SIMC vs DATA Yield Comparison For SIDIS RUNS

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Hem Bhatt
Mississippi State University
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Calculation of Scale factor for Dummy Subtraction for Hydrogen and Deuterium Targets

Loop 2 : H_2 Target thickness , T_{H2} = 0.150 + 0.191 = 0.341 mm

Loop3 : D_2 Target thickness, T_{D2} = 0.130 + 0.188 = 0.318 mm

Al Dummy target mass density = 0.1816 + 0.1815 = 0.3631 gm/cm^2

Density of Al 7075 = 2.81 gm / cm^3

Hence, Thickness of Dummy target = 0.3631 / 2.81

T_{al} = 0.1292 cm ≡ 1.30 mm

Thickness Ratios :

T_{H2} / T_{al} = 0.341 / 1.30 = 0.262307 ≡ 0.262

T_{D2} / T_{al} = 0.318 / 1.30 = 0.2446154 ≡ 0.245

These ratios are Denoted by dummy_factor in the analysis.

Thus, we scale the Dummy data with the factor of **0.262** when subtracting from the H2 data and by a factor of **0.245** when subtracting from D2 data.

Hallc Targets

4 Target Thicknesses

4.1 Hydrogen loops

Entrance and exit window thicknesses are given below. Loop 1 is in standby with helium gas. Loop 2 is connected to the H2 panel and Loop 3 is connected to the D2 panel.

Target	Entrance (mm)	Exit (mm)	Length (mm)	Material
Loop 1 (4 cm)	0.165 ± 0.0019	0.151 ± 0.0053 Tip 0.151 ± 0.0097 Wall	40 ± 0.26	AL 7075
Loop 1 (10 cm)	0.104 ± 0.0025	0.133 ± 0.0096 Tip 0.162 ±0.014 Wall	100 ± 0.26	AL 7075
Loop 2 (10 cm)	0.150 ± 0.011	0.191± 0.019 Tip 0.219 ± 0.018 wall	100 ± 0.26	AL 7075
Loop 3 (10 cm)	0.130 ± 0.012	0.188 ± 0.013 Tip 0.184 ± 0.017 wall	100 ± 0.26	AL 7075

4.2 Dummy Targets

The dummy targets are aluminum foils mounted on separate frames with foils located at Z positions corresponding to the cryotarget exit and entrance windows.

Target	Thickness Total (g/cm^2)	Material
4 cm Dummy	0.0789 ± 0.00014 0.0811 ± 0.00014	Al 7075
10 cm Dummy	0.1816 ± 0.0003 0.1815 ± 0.0003	Al 7075

Setting 3-4 : SHMS at +ve polarity : Setting 4-4 : SHMS at -Ve Polarity : z = 0.35, pt = 0.04 GeV
x = 0.31, Q^2 = 3.10 GeV^2 ,P_{hms} = -5.27 GeV, P_{shms} = ±1.96 GeV , Θ_{hms} = 13.5° ,Θ_{shms} = 14°

Target	Run No	Charge (Q) mC	SHMS Tr. Eff. (1)	HMS Tr. Eff. (2)	Live Time (3)	Effective charge Q_{eff} = Q / [(1)*(2)*(3)] mC	Sum of Charges for a Target
Al	3838	16.10	0.9747	0.9984	0.9094	18.20	
	3839	31.70	0.9751	0.9987	0.9102	35.76	53.96
LH2	3840	23.10	0.9744	0.9983	0.9230	25.73	
	3841	23.10	0.9746	0.9983	0.9210	25.78	
	3842	22.80	0.9747	0.9984	0.9210	25.43	76.94
LD2	3835	16.68	0.9752	0.9983	0.9231	18.56	
	3836	15.96	0.9753	0.9982	0.9228	17.77	
	3837	16.10	0.9752	0.9753	0.9282	18.34	54.67

Scale factor for **Dummy subtraction**, $(f_{H2}) = [Q_{eff}]_{H2}$ / $[Q_{eff}]_{Al}$ * (dummy factor)

Hence, Scale factor for Dummy Runs = [76.94/53.96]*0.262 = 0.374
(to be subtracted from H2 data histogram)

And For Charge Normalization, as we use 1 mC in Simc, so we make the same in Data by :

For H2 Data, for charge Normalization, 1 / $[Q_{eff}]_{H2}$ = 1 / 76.94 = 0.012997 ≡ 0.013
(to scale the H2 data to get normalized yield)

Similarly, Scale factor for D2 Runs = 0.25 and charge Normalization factor = 0.0183

Setting 3-4 : SHMS at +ve polarity : Setting 4-4 : SHMS at -Ve Polarity : z = 0.35, pt = 0.04 GeV
x = 0.31, Q^2 = 3.10 GeV^2 ,P_{hms} = -5.27 GeV, P_{shms} = ±1.96 GeV , Θ_{hms} = 13.5° ,Θ_{shms} = 14°

For Data

Thus, a clean Histogram consists of :

1) The raw histogram obtained from Data
2) With accidentals subtracted
3) With Dummy Subtracted
4) Charge Normalized (i.e. we have the histograms for Yield per mc)

For SIMC

Normfac for setting 3-4 = 0.138391E+12
No. of Events Simulated = 500,000
Simc Factor = 0.138391E+12 / 500,000
We weight the simc histogram by getting "weight" from Simc Leaf and then multiplying by Simc Factor, that is new weight is **wt = weight * Simc Factor.**

PID_CUTS:

SHMS : pion_cut : P.aero.npeSum > 1.0 && P.cal.eprtracknorm < 0.2
HMS : electron_cut : H.cer.npeSum > 1.0 && H.cal.etottracknorm > 0.6
&& H.cal.etottracknorm < 2.0 && H.cal.eprtracknorm > 0.2

Looking at Setting 3 -4, 3 -8 and 3 -12 with SHMS at Positive Polarity And 4 -4, 4 -8 and 4 -12 with SHMS at Negative Polarity

Kinematic Group 3

KInematics: x=0.31, Q2=3.10 GeV2, W=2.79 GeV

HMS settings: p=-5.27 GeV, theta = 13.5

SHMS polarity: positive

					PTrig6	approximate			Goals and actual mC						
	SHMS	SHMS			LH2	beam current			LH2		LD2		Dummy		Done?
#	P	The	z	pt	Hz/3	LH2	LD2	Dum	goal	got	goal	got	goal	got	
1	1.96	8.0	0.35	-0.16	47.	4.1	2.0	9.1	37.	37.	26.	26.2	33.	33.2	done
2	1.96	10.0	0.35	-0.09	96.	6.1	3.0	13.5	44.	45.	31.	31.3	41.	41.7	done
3	1.96	12.0	0.35	-0.02	182.	9.2	4.6	20.4	55.	58.8	39.	39.7	50.	52.7	done
4	1.96	14.0	0.35	0.04	273.	14.2	7.1	31.6	68.	69.	48.	48.6	62.	63.4	done
5	1.96	16.0	0.35	0.11	359.	22.4	11.2	40.0	85.	85.	60.	61.	70.	70.	done
6	1.96	18.0	0.35	0.18	388.	35.9	17.9	40.0	108.	112.	77.	81.	70.	71.	done
7	1.96	20.0	0.35	0.25	587.	58.5	29.2	40.0	138.	141.	98.	101.	70.	70.	done
8	1.96	22.0	0.35	0.32	504.	60.0	48.4	40.0	140.	142	126.	126.	70.	71.	done
9	1.96	24.0	0.35	0.39	303.	60.0	60.0	40.0	140.	141.	140.	141.	70.	71.	done
10	1.96	26.0	0.35	0.45	182.	60.0	60.0	40.0	140.	141.	140.	141.	70.	73.	done
11	1.96	28.0	0.35	0.52	109.	60.0	60.0	40.0	140.	147.	140.	146.	70.	81.	done
12	1.96	30.0	0.35	0.58	64.	60.0	60.0	40.0	140.	150.	140.	140.	70.	80.	done

Kinematic Group 4

KInematics: x=0.31, Q2=3.10 GeV2, W=2.79 GeV

HMS settings: p=-5.27 GeV, theta = 13.5

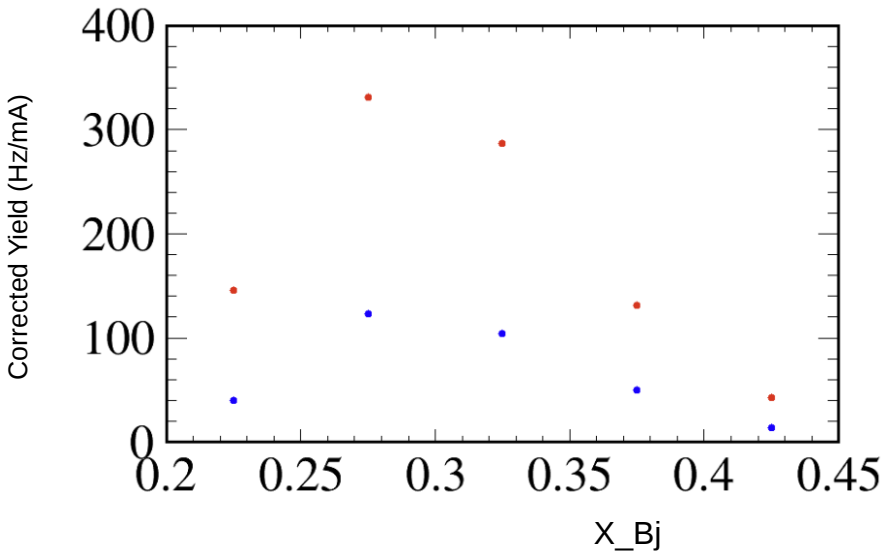
SHMS polarity: negative

					PTrig6	approximate			Goals and actual mC						
	SHMS	SHMS			LH2	beam current			LH2		LD2		Dummy		
#	P	The	z	pt	Hz/3	LH2	LD2	Dum	goal	got	goal	got	goal	got	
1	-1.96	8.0	0.35	-0.16	47.	4.1	2.0	9.1	37.	37.9	26.	27.8	33.	34.6	done
2	-1.96	10.0	0.35	-0.09	96.	6.1	3.0	13.5	44.	45.3	31.	31.	41.	43.7	done
3	-1.96	12.0	0.35	-0.02	182.	9.1	4.6	20.3	55.	56.0	39.	39.9	50.	51.3	done
4	-1.96	14.0	0.35	0.04	273.	14.0	7.1	31.4	68.	69.0	48.	48.2	62.	62.8	done
5	-1.96	16.0	0.35	0.11	359.	20.7	11.1	40.0	82.	82.2	60.	43.4	70.	70.8	done
6	-1.96	18.0	0.35	0.18	388.	29.1	17.8	40.0	98.	99.4	76.	75.7	70.	71.37	done
7	-1.96	20.0	0.35	0.25	587.	46.3	29.1	40.0	123.	124.9	97.	98.4	70.	74.37	done
8	-1.96	22.0	0.35	0.32	504.	60.0	48.1	40.0	140.	141.5	125.	125.3	70.	78.9	done
9	-1.96	24.0	0.35	0.39	303.	60.0	60.0	40.0	140.	141.8	140.	142.4	70.	72.8	done
10	-1.96	26.0	0.35	0.45	182.	60.0	60.0	40.0	140.	145.4	140.	142.6	70.	72.5	done
11	-1.96	28.0	0.35	0.52	109.	60.0	60.0	40.0	140.	146.0	140.	144.0	70.	79.0	done
12	-1.96	30.0	0.35	0.58	64.	60.0	60.0	40.0	140.	144.0	140.	141.0	70.	89.0	done

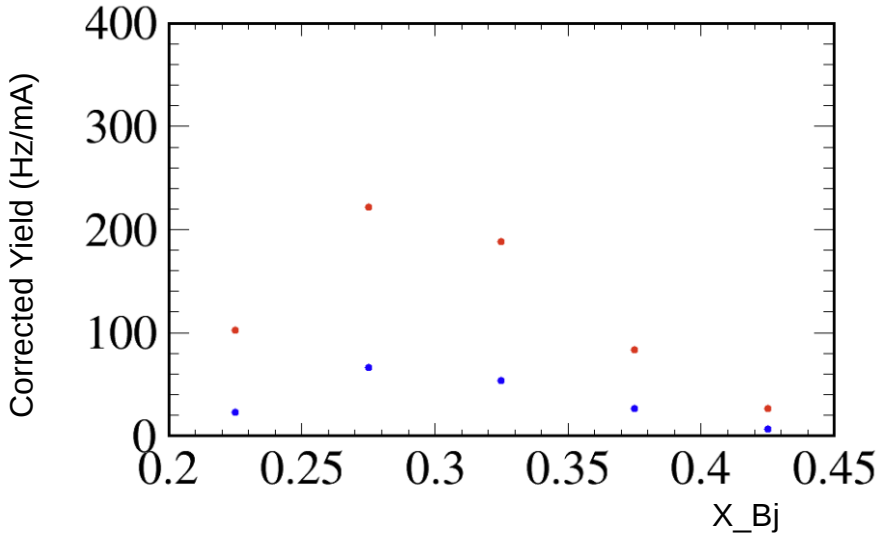
Setting 3-4 : SHMS at +ve polarity : Setting 4-4 : SHMS at -Ve Polarity : z = 0.35, pt = 0.04 GeV
x = 0.31, Q^2 = 3.10 GeV^2 ,P_{hms} = -5.27 GeV, P_{shms} = ±1.96 GeV , Θ_{hms} = 13.5°, Θ_{shms} = 14°

H2 target

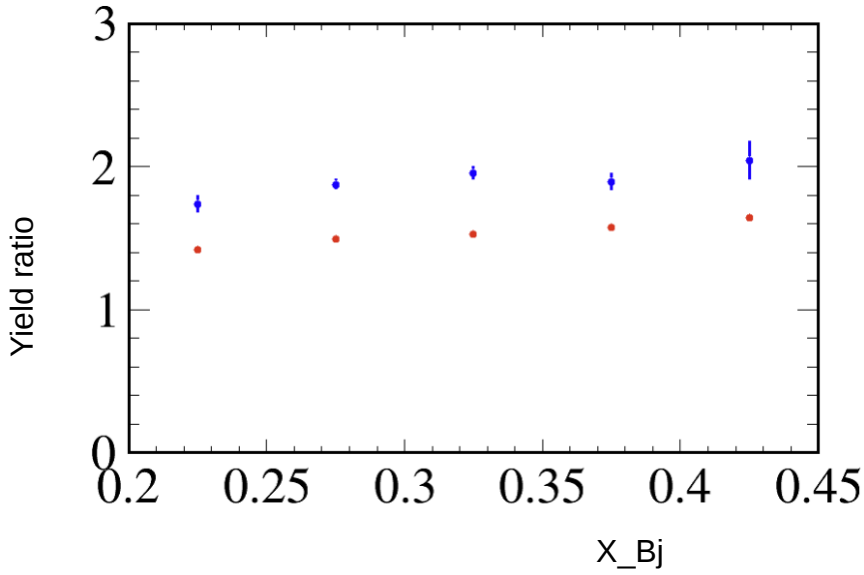
Pi+ Yield for **Data** and **SIMC**



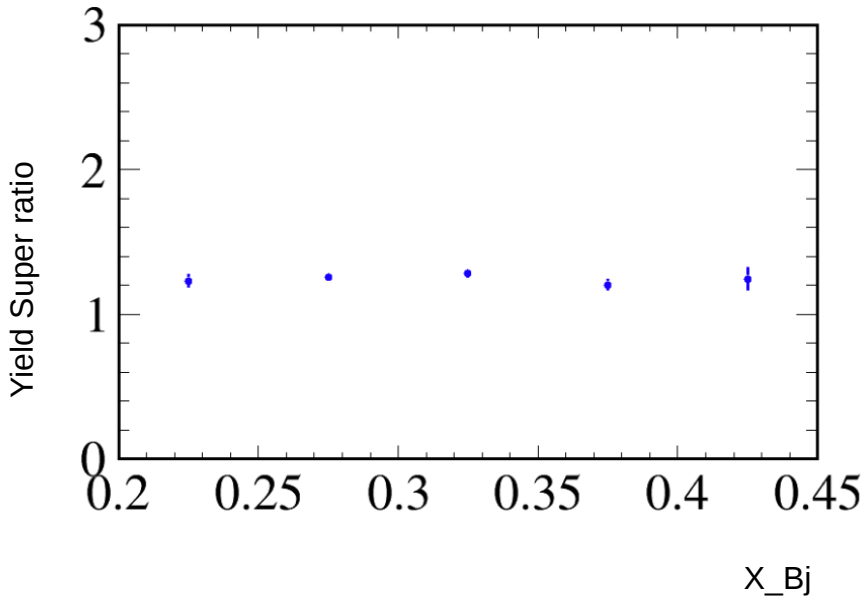
Pi- Yield for **Data** and **SIMC**



Yield ratio (pi+ & pi-) for **Data** and **SIMC**



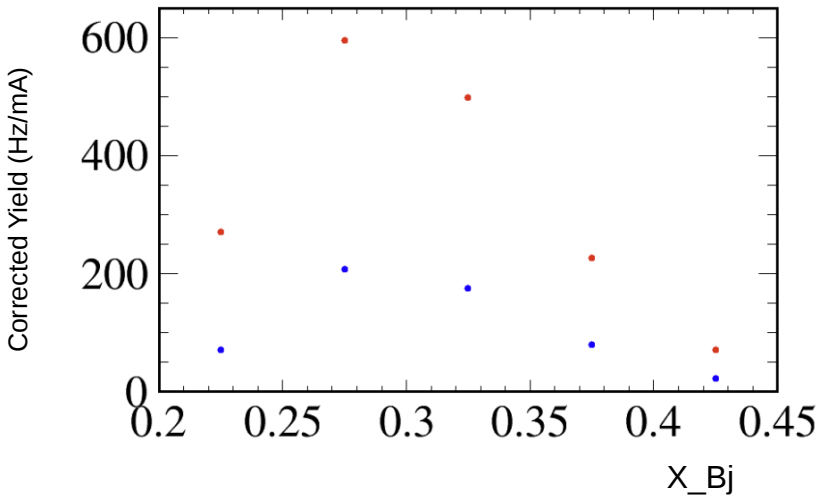
Yield Super ratio of [(pi+ / pi-) **Data**] / [(pi+ / pi-) **SIMC**]



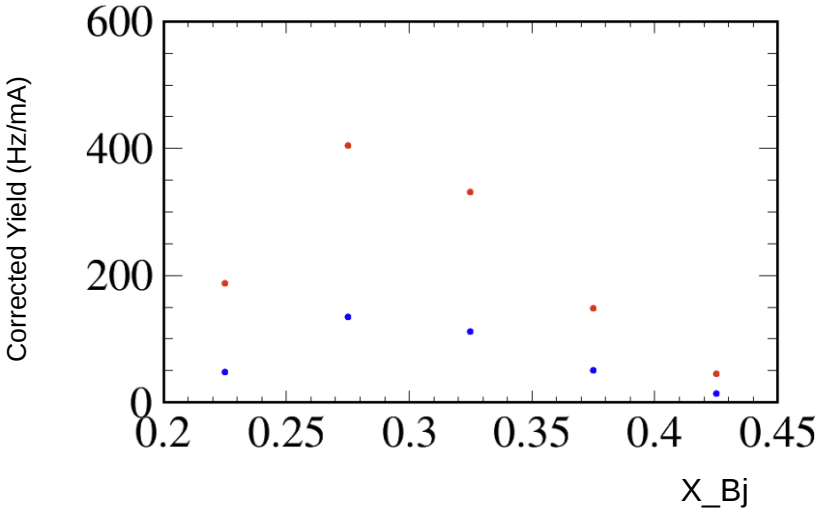
Setting 3-4 : SHMS at +ve polarity : Setting 4-4 : SHMS at -Ve Polarity : z = 0.35, pt = 0.04 GeV
x = 0.31, Q^2 = 3.10 GeV^2 ,P_{hms} = -5.27 GeV, P_{shms} = ±1.96 GeV , Θ_{hms} = 13.5°, Θ_{shms} = 14°

D2 Target

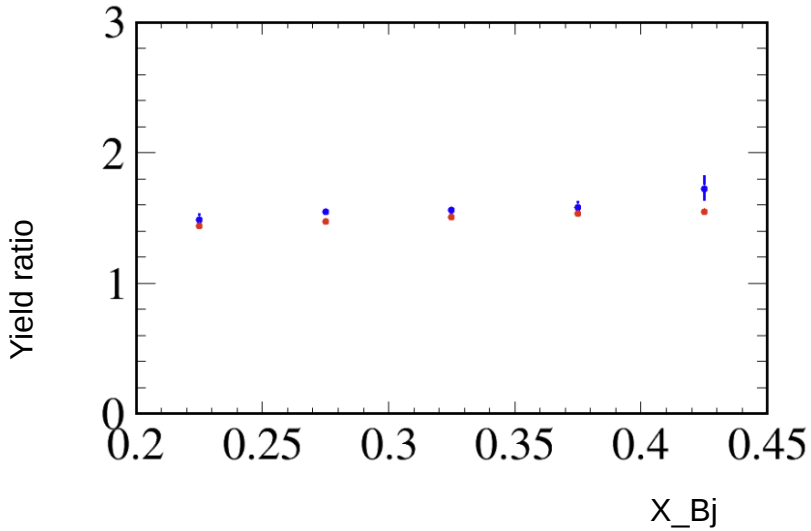
Pi+ Yield for **Data** and **SIMC**



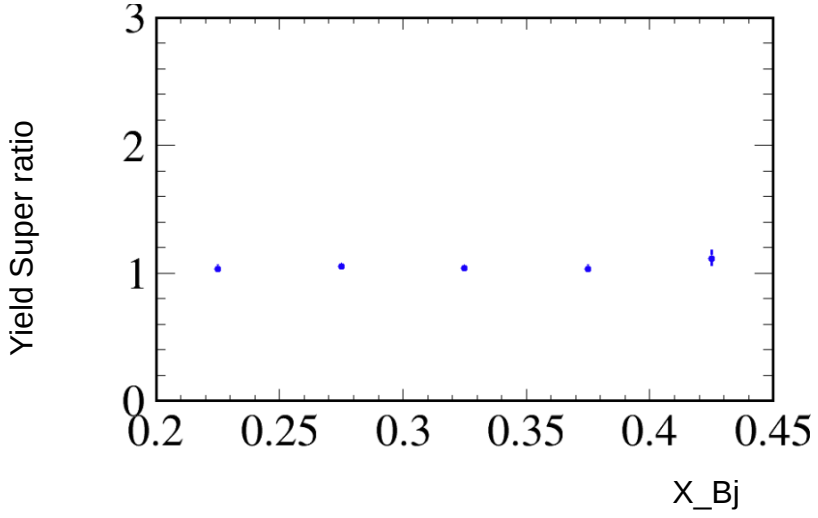
Pi- Yield for **Data** and **SIMC**



Yield ratio (pi+ & pi-) for **Data** and **SIMC**



Yield Super ratio of [(pi+ / pi-) **Data**] / [(pi+ / pi-) **SIMC**]

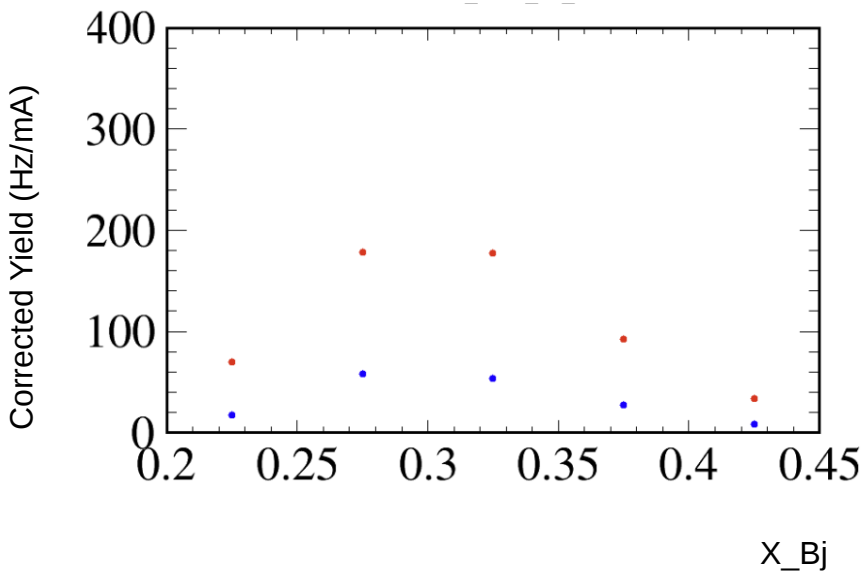


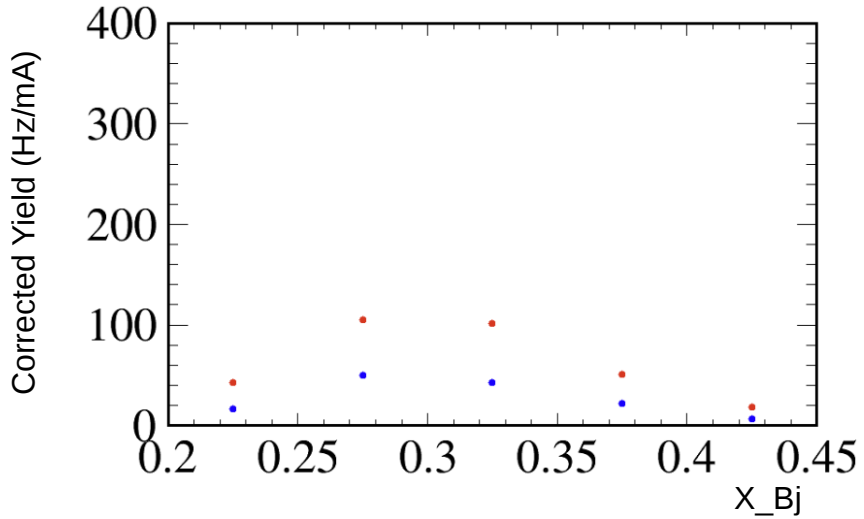
Setting 3-8 : SHMS at +ve polarity : Setting 4-8 : SHMS at -Ve Polarity : z = 0.35, pt = 0.32 GeV
$x = 0.31$, $Q^2 = 3.10\ GeV^2$, $P_{hms} = -5.27\ GeV$, $P_{shms} = \pm 1.96\ GeV$, $\Theta_{hms} = 13.5^\circ$, $\Theta_{shms} = 22^\circ$

Pi+ Yield for **Data** and **SIMC**

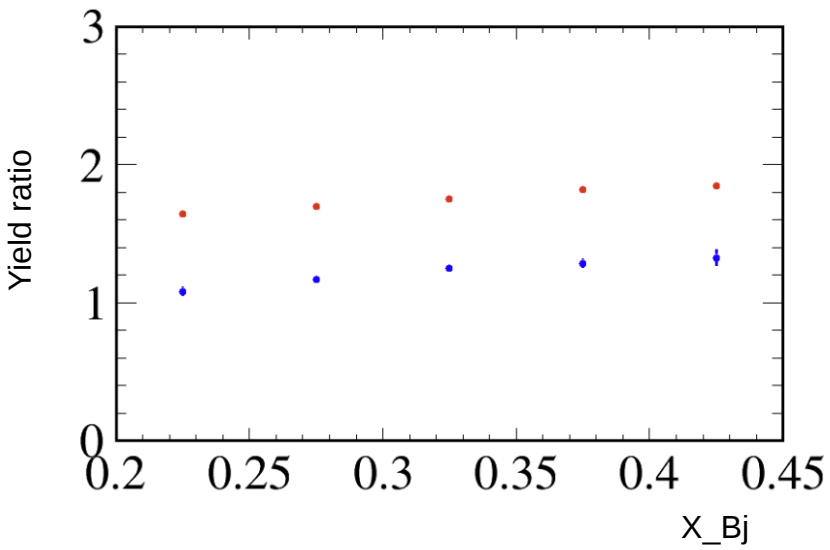
H2 target

Pi- Yield for **Data** and **SIMC**

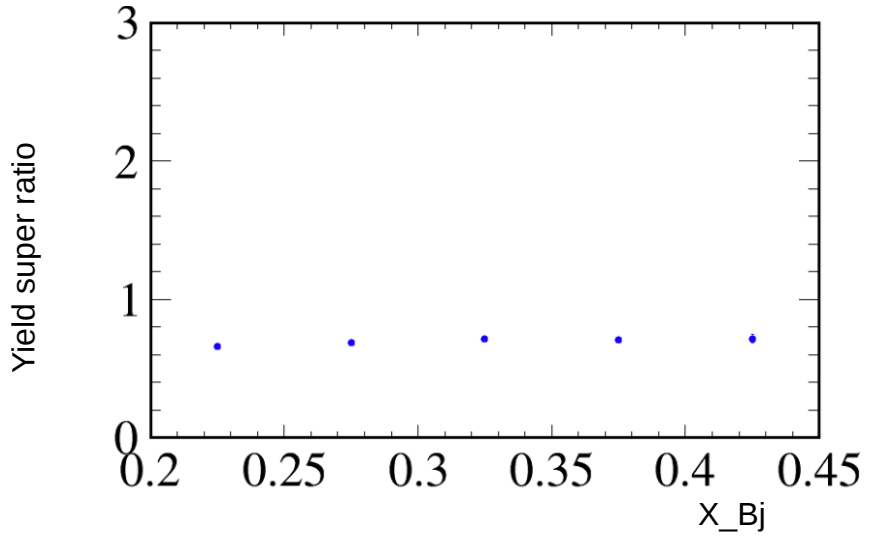




Yield ratio (pi+ & pi-) for **Data** and **SIMC**



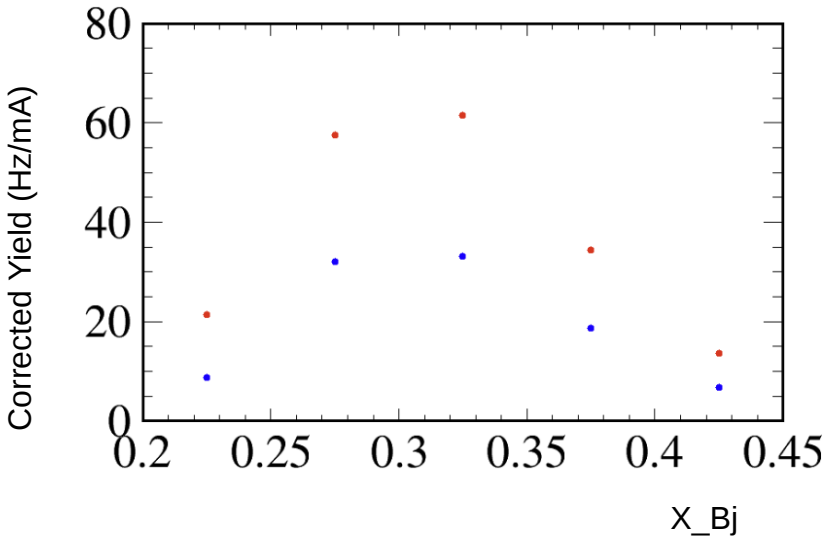
Yield Super ratio of [(pi+ / pi-) **Data**] / [(pi+ / pi-) **SIMC**]



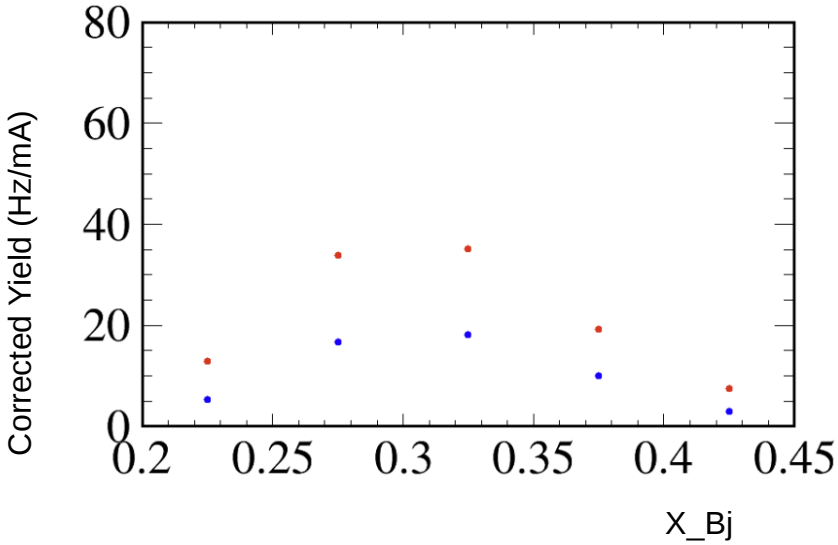
Setting 3-12 : SHMS at +ve polarity : Setting 4-12 : SHMS at -Ve Polarity : z = 0.35, pt = 0.58 GeV
x = 0.31, Q^2 = 3.10 GeV^2 ,P_{hms} = -5.27 GeV, P_{shms} = ±1.96 GeV , Θ_{hms} = 13.5°,Θ_{shms} = 30°

H2 target

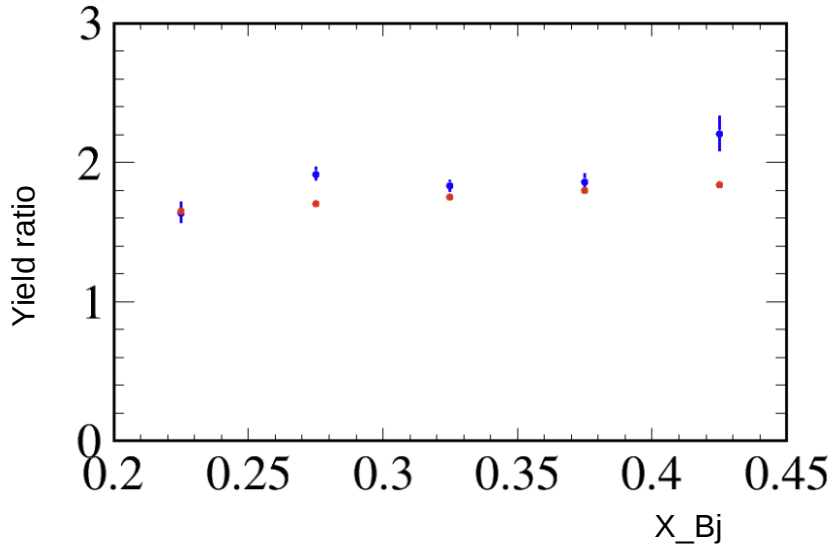
Pi+ Yield for **Data** and **SIMC**



Pi- Yield for **Data** and **SIMC**



Yield ratio (pi+ & pi-) for **Data** and **SIMC**



Yield Super ratio of [(pi+ / pi-) **Data**] / [(pi+ / pi-) **SIMC**]