Preliminary $\frac{F_2^n}{F_2^p}$ From Pass1 Analysis

Tong Su

MARATHON Analysis Day

Introduction

- $\frac{F_2^n}{F_2^p}$ are extracted from $\frac{\sigma(D2)}{\sigma(H1)}$ and $\frac{\sigma(H3)}{\sigma(He3)}$
- The cross section ratio is calculated in the same way, as presented at the last analysis day. Details will not be repeated in this presentation
- Modified Tritium density has been applied
- For the cross section ratio, only the statistical error and a random +-0.5% point to point error is included
- All results are just based on the Pass1 analysis and are very preliminary. A variety of details still need to be refined

From cross-section ratio to $\frac{F_2^n}{F_2^p}$

- **Kulagin-Petti model** is used for both of the $\frac{F_2^n}{F_2^p}$ extraction
- From KP model: $\begin{cases} R_2 = \frac{F_2^D}{F_2^n + F_2^p} \\ R_{31} = \frac{F_2^{H3}}{2F_2^n + F_2^p} \\ R_{32} = \frac{F_2^{He}}{F_2^n + 2F_2^p} \end{cases}$ ***super*** $\mathfrak{R} = \frac{R_{32}}{R_{31}}$
- $\frac{F_2^n}{F_2^p} = \frac{\mathbf{D/p}}{R_2} - 1$ $\frac{F_2^n}{F_2^p} = \frac{2\mathfrak{R} - \mathbf{He^3/H^3}}{2(\mathbf{He^3/H^3}) - \mathfrak{R}}$

Kulagin-Petti Model

[S. A. Kulagin and R. Petti, Nucl. Phys. A 765, 126 (2006).]

[S. A. Kulagin and R. Petti, Phys. Rev. C 82,054614(2010)]

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NUCLEAR PHYSICS A

Global study of nuclear structure functions

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Structure functions for light nuclei

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We discuss the nuclear EMC effect with particular emphasis on recent data for light nuclei including ^{2}H, ^{3}He, ^{4}He, ^{9}Be, ^{12}C, and ^{14}N. In order to verify the consistency of available data, we calculate the χ^2 deviation between different data sets. We find a good agreement between the results from the NMC, SLAC E139, and HERMES experiments. However, our analysis indicates an overall normalization offset of about 2% in the data from the recent JLab E03-103 experiment with respect to previous data for nuclei heavier than ^{3}He. We also discuss the extraction of the neutron/proton structure function ratio F_2^n/F_2^p from the nuclear ratios ^{3}He/^{2}H and ^{2}H/^{1}H. Our analysis shows that the E03-103 data on ^{3}He/^{2}H require a renormalization of about 3% in order to be consistent with the F_2^n/F_2^p ratio obtained from the NMC experiment. After such a renormalization, the ^{3}He data from the E03-103 and HERMES experiments are in a good agreement. Finally, we present a detailed comparison between data and model calculations, which include a description of the nuclear binding, Fermi motion, and off-shell corrections to the structure functions of bound proton and neutron, as well as the nuclear pion and shadowing corrections. Overall, a good agreement with the available data for all nuclei is obtained.

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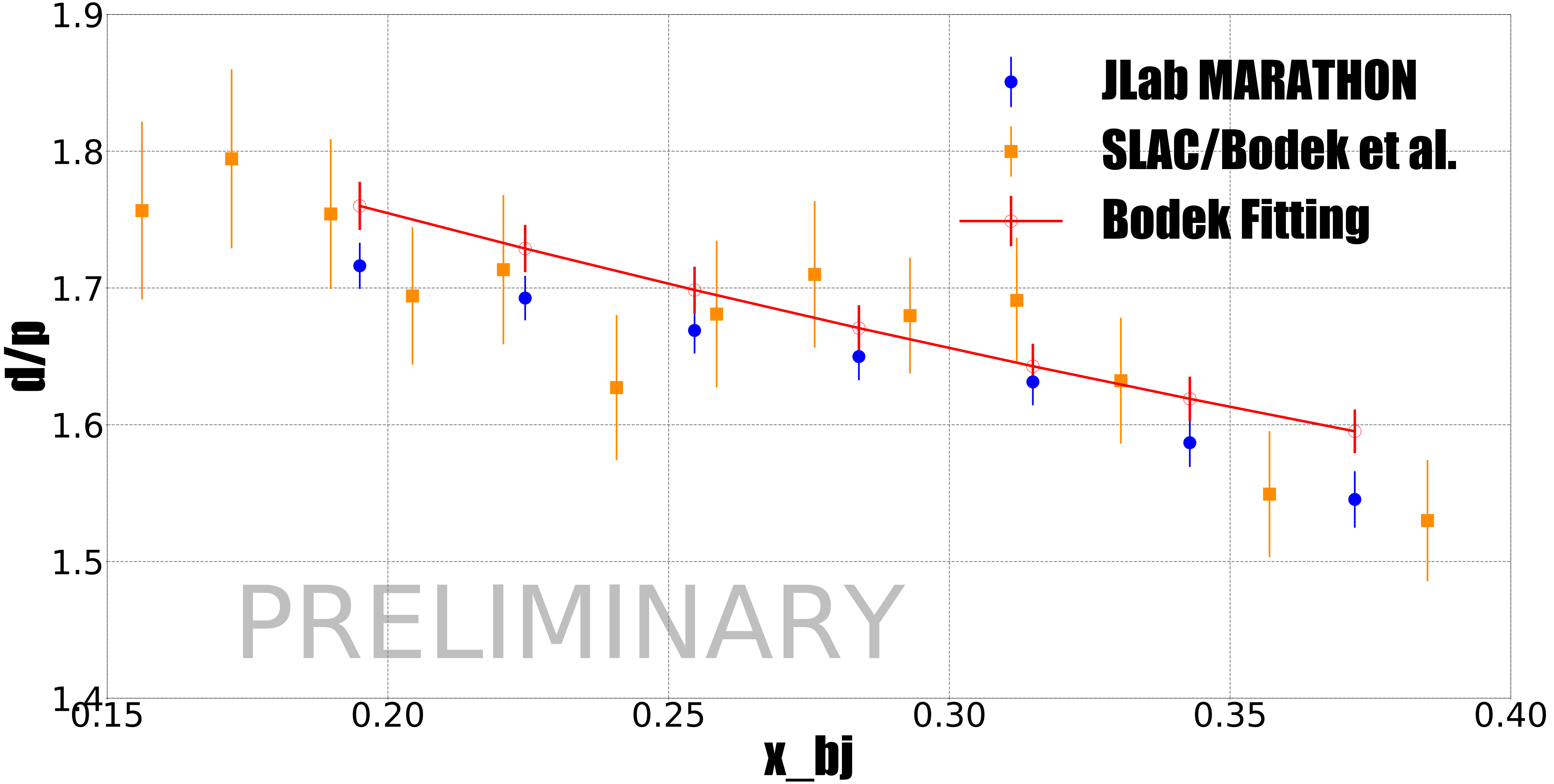
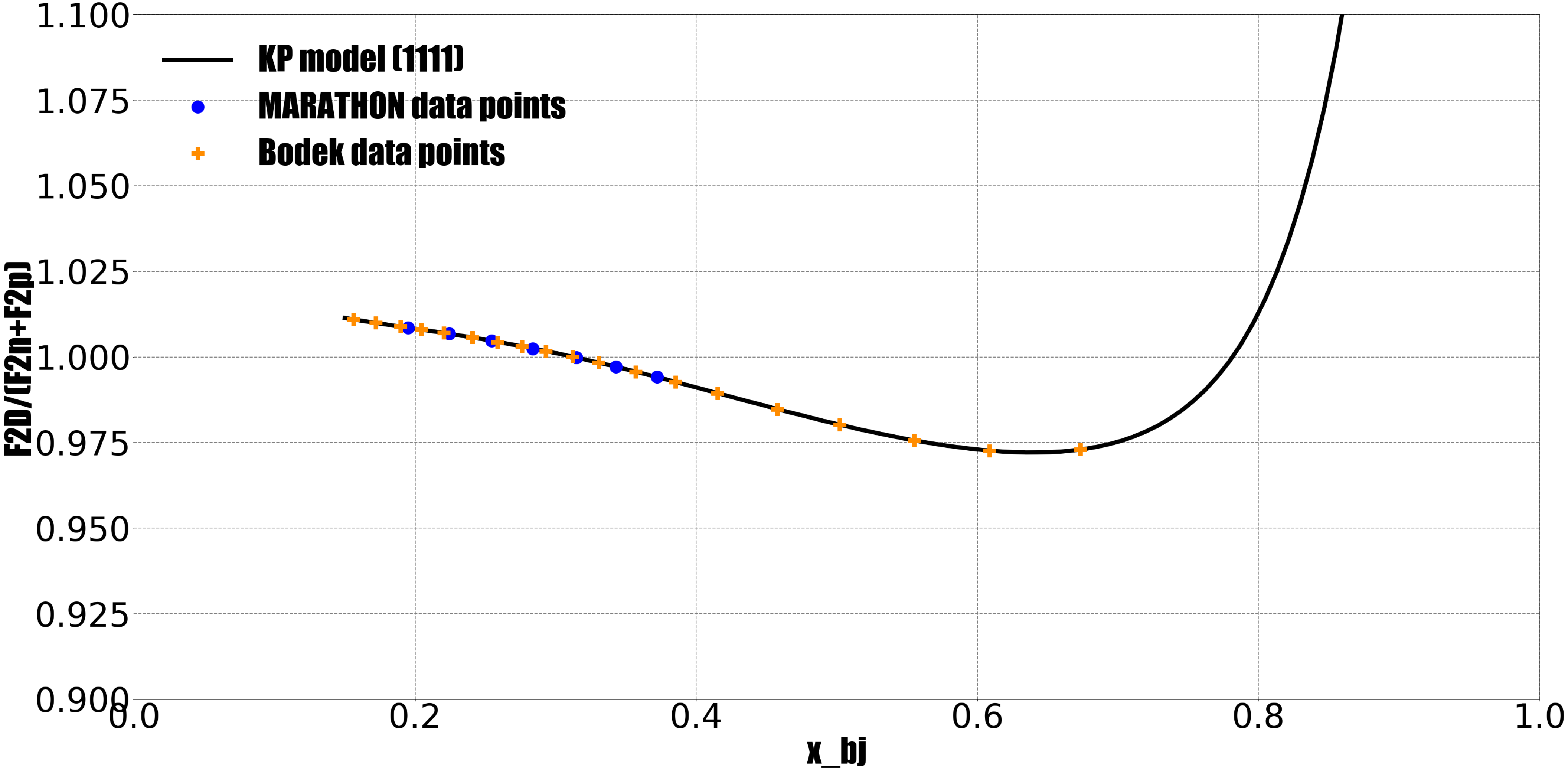
MARATHON $\frac{\sigma(D2)}{\sigma(H1)}$

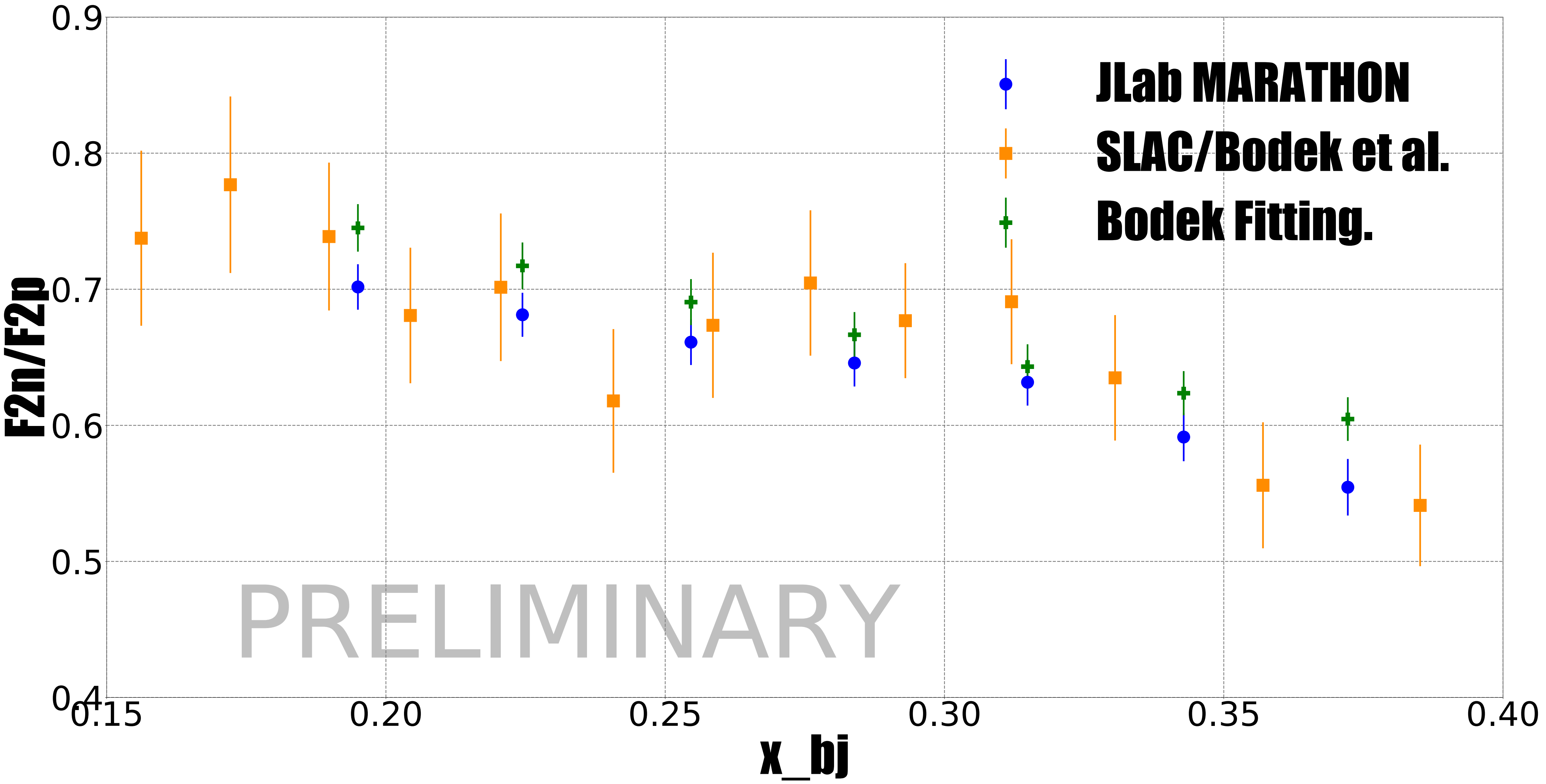


Bodek data : A. Bodek et al., Phys. Rev. D20, 1471 (1979).

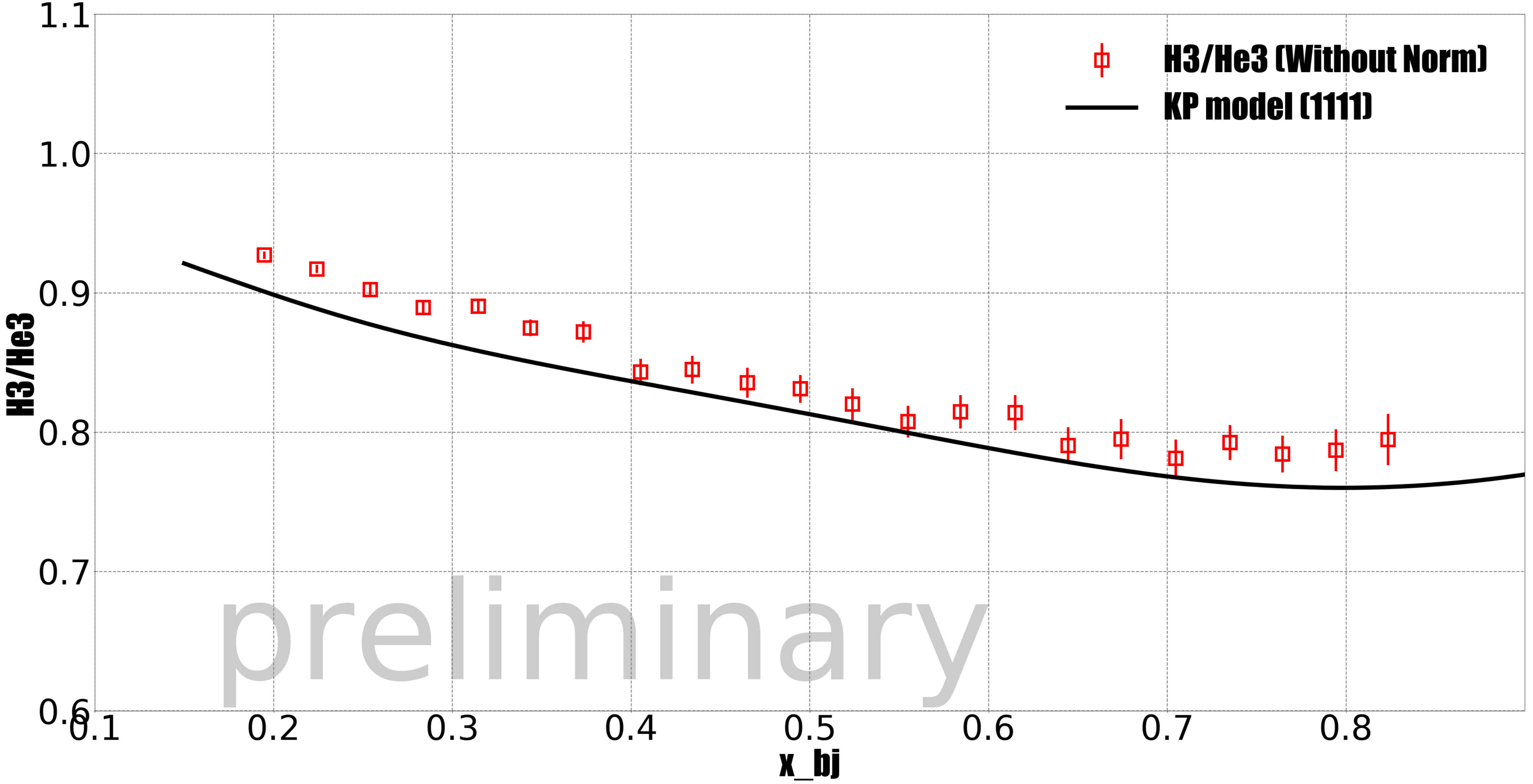
KP model for R_2



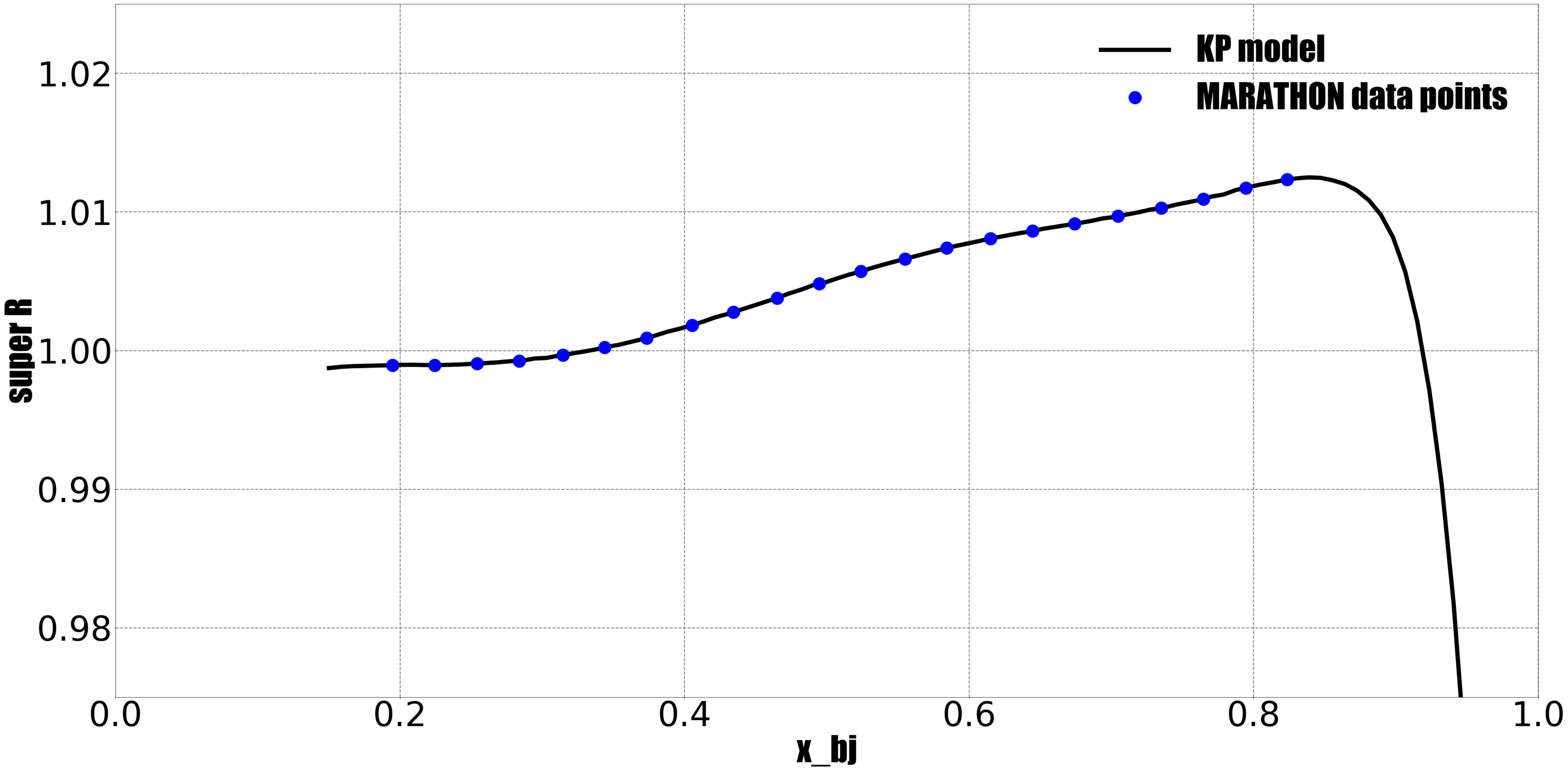
$$\frac{F_2^n}{F_2^p} \text{ from } \frac{\sigma(D2)}{\sigma(H1)}$$



MARATHON $\frac{\sigma(H3)}{\sigma(He3)}$



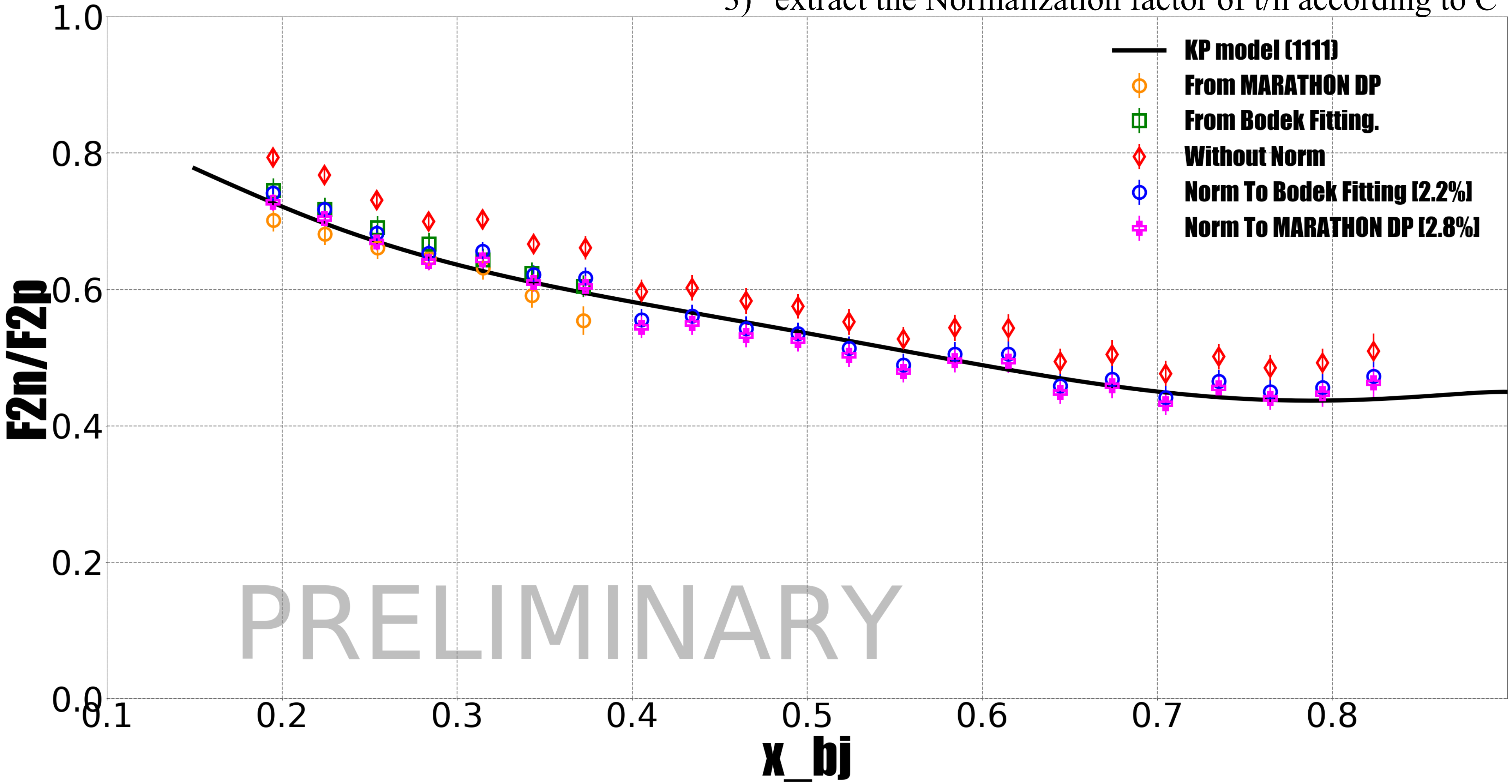
KP model for super R



$$\frac{F_2^n}{F_2^p} \text{ from } \frac{\sigma(H3)}{\sigma(He3)}$$

Comments for the Normalization :

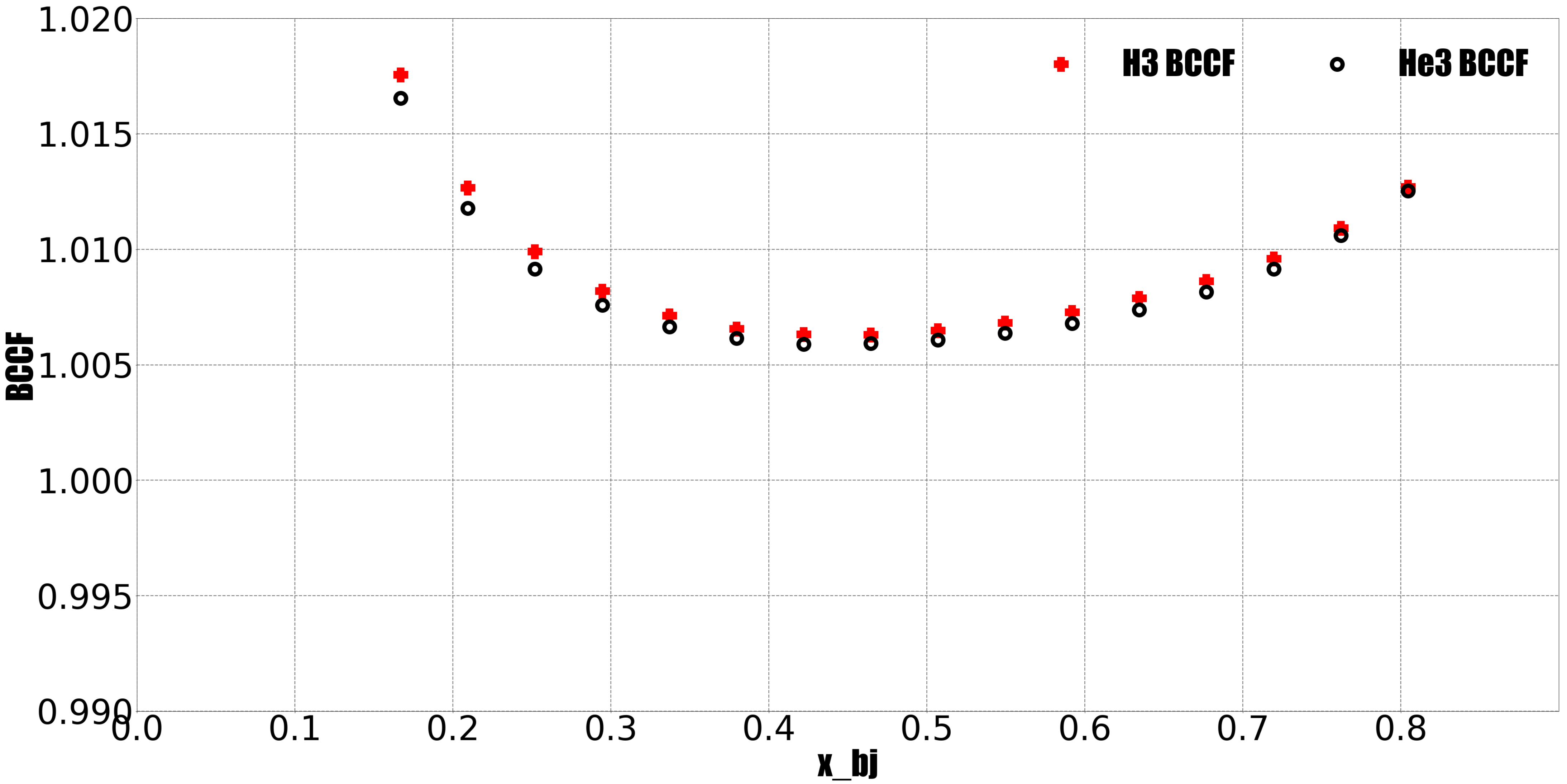
1) Just use the two points x~0.3 to do the Normalization
2) $\min \sum \left(\left(\frac{y}{\sigma^2}\right)_{target} - C * \left(\frac{y}{\sigma^2}\right)_{object} \right)^2$
3) extract the Normalization factor of t/h according to C



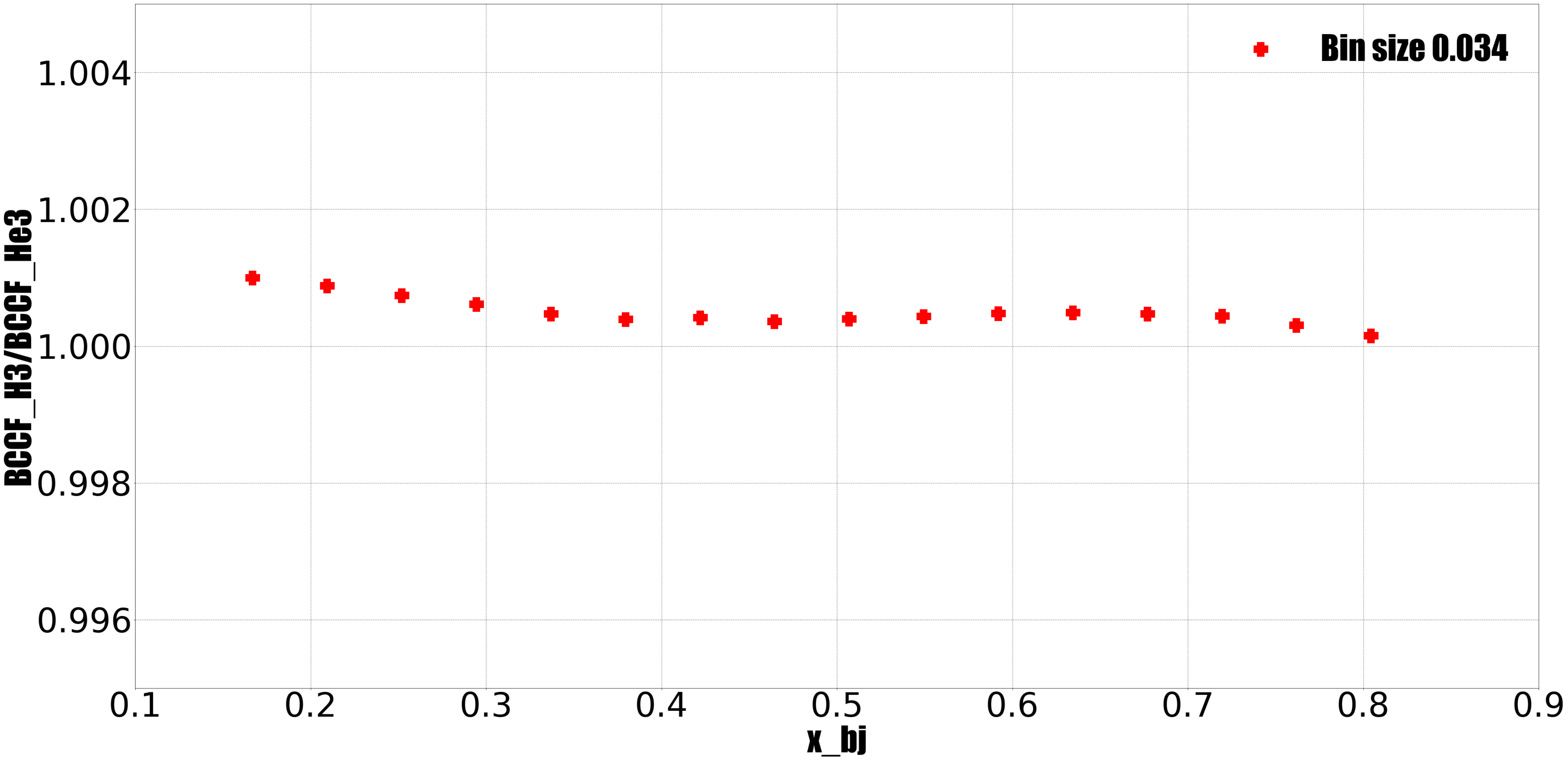
Quick Check of the Bin Center Correction

- Goal for this analysis is just to have a general idea of the magnitude of the bin center correction
- KP model is also used for this quick check
- For each individual bin, $BCCF = \frac{\sigma_{model}^{ave}}{\sigma_{model}^{BC}}$
- For the t/h : $BCCF_{t/h} = \frac{BCCF_{H3}}{BCCF_{He3}}$
- According to this analysis ,the BFFC for the t/h ratio is smaller than 0.1%

Bin Center Correction Factor



Bin Center Correction Factor for the ratio



Thanks!