

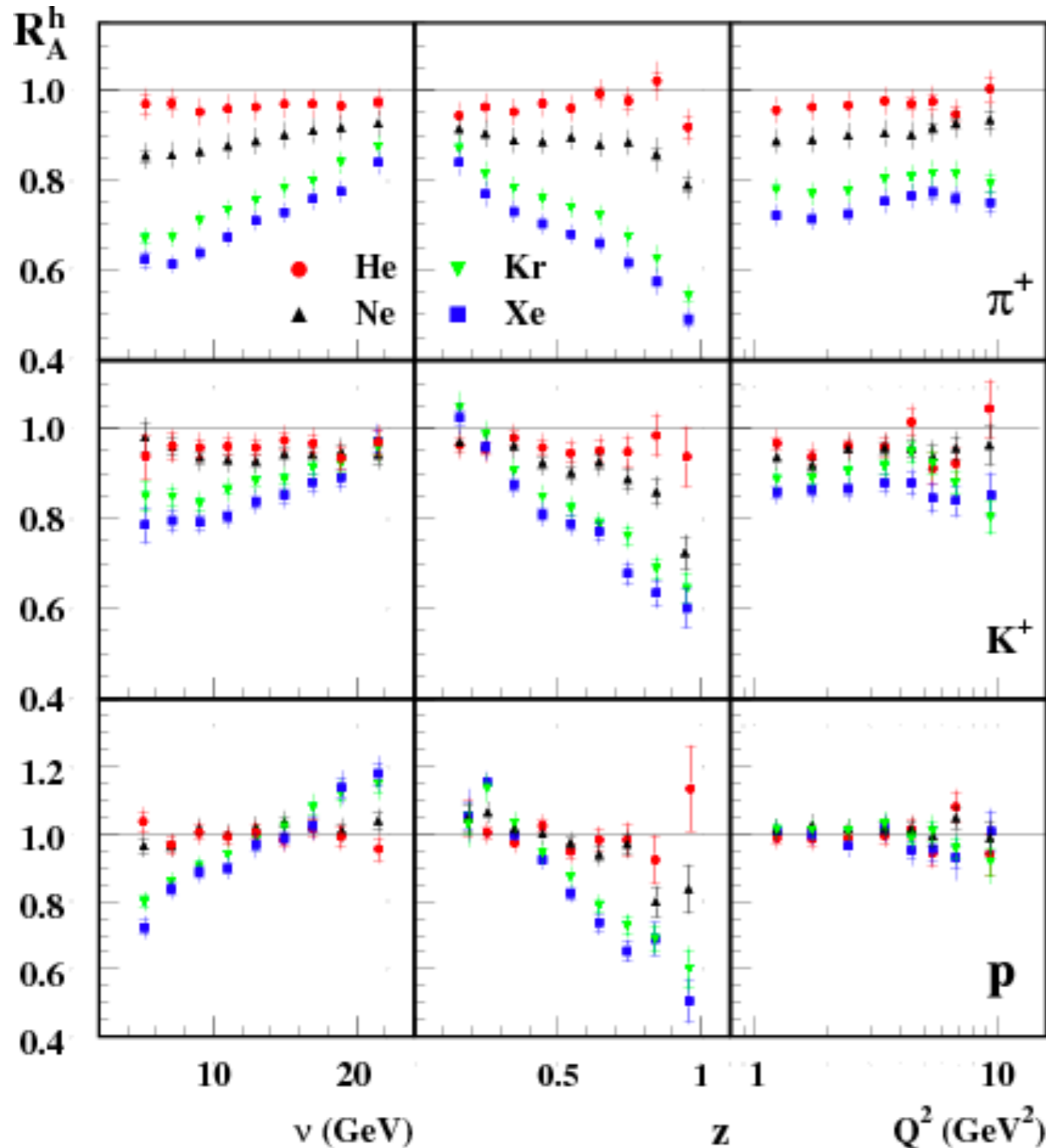
SIDIS in the nuclear medium

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05/10/20

Only one experiment: HERMES

Nucl. Phys. B 780 (2007), 1-27



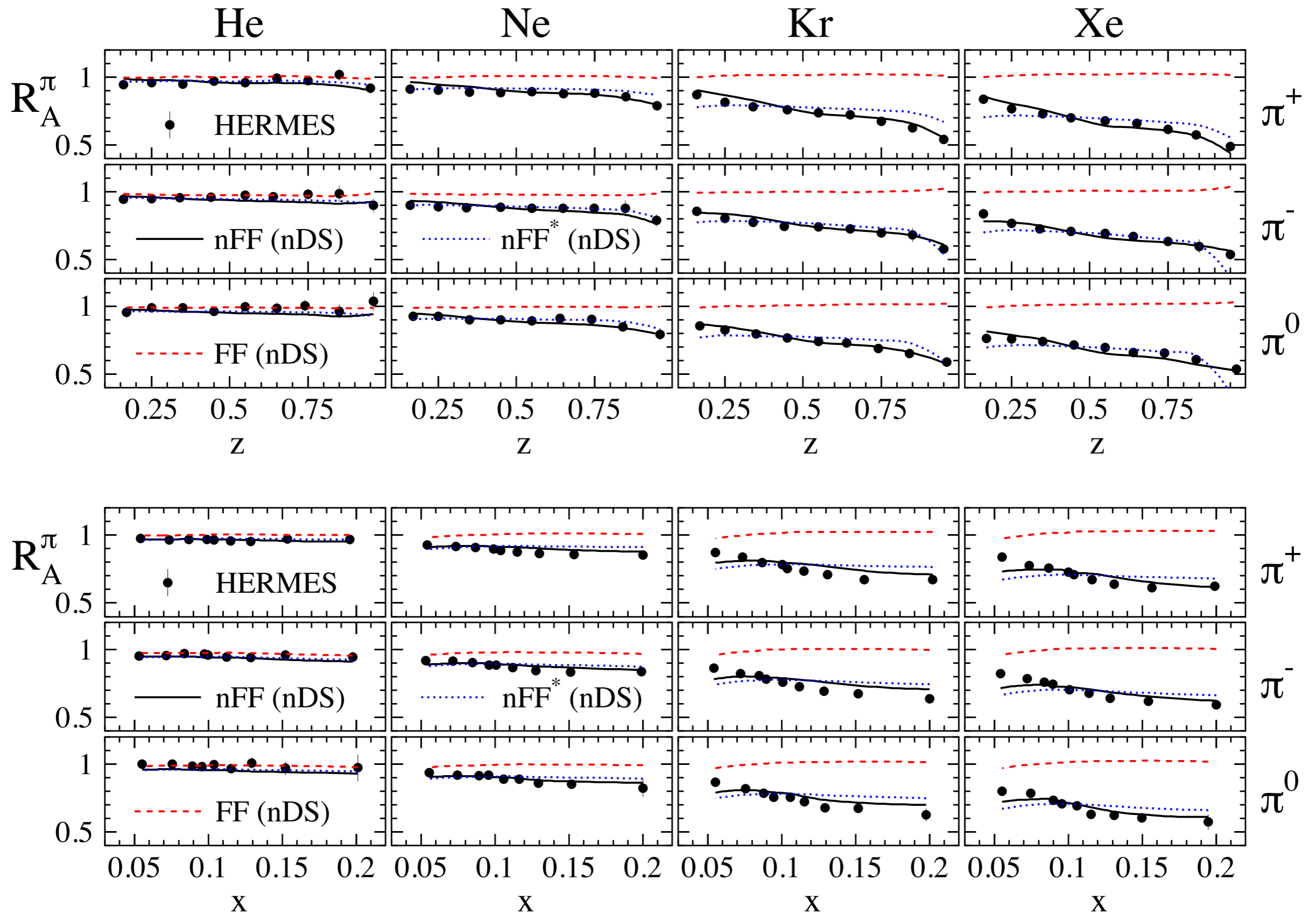
$$R_A^h(\nu, Q^2, z, p_t^2) = \frac{\left(\frac{N^h(\nu, Q^2, z, p_t^2)}{N^e(\nu, Q^2)}\right)_A}{\left(\frac{N^h(\nu, Q^2, z, p_t^2)}{N^e(\nu, Q^2)}\right)_D}$$

$$0.023 \leq x \leq 0.8$$

$$0.2 \leq z$$

$$1 \text{ GeV}^2 \leq Q^2 \leq 25 \text{ GeV}^2$$

$$\sqrt{s} \approx 7.5 \text{ GeV}$$

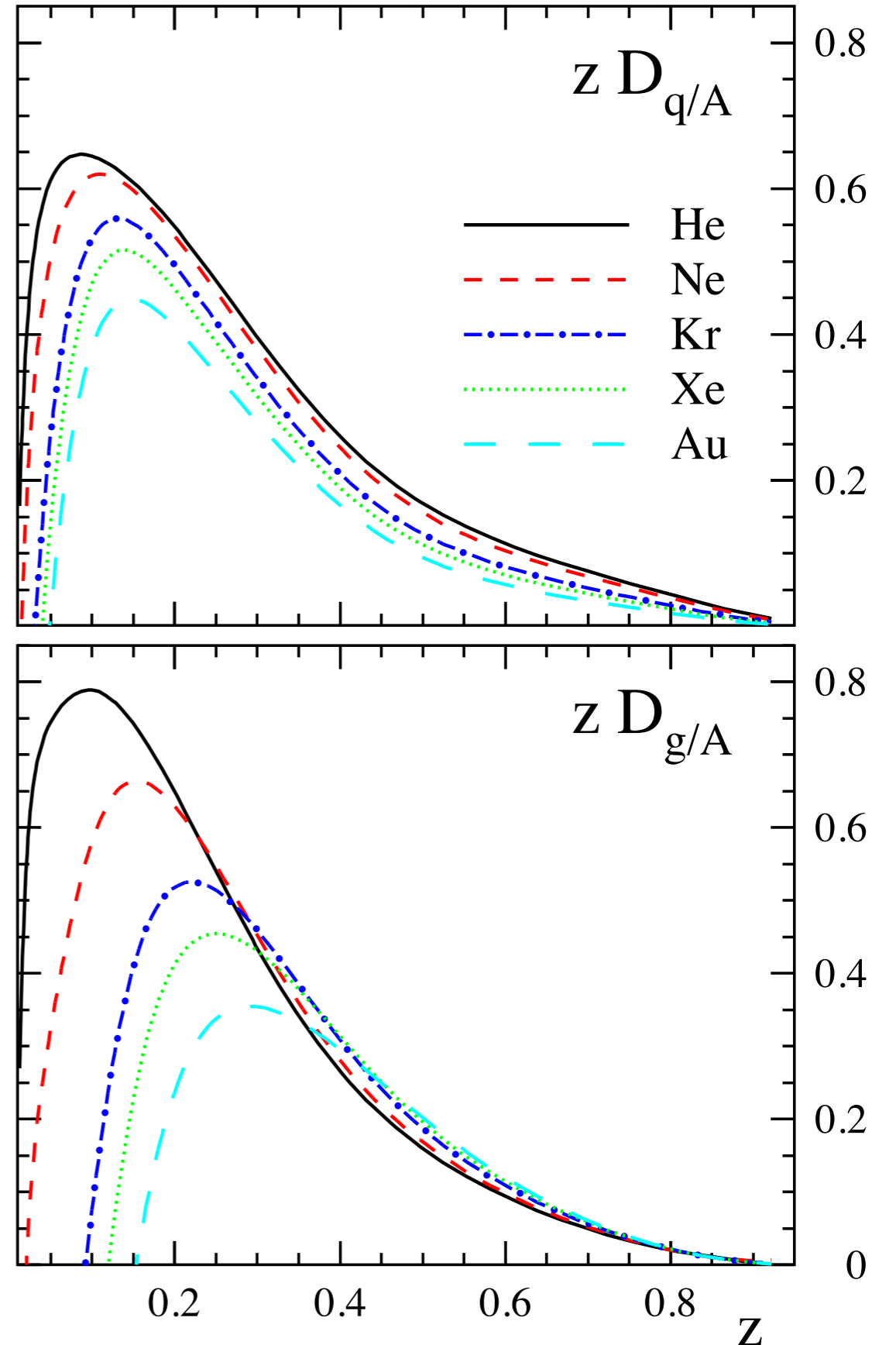


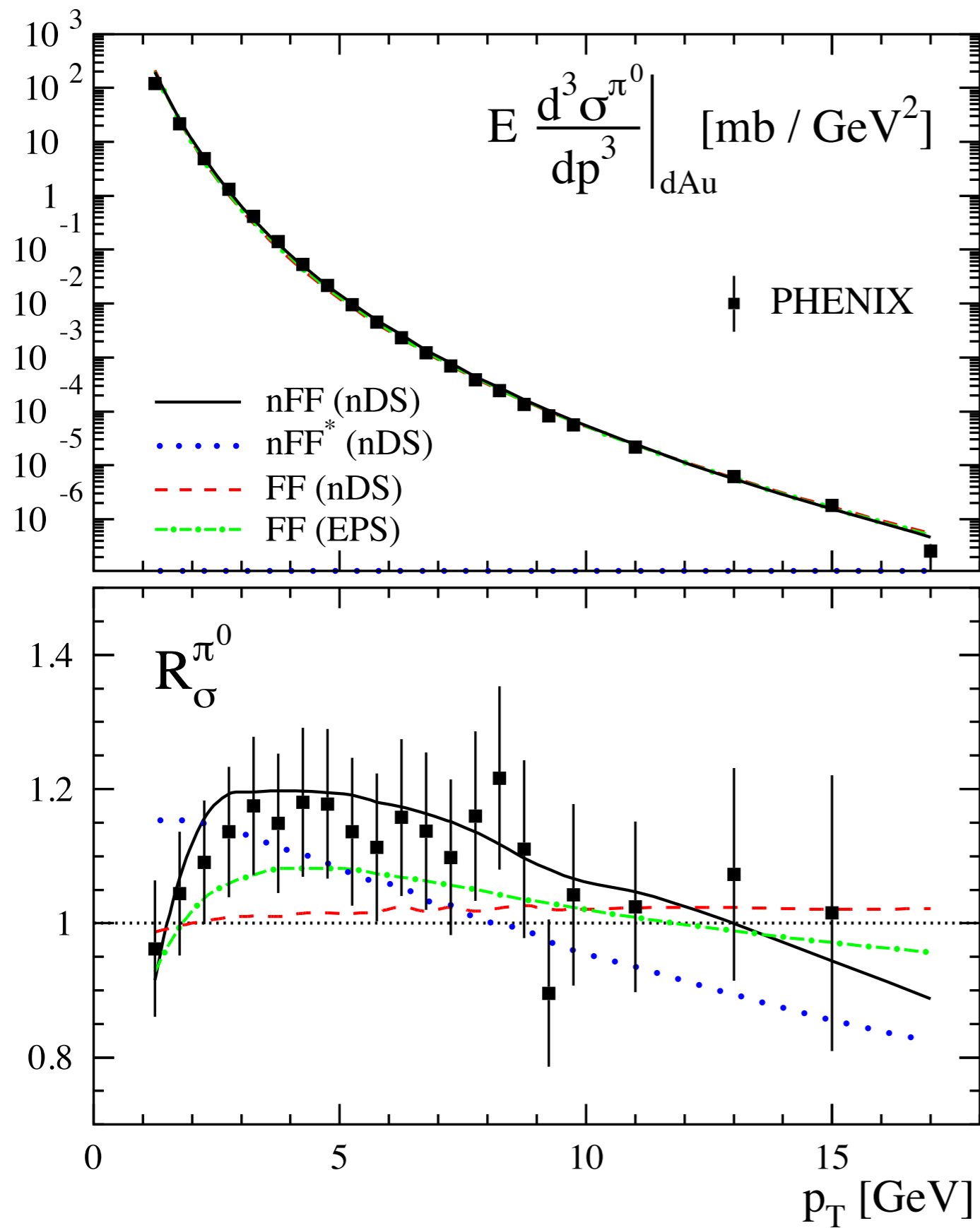
$$D_{i/A}^H(z, Q_0^2) = \int_z^1 \frac{dy}{y} W_i^H(y, A, Q_0^2) D_i^H\left(\frac{z}{y}, Q_0^2\right)$$

$$W_i^H(y, A, Q_0^2) = n_i y^{\alpha_i} (1 - y)^{\beta_i}$$

TABLE III: Data sets included in the NLO global analysis of pion nFFs, the individual χ^2 values for each set, and the total χ^2 of the fit.

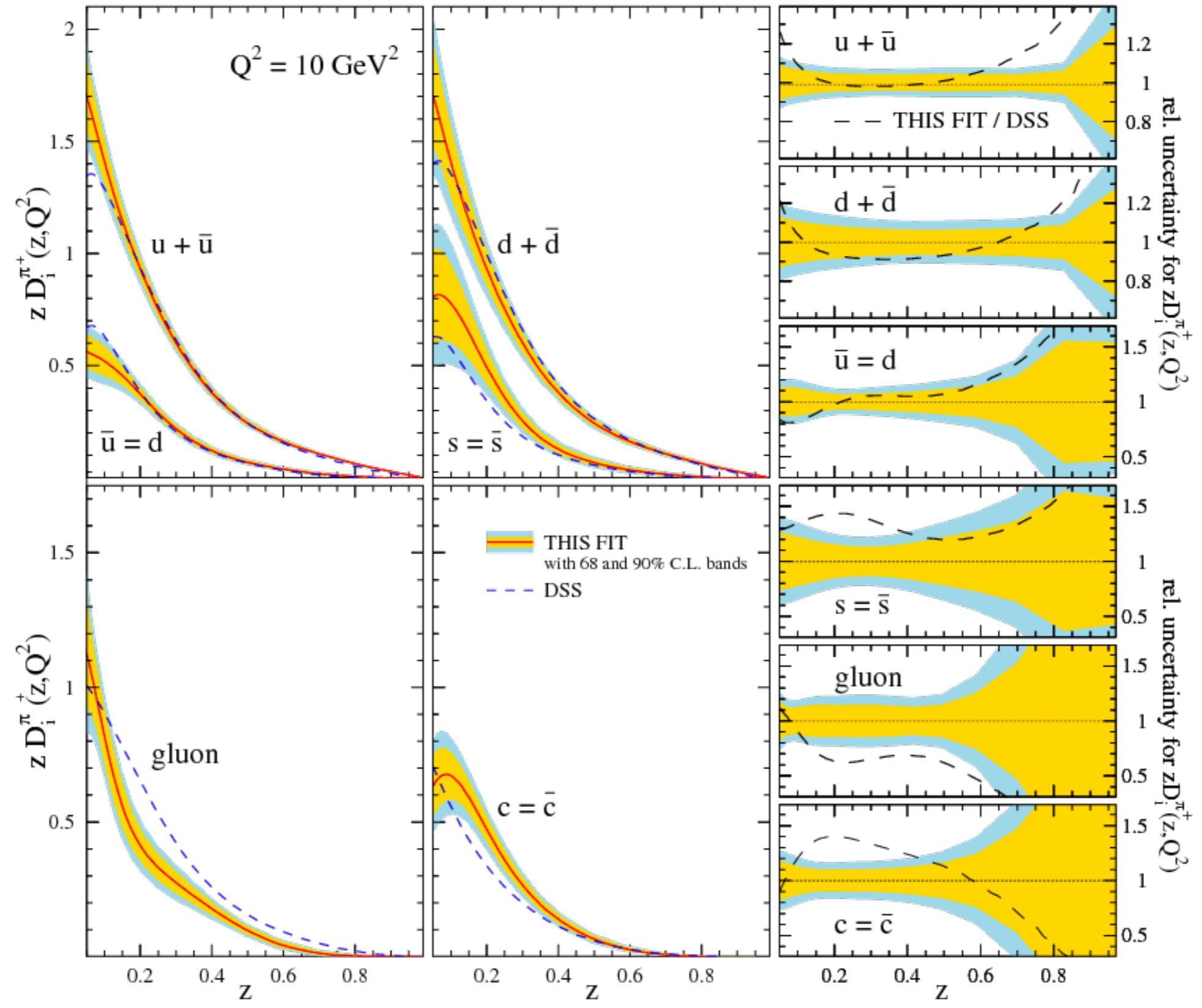
Experiment	A	H	Data type	Data points	χ^2
HERMES [6]	He,Ne,Kr,Xe	π^+	z	36	39.3
		π^-	z	36	23.0
		π^0	z	36	27.4
		π^+	x	36	69.4
		π^-	x	36	55.4
		π^0	x	36	49.7
		π^+	Q^2	32	21.0
		π^-	Q^2	32	27.1
		π^0	Q^2	32	34.7
PHENIX [14]	Au	π^0	p_T	22	13.7
STAR (prel.) [16]	Au	π^0	p_T	13	12.8
STAR [15]	Au	π^\pm	p_T	34	22.5
Total				381	396.0





$$R_{\sigma} \neq R_{dAu}$$

DSS2007 is very different from DEHSS2014



Time to update the nFFs: new fit, using xFitter

$$D_i^h(z, Q_0) = N_i x^{\alpha_i} (1-x)^{\beta_i} \left[1 + \gamma_i (1-x)^{\delta_i} \right]$$

$$i = u + \bar{u}, d + \bar{d}, s + \bar{s}, c + \bar{c}, b + \bar{b}, \bar{u}, g$$

$$D_i^h(z, Q_0) \rightarrow D_i^h(z, Q_0, A)$$

$$Q_0 = 1 \text{ GeV}, m_c, m_b$$

$$N_i \rightarrow N_i \left[1 + N_{1,i} (1 - A^{N_{2,i}}) \right]$$

$$p_i \rightarrow p_i + p_{1,i} (1 - A^{p_{2,i}})$$

$$i = \beta, \gamma, \delta$$

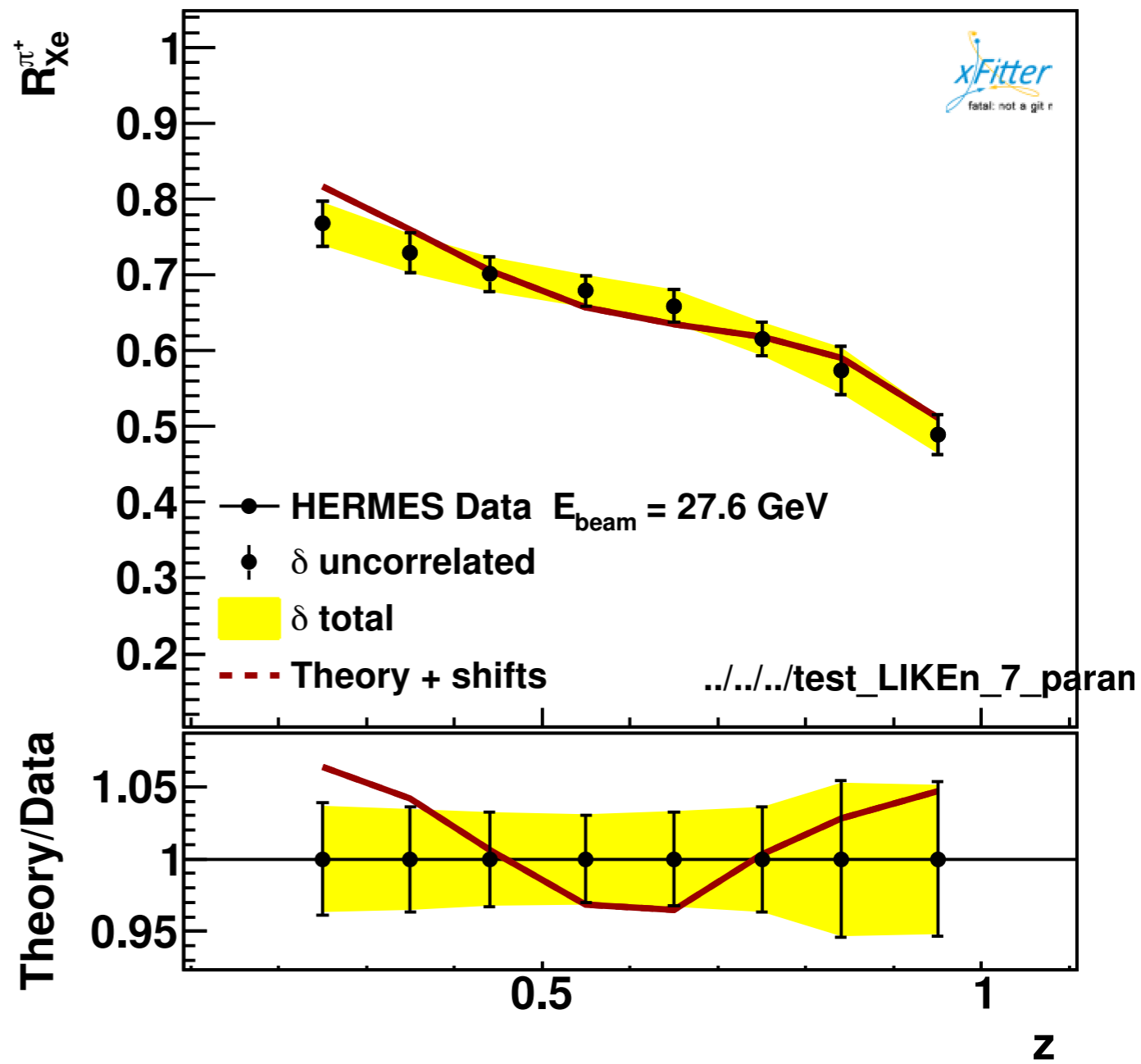
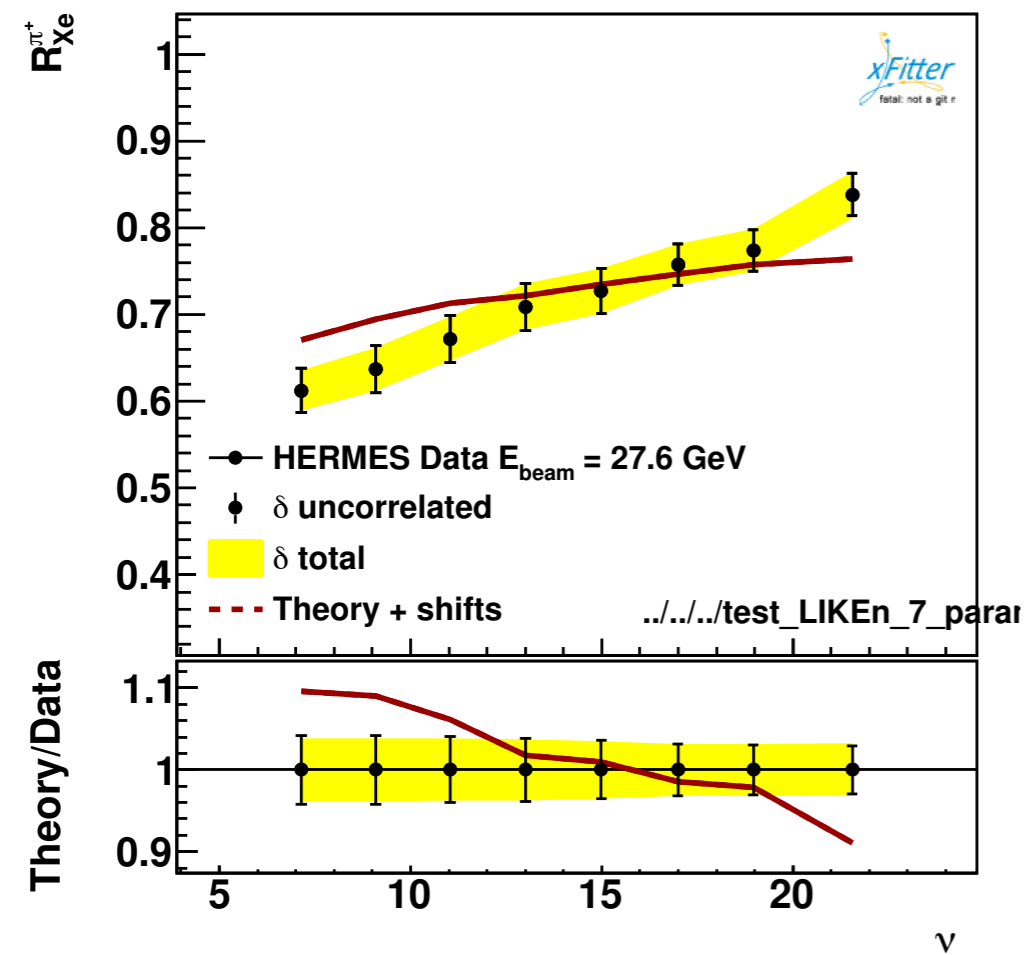
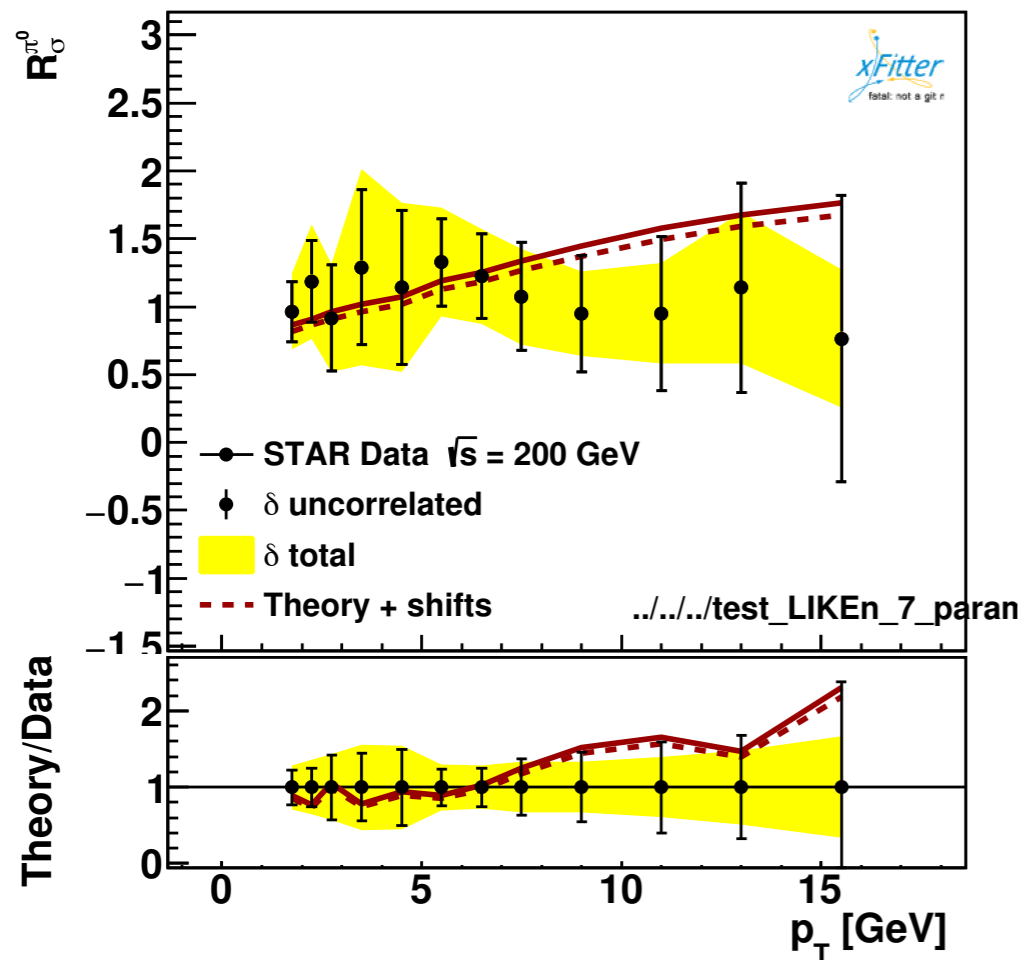
no sensitivity at low z
no flavour sensitivity

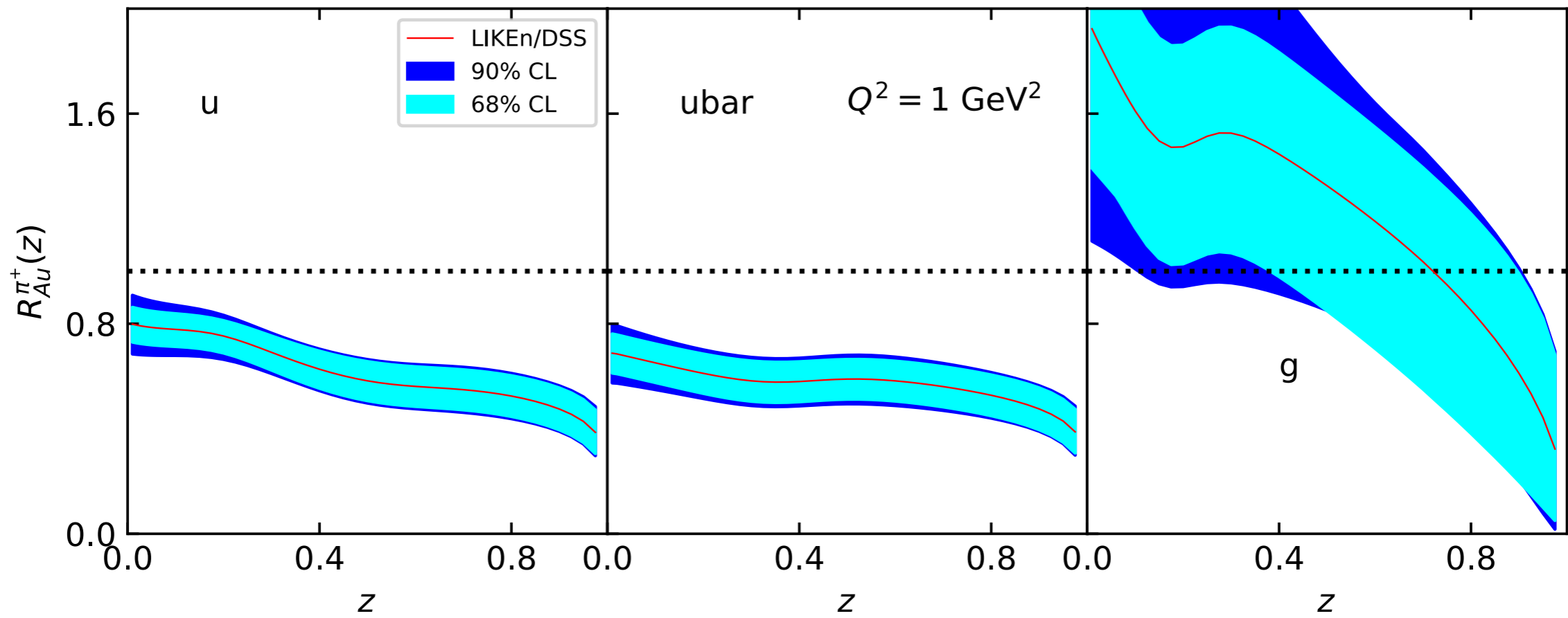
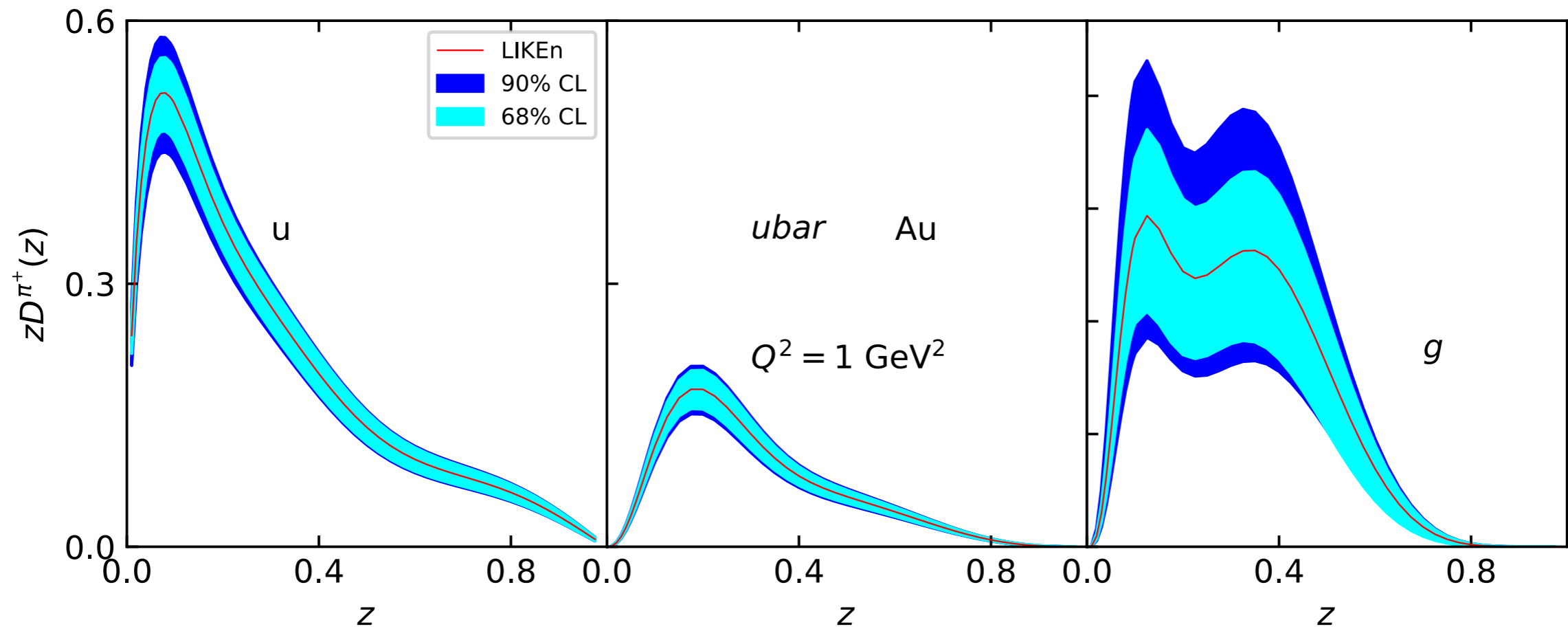
$N_{g,1}$	$N_{g,2}$	$\beta_{g,1}$	$\beta_{g,2}$	$\gamma_{g,1}$	$\gamma_{g,2}$	$\delta_{g,1}$	$\delta_{g,2}$	$N_{q,1}$	$N_{q,2}$	$\beta_{q,1}$	$\beta_{q,2}$	$\gamma_{q,1}$	$\gamma_{q,2}$	$\delta_{q,1}$	$\delta_{q,2}$
free	free	free	$N_{g,2}$	free	$N_{g,2}$	free	$N_{g,2}$	free	free	$\beta_{g,1}$	$N_{q,2}$	$\gamma_{g,1}$	$N_{q,2}$	$\delta_{g,1}$	$N_{q,2}$

Experiment	H	Dependence	N° points	χ^2	diff
HERMES	π^+	z	36	30.89	-8.41
	π^-		36	14.64	-8.36
	π^0		36	28.03	+0.63
	π^+	x	36	47.76	-21.64
	π^-		36	46.57	-8.83
	π^0		36	35.84	-13.86
	π^+	Q^2	32	6.89	-14.11
	π^-		32	9.17	-17.93
	π^0		32	16.09	-18.61
STAR	π^0	ρ_T	13	5.77	-7.03
	π^+, π^-		30	46.14	+11.44

not a fit

**Older STAR neutral pion data were preliminary
PHENIX data not available**





NOW: EIC

I gave the OLD grid for Au to Ralf. He sent back (tons) of pseudo data

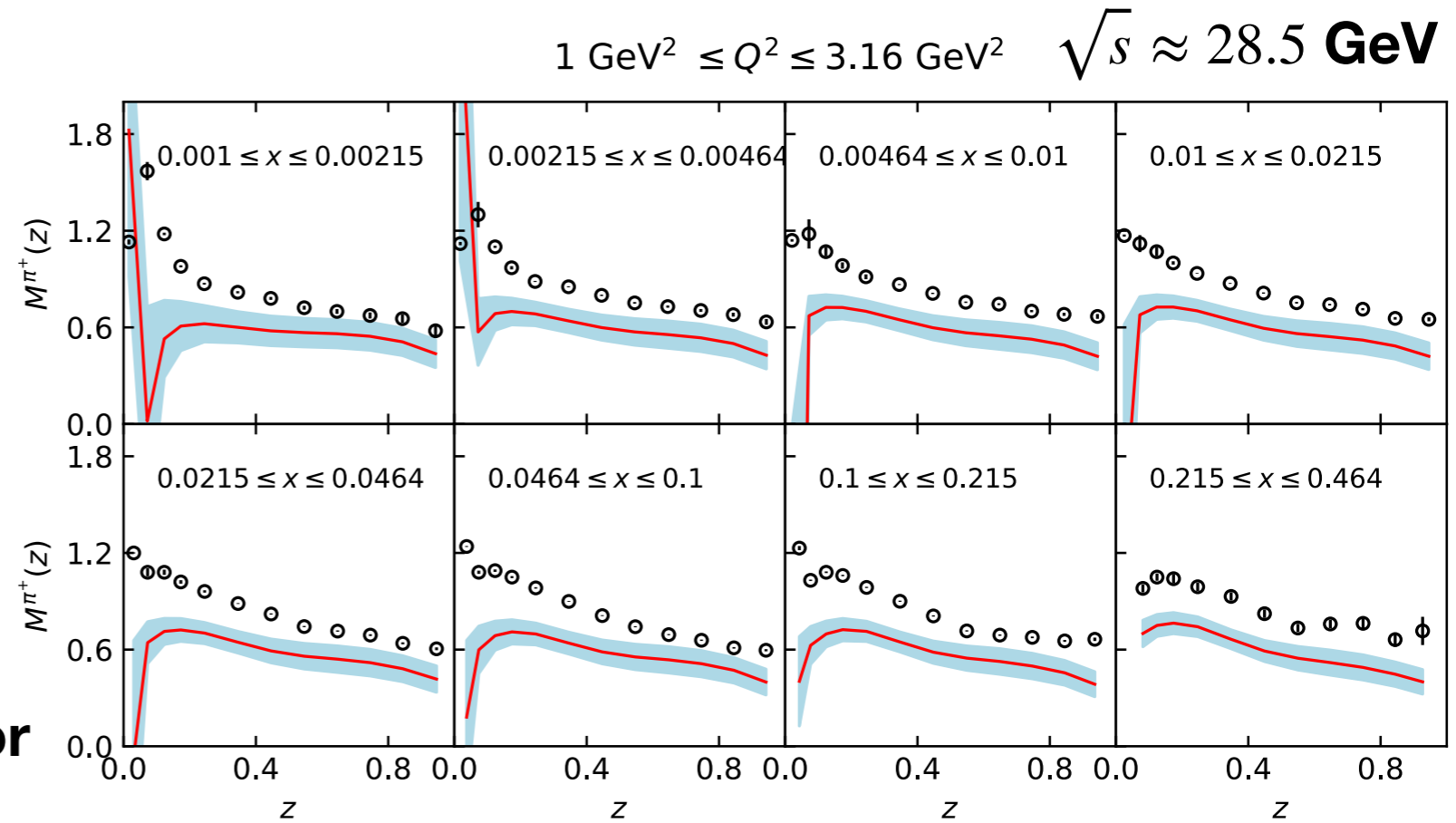
$$0.00001 \leq x \leq 1$$

$$0 \leq z \leq 1$$

$$1 \text{ GeV}^2 \leq Q^2 \leq 10000 \text{ GeV}^2$$

$$\sqrt{s} \approx 28.5, 63.24, 84.85 \text{ GeV}$$

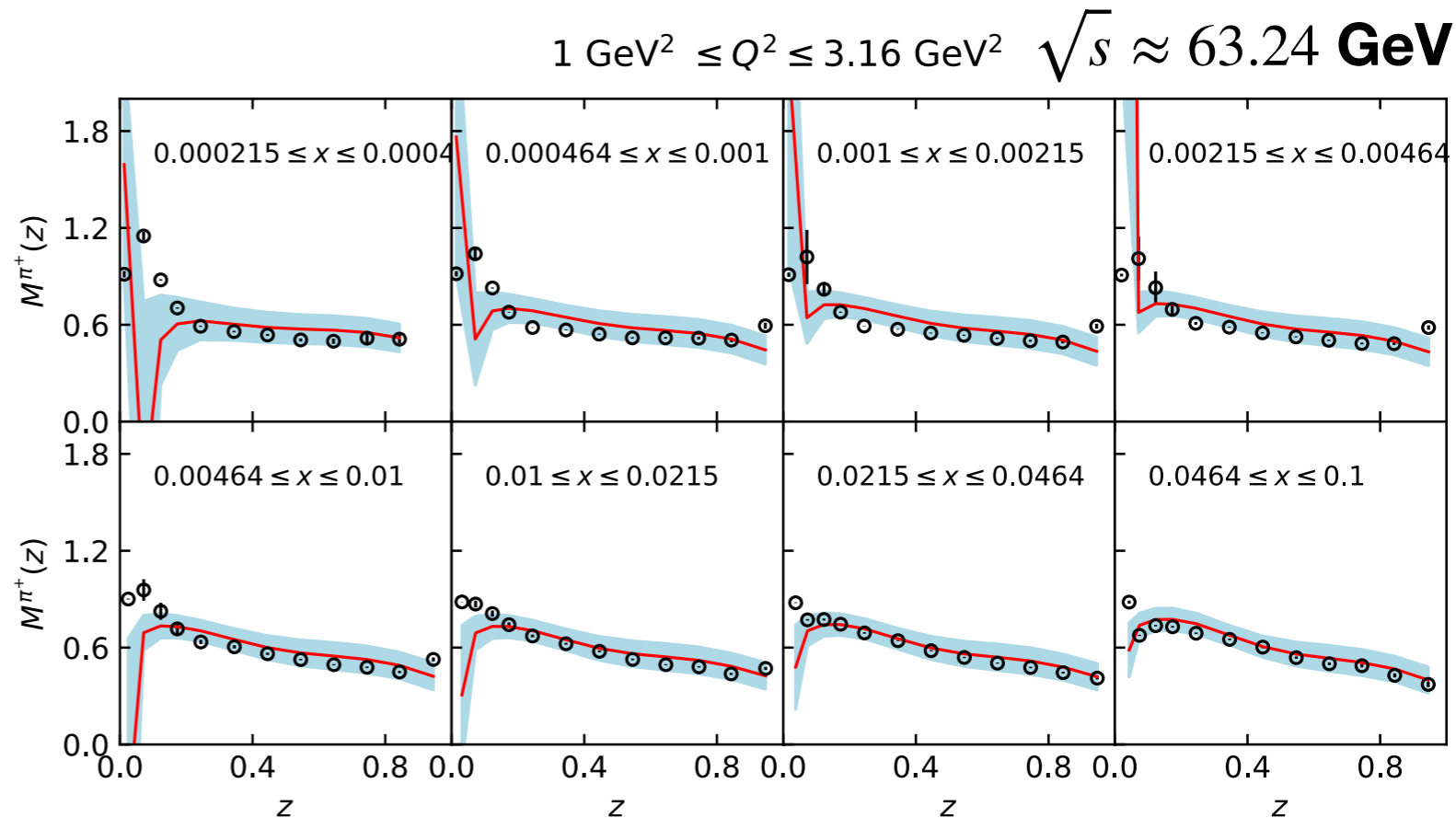
Two configurations for the detector
(up to Ralf to explain)



Comparison of pseudo data
with new theory predictions

Uncertainties are too small to
do a re-weighting

NaNs everywhere



I tried creating pseudo data using the old set of nFFs: didn't work

I tried creating pseudo data using the new set of nFFs

$$M_i \rightarrow M_i + \delta_i r_i \qquad \delta_i = \sqrt{\Delta_{syst,i}^2 + \Delta_{stat,i}^2}$$

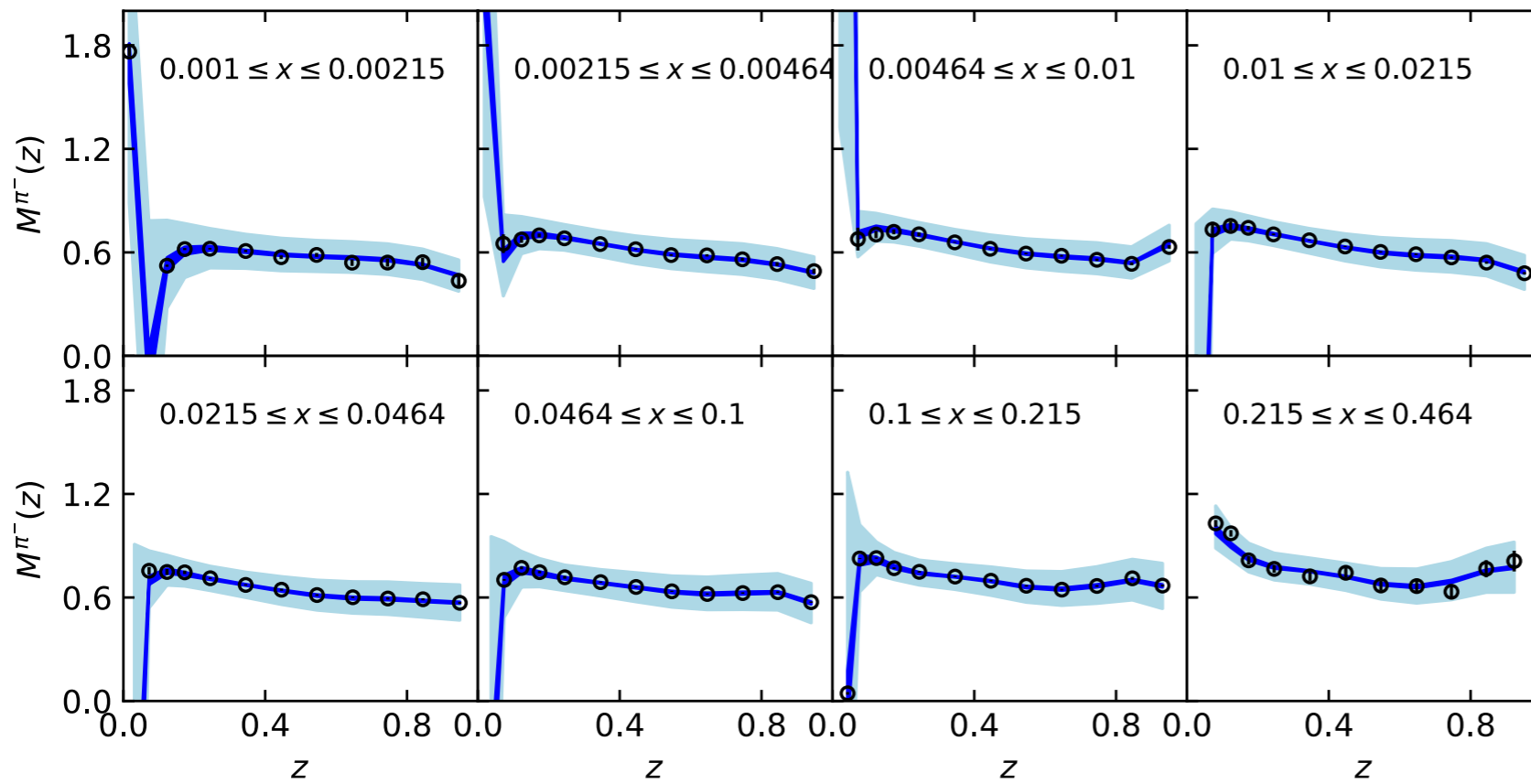
r_i random number

With this I did the re-weighting, considering:

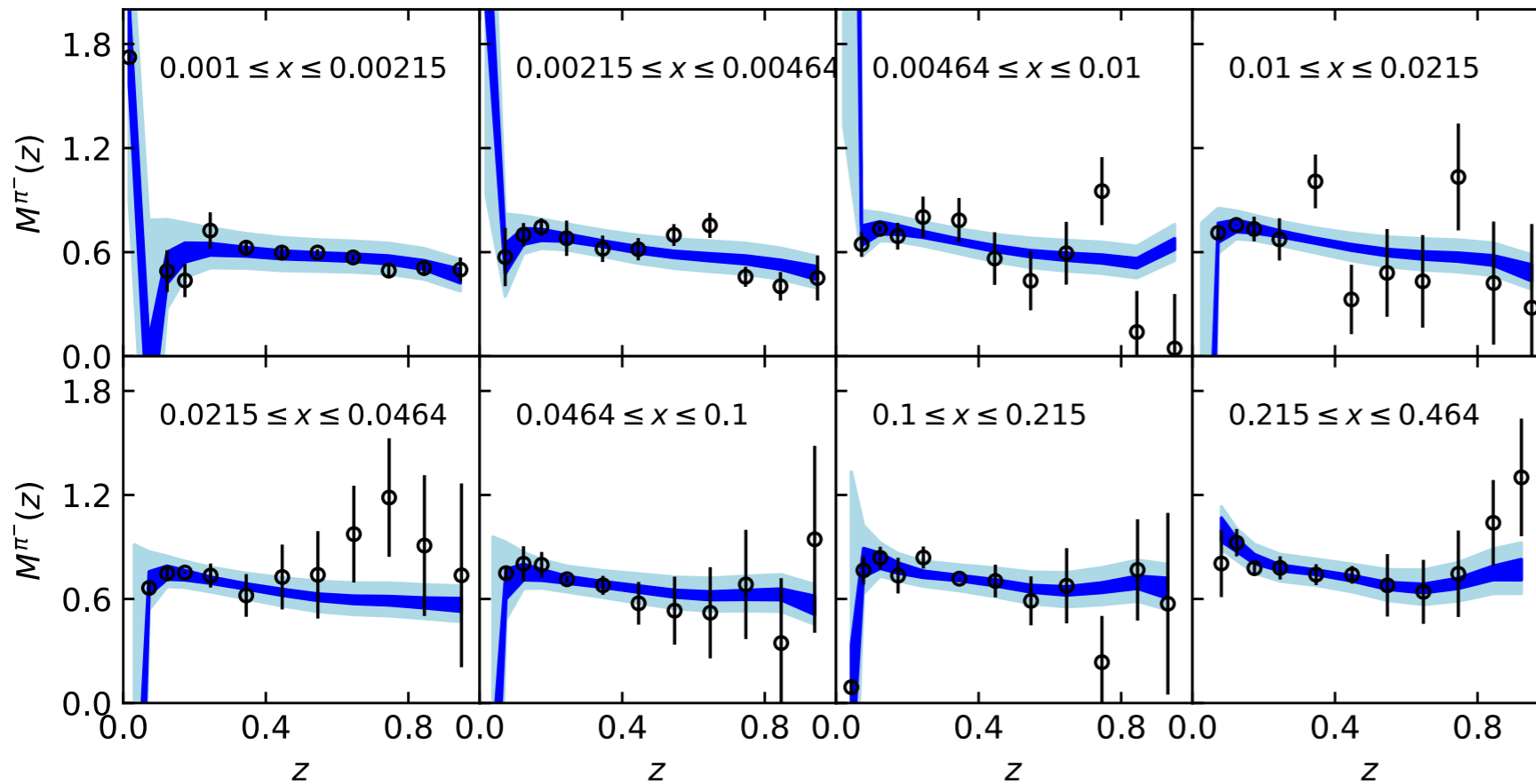
- For some kinematic bins the prediction becomes negative, so those are NOT included in the weights (only in the comparison). Idem with $z < 0.2$**
- The estimated uncertainties are so small that most of the time one obtains one remaining replica (out of 1000)**
- Best case scenario 10% of the replicas remain**

$\sqrt{s} \approx 28.5 \text{ GeV}$

$1 \text{ GeV}^2 \leq Q^2 \leq 3.16 \text{ GeV}^2$

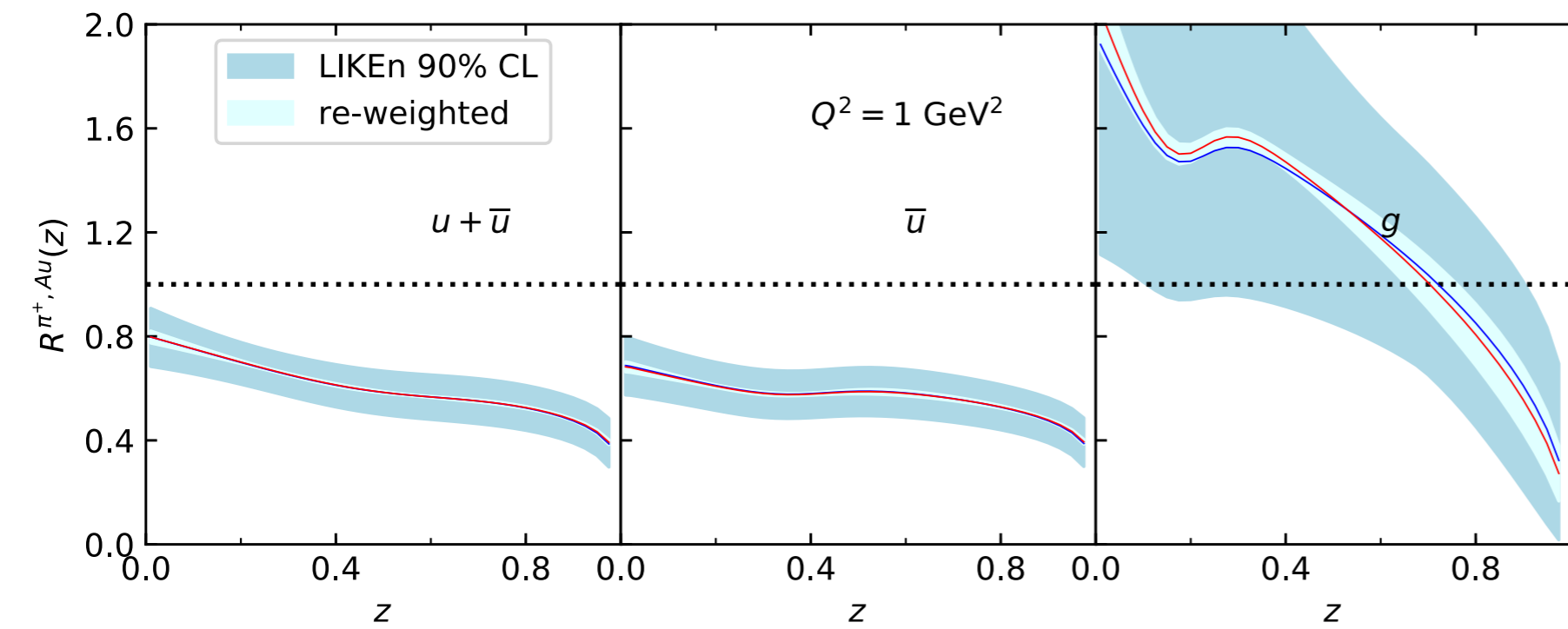
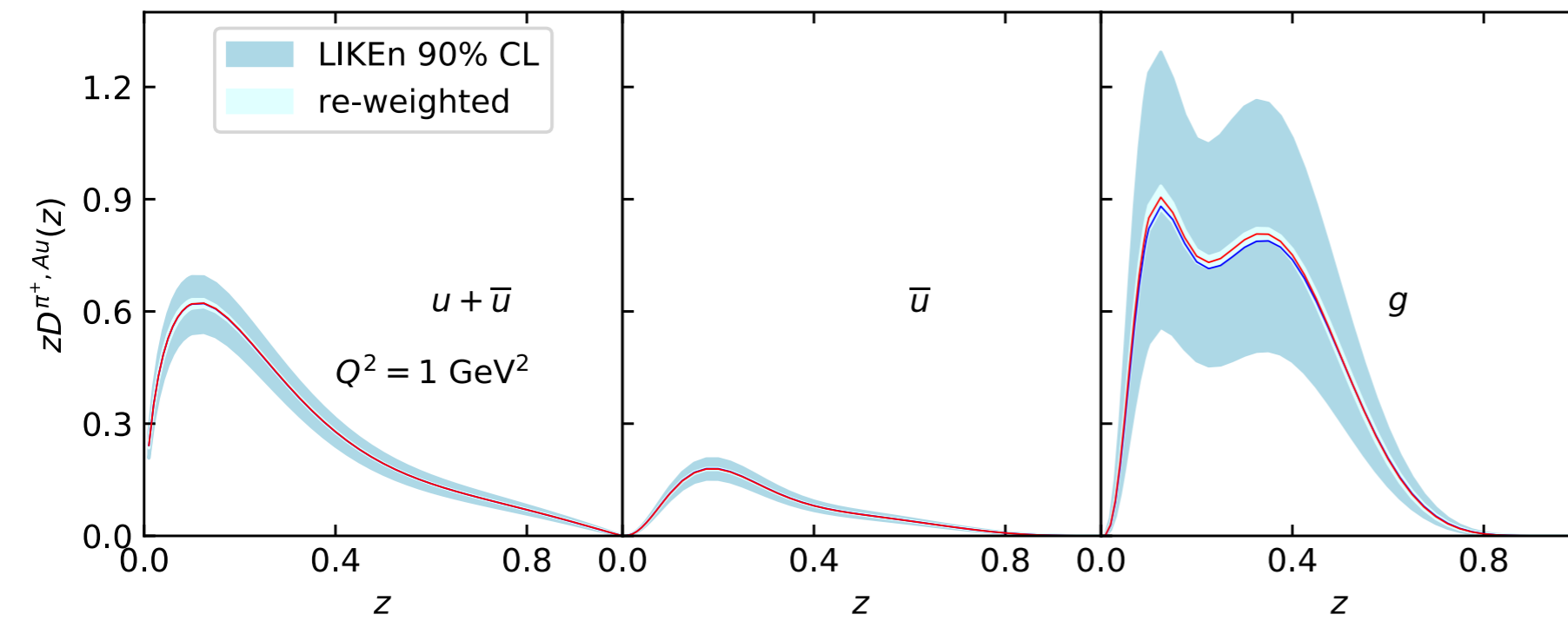


$1 \text{ GeV}^2 \leq Q^2 \leq 3.16 \text{ GeV}^2$

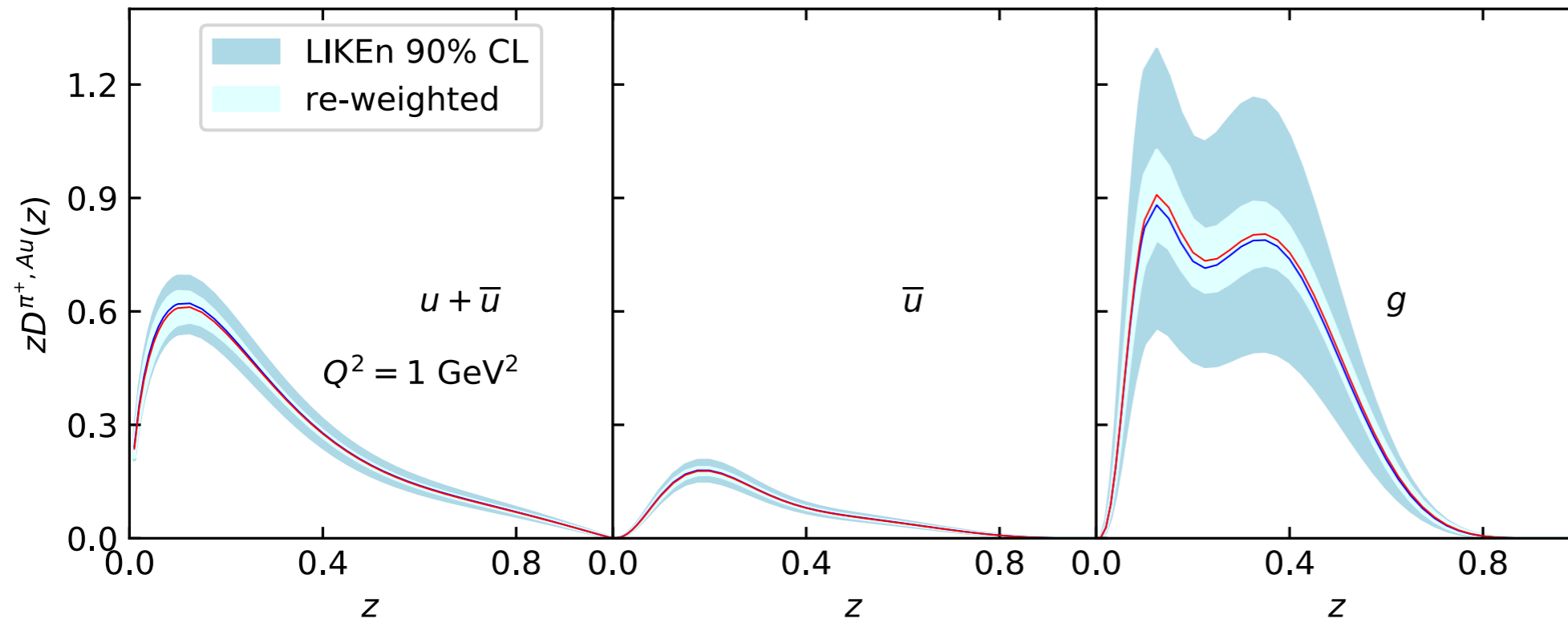


$\sqrt{s} \approx 28.5$ GeV

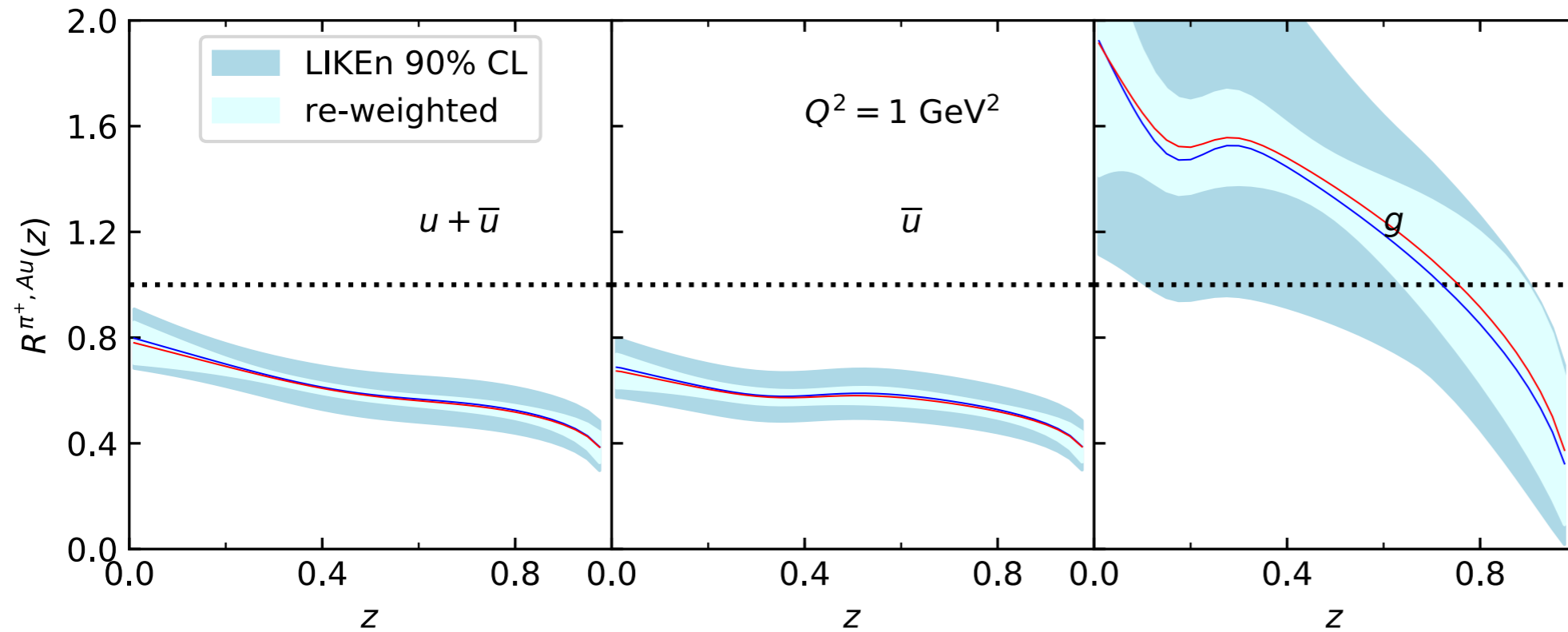
ACC



$\sqrt{s} \approx 28.5$ **GeV**

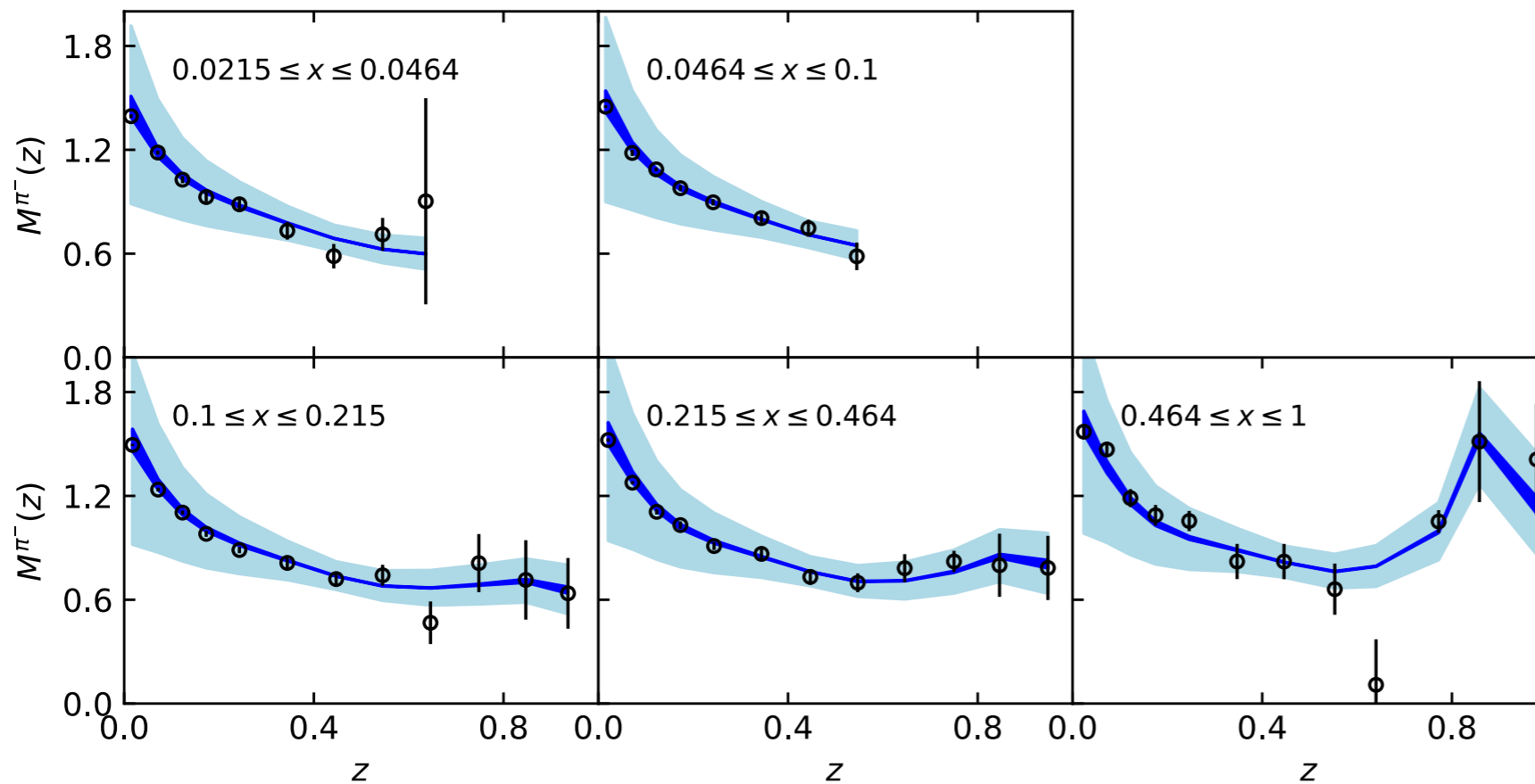


HB



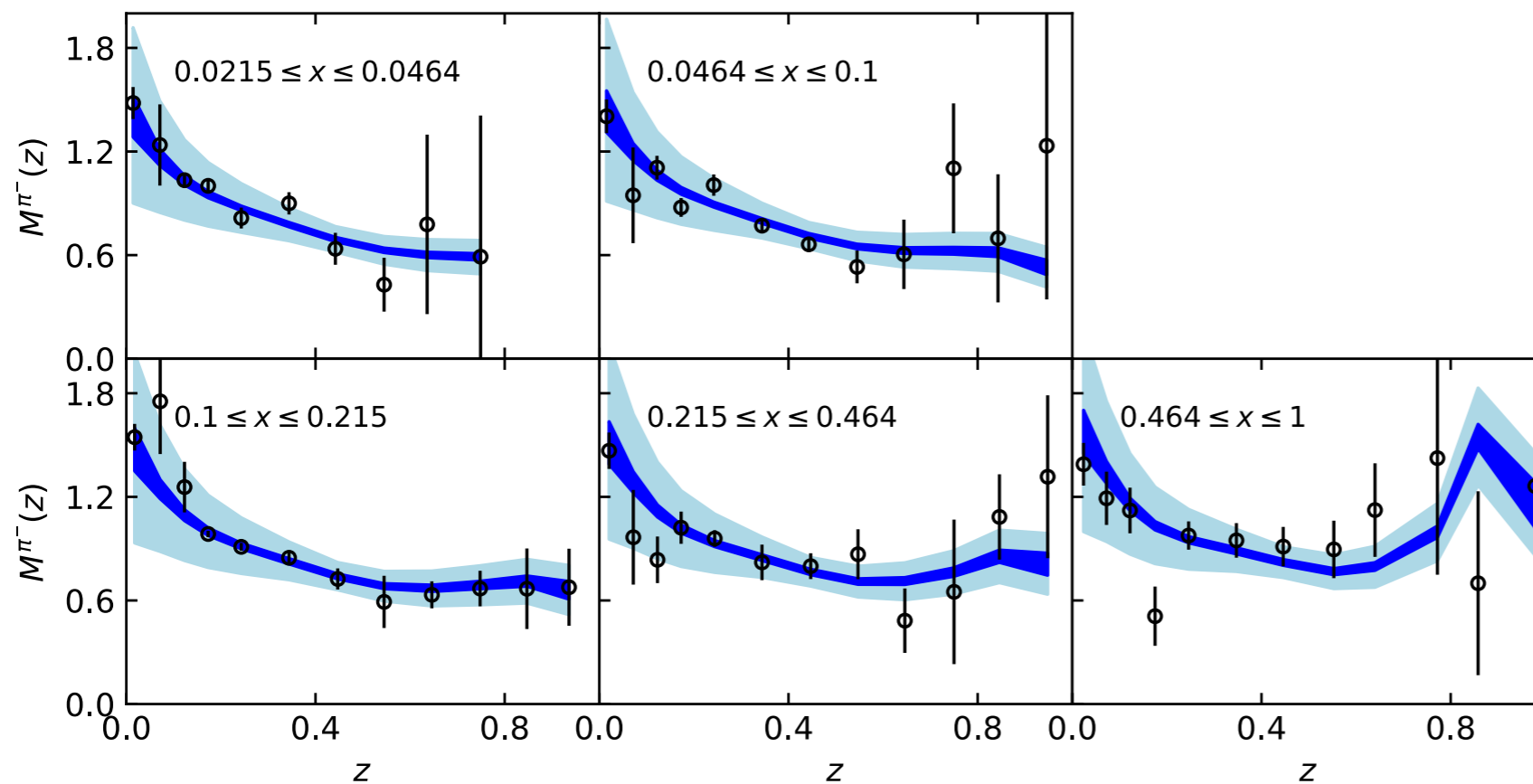
$100 \text{ GeV}^2 \leq Q^2 \leq 316 \text{ GeV}^2$

$\sqrt{s} \approx 63.24 \text{ GeV}$



ACC

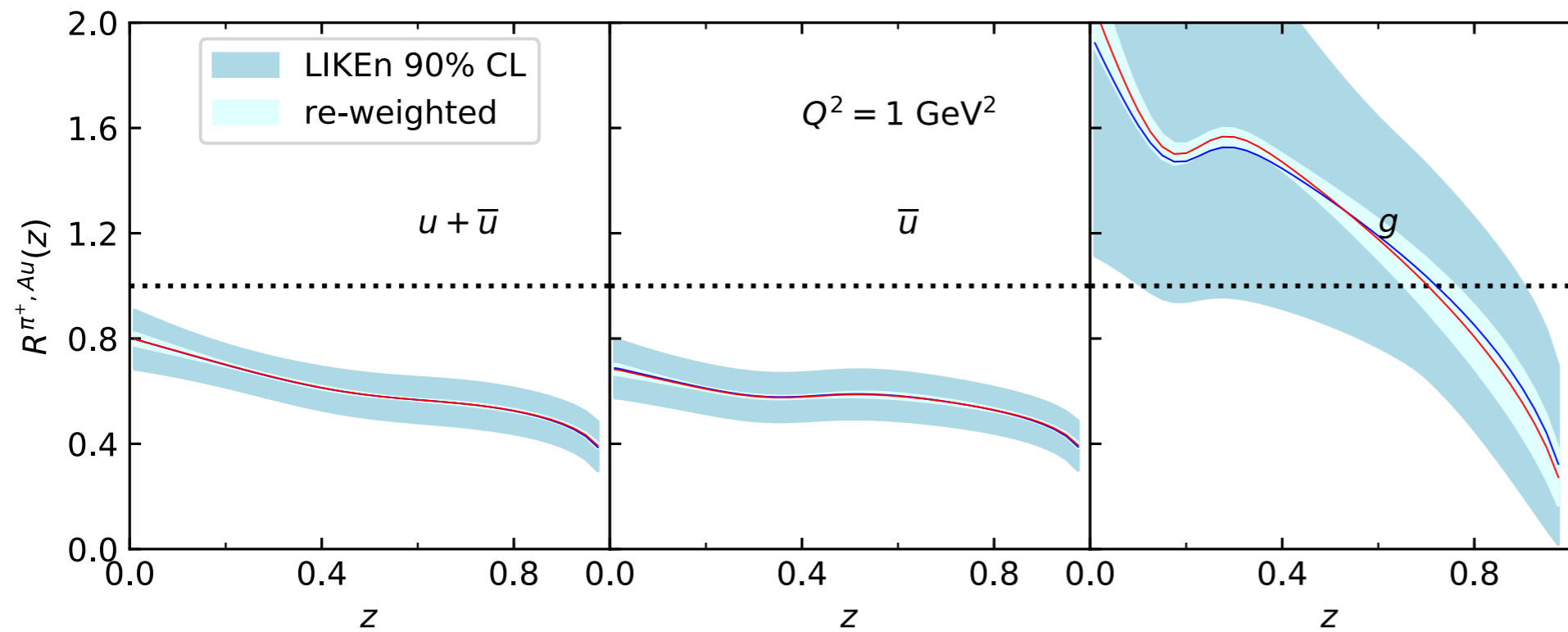
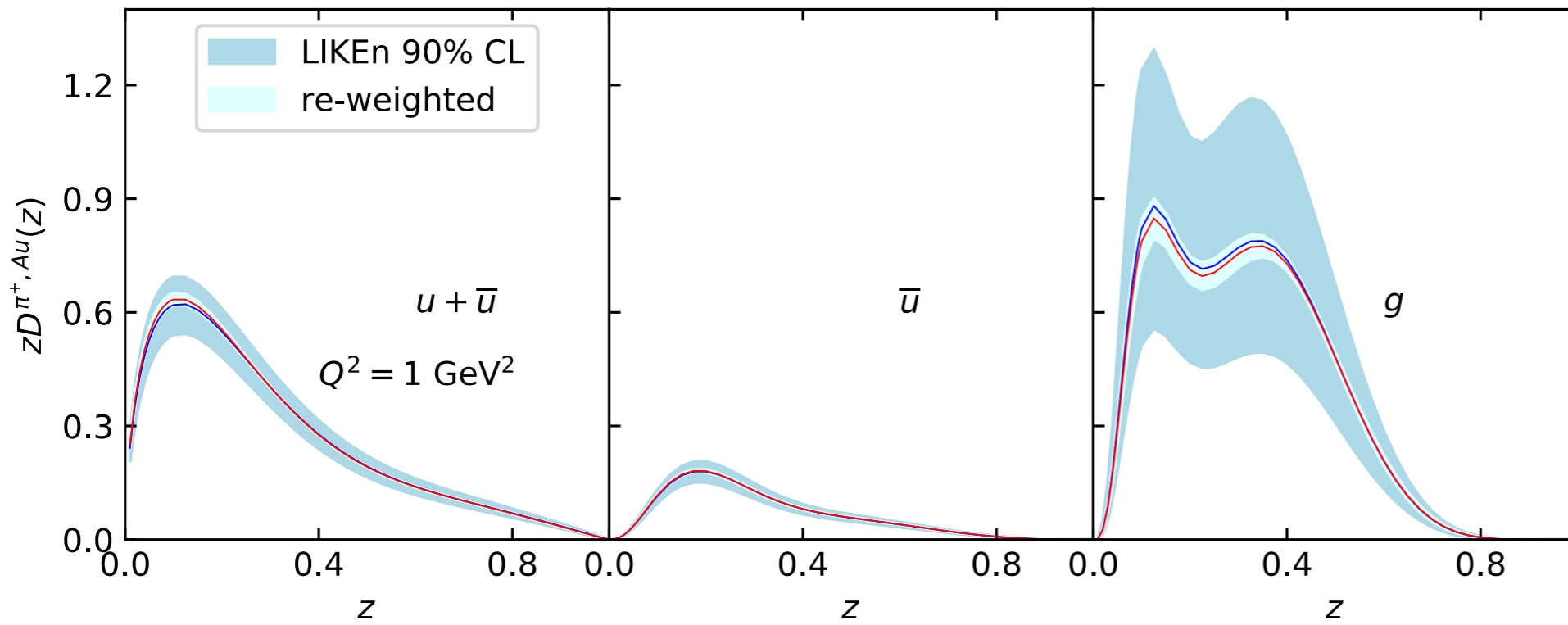
$100 \text{ GeV}^2 \leq Q^2 \leq 316 \text{ GeV}^2$



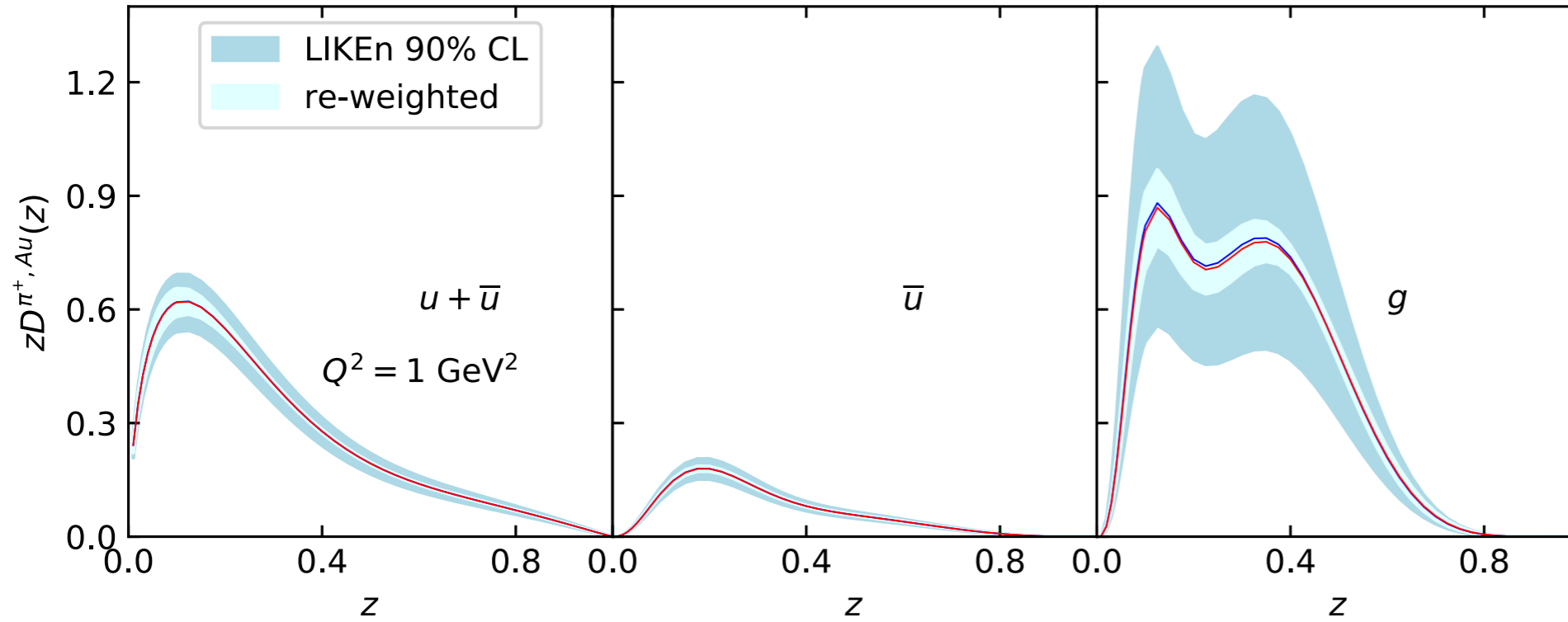
HB

$\sqrt{s} \approx 63.24$ **GeV**

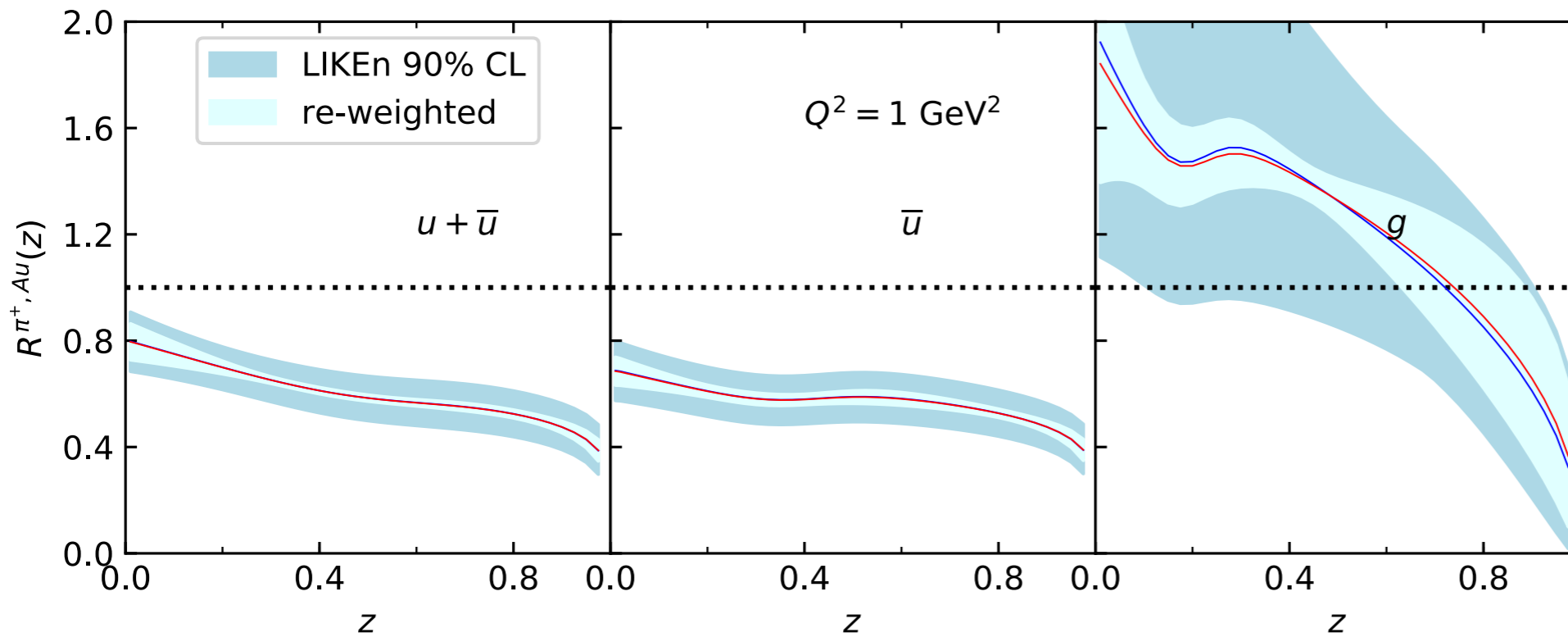
ACC



$\sqrt{s} \approx 63.24$ **GeV**

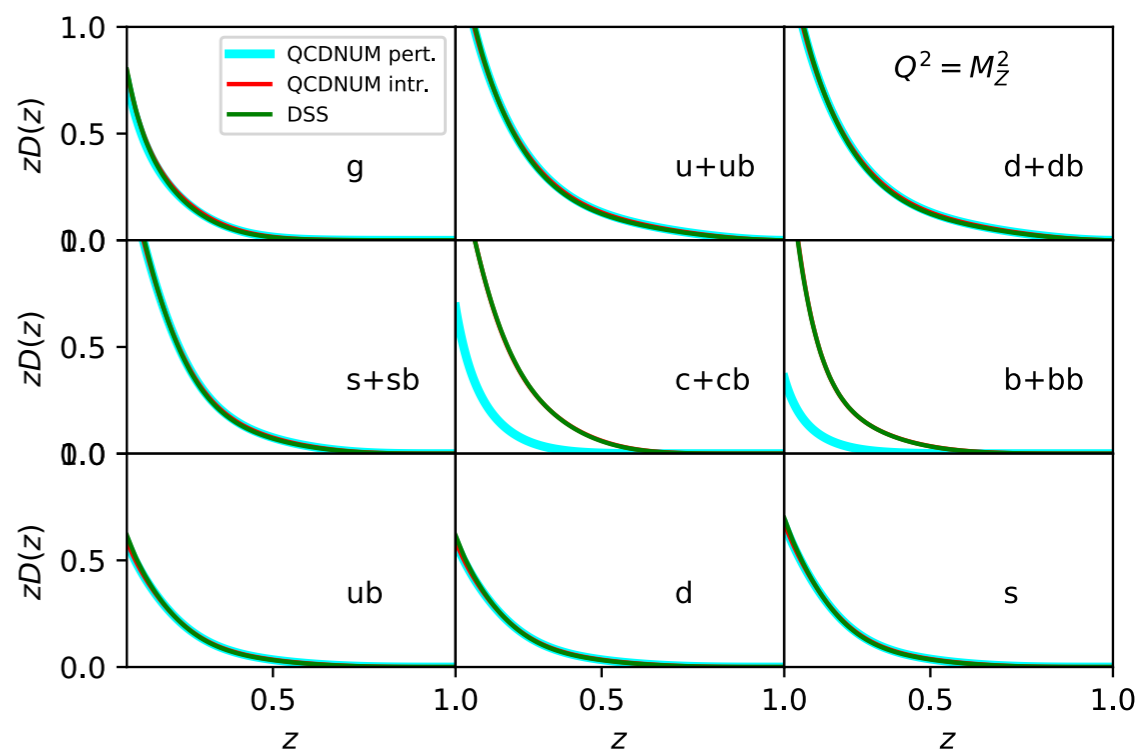
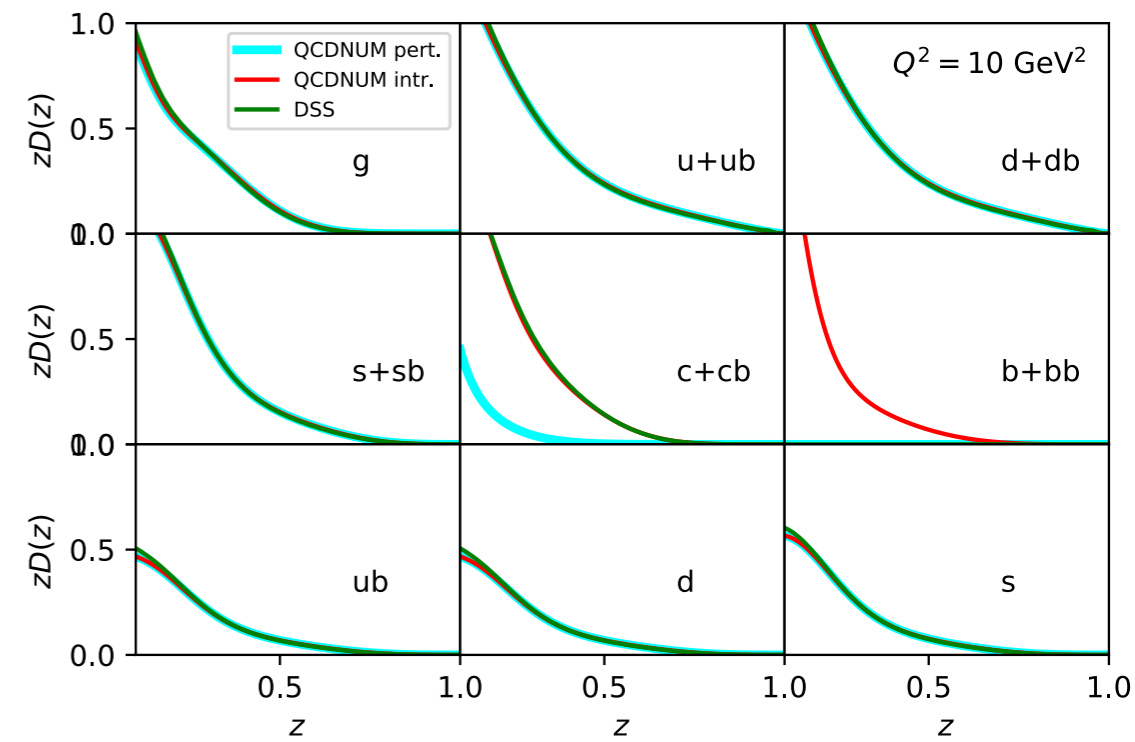
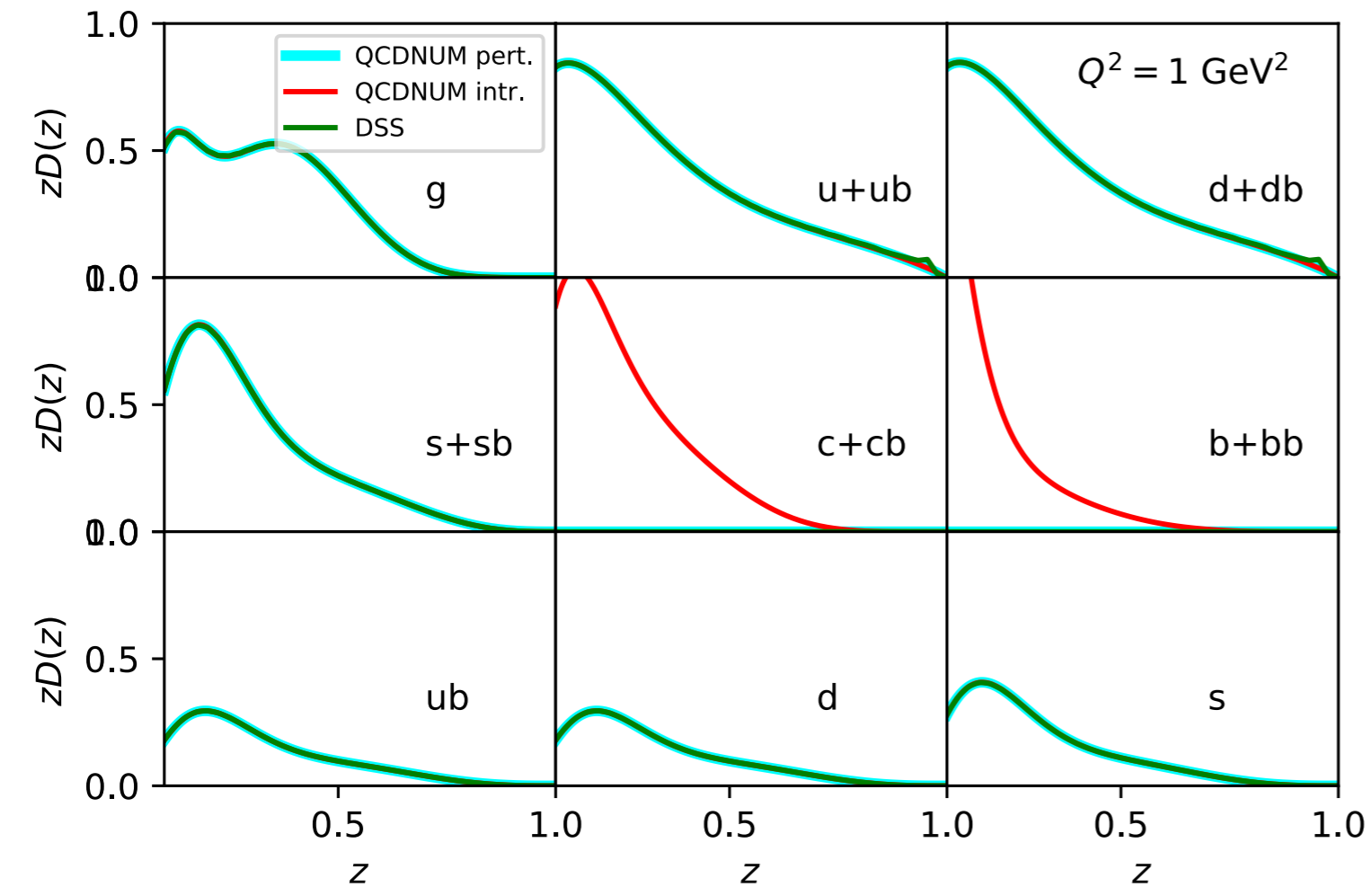


HB



BACK UP

Comparison of DEHSS2014 (pions) with QCDNUM



Comparison of DEHSS2017 (kaons) with QCDNUM

