Discussion topics

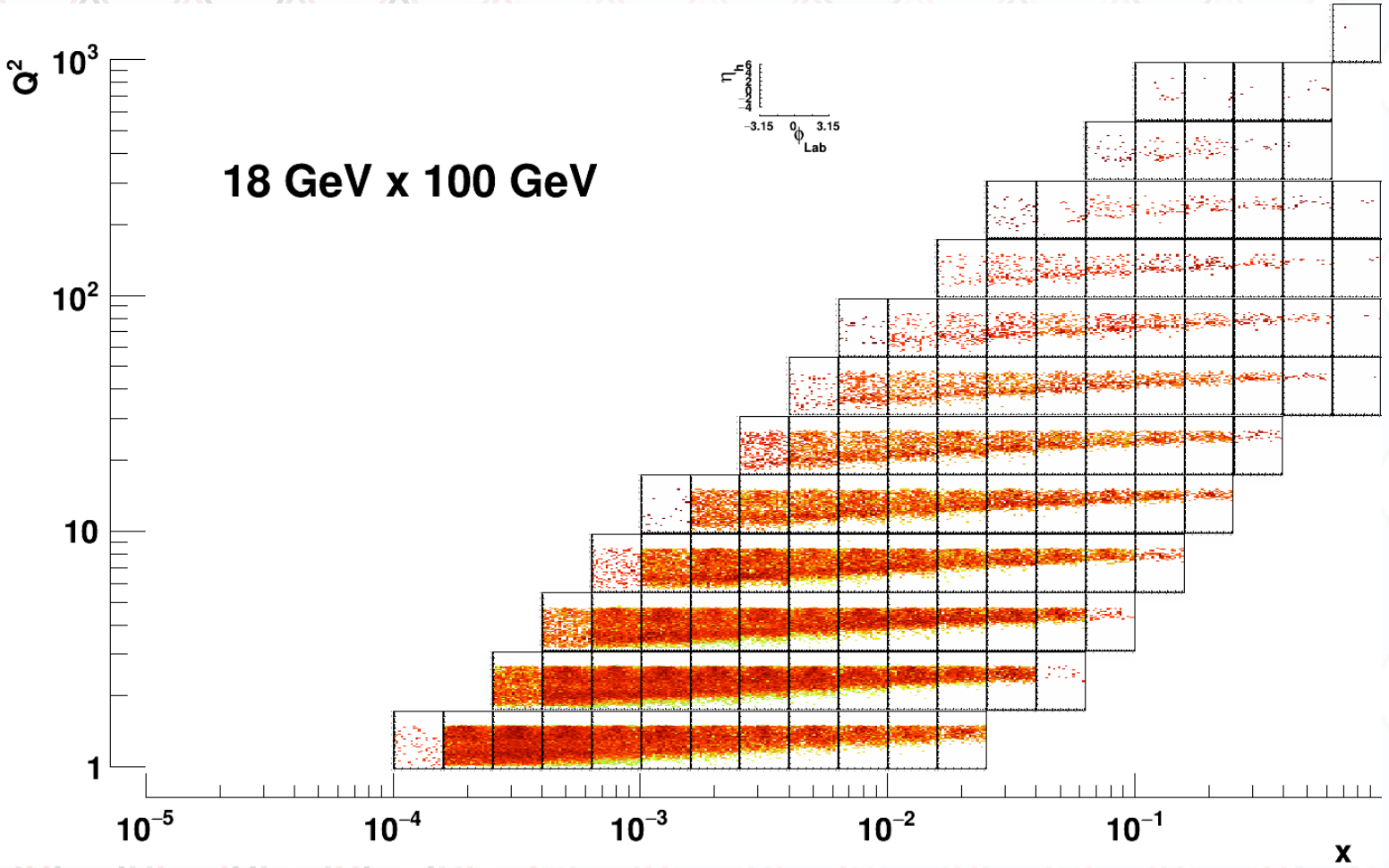
SIDIS meeting
June 8

Charlotte Van Hulse
Ralf Seidl (RIKEN)

Crossing angle

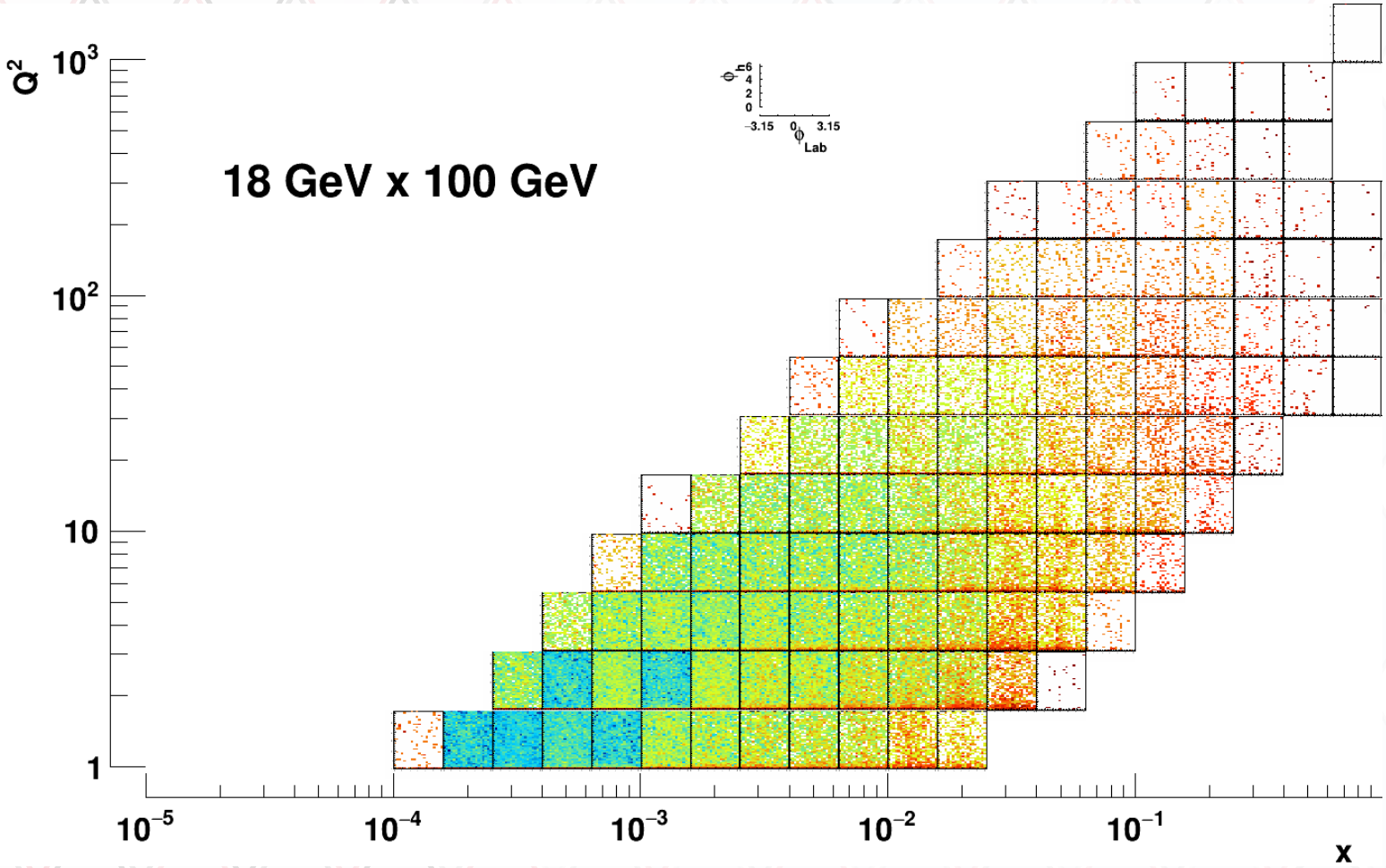
- Crossing angle of 25mrad seems to correctly implemented in simulations (checked between HEPMC and G4Truth)
- Question in simulation/physics meeting about impact from limited acceptance on azimuthal angles → next slides

Lab ϕ and rapidity distribution for pions

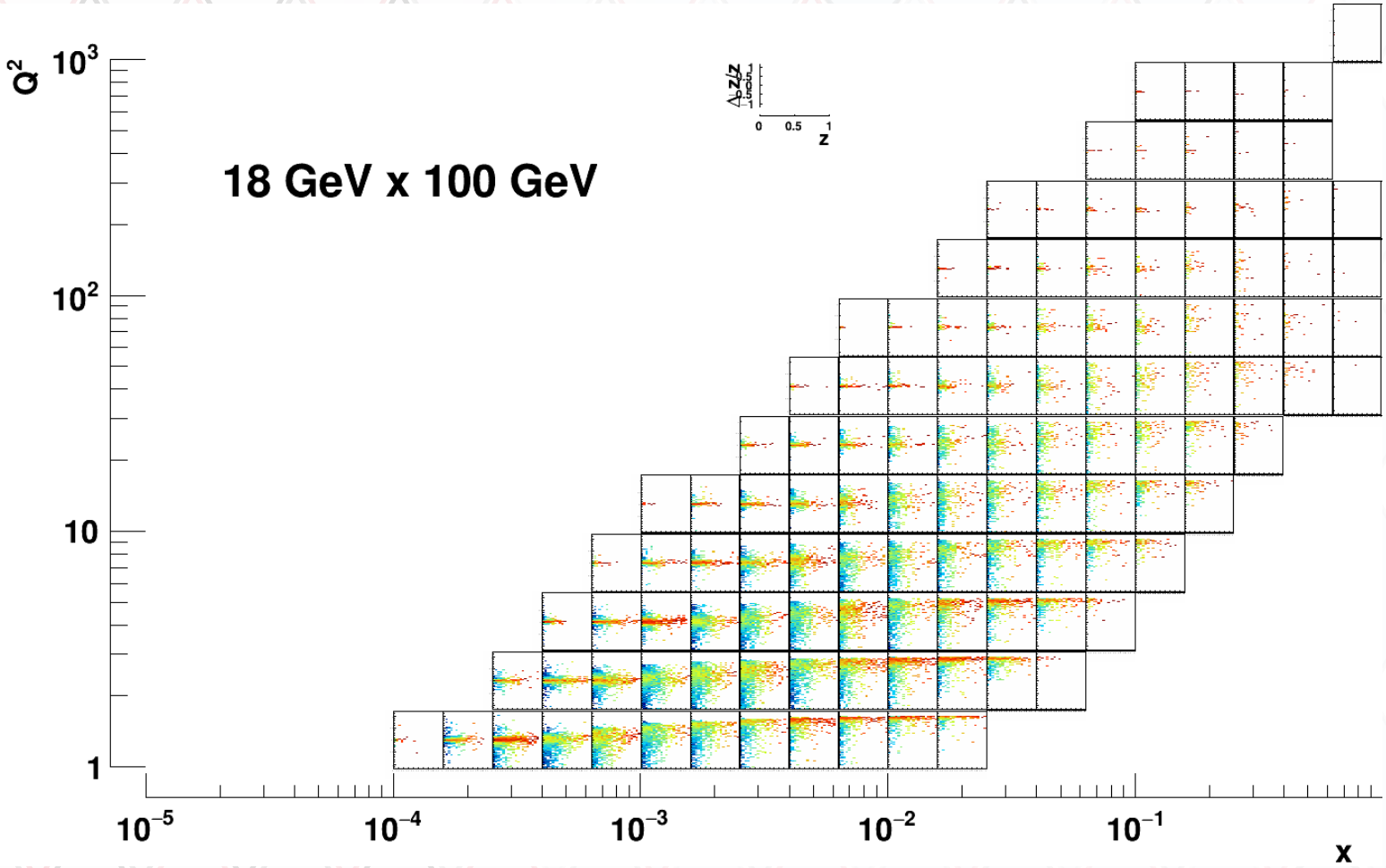


Higher x at higher rapidity, but no holes visible (yet?)

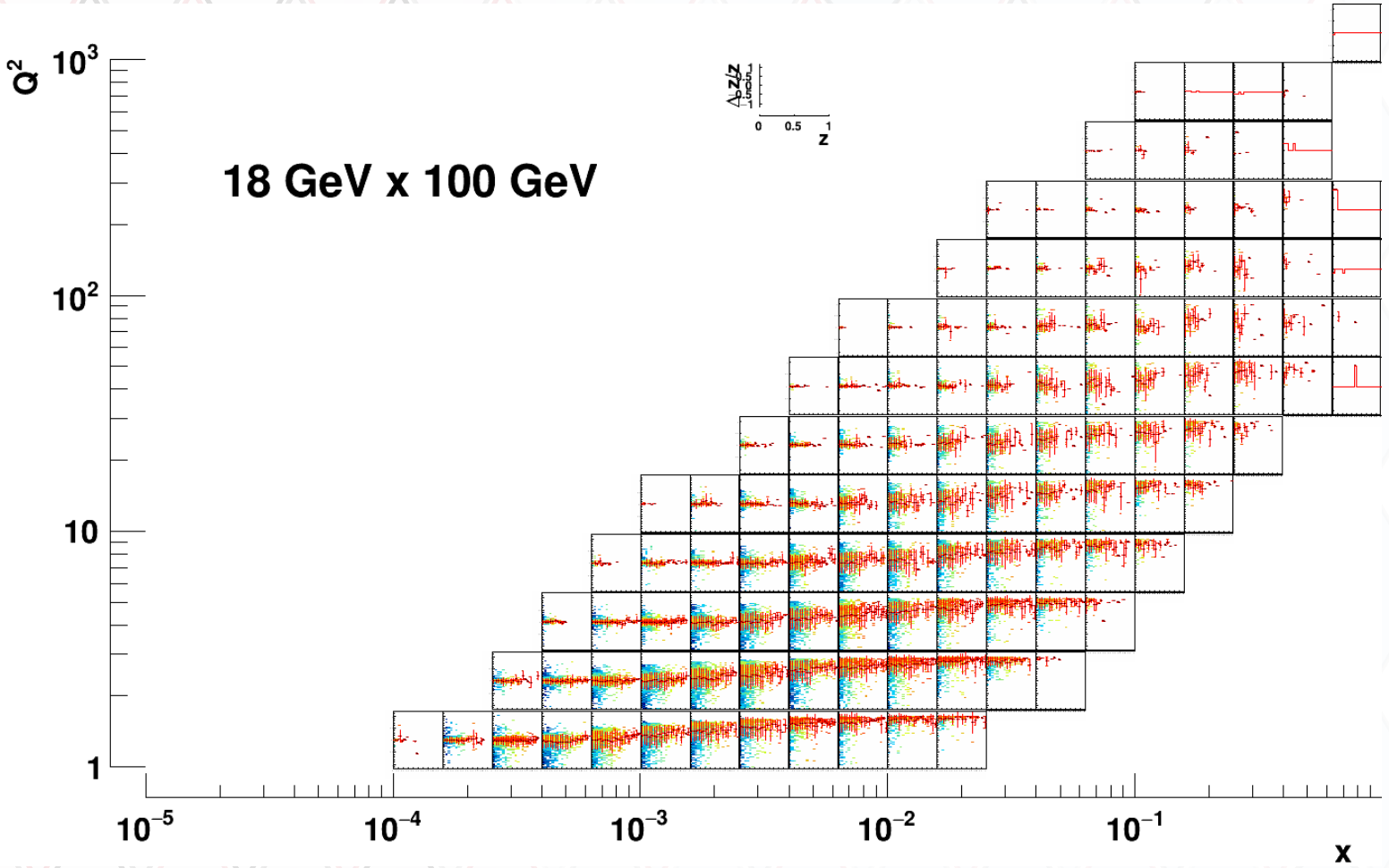
ϕ_h and lab ϕ distribution



Resolutions in z for pions

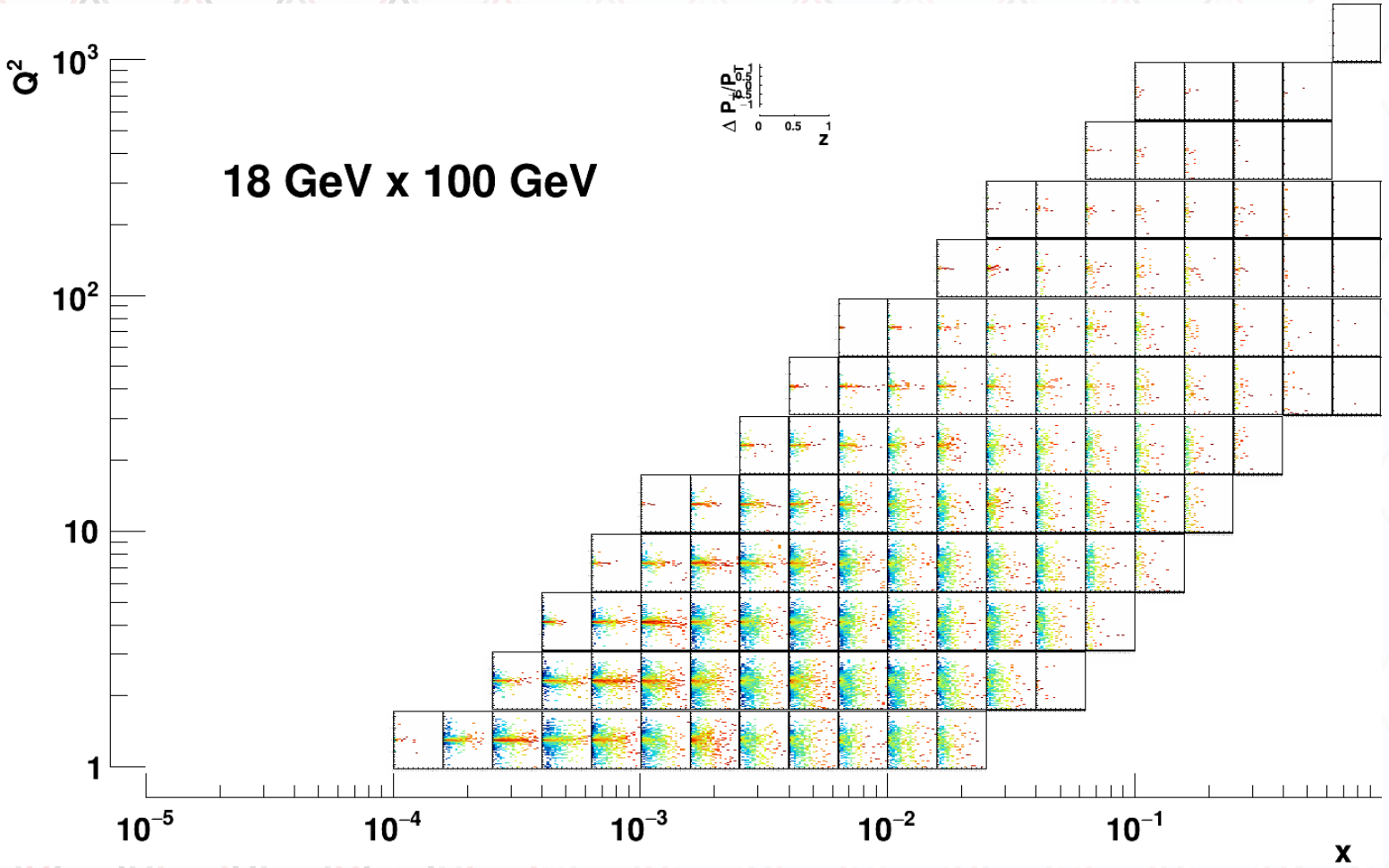


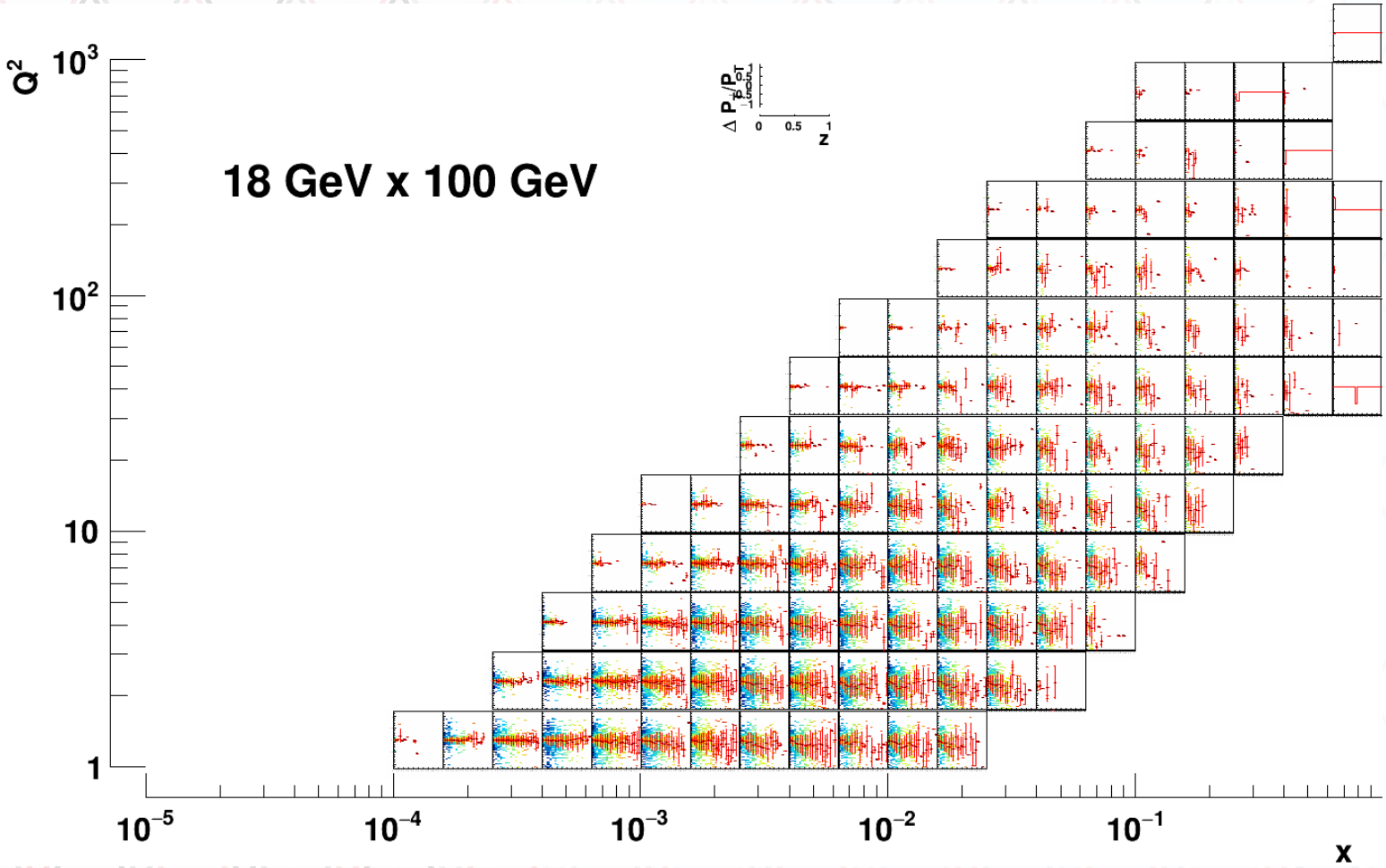
..including profile



Shift visible at higher x/low Q2 region (ie low y)

Pt resolutions

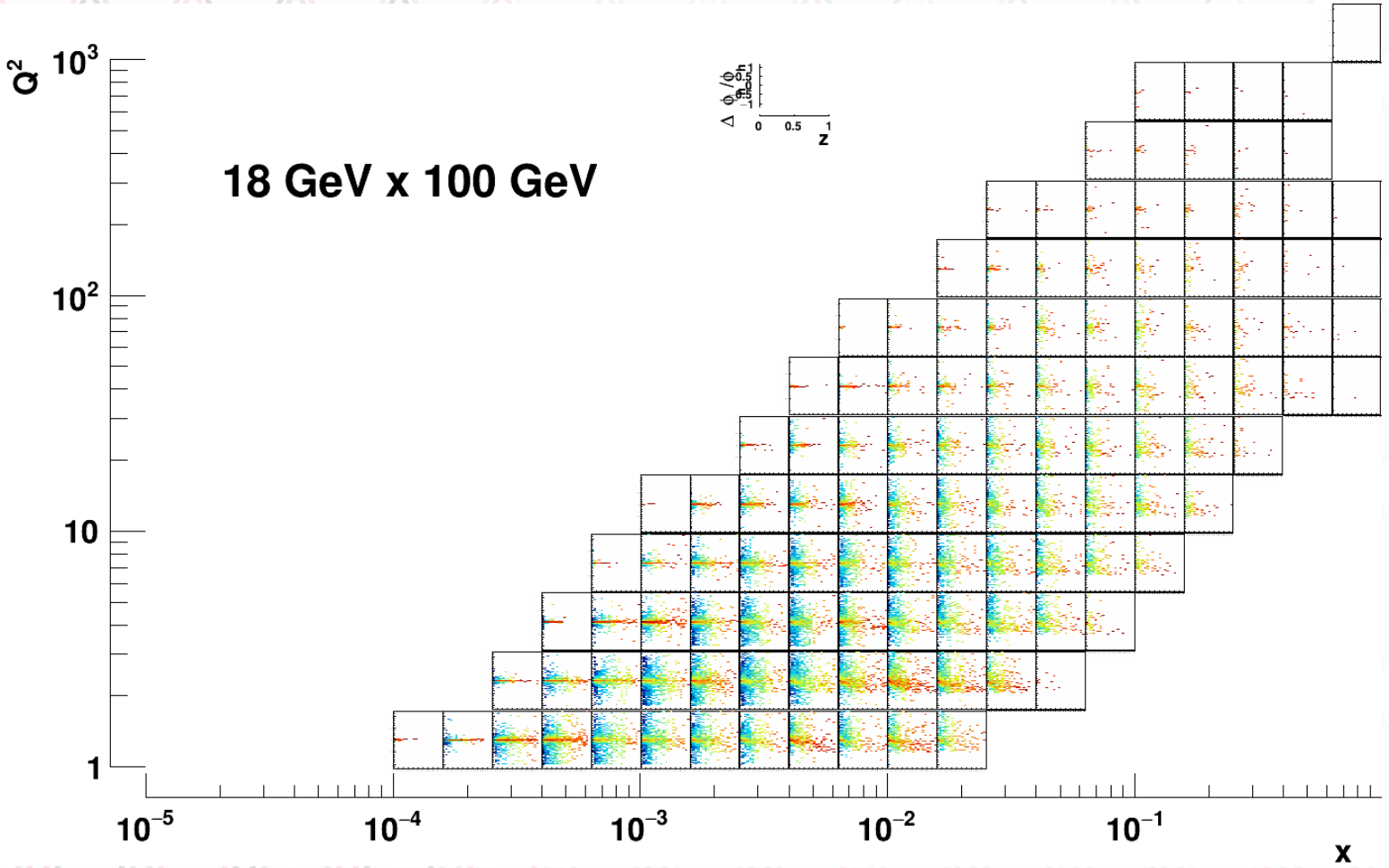


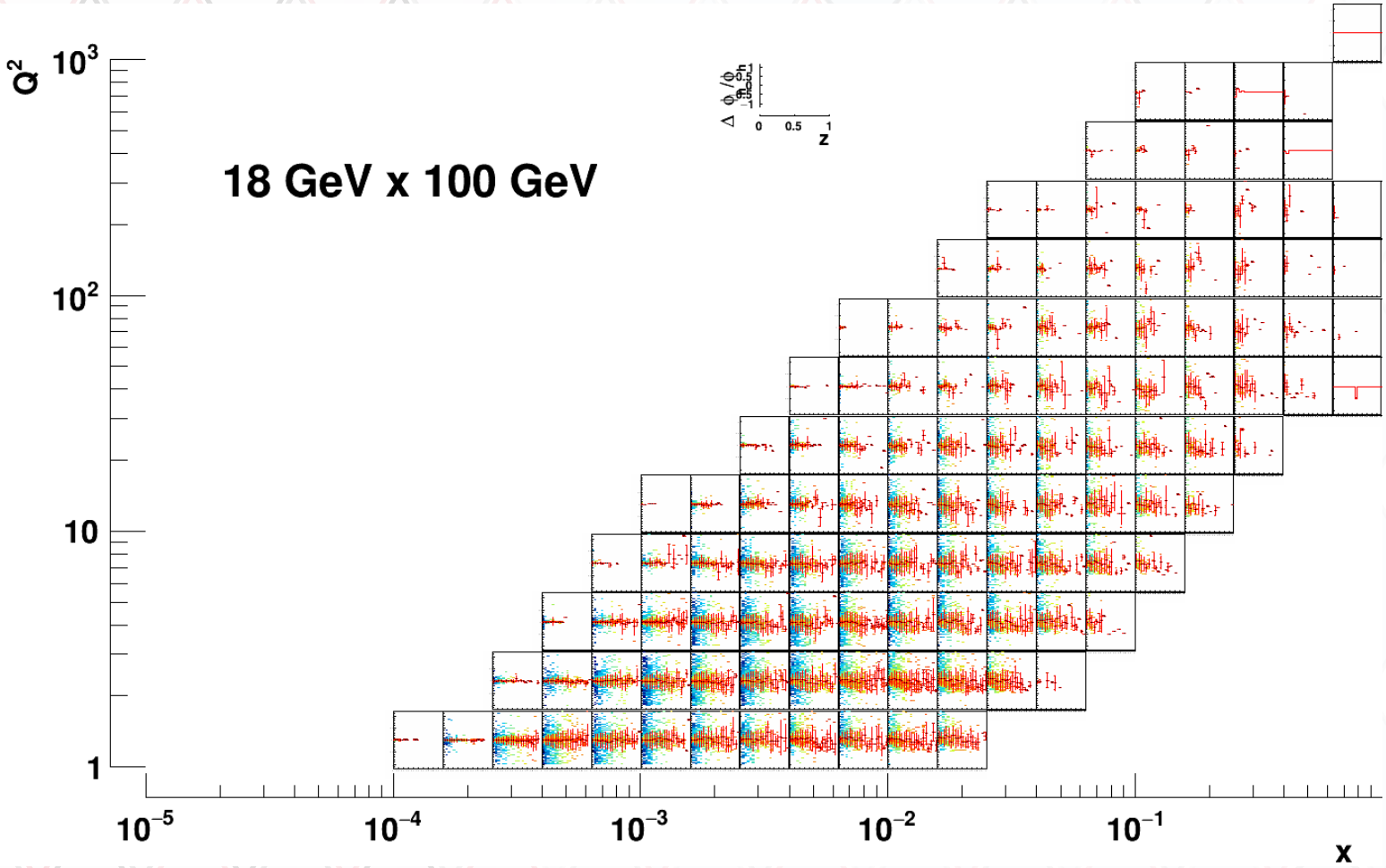


Not too much shift in hadron Pt

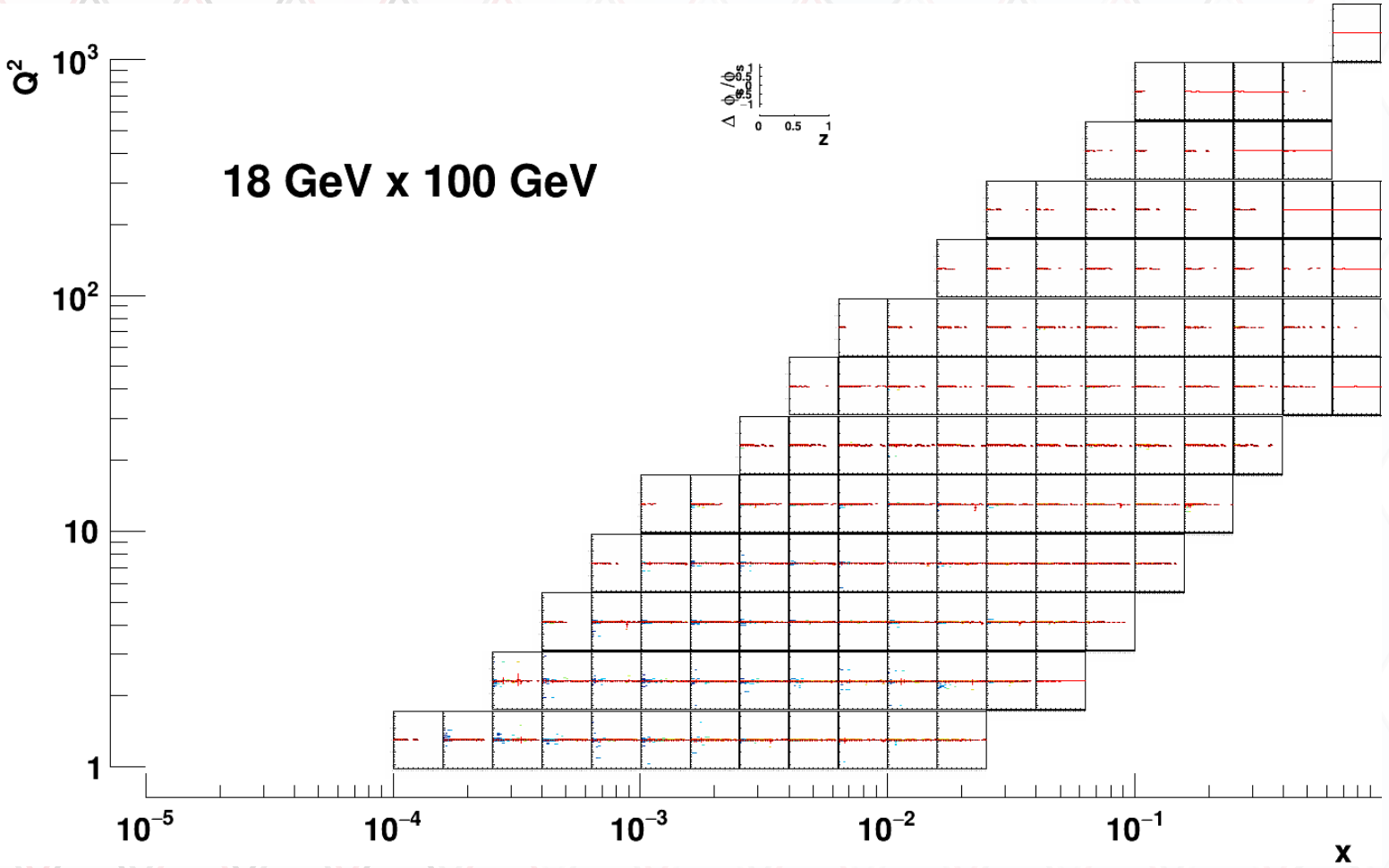
RIKEN

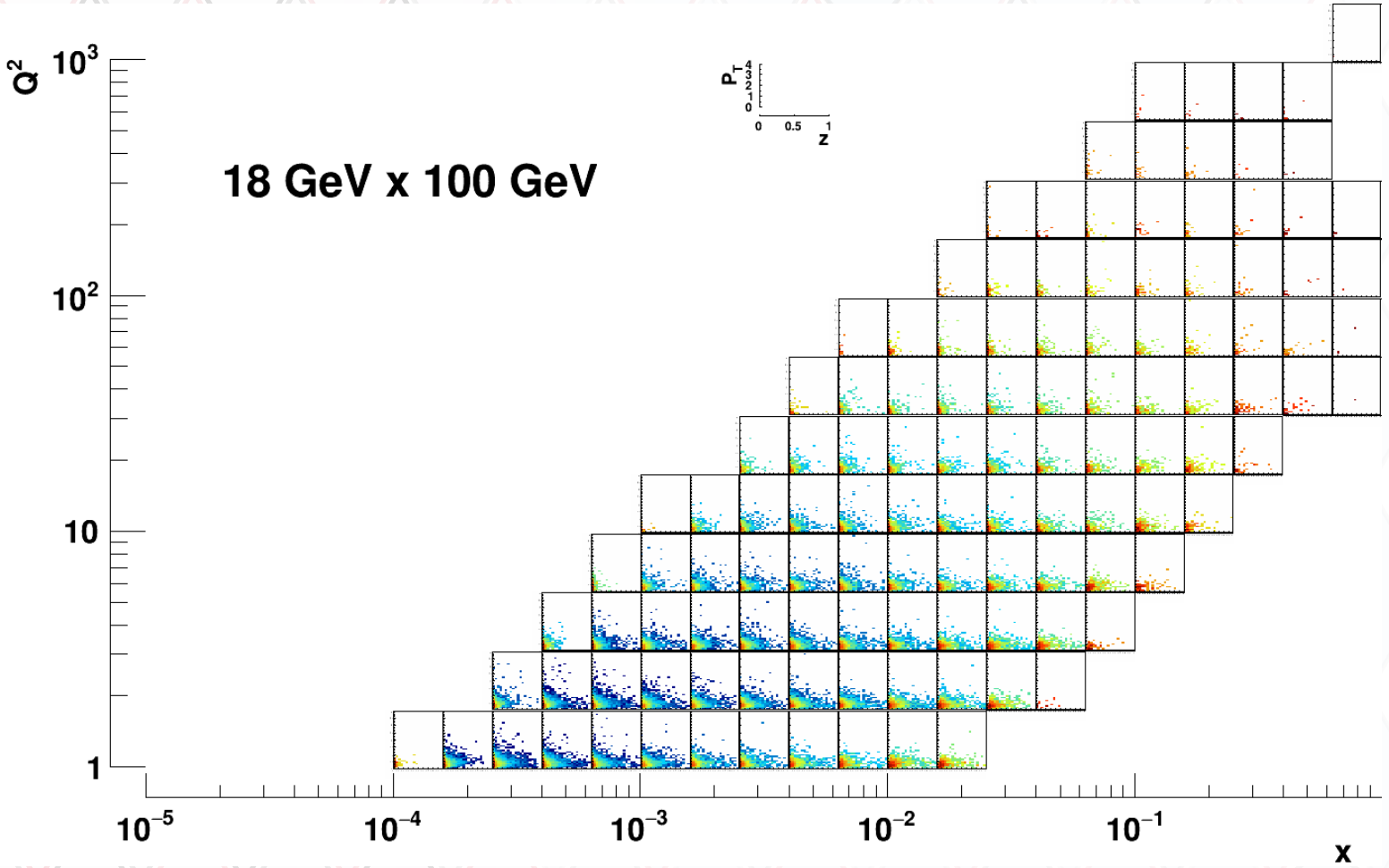
ϕ_h resolutions

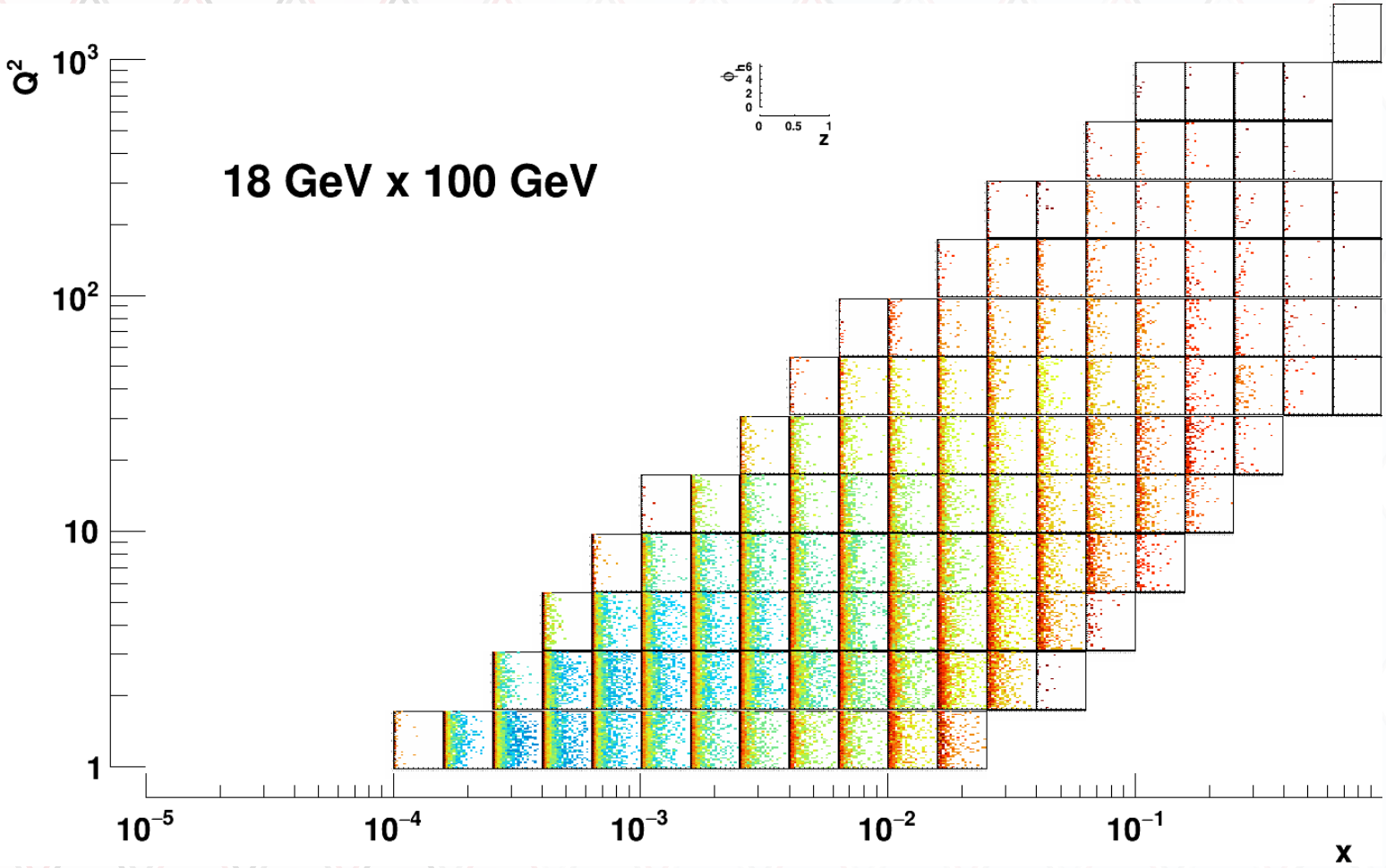



18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
$\Delta\phi_h/\phi_h$
0
0.5
1
z

phis


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
$\Delta\phi_s/\phi_s$
z


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_T
0
1
2
3
4
0
0.5
1
z


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
ϕ_h
6
4
2
0
0
0.5
1
z

- Tracking group requests input about tracking requirements from physics groups:
  - How to address this?
  - x, Q^2, ϕ_S and z, P_{hT}, ϕ_h resolutions for different tracking assumptions ?
  - Could be done via eic-smear studies rapidly.

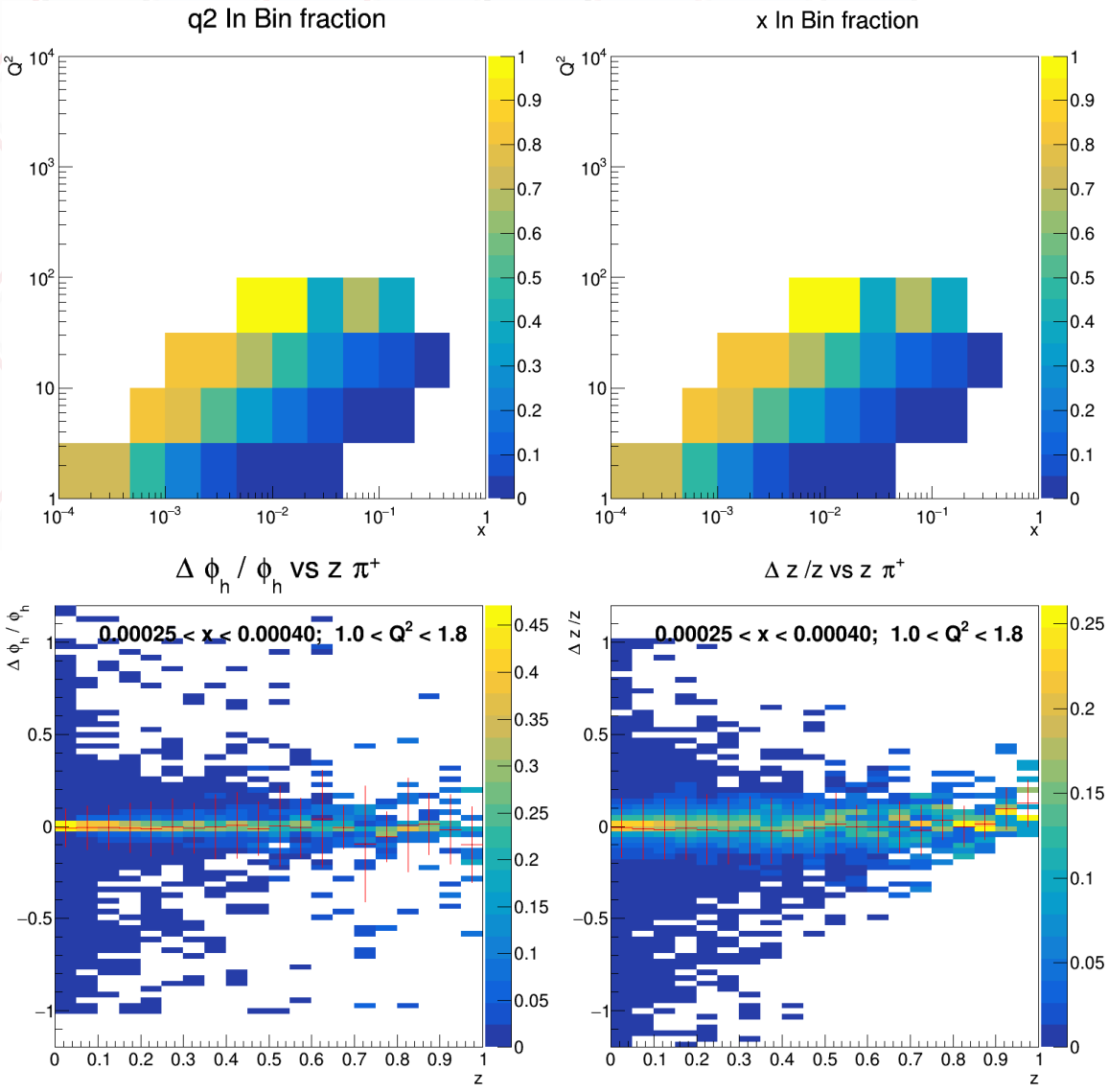
  →require momentum resolutions as a function of rapidity from tracking group and feed it into eic-smear
- Would minimum momentum ranges for detector options affect measurements?
  - Check 4D plots for different min possibilities

Impact studies and plots for proposal

- Concentrate on two energy combinations? Highest and lowest energies (5x41, 18x250 or only 10x250,)? Reasonable for simple asymmetry feasibility at low x/low Q2 corner, high x/high Q2 corner and low y corners
- What are the early physics goals that can be achieved in 1^{st} year $5fb^{-1}$?
- Apart from impact plots also show the explicit expected asymmetries, or both
  - Compare perfect detector, YR, 1-2 ECCE configurations?
  - How to discuss and estimate systematics?
- Sample asymmetry plots (fixed bin(s)), show asymmetries for different configurations and effect of smearing

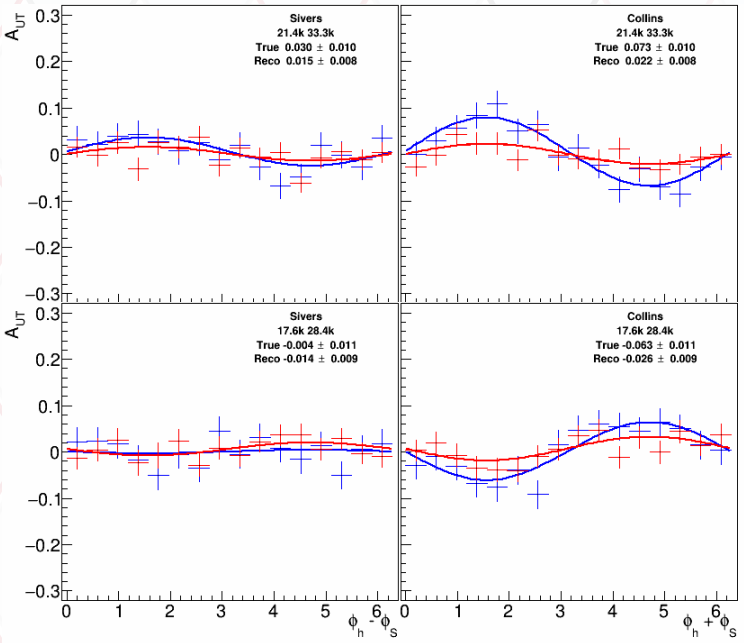
Some example Output I

- Low level: DIS in-bin efficiencies (using scattered lepton only)
- Medium level: Some resolutions for hadron z, azimuthal angles in one particular z-Q^2 bin



Some example Output II

- High level: Reweighted azimuthal single spin asymmetries
  - Very simplified constant (in x, Q^2, z, P_{hT}) weights in true variables
  - Far from enough statistics, but demonstration of smeared asymmetry test

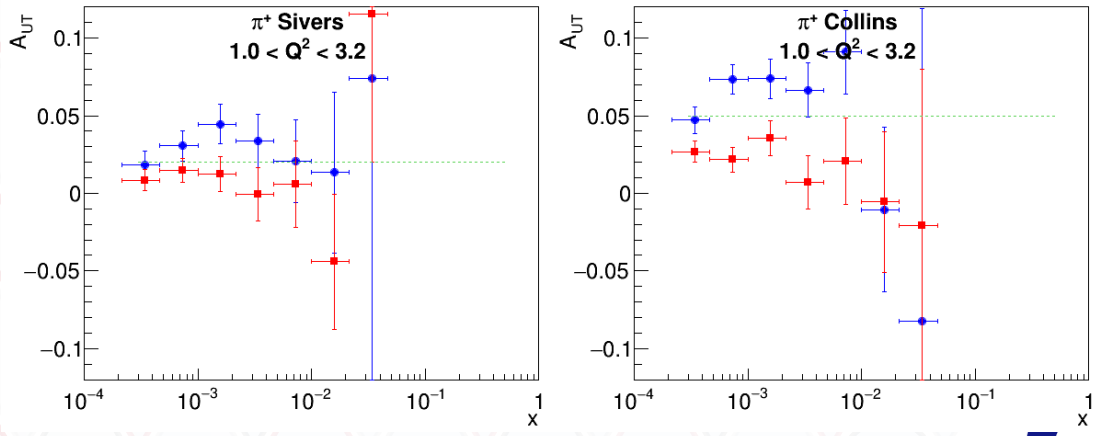


$0.0005 < x < 0.0010$
$1.0 < Q^2 < 3.2$
π^+

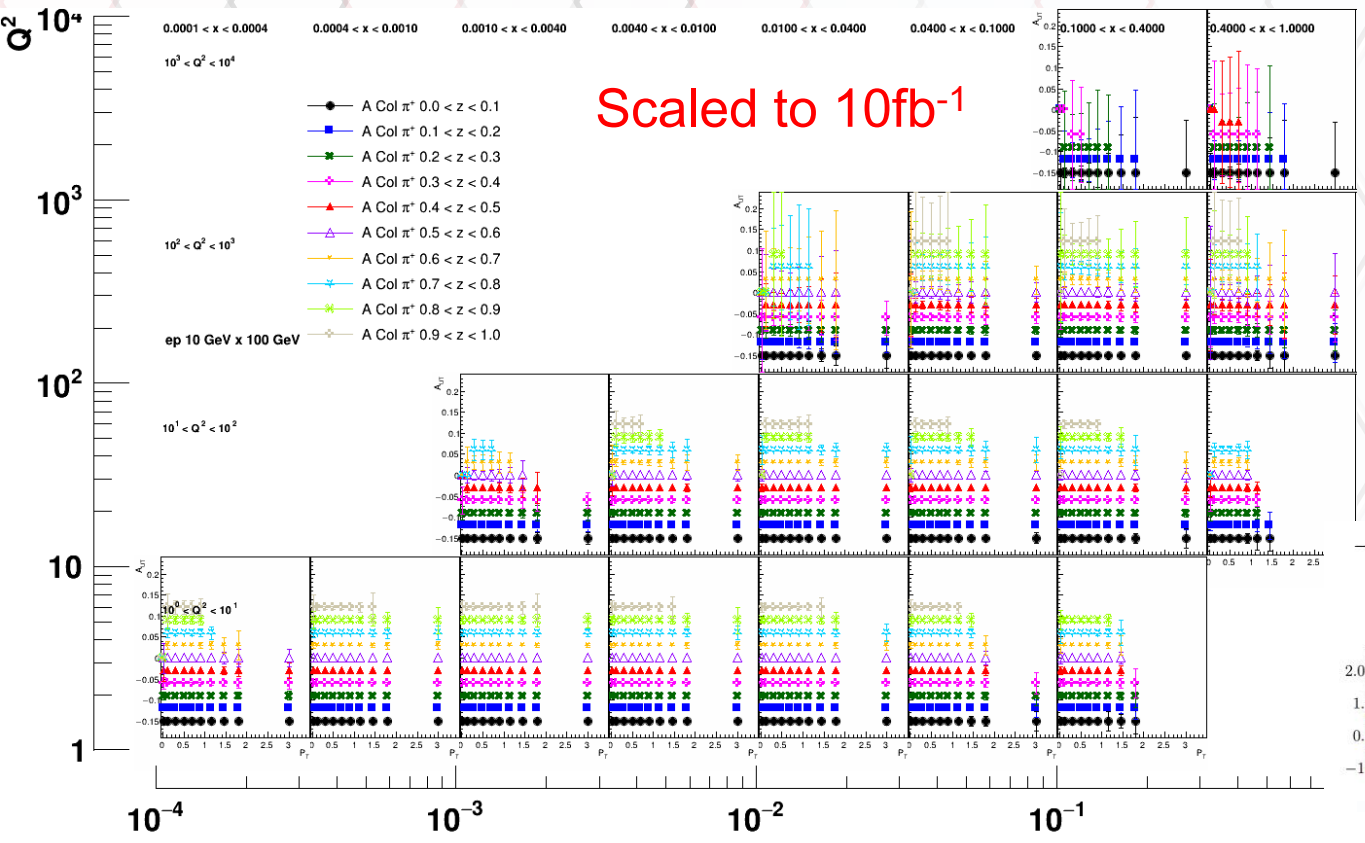
Truth
Smeared

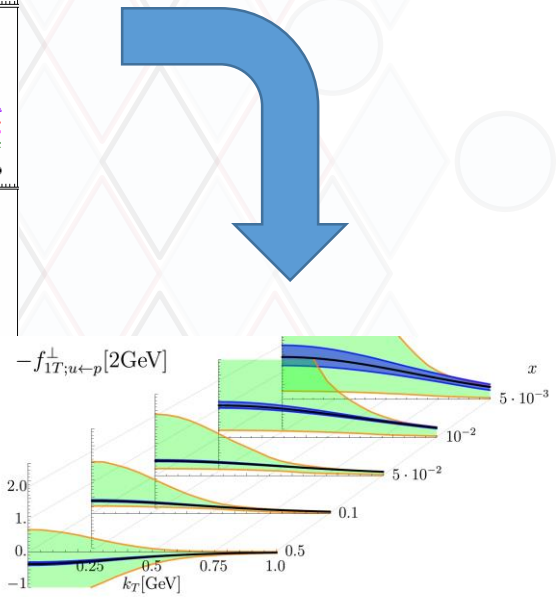
$0.0005 < x < 0.0010$
$1.0 < Q^2 < 3.2$
π^-

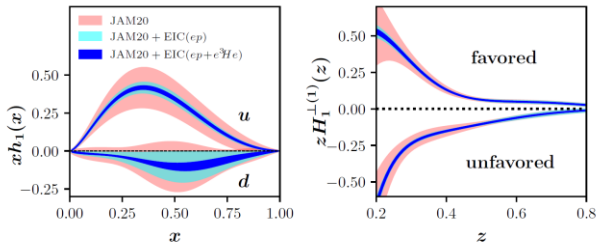
Truth
Smeared



Expected Sivers/Collins asymmetries







- Note: This is still from YR work, based on eic-smear output only, NOT YET GEANT based!!

Key SIDIS physics measurements (must-do)

- Quark Sivers function as a function of x, k_t for valence and sea flavors: $A_{UT}\sin(\phi_S-\phi_h)$ moments for IDed pions and kaons (Golden channel)
- Tensor charges for valence and sea quarks $A_{UT}\sin(\phi_S+\phi_h)$ moments for IDed pions and kaons (silver channel)
- Unpolarized TMD PDFs and its QCD evolution (silver channel, implicit requirement for Sivers)
- Sea quark helicities via SIDIS A_1 (A_{LL}) measurements for IDed pions and kaons (golden channel)
- Gluon Sivers function via di-jet or HF pair A_{UT}s (Still open)

RIKEN

Other measurements (can-do)

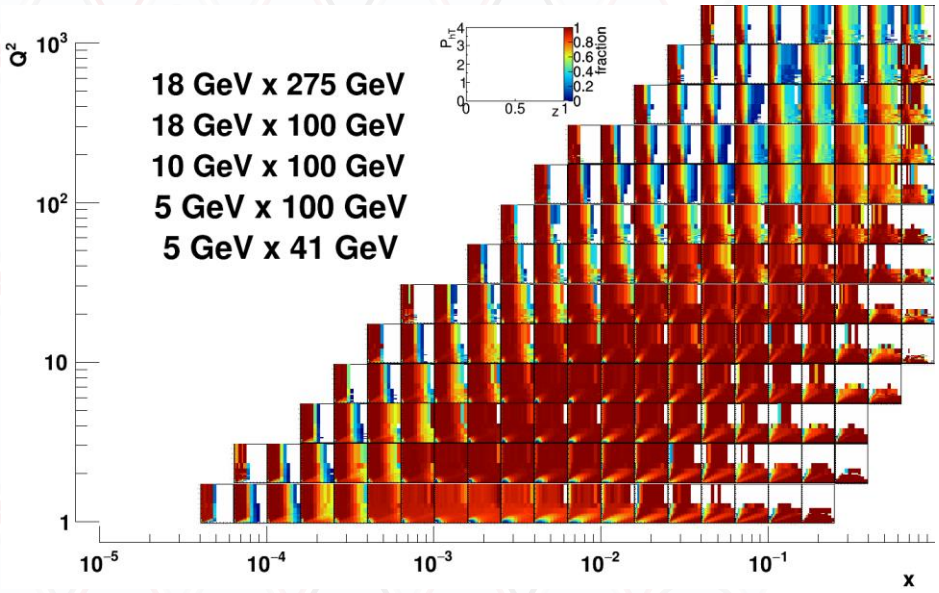
- Boer-Mulders function measurements via IDed pion and kaon cos($n\phi_h$) moments (likely most acceptance sensitive)
- Fragmentation function FF measurements and nFF measurements for light hadrons
- Unpolarized sea quark PDF meausurements using FFs
- Various other single and di-hadron azimuthal moments related to tensor charge, higher twist function e, and others
- XYZ production measurements (mostly photo-production, not SIDIS but part of SIDIS YR, could also be in HF group
- Other Jet related TMD measurements →HF/Jet group?

RIKEN

Main figures for the report

- 4D (x-Q^2-P_{hT}-z) kinematical + PID coverage figure similar to YR
  - Concentrate for the most part on certain x-Q2 ranges due to simulation cost
- Closely related: z, P_{hT} and ϕ_s, ϕ_h smearing figure for different ECCE configurations
- Simulations can start from the YR Pythiaerhic/eic-smear files

Fig. 8.29



➔Already prepared for the most part

Sivers/Collins/unpol TMD figures

- Redo these YR analyses (AUTs require reweighting of events in truth kinematics+parton flavor)
- Need to take into account crossing angle and related acceptance/smearing effects
- Similar to YR guess systematics via variation between perfect and smeared options
- Extrapolate from some x-Q2 bins to all and give to Alexey Vladimirov (Sivers, unpol TMD) or Daniel Pitonyak (Tensor charge) for impact studies

Fig. 7.53: Sivers

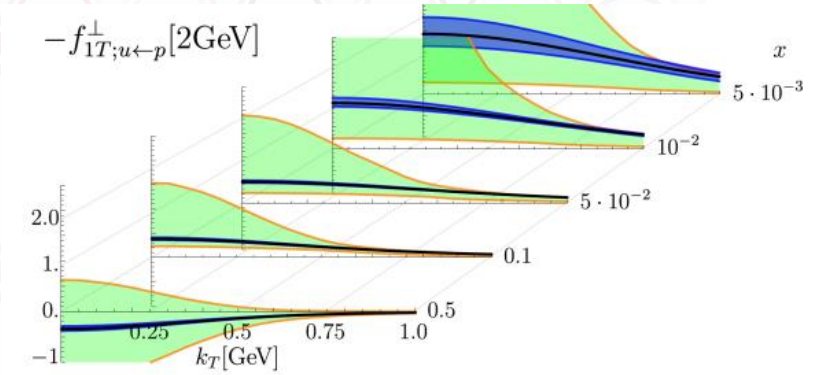
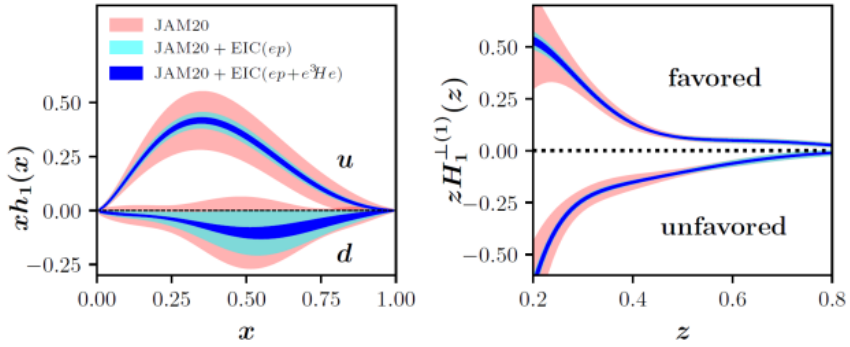


Fig. 7.54: Transversity



➔feasible using EventEvaluator, reweighting machinery still to be transferred from eic-smear based work