

# EICΦ collaboration review: *Hadron structure for EIC*

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# What are Hadronic Structure Functions?

Encode the momentum and spin distributions of quarks and gluons inside hadrons.

Key observables in deep inelastic scattering (DIS):

$F_2(x, Q^2)$  – unpolarized structure functions and  $g_2(x, Q^2)$  – polarized counterparts

Why EIC?

The EIC will explore nucleon and nuclear structure with high precision across a wide range of  $x$  and  $Q^2$  values.

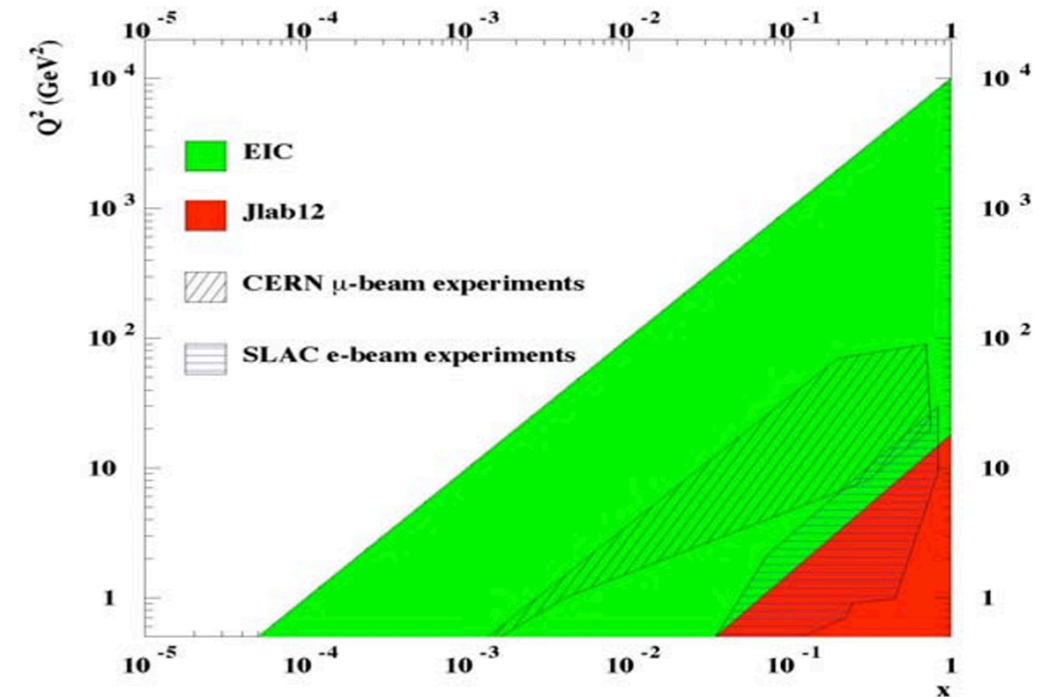
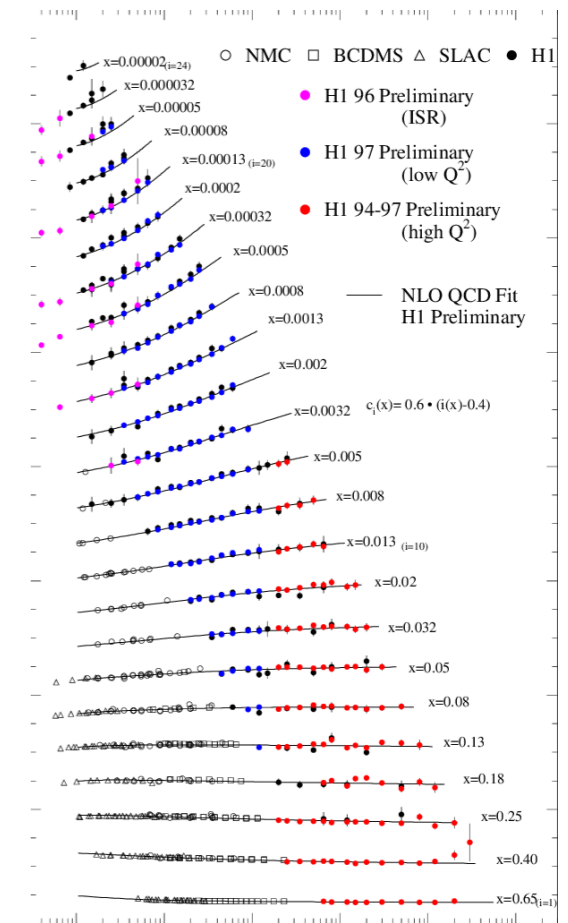
Enables 3D tomography of hadrons: transverse momentum distributions (TMDs), generalized parton distributions (GPDs), and spin-dependent PDFs.

Physics Goals:

Understand spin decomposition of the proton

Gluon saturation and small- $x$  dynamics

Partonic structure of light and heavy nuclei



## Structure Functions at EIC – Opportunities

Key Measurements at EIC:

Precise F2 and g2 for proton and light nuclei

Flavor-separated PDFs using polarized beams

Tagged DIS on deuterium and heavier nuclei

Novel Opportunities:

**TMDs:** Access to parton transverse motion

**GPDs:** Spatial distributions via exclusive processes

Diffractive structure functions: Probe color-neutral exchanges

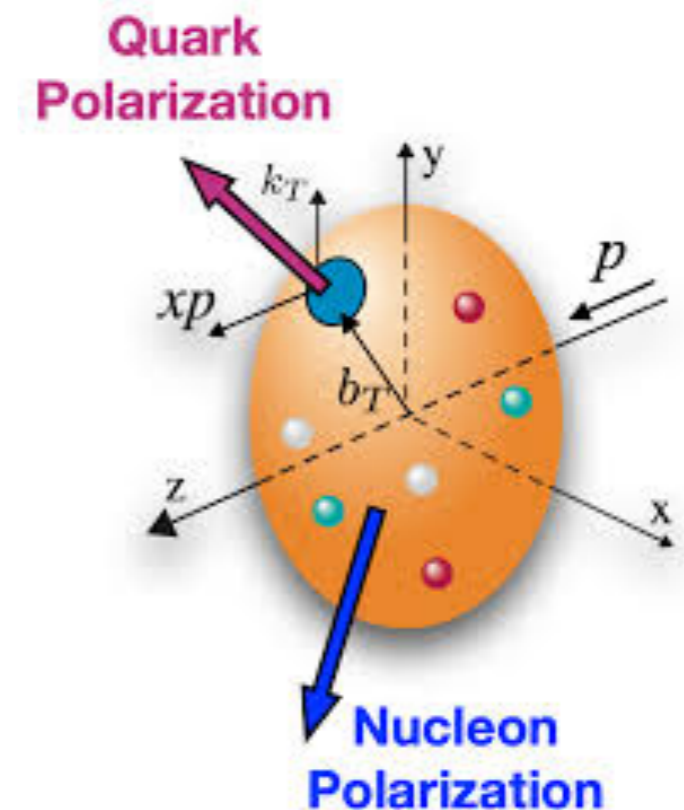
Impact on QCD and Beyond:

Nonperturbative QCD insights from global fits

Constraints on lattice QCD and phenomenological models

Input for collider physics, neutrino scattering, and nuclear theory

LaMET for Effective models and Lattice QCD



$$\tilde{q}(x, \mu^2, P_3) = \int \frac{dz}{4\pi} e^{ixP_3z} \langle N | \bar{\psi}(z) \Gamma \mathcal{A}(z, 0) \psi(0) | N \rangle.$$

Quasi PDF in LaMET