Parton and Gluon Distributions in Nucleons and Nuclei

session summary

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5/28-6/3, 2018

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Juan Rojo(Oxford), Ralf Seidl (RIKEN)

RIKEN NiSHiNA CENTER

RIKEN

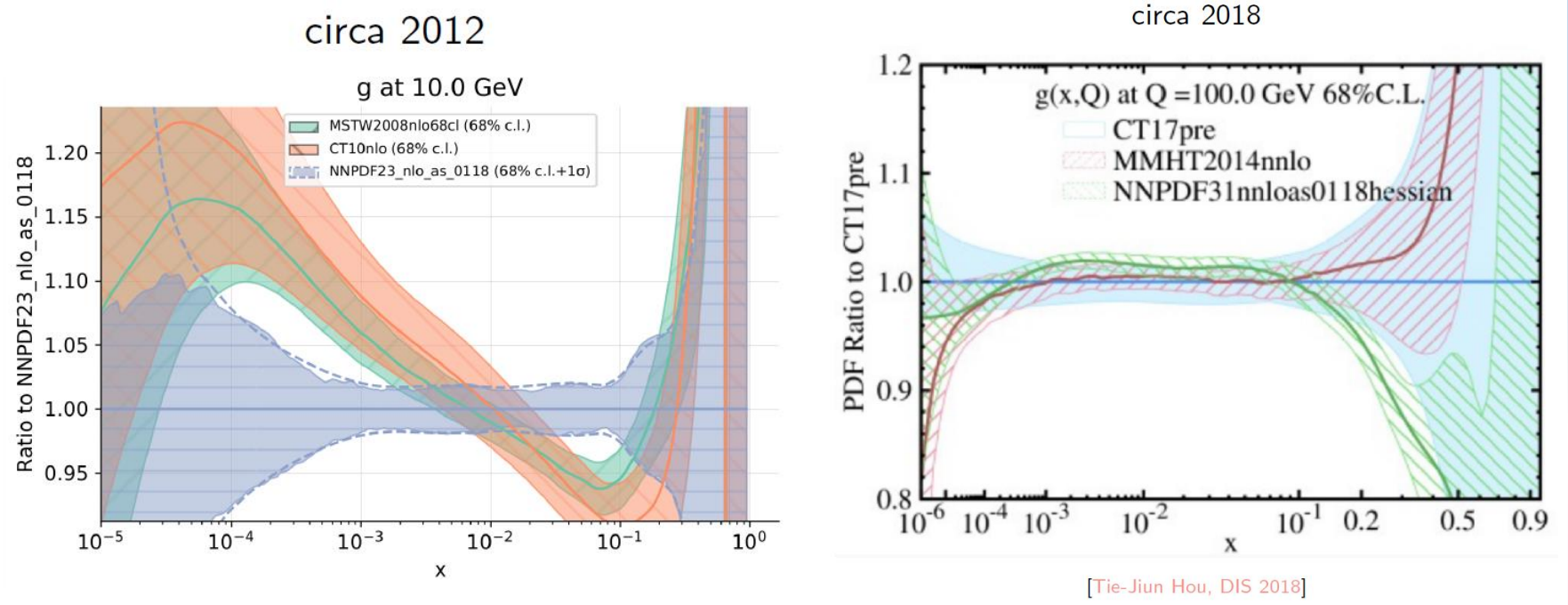
4+1 Sessions

- Parallel 5 — Parton Helicities and the Spin Sum Rule
- Parallel 7 — Unpolarized PDFs
- Parallel 8 — Transverse Spin Structure and Fragmentation
- Parallel 9 — Exclusive Physics and Future
- Joint PGDNN / QMHI session: Parallel 4 — Nuclear PDFs and Heavy Ion Physics

Unpolarized PDFs

Nocera

- Substantial improvement in global fits' consistency
- NNLO calculations become available for more and more processes



- Plenty of new LHC results entering the global fits

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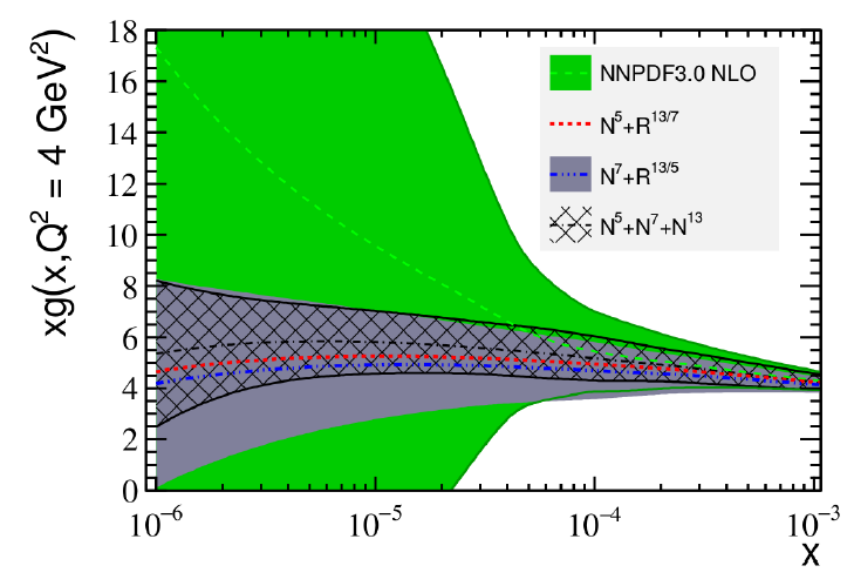
Low-x gluons

Nocera

- LHCb forward D-meson production sensitive to gluon x to 10^{-5}
- Potentially more information from ultra-high energy cosmic neutrinos and LHeC

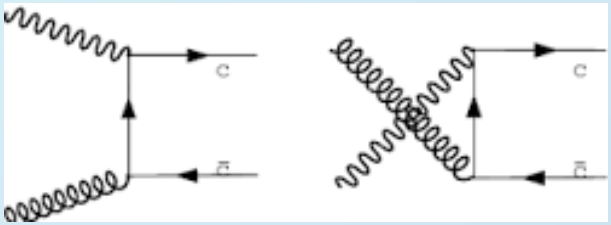


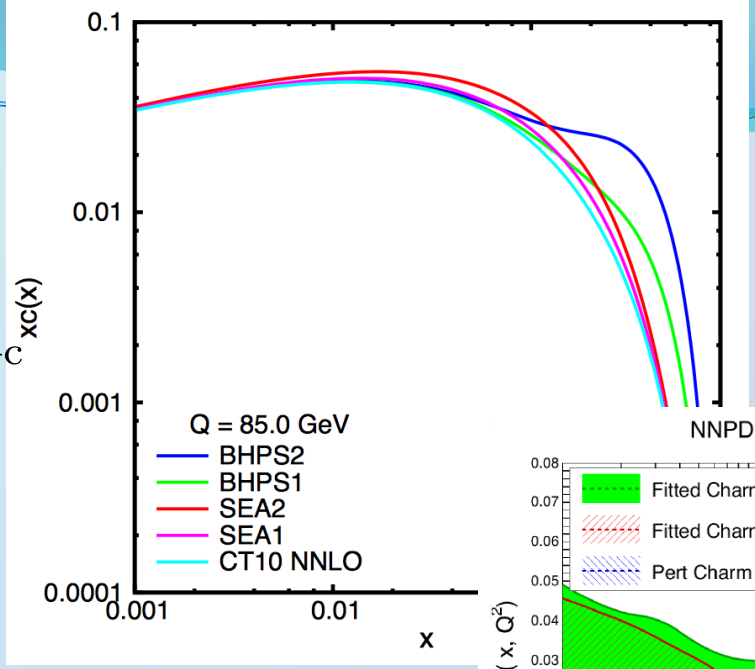
Intrinsic charm

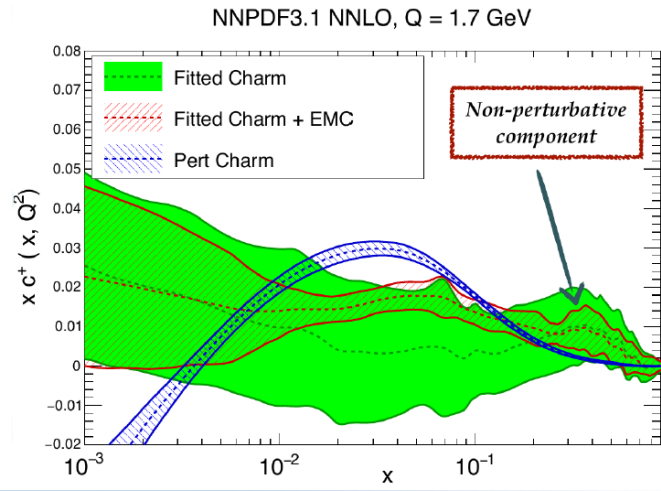
Guzzi
Nocera

1. Perturbative charm CT14:

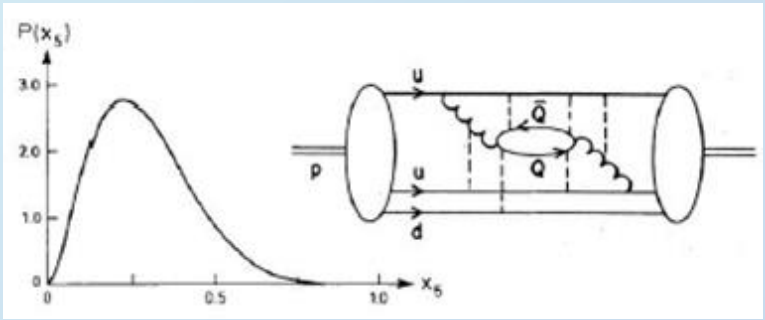
$$c(x, Q_0) = 0 \quad \text{at} \quad \mu = Q_0 = m_c$$







2. Intrinsic ``valence like'' charm:



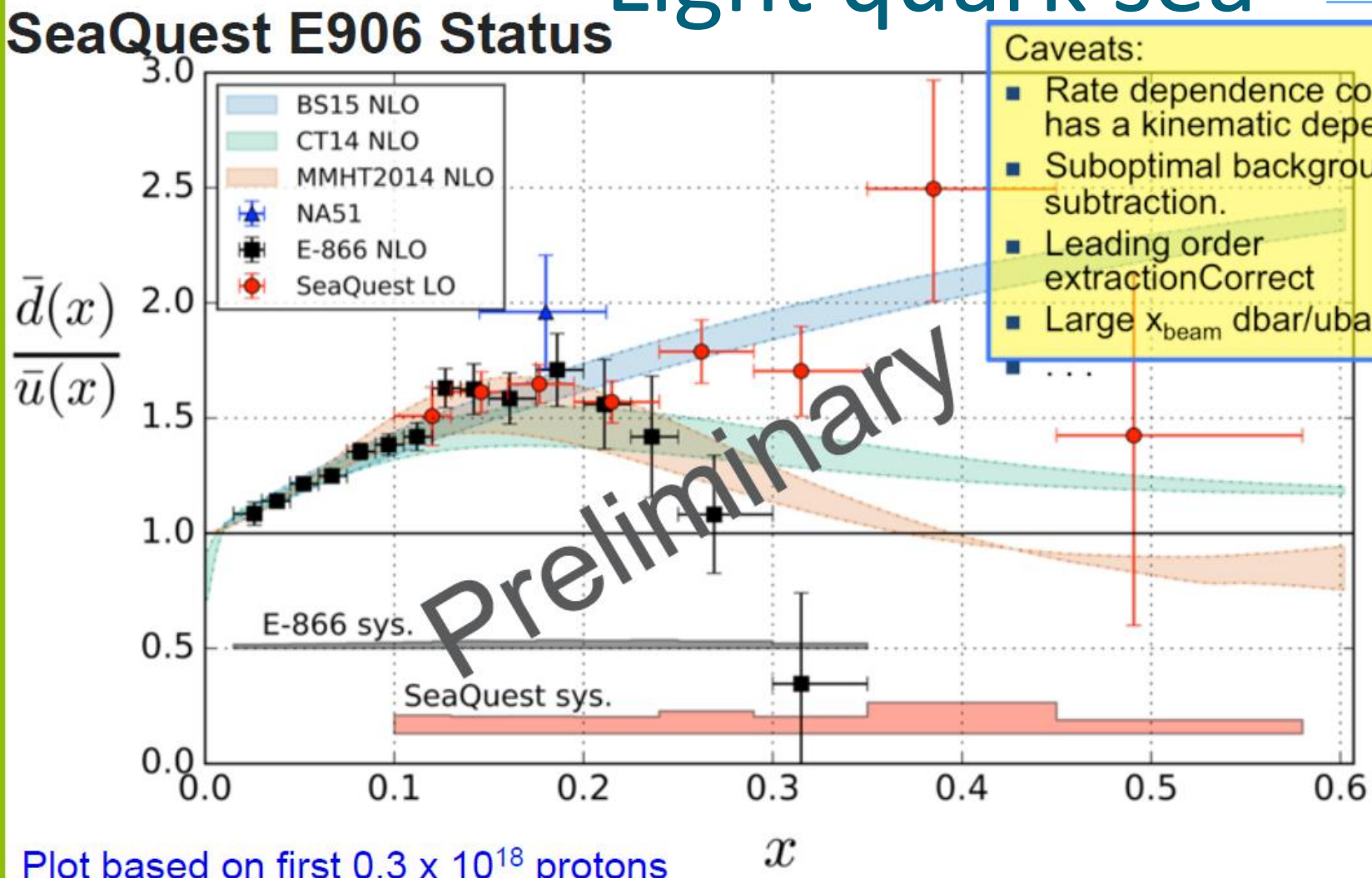
Light cone models BHPS (Brodsky et al. 1980)(see also 1504.06287 by Brodsky, Kusina, Lyonnet, Schienbein, Spiesberger, Vogt)

3. ``sea like'' charm:

a purely phenomenological scenario in which the shape of the charm distribution is sea-like—i.e., similar to that of the light flavor sea quarks, except for an overall mass-suppression.

Light quark sea

Reimer



Plot based on first 0.3 x 10^{18} protons

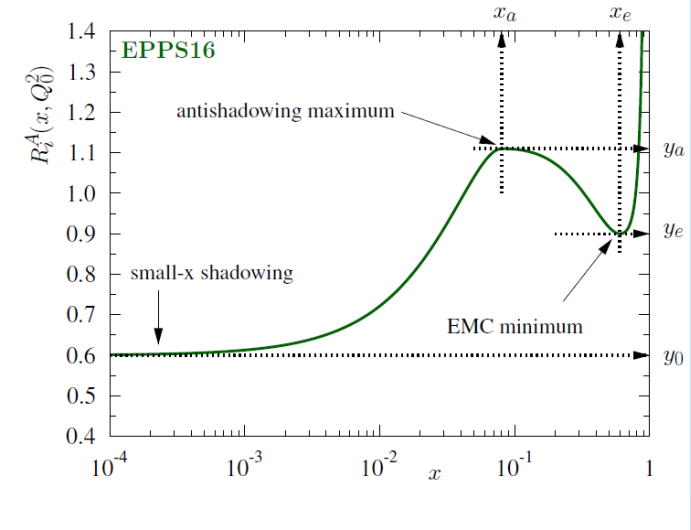
SeaQuest has recorded 1.8 x 10^{18} protons

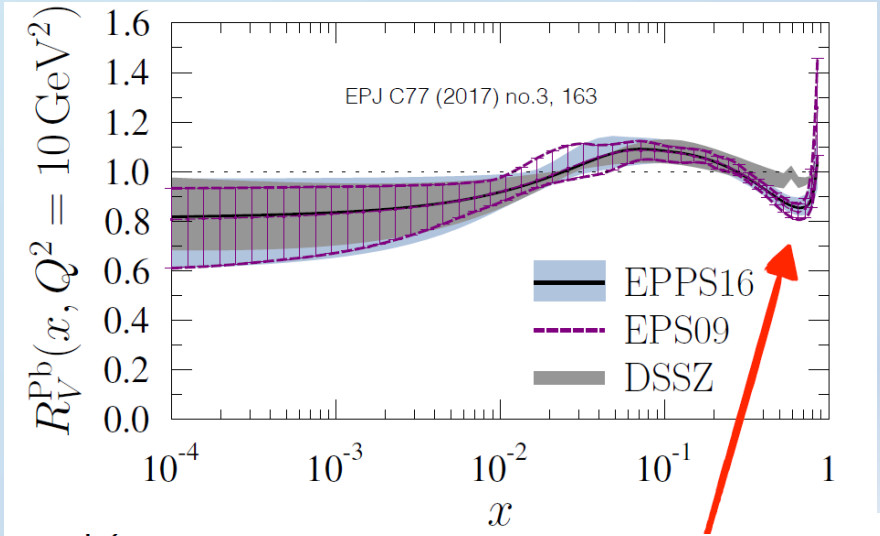
Acceptance improvements so later protons are "worth" more

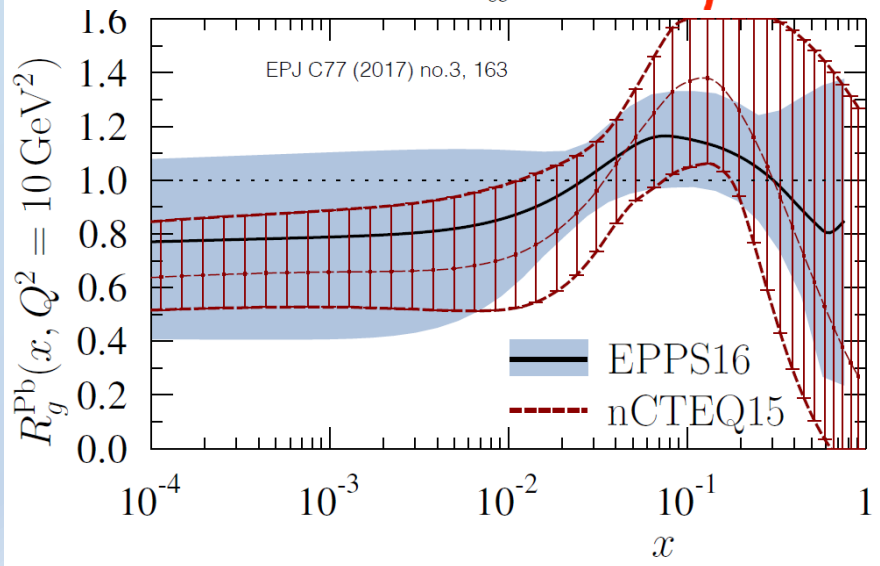
From PDFs to nuclear PDFs

Zurita

$$f_{i/A}\left(x, Q_0^2\right) \equiv f_{i/p}\left(x, Q_0^2\right) R_i^A\left(x, Q_0^2\right)$$



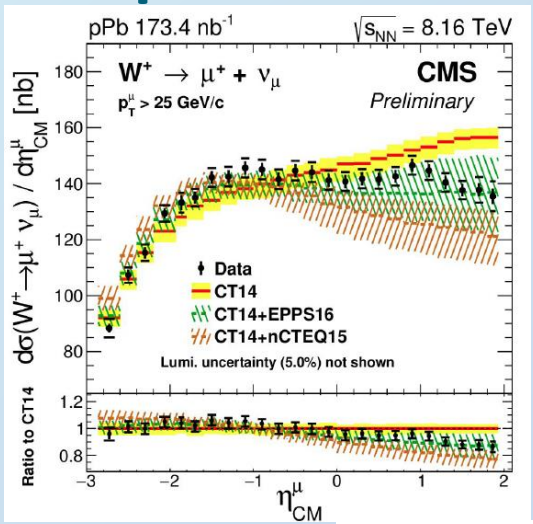




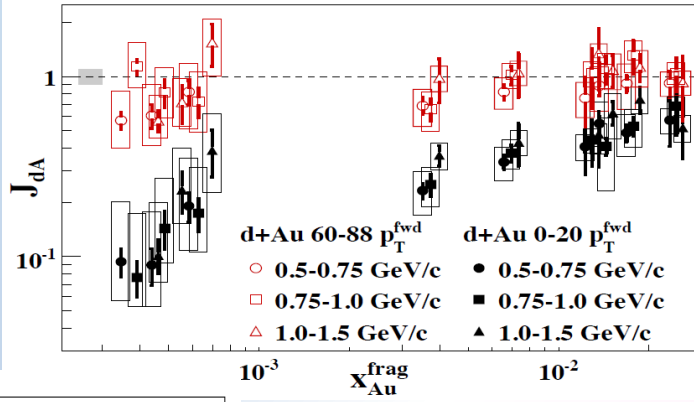
- Updated fits; so far only some impact from LHC due to high scale

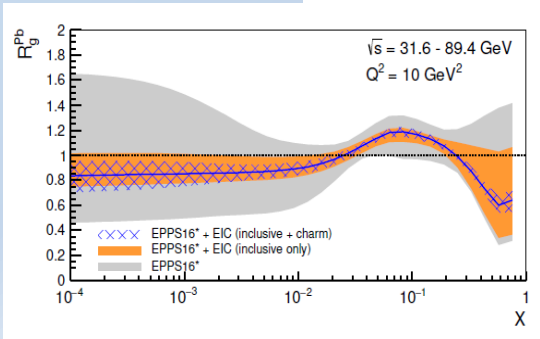
Experimental updates on nPDFs

- Various new R_{pA} results arriving from RHIC and LHC
- More to be expected from future RHIC running
- Precise measurements from the EIC and potentially LHeC



Li
Mohapatra
Drachenberg
Tribedy



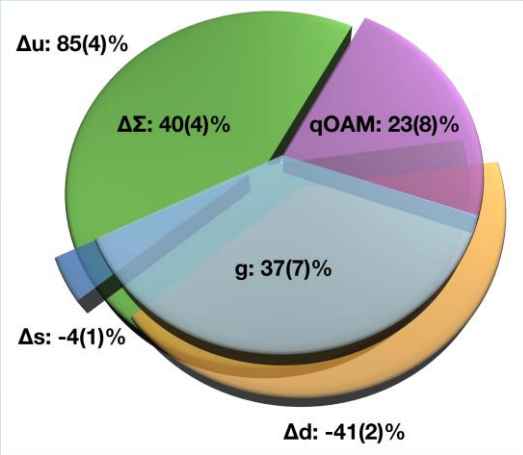


Longitudinal spin structure

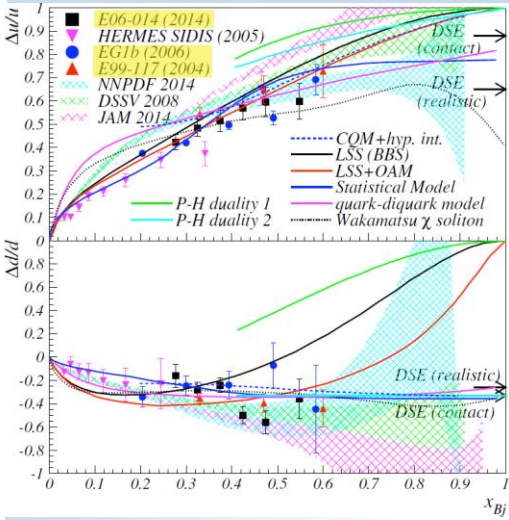
- Substantial improvements from Lattice to calculate gluon spin contribution and disconnected insertions
- Experimentally:

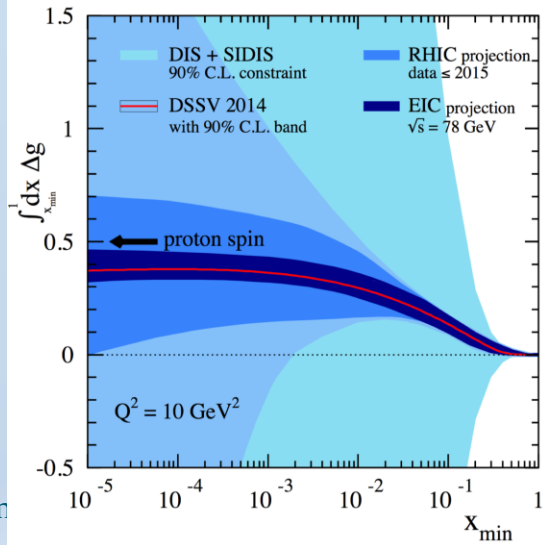
$$\Delta q \sim 30\% \quad (SIDIS/DIS)$$
$$\Delta G \sim 40\% \quad (RHIC)$$

- High x input from JLAB and low energy connections



K.F. Liu
M. Liu
Deur

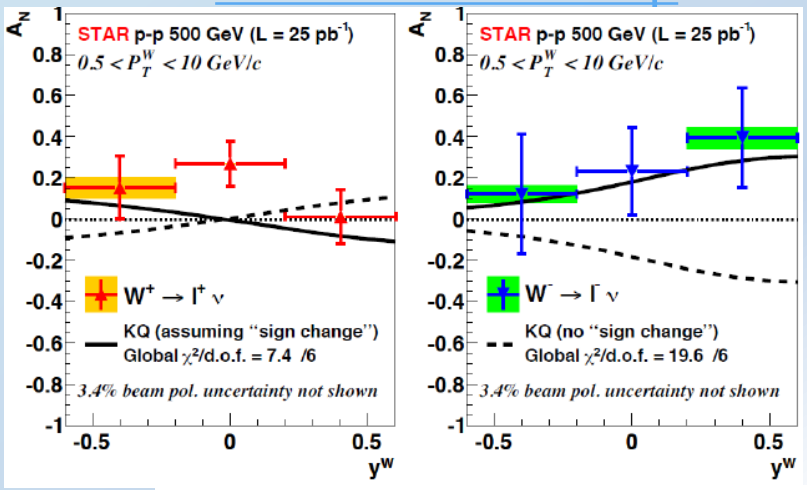


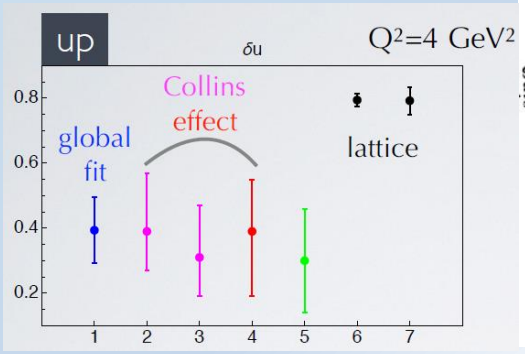


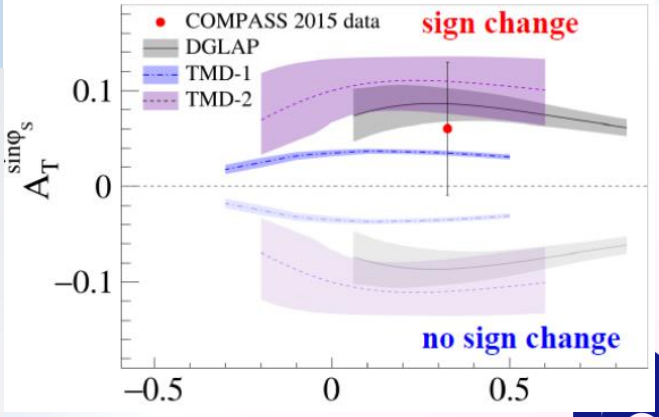
Transverse spin and momentum structure

Signori
Eyser
Seitz
Radici
Grosse-Perdekamp

- Hint for the famous sign change both from STAR (W) and COMPASS (DY)
- First global transversity fit using both SIDIS and pp data (and Belle for the FFs)



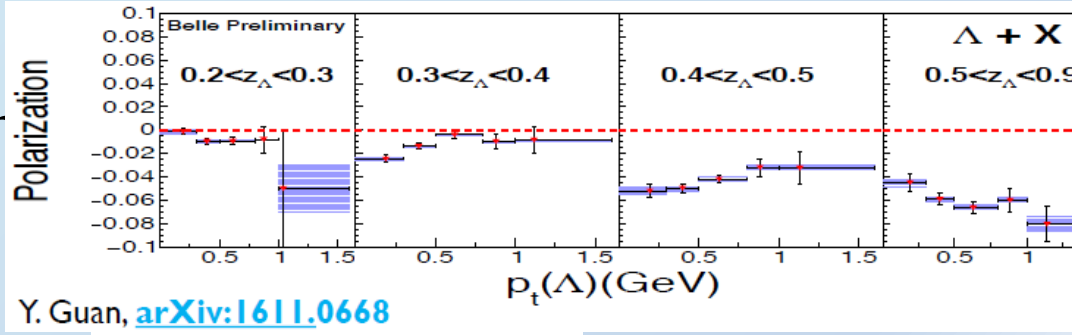




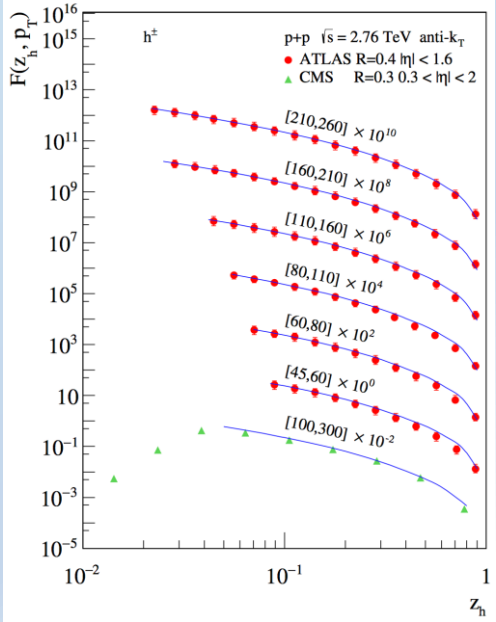
Fragmentation functions

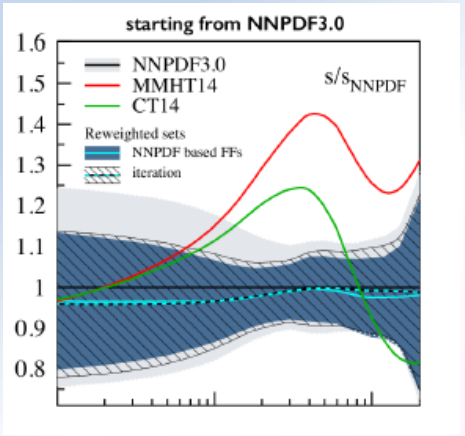
Ringer
Vossen
Nocera

- Important theoretical advances into jet+hadron and jet substructure descriptions
- Di-hadron and polarizing Λ fragmentation from Belle
- Improvements in fits, becoming more “global”, higher orders and first combine PDF+FF fit



Y. Guan, arXiv:1611.0668

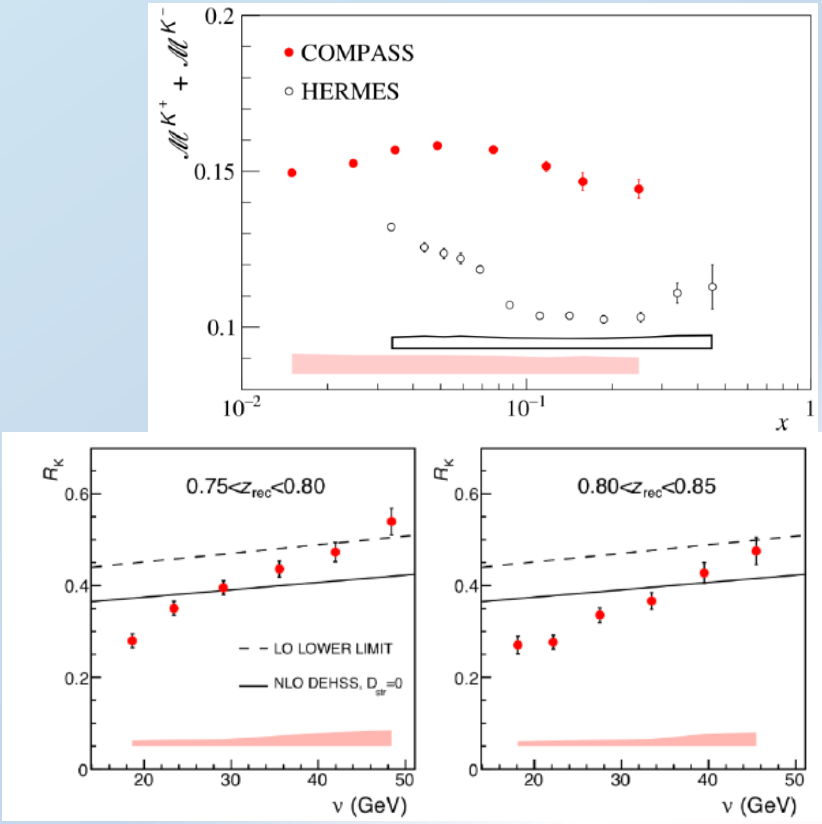




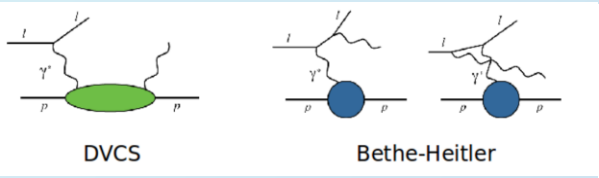
Strangeness

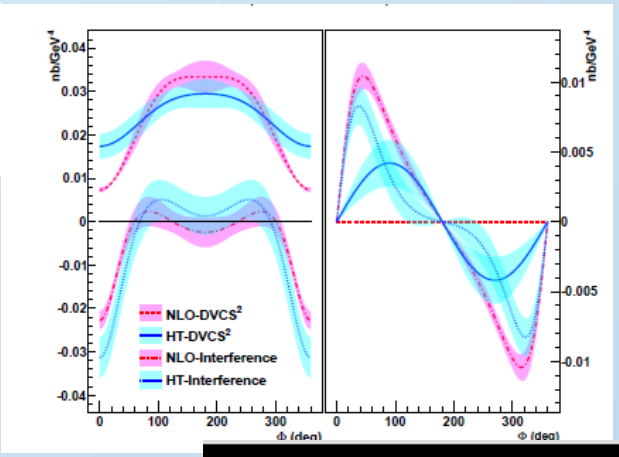
Pierre

- Impact of fragmentation functions on strange PDF and Δs very relevant
- Effort to understand differences between HERMES and COMPASS Kaon results
- Some indication of ν or M_x dependence



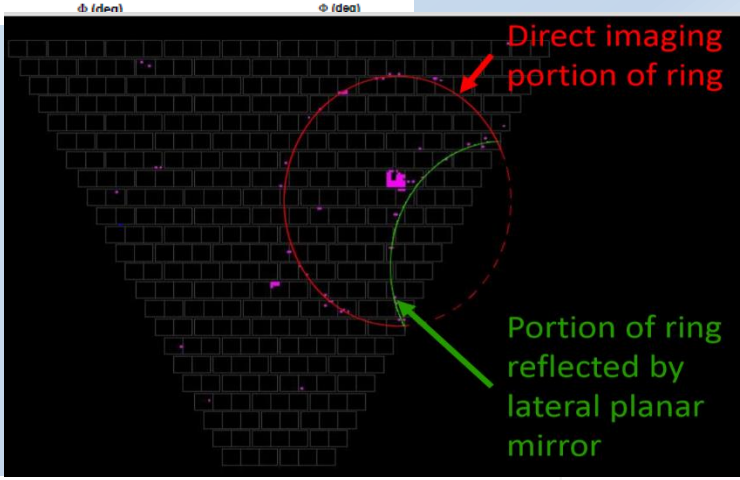
GPDs and Future measurements

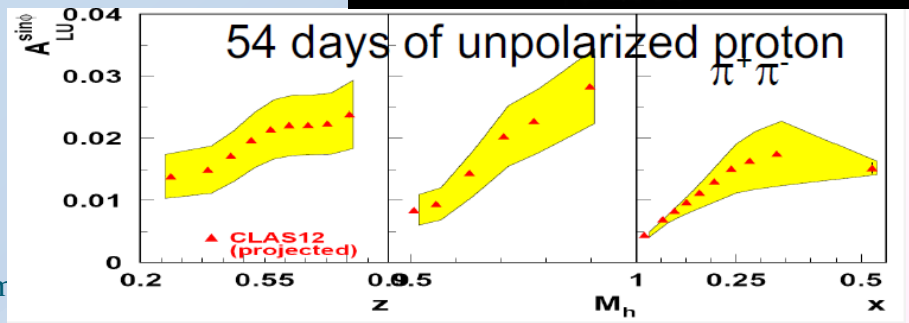




[Defurne](#)
[Freese](#)
[Vossen](#)
[Bemokhtar](#)

- Nice DVCS and DVMP results from JLAB 6, but clear indication that higher twist contribution substantial
- GPD calculations for Deuteron and other nuclei
- SIDIS plans using new RICH at CLAS
- Synergies of di-hadron and Λ Fragmentation with future CLAS measurements





Summary

- Important results from RHIC on gluon and sea quark helicities; also Lattice getting closer
- Sivers function sign change suggested by both STAR and COMPASS; improved transversity/tensor charge via dihadrons from SIDIS+STAR+Belle
- Plenty of LHC input on unpolarized PDFs
- …also on nuclear PDFs
- JLAB 11 GeV measurements starting

- EIC is the Future!

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