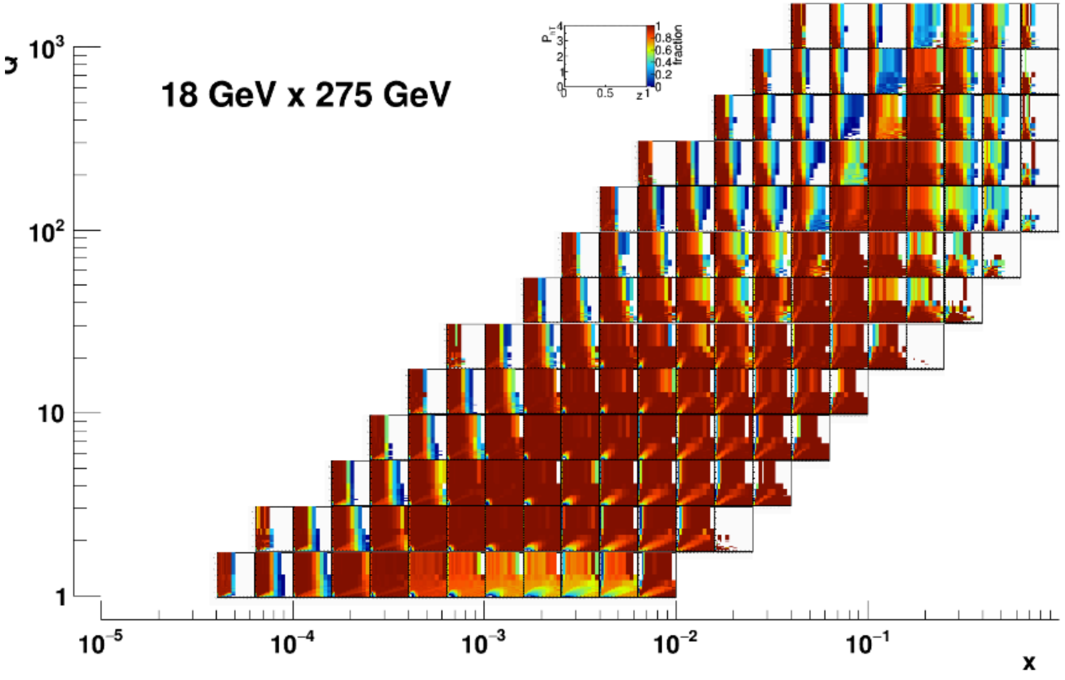
# SIDIS Detector Complimentarity

- Which physics processes have contradictory requirements not possible to consolidate in one detector
  - No significant conflicts identified (caveat: we could not study min Pt vs high pT resolution in detail)
- What physics processes need a dedicated detector / cannot be fulfilled by a general- purpose detector
  - None identified
- Is the large rapidity acceptance (|eta| 3-4) critical for your physics? Any problems if the focusing quadrupoles would be inside the detector volume
  - Not critical, but very important
  - Not clear how acceptance would be compromised by the magnets
- What is the absolute best detector performance you would like to see and what is the detector performance you anticipate your physics not be possible anymore
  - Resolution of reference detector is sufficient. Ideally momentum range of central PID will be extended (assuming proposed forward momentum range up to 50 GeV). Hermetic coverage up to 4.0 desirable for the SIDIS program
  - Di-hadron Sivers program would profit from coverage up to 4.0
  - Hermiticity very important for the gluon Sivers in dijets measurement

- Can you briefly summarize your planned physics program in terms of processes of interest and (where applicable) basic kinematic ranges in (x,Q2) or other relevant variables.

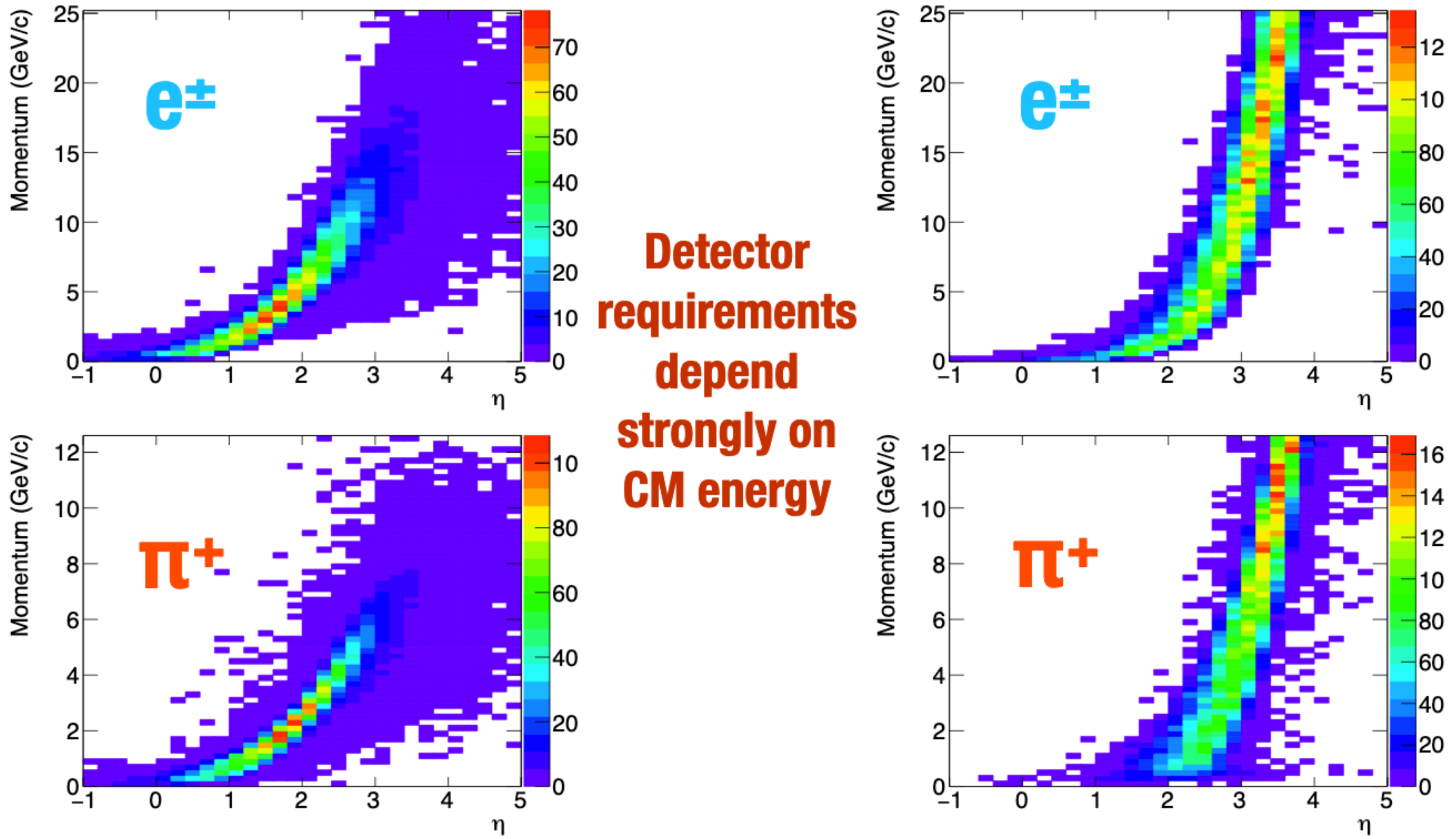
| Final 8 | π/K/p |
|---|---|
| -3.5 - -1.0 | 0.2 - 7 |
| -1.0 - 1.0 | 0.2 - 6 |
| 1.0 - 2.0 | 0.2 – 50 |
| 2.0 - 3.0 | 0.5 – 50 |
| 3.0 - 3.5 | 0.5 – 50 |



# $Z_c^+(3900)$ at an EIC

$$Z_c^+ \rightarrow J/\psi\pi^+ \quad J/\psi \rightarrow e^+e^-$$

**5 x 41 GeV: CM = 28.6 GeV** | **18 x 275 GeV: CM = 140 GeV**




- Decay e± and π⁺ boosted in proton direction: detector requirements can depend strongly on production with CM energy

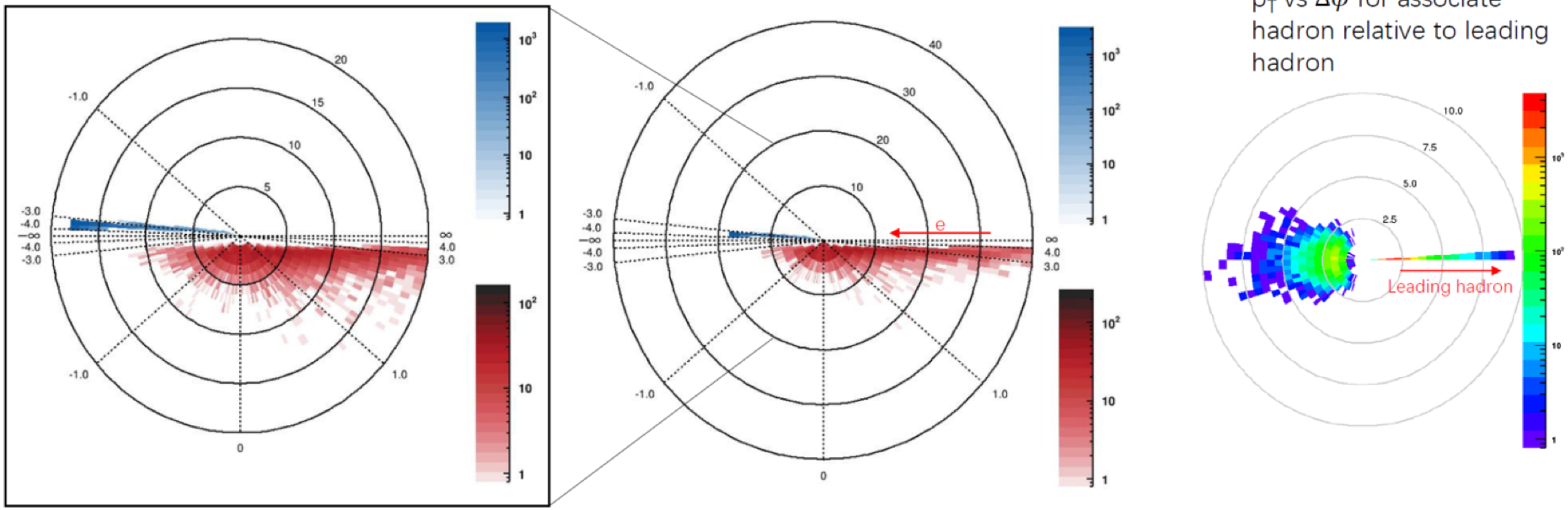
# Results for Gluon Sivers: kinematics

## Gluon Sivers measurement requirement from charged dihadron channel

ep 18x275 GeV
0.01<y<0.95, 1<$Q^2$<2 $GeV^2$
charged hadron, |η|<4.5, $p_T^*$>1.4 GeV, $z_h$>0.1,
$k^*_T/P^*_T$<0.7, * indicates $\gamma^*$p c.m.s frame

$p$ vs $\eta$ for scattered electron and charged hadron pairs

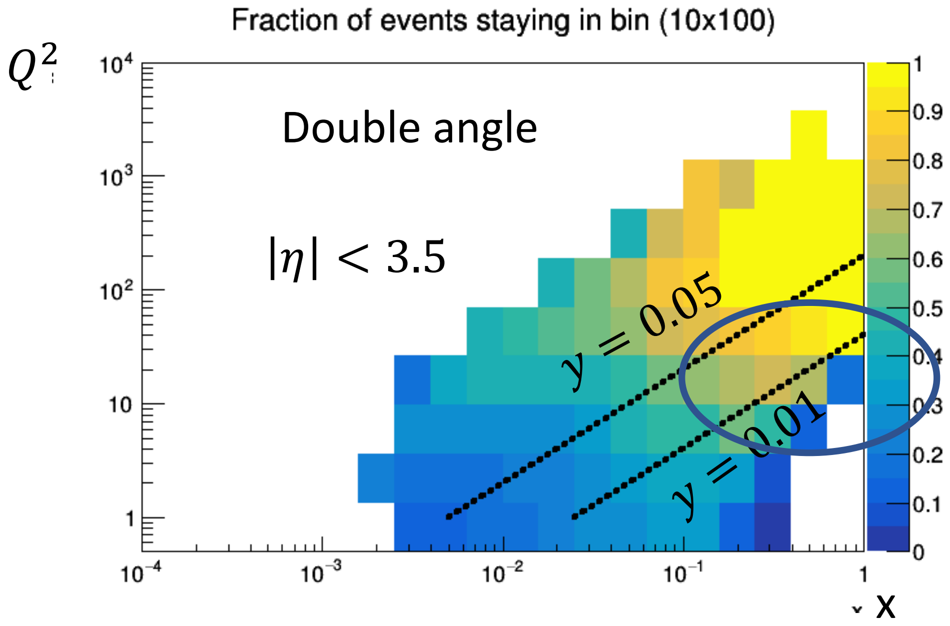
$p_T$ vs $\Delta\phi$ for associate hadron relative to leading hadron

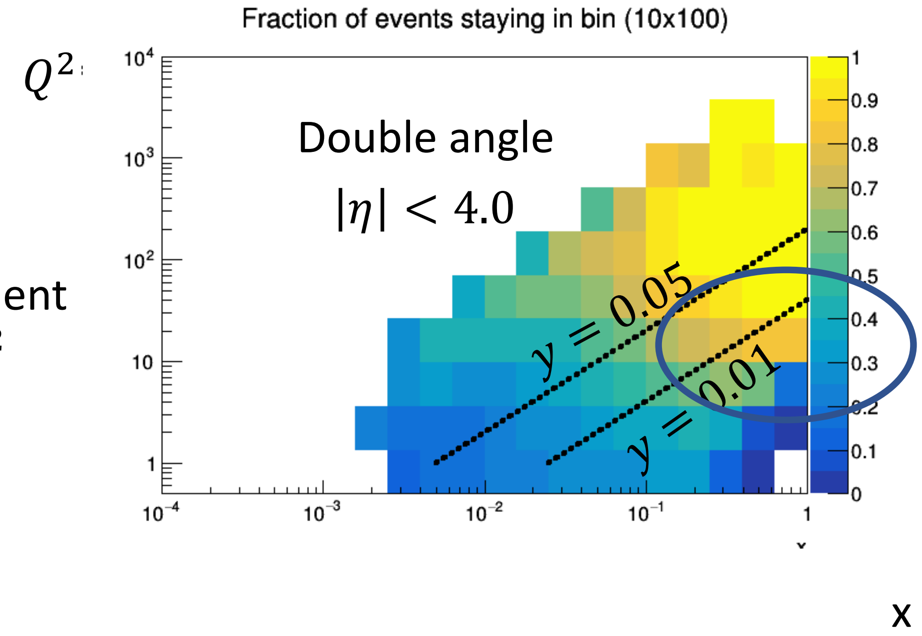


- Which basic detector-level measurements (eg track pT/eta, scattered electron, forward neutron/proton observables, overall HFS, displaced vertices, dE/dx ...) are most essential to realise your physics aims? Can you already say what sort of measurement (acceptance) ranges and resolutions / performance you need?
    - As documented: Charged tracks momenta and PID. $\Lambda$ displaced vertex (but that should be easy)
- How important is the Interaction Region design for your physics observable and do you have criteria that might impact the design? For example, would you be impacted by reduced forward acceptance for neutrons, protons, photons?
    - Reduced forward acceptance of the main detector $(\eta < 4.0)$ will have some impact on $\Sigma^0$ reconstruction, $\pi^0$ in the forward direction, but likely not critical
    - Far forward acceptance likely no impact
- What is the sensitivity of your physics to the lower y-cut and the depolarization factor
    - Lower y needed for overlap with fixed target
    - Low y region also sensitive to physics of interest (see impact plots later in the slideset)

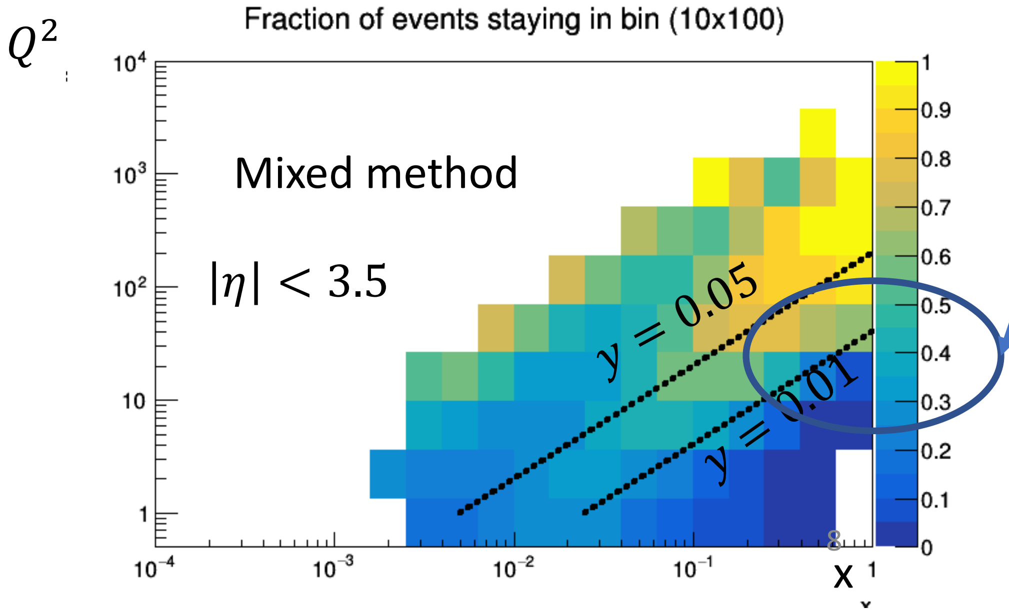
- For charged particles, how important is low momentum acceptance versus high momentum resolution (this informs the optimal choice of magnetic field). What is the sensitivity to the magnitude of the magnetic field.
  - For $\Lambda$ low momentum acceptance critical (100 MeV)
  - High momentum resolution has not been studies explicitly. Some indication that low z
- How important is integrated luminosity? For the anticipated integrated luminosities, will your observable be systematic or statistics-limited? If you expect to be systematically limited, which systematic source (or sources) are the most important?
  - We are currently statistically limited (multidimensional studies)
  - Dominating systematics will likely be from
    - 1h/2h: detector smearing (unfolding will also perform better with higher statistics)
    - Lambda: feed-down
    - Spectroscopy: PID/backgrounds
    - Di-jets: Jet reconstruction
- How important is polarisation to your physics programme (quantify if possible, in terms of polarisation level and systematic precision requirements)? If applicable, discuss lepton and hadron polarization separately.
  - Most observables are single spin observables
- What beam energies are ideal for your physics aims (quantify if possible)?
  - Need full CME reach. Different physics quantities have different requirements

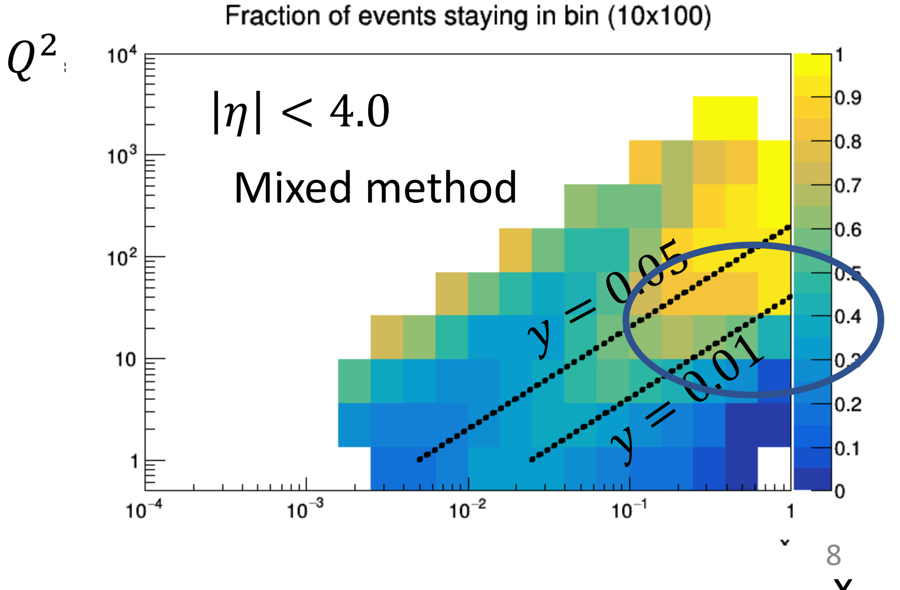
# Comparison




Some improvement
At low $x$ high $Q^2$

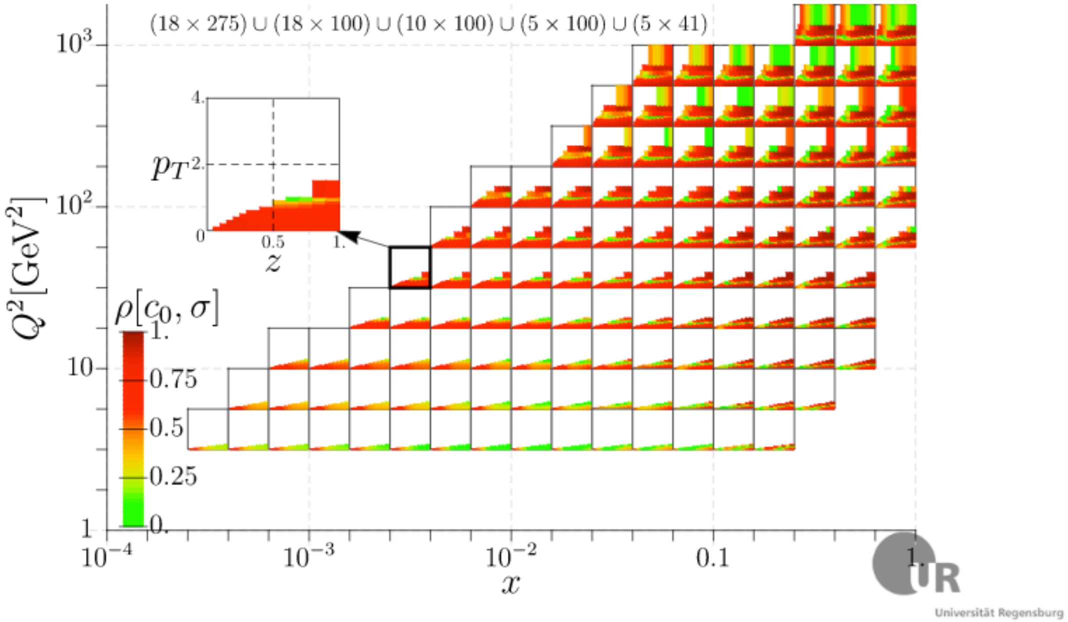


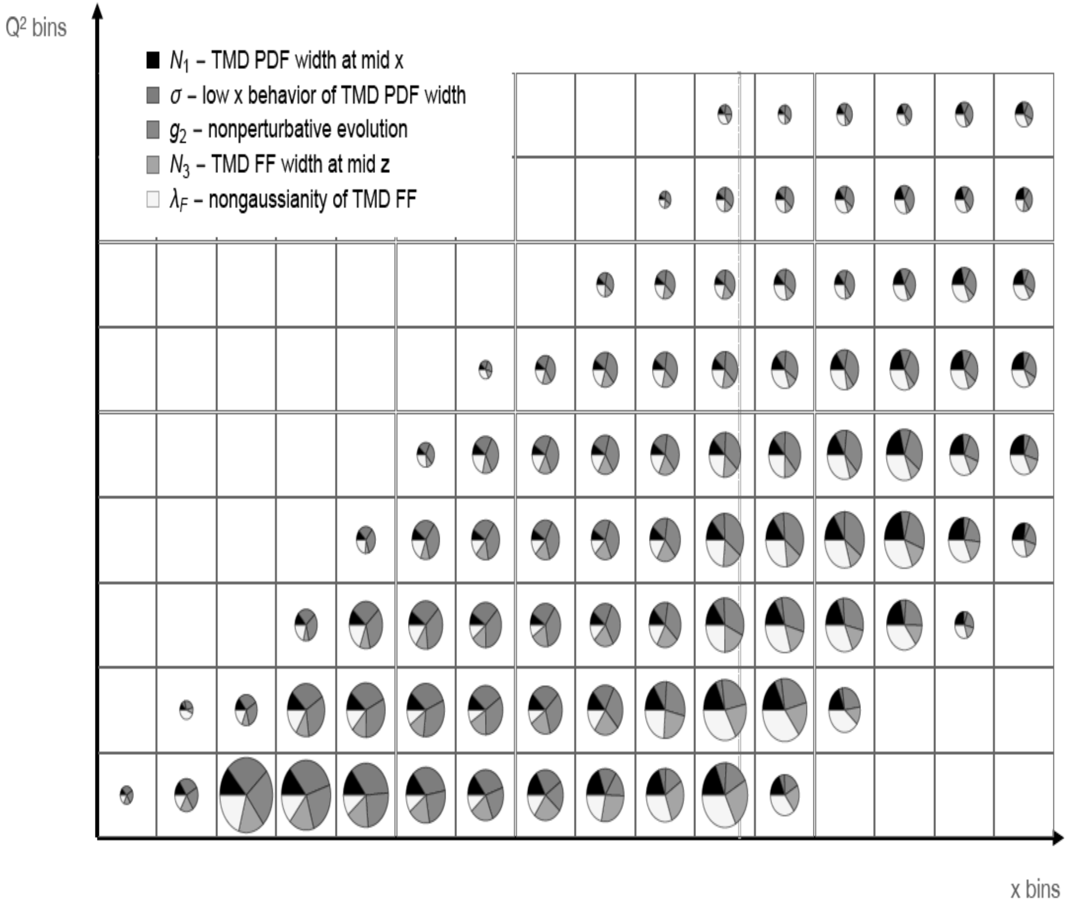



## Sensitivity coefficients for PV17 parameters

TMD evolution

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

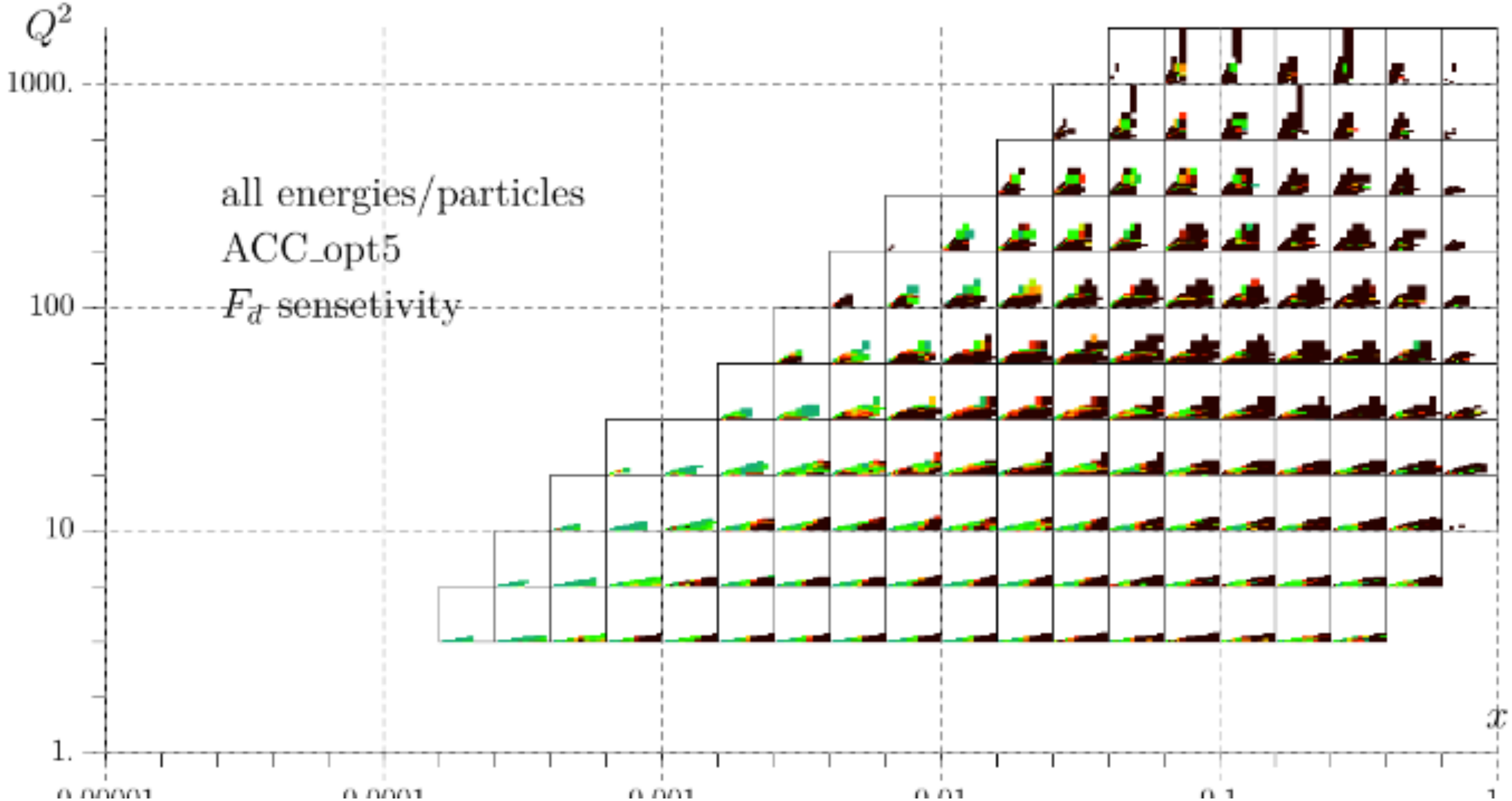



10x100 beam configuration

Preliminary plot from Alessandro Bacchetta

Alexey Vladimirov
https://indico.bnl.gov/event/9744/contributions/42448/attachments/30787/48366/12Oct.pdf




A Vladimirov, sensitivity to upol TMD, https://indico.bnl.gov/event/9744/contributions/42448/attachments/30787/48366/12Oct.pdf