

Status update:  
impact studies for EIC  
unpolarized TMDs and Sivers function

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For details of derivation see previous meetings  
today I will show only the final plots with minimal comments

### Plan of the talk

- ▶ Part 1: TMD evolution
- ▶ Part 2: Unpolarized distributions
- ▶ Part 3: Sivers function



## Unpolarized case

Repository: [https://github.com/VladimirovAlexey/EIC\\_YR\\_TMD](https://github.com/VladimirovAlexey/EIC_YR_TMD)

Data by Ralf: /Data4\_cut\_HB\_opt5

- ▶ Energies:  $(5 \times 41) \& (5 \times 100) \& (18 \times 100) \& (18 \times 285)$
- ▶ Usual TMD cut:  $p_T < 0.25zQ$ ,  $Q > 2$  (and  $z > 0.05$  for technical reasons)
- ▶ I took only  $\pi^+$
- ▶ To speed-up computation + **uncertainty < 10%**  $\Rightarrow$  **3408 points**

### Uncertainty estimation procedure:

- ▶ Reweighting not possible (too small errors)  
 $\Rightarrow$  fit together with global data (reduced set ATLAS(very slow) + E228 + HERMES)
- ▶ Estimation of errors by hesse (fastest)
- ▶ No PDF uncertainties (extremely time-consuming)

### Input model = SV19:

- ▶ NNLO+N<sup>3</sup>LL
- ▶ No flavor separation

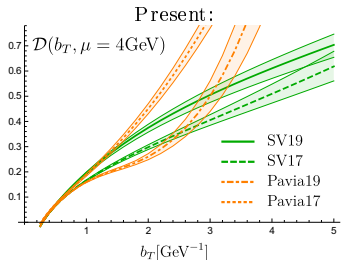




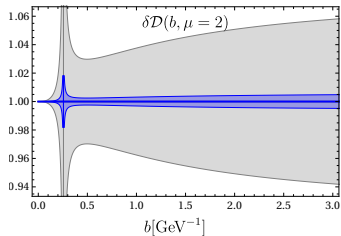
$$\text{TMD evolution}$$

$$\mathcal{D}(b, \mu) = \mathcal{D}_{\text{resum}}(b, \mu) + c_0 b b^* = -K/2$$

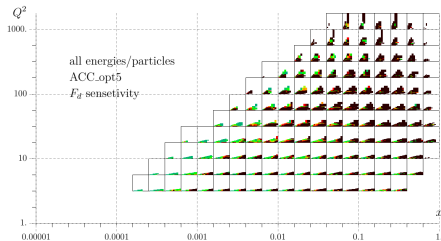
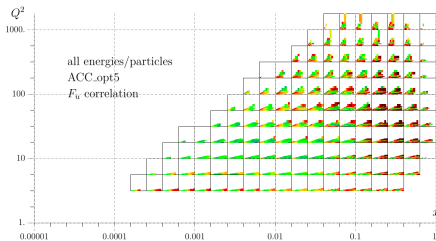
## EIC will make enormous impact on CS-kernel



picture from [AV,2003.02288]



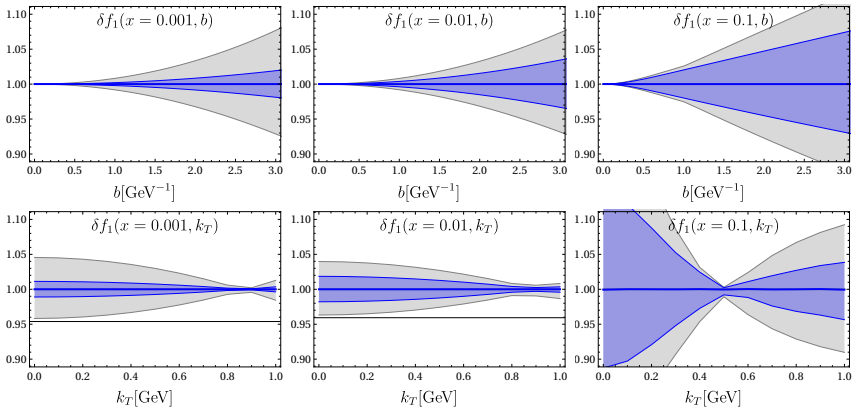
## unpolarized TMDPDF



Expected precision is better than our best fits



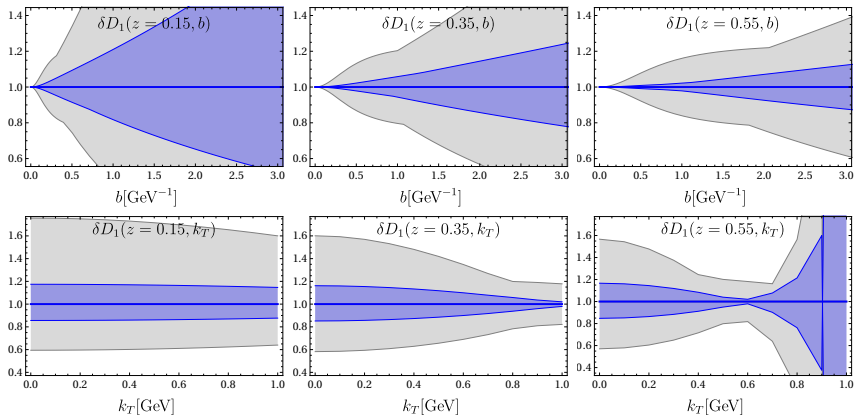
# unpolarized TMDPDF



Smaller- $x$  bigger impact



## unpolarized TMDFF



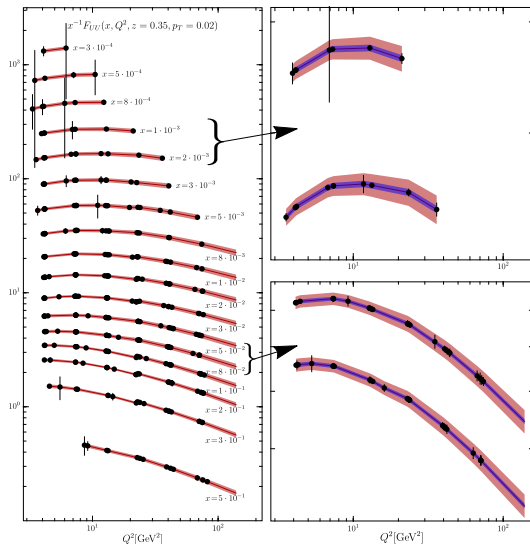
**3-4 times reduction of uncertainties everywhere**



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# Example for structure function



- ▶ red current theory prediction
- ▶ blue theory prediction after EIC

## Sivers asymmetry

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Data by Ralf: /Data1\_cut\_HB\_opt5

- ▶ Energies:  $(5 \times 41) \& (18 \times 285)$  (to speed up)
- ▶ Usual TMD cut:  $p_T < 0.25zQ$ ,  $Q > 2$  (and  $z > 0.05$  for technical reasons)
- ▶ I took only  $\pi^+$
- ▶  $\Rightarrow$  **2232 points**

### Uncertainty estimation procedure:

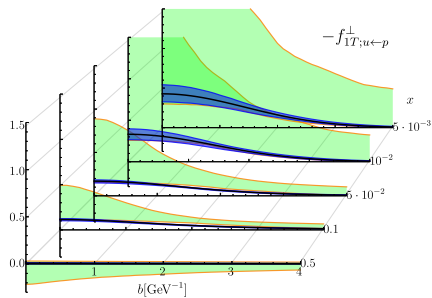
- ▶ Pseudodata is astonishingly precise  $\Rightarrow$  Ignoring global data
- ▶ Reweighting not possible (too small errors)
- ▶ 100 replicas
- ▶ No unpolarized TMD uncertainties

Input model = SV19(unpol.) + BPV20:

- ▶ N<sup>3</sup>LL
- ▶ For details see talk on previous meeting



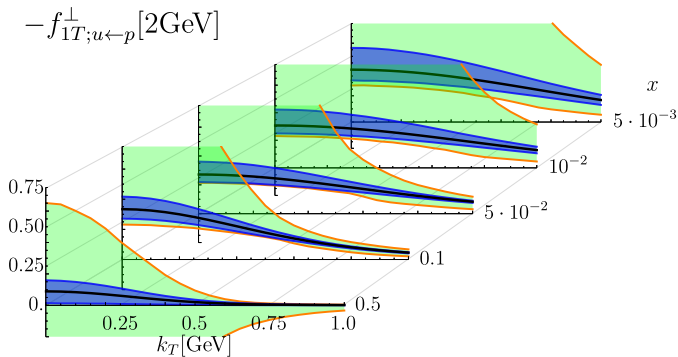
## Sivers function



Impact it so large that it is complicate to compare



# Sivers function



## Sivers function

