is the nuclear mass number of the respective nucleus. We note the approximately linear dependence on this scaling variable. At low beam momentum, the slope exhibits a strong dependence on beam particle type, which tends to disappear with higher beam momentum.

Figure 2 shows the increase of the inclusive cross-sections of π^+ and π^- production by incoming protons of 8.0 GeV/ c (in the case of beryllium target nuclei: +8.9 GeV/ c) from the light beryllium nucleus to the heavy lead nucleus, for pions in the polar angle range $20^\circ < \theta < 30^\circ$. It is interesting to note that π^- production is slightly favoured on heavy nuclei, while π^+ production is slightly favoured on light nuclei.

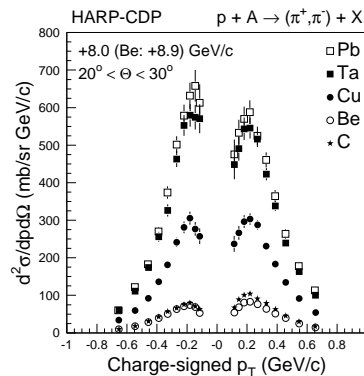


Figure 2: Inclusive pion production cross-sections.

References

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