

DVCS@EicC: CFF impact

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Mar. 3, 2021

*Experiment & Theory Interactions:
Current Status & Future Planning*



Schematic Design of EicC

- **Energy:**

arXiv:2102.09222

electron + proton: $3.5 \text{ GeV} \times 20 \text{ GeV}$

electron + ${}^3\text{He}$: $3.5 \text{ GeV} \times 40 \text{ GeV}$ (nucleus energy)

- **Luminosity:**

Instantaneous Lumi: $2 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

Integrated Lumi for simulation = 50 fb^{-1} for ep & e ${}^3\text{He}$

- **Polarization:**

electron: 80% L

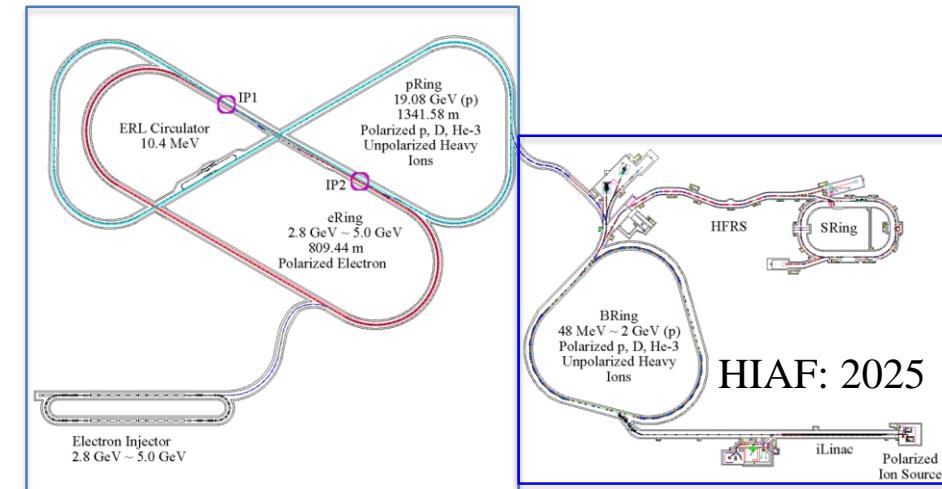
proton: 70% L&T

${}^3\text{He}$: 70% L&T

- **Phase space coverage**

$\sqrt{s} \sim 16.7 \text{ GeV}$

$4 \times 10^{-3} < x < \sim 0.1$



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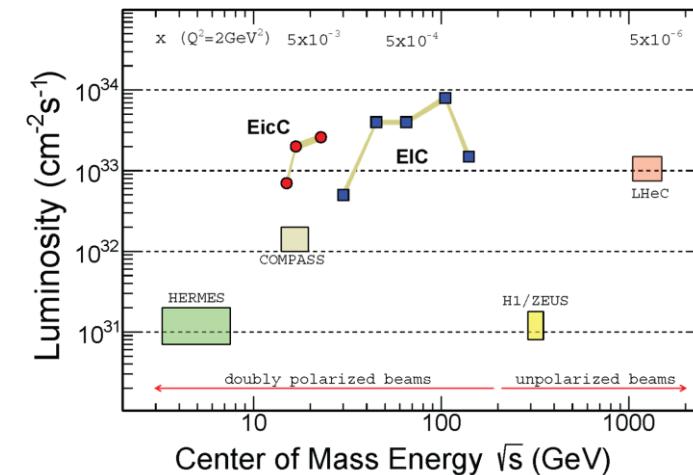
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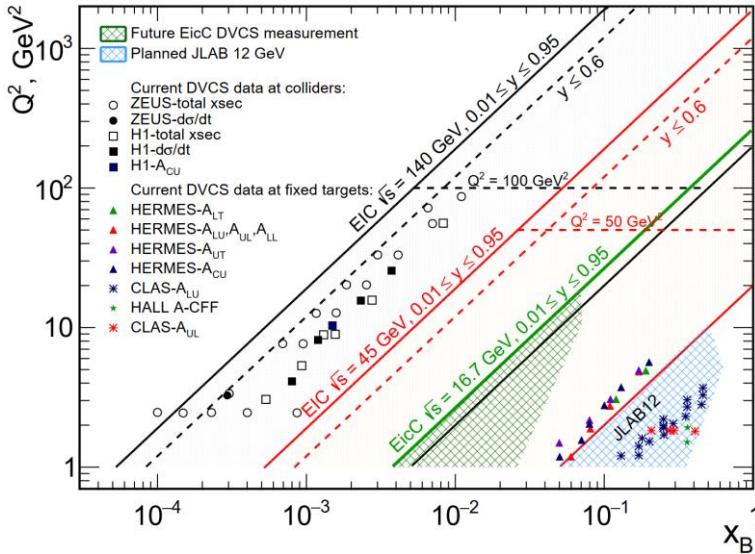
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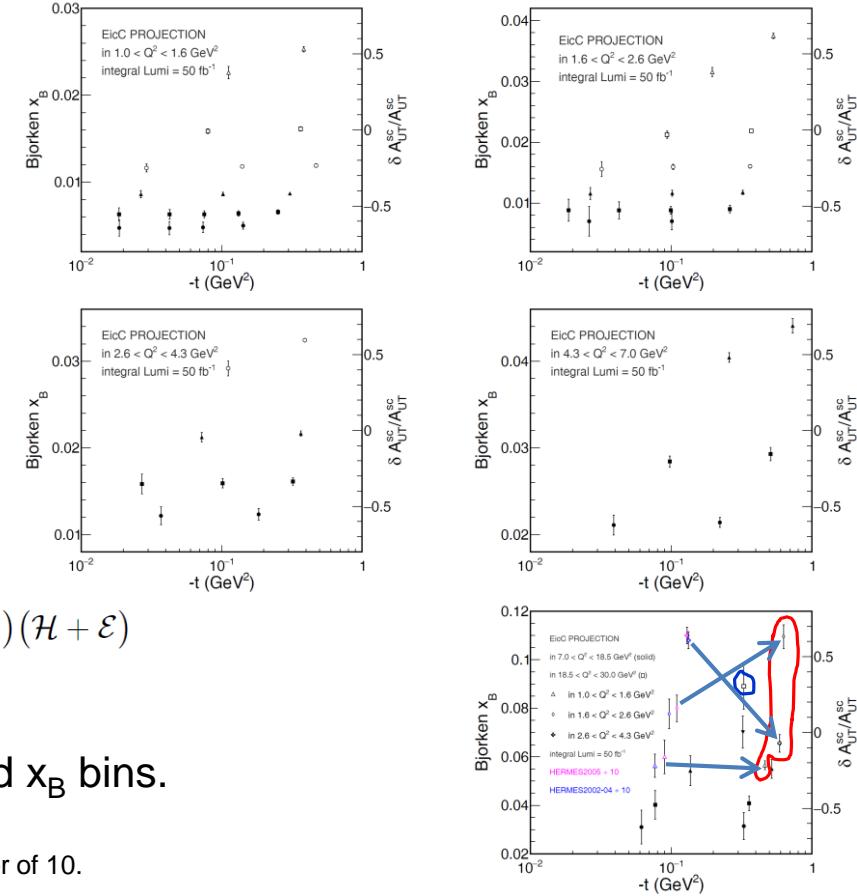


Projection Bins of DVCS@EicC

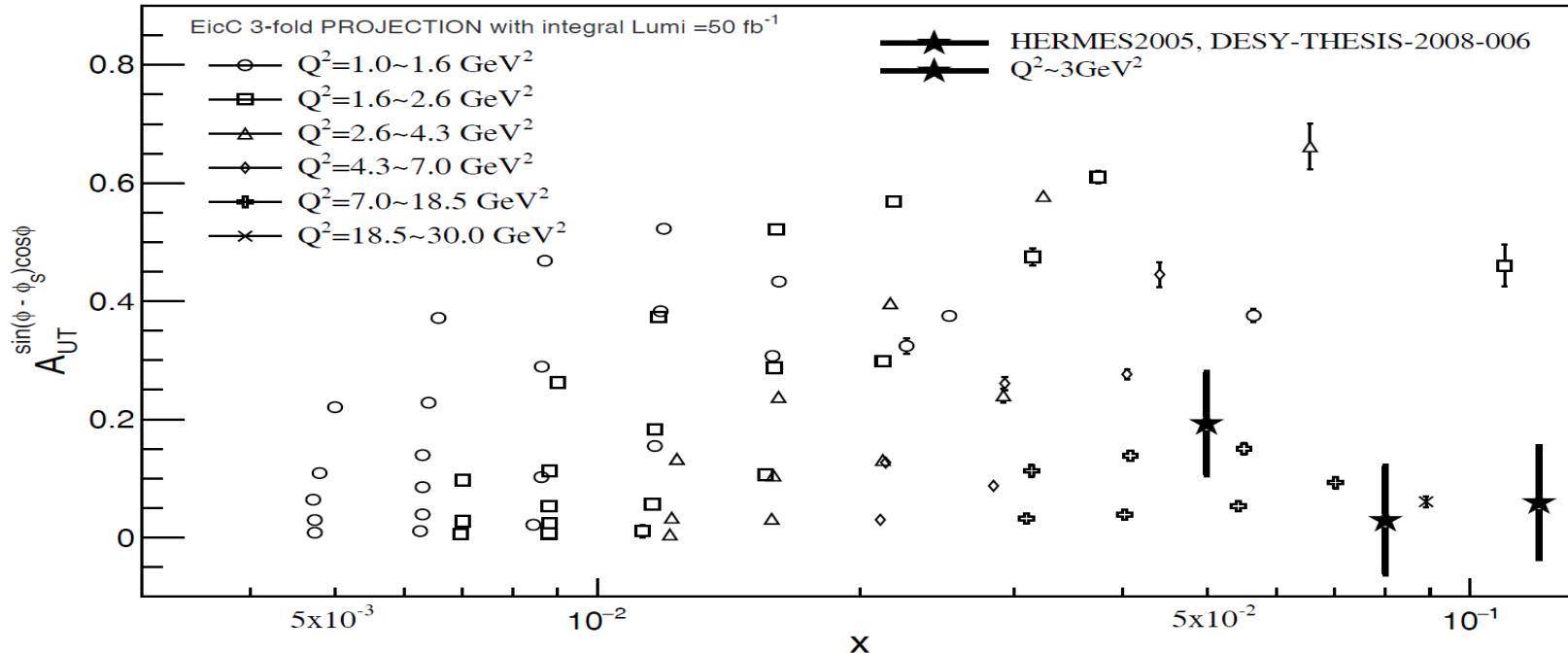


$$A_{UT,I}^{\sin(\phi - \phi_s) \cos \phi} \propto \text{Im} \left[-\frac{t}{4M^2} (\mathcal{F}_2 \mathcal{H} - \mathcal{F}_1 \mathcal{E}) + \xi^2 \left(F_1 + \frac{t}{4M^2} F_2 \right) (\mathcal{H} + \mathcal{E}) - \xi^2 (F_1 + F_2) (\tilde{\mathcal{H}} + \frac{t}{4M^2} \tilde{\mathcal{E}}) \right],$$

- A_{UT} with $-t$ in all $1.0 < Q^2 < 80.0 \text{ GeV}^2$ and x_B bins.
- HERMES data with the relative statistical errors divided by a factor of 10.



Projection Bins of DVCS@EicC



Is it possible study the impact of pseudo-data on CFF & GPD?
Strong support to the construction of machine!

Projection Bins of DVCS@EicC

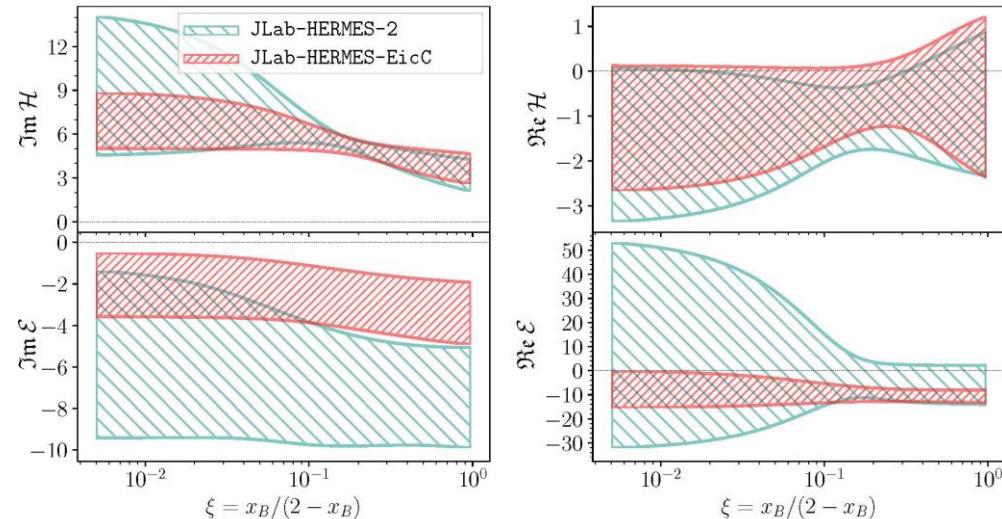
$Q^2 = 2 \text{ GeV}^2, -t = 0.2 \text{ GeV}^2$

Kresimir Kumericki, Dieter Mueller, Andreas Schafer, JHEP 07 (2011) 073

The CFF impact pre-study of electron-ion collider within artificial neural network (NN)

Assume $\text{Re}\tilde{E} = 0, \text{Re}\tilde{H} = 0$

Statistical uncertainties only

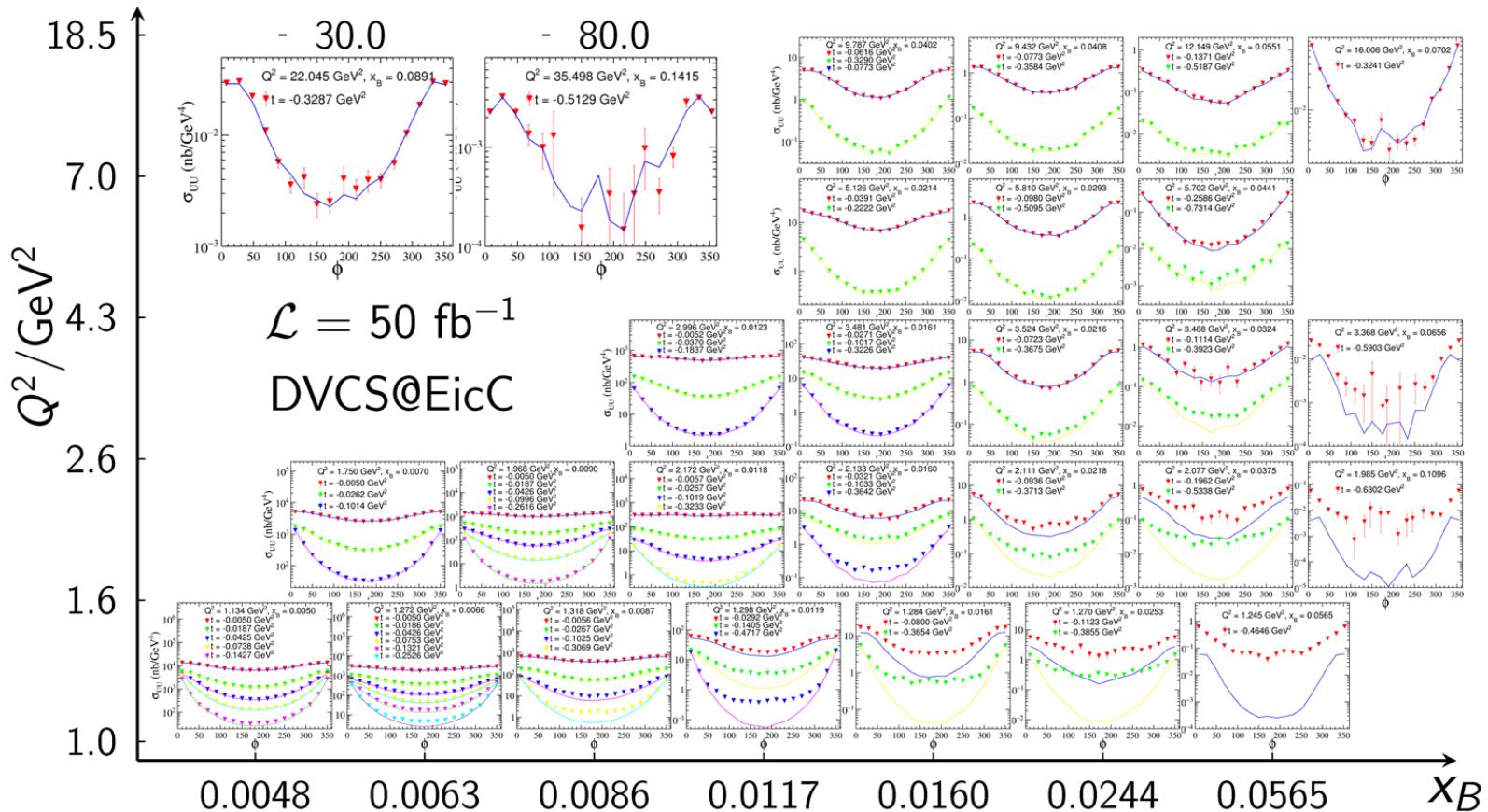


$$A_{LU,I}^{\sin\phi} \propto \text{Im} \left[\textcolor{red}{F}_1 \mathcal{H} + \xi(F_1 + F_2)\tilde{\mathcal{H}} - \frac{t}{4m^2} \textcolor{blue}{F}_2 \mathcal{E} \right],$$

$$A_{UT,I}^{\sin(\phi-\phi_s)\cos\phi} \propto \text{Im} \left[-\frac{t}{4M^2} (\textcolor{blue}{F}_2 \mathcal{H} - \textcolor{red}{F}_1 \mathcal{E}) + \xi^2 \left(F_1 + \frac{t}{4M^2} F_2 \right) (\mathcal{H} + \mathcal{E}) - \xi^2 (F_1 + F_2) (\tilde{\mathcal{H}} + \frac{t}{4M^2} \tilde{\mathcal{E}}) \right],$$

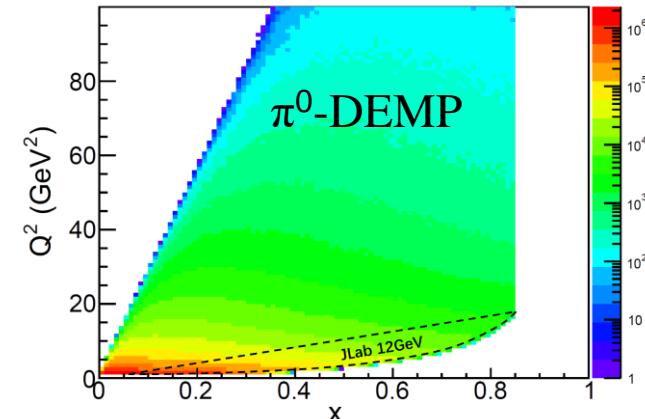
Bin-to-Bin error propagation: (Q^2, x_B, t)

Projection Bins of DVCS@EicC



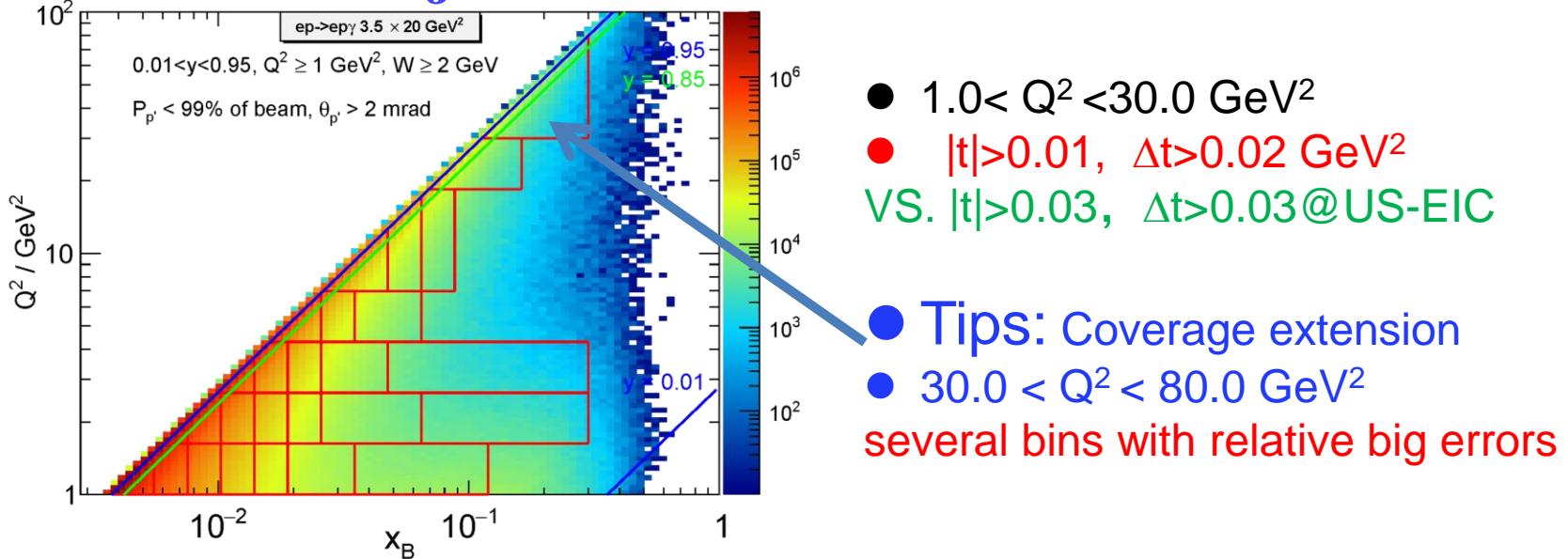
Impact study within various framework

- The exclusives of EicC (DVCS, TCS, DEMP):
- Impact of A_{UT} is noticeable to imaginary CFF-E (KK);
- Present data constraining power in sea:
~ several fb^{-1} (PARTONS-NN);
- Local extracting of CFF
- Feed the numerical framework and models
- ... GPD impact study of electron-ion collider



Special Thanks to PARTONS, K. Kumericki,
S. Liuti, B. Kriesten, Yuxiang, Jinlong, Zhihong ...

Projection Bins of DVCS@EicC



After communication with global fit community:

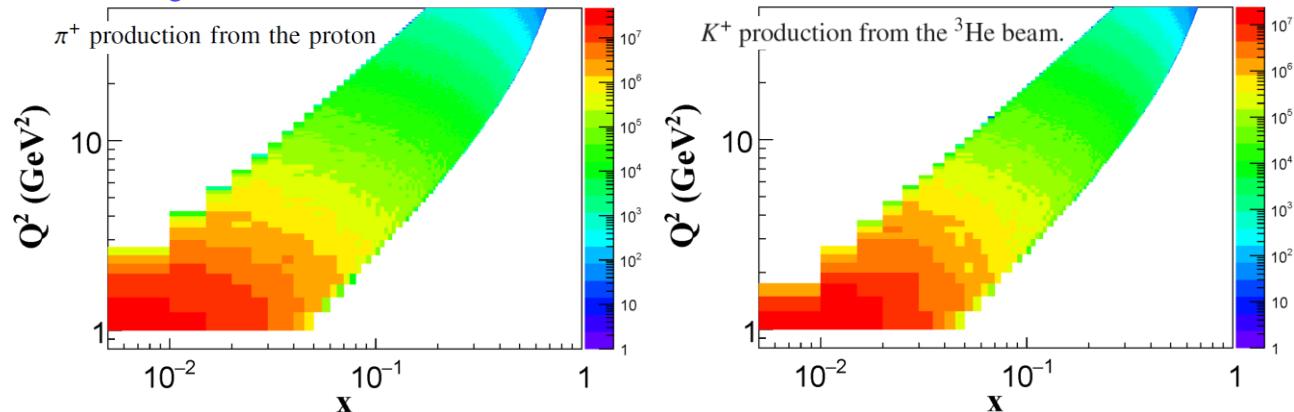
69 bins (Q^2, x_B, t), $69 \times 18 \times 7 = 8694$ (Q^2, x_B, t, ϕ) data points

A lot of details under discussion: coordinates, definitions, code....

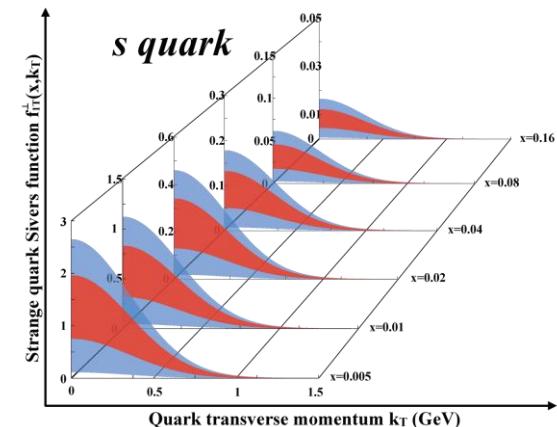
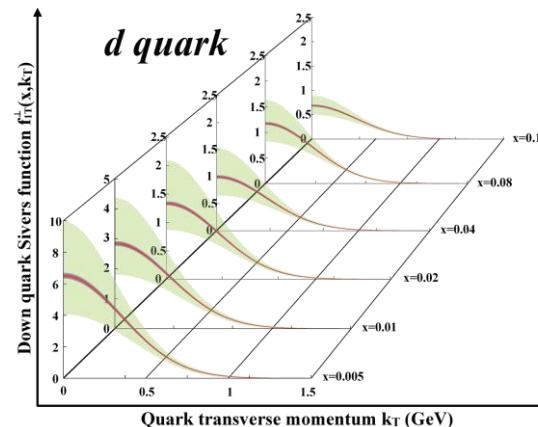
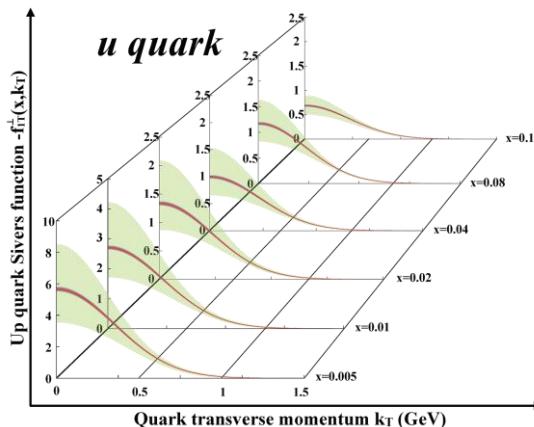
Impact study of TMDs – Sivers function

arXiv:2102.09222

$Q^2 > 1 \text{ GeV}^2$, $W > 5 \text{ GeV}$,
 $W' > 2 \text{ GeV}$, $0.3 < z < 0.7$



The precision of extractions of Sivers functions from SIDIS@EicC



High-Intensity Heavy Ion Accelerator Facility-HIAF

From Lanzhou to Huizhou

