FF
status update

YR SIDIS sub-group meeting
May 18

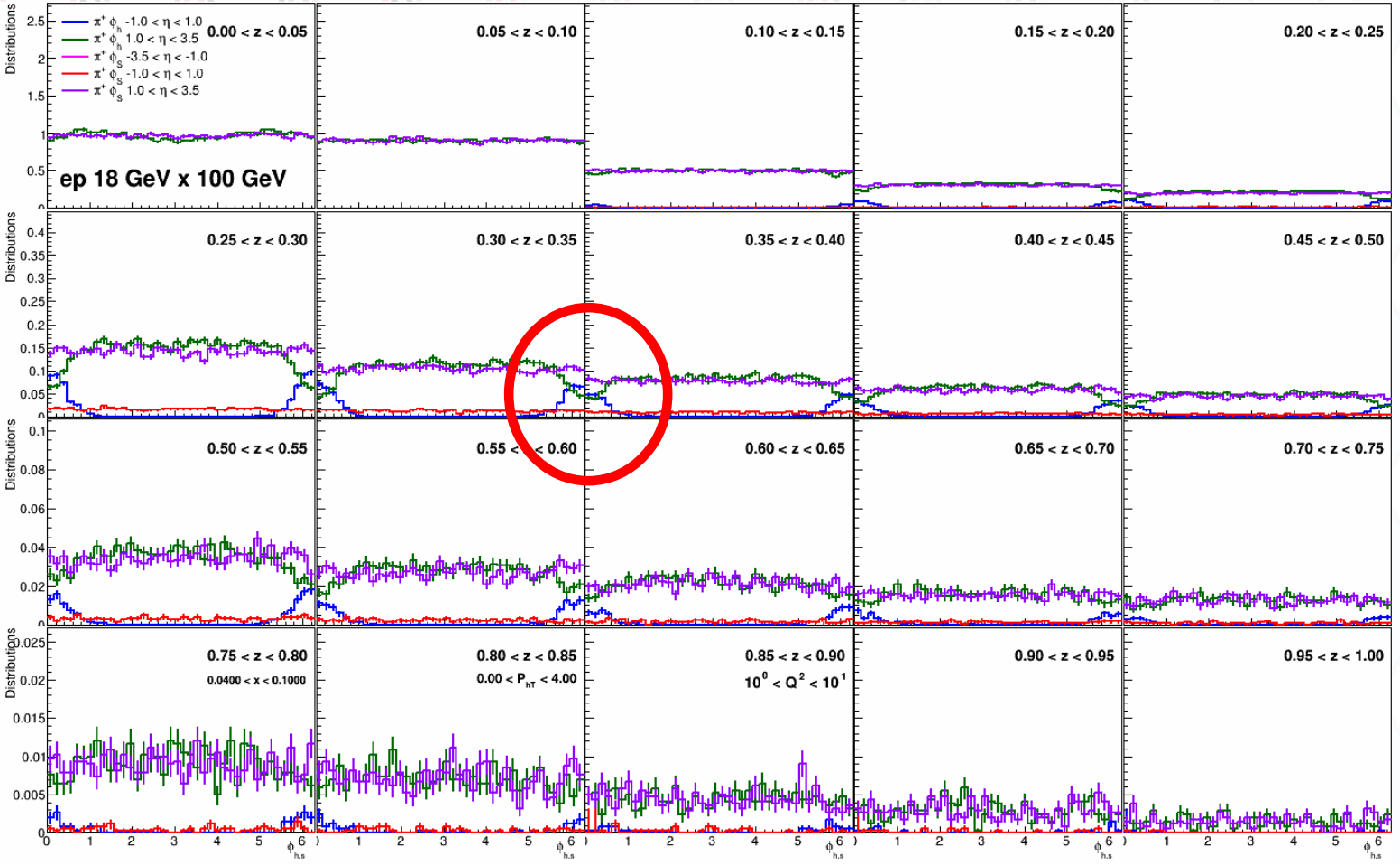
Ralf Seidl (RIKEN)

Azimuthal angular studies

- Used eicsmear's computeHermesPhiH() as basis for the azimuthal angle calculations of ϕ_h and ϕ_S (assuming 0,1,0 as spin direction) in the Proton rest frame and angle around virtual photon
- Studied the smearing in official handbook (HB) and Beast parameterizations
- Important points on smeared variables:
  - Momenta come from Momentum smearing, energy from Calorimetry smearing → using Get4Vector() will be problematic as you normally would use the total momentum and mass hypothesis for charged hadron energies
  - Particles that are only in tracking or calorimetry acceptance have only that part filled and the rest is zero

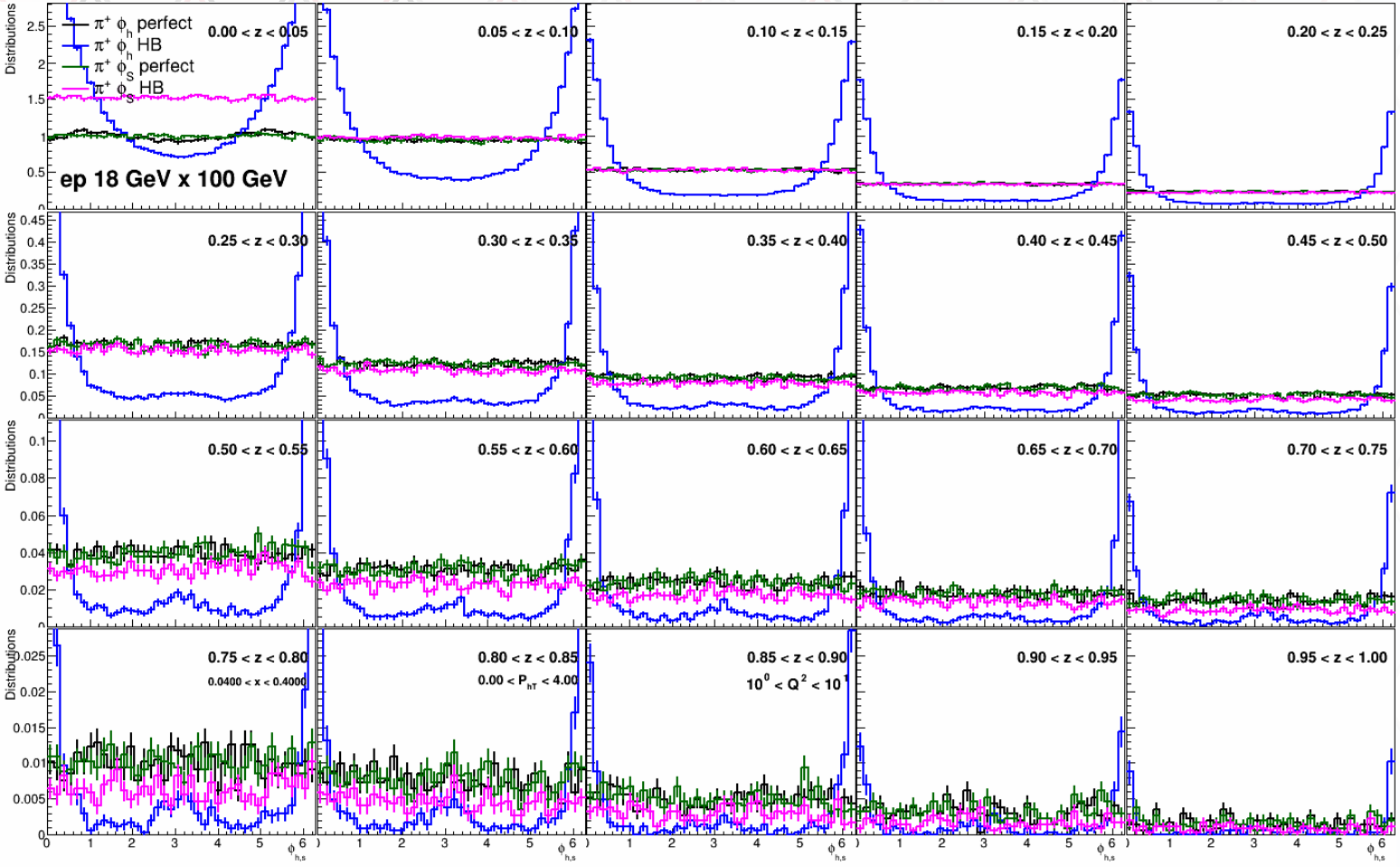
Perfect detector angles in two eta regions

Smooth azimuthal coverage over different rapidity regions is important!!!



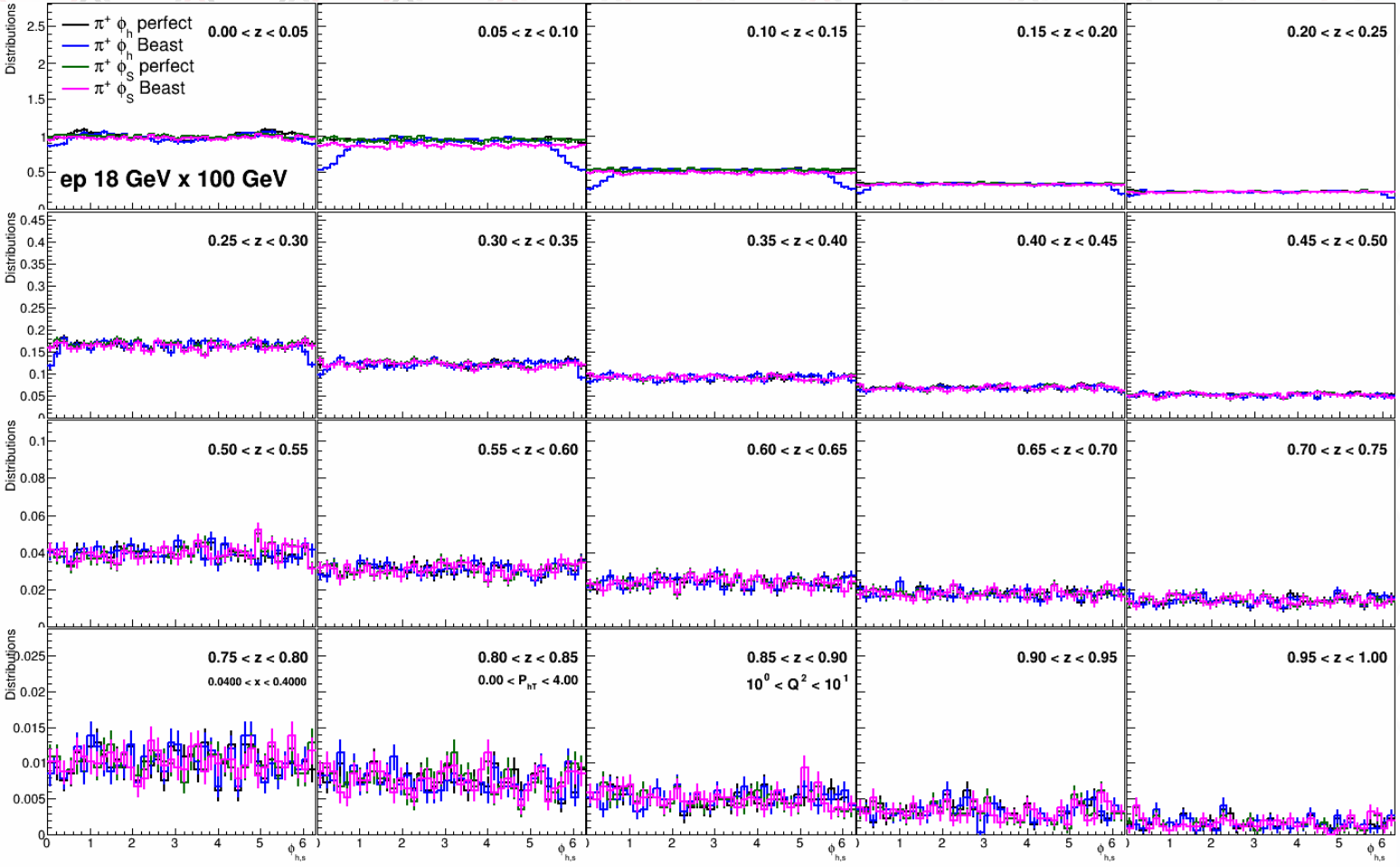
Angles in perfect detector and HB

Smeared scattered lepton causes different boost→ ϕ_h often in-plane

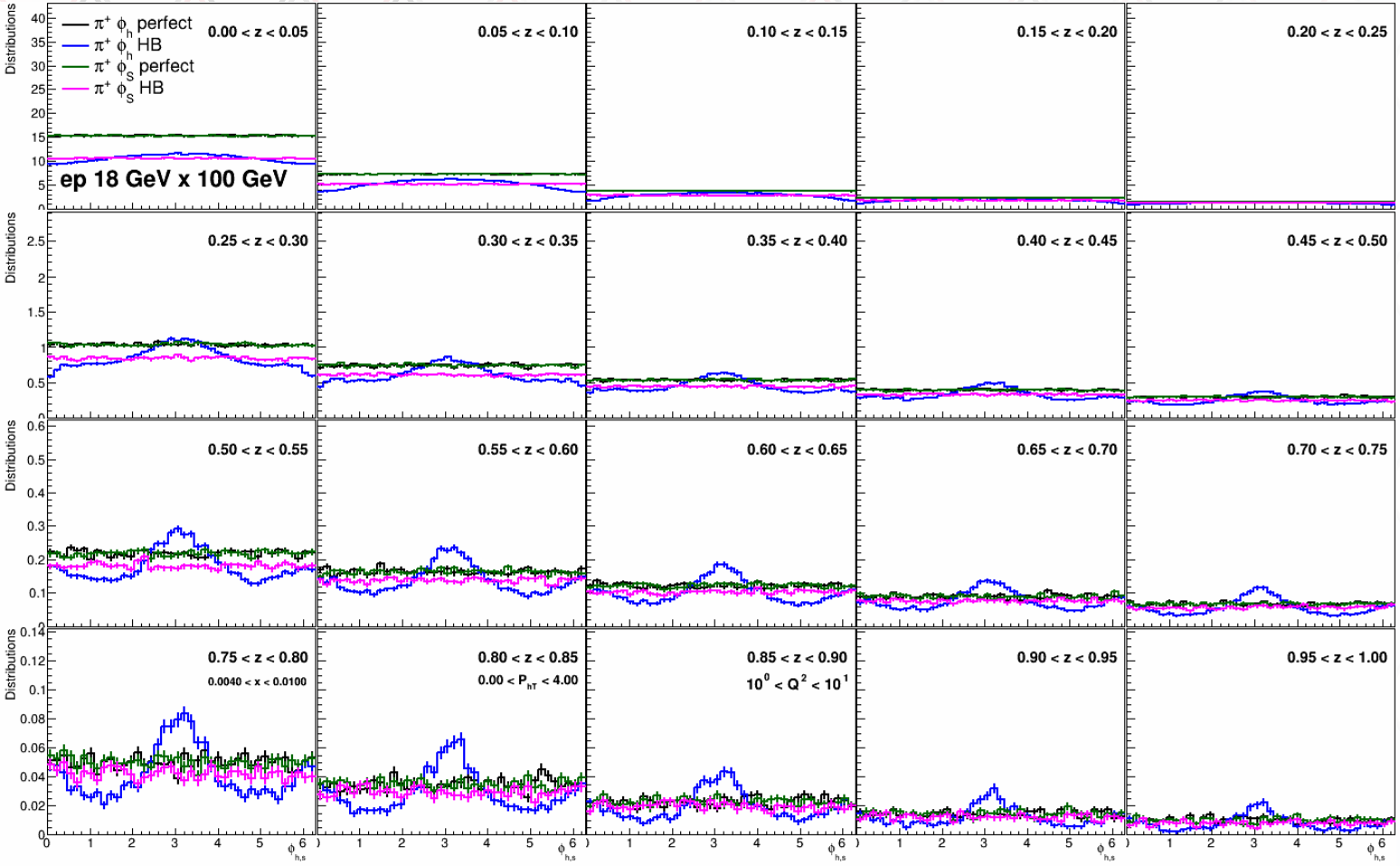


Angles in perfect detector and Beast

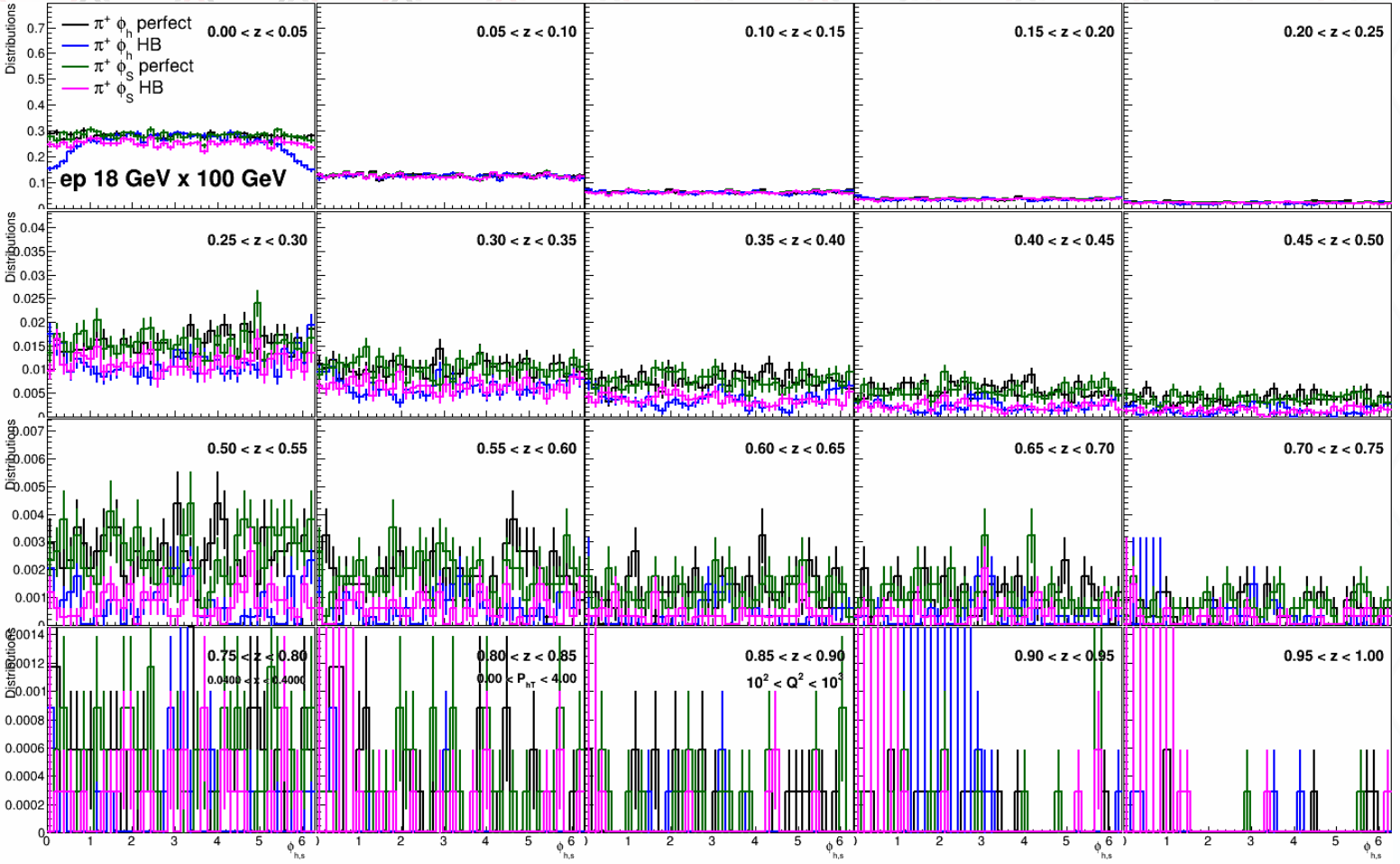
Hadrons smeared, lepton not → boost ok, distributions ok



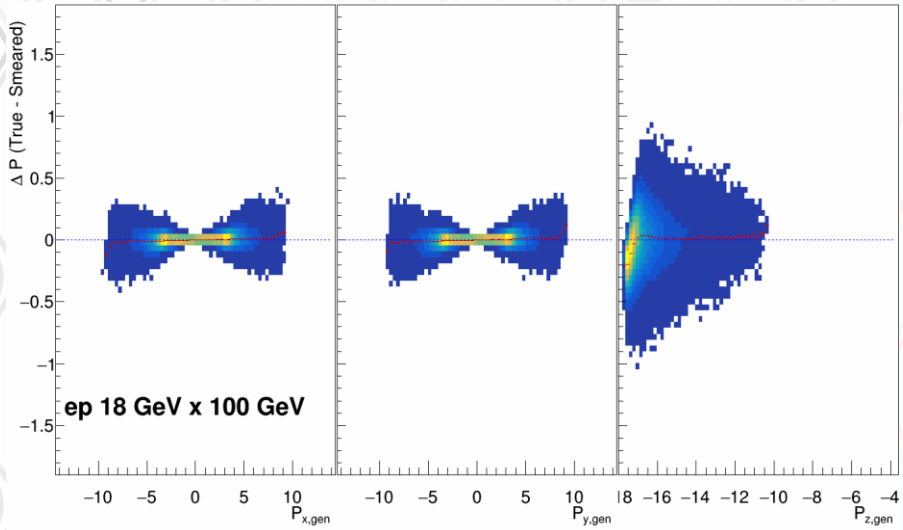
Lower x only somewhat better



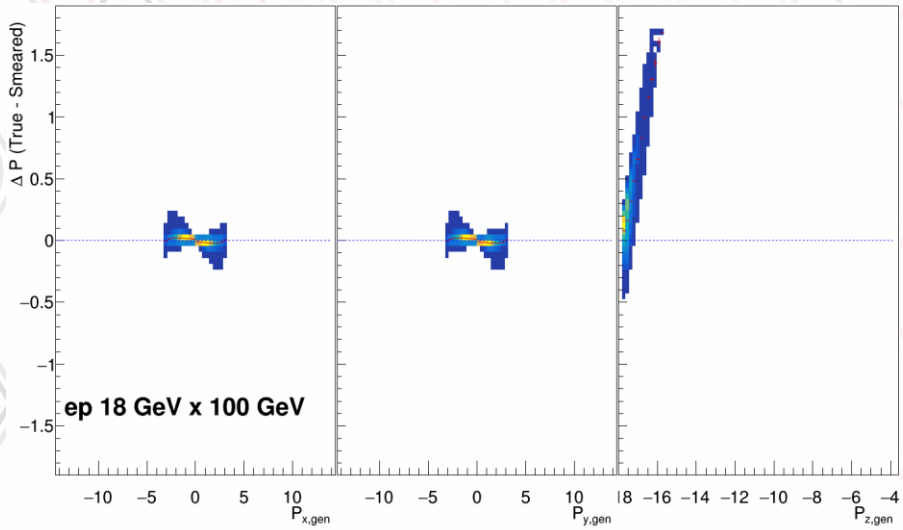
Higher q2 bins better



Scattered lepton smearing

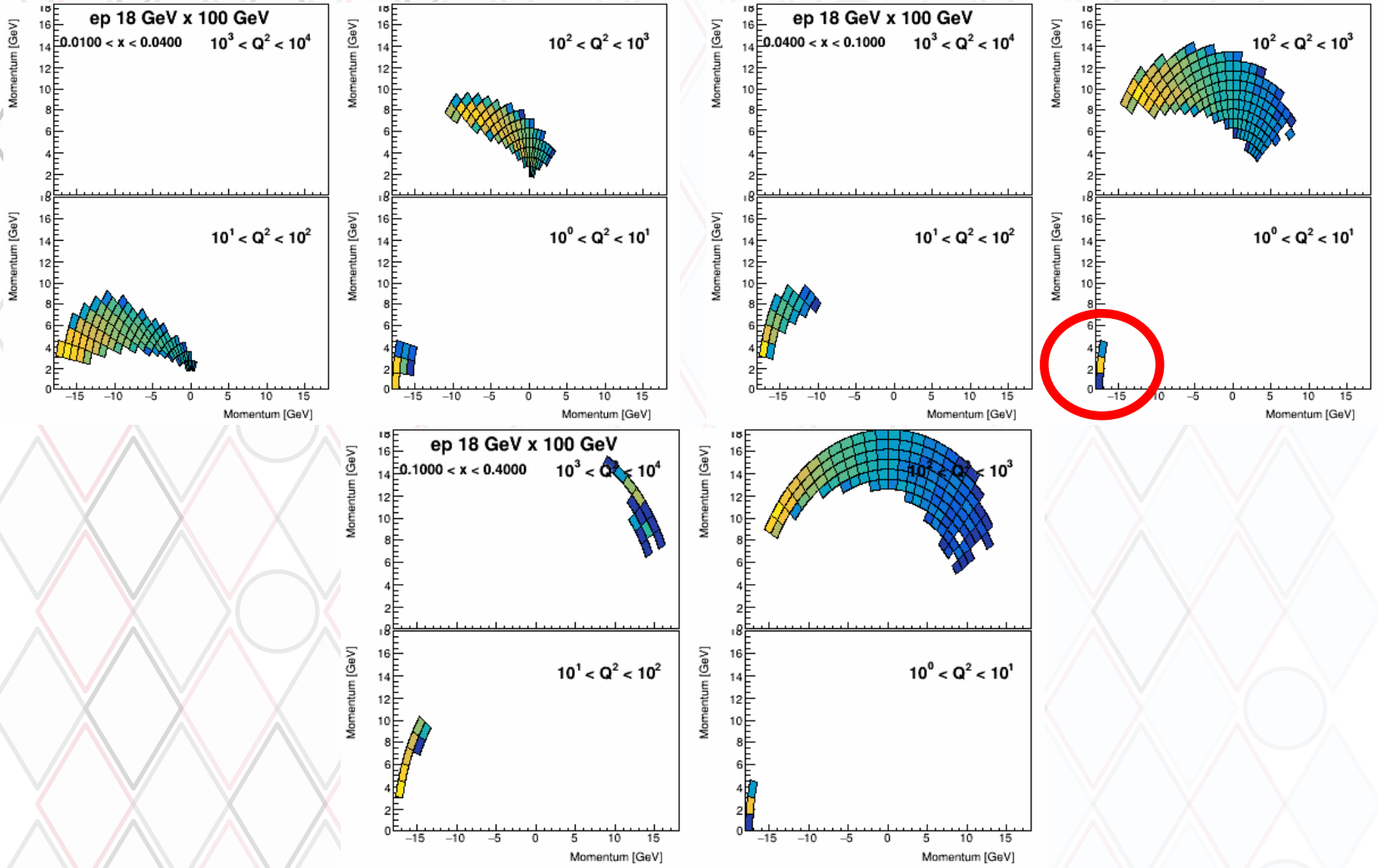


$10<Q^2<100$



$1<Q^2<10$

Scattered leptons



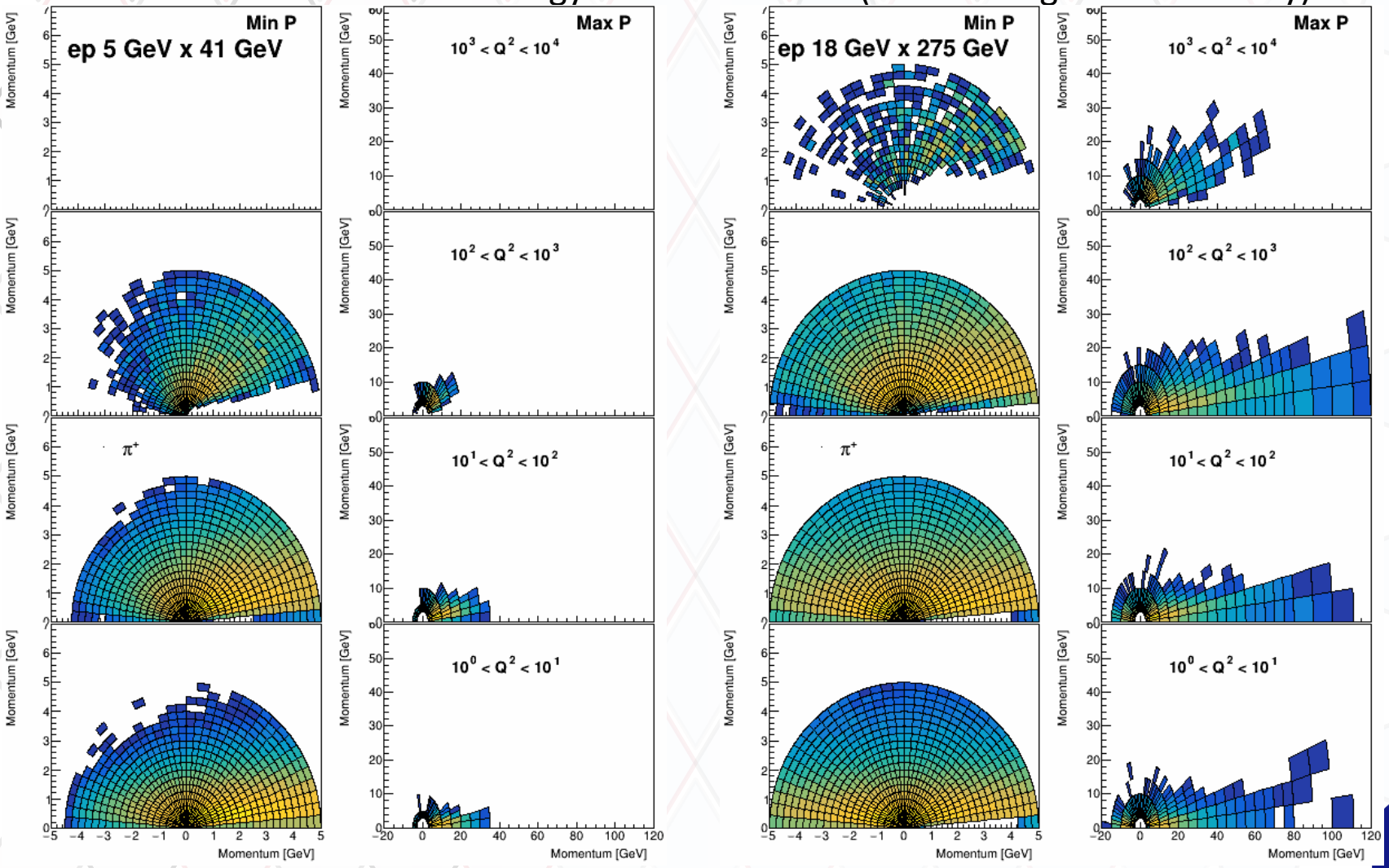
Comments

- Scattered lepton kinematics very important for correct boost in calculating hadron azimuthal angles
- Especially lower Q^2 show largest smearing effects
- Smearing may be ok for spin asymmetries but could be a nightmare for unpolarized effects (such as BM, etc)

For Detector group request:

Energy ranges for SIDIS measurements (for PID detectors)

- Assume hadron fractional energy from 0.05 to 0.9 (current fragmentation only):



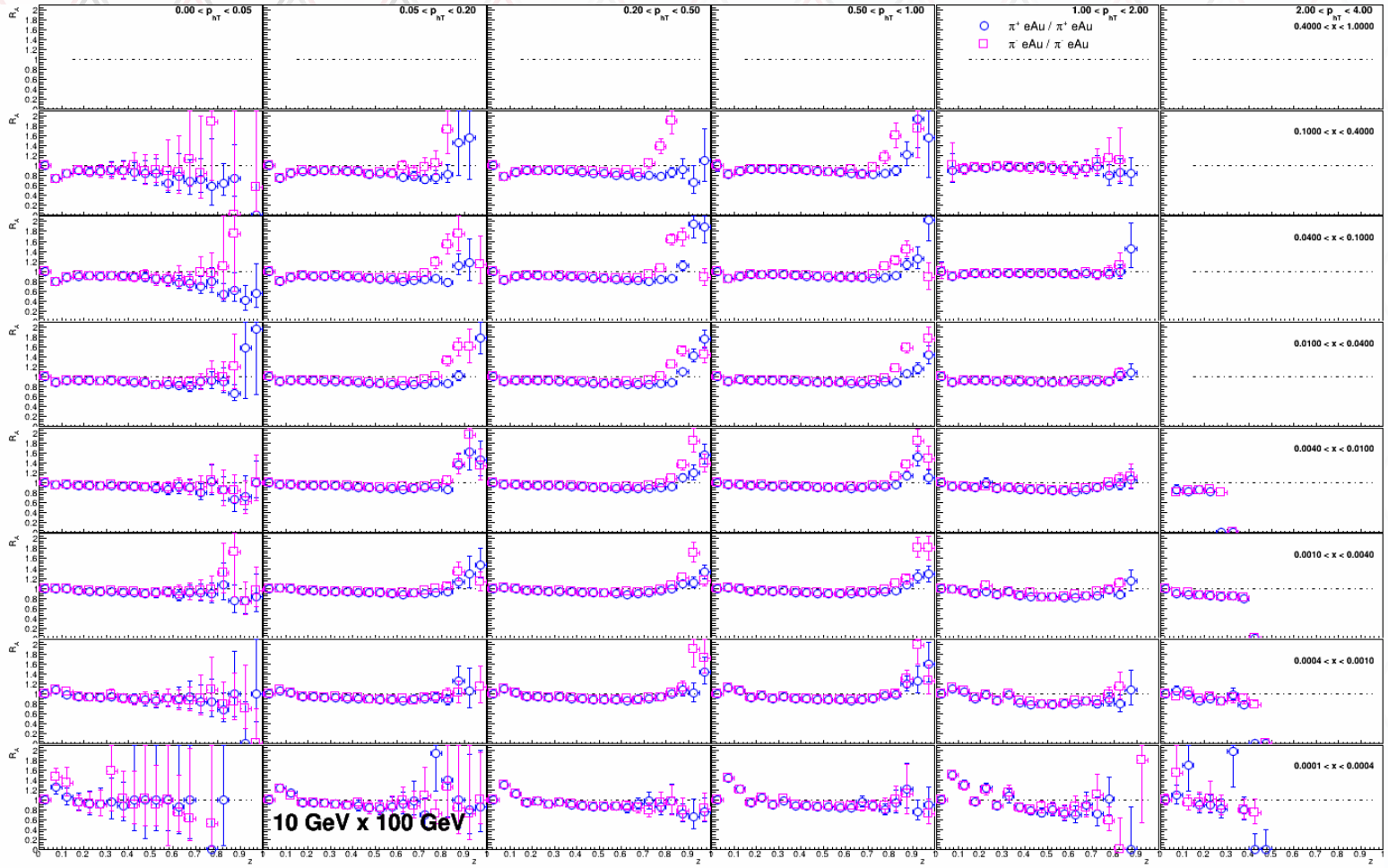
PID ranges

rapidity	pion momentum [GeV]	kaon momentum [GeV]	proton momentum [GeV]
$-3.5 <$ rapidity < -1.0 (RICH)	$0.5 < p_H < 5.0$	$1.6 < p_H < 5.0$	$3.0 < p_H < 8.0$
$-1.5 <$ rapidity < -1.0 (dE/dx)	$0.2 < p_H < 0.6$	$0.2 < p_H < 0.6$	$0.2 < p_H < 1.0$
$-1.0 <$ rapidity < 1.0 (DIRC and dE/dx)	$0.2 < p_H < 4.0$	$0.2 < p_H < 0.7$ $0.8 < p_H < 4.0$	$0.2 < p_H < 1.1$ $1.5 < p_H < 4.0$
$1.0 <$ rapidity < 3.5 (RICH)	$0.5 < p_H < 50.0$	$1.6 < p_H < 50.0$	$3.0 < p_H < 50.0$
$1.0 <$ rapidity < 1.5 (dE/dx)	$0.2 < p_H < 0.6$	$0.2 < p_H < 0.6$	$0.2 < p_H < 1.0$

nFF reweighting

- From Pia I obtained the pion NLO grids from DSSZ and DSS including their interpolators
- Implemented calls to these fortran routines for pions in the covered z range (>0.0099) if pion got traced to a fragmenting parton in Processes 99, 131, 132, 135, 136 (now either using partons from ancestry (wrong), using parton flavor with closest angles to hadron or parton flavor and z from closest parton)
- Weighted the event with ratio of corresponding outputs, (e.g. $wgt = \frac{zD_{1,u}^{nFF}(z,Q^2)}{zD_{1,u}^{FF}(z,Q^2)}$)

Ratios of eAu pions with reweighting over w/o



Guidance from Handbook

EIC Detector Requirements

η	Nomenclature			Tracking			Electrons		π/K/p PID		HCAL	Muons
				Resolution	Allowed X/X_0	Si-Vertex	Resolution σ_E/E	PID	p-Range (GeV/c)	Separation	Resolution σ_E/E	
-6.9 — -5.8	↓ p/A	Auxiliary Detectors	low-Q^2 tagger	$\delta\theta/\theta < 1.5\%$; $10^{-6} < Q^2 < 10^{-2}$ GeV^2								
…												
-4.5 — -4.0			Instrumentation to separate charged particles from photons									
-4.0 — -3.5												
-3.5 — -3.0		Central Detector	Backwards Detectors	$\sigma_p/p \sim 0.1\%\times p + 2.0\%$	~5% or less	TBD	2%/√E	π suppression up to $1{:}10^4$	≤ 7 GeV/c	≥ 3σ	~50%/√E	
-3.0 — -2.5												
-2.5 — -2.0				$\sigma_p/p \sim 0.05\%\times p + 1.0\%$								
-2.0 — -1.5							7%/√E					
-1.5 — -1.0												
-1.0 — -0.5			Barrel	$\sigma_p/p \sim 0.05\%\times p + 0.5\%$		$\sigma_{xyz} \sim 20$ μm, $d_0(z) \sim d_0(r\phi) \sim 20/p_T$ GeV μm + 5 μm	(10-12)%/√E		≤ 5 GeV/c		TBD	TBD
-0.5 — 0.0												
0.0 — 0.5												
0.5 — 1.0												
1.0 — 1.5			Forward Detectors	$\sigma_p/p \sim 0.05\%\times p + 1.0\%$		TBD			≤ 8 GeV/c		~50%/√E	
1.5 — 2.0												
2.0 — 2.5									≤ 20 GeV/c			
2.5 — 3.0				$\sigma_p/p \sim 0.1\%\times p + 2.0\%$								
3.0 — 3.5									≤ 45 GeV/c			
3.5 — 4.0	↑e	Auxiliary Detectors	Instrumentation to separate charged particles from photons									
4.0 — 4.5												
…												
> 6.2			Proton Spectrometer	$\sigma_{intrinsic}(|t|)/|t| < 1\%$; Acceptance: $0.2 < p_T < 1.2$ GeV/c								