Separation of quark flavors using DVCS data

Krešimir Kumerički (University of Zagreb)

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# Study motivated by recent Hall A paper:

Deeply virtual Compton scattering off the neutron

M. Benali [1,2,*], C. Desnault[3], M. Mazouz[1], Z. Ahmed[4], H. Albataineh[5], K. Allada[6], K. A. Aniol[7], V. Bellini[8], W. Boeglin[9], P. Bertin[2,10], M. Brossard[2], A. Camsonne[10], M. Canan[11], S. Chandavar[12], C. Chen[13], J.-P. Chen[10], M. Defurne[14], C. W. de Jager[10,42], R. de Leo[15], A. Deur[10], L. El Fassi[16,17],
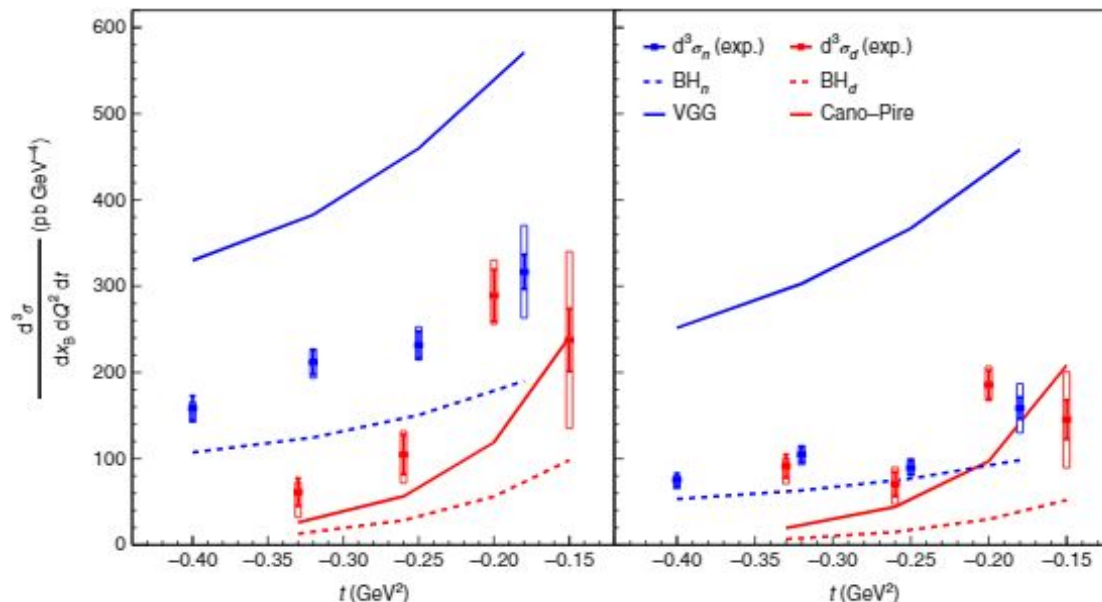
Still, separation of flavors is difficult:
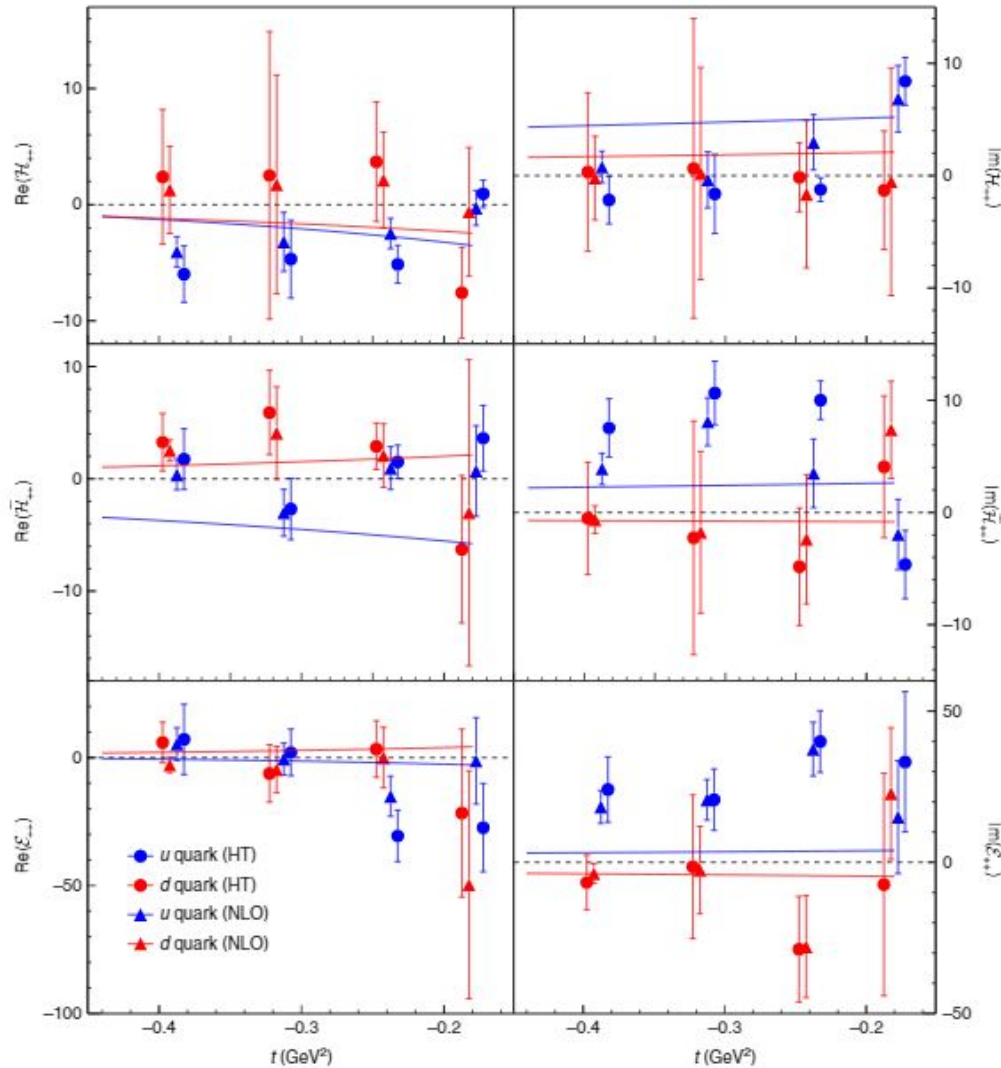
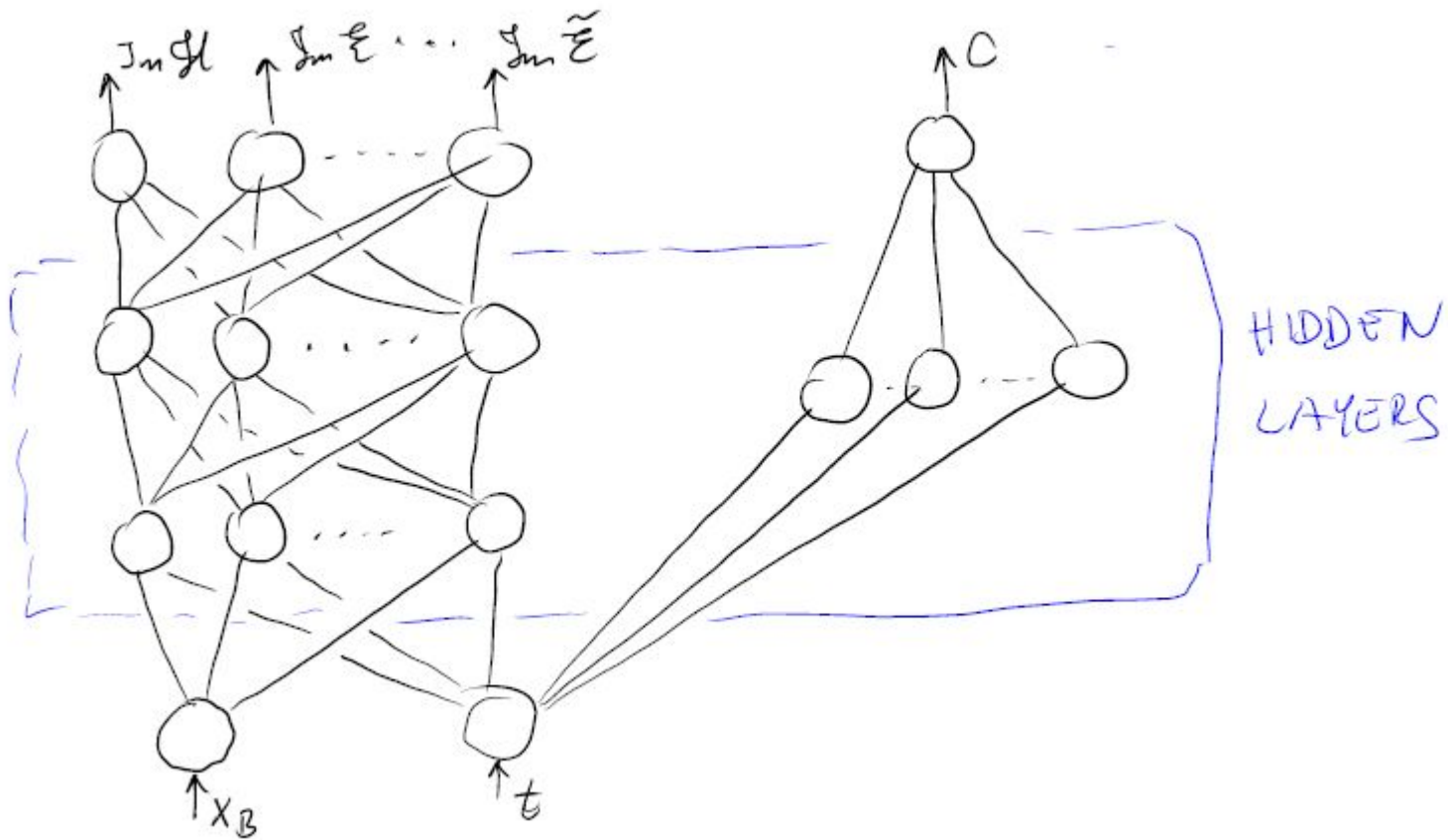# Can we do better? Maybe, with help from:

1. Global fit (actually, only JLab data CLAS+Hall A)

2. Dispersion relations constraints

$$\mathfrak{Re}\,\mathcal{H}(\xi,t) = \Delta(t) + \frac{1}{\pi}\text{P.V.}\int_0^1 dx \left(\frac{1}{\xi - x} - \frac{1}{\xi + x}\right) \mathfrak{Im}\,\mathcal{H}(x,t)$$

Two types of fits:

1. Model fit ("KM" type)

2. Neural networks (with or without dispersion relations)

Architecture of nets + dispersion relations:

chi^2/n$_{\text{dof}}$ of fits (look better in φ-space)

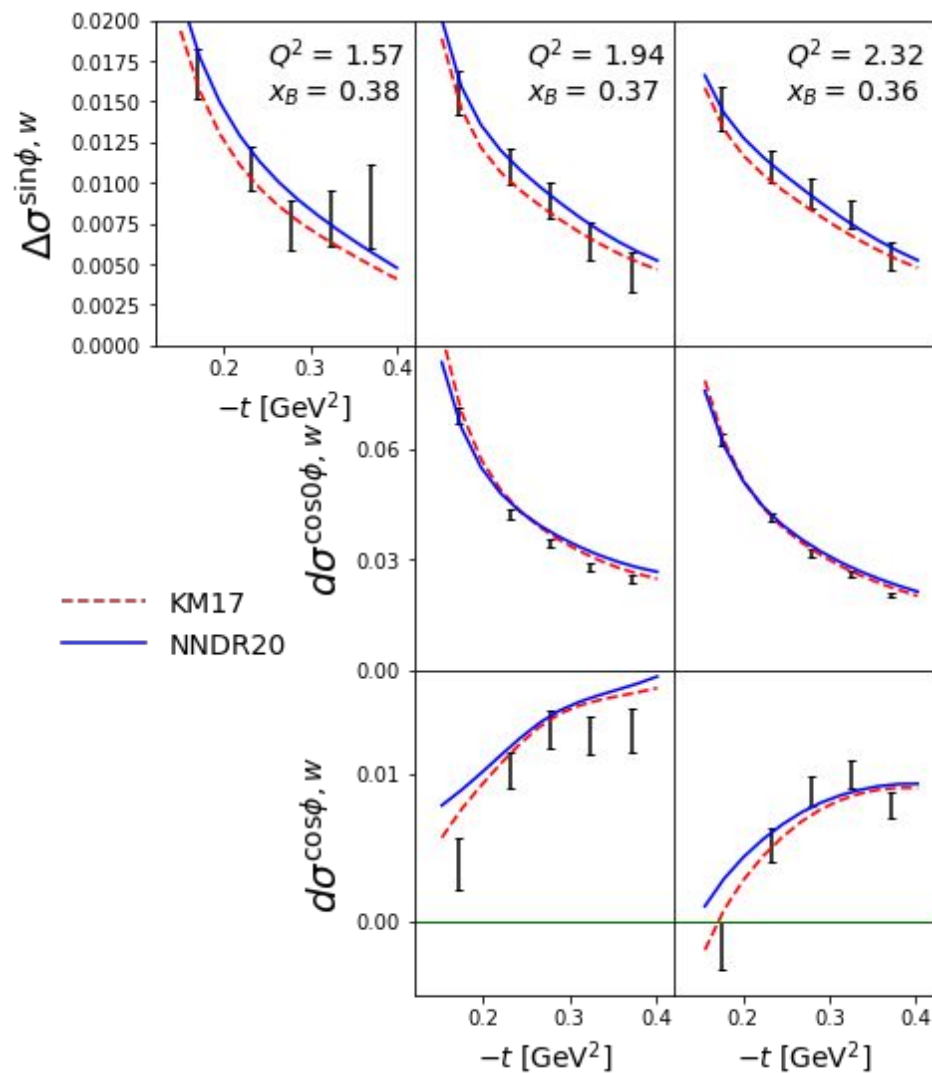| Observable	n_{pts}	KM17	NN20	NNDR20	fKM20	fNNDR20
CLAS [13] A_{LU}	162		1.		1.2	
CLAS [13] A_{UL}	160		1.7		1.8	
CLAS [13] A_{LL}	166		3.9		1.1	
CLAS [14] $d\sigma$	1014		0.95		1.2	
CLAS [14] $\Delta\sigma$	1012		0.93		0.9	
Hall A [15] $d\sigma$	240		1.95		0.9	
Hall A [15] $\Delta\sigma$	358		0.76		0.7	
Hall A [16] $d\sigma$	450		1.65		1.9	
Hall A [1] $d\sigma_n$					1.2	
Total (ϕ-space)	3562		1.25		1.2	
Total (harmonics)		1.3	1.6	1.7?	1.7	1.8?

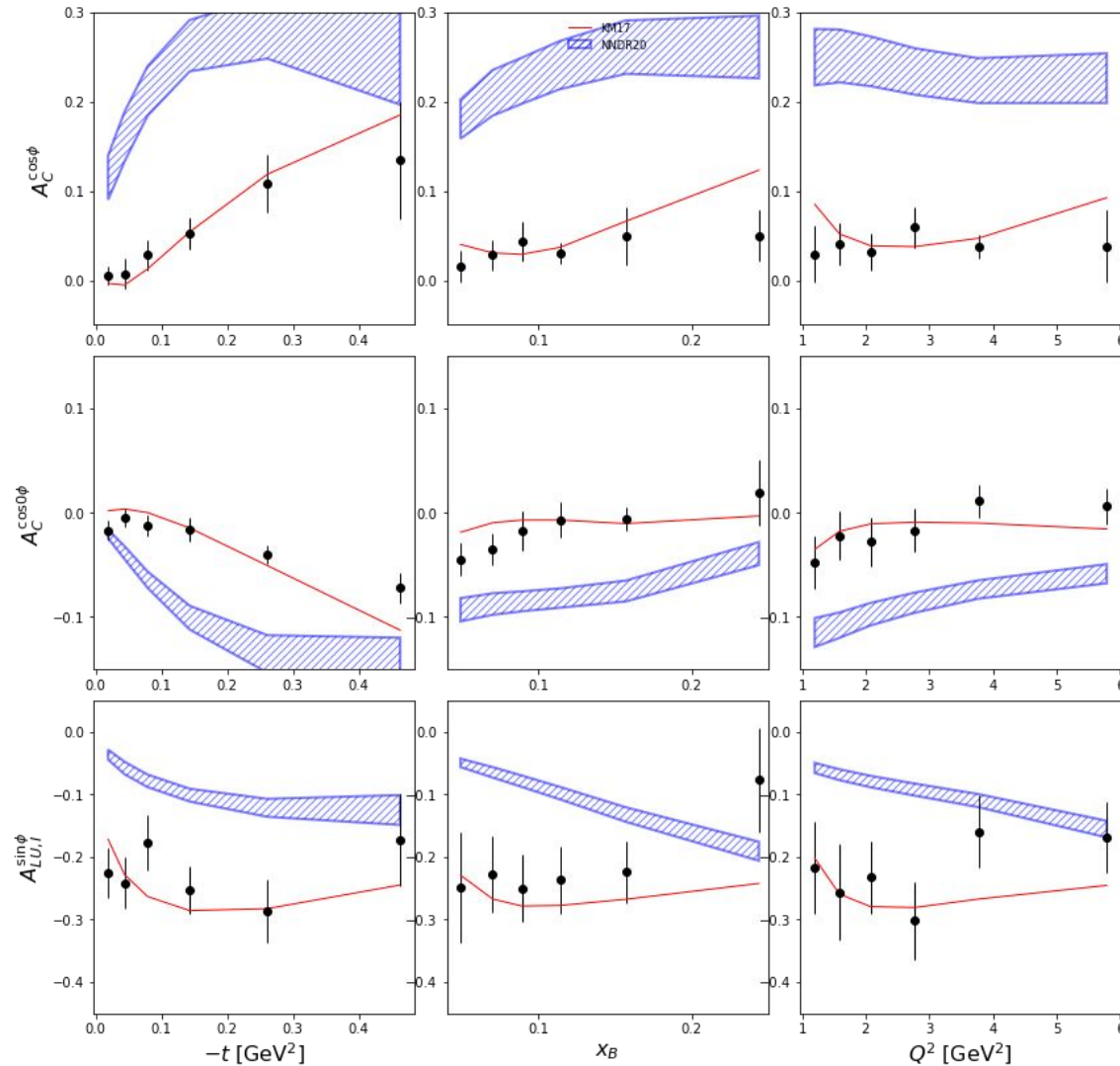# But plots look satisfying:
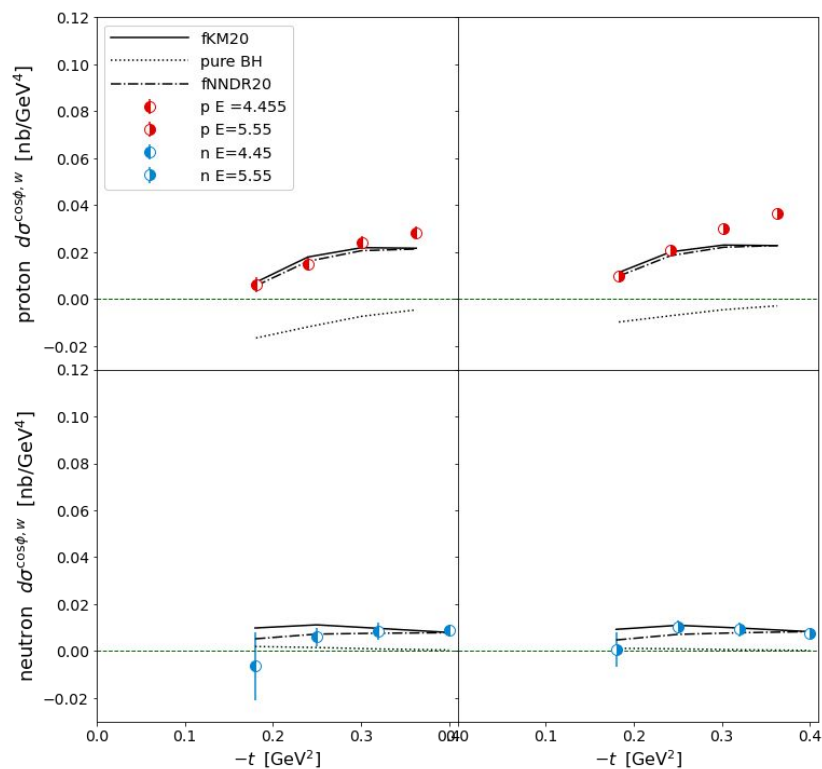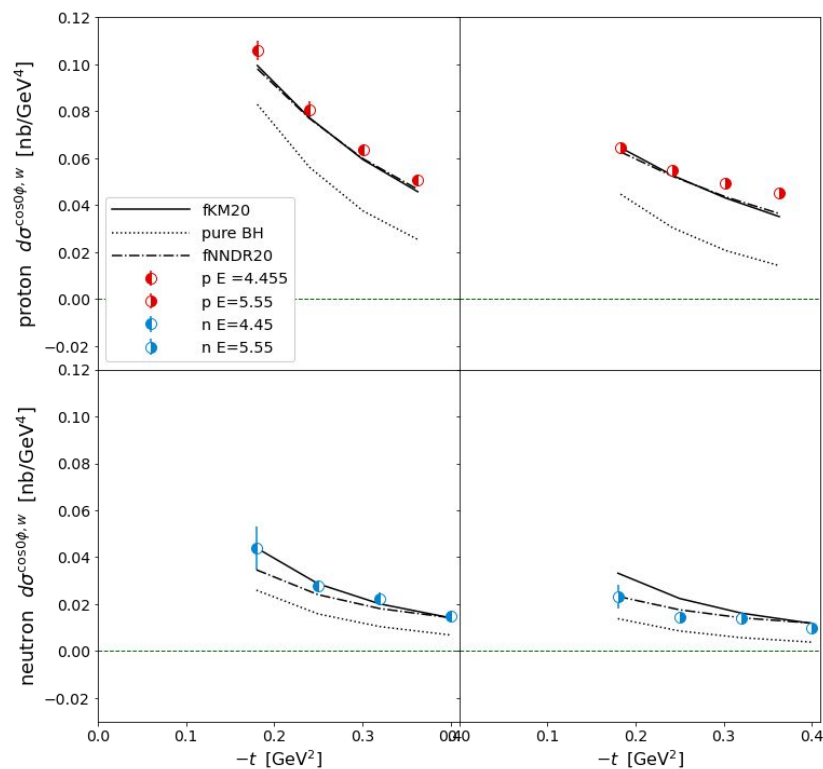
Hall A 2015
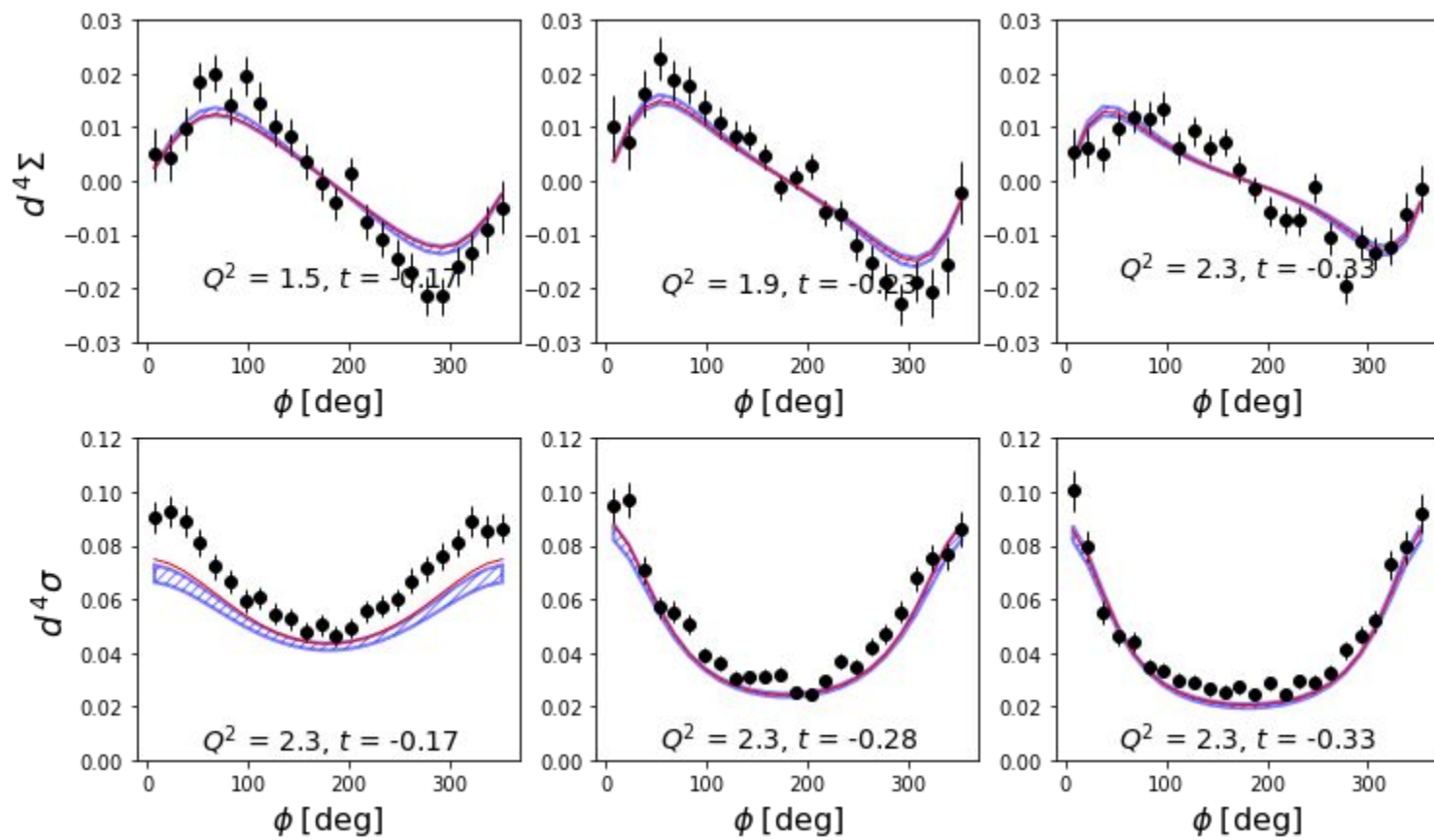
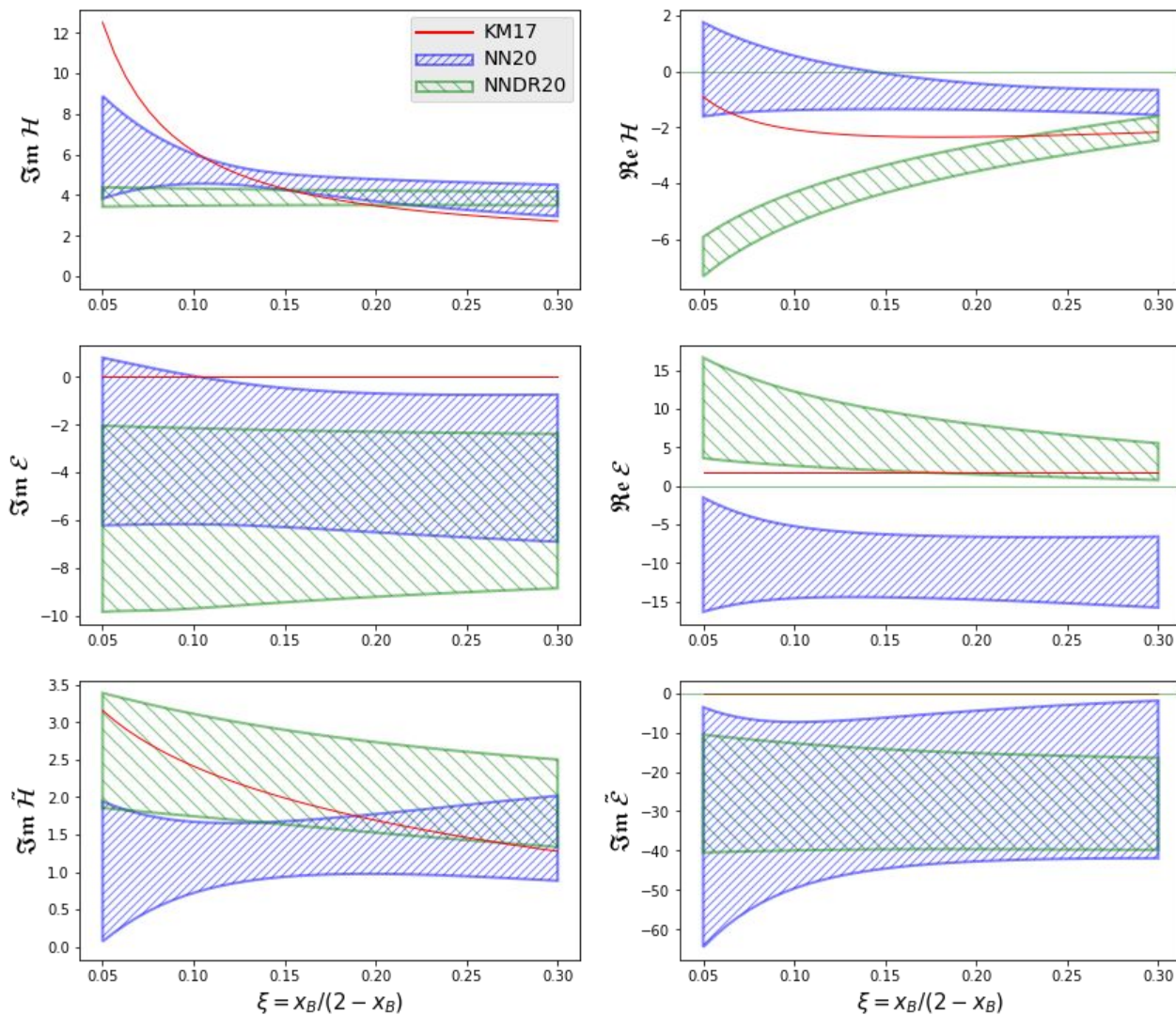# Hall A 2015 - weighted Fourier harmonic space
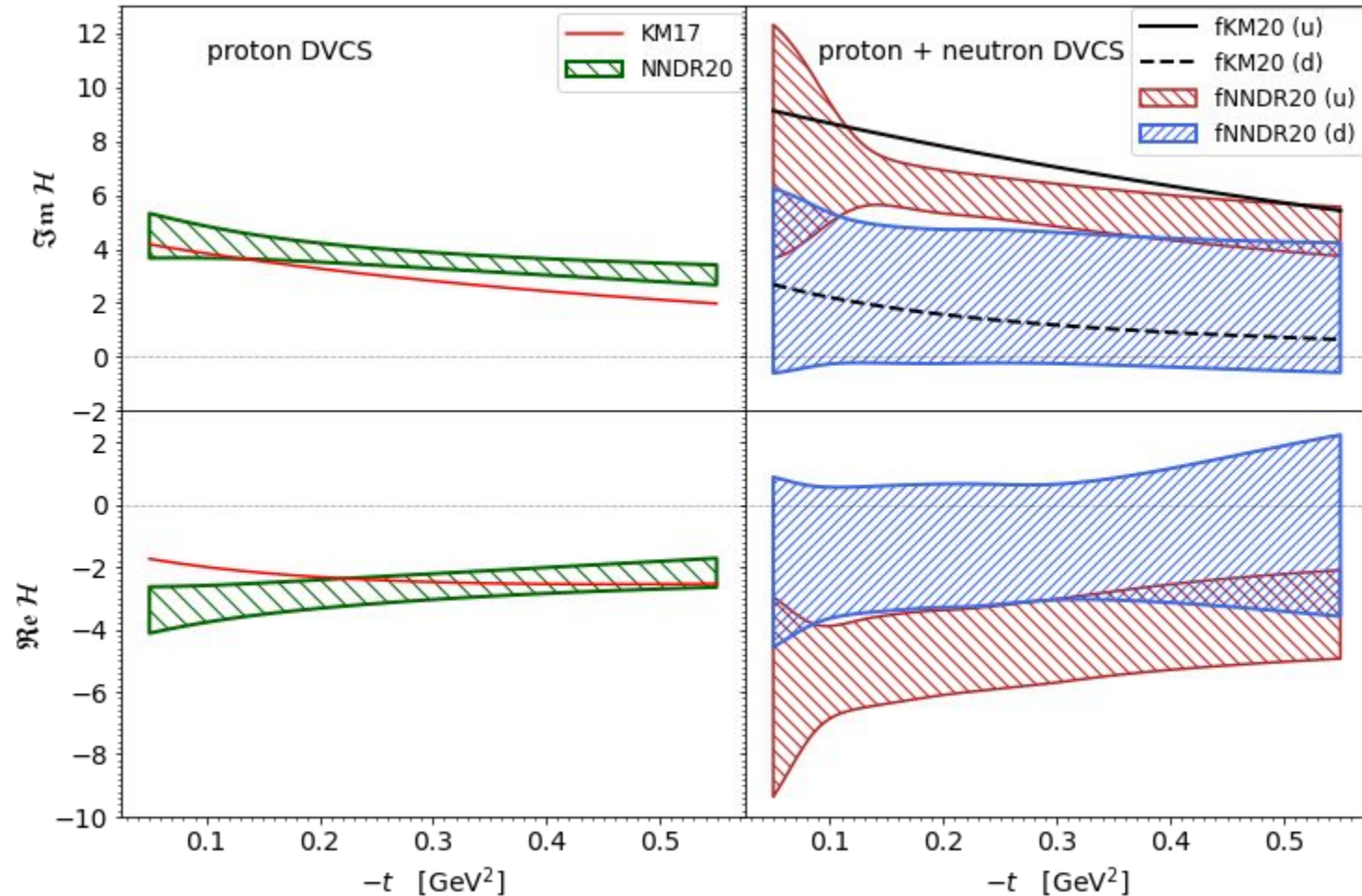
Hall A 2017 cross-sections (Fourier space)
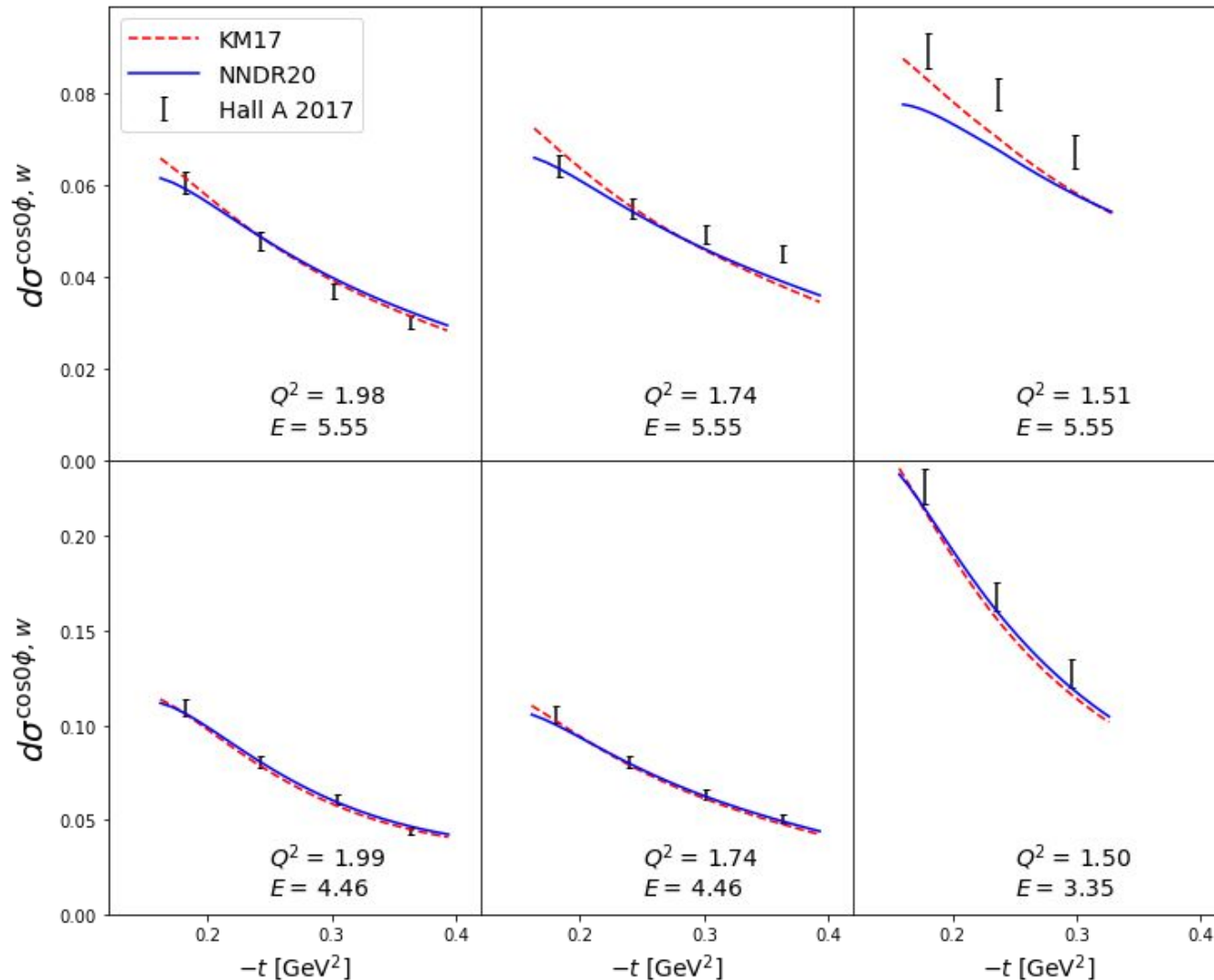
HERMES not fitted to and not described by NNets

Power of dispersion relations

Separation of flavors: CFFs H_u (red) and H_d (blue)

For CFF **E**, no separation of course