

Bggen Rate previous issue

“For files Rakitha made at /work/halla/solid/evgen/solid_bggen/lund_format/10k_lundfiles/SIDIS_He3 pi+ for He3 of "halD_pion_p_3He_10k_1.lund", the rate factor at the end of header line is 7704 pi+ for one window of "halD_pion_p_DST_Winu_10k_1.lund", the same factor is 230 the ratio is $7704/230=33$ Assuming pi+ cross section is same for neutron and proton, this ratio is only proportional to nucleon luminosity ratio nucleon luminosity ratio between 3He and one window should 1.6.” ---- from Zhiwen

Bggen Rate from generator code: bremsbeam_ini.F
$$vv = xstot * flx * xlum = xstot * (N_omega_EPA + N_omega_BREM) * de / e * xlum$$

$$xlum = ecurr / 1.6E-19 * target_length * target_density * 0.6022$$

luminosity ratio between 3He and one window should 1.6

Problem check

Two method:

1) **Fix the target** density=0.071, radiation length $X_0=63.047$ ----Rakitha

calculate event weighted rate: HalD_gen_lund.cc


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rate_LD_correction[i] = targ_density[i]/targ_A[i]/targ_density[0];
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hd_total_rate[i]*=rate_LD_correction[i];
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2) **From the event generator (Jixie's version):** put real target density and X_0 ----Ye

Two methods' difference:

$$\text{Rad_len} = (\text{Target density} * \text{length}) / X_0$$


$$\frac{N_{EPA}^{target}(\omega) + N_{Brem}^{target}(\omega)}{N_{EPA}^{LH}(\omega) + N_{Brem}^{LH}(\omega)}$$

Problem check

Compare two methods for the following setups:

PVDIS_LH: $\rho = 0.071 \text{ g/cm}^3$, $X_0 = 63.22 \text{ g/cm}^2$, and $\text{TargetL} = 40 \text{ cm}$

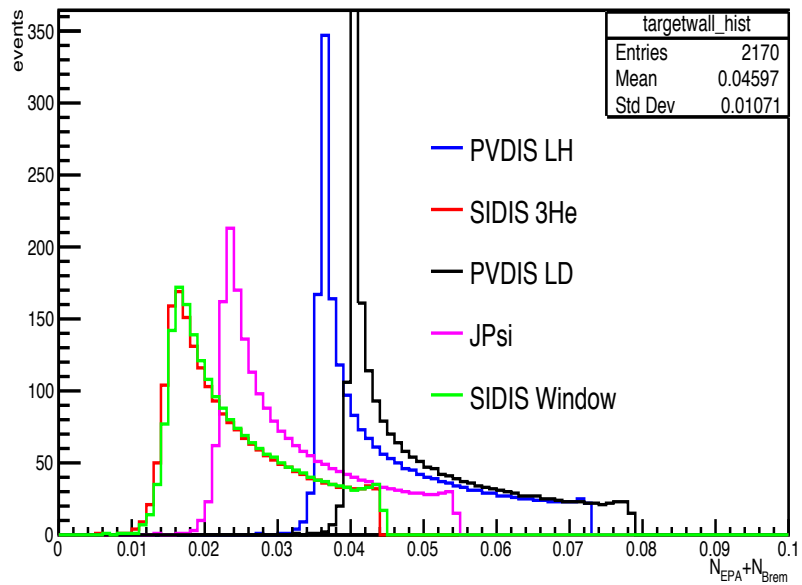
PVDIS_LD: $\rho = 0.169 \text{ g/cm}^3$, $X_0 = 125.97 \text{ g/cm}^2$, and $\text{TargetL} = 40 \text{ cm}$

SIDIS_3He: $\rho = 1.345 \times 10^{-3} \text{ g/cm}^3$, $X_0 = 67.42 \text{ g/cm}^2$, and $\text{TargetL} = 40 \text{ cm}$

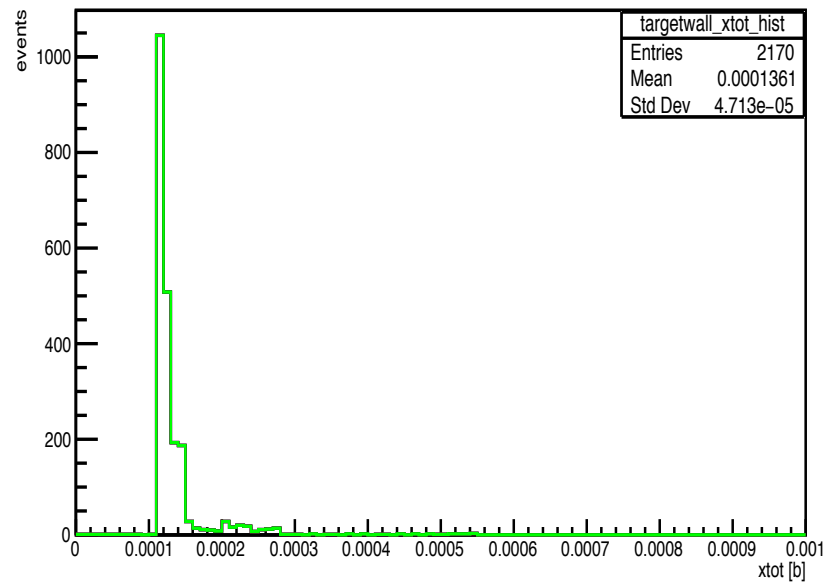
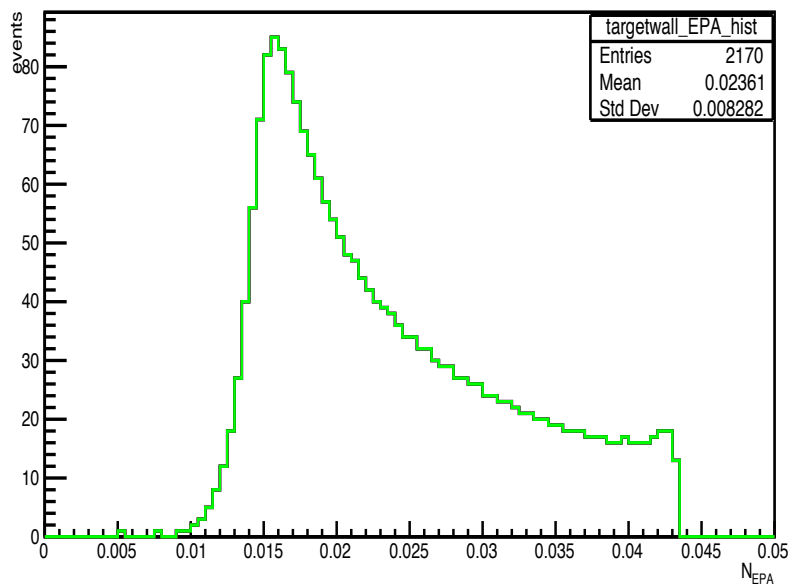
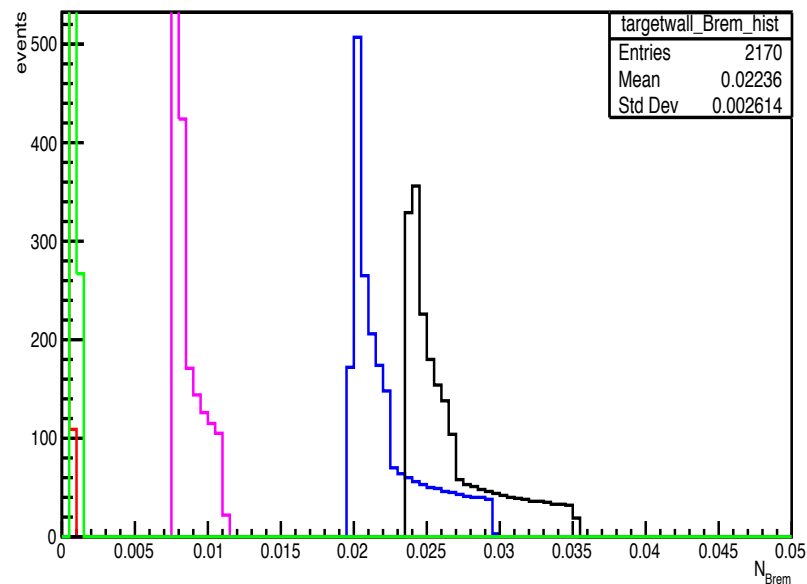
SIDIS_windows: $\rho = 2.76 \text{ g/cm}^3$, $X_0 = 19.42 \text{ g/cm}^2$, and $\text{TargetL} = 0.012 \text{ cm}$

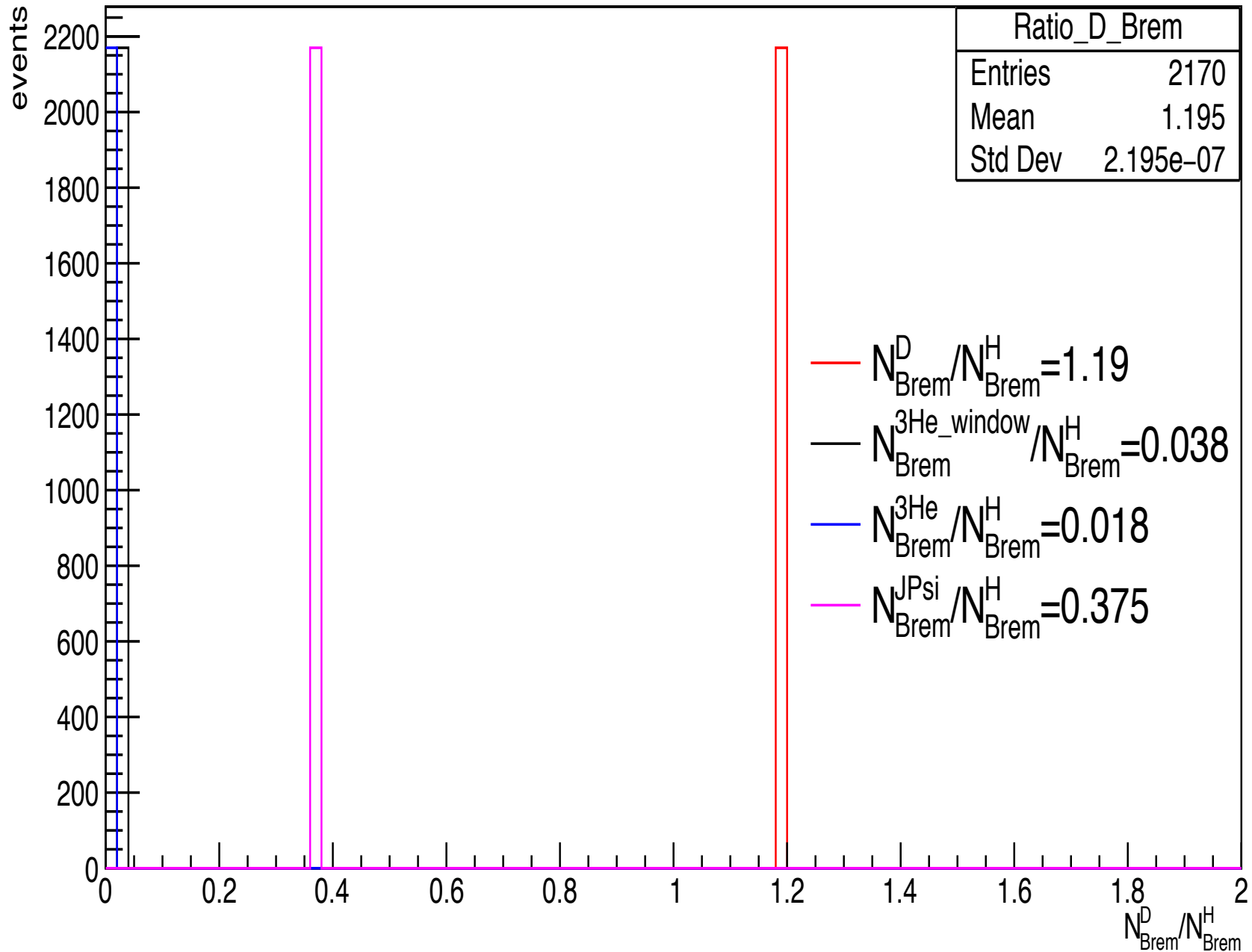
JPsi : $\rho = 0.071 \text{ g/cm}^3$, $X_0 = 63.22 \text{ g/cm}^2$, and $\text{TargetL} = 15 \text{ cm}$

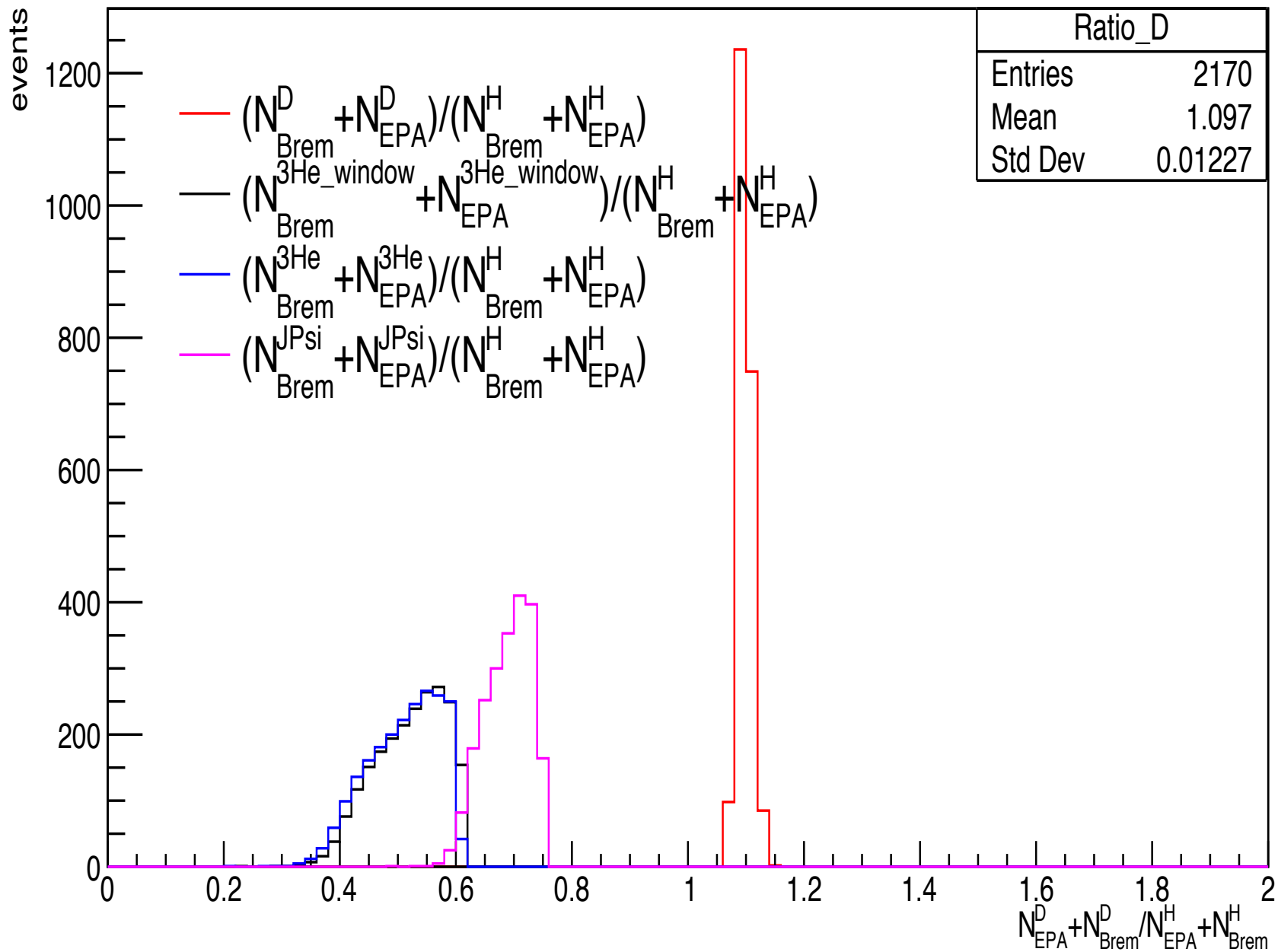
Rakitha's results from: /home/rakithab/Simulation_Analysis/Generators/HallD/ElectroProduction/10k_lund_files

$N_{\text{EPA}} + N_{\text{Brem}}$ 

xstot

 N_{EPA}  N_{Brem} 





Generate Rates Comparison (per event)

	PVDIS LH				
	Wiser kHz	Bggen (Rakitha) kHz	Bggen (rerun) kHz	Bggen (Ye) kHz	BggenYe/ bggenR
π^+	8.657e+3		1.473e+3	1.471e+3	1
π^-	3.548e+3		7.23e+2	7.22e+2	1
π^0	2.44e+3		1.185e+3	1.184e+3	1

10e4 events

Generate Rates Comparison (per event)

	PVDIS LD			
	Wiser kHz	Bggen (Rakitha) kHz	Bggen (Ye) kHz	Bggen-Y/ bggen-R
π^+	1.558e+4	2.88e+3	2.845e+3	0.98
π^-	1.558e+4	2.88e+3	2.845e+3	0.98
π^0	6.23e+4	2.75e+3	3.07e+3	1.1

Generate Rates Comparison (per event)

	SIDIS 3He			
	Wiser kHz	Bggen (R) kHz	Bggen(Y) kHz	Bggen-Y/ Bggen-R
π^+	24.199	7.726	3.89	0.56
π^-	18.2732	6.015	3.064	0.55
π^0	84.946	6.546	3.786	0.57

Generate Rates Comparison (per event)

	SIDIS 3He Windows			
	Wiser kHz	Bggen (Rakitha) kHz	Bggen(Ye) kHz	Bggen-Y/ Bggen-R
π^+	13.387	0.230	2.148	9.3
π^-	13.711	0.235	2.191	9.3
π^0	54.20	0.223	2.36	10

Generate Rates Comparison (per event)

	JPsi			
	Wiser kHz	Bggen (R) kHz	Bggen(Y) kHz	Bggen-Y/ Bggen-R
π^+	147.885	37.30	23.873	0.64
π^-	60.606	17.183	11.55	0.67
π^0	416.983	26.153	19.21	0.73

Isospin Symmetry Assumption

- Cross section calculation for $A > 1$:

$$\sigma_{\pi^-}(A) = \sigma_{\pi^+}(p) * (A - Z) + \sigma_{\pi^-}(p) * Z$$

Nucleon cross section

Summary

- From the above comparison, the rate ratio results between Ye and Rakitha is same for PVDIS_LH, and is about 1.1 for PVDIS_LD. However, this ratio is about 0.56 for SIDIS_3He.
- This rate ratio should be about 0.56 for SIDIS_3Hewindow also, which is shown on the plot of Page 6. Even though it is shown as 10 in the table. I think because of something is wrong in Rakitha's results. And the rate ratio is about 0.7 for JPsi setup.
- In conclusion, the hadron background rate for SIDIS_3He should be about half lower than that with the current simulation results.
- From the cross section comparison, the ration between the simulation and data are about 0.7 to 1.3. Next step, try to treat isospin assumption differently for resonance and DIS regions.