

LHRS Analysis for d_2^n

SAMC and Acceptance Cut Study (Reprise) and Raw ^3He Cross Sections

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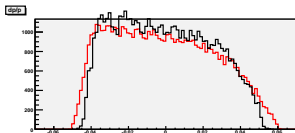
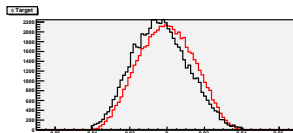
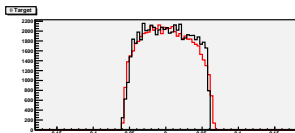
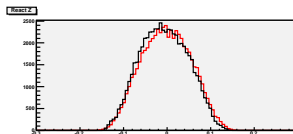
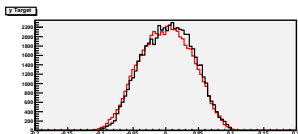
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Outline

- 1 Acceptance
 - SAMC and Acceptance Cuts (Reprise)
- 2 Raw ^3He Cross Sections
 - Updated Calculations
- 3 Summary

Acceptance (1)

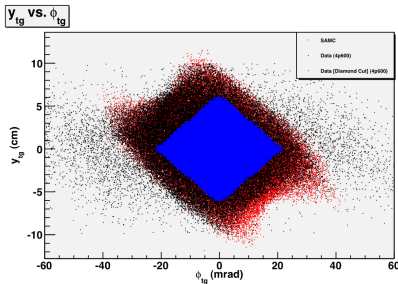
A Recap of Last Time: Reconstructed Target Variables



Acceptance (2)

Edge Effects: Target Variables y and ϕ

- Before choosing cuts on the acceptance, we need to remove edge effects
 - Look at the plot of y_{tg} vs. ϕ_{tg}



- Cut: $|y_{tg} + 2.9\phi_{tg}| < 0.06$
 && $|y_{tg} - 2.9\phi_{tg}| < 0.06$

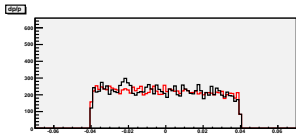
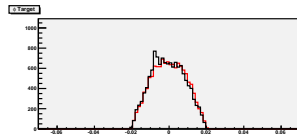
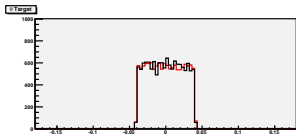
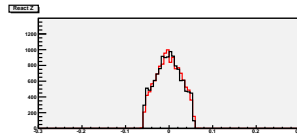
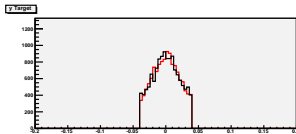
Acceptance (3)

Weight Factor: Results

Cut Sets for Acceptance Study						
Set #	$\delta p/p$ (%)	θ_{tg} (mrad)	ϕ_{tg} (mrad)	y_{tg} (cm)	Z_r (cm)	w
1	4	50	20	5	10	0.7005 ± 0.0071
2	0.5	50	20	5	10	0.7219 ± 0.0147
3	1	50	20	5	10	0.7219 ± 0.0147
4	2	50	20	5	10	0.7204 ± 0.0103
5	3	50	20	5	10	0.7138 ± 0.0084
6	4	10	20	5	10	0.7027 ± 0.0161
7	4	20	20	5	10	0.7015 ± 0.0114
8	4	30	20	5	10	0.7024 ± 0.0093
9	4	40	20	5	10	0.7036 ± 0.0080
10	4	50	10	5	10	0.7000 ± 0.0084
11	4	50	13	5	10	0.7000 ± 0.0084
12	4	50	17	5	10	0.7005 ± 0.0071
13	4	50	20	5	10	0.7005 ± 0.0071
14	4	50	20	1	10	0.6955 ± 0.0127
15	4	50	20	2	10	0.7038 ± 0.0095
16	4	50	20	3	10	0.7034 ± 0.0082
17	4	50	20	4	10	0.7013 ± 0.0075
18	4	50	20	5	2	0.6969 ± 0.0109
19	4	50	20	5	4	0.7038 ± 0.0083
20	4	50	20	5	6	0.7012 ± 0.0074
21	4	50	20	5	8	0.7005 ± 0.0071
22	3.5	40	20	4.5	10	0.7037 ± 0.0084

Acceptance (4)

Optimal Cut + Diamond Cut



Raw ^3He Cross Sections (1)

New Acceptance Cuts (Determined at $p = 0.60$ GeV)

- We utilize the new acceptance cuts discussed previously:
 - $\Delta\theta = 80$ mrad
 - $\Delta\phi = 40$ mrad
 - $\Delta\Omega = 3.2$ msr
 - $\Delta Z_r = 20$ cm
 - $\Delta y_{tg} = 9.0$ cm
 - $\Delta p/p = 7.0\%$
 - $|y_{tg} + 2.9\phi_{tg}| < 0.06$ && $|y_{tg} - 2.9\phi_{tg}| < 0.06$
 - $w = 0.7037 \pm 0.0084$
 - **Note:** $\Delta Z \neq \Delta Z_r!$
 - $\Delta Z = 35.6$ cm

Raw ^3He Cross Sections (2)

Before and After: Results at 4-pass With New Acceptance Cuts

- $\frac{d^2\sigma}{d\Omega dE'}$ units: $\frac{\text{pb}}{\text{sr}\cdot\text{MeV}}$

Raw ^3He Cross Sections: $E_b = 4730$ MeV			
p (MeV)	$\frac{d^2\sigma_{\text{raw}}}{d\Omega dE'}$ [before]	$\frac{d^2\sigma_{\text{raw}}}{d\Omega dE'}$ [after]	% Difference
600	11.2548 ± 0.1859	9.0328 ± 0.0956	10.9525
800	4.3215 ± 0.1103	3.4260 ± 0.0549	11.5583
1120	1.4088 ± 0.0392	1.0702 ± 0.0164	13.6573
1190	1.0765 ± 0.0309	0.8599 ± 0.0134	11.1857
1260	0.8377 ± 0.0254	0.6615 ± 0.0108	11.7505
1420	0.4630 ± 0.0164	0.3640 ± 0.0073	11.9732
1510	0.2977 ± 0.0108	0.2440 ± 0.0046	9.90974
1600	0.1979 ± 0.0082	0.1465 ± 0.0033	14.9285

Raw ^3He Cross Sections (3)

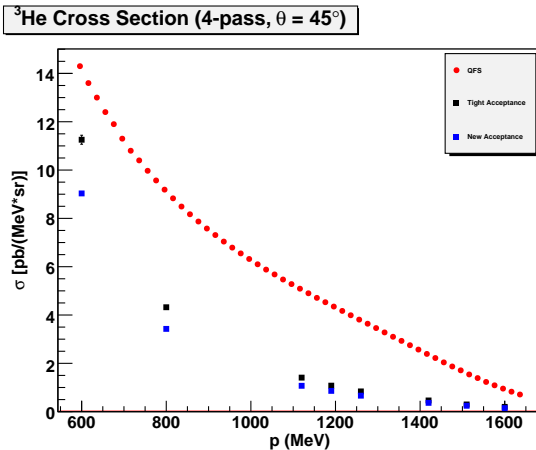
Before and After: Results at 5-pass With New Acceptance Cuts

- $\frac{d^2\sigma}{d\Omega dE'}$ units: $\frac{\text{pb}}{\text{sr}\cdot\text{MeV}}$

Raw ^3He Cross Sections: $E_b = 5890 \text{ MeV}$			
p (MeV)	$\frac{d^2\sigma_{\text{raw}}}{d\Omega dE'}$ [before]	$\frac{d^2\sigma_{\text{raw}}}{d\Omega dE'}$ [after]	% Difference
600	11.2205 ± 0.1097	8.8861 ± 0.0549	11.6101
700	6.2678 ± 0.0994	4.9296 ± 0.0460	11.9507
900	2.2154 ± 0.0529	1.7601 ± 0.0227	11.4518
1130	0.9350 ± 0.0262	0.7452 ± 0.0114	11.2979
1200	0.6477 ± 0.0247	0.5637 ± 0.0116	6.93121
1270	0.5344 ± 0.0162	0.4456 ± 0.0070	9.05863
1340	0.4360 ± 0.0190	0.3432 ± 0.0085	11.9132
1420	0.3035 ± 0.0105	0.2445 ± 0.0044	10.7601
1510	0.2144 ± 0.0096	0.1705 ± 0.0040	11.3984
1600	0.1450 ± 0.0064	0.1159 ± 0.0028	11.1639
1700	0.0952 ± 0.0063	0.0728 ± 0.0028	13.3425

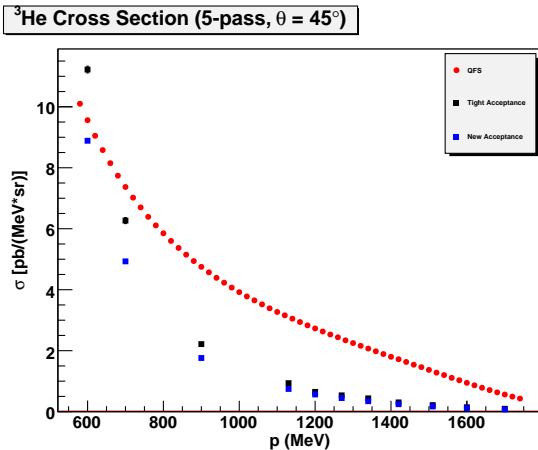
Raw ^3He Cross Sections (4)

Comparison to QFS at 4-pass



Raw ^3He Cross Sections (5)

Comparison to QFS at 5-pass



Summary

- Acceptance:
 - Cut studies show $w \sim 0.7 \pm 1\%$
 - There seems to be some edge effects in ϕ_{tg} which can be suppressed by the so-called 'diamond cut'
- Raw ^3He Cross Section:
 - New acceptance cuts increase statistics, but also have a substantial effect on the cross section
 - A change in $\frac{d^2\sigma}{d\Omega dE'}$ on the order of $\sim 10\%$

What's Next?

- Acceptance:
 - Gather more statistics in SAMC
 - 1M events will get us to $\sim 0.1\%$ \Rightarrow how low should we go (given that it takes well over a week to run for 1M events)?
 - Extend study to all other kinematics
 - Informed by the first point
- Cross Section:
 - Nitrogen:
 - Determine density and dilution factors
 - Calculate σ_N and compare to QFS
 - Play with QFS to scale to our data
 - Start thinking about systematic errors associated with detector cuts (GC, PR, etc.), live time and others
- Asymmtery:
 - On the verge of e^- and π^- raw asymmetries
 - Target polarizations are in the queue for Yawei. . .