

Discussion

The Strong Interactions Working Group

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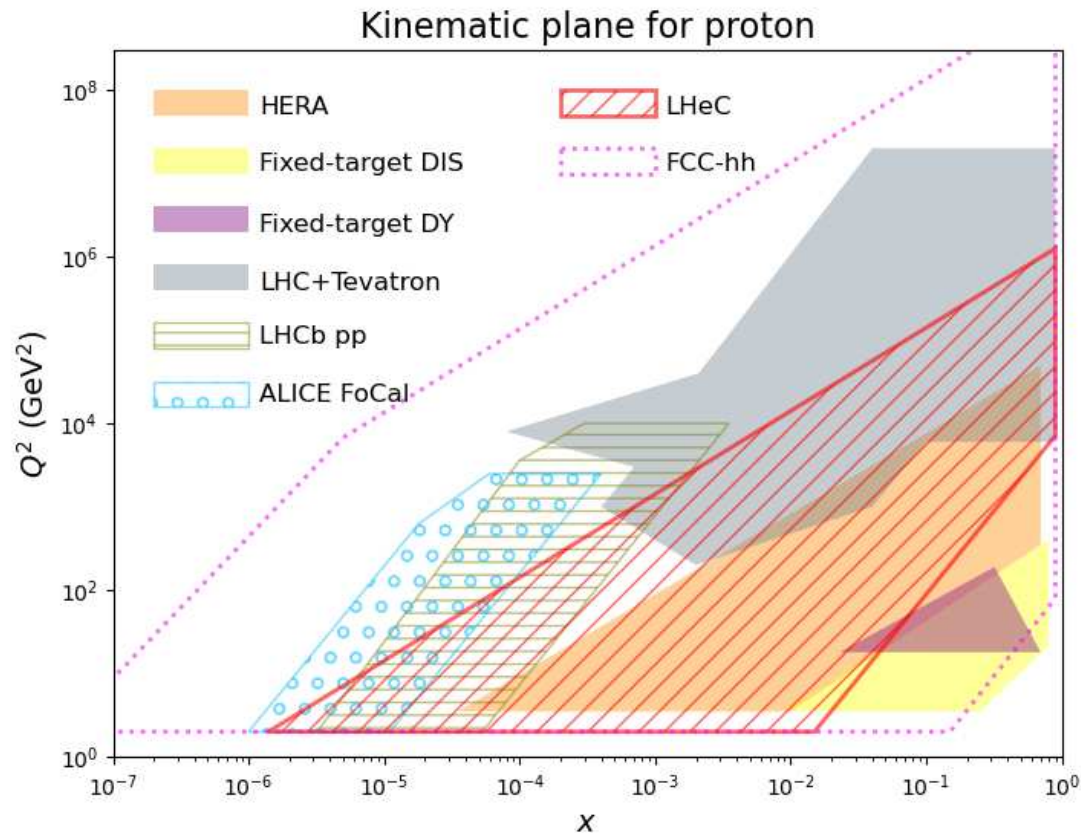
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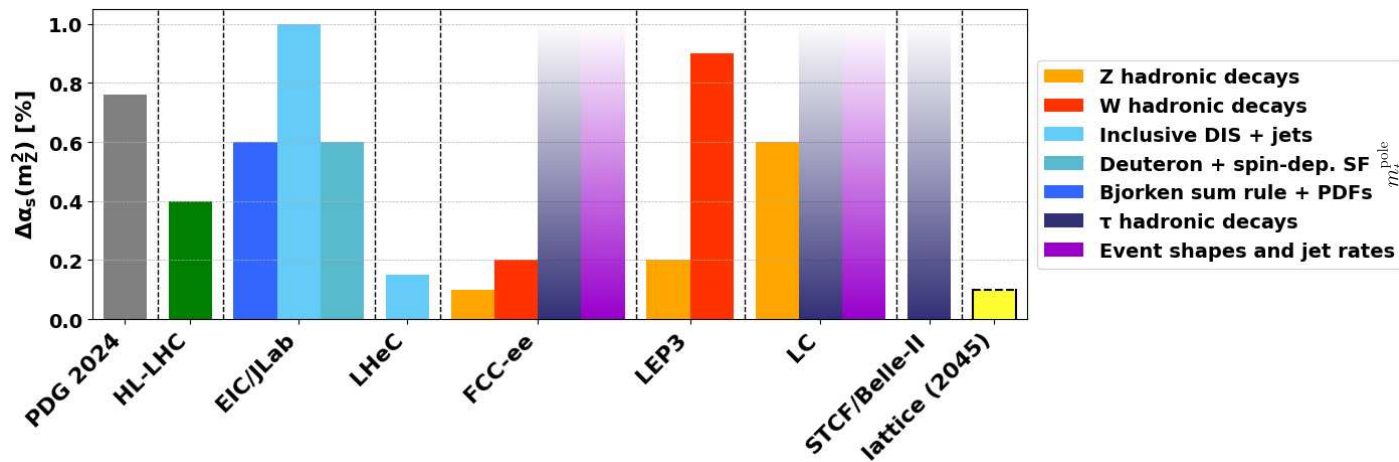
Open Symposium “*European Strategy for Particle Physics*”, Venice, June 23, 2025

Exploring the deep hadron structure

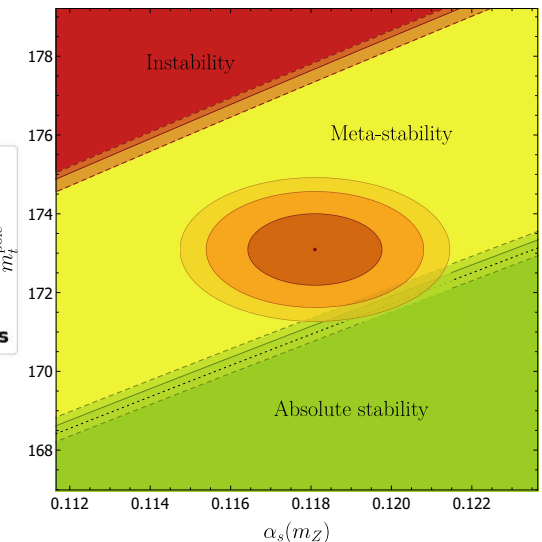


- Will foreseeable data be sufficient to constrain all PDFs/TMDs/GPDs?
(*novel kinematic regime at small x*) $\longrightarrow$ *new QCD discoveries*
(*input for HEP physics*) $\longrightarrow$ *QCD expertise as a resource*
(*EW and Higgs precision, BSM discovery potential, etc.*)
- Which theoretical accuracy is needed for study of proton/nuclei structure?
(*for PDFs, TMDs, GPDs: for small x studies*)

QCD research at precision frontier

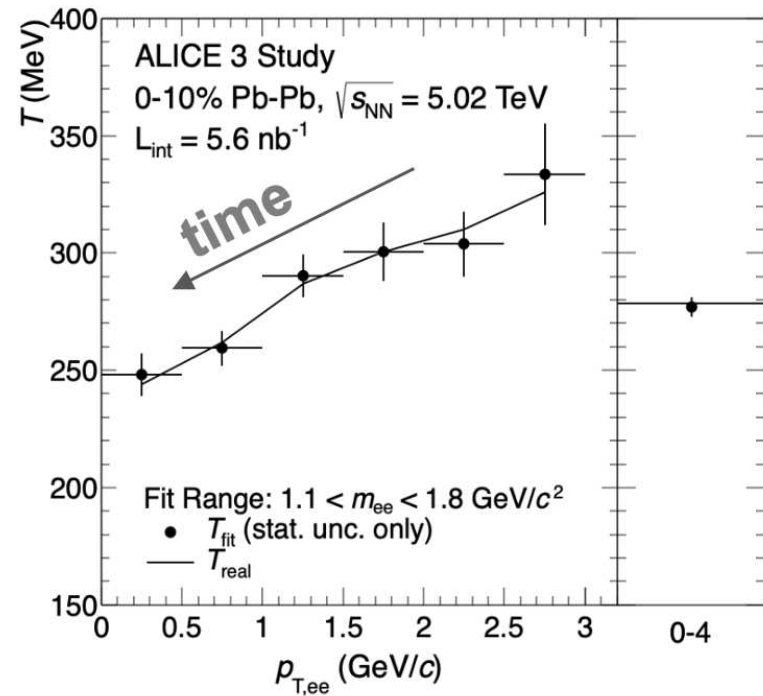
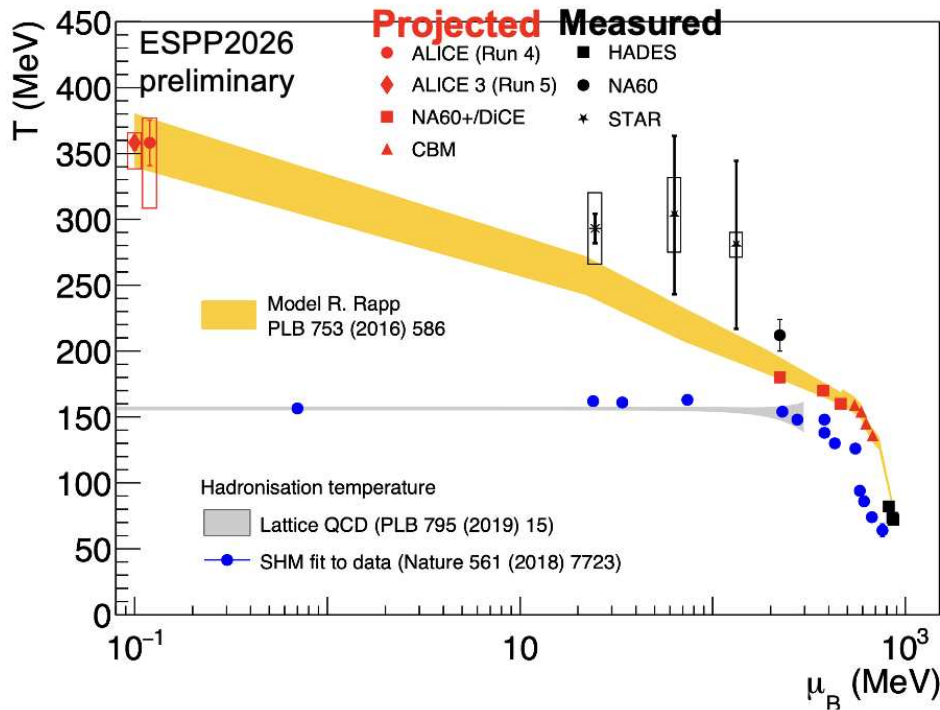


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- How do we reach ultimate precision for α_s and m_t ?
(collider options LHeC, FCC-ee, etc)
- Which progress in theory predictions is needed?
(for higher loops in pQCD; for MC developments)
- How to relate α_s lattice result to extractions from collider data?
(BSM physics and experimental systematics vs. continuum extrapolation on lattice)

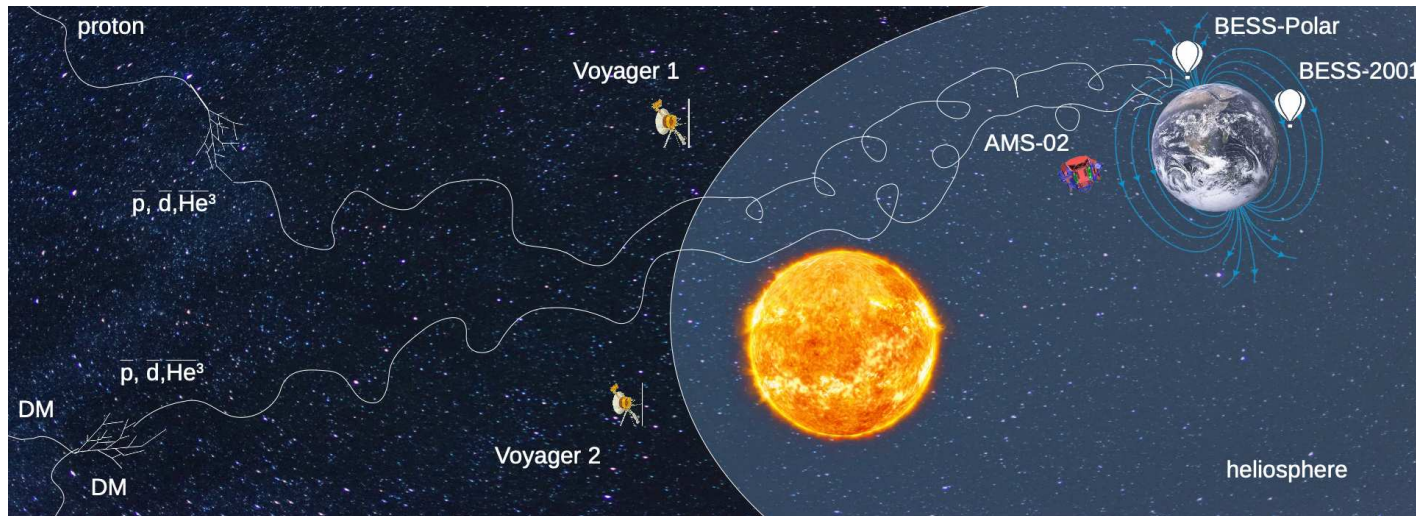
Hot and dense QCD



- How to maximize exploitation of planned measurements?
(HL-LHC with Alice 3, LHCbUp2; SPS with NA60+/DiCE; heavy quarks as QGP probe; QCD radiation)
- Which theoretical developments are needed to profit from this program?
(Bayesean analysis with heavy quarks; QCD hydrodynamics, QCD kinetic theory)
- What are ideas or plans beyond HL-LHC?

QCD connections

Hadronic, nuclear, and astro(particle) physics



- How to maintain diverse experimental program to provide all needed QCD constraints as input? $\longrightarrow$ *reflecting the ubiquitous role of QCD*
- Can we solve pressing problems involving strong interactions?
(*nature and formation mechanism of hadrons still holds many open questions*)
(*DM searches in cosmic rays need input from (anti-)nuclei hadroproduction*)
(*μ puzzle in air-showers of high-energy cosmic rays*)
(*high-energy ν production and interaction with hadrons*)
(*physics of astrophysical compact objects; nucleonic equation of state for neutron stars*)