

Backward nucleon production by heavy baryonic resonances in proton-nucleus collisions

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The production of backward nucleons, $N(180^\circ)$, at 180° in the nuclear target rest frame in proton-nucleus ($\tilde{p} + \tilde{A}$) collisions is studied. The backward nucleons appearing outside of the kinematically allowed range of proton-nucleon ($\tilde{p} + \tilde{N}$) reactions are shown to be due to secondary reactions of heavy baryonic resonances produced inside the nucleus. Baryonic resonances R created in primary $\tilde{p} + \tilde{N}$ reactions can change their masses and momenta due to successive collisions $R + N \rightarrow R + N$ with other nuclear nucleons. Two distinct mechanisms and kinematic restrictions are studied: the reaction $R + N \rightarrow N(180^\circ) + N$ and the resonance decay $R \rightarrow N(180^\circ) + \pi$. Simulations of $\tilde{p} + \tilde{A}$ collisions using the Ultra-relativistic Quantum Molecular Dynamics model support these mechanisms and are consistent with available data on proton backward production.

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