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Proton internal pressure from deeply virtual Compton scattering at the future Electron-Ion Collider

As unexpected as it may seem, the past few years revealed that it is possible to ascribe a well-defined meaning to the notion of proton internal pressure, to identify several associated observables that can be measured in contemporary experiments and from them to extract this internal pressure in a theoretically controlled manner. The conceptual breakthrough originates from the definition of generalized parton distributions providing a direct connection between the energy-momentum tensor and exclusive processes measurements accessible at facilities colliding leptons and hadrons.

This unique experimental connection has been highlighted with attempts to extract the nucleon pressure and shear forces distributions. If, in principle, this can be performed in a model-independent way from experimental data, in practice, limited precision and restricted kinematic coverage make such an extraction very challenging. We outline a next-to-leading order formalism allowing a reanalysis of existing global fits with genuine gluonic degrees of freedom. We also provide an estimate of the reduction in uncertainty that could stem from the extended kinematic range relevant for the future Electron-Ion Collider, currently under construction at Brookhaven National Laboratory.

More generally we discuss the impact of future measurements of deeply virtual Compton scattering with the ePIC detector at the Electron-Ion Collider. This provides a reference point for future analyses. In addition to presenting distributions of basic kinematic variables obtained with the latest ePIC design and simulation software, we also examine the impact of future measurements on nucleon tomography. We explain why these developments naturally fit in a versatile software framework, named PARTONS, dedicated to the phenomenology and theory of generalized parton distributions.

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