Electron Scatter on A=3 Nuclei from MARATHON

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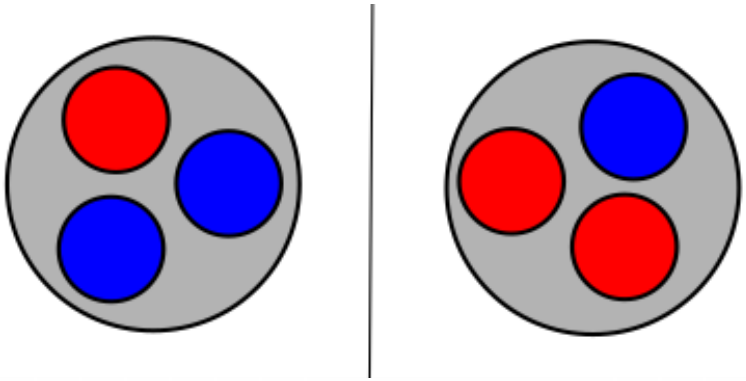
The MARATHON Experiment

MeAsurement of F_2^n/F_2^p, d/u RAtios and $A = 3$ EMC Effect in Deep Inelastic Electron Scattering off the Tritium and Helium MirrOr Nuclei.



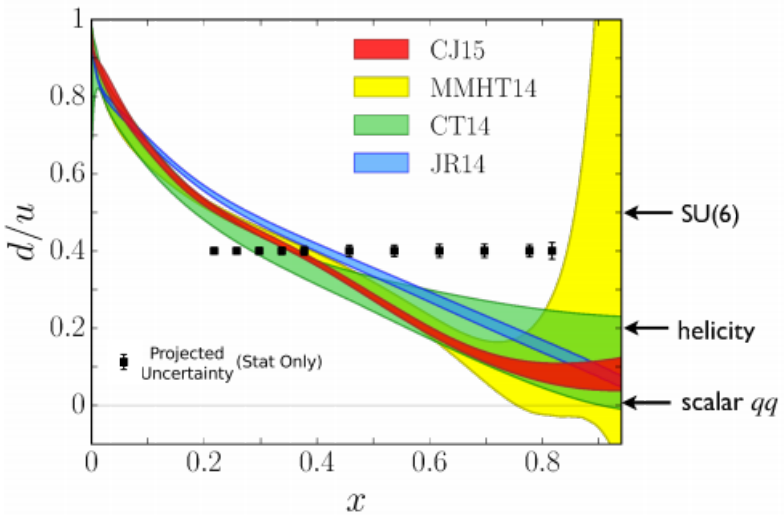
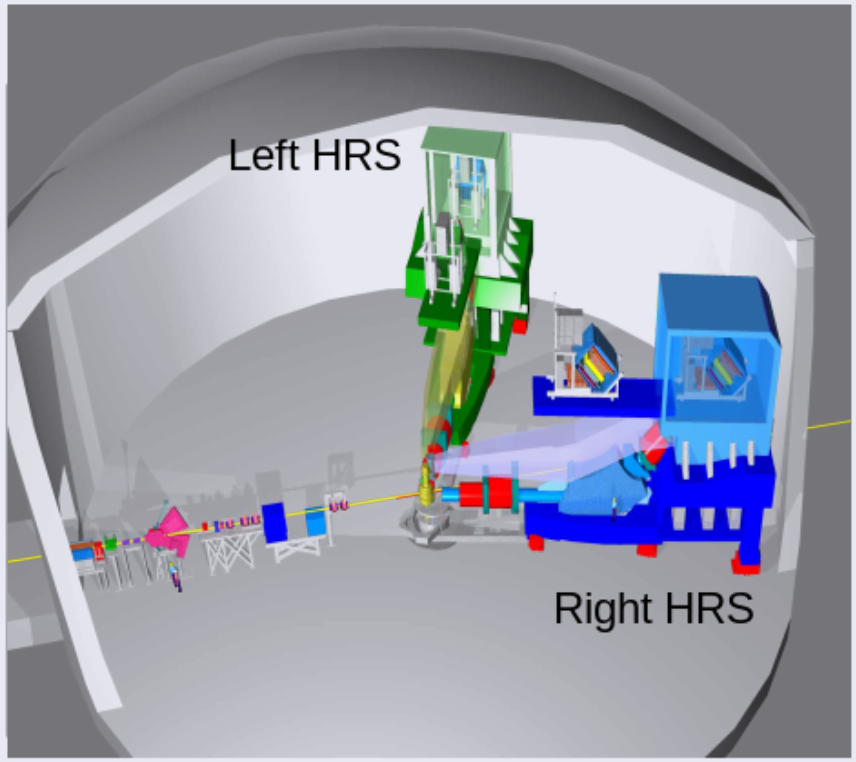


Figure: d/u quark distribution ratios

- Lightest and simplest mirror system
  - Number of protons in ^3H = neutrons in ^3He
- Differences in the nuclear effects are small
- Improve the current measurement and understanding of F_2^n/F_2^p ratio
- Restrict the assumptions and parameters made in the model calculations of the down to up quark distribution ratio
- 6 students from 4 universities

Jefferson Lab Hall A



Cross Section

$$\frac{d\sigma}{d\Omega dE'} = \frac{Yield}{Luminosity} = \frac{Ne-BG}{Luminosity*\epsilon}$$

$$N_e = L * \left(\frac{d\sigma}{d\Omega dE'}\right) * (\Delta E' \Delta\Omega)\, \epsilon * A(E'\theta) + BackGround$$

- L Luminosity $\equiv$ # of electrons per scattering centers
- $(\Delta E' \Delta\Omega)$ = size of bin
- ϵ = efficiencies
- $A(E'\theta)$ = Acceptance

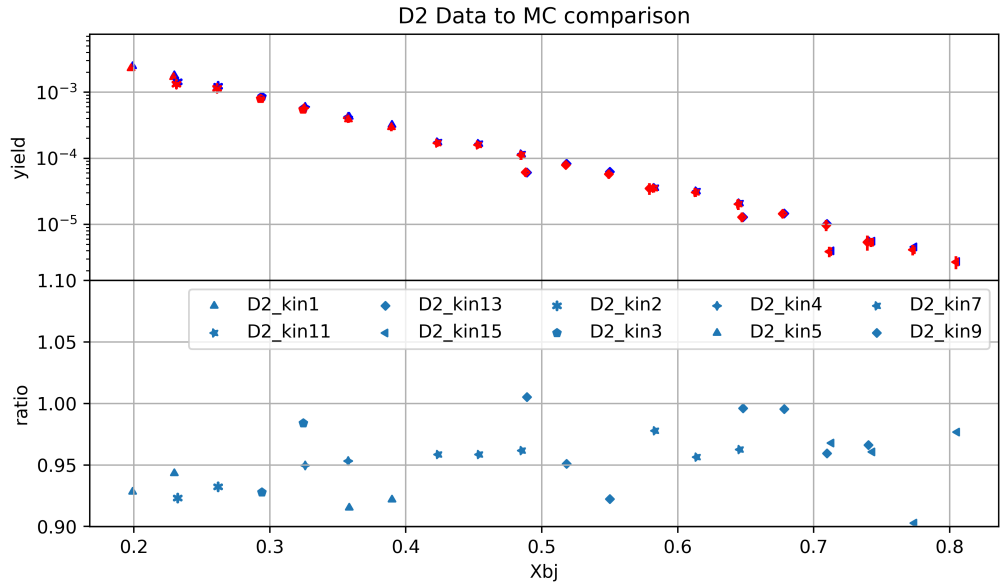
$$Yield_{data} = \frac{(N_e - BackGround)}{Efficency} = L * \sigma^{data} * (\Delta E' \Delta\Omega) * A(E'\theta)$$

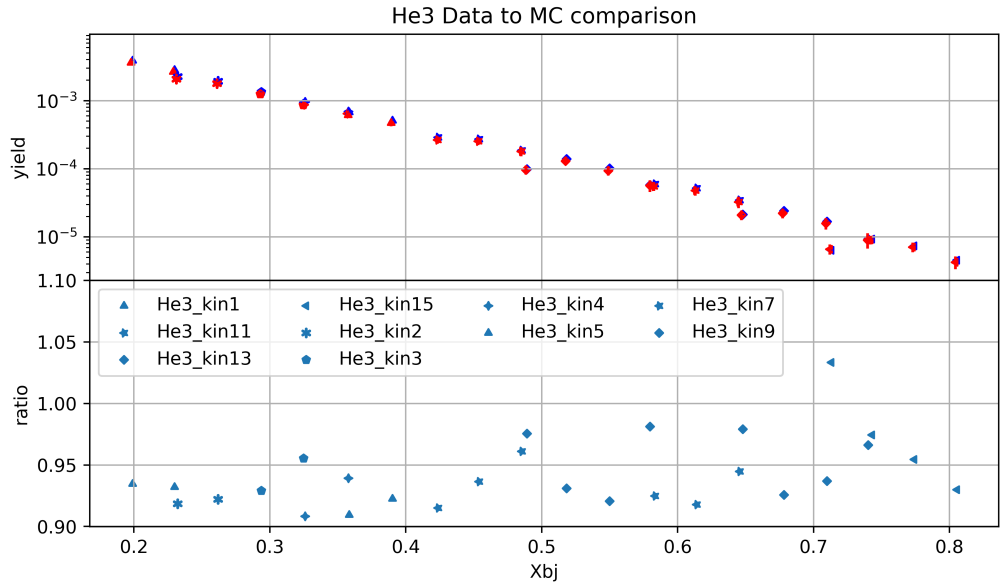
$$Yield_{MC} = L * \sigma^{mod} * (\Delta E' \Delta\Omega) * A(E'\theta)$$

Cross section by Monte carlo ratio method: $\frac{d\sigma}{d\Omega dE'} = \sigma^{mod} * \left[\frac{Yield_{data}(E',\theta)}{Yield_{MC}(E',\theta)}\right]$

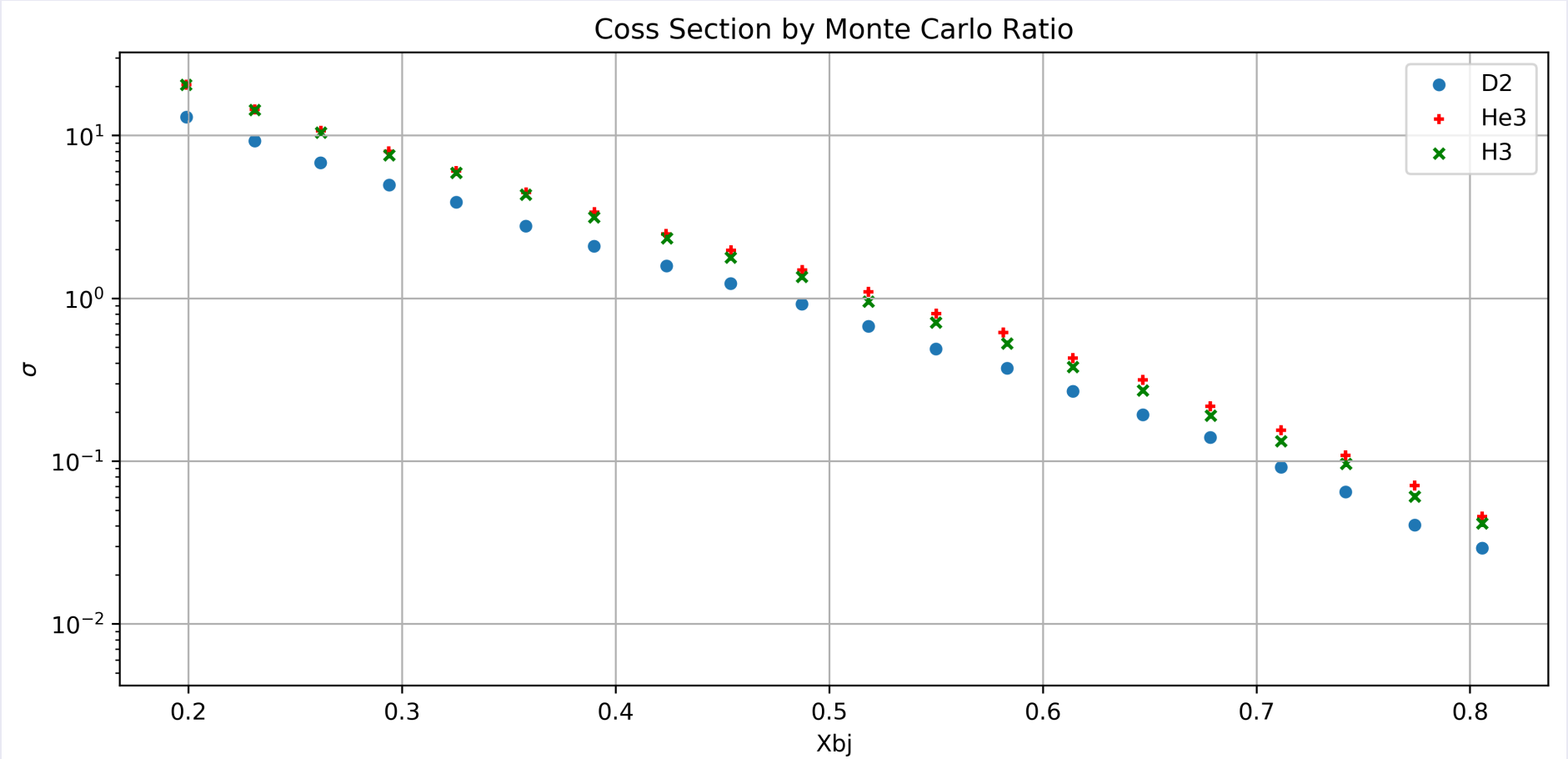
Monte Carlo to Data

- For Deuterium on kin15, we have 66 runs
- Use enough runs to average 10k events per bin
- monitoring the kinematic overlapping region

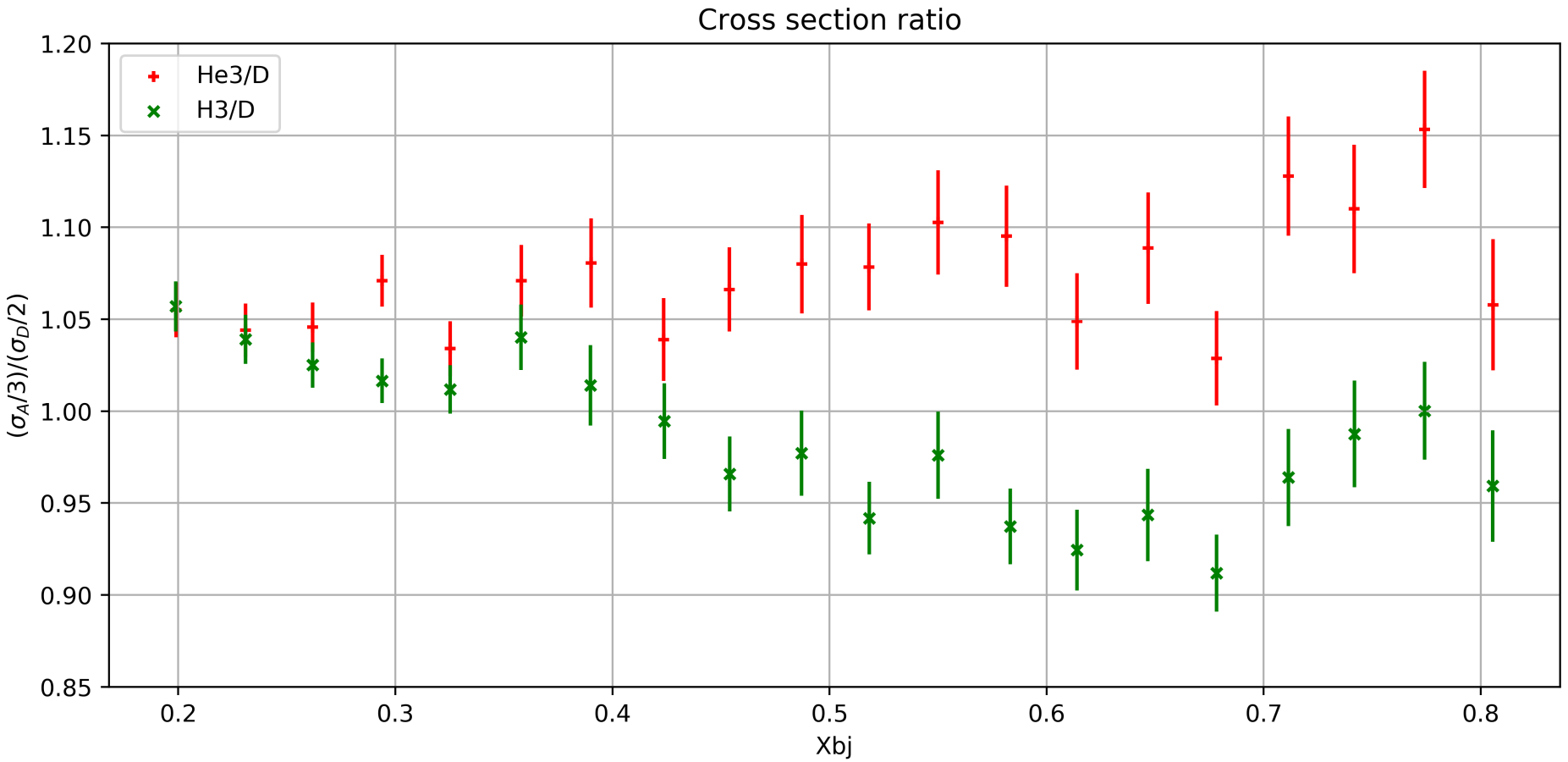




DIS (e,e′) Cross section



EMC effect



- Includes statistical error
- Need to add error from systematic studies