$^{H3}/_{D2}$ status

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Reminder : Pass 1 cuts and corrections

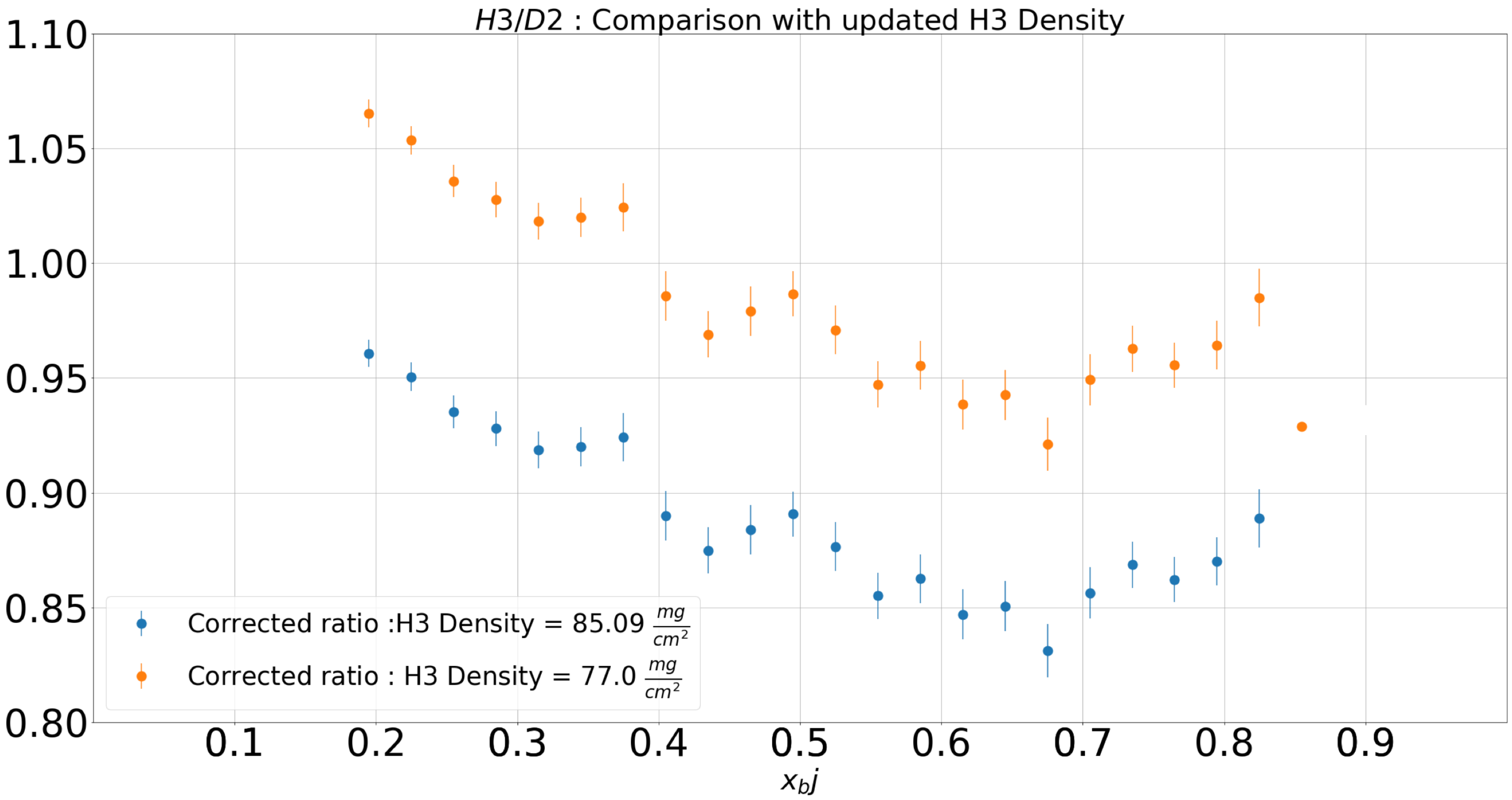
Cuts

- $\theta < |0.06|$
- $\phi < |0.03|$
- $\delta p < |0.04|$
- $z > -0.09$ & $z < 0.01$
- Cherekov sum > 2000
- $E/p > 0.75$
- Triggers:
  - T2 & T5
- $W^2 > 3.0$

Corrections

- Live Time
- **Density** : new H3 density
- e^+
- End Cap
- Beta Decay
- Radiative Corrections – (T2 externals)

$^{H3}/_{D2}$ with updated H3 density

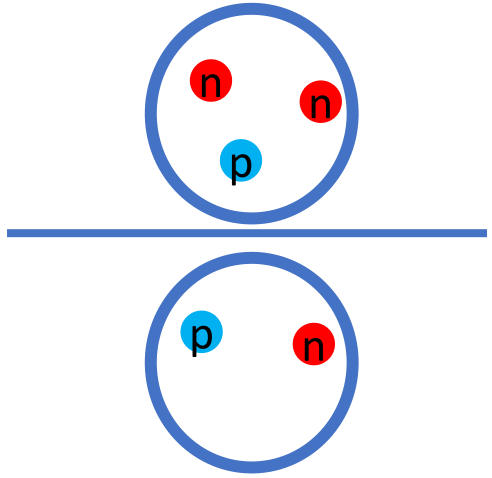


consistent with expectations ✓

Next Step

Isoscalar correction

Isoscalar factor

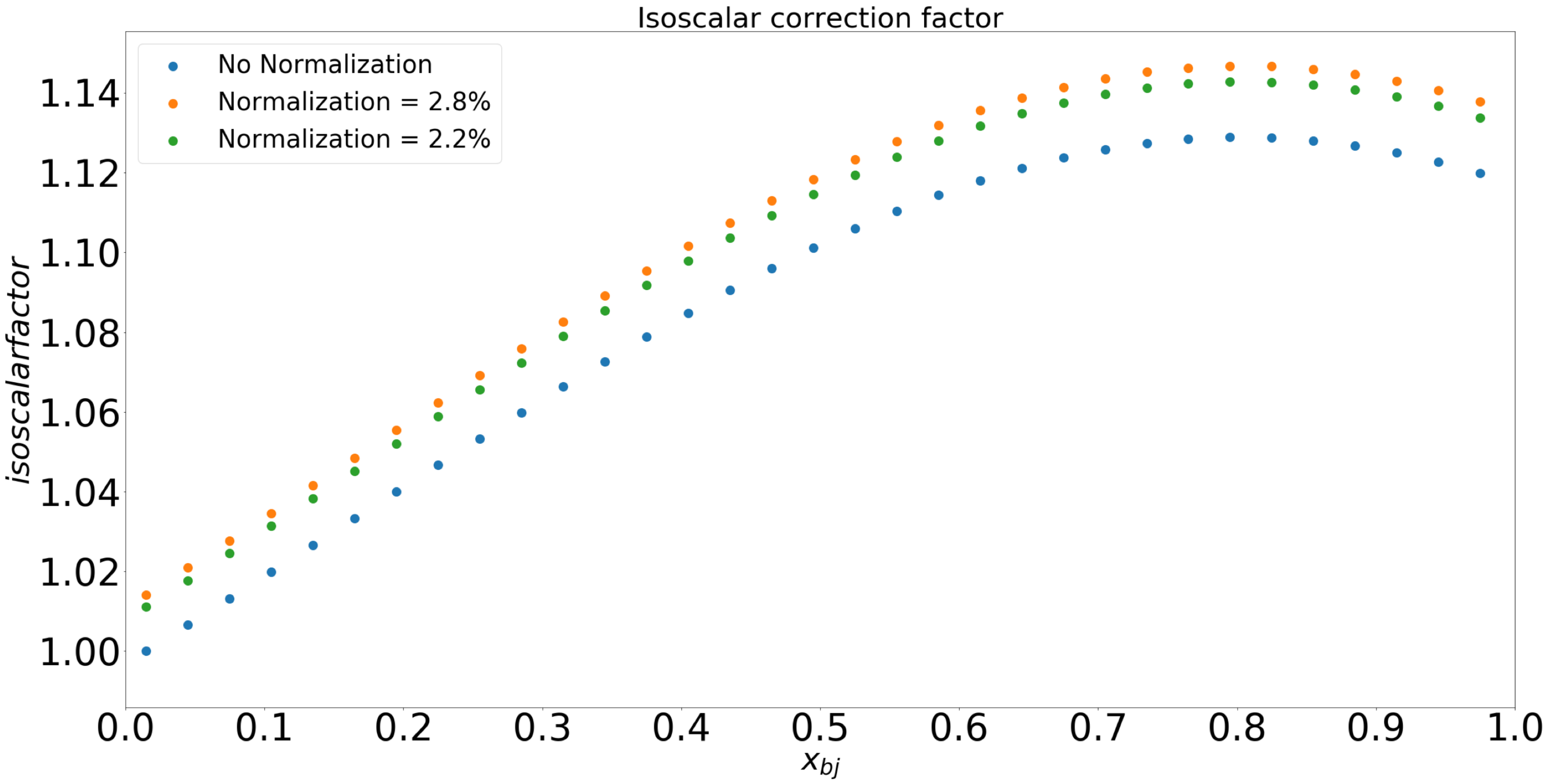


- EMC ratio : Ratio of per nucleon cross sections
  - where the per nucleon cross section is : $\frac{\sigma^A}{A}$
- For non-isoscalar nuclei : Z≠A/2
  - need to apply isoscalar correction to account for difference in proton and neutron cross sections

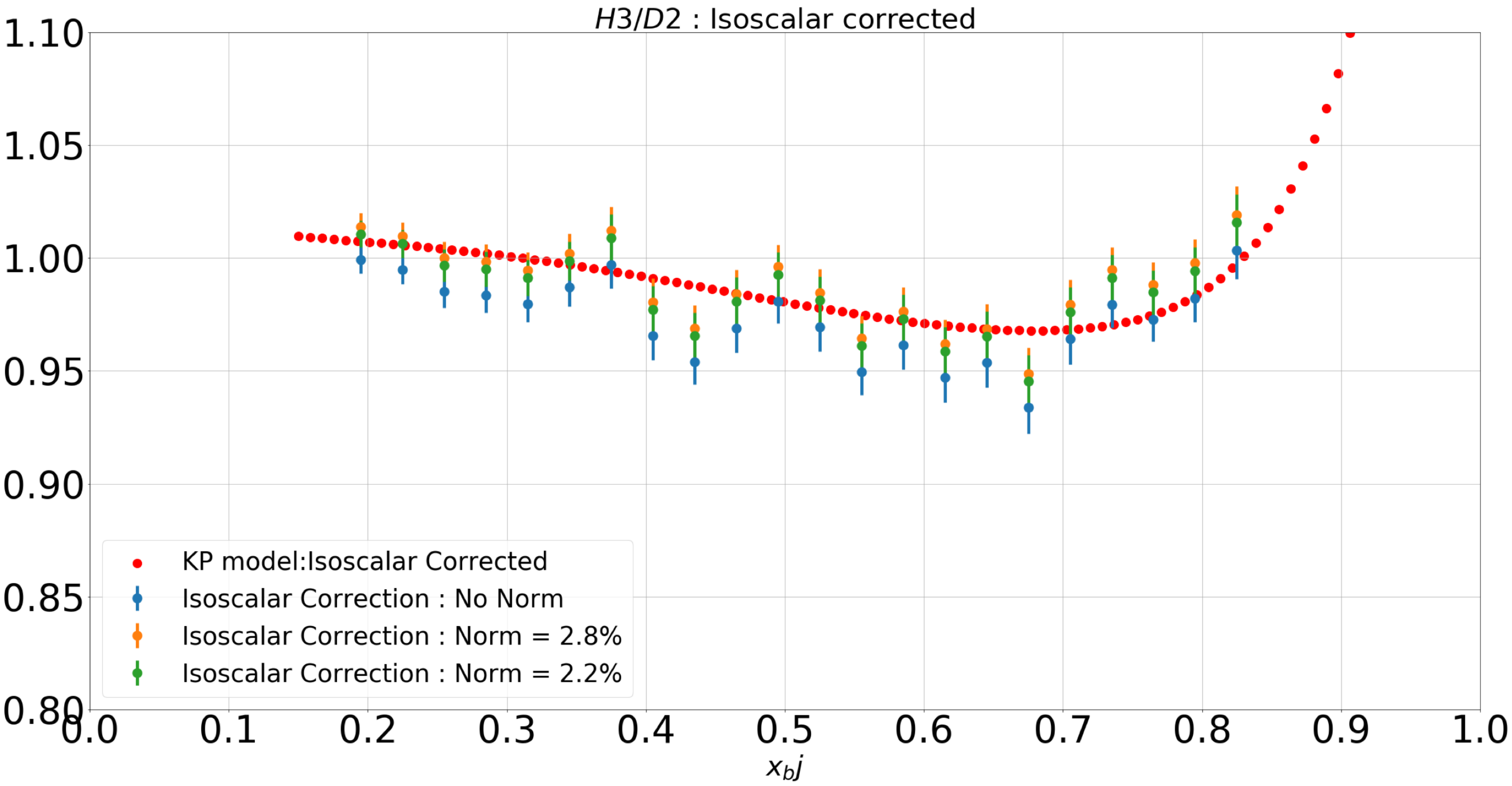
f_{iso} depends on $\frac{F_2^n}{F_2^p}$ input (Tong Su)

- $f_{iso} = \frac{\frac{1}{2}[F_2^n + F_2^p]}{\frac{1}{A}[ZF_2^p + (A-Z)F_2^n]} \Rightarrow f^{iso} = \frac{\frac{1}{2}\left[1 + \frac{F_2^n}{F_2^p}\right]}{\frac{1}{A}\left[Z + (A-Z)\frac{F_2^n}{F_2^p}\right]}$

Isoscalar correction factor for ${}^{H3}/_{D2}$ with different $\frac{F_2^n}{F_2^p}$ normalizations



H3/D2 Isoscalar corrected ratio Kulagni & Petti model



- Appears to match well with KP model
- Need to look into ”Bumps” [~0.37,~0.49] – pass2

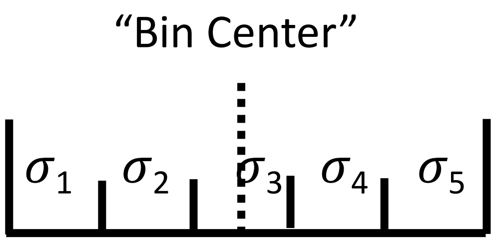
- 0.5% random systematic uncertainty is included along with statistical errors

Bin Centering Check

- In a given bin, the yield will be the averaged value not the central value of the bin
  - Bin Centering Correction Factor for MARATHON?
  - **Should be in terms of the ratio (since that is ultimately what we are doing)**
  - large? small?
- Check the **relative magnitude** of the correction for each target with a model (Kulagin and Petti)
  - **Look at the ratio of these factors**

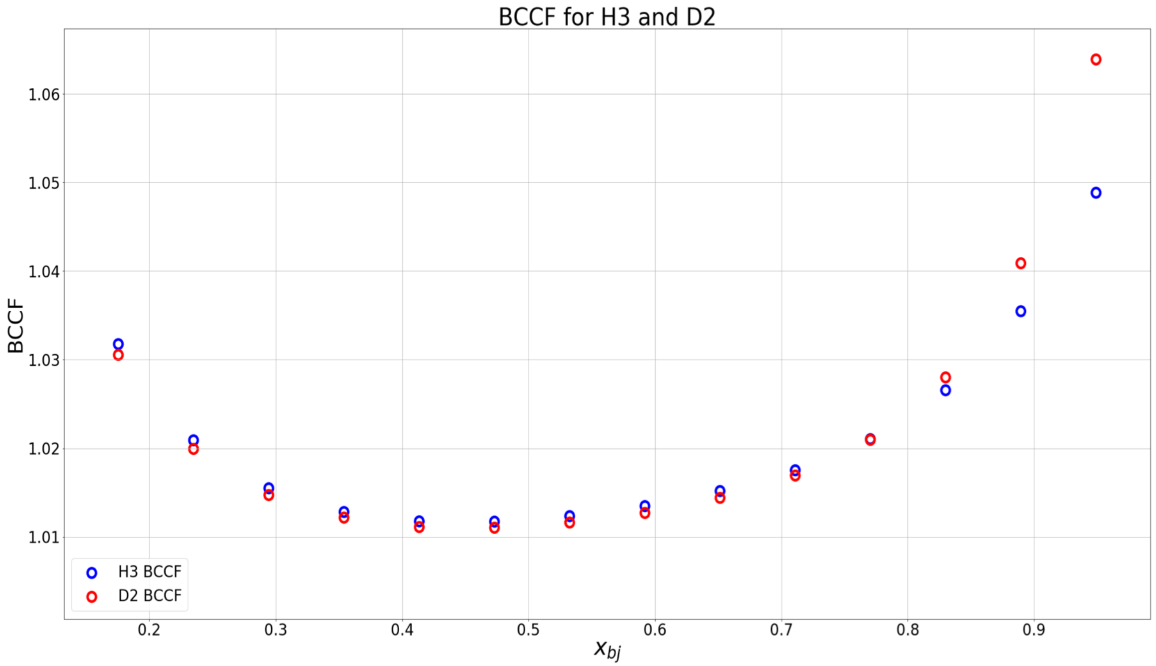
General Procedure

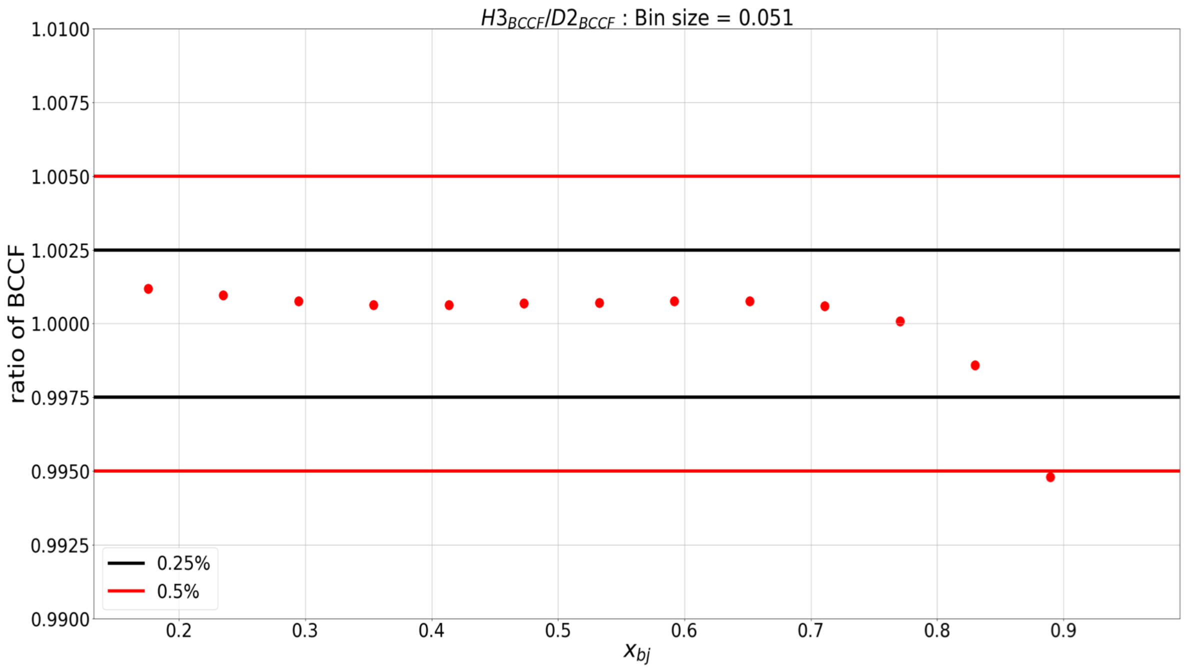
- KP model provides F_2 and x_b for Tritium, Helium 3, and Deuterium:
  - Use this to calculate : σ_{3_H}, $\sigma_{3_{He}}$, σ_{2_D}
  - Using the cross sections and x_{bj} we can test how different the average value for a given bin is from the bin center
  - Create bins from model
    - example : bin data in groups of 5



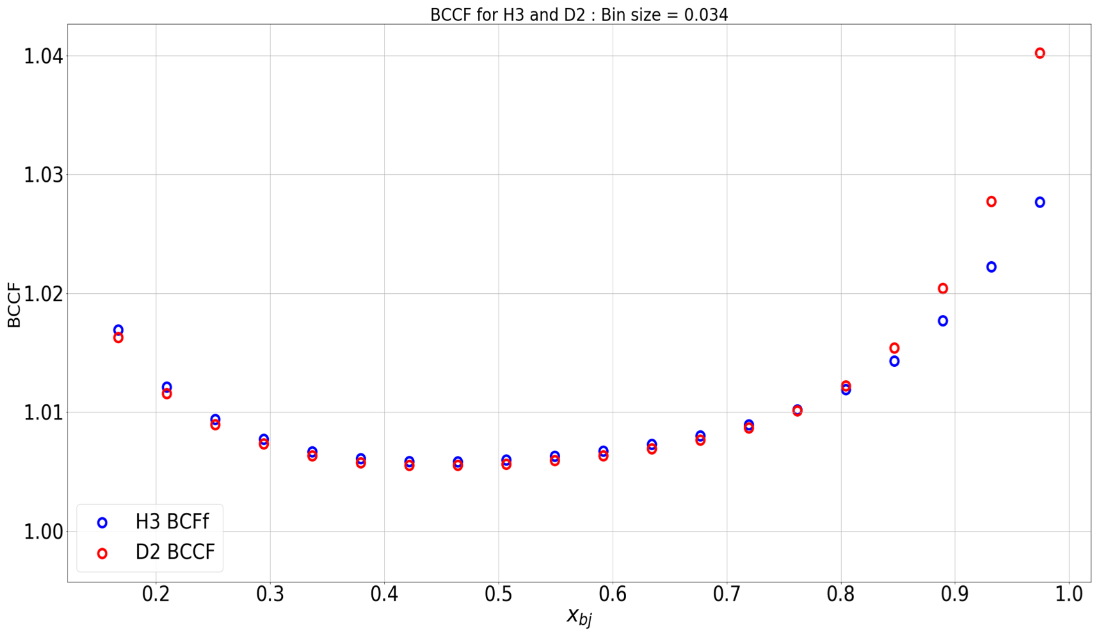
  - BCCF = how different the average value of the group is from the bin centered value
  - **What is the ratio of these corrections for H3,He3,D2 targets?**
- Rinse and repeat : vary bins size
  - compare with our nominal bin size : 0.03

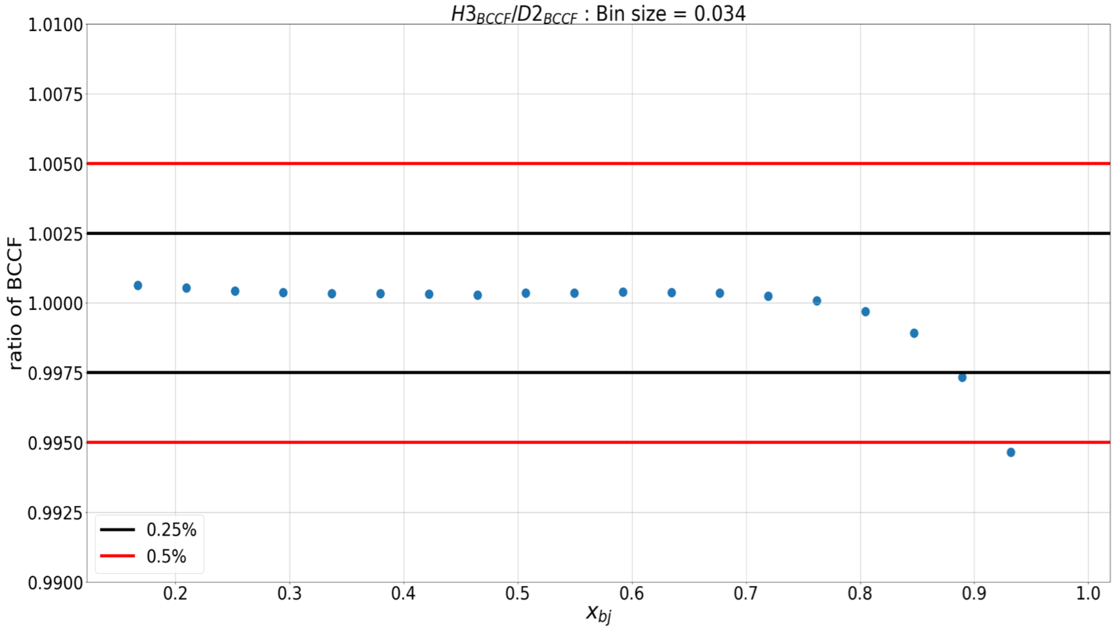
Bin size = 0.051





Bin Size = 0.034 (≈ our bin size)





Conclusions

- The larger the bin, the larger the correction factor (not surprising)
- Bin size = 0.034 : the **ratio** of the Bin Centering Correction factor for $\frac{^3H}{^3He}$, $\frac{^3He}{^2D}$, & $\frac{^3H}{^2D}$ **is $\lesssim$ 0.1 %** [Our nominal bin size]
- Suggests that we do not need to add a bin centering correction for the **ratios**

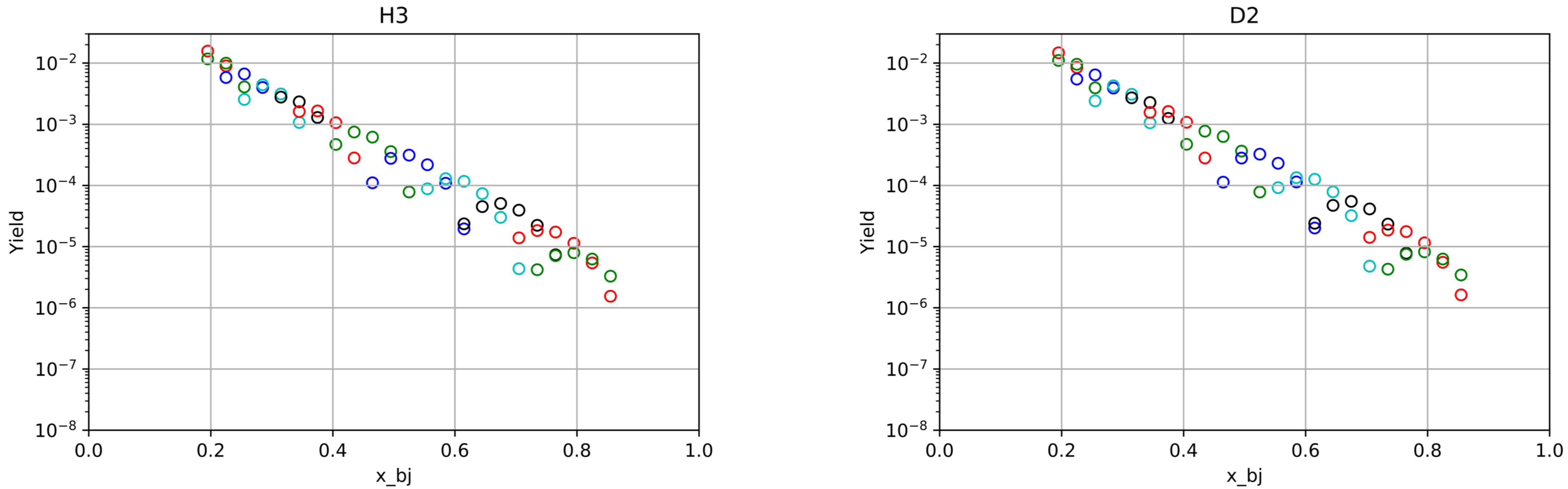
Thanks

(Will post some comparison plots for pass 2 shortly…)

Checks and Double Checks

- Checked corrections ✓
- Checked Yields for each Target ✓
- Checked need for Bin Centering ✓

Yields for Tritium and Deuterium



Plot of corrected H3/D2