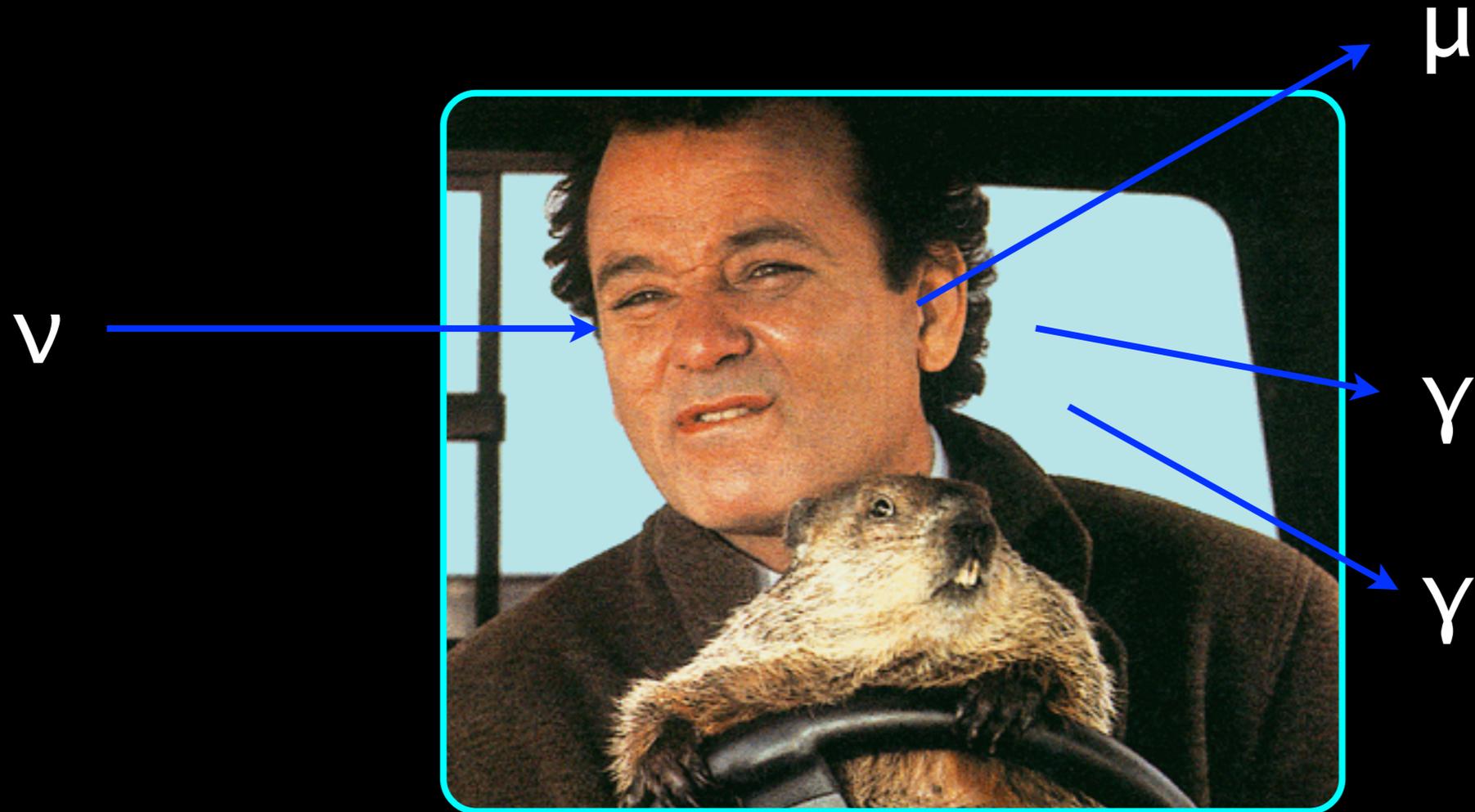


$CC\pi^0$ differential cross-sections

Robert Nelson
2010.02.02

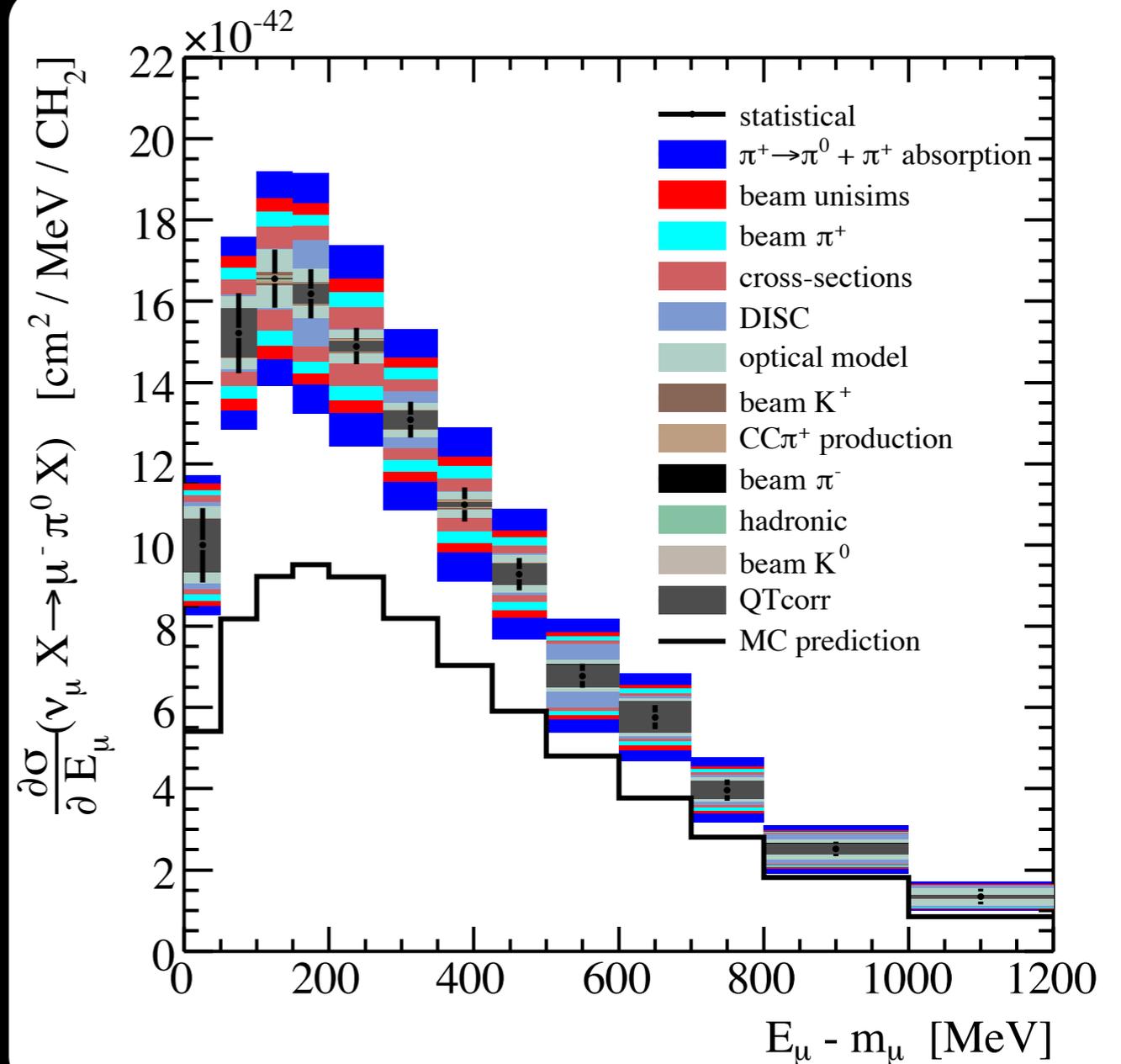


Differential cross-sections

- Muon kinetic energy
- Pion momentum
- Q^2
- Summary

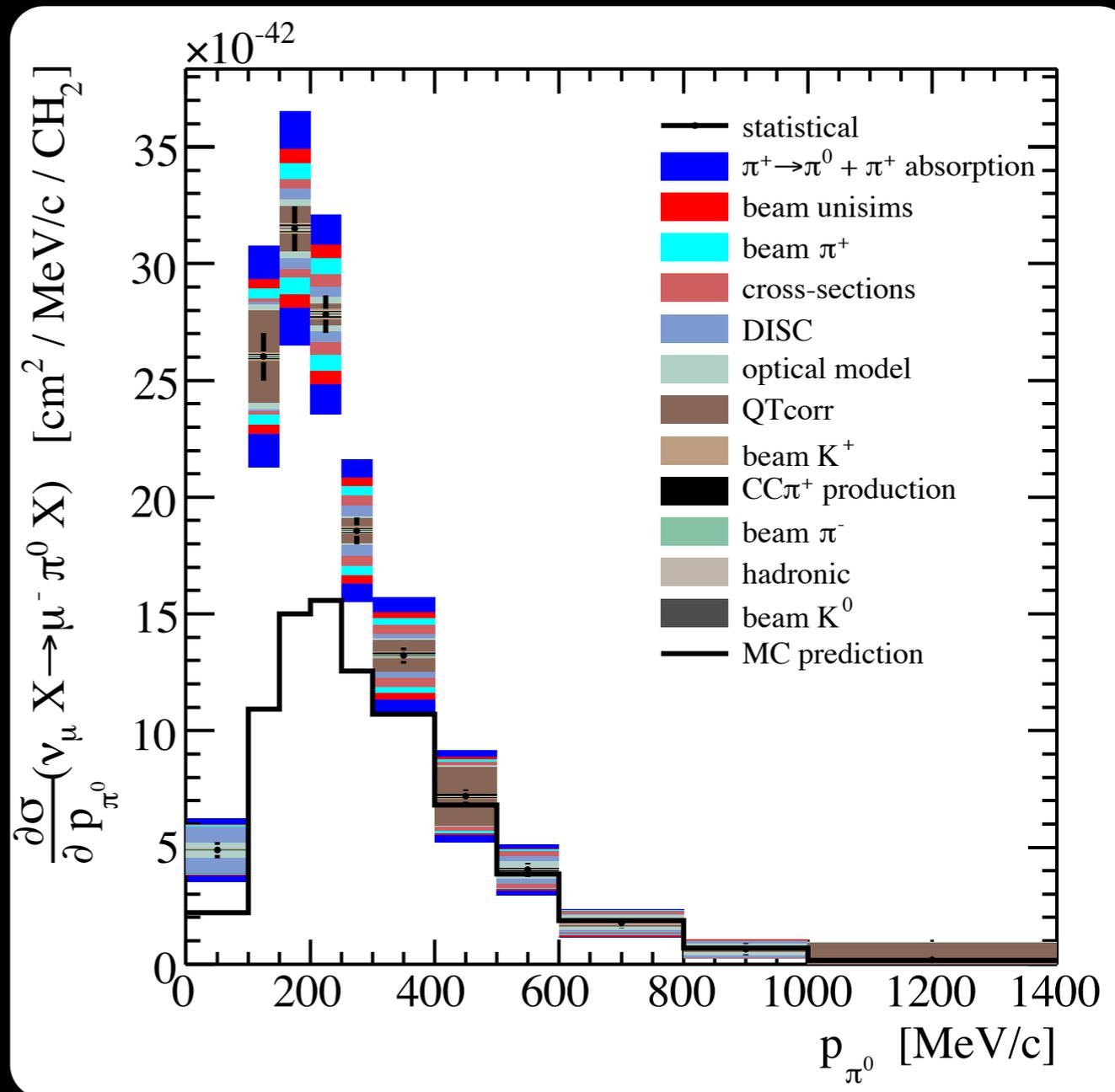
Muon kinetic energy

- Flux is restricted between 500 MeV and 2000 MeV to be consistent with the total cross-section.
- Binning was increased to smooth fluctuations in the error bands.
- Flux averaged cross-section agrees with the total cross-section measurement.



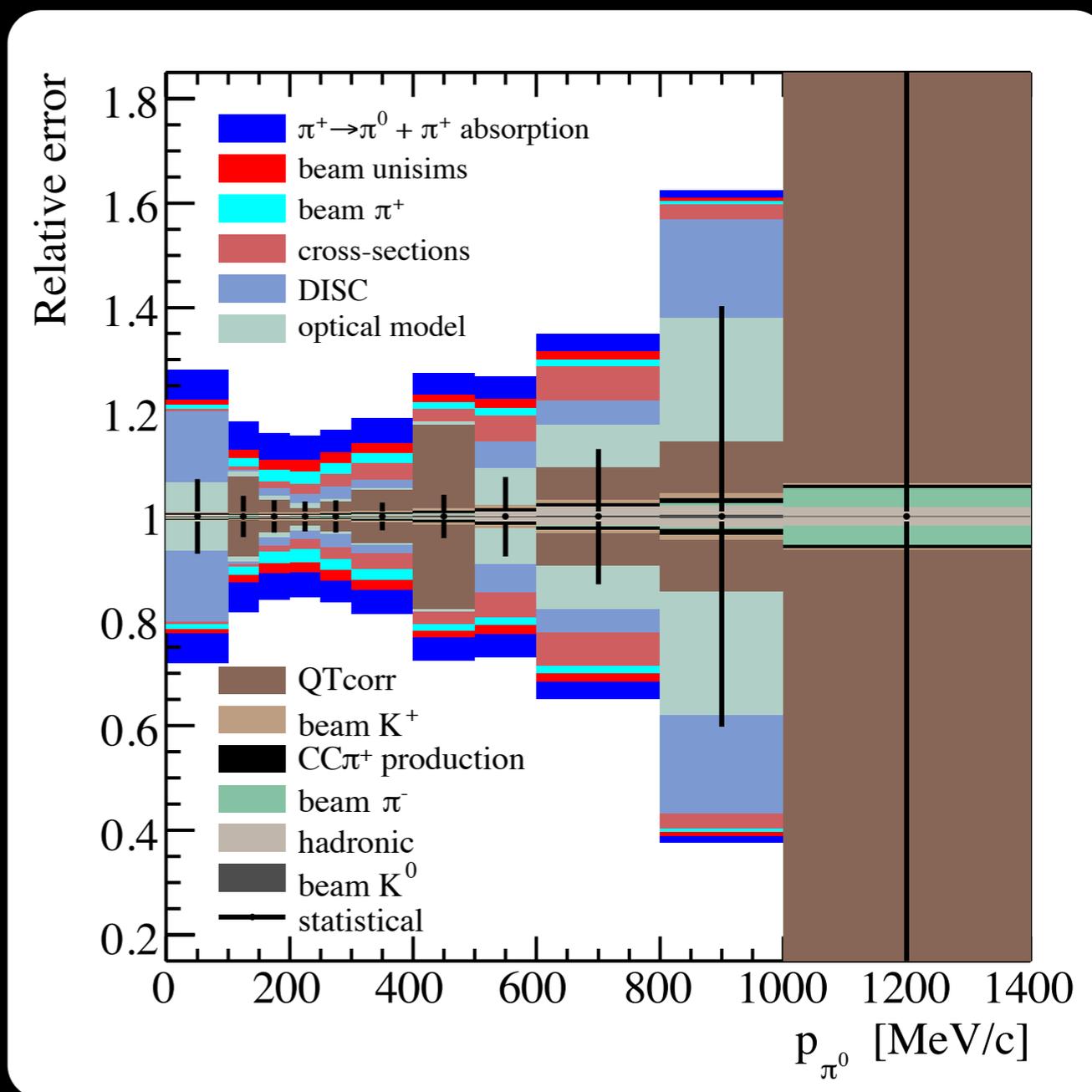
Pion momentum

- Binning set by $N_{C\pi^0}$.
- Binning is not optimal!
- Observable $C\pi^0$ have a lower momentum spectrum than expected. Probably due to π^0 reinteractions in the nucleus before it decays.



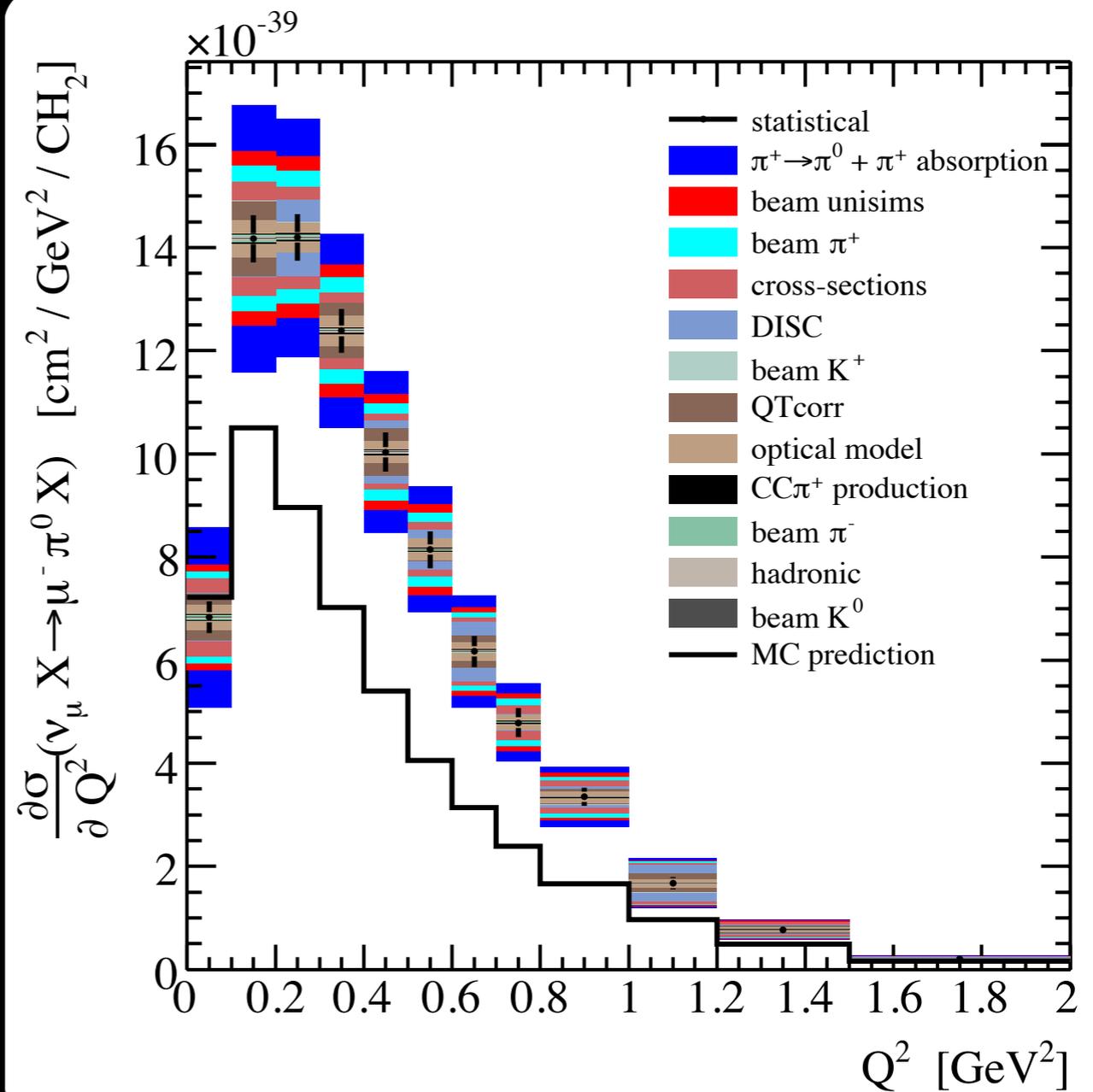
Pion momentum

- Normalization error of 16.3%
- Errors are not well behaved.
- QT corr blows up because of statistics in the last bin.
- Perhaps I'll combine a few bins....



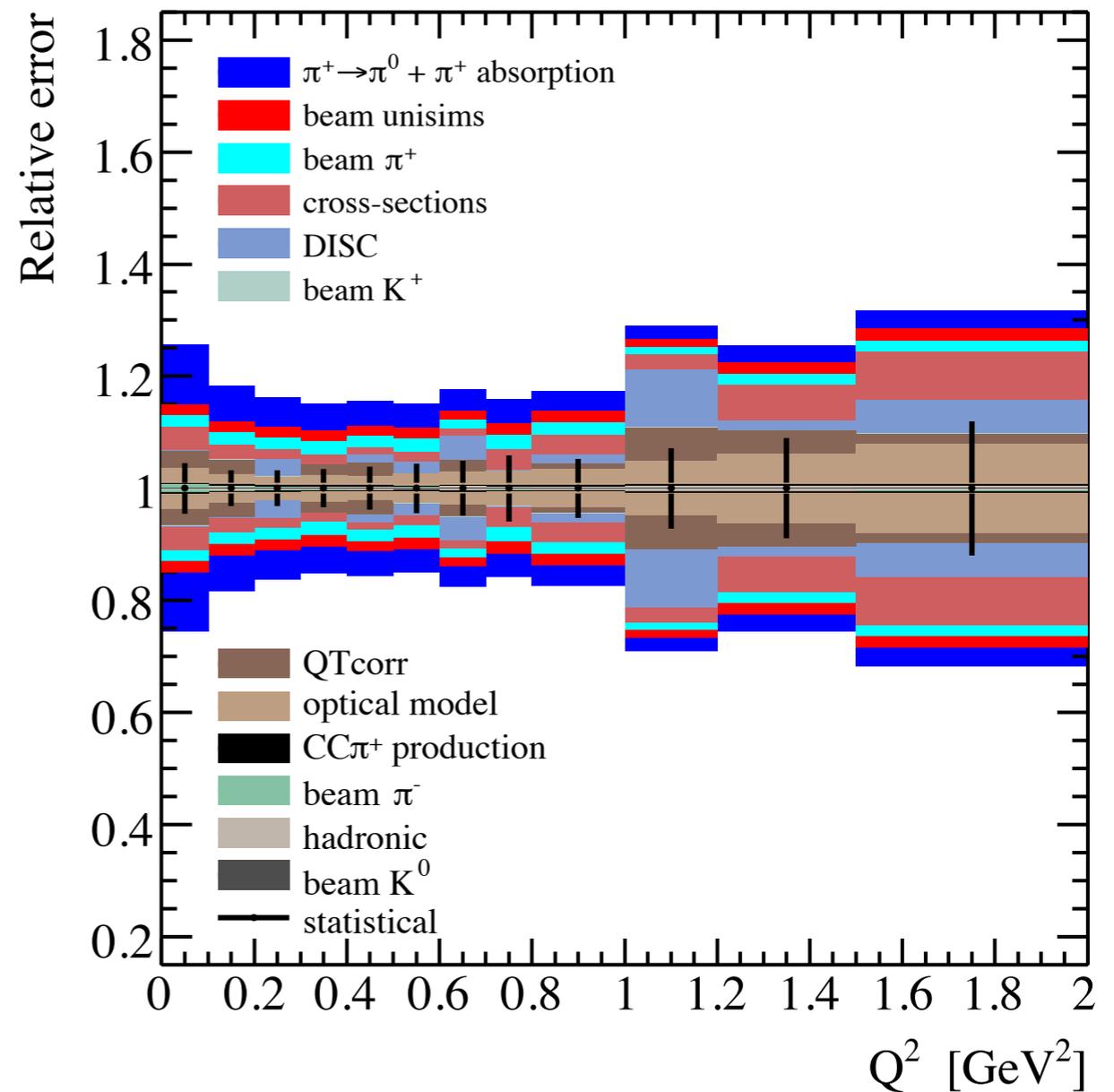
Q^2

- Shows a harder spectrum than data, with a fall-off at low Q^2 .



Q²

- Normalization error of 16.4%.
- Beam K⁺ is a surprise, but it is still less than 1%. QTcorr and OM errors reduced in normalization error to just below K⁺ errors.



Flux averaged total cross-section

- Flux: $\Phi \in (500 \text{ MeV}, 2000 \text{ MeV})$
- Total cross-section: $\langle \sigma \rangle_{\Phi} = \Phi^{-1} \sum \sigma_i \Phi_i$
- Differential cross-sections: $\langle \sigma \rangle_{\Phi} = \sum (d\langle \sigma \rangle_{\Phi}/dx)_i \Delta x_i$
- By using the same flux range for the total and differential cross-sections, we can compare their flux-averaged total cross-sections.

Cross-section summary

	σ [cm ² / CH ₂]	$d\sigma/dE_\mu$ [cm ² / MeV / CH ₂]	$d\sigma/dp_\pi$ [cm ² / MeV/c / CH ₂]	$d\sigma/dQ^2$ [cm ² / GeV ² / CH ₂]
$\langle\sigma\rangle_\phi$	8.8×10^{-39}	8.9×10^{-39}	8.7×10^{-39}	9.0×10^{-39}
$\pi^+ \rightarrow \pi^0$ and π^+ absorption	13.2%	12.0%	12.3%	12.4%
DISC	6.1%	2.1%	2.1%	2.4%
Beam Unisims	7.7%	6.6%	6.6%	6.5%
Cross-sections	6.2%	5.6%	5.2%	5.3%
Beam π^+	7.4%	6.2%	6.2%	6.1%
QT correlation	0.6%	0.1%	0.9%	0.6%
Optical Model	2.8%	0.8%	0.9%	0.6%
Beam K^+	0.9%	0.7%	0.7%	0.7%
CC π^+ production	0.5%	0.4%	0.4%	0.5%
Beam π^-	0.3%	0.2%	0.3%	0.3%
Hadronic	0.2%	0.1%	0.1%	0.1%
Beam K^0	0.03%	0.04%	0.03%	0.04%
Total	19.3%	16.2%	16.3%	16.4%

- Total cross-section error is probably enhanced by flux shape errors.

To do

- Muon and pion angles.
- Make sense of the 2D single differential cross-sections.