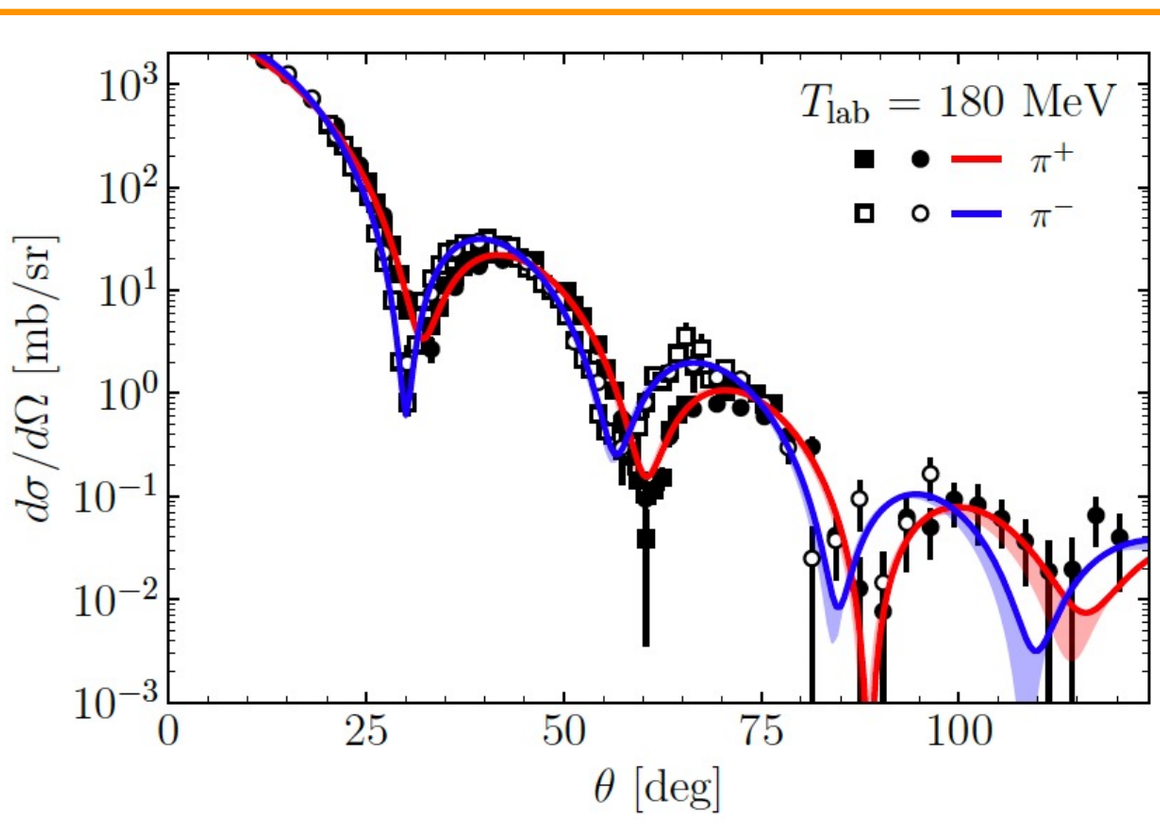
Bridging reaction theory and nuclear structure in $\pi^{\pm}$-^{48}Ca scattering

U.S. DEPARTMENT OF ENERGY | Office of Science

NUCLEI Nuclear Computational Low-Energy Initiative

Objectives

- Develop a more accurate model of pion-nucleus scattering by incorporating second-order contributions in the scattering potential, focusing on the case of ^{48}Ca.
- Employ modern nuclear structure input (one-body densities and two-body correlation functions), based on chiral effective field theory interactions, in the scattering potential.



Predicted differential cross section for π^+ (red) and π^- (blue) scattering on ^{48}Ca as a function of the scattering angle, compared to experimental data (black) for a pion laboratory kinetic energy of 180 MeV.

Impact (as of now)

- Our theoretical framework successfully reproduces experimental differential cross sections for $\pi^{\pm}$-^{48}Ca scattering.
- Second-order contributions to the scattering potential are key to achieve agreement with experimental data.
- The results exhibit only mild sensitivity to the choice of the *ab initio* chiral nuclear interaction, which might become a more significant source of uncertainty in the low-energy regime.

Accomplishments (as of now)

- Pre-print: V. Tsaran, F. Marino, S. Bacca, F. Bonaiti, M. Vanderhaeghen, arXiv:2505.18459 [nucl-th].