Cross Sections and EMC effect.

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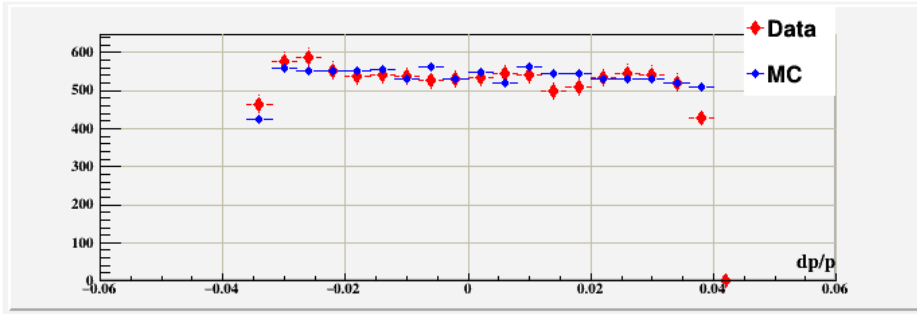
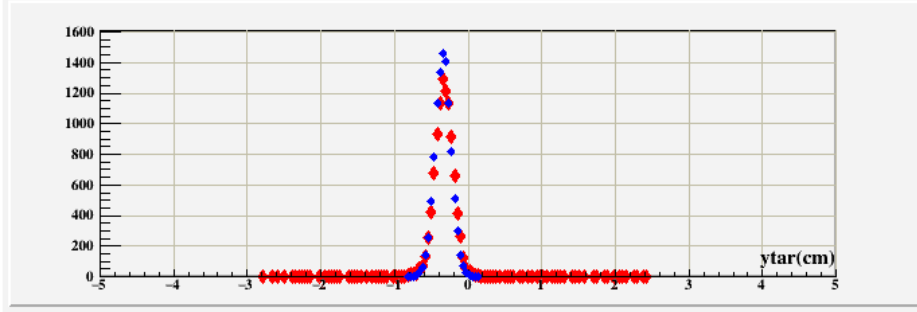
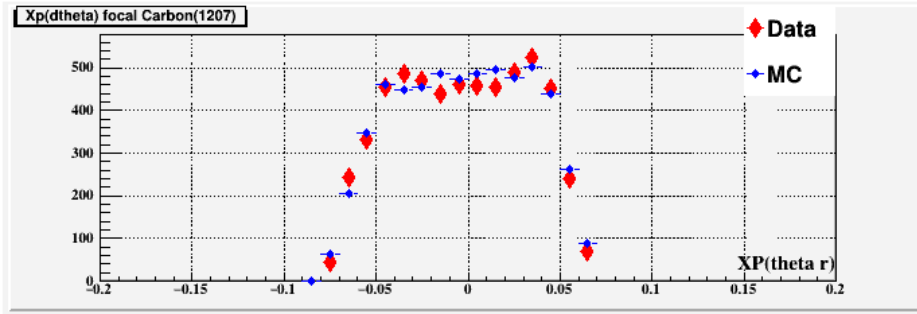
Monte Carlo

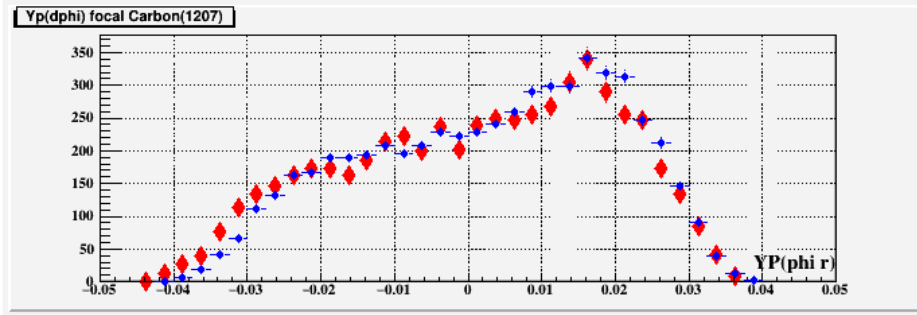
- Generate events → Pass through magnetic apertures
- Tune Simulation offsets to match detector response
- Use model to weight events
  - Deep Inelastic and resonance region from Ari Bodek Fit from E139
  - Full Mo and Tsai radiative correction

[A. Bodek and U.K. Yang, 2002]
[L.W. Mo and Y.S. Tsai, 1969]

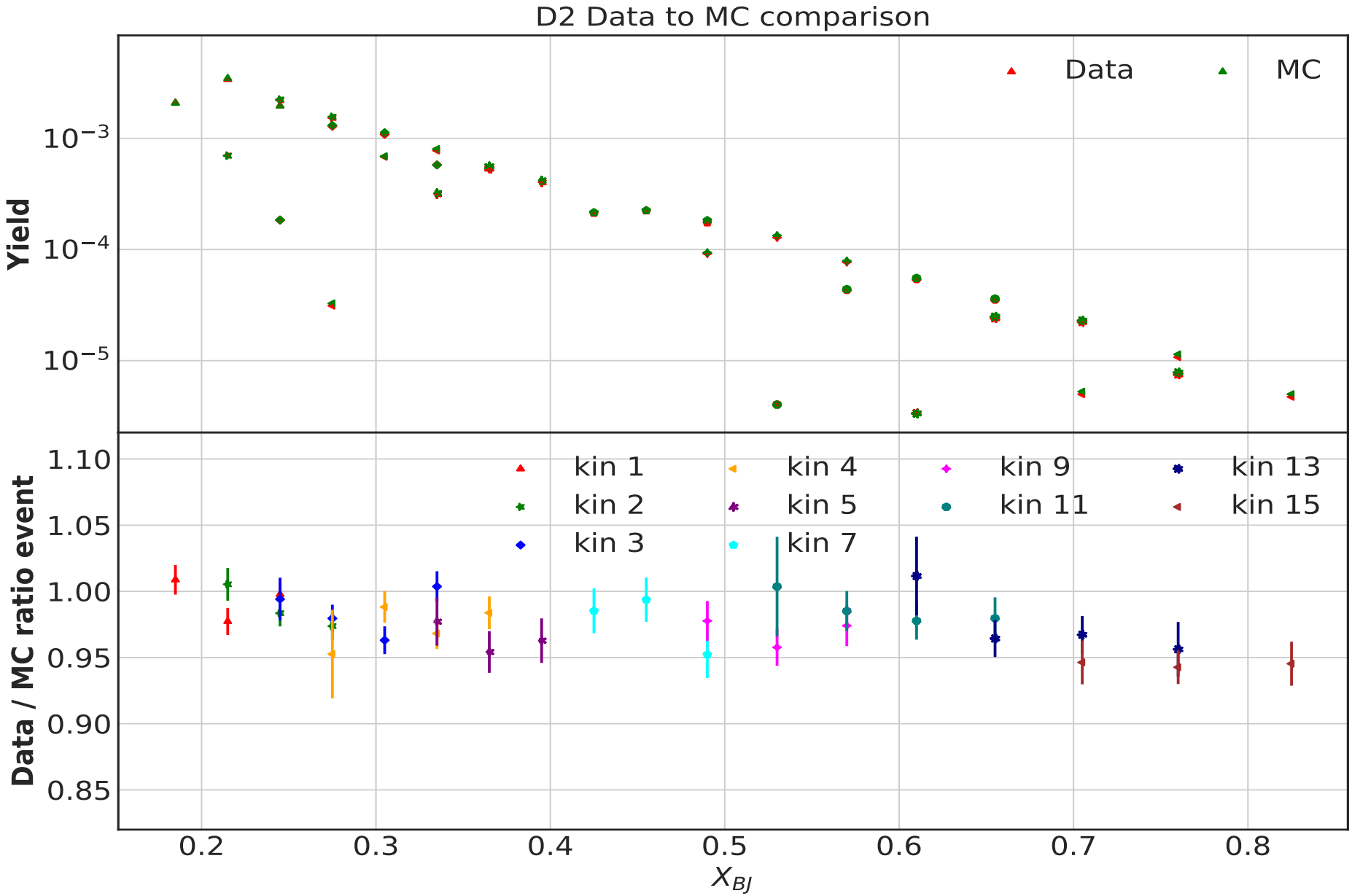




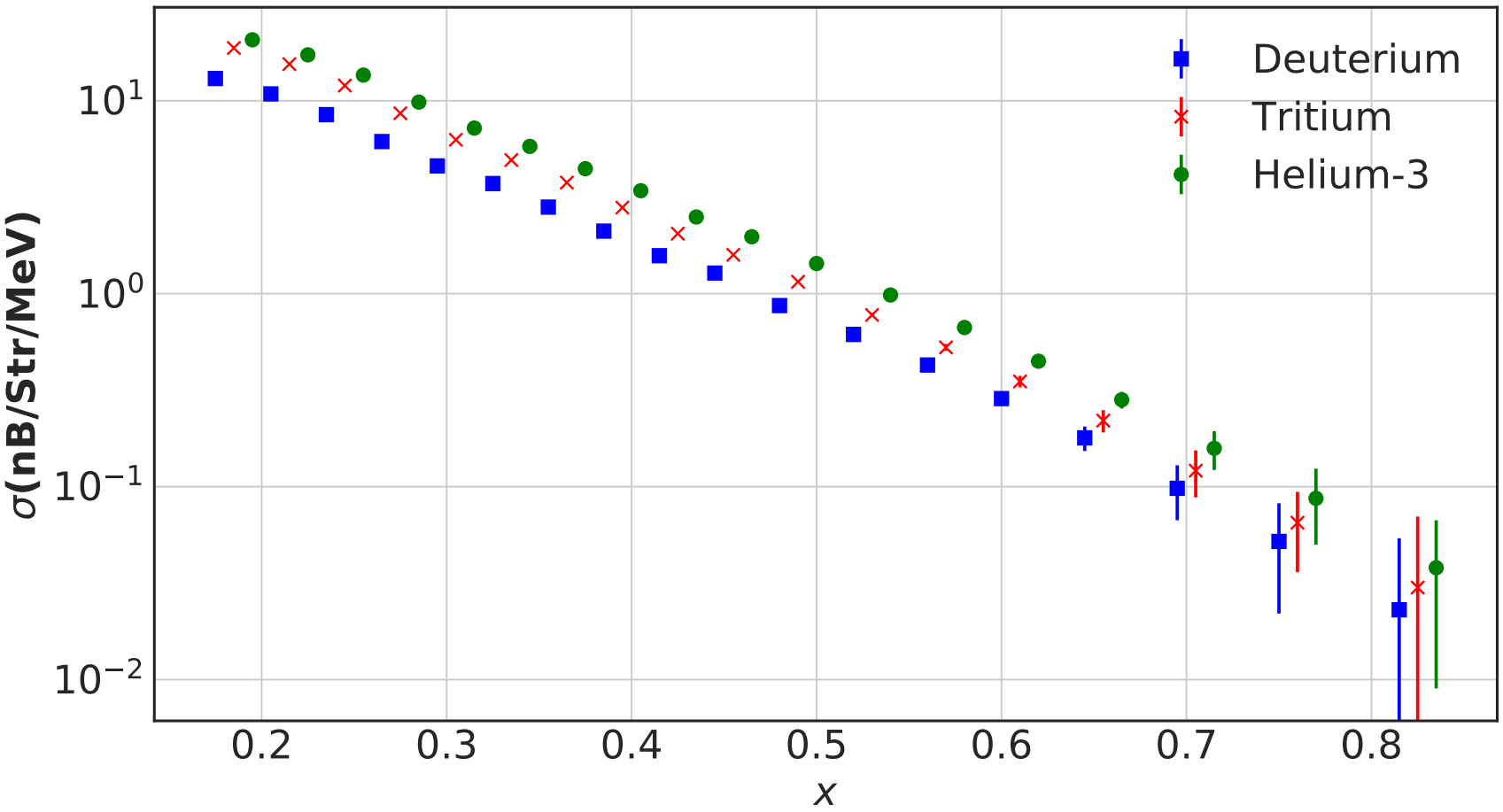




Yield & MC ratio D



DIS Cross Section



Normalization uncertainty due to target thickness uncertainty

^{3}He - 1.12% • ^{3}H - 0.97% • D - 0.56%

Relative uncertatiny contributions for the cross section ^{3}H.

Xbjc	**0.185**	**0.305**	**0.49**	**0.57**	**0.705**	**0.825**
Yield Error	0.01	0.0107	0.0149	0.0151	0.0141	0.0163
Stat Error*	0.0055	0.0059	0.01	0.0111	0.0113	0.0143
End Cap*	0.007	0.007	0.007	0.007	0.007	0.007
Eff Error*	0.004	0.0051	0.0083	0.0071	0.0041	0.0032
MC&Model	0.016	0.014	0.013	0.016	0.03	0.037
Resolution**	0.015	0.011	0.005	0.001	0.007	0.018
Model**	0.006	0.009	0.012	0.016	0.029	0.032
Total Error	0.019	0.018	0.02	0.022	0.033	0.04

* Largest contributers to the uncertainty in the yield calculation

** Largest contributers to the uncertainty in Monte Carlo and Cross section model calculation.

Cross section model

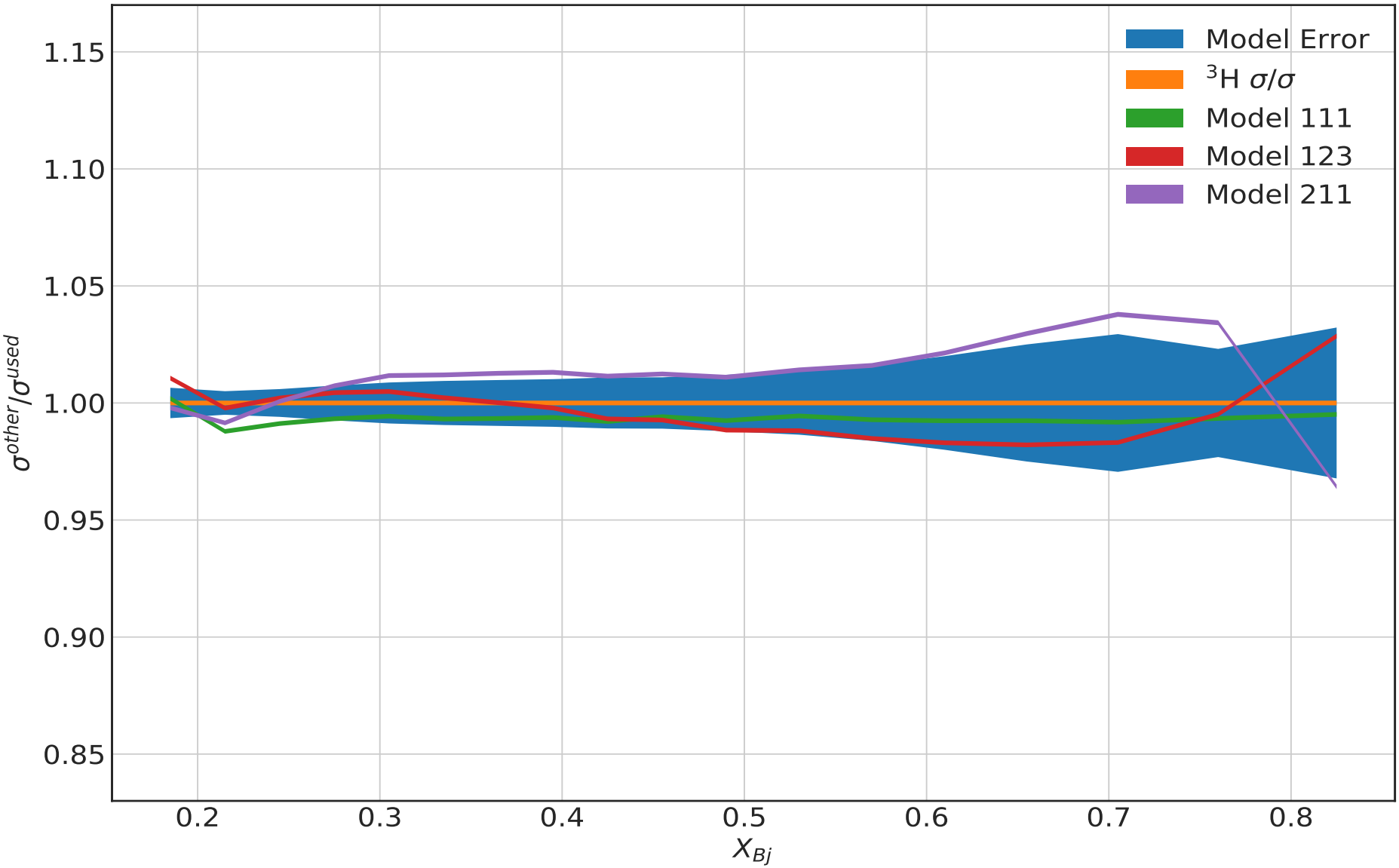
- Cross section code from Dr. Gaskell
- DIS model corrected with an EMC model -Bodek E139
  - neutron and proton structure functions from a Hydrogen fit and deuterium fit
  - proton - 24 parameter fit for background and resonance and 11 parameters OMEGAW fit for F2.
  - deuterium - 26 parameter fit for background and resonance and 11 parameters OMEGAW fit for F2
- EMC - 8th-degree polynomial with a quadric polynomial in an exponential
  - $C = exp(0.017 + 0.018 \times log(x) + 0.005 \times log(x)^2)$
  - α is polynomial
  - EMC correction $= C \times A^{\alpha}$

Cross section Models

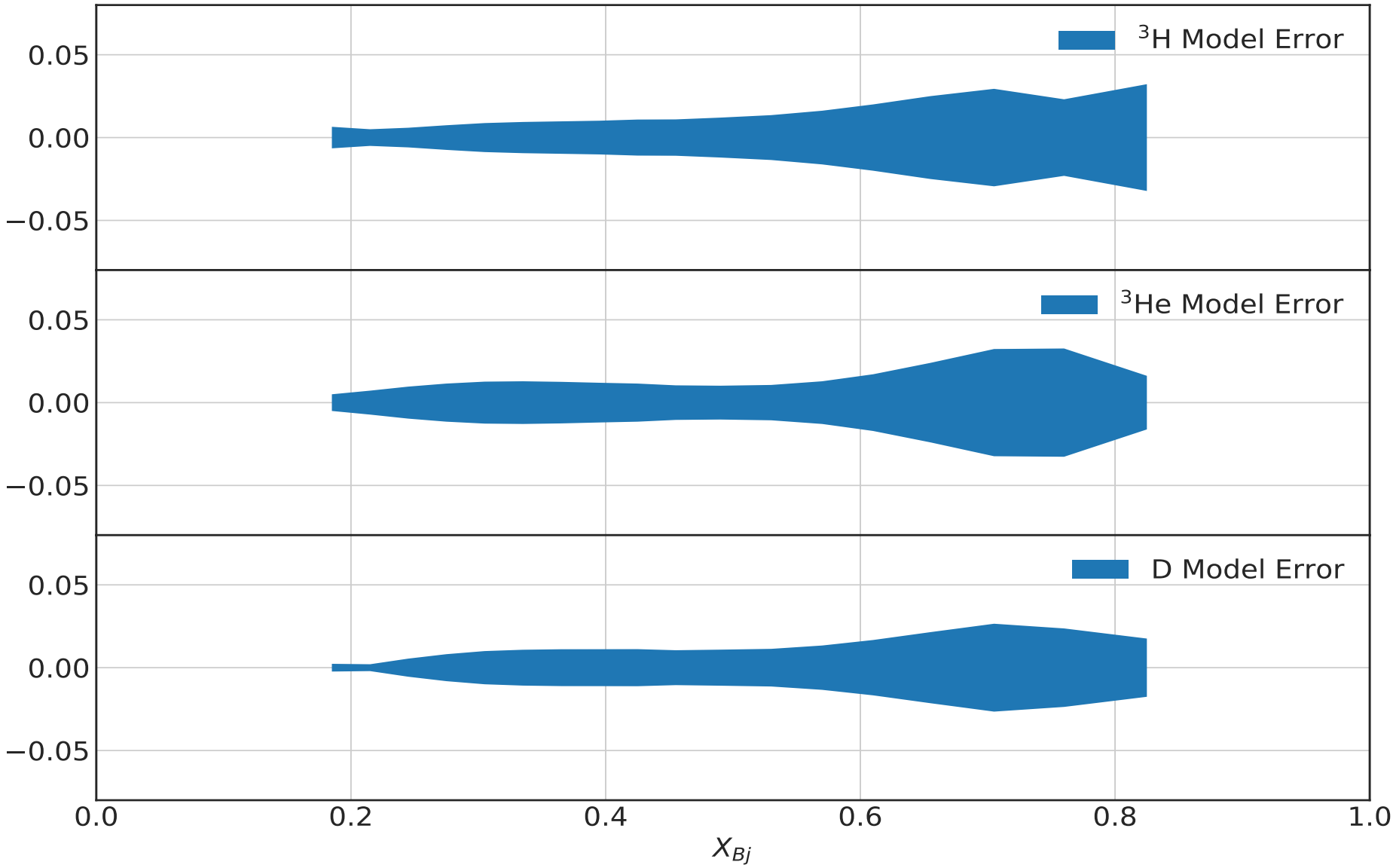
- F_{2d}:
  1. Bodek;
  2. NMC 1995 (Phys. Lett. B364 107-115,1995)
- EMC ratio $\frac{F_2(A=3)}{F_{2d}}$
  1. K&P (no isoscalar correction);
  2. SLAC EMC (isoscalar nuclei)
- F_{2n}/F_{2p}
  1. linear: $F_{2n}/F_{2p} = 1 - 0.8 * x$
  2. CJ15;
  3. NMC 1992 (Nucl. Physics. B 371(1992) 3-31)

model111: Bodek + K&P;
model211: NMC + K&P;
model121: Bodek + SLAC EMC + linear F_{2n}/F_{2p};

Model Cross Section Error



Model Cross Section Error

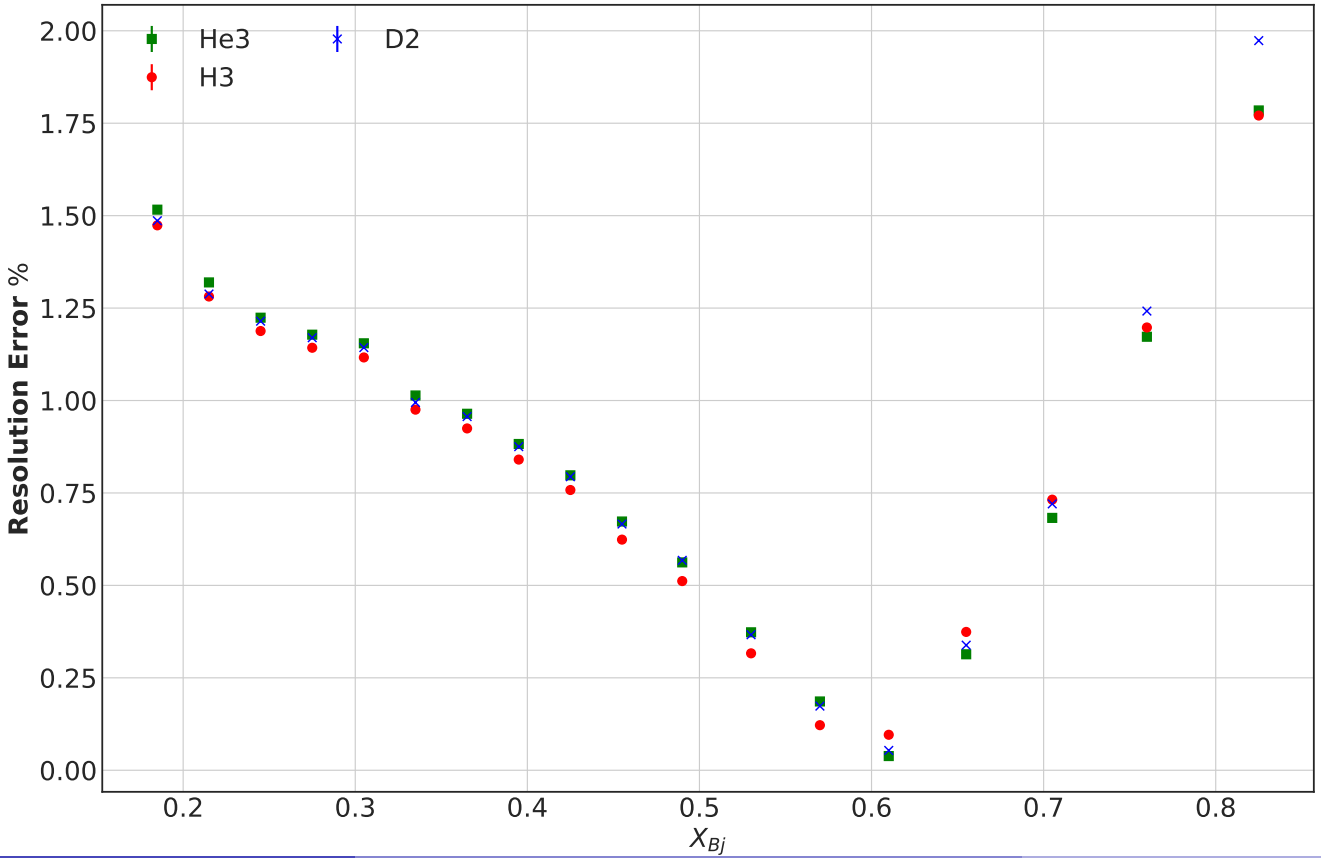


Tacking/Reconstruction Error

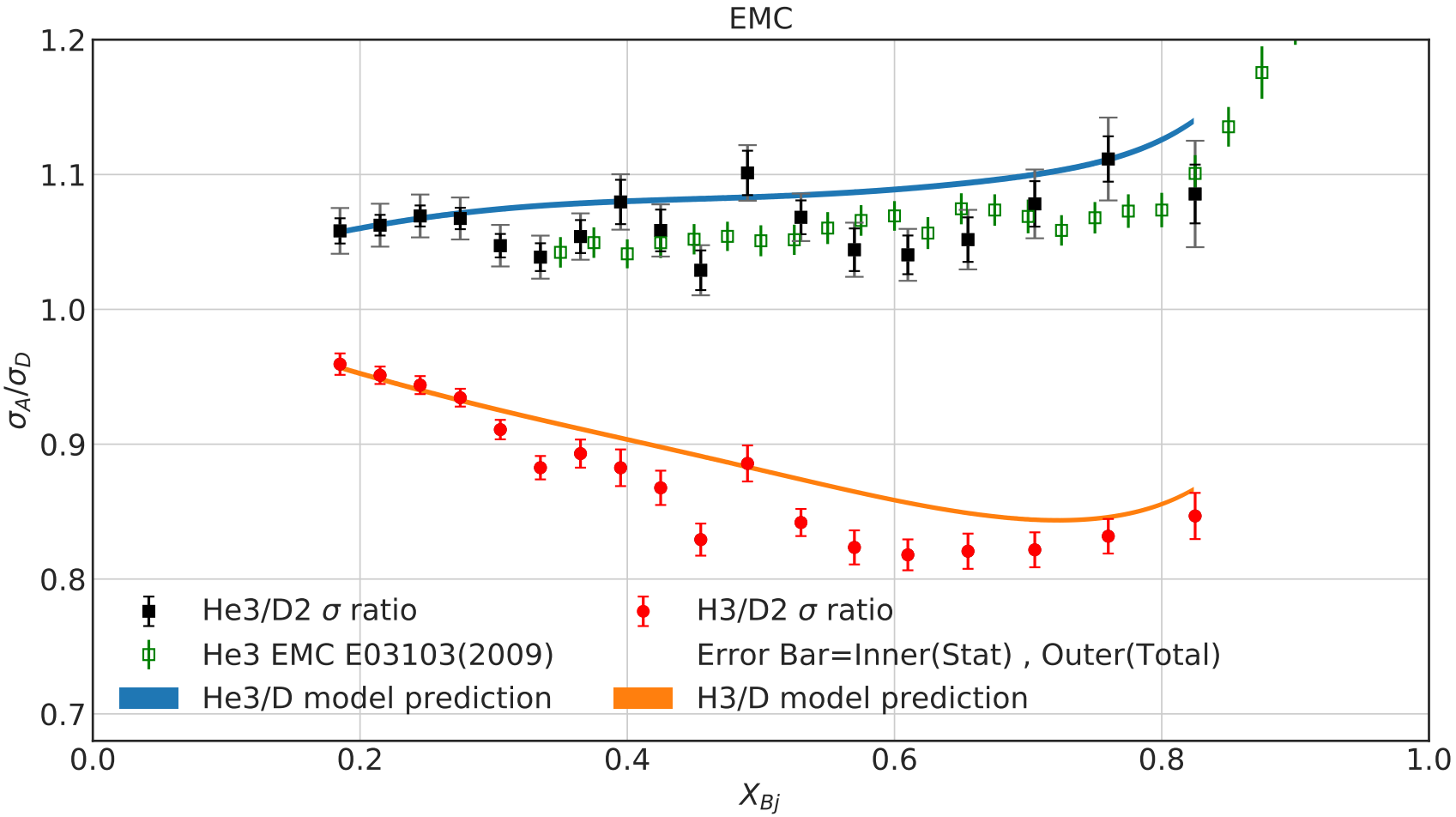
$\delta\theta = \pm 0.15\% \bullet \delta E' = \pm 0.025\% \bullet \delta E_{beam} = \pm 0.005\%$

Determine new Q^2 and x_{bj}

Calculated new cross sections for extreme situation.



Per Nucleon Cross Section Ratio

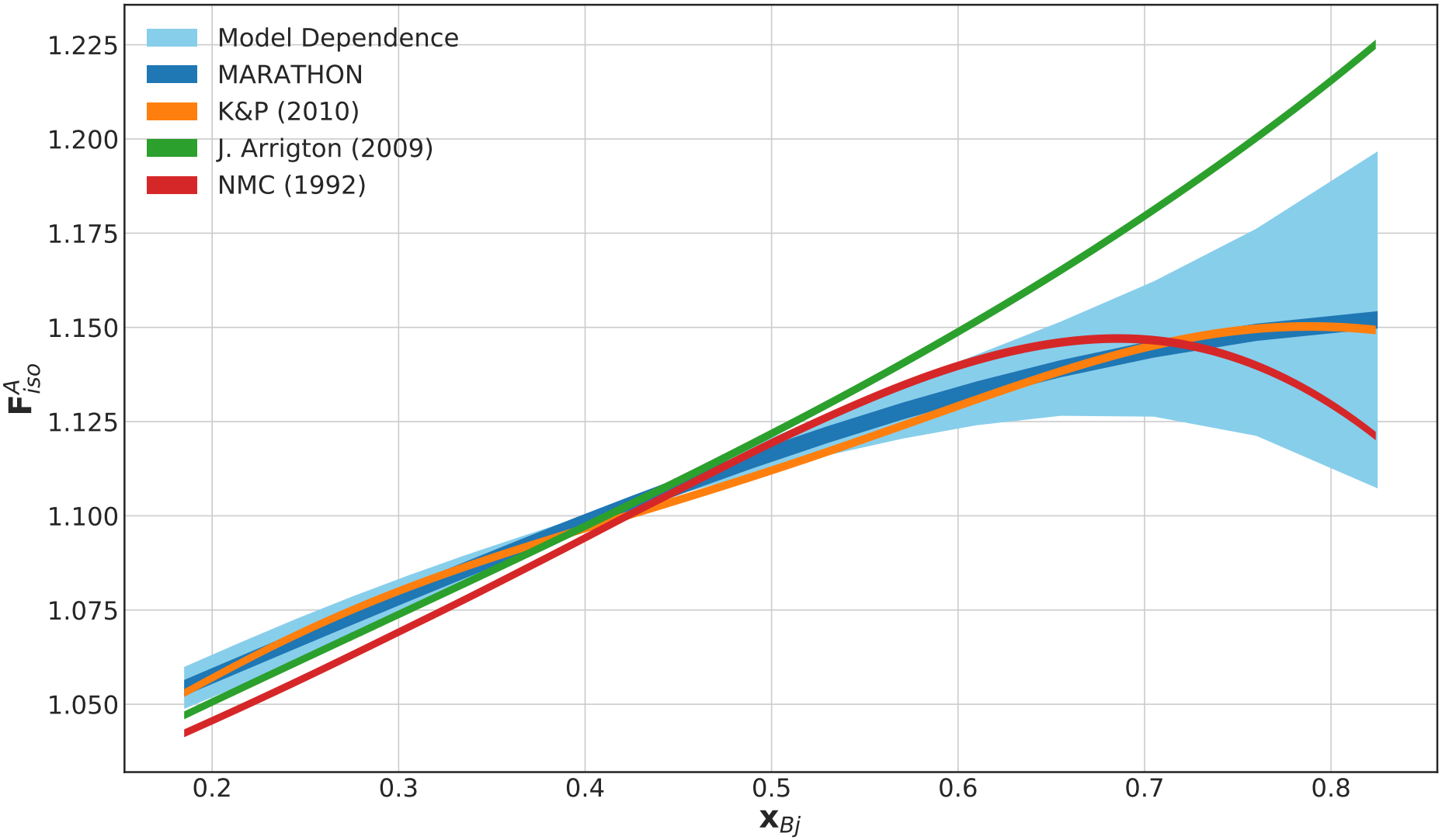


MARATHON results compared with E03103 [J.Seely, A. Daniel et al, 2009] and the A/D ratios from a DIS scattering model from Arie Bodek model [A. Bodek and U.K. Yang, 2002].

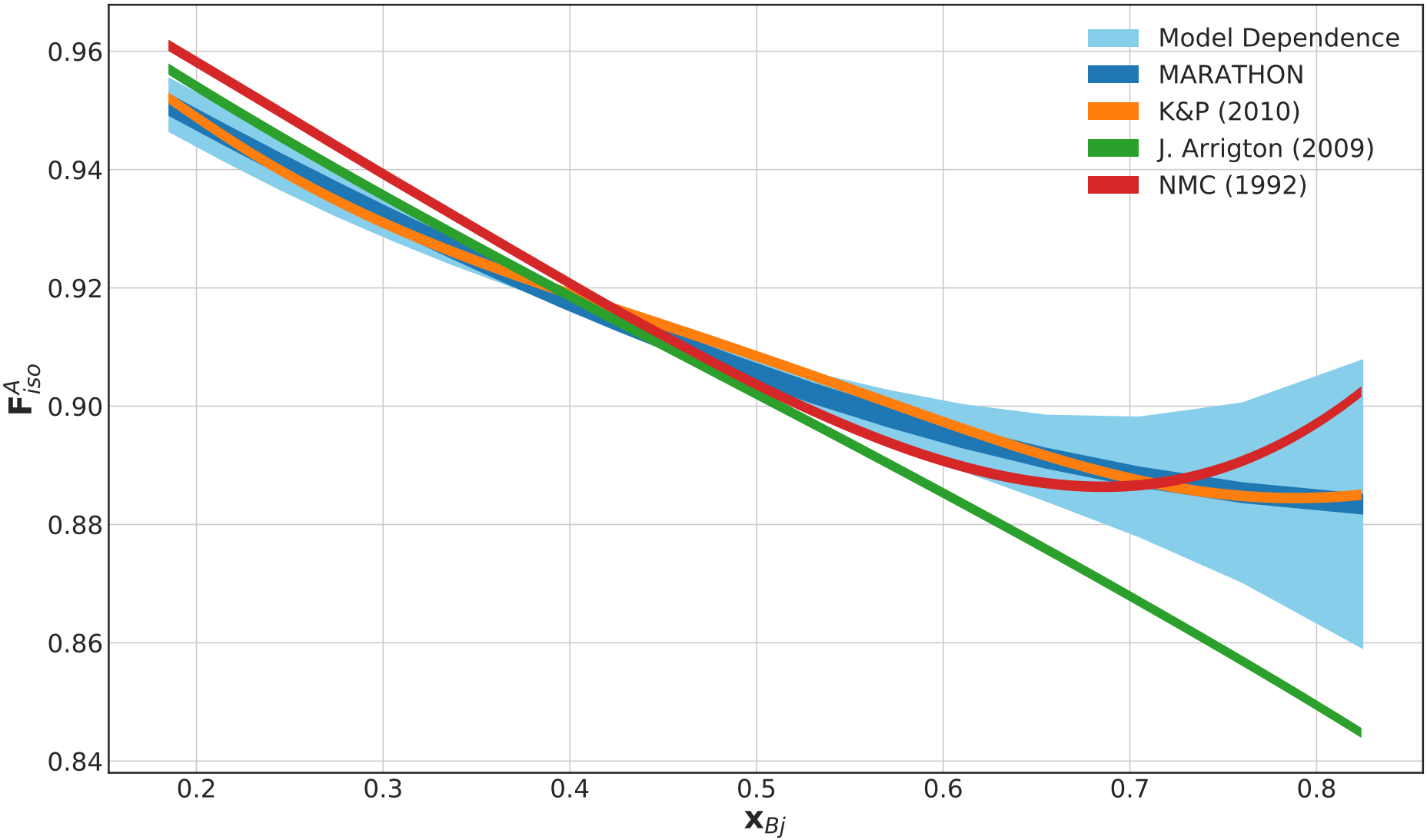
F^2 ratio

- J.Arrigton.
  - p=[0.0,0.816,-0.661,0.184,5.509,-0.034,8.714,-0.072,0.450]
  - $(p[1] + p[2] * epl) + p[3] * np.exp(-p[4] * epl) + p[5] * np.exp(-p[6] * (1 - epl)) + p[7] * pow(max(0, epl - p[8]), 2)$
- NMC
  - $AX = 0.979 - 1.692 * x + 2.797 * x^2 - 4.313 * x^3 + 3.075 * x^4$
  - $BX = -0.171 * x + 0.244 * x^2$
  - $F2NP_NMC = AX((Q2/20.0)^{BX}) * (1 + x^2/Q2)$
- K&P from table

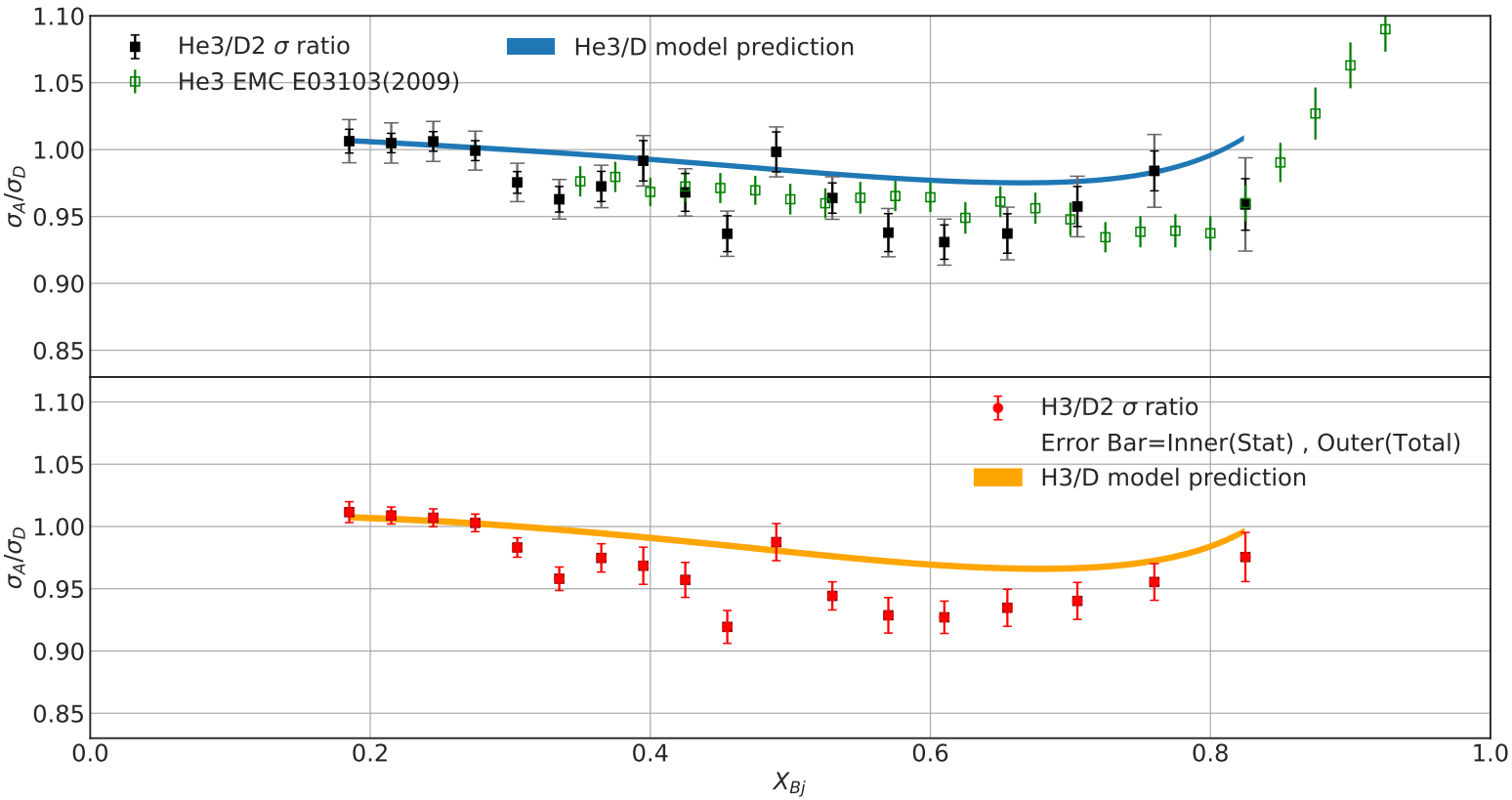
Isoscalar Correction Error for ^{3}H



Isoscalar Correction Error for ^{3}He



- My EMC results for He3 in black • H3 in red
- Previous Jlab He3 in green



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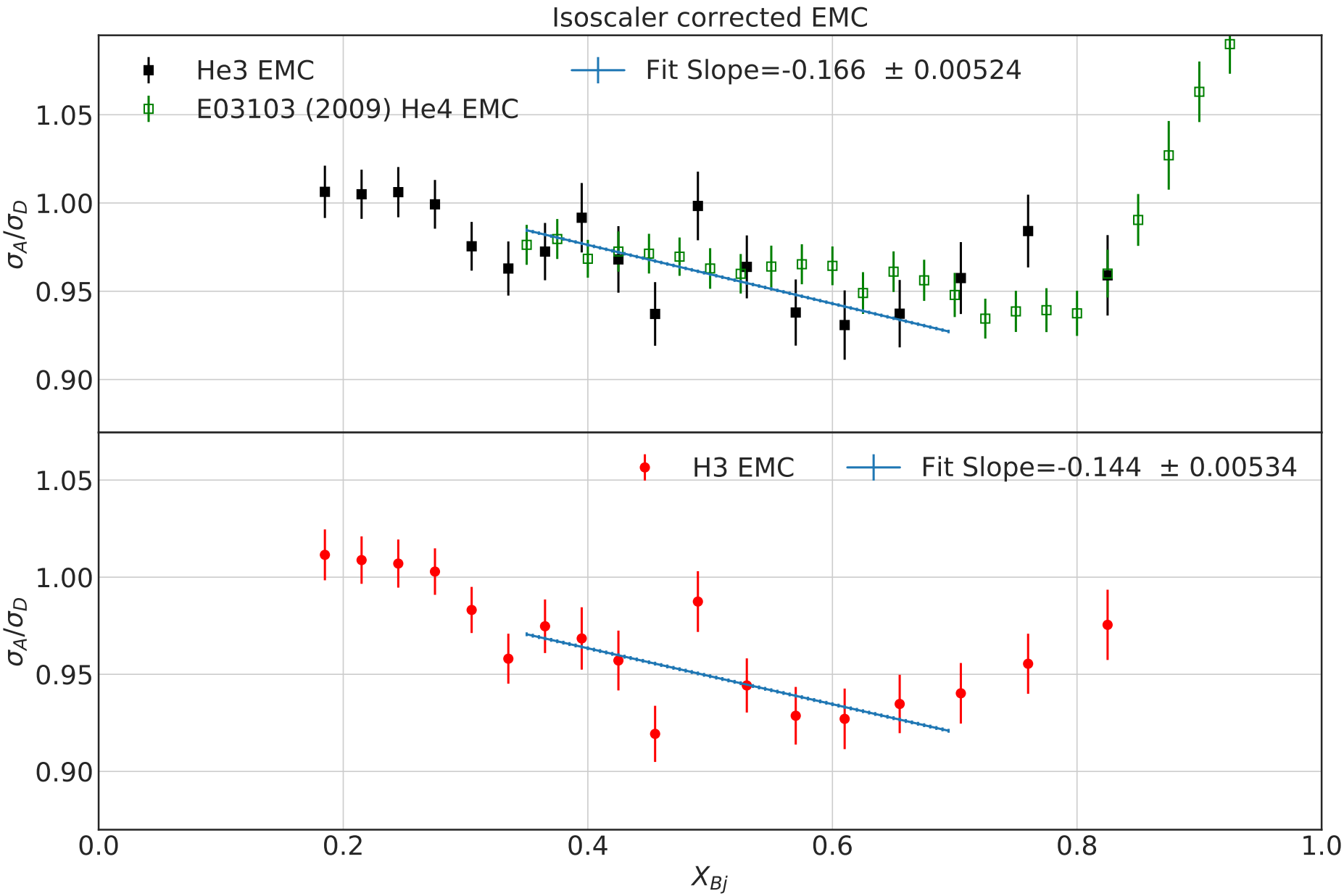
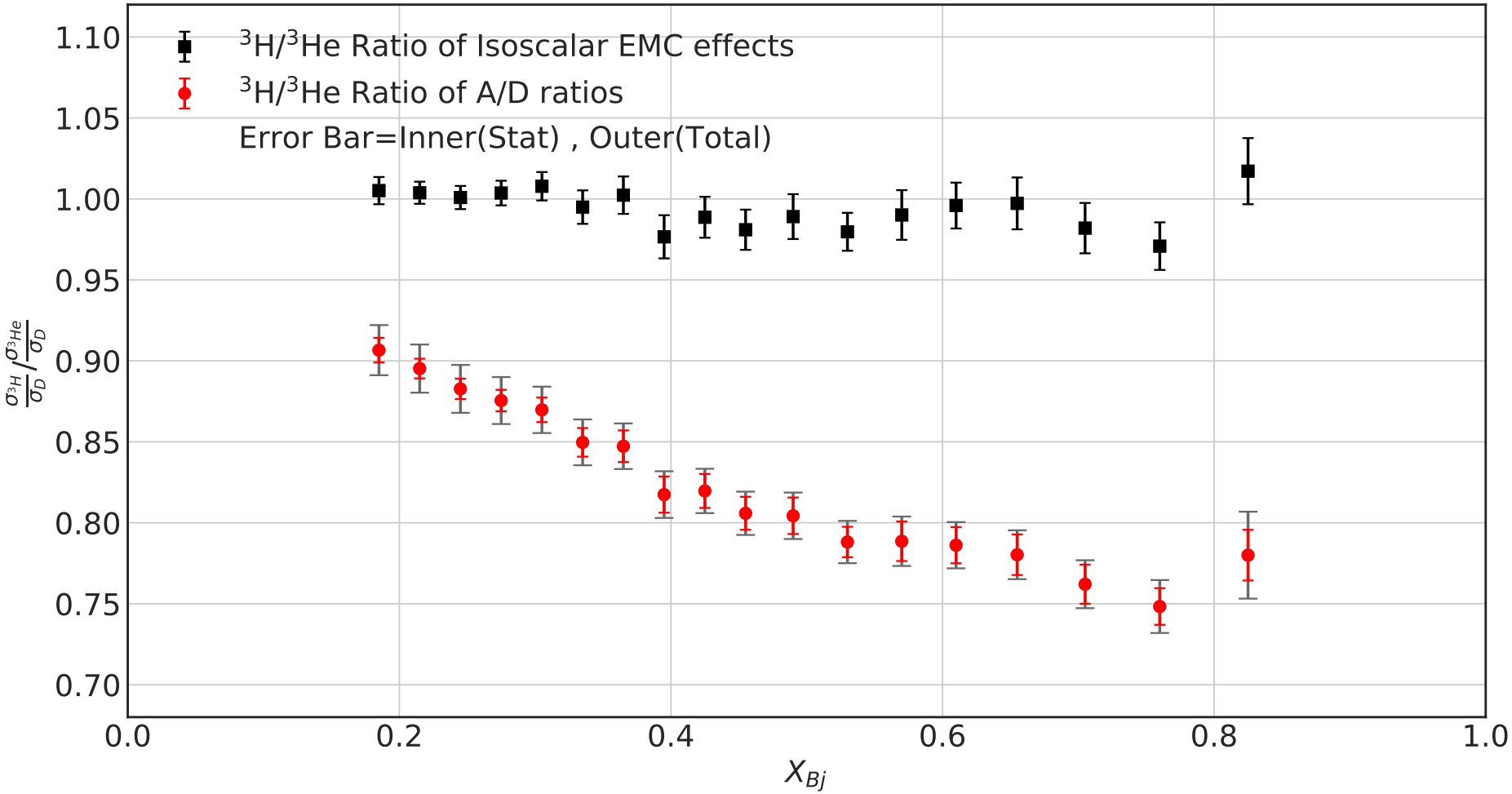
EMC results with fits (0.35 - 0.7 in x)



Ratio of $^3H/^3He$ EMC effects



Ratio of EMC effects.

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