

# Comparison of the JINR-model with modern $\nu_\mu$ and $\bar{\nu}_\mu$ CCQE-like data

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JINR, Dubna

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# Brief Review of JINR-model (a bit dated)

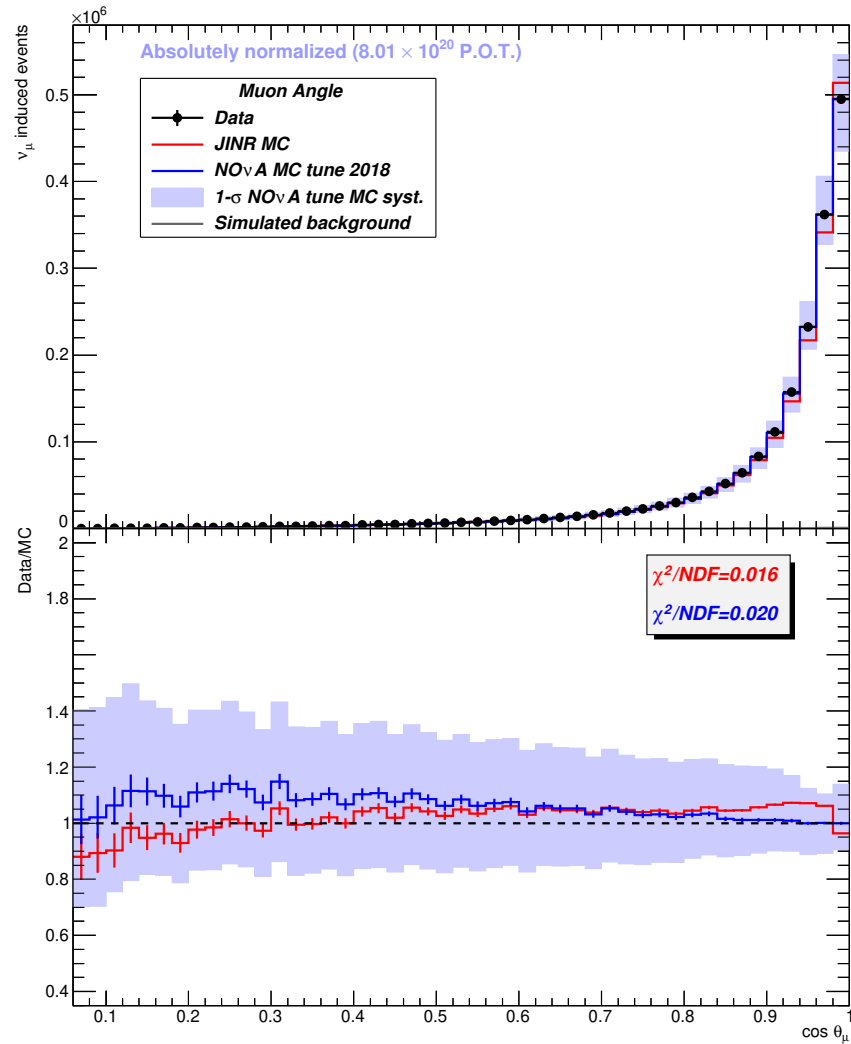
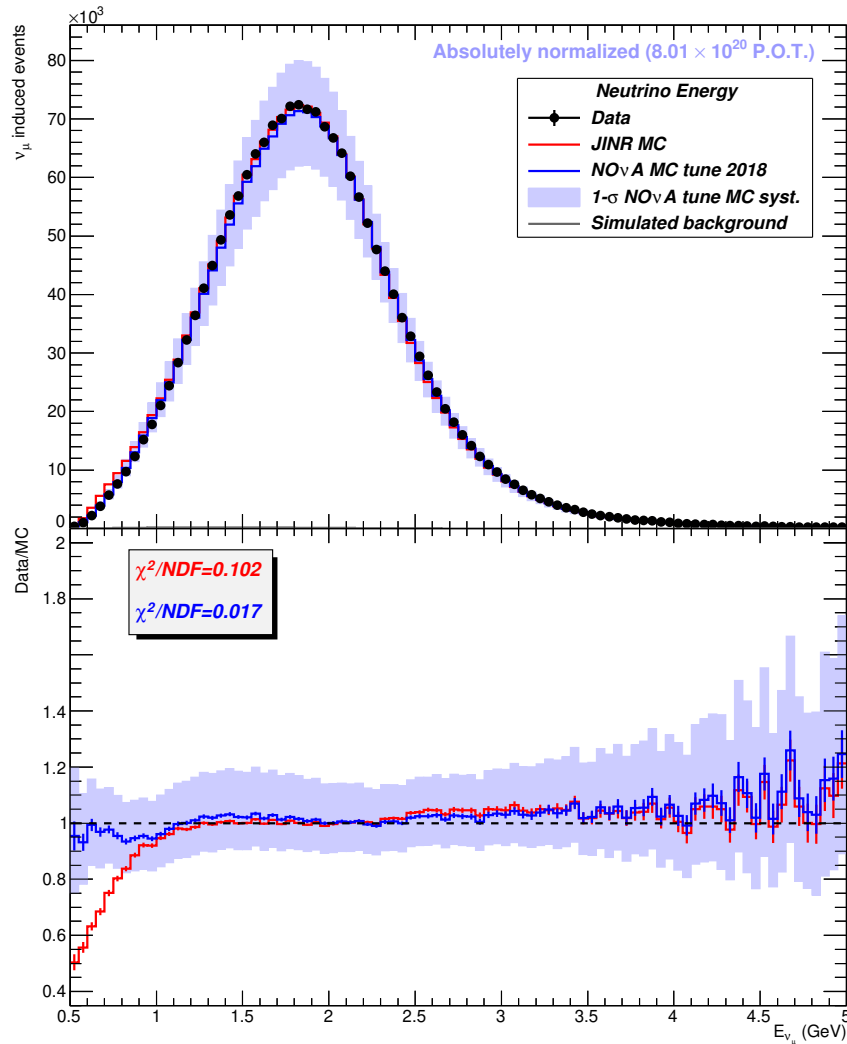
- All details about JINR-model can be found in doc 32490
- CAF (release S18-09-15)
- Forth production neutrino datasets (MC & Data):  
[prod\\_caf\\_R17-11-14-prod4reco.d\\_nd\\_genie\\_nonswap\\_fhc\\_nova\\_v08\\_full\\_v1](#)  
[prod\\_caf\\_R17-09-05-prod4recopreview.f\\_nd\\_numi\\_fhc\\_full\\_v1\\_addShortSimpleCVN\\_goodruns](#)
- Forth production antineutrino datasets (MC & Data):  
[prod\\_caf\\_R17-11-14-prod4reco.e\\_nd\\_genie\\_nonswap\\_rhc\\_nova\\_v08\\_full\\_v1](#)  
[prod\\_caf\\_R17-09-05-prod4recopreview.f\\_nd\\_numi\\_rhc\\_full\\_v1\\_addShortSimpleCVN\\_goodruns](#)
- kStandardSpillCuts
- kCCE, kMuE, kCosNumi, kHadE, kRecoQmag, kRecoQ2, kRecoW
- kNumuCutND2018
- kXSecCVWgt2018RPAFix\_noDIS\*kPPFXFluxCVWgt
- Simulated background:  
kNumuCutND2018 && !klsNumuCC, kNumuCutND2017Prod4 && !klsNumuCC
- Band: getAna2018LargeXsecSysts(kNumuAna2018).

# Brief Review of JINR-model (a bit dated)

FHC mode

Neutrino energy

Cosine of the muon angle scattering

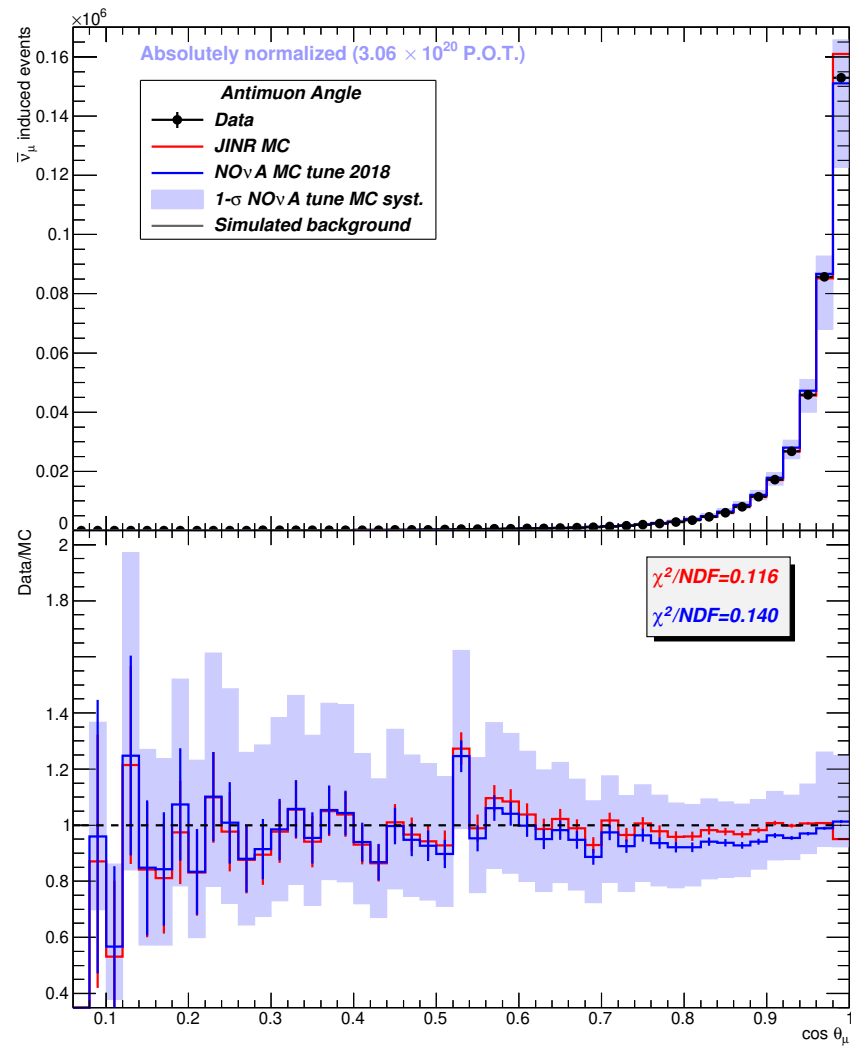
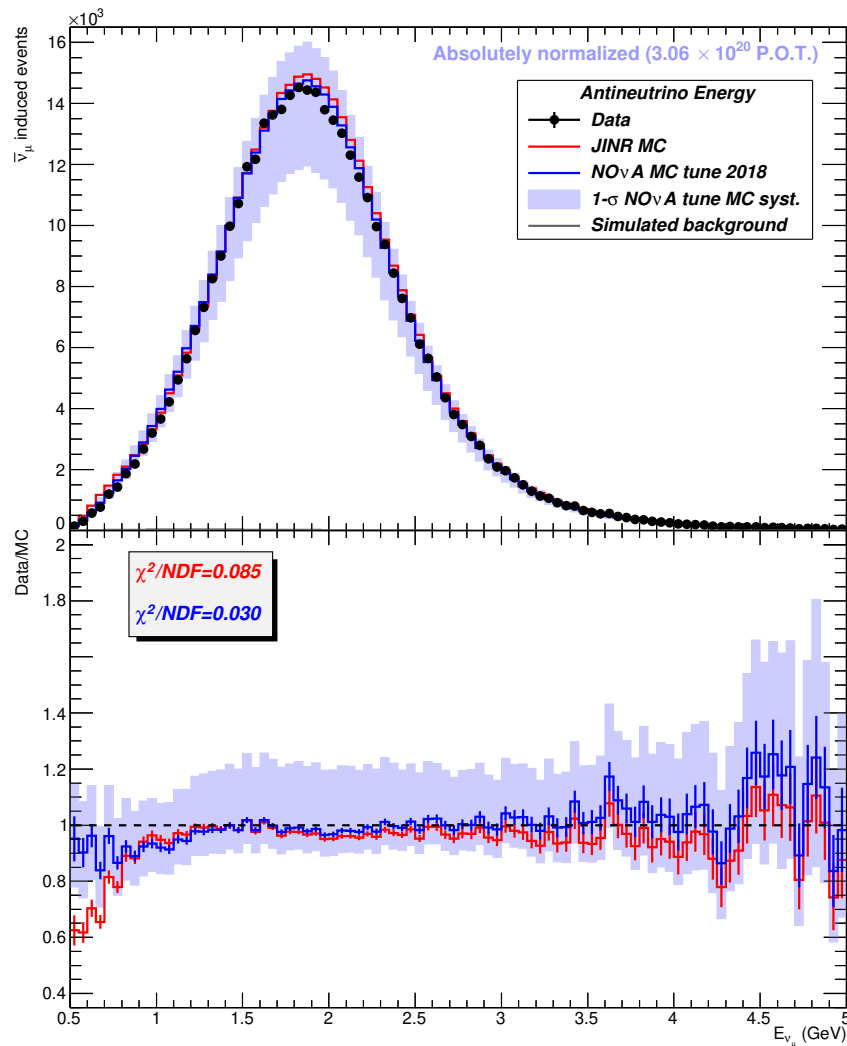


# Brief Review of JINR-model (a bit dated)

RHC mode

Antineutrino energy

Cosine of the antimuon angle scattering

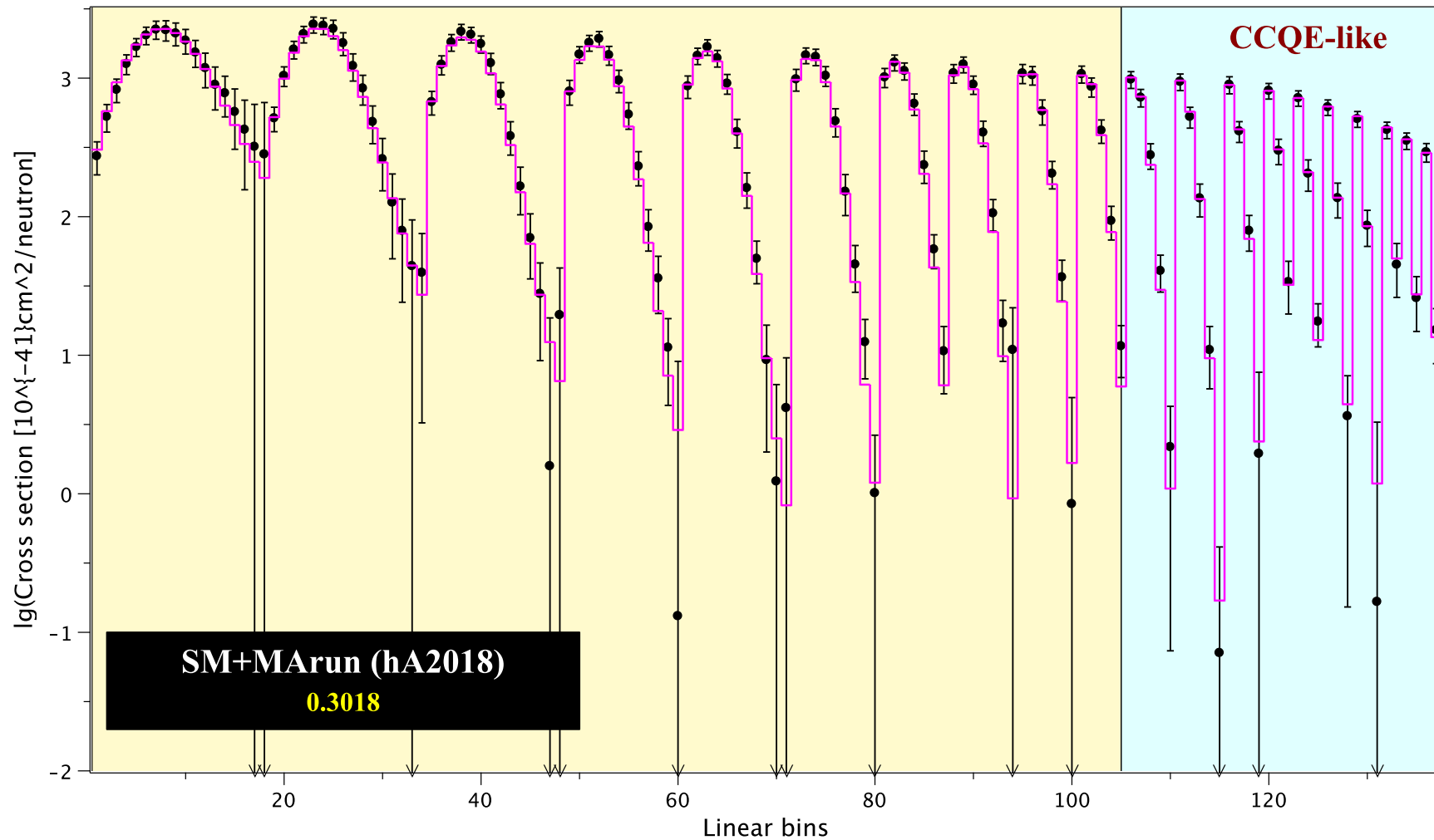


# Brief Review of JINR-model (a bit dated)

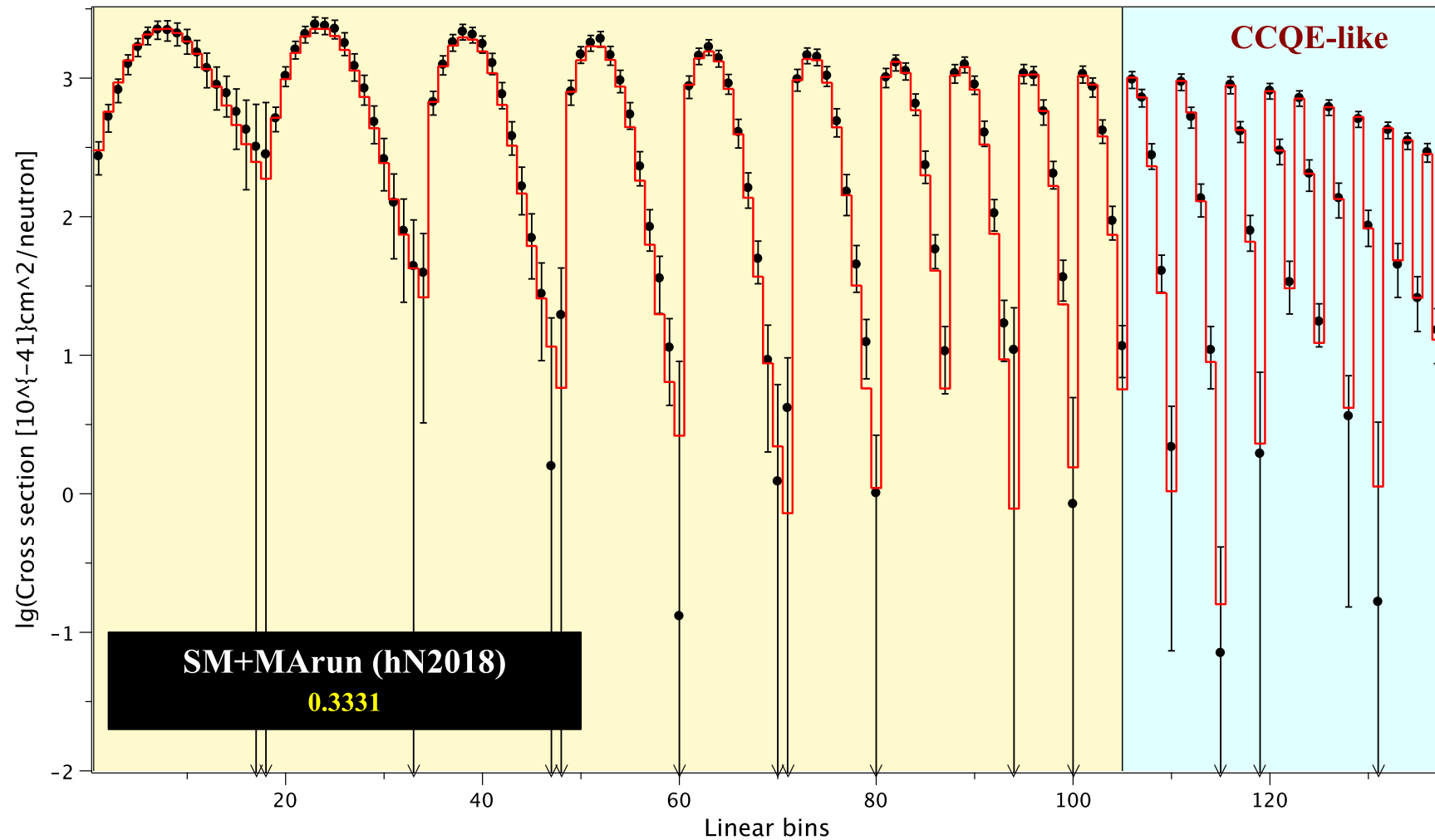
All other comparisons can be found in the backup slides:

- muon energy
- hadron energy
- 3-momentum transfer
- 4-momentum transfer
- invariant hadronic mass.

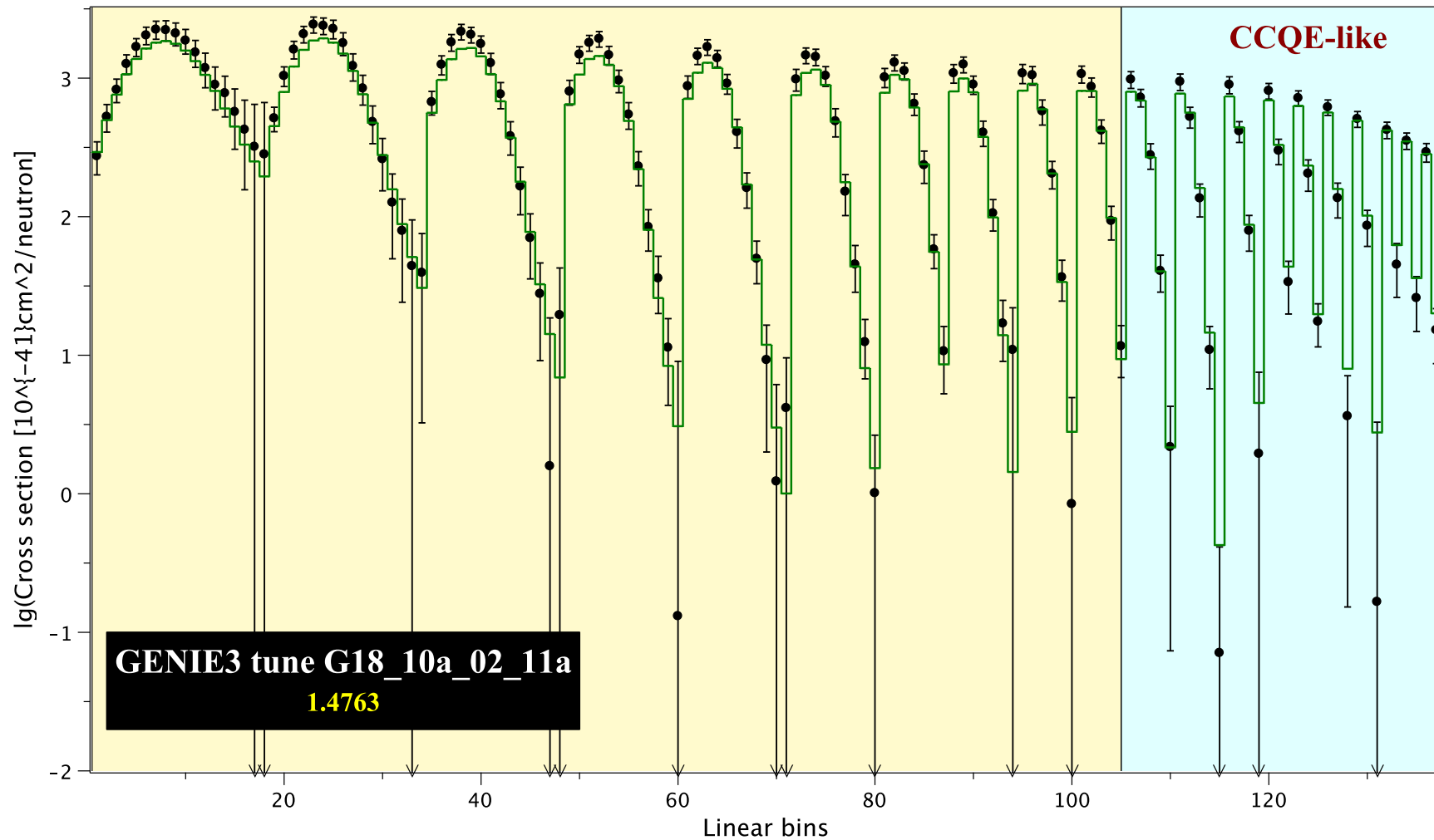
# Comparison with MiniBooNE $\nu_\mu$ data target Carbon



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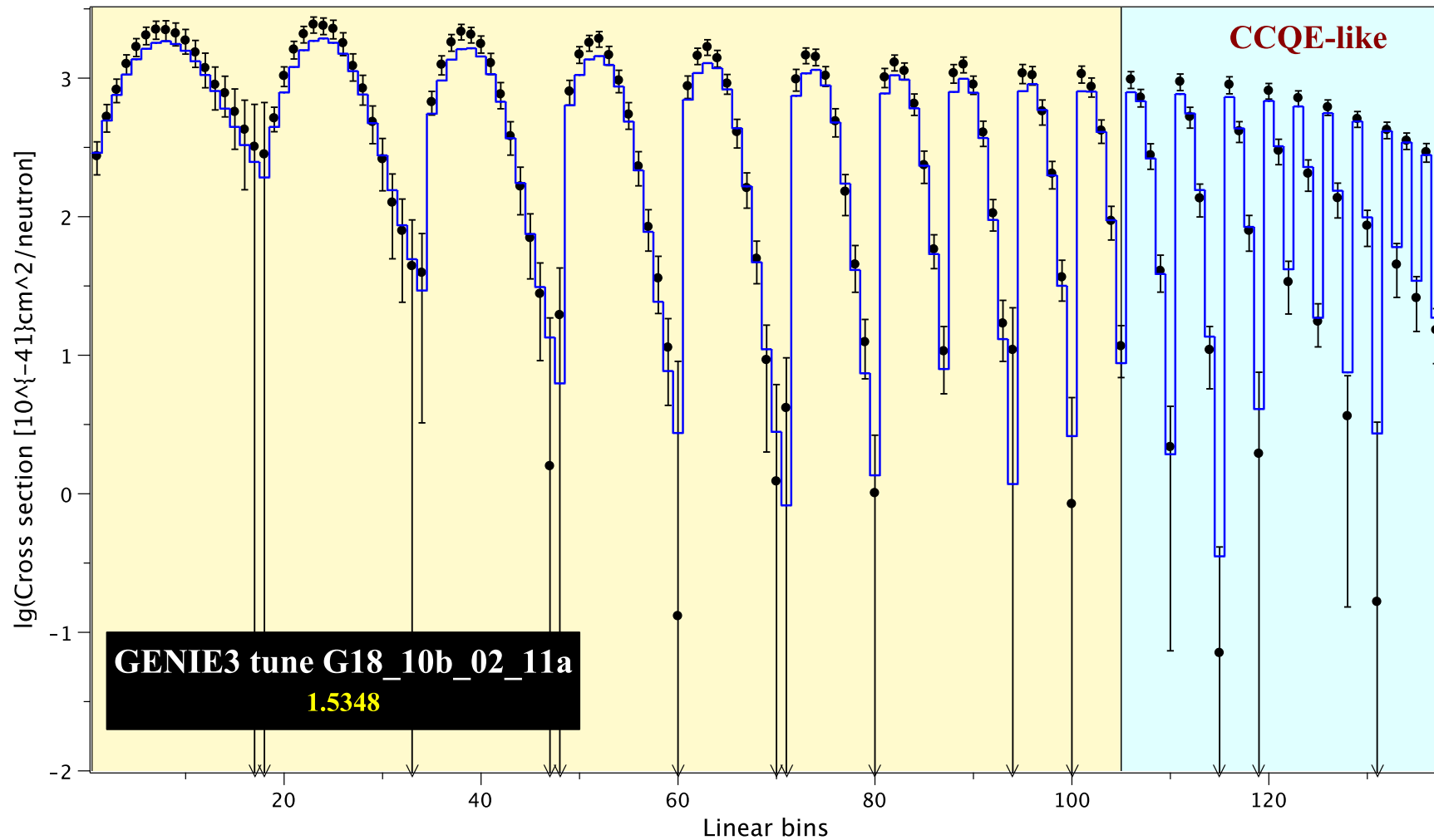


# Comparison with MiniBooNE $\nu_\mu$ data target Carbon

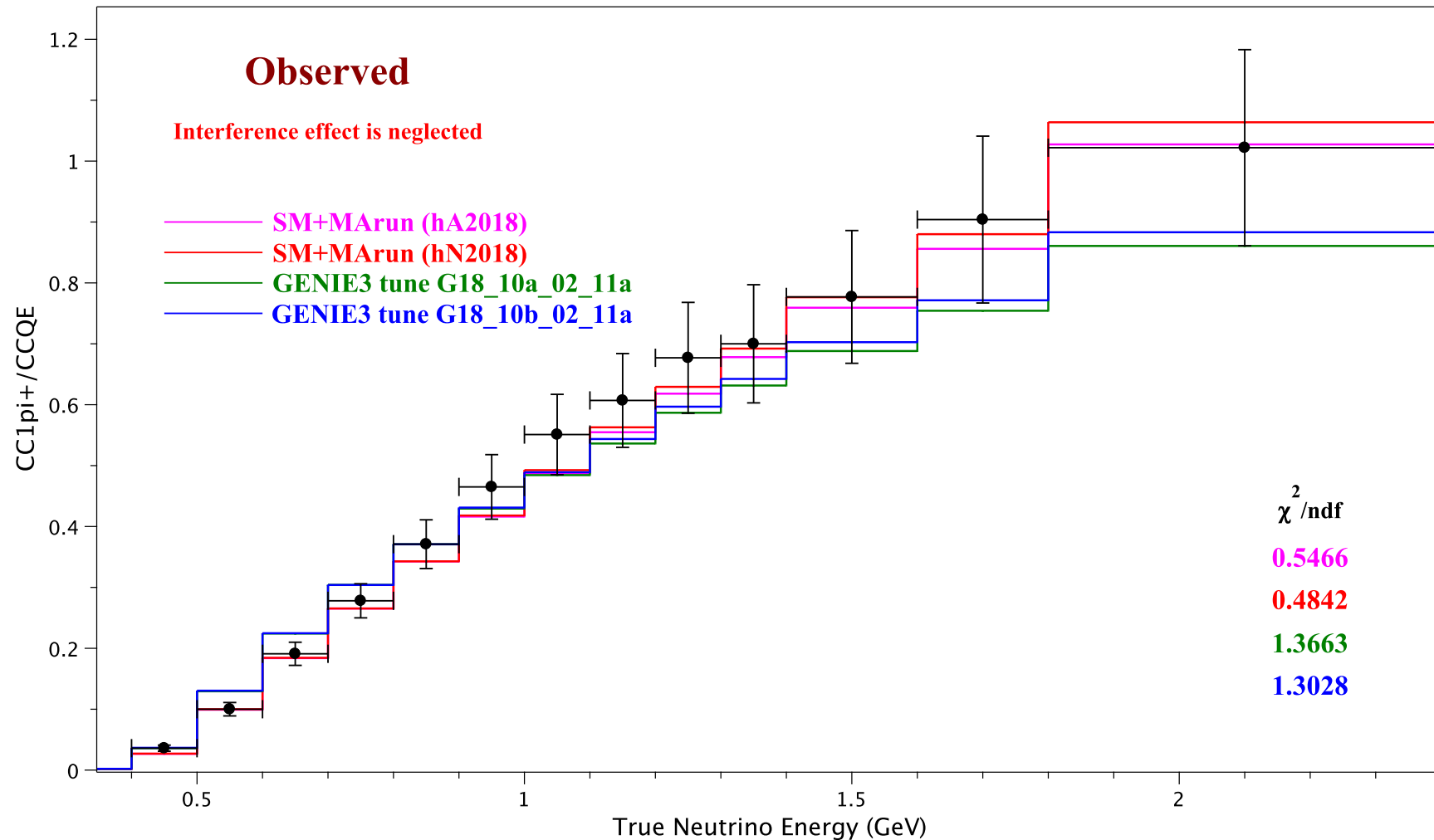




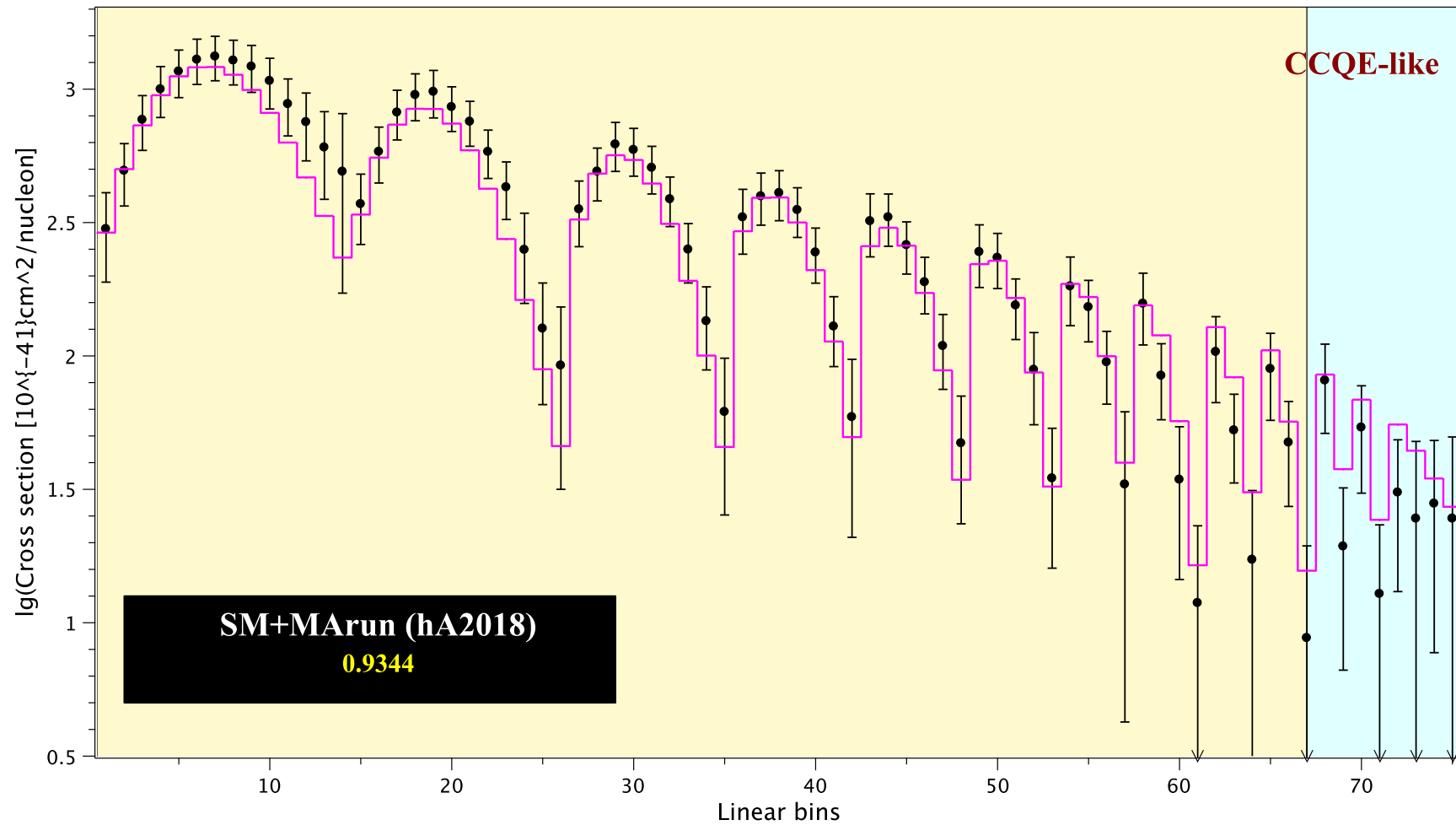
# Comparison with MiniBooNE $\nu_\mu$ data target Carbon



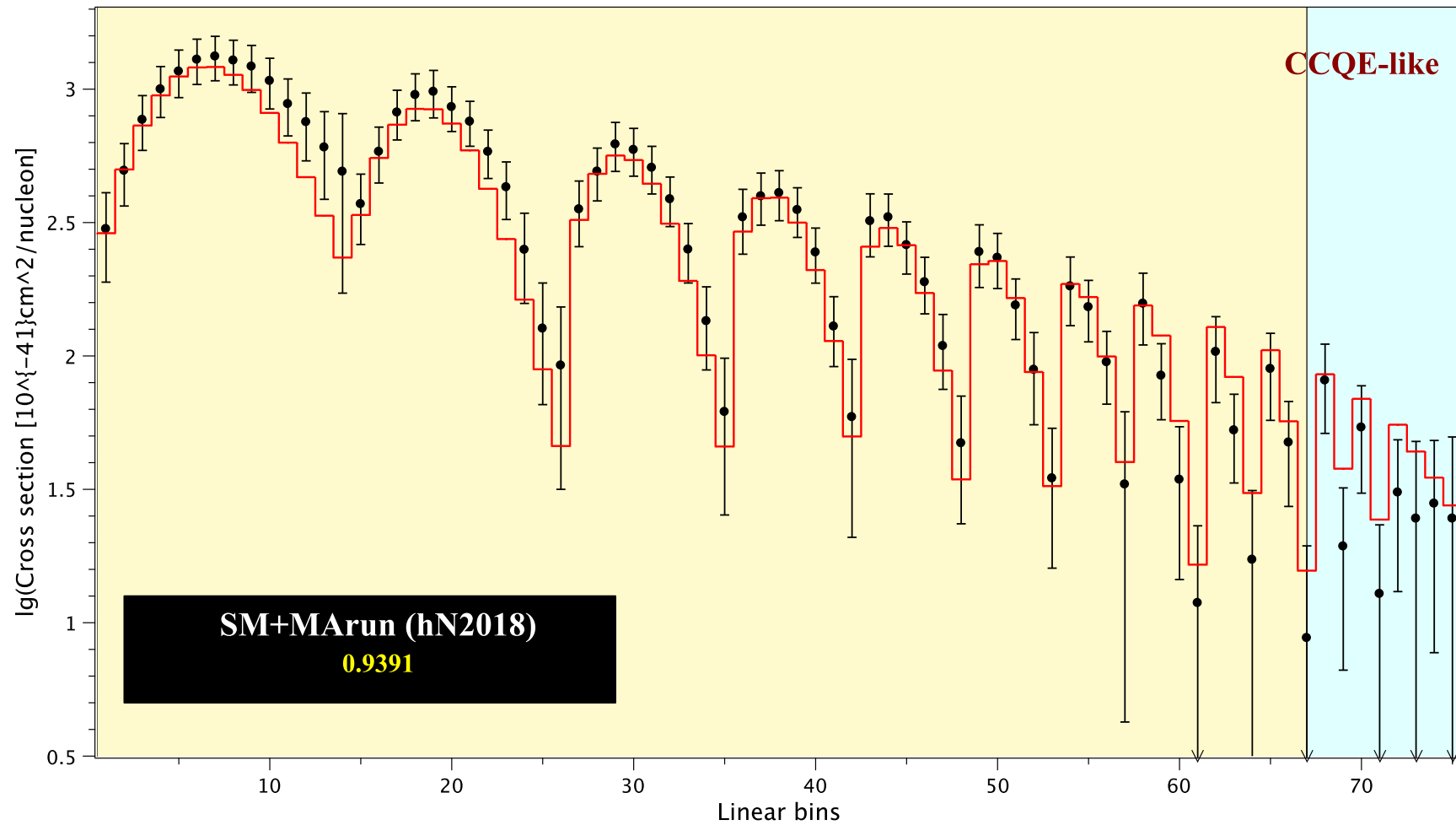
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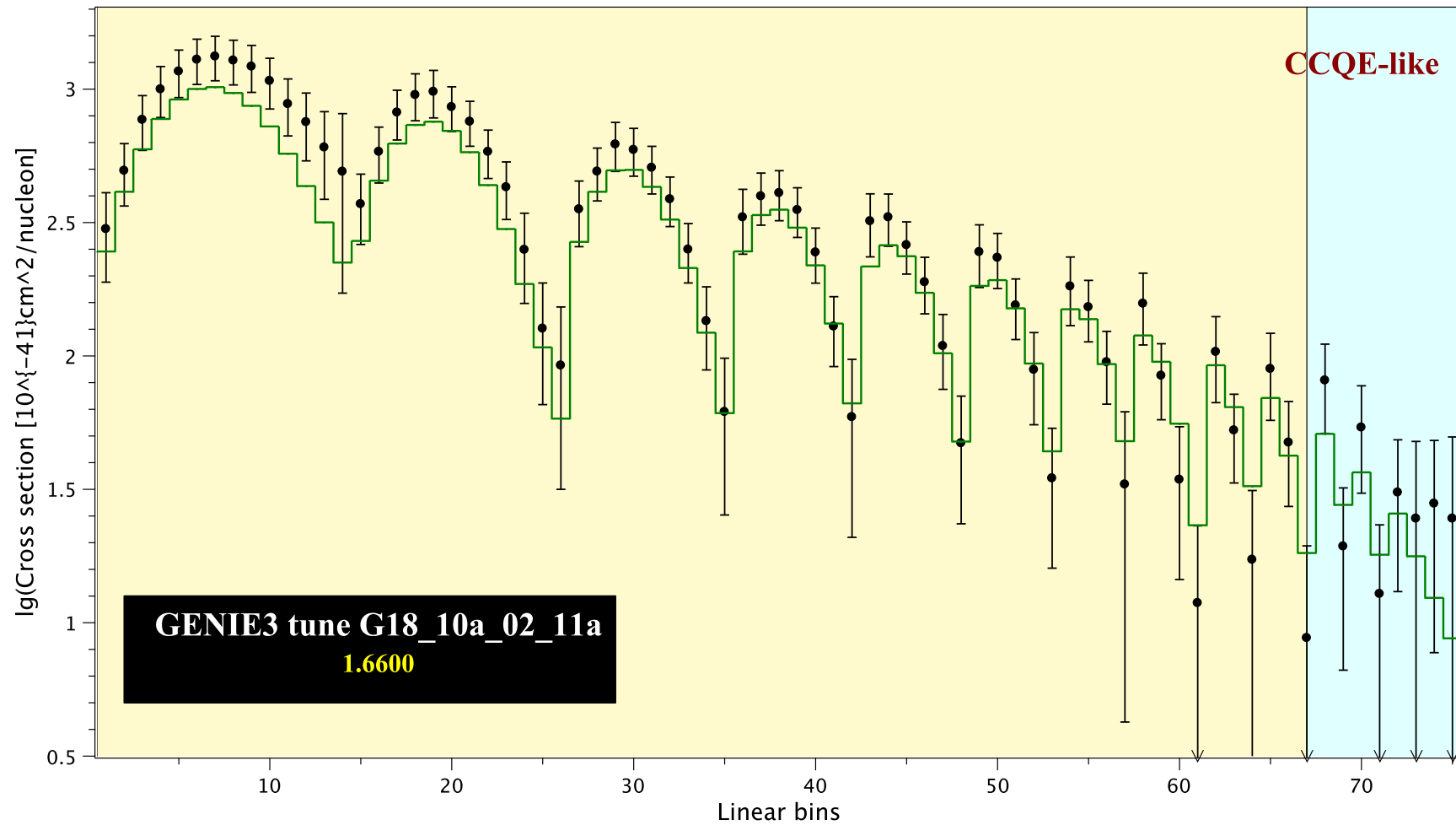
# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target Carbon



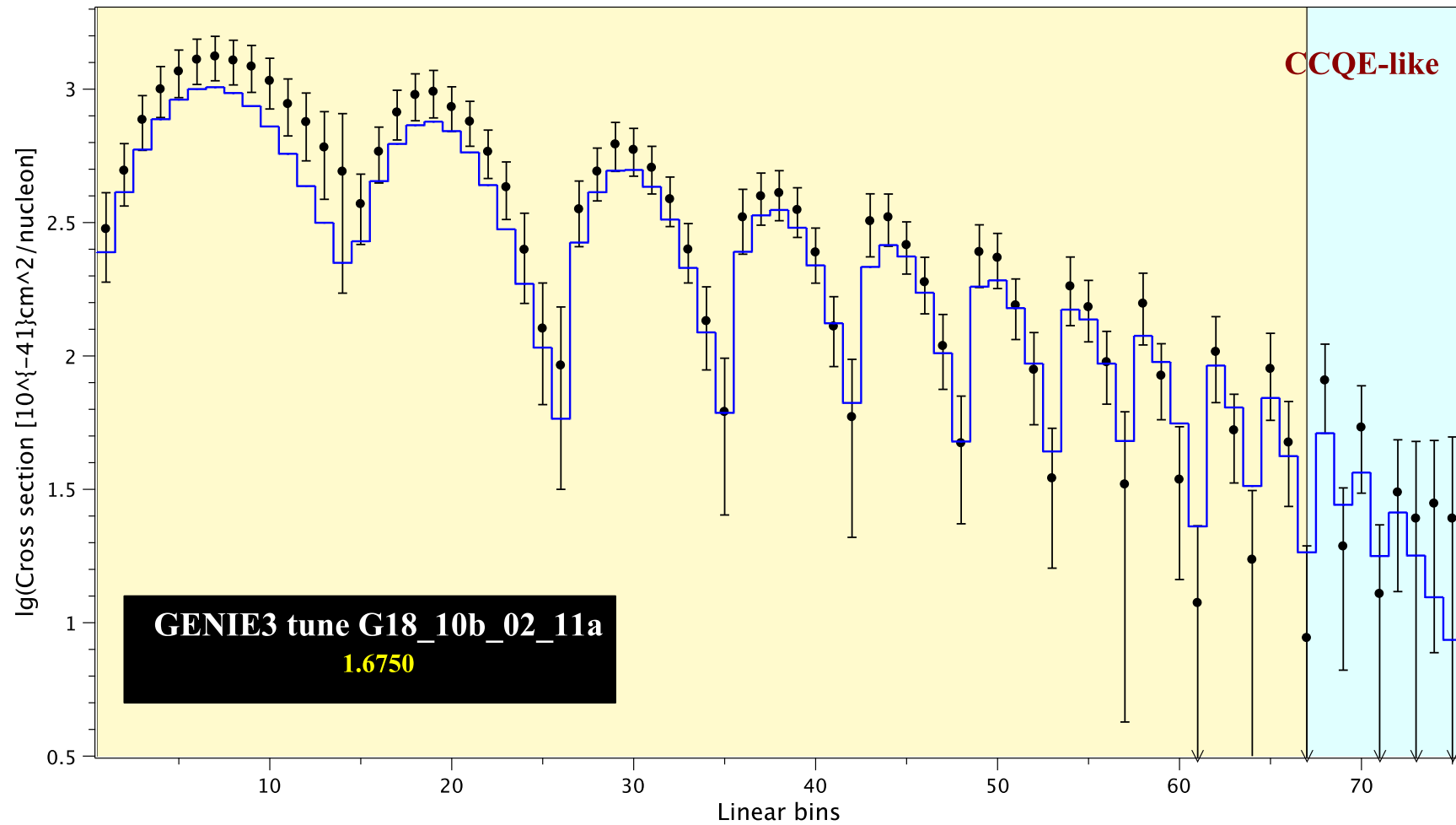
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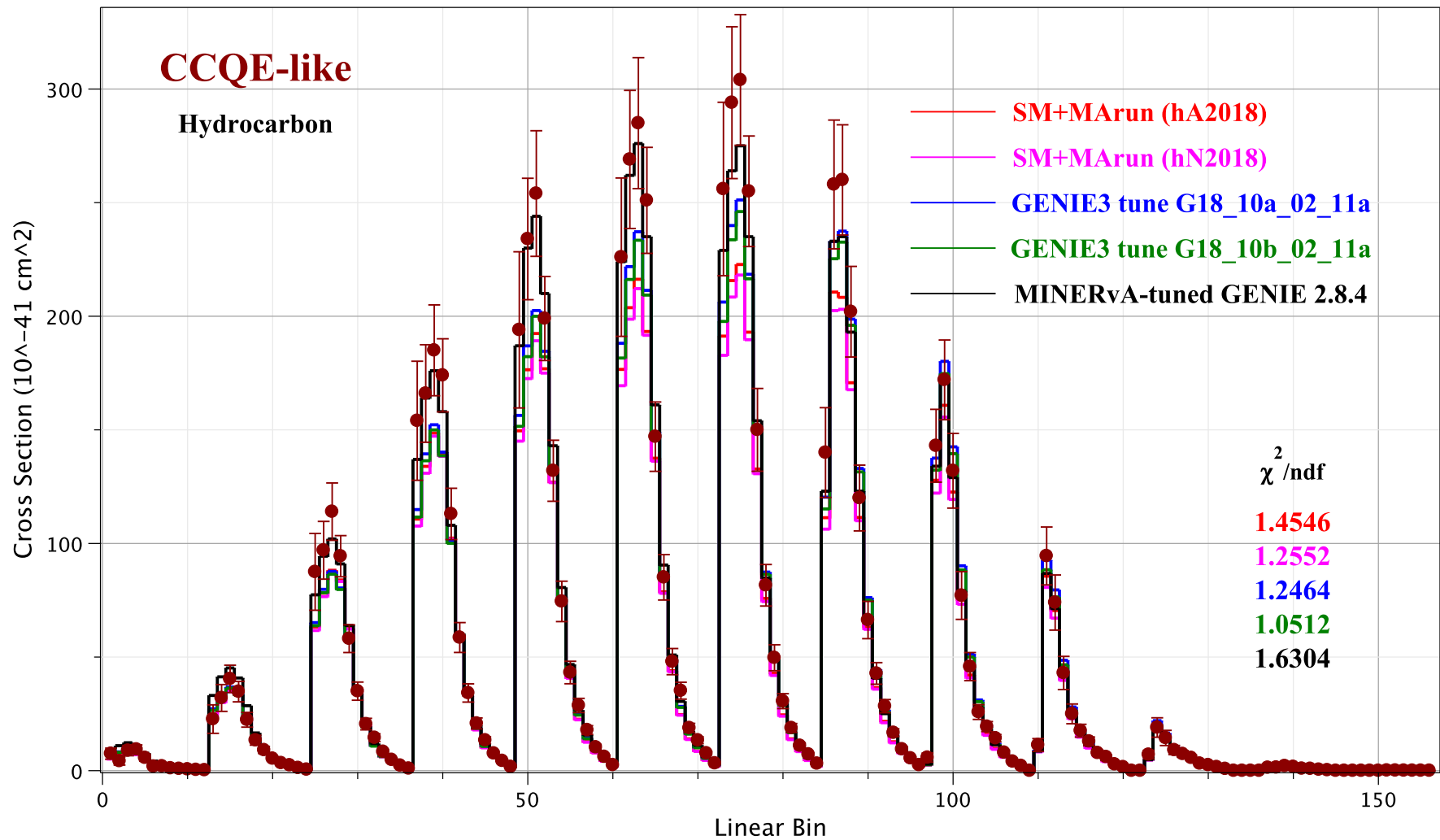
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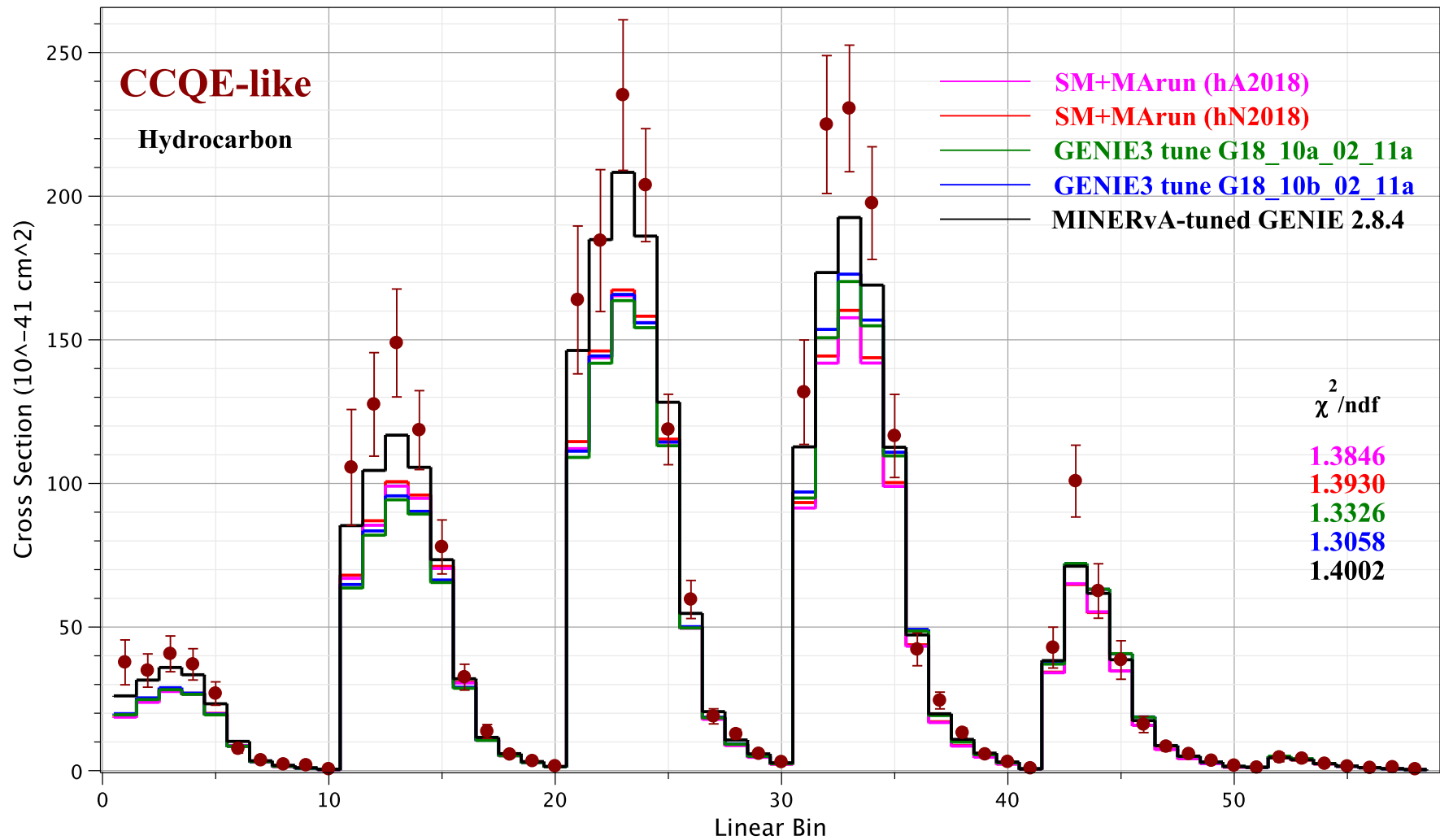
# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target Carbon



# Comparison with MINERvA $\nu_\mu$ data

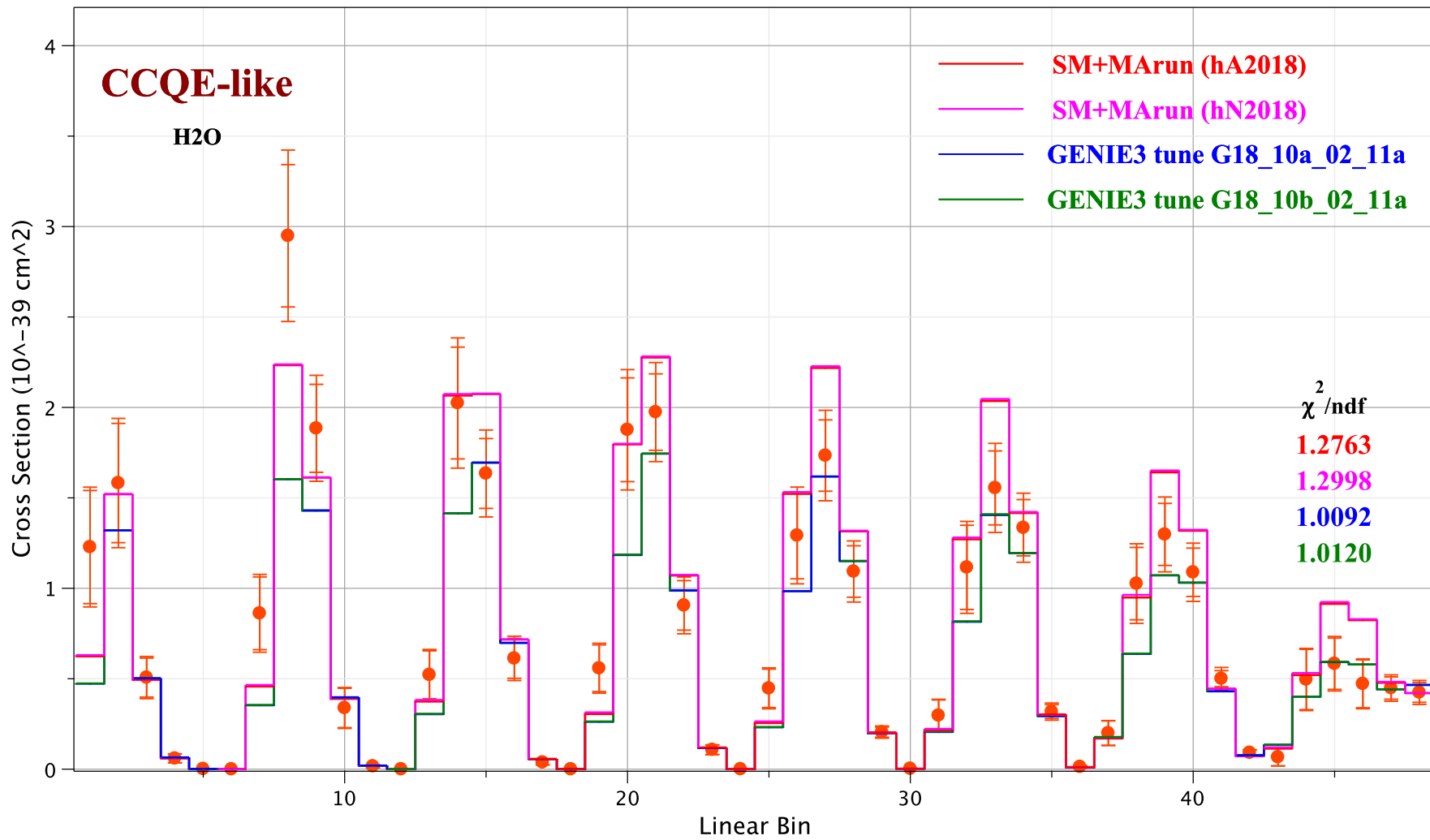


# Comparison with MINERvA $\bar{\nu}_\mu$ data

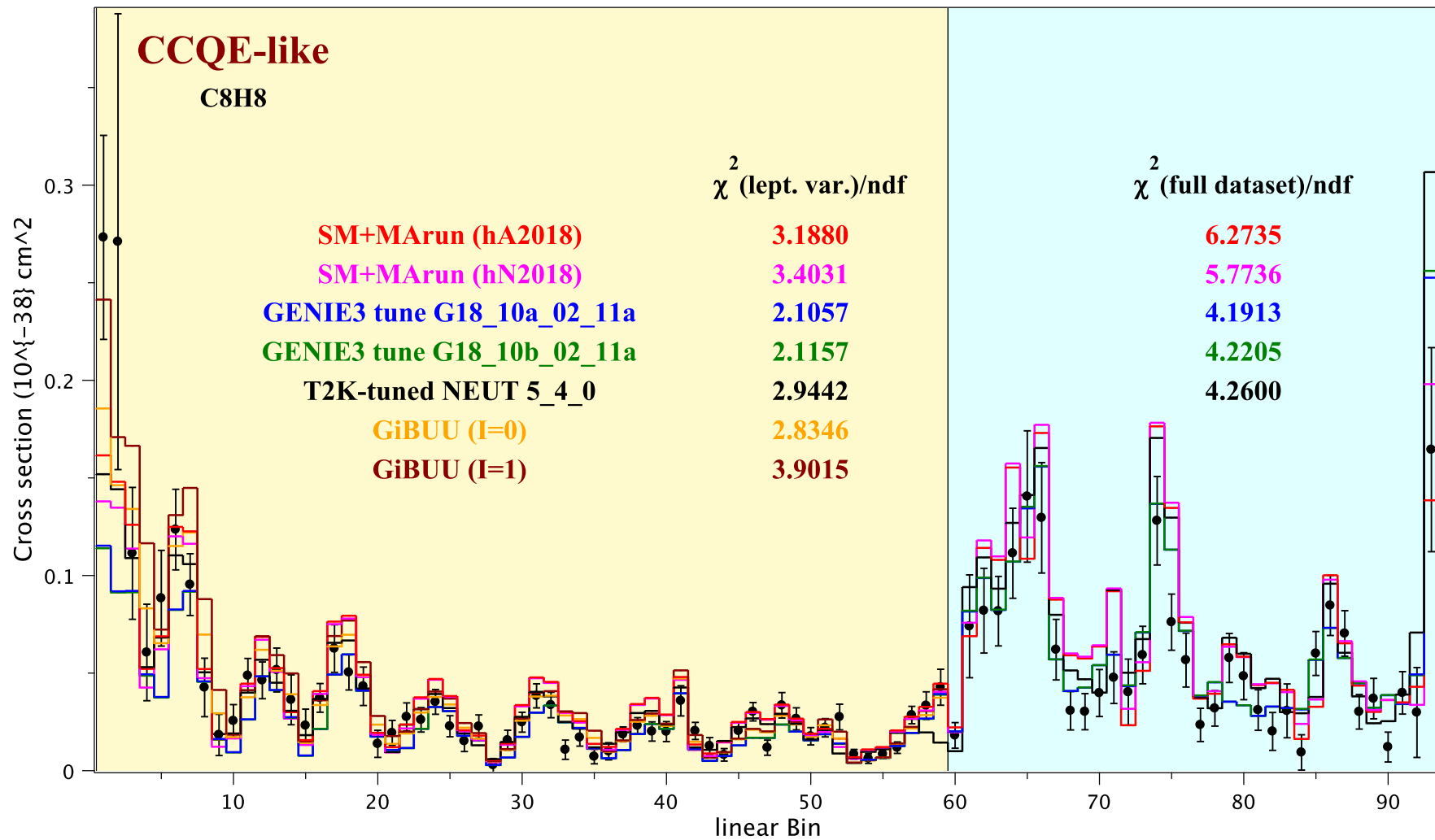




# Comparison with T2K $\nu_\mu$ data



# Comparison with T2K $\nu_\mu$ data



# Conclusions

We have compared the JINR-model with almost all modern accelerator experiments. It is impossible to show all results, so we have presented only a few selected (mainly 2D) examples. The other comparisons (eg with true CCQE data) can be found in backup slides.

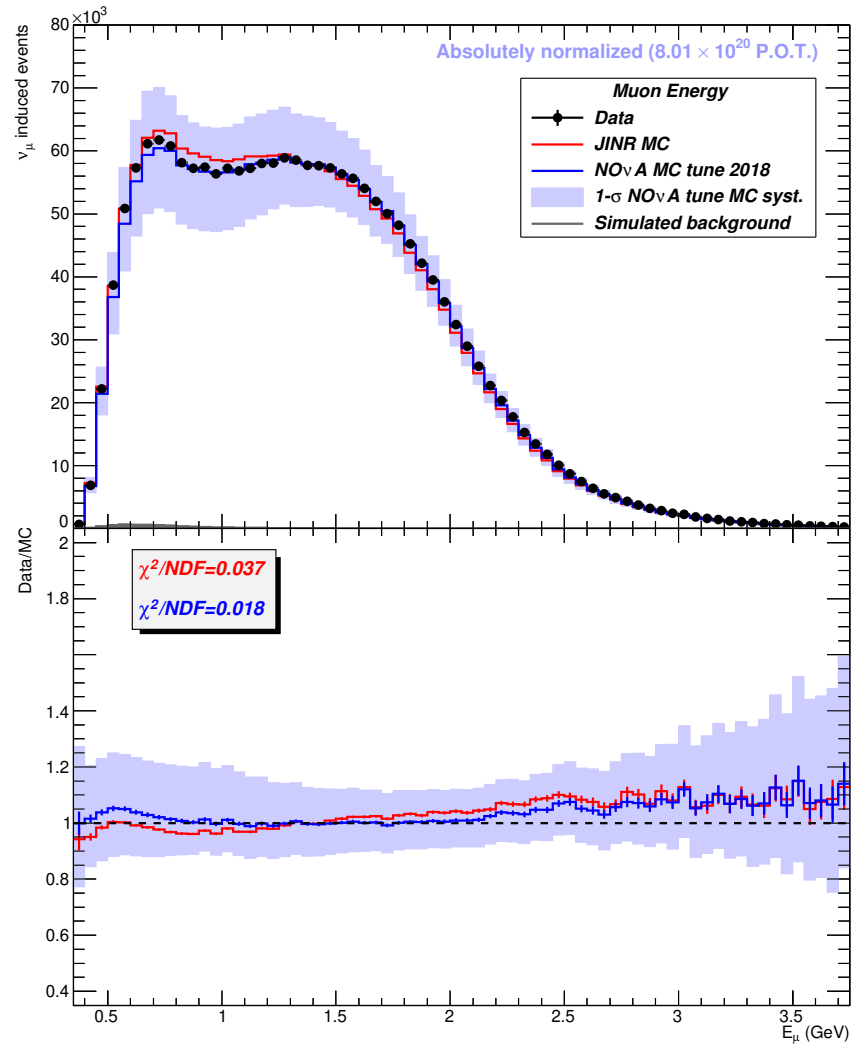
The main findings are as follows:

- The JINR-model describes MiniBooNE data very well.
- The MINER $\nu$ A and T2K(H<sub>2</sub>O) data are in good agreement with JINR-model prediction.
- The description of T2K(C<sub>8</sub>H<sub>8</sub>) by the model is so-so. But all other models (including T2K-tuned NEUT) exhibit similar problem.

# Backup

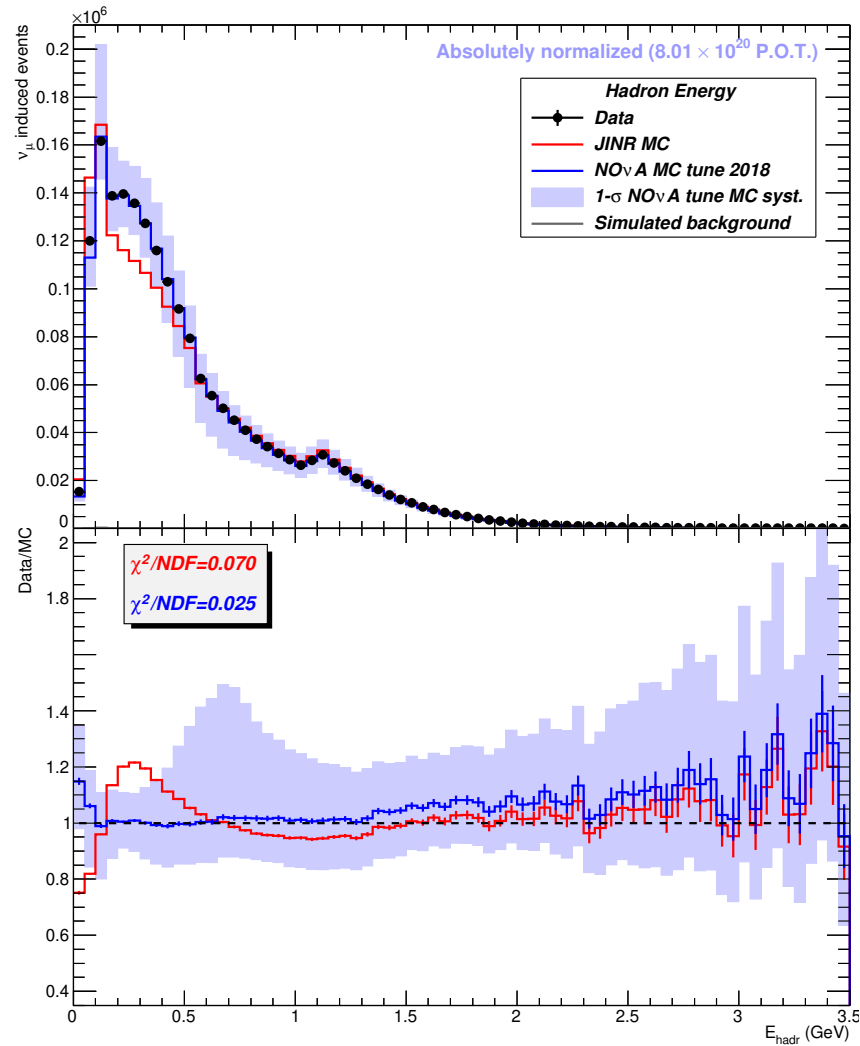
# ND data comparison (FHC mode)

Muon energy



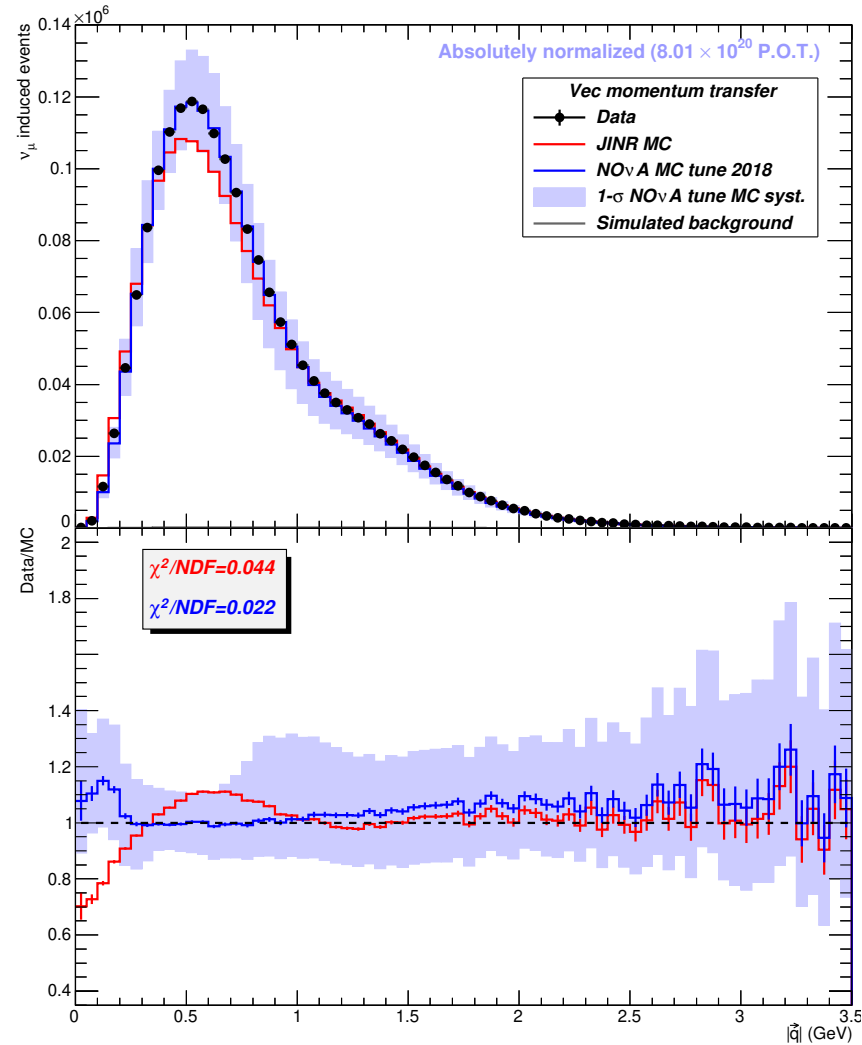
# ND data comparison (FHC mode)

Hadron energy



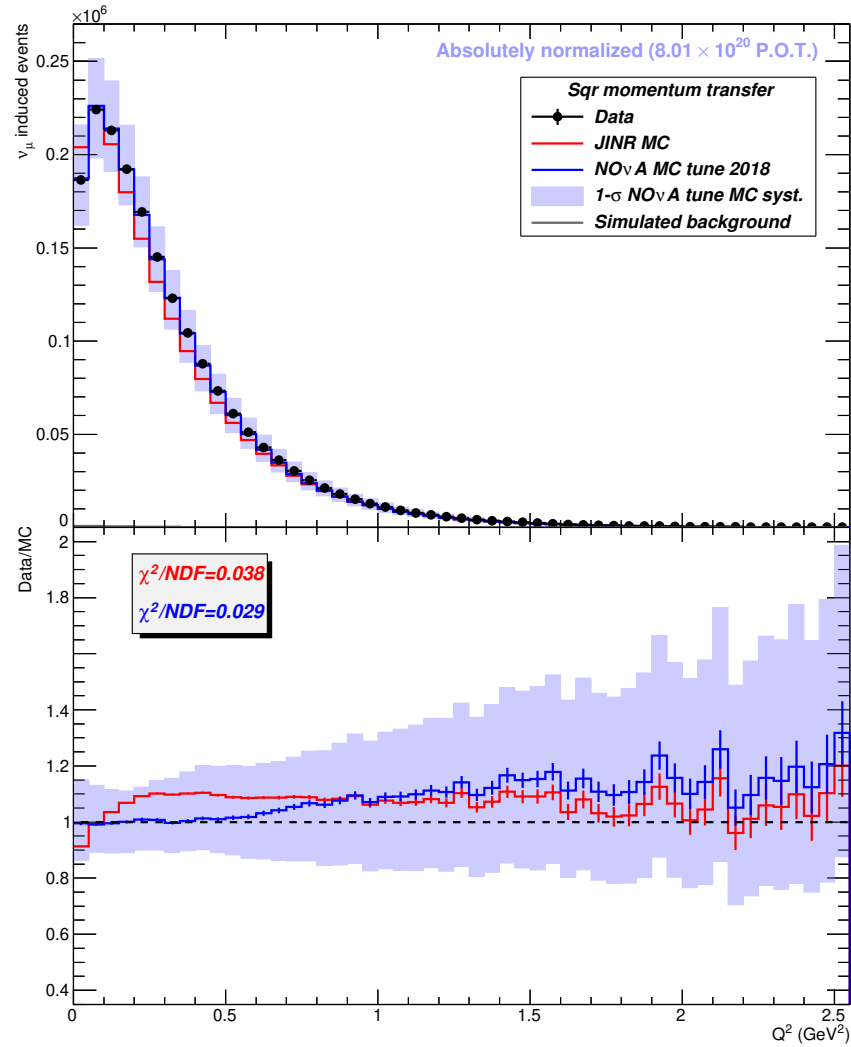
# ND data comparison (FHC mode)

Module of 3-momentum transfer



# ND data comparison (FHC mode)

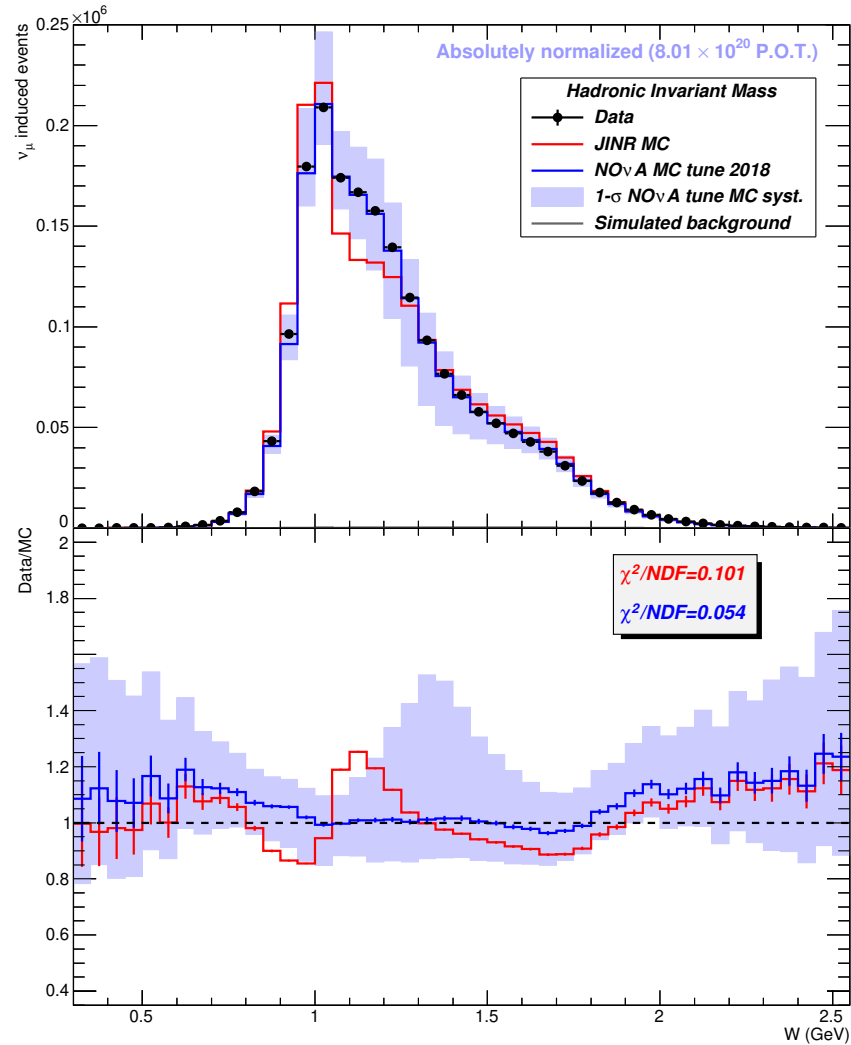
4-momentum transfer squared





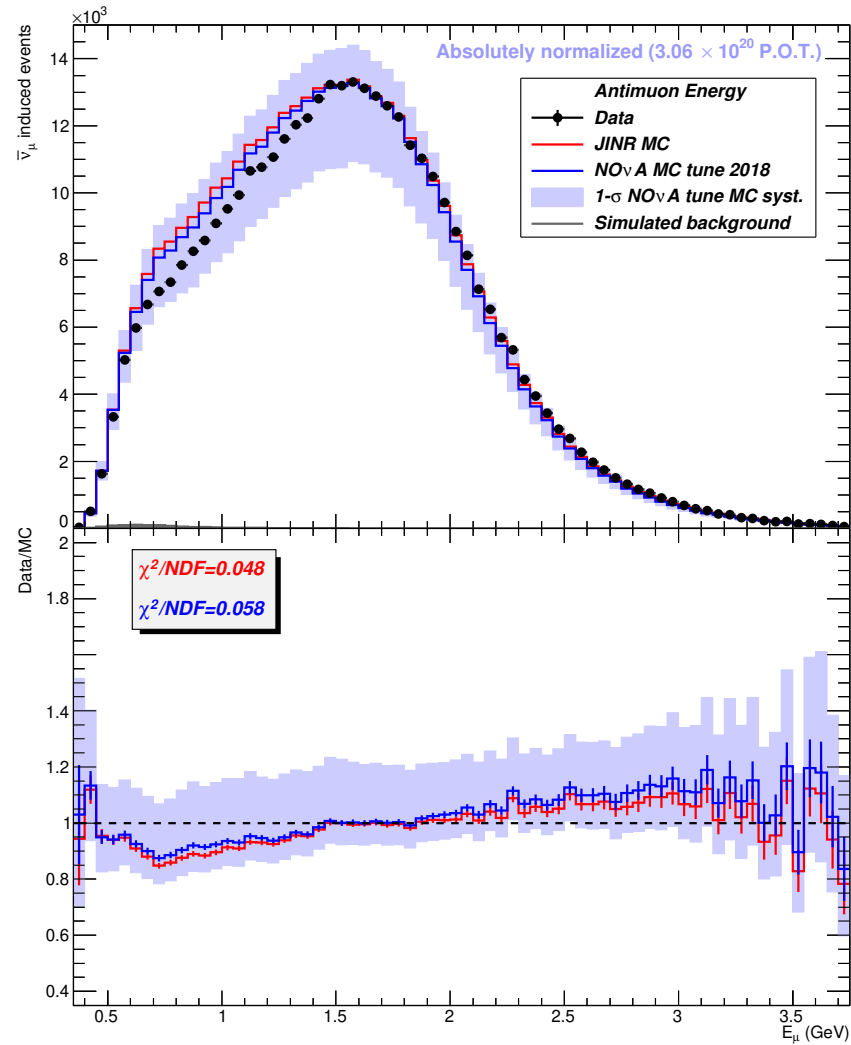
# ND data comparison (FHC mode)

## Invariant hadron mass



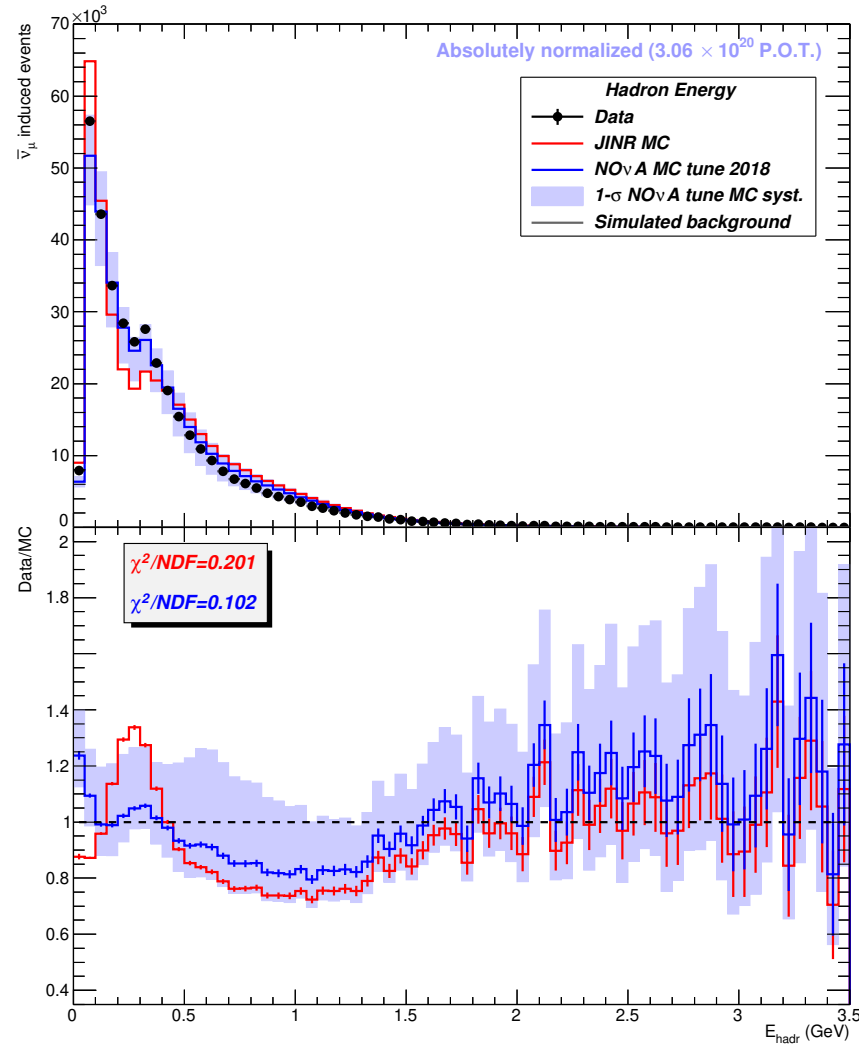
# ND data comparison (RHC mode)

Antimuon energy



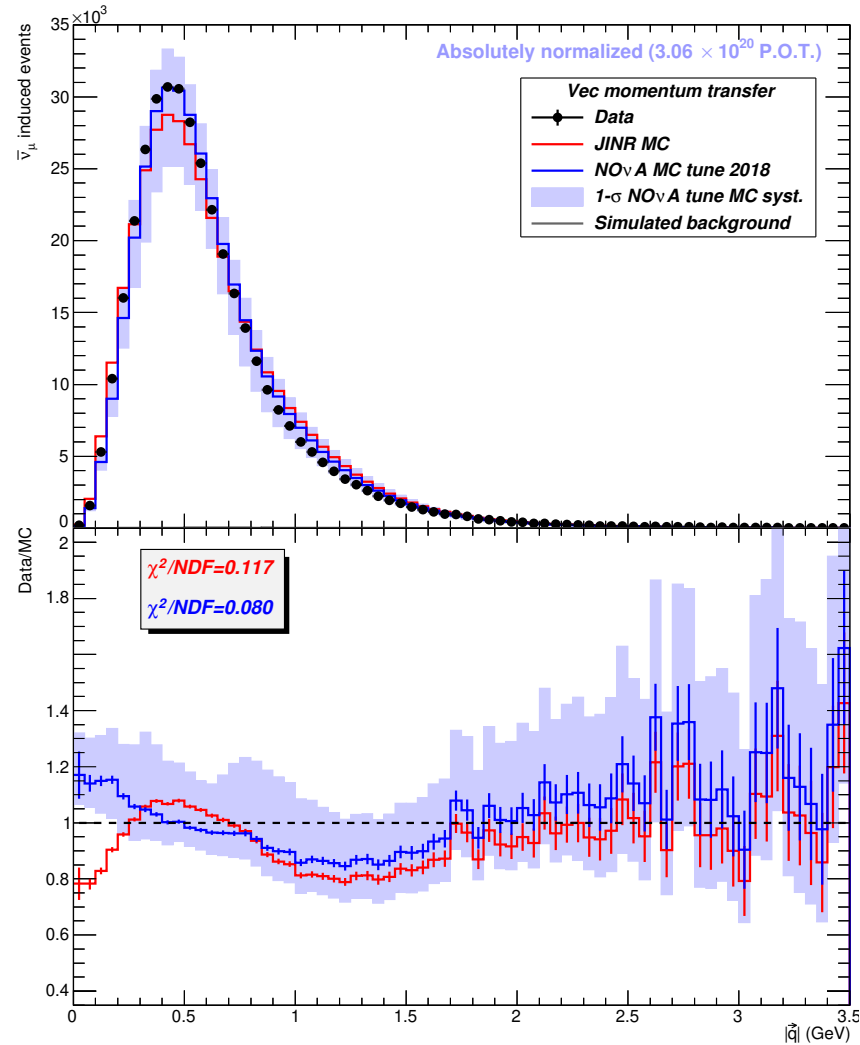
# ND data comparison (RHC mode)

Hadron energy



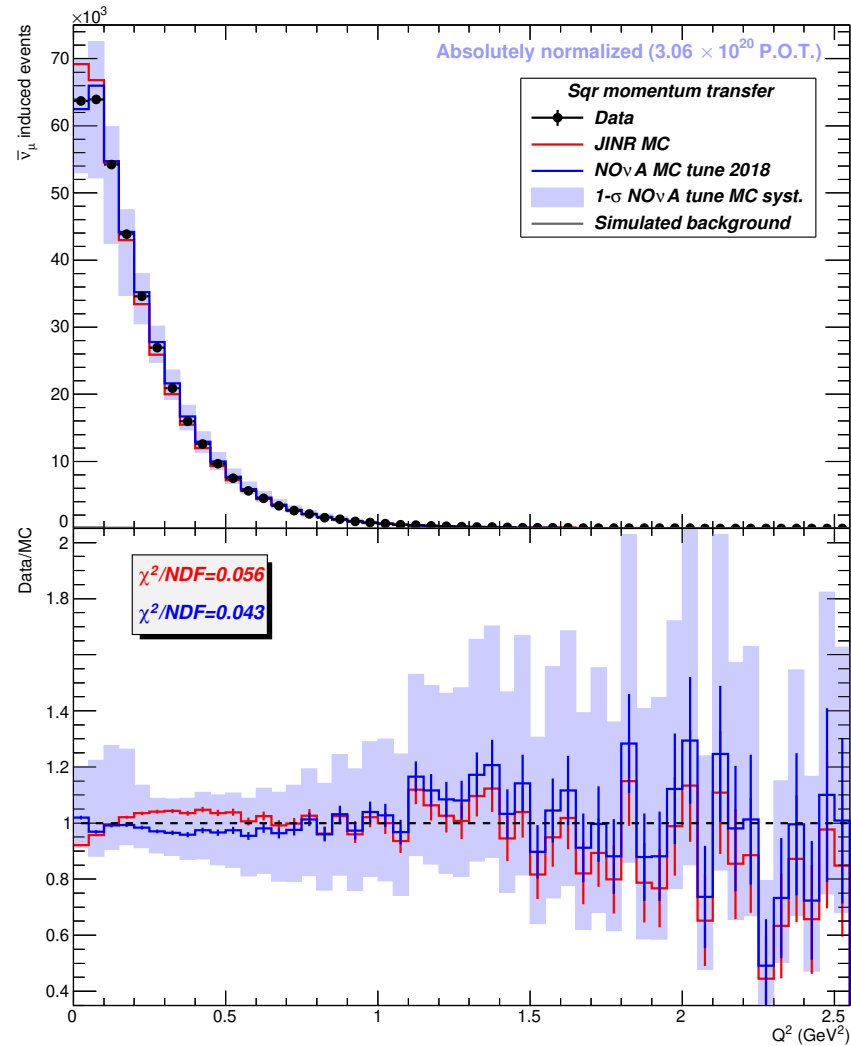
# ND data comparison (RHC mode)

Module of 3-momentum transfer



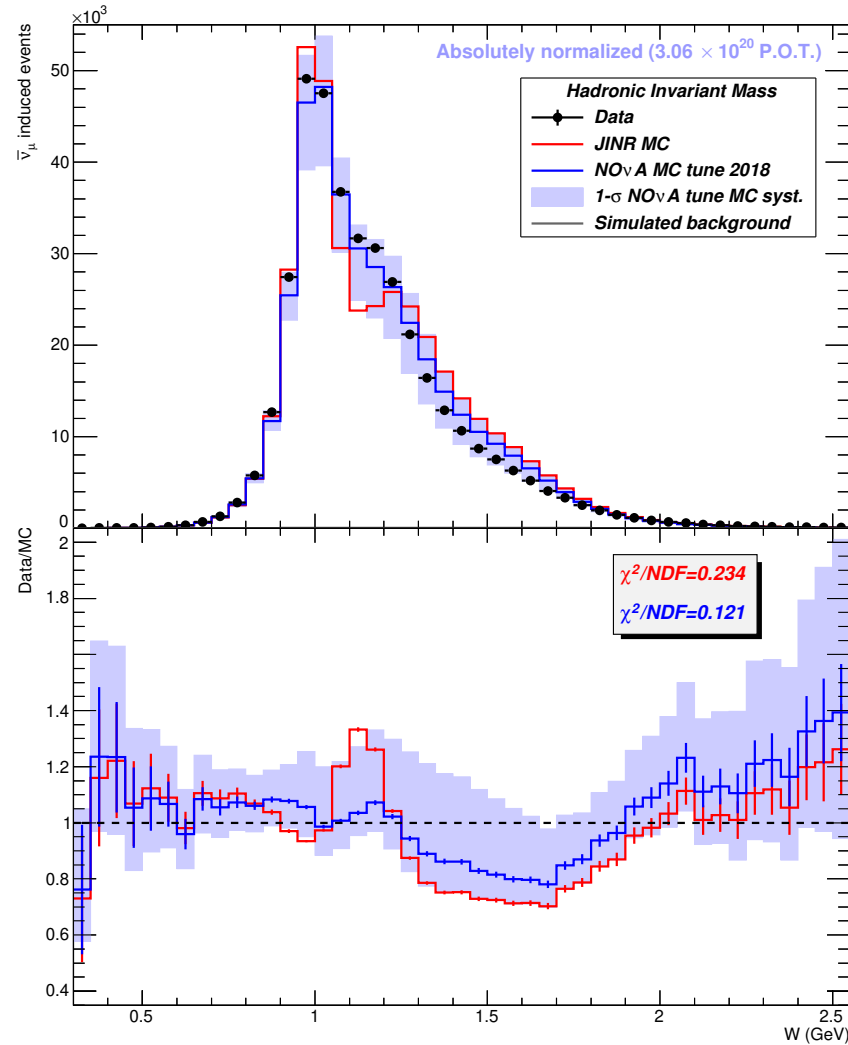
# ND data comparison (RHC mode)

4-momentum transfer squared

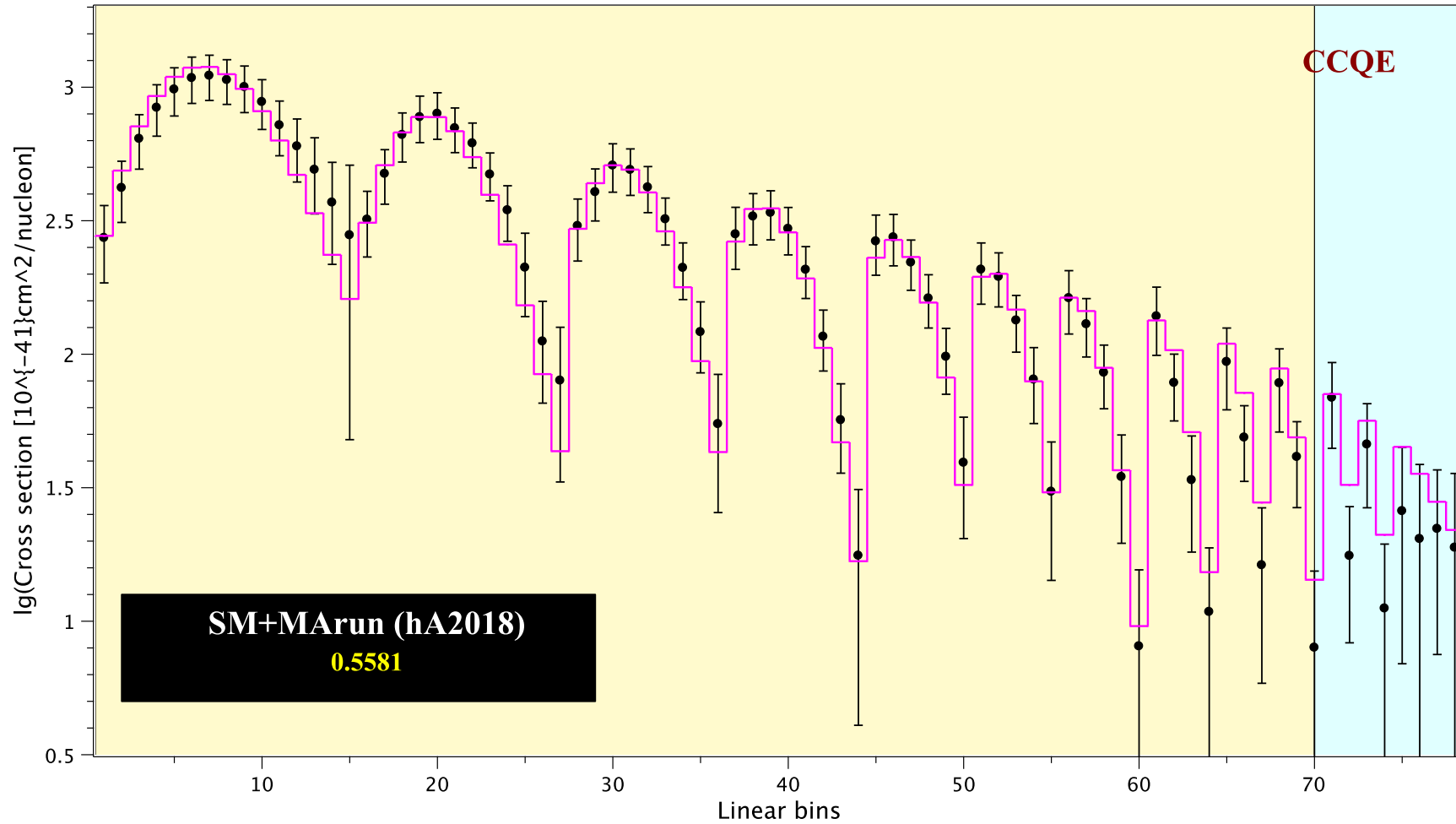


# ND data comparison (RHC mode)

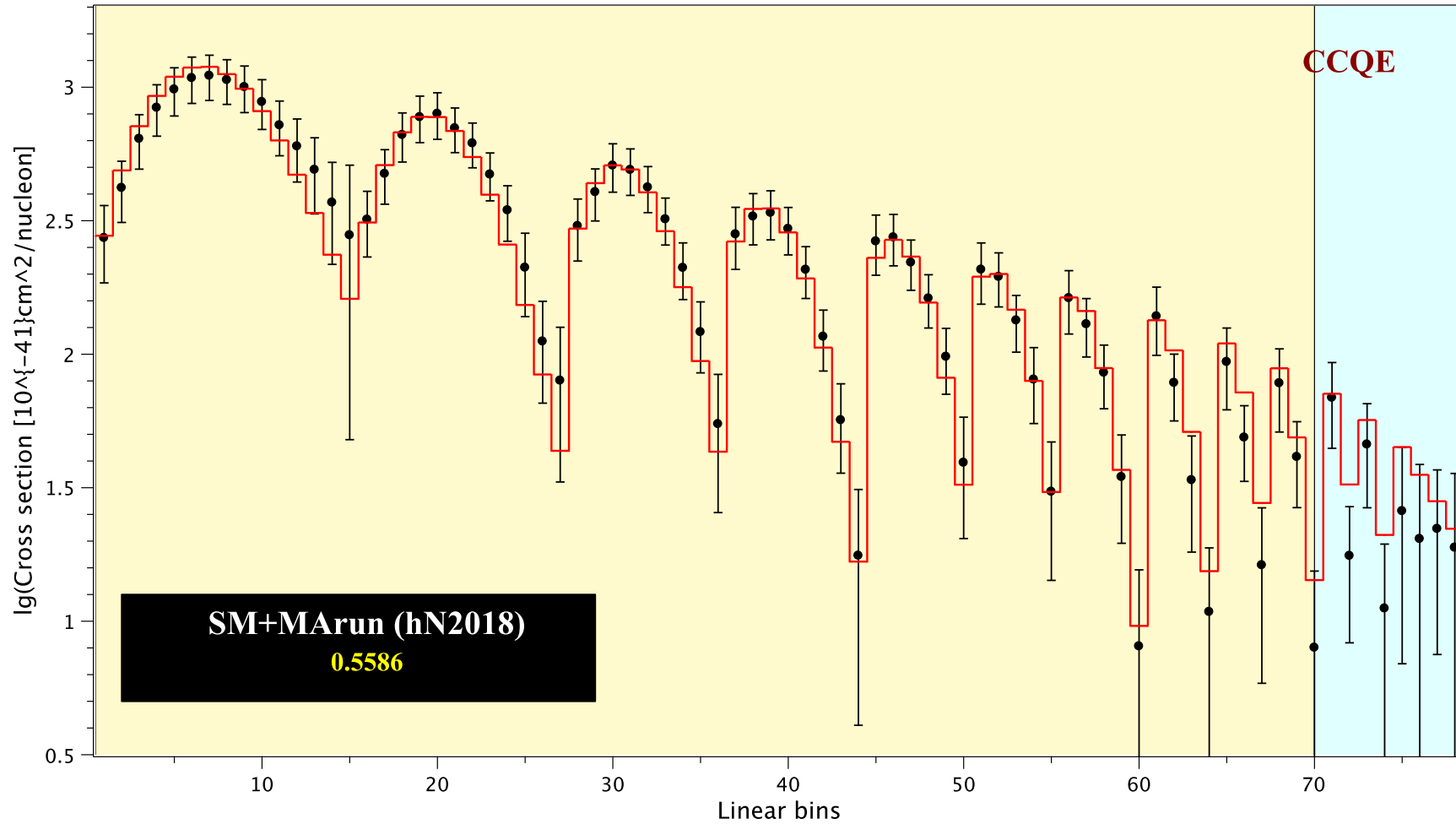
Invariant hadron mass



# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target $^{12}\text{C}$

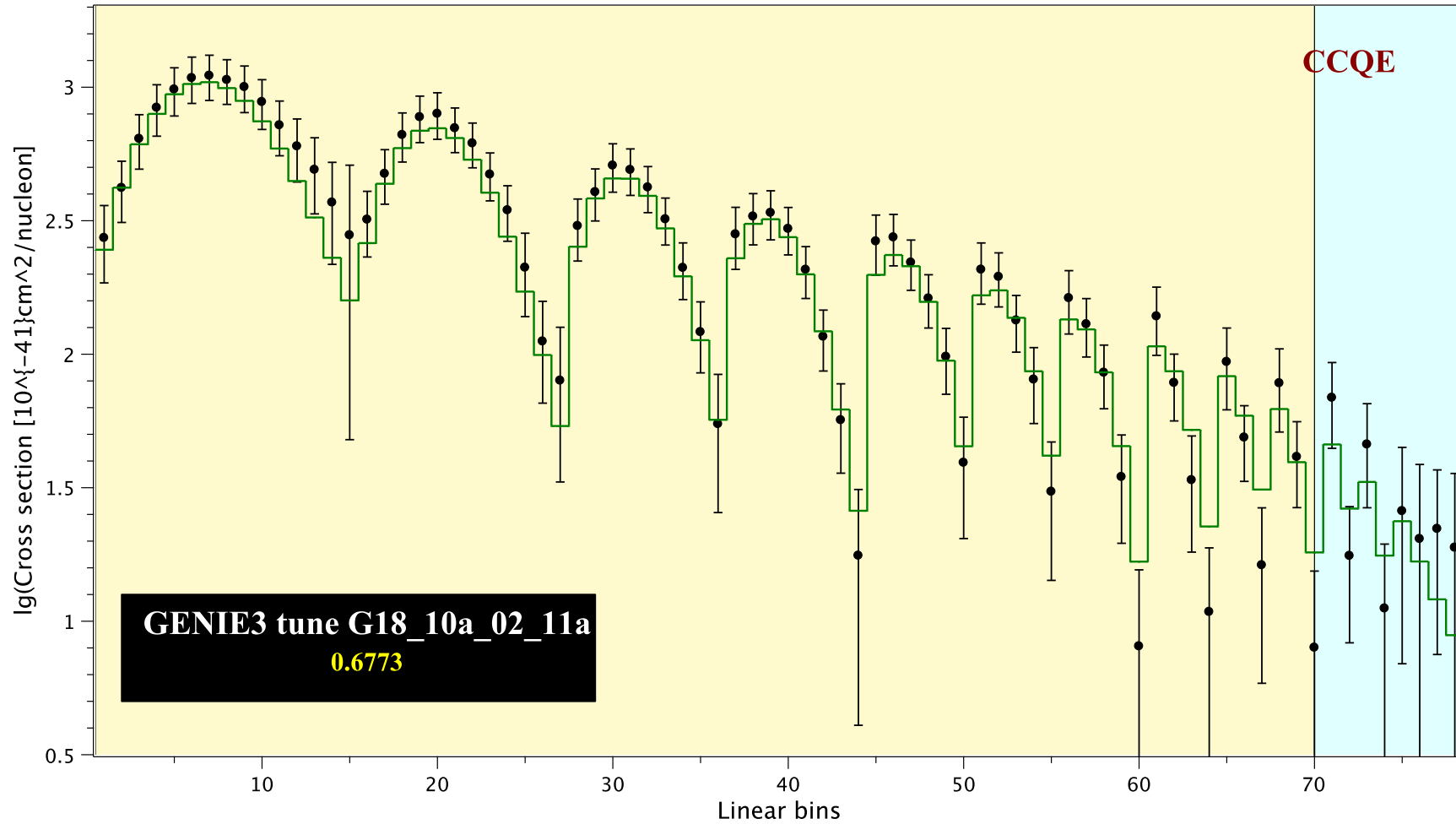


# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target $^{12}\text{C}$

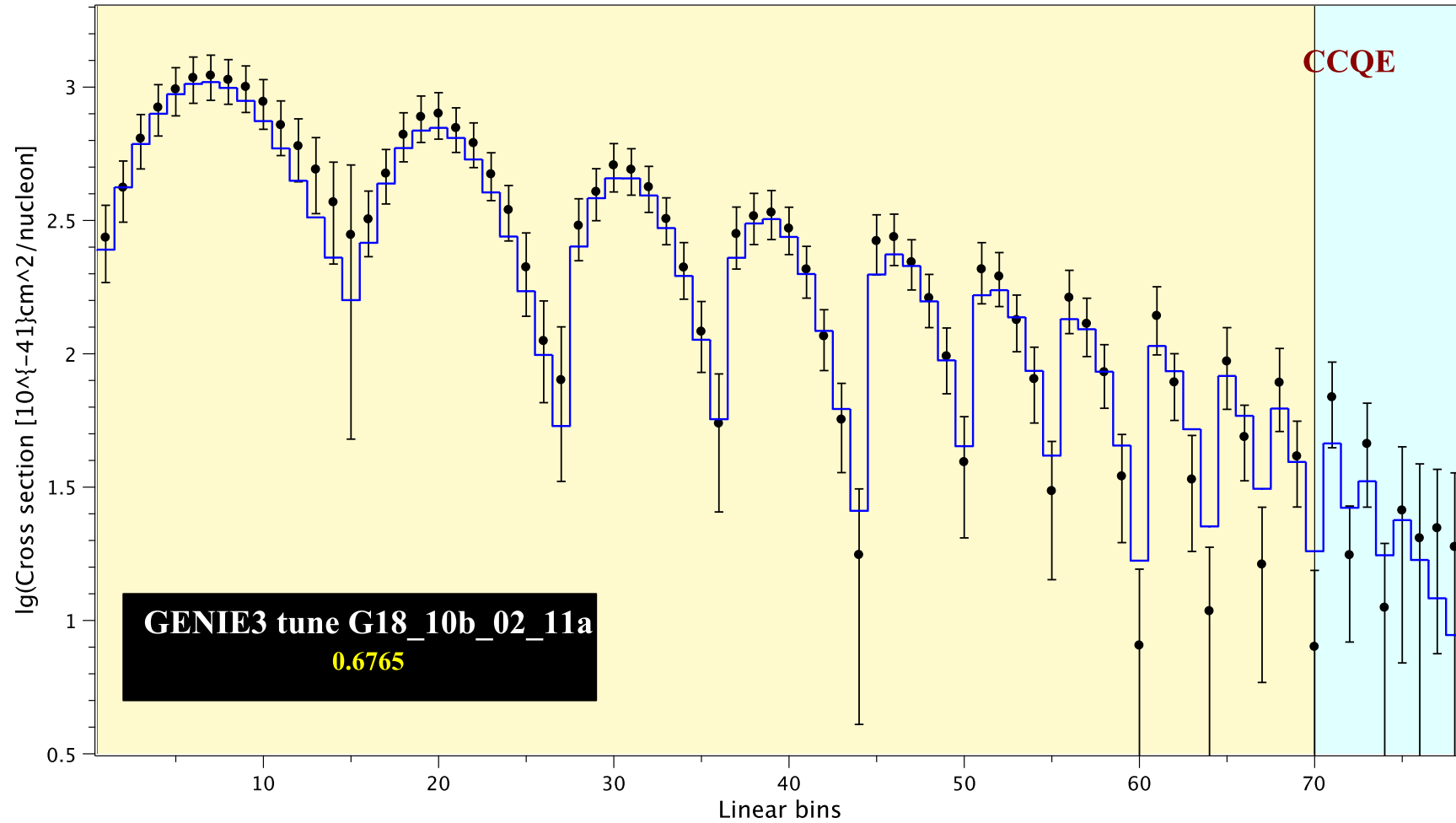




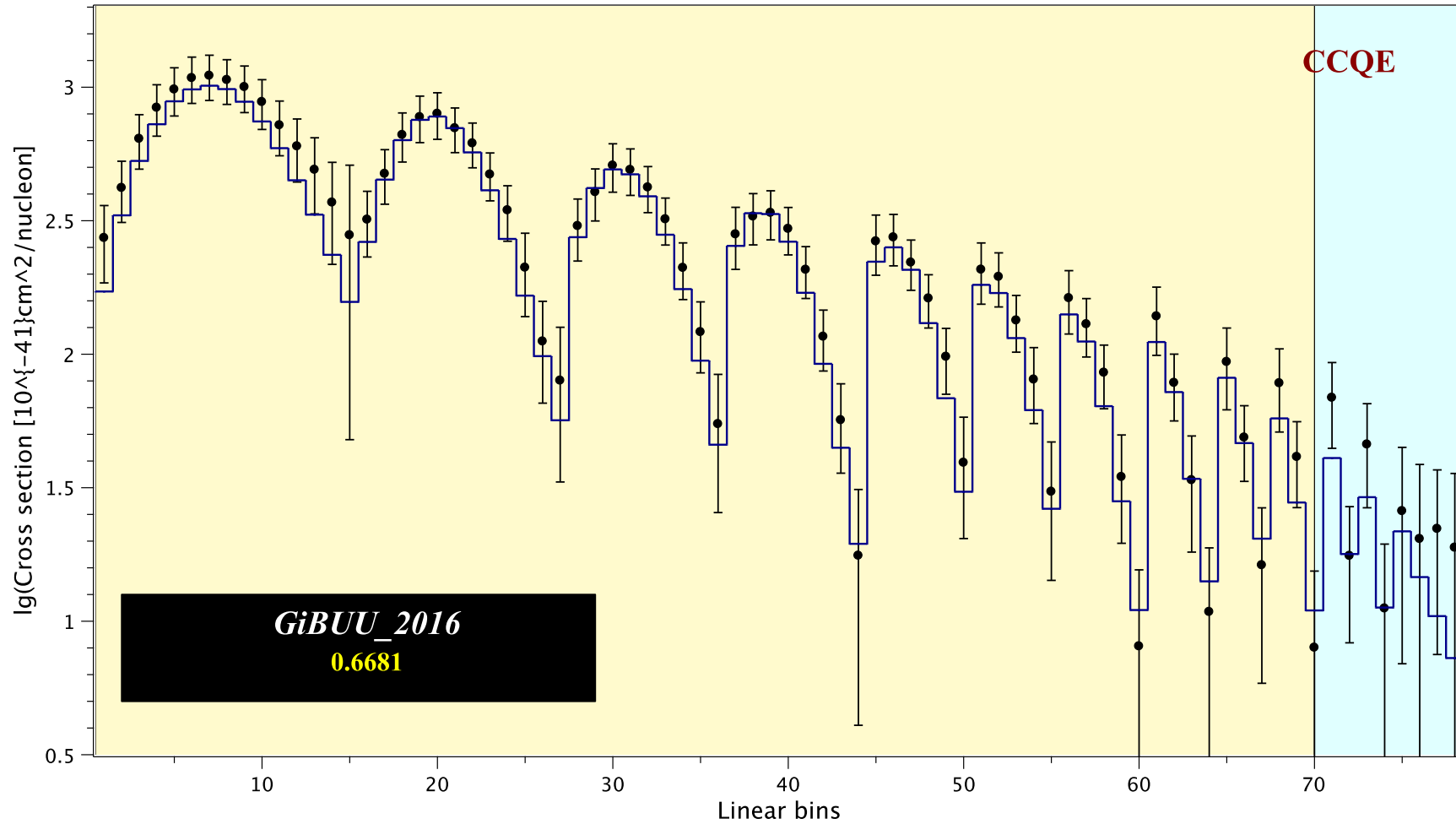
# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target $^{12}\text{C}$



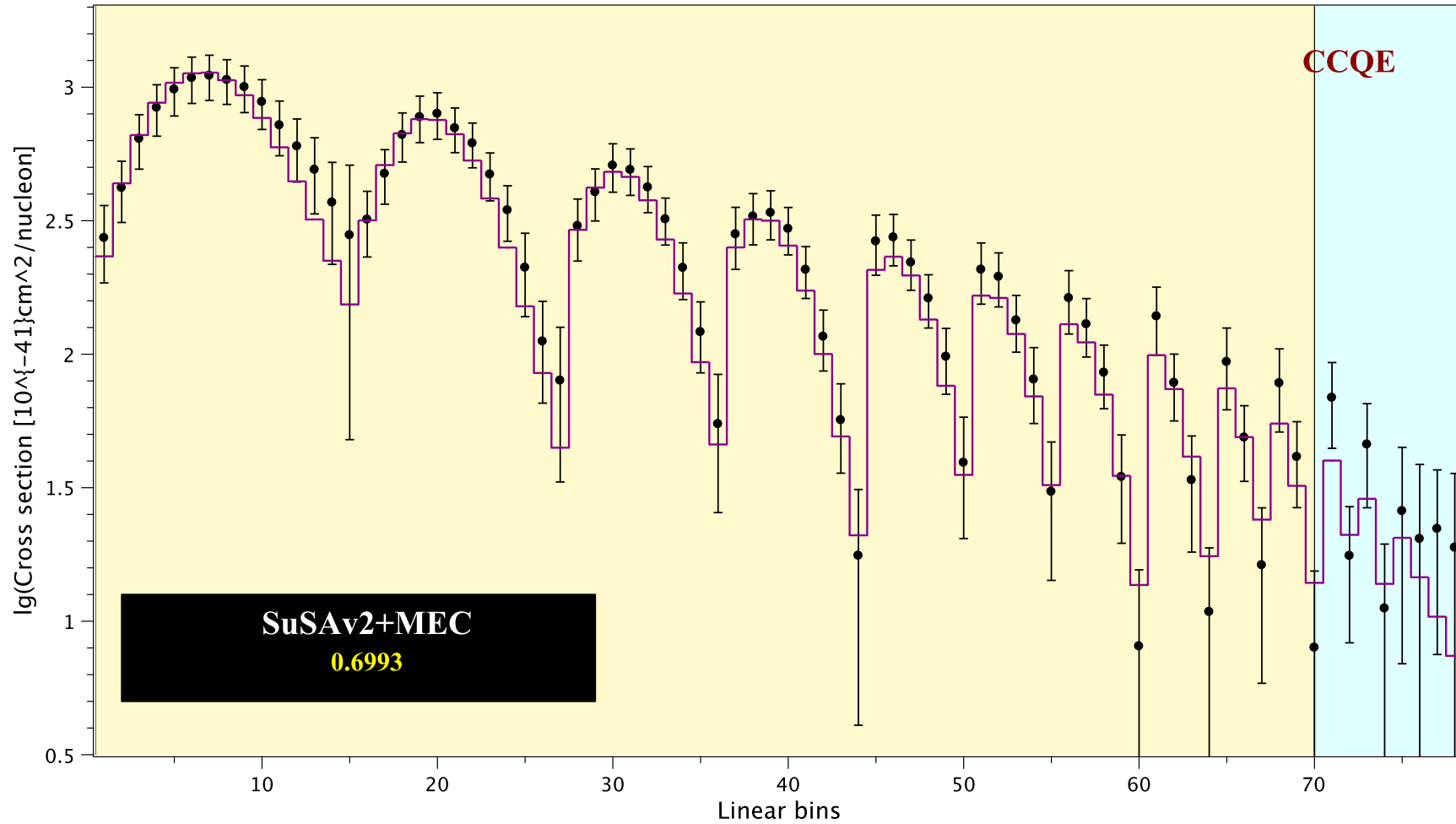
# Comparison with MiniBooNE $\bar{\nu}_\mu$ data target $^{12}\text{C}$



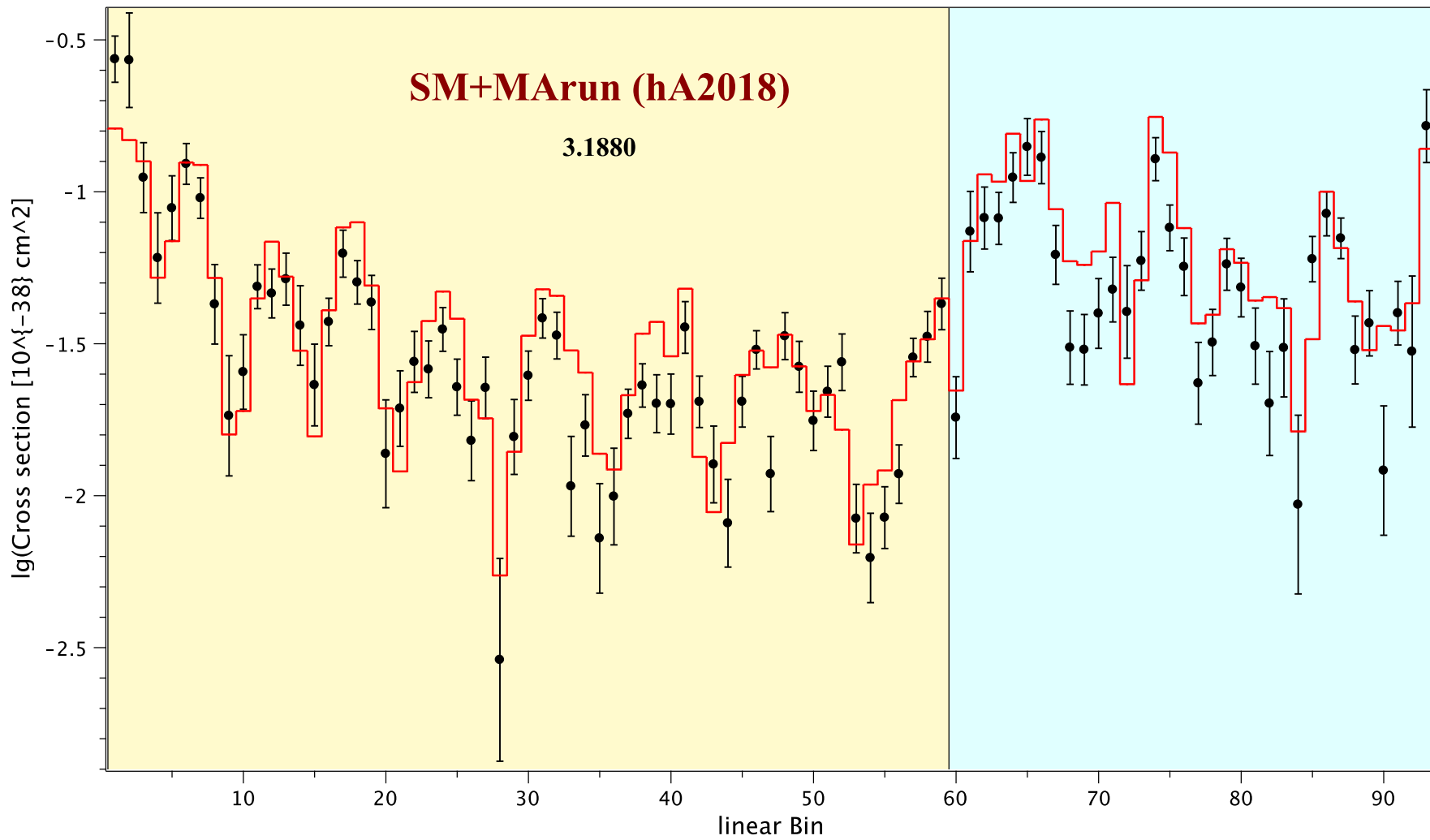
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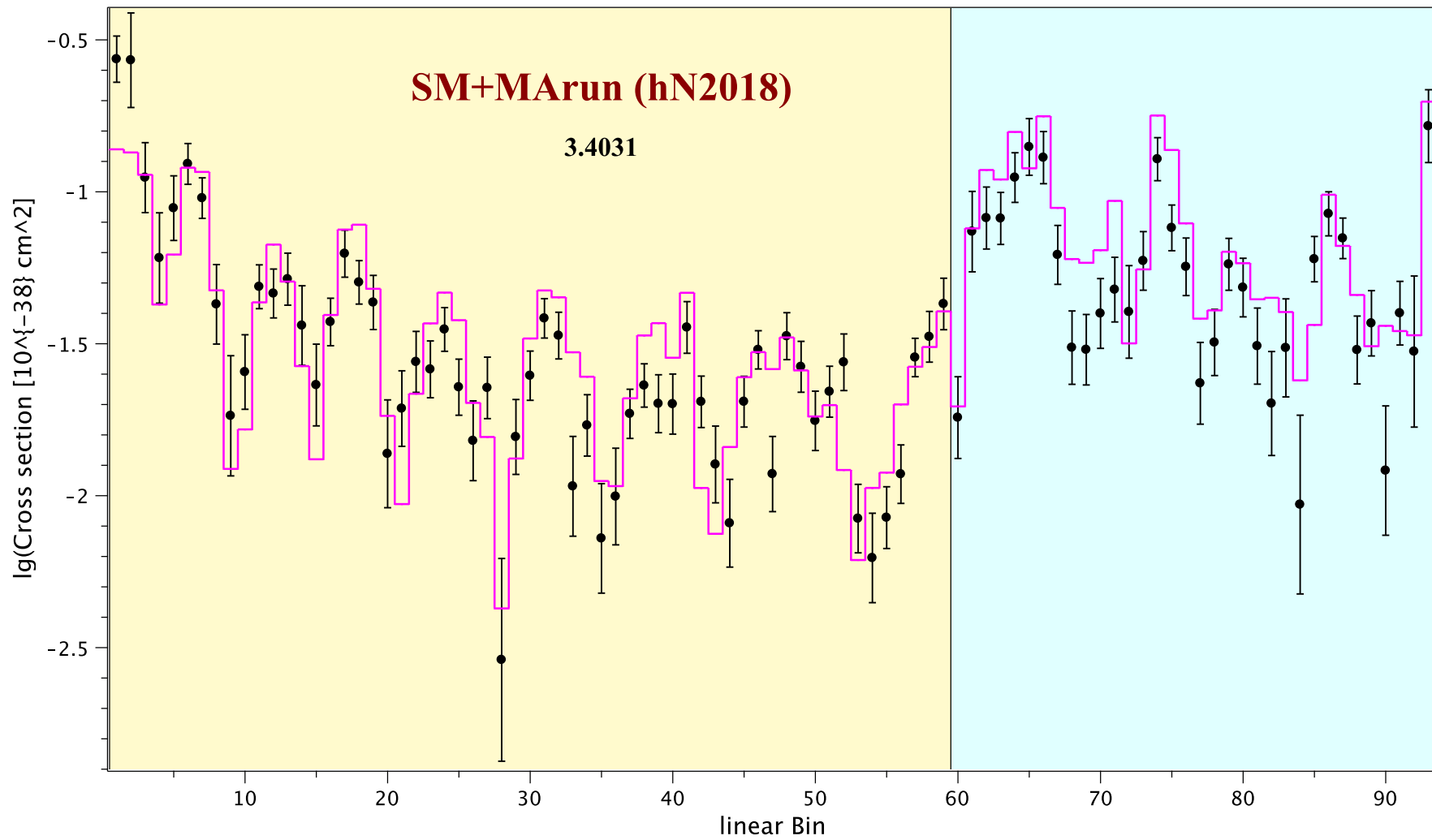
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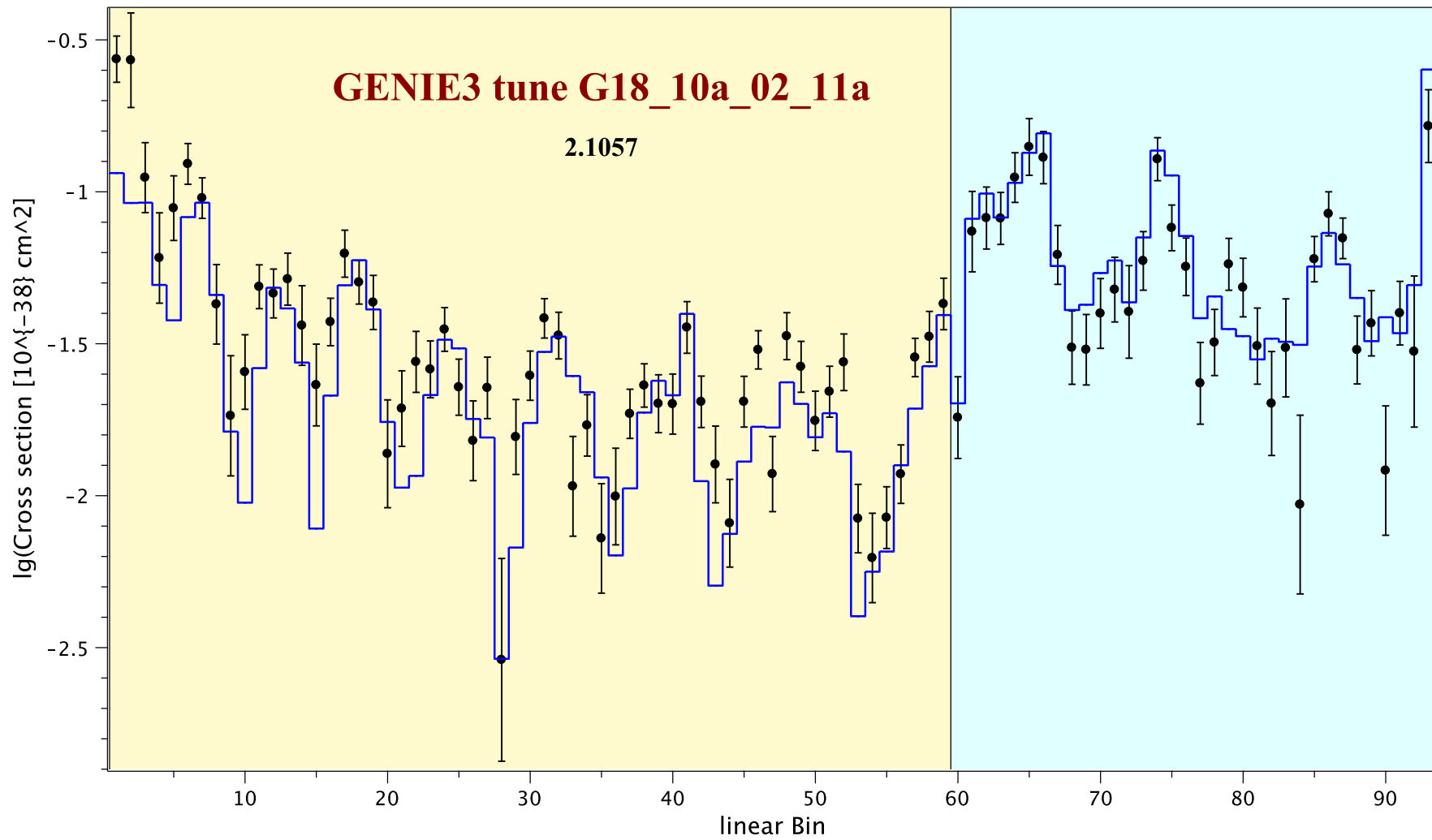
# Comparison with T2K $\nu_\mu$ data



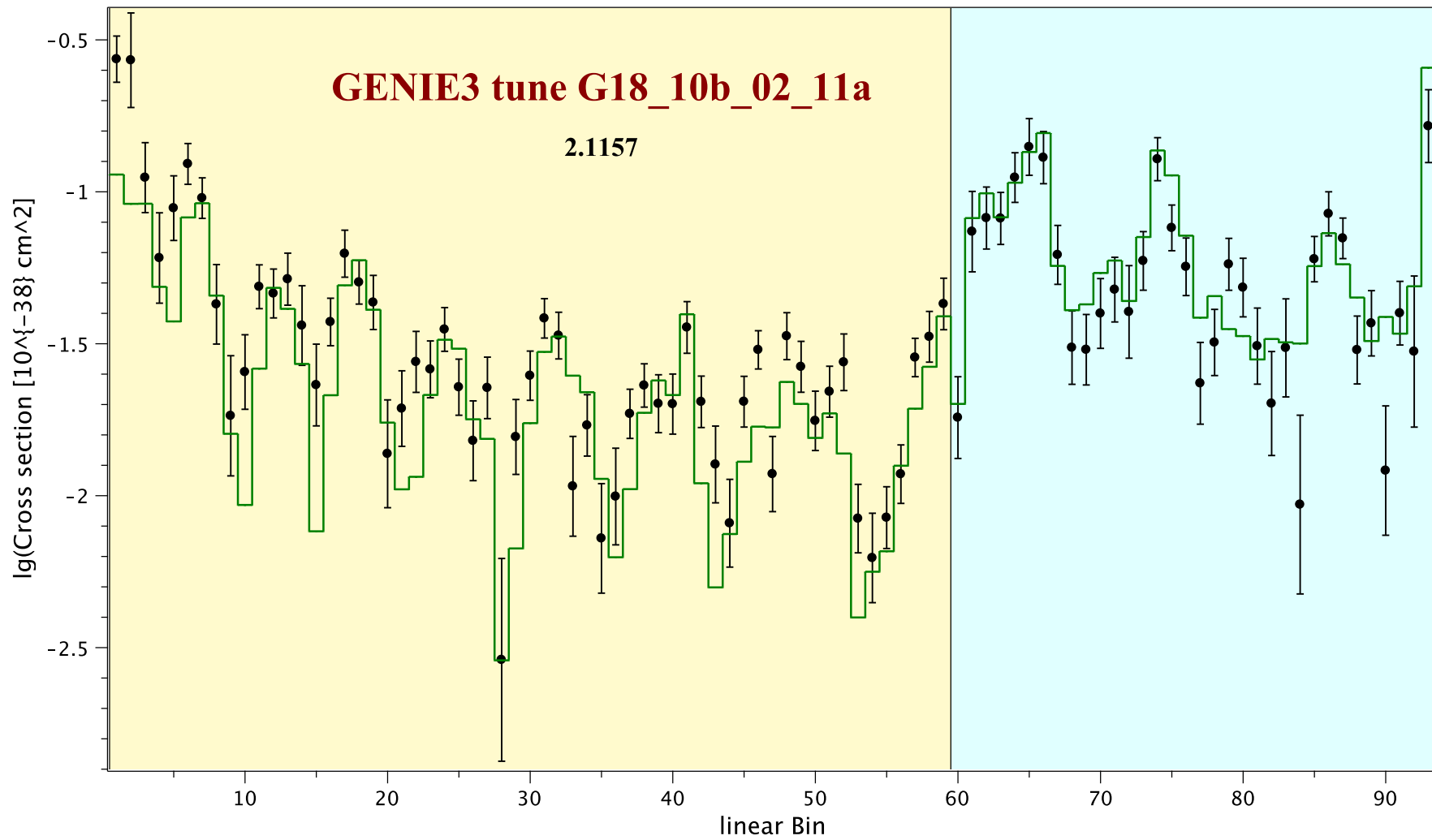
# Comparison with T2K $\nu_\mu$ data



# Comparison with T2K $\nu_\mu$ data

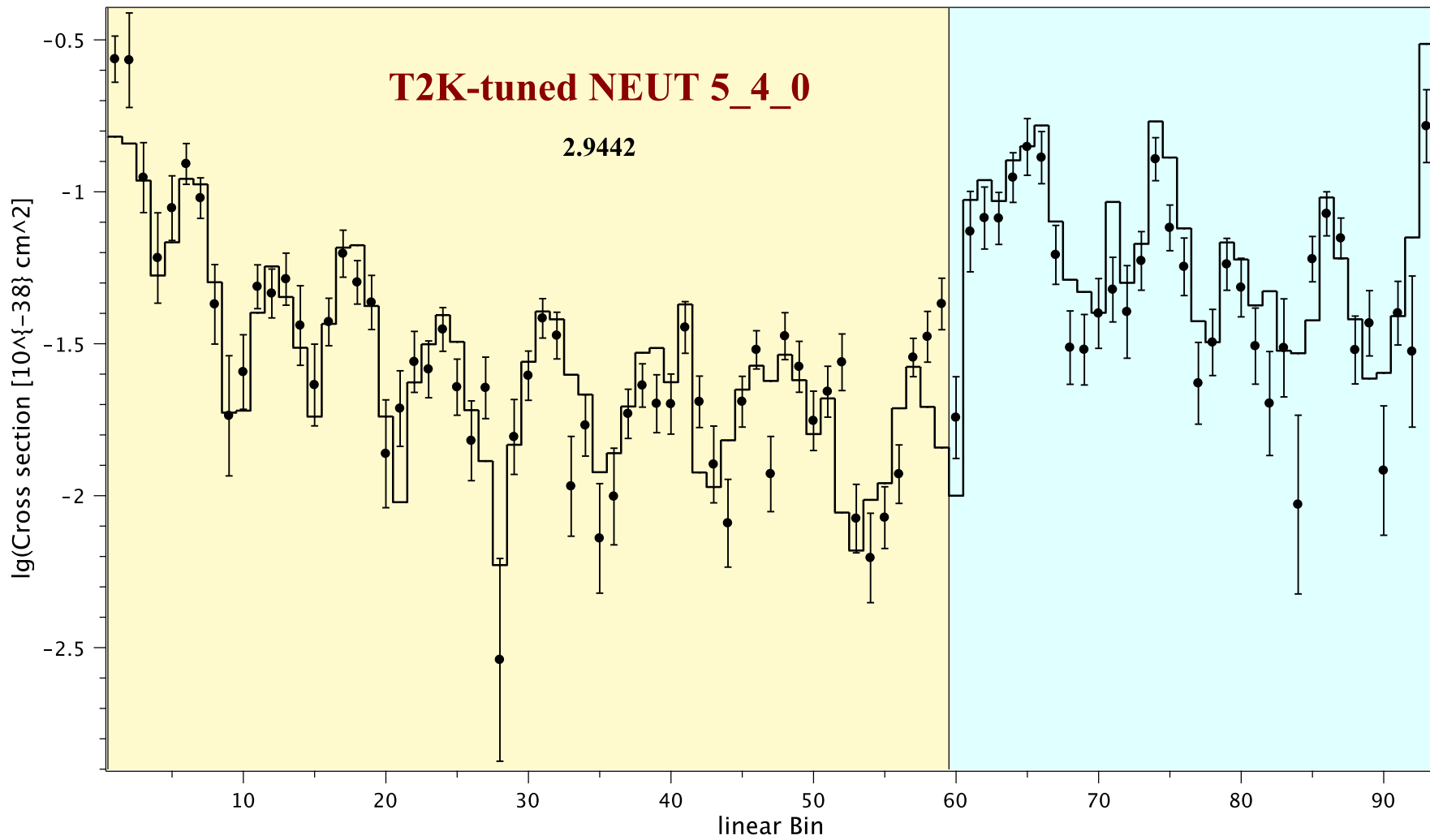


# Comparison with T2K $\nu_\mu$ data

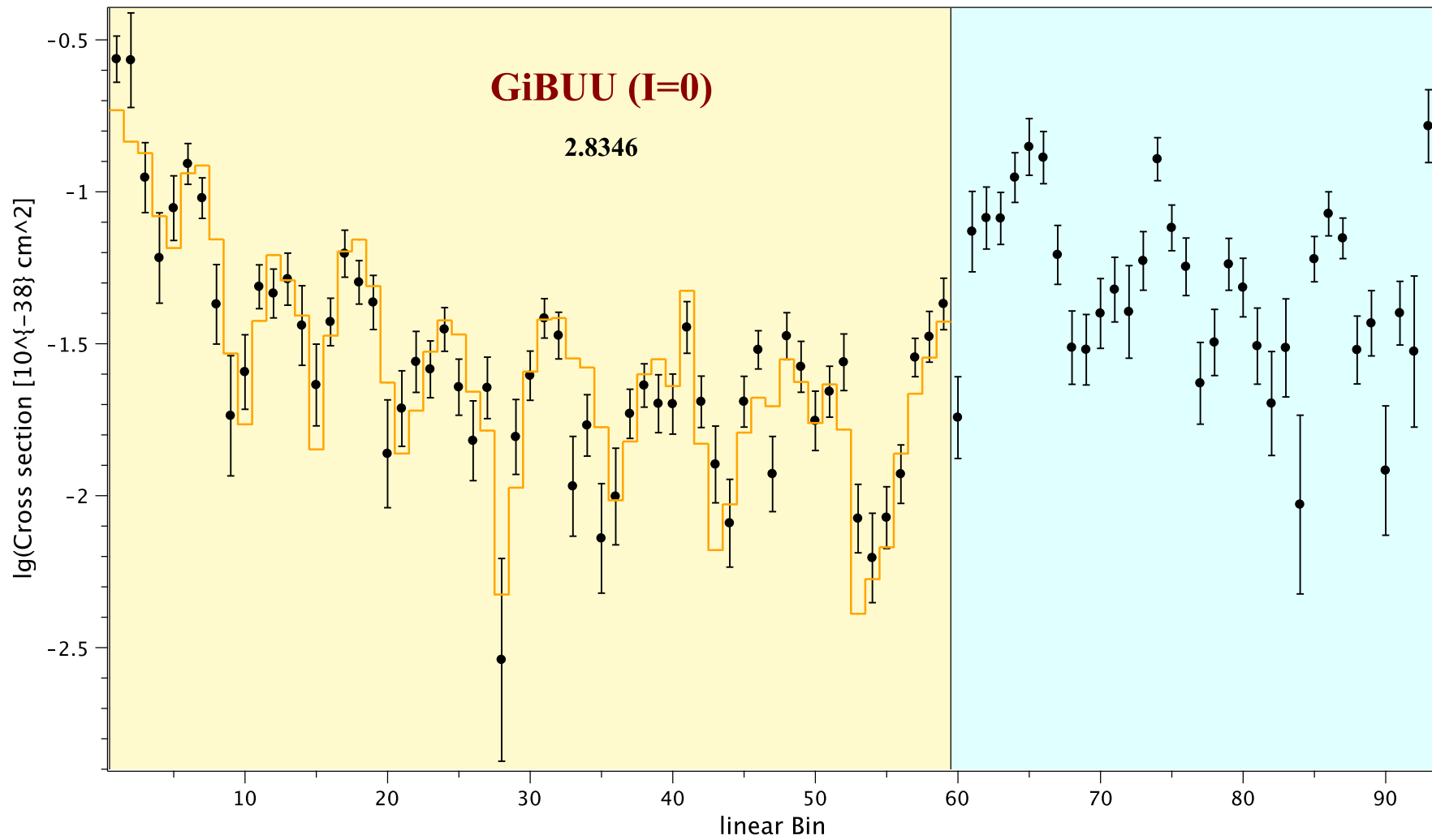




# Comparison with T2K $\nu_\mu$ data



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