

RATE ESTIMATES FOR $d_2^n(Q^2)$

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The tables below are a first estimate of the expected rates and asymmetries for the different kinematics proposed by B. Sawatzky. The JLab PDF parameterization CJ15NLO was used for the estimates of nucleon rates here. The errors in the raw asymmetries shown in the tables below is based on electrons emerging from the target region only.

TABLE 1. Input parameters.

E [GeV]	l_{tgt} [cm]	ρ_{tgt} (fill) [amg]	ρ_{tgt} (T-corr.) [amg]	P_{tgt}	P_{beam}	I [μ A]	Be [mil]	GE180 [μ m]	A_{charge} [ppm]
10.4	40	8.26	10.56	0.50	0.80	30	10	280	200

Assumptions:

- SHMS
 - SHMS acceptance: 50 cm, -15% , $+25\%$ (relative to p_0)
 - N_2 density of $1.4 \times 10^{19} \text{ cm}^{-3}$
 - $\Delta P_{tgt} = 0$
 - $\Delta P_{beam} = 0$
 - $\Delta A_{charge} = 0$
- HMS
 - HMS acceptance: 10 cm, -10% , $+10\%$ (relative to p_0)
 - N_2 density of $1.4 \times 10^{19} \text{ cm}^{-3}$
 - $\Delta P_{tgt} = 0$
 - $\Delta P_{beam} = 0$
 - $\Delta A_{charge} = 0$

Note: The angles for the Be window and the GE180 end windows are not properly accounted for. The central spectrometer angles were used for all components. A total data taking time of 125 hours per setting was assumed.

Disclaimer: Some new additions to the code have not been extensively tested!!!

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The proposed kinematic settings for a beam energy of 10.4 GeV are shown in the following two tables. Either the primed or the unprimed will be used. .

TABLE 2. HMS settings

Label	E' [GeV]	θ [°]	Label	E' [GeV]	θ [°]
A	4.2	13.5	A'	4.3	13.5
B	4.2	16.4	B'	5.1	16.4
C	4.0	20.0	C'	3.5	20.0

TABLE 3. SHMS settings

Label	E' [GeV]	θ [°]	Label	E' [GeV]	θ [°]
X	7.5	11.0	X'	7.5	11.0
Y	6.4	14.5	Y'	7.0	13.3
Z	5.6	18.0	Z'	6.3	15.5

1. HMS: Kinematics A

TABLE 4. Results for kinematics A.

# of bins	1
E' [GeV]	4.305
Q^2 [GeV ²]	2.474
x_{Bj}	0.216
W [GeV]	3.140
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	2,973
total electron rate [Hz]	3,083
π/e^- ratio	0.964
e^+/e^- ratio (π^0 decay only)	0.029
He3 electron rate [Hz]	465
N electron rate [Hz]	123.2
Be window electron rate [Hz]	467
GE180 windows electron rate [Hz]	2,029
Optimum time T_{\parallel} [hrs]	8.06
Optimum time T_{\perp} [hrs]	116.9
Total number of good electrons (par)	1.349e+07
Total number of good electrons (perp)	1.958e+08
Total number of electrons (3He+N2+Be+GE180, par)	8.943e+07
Total number of electrons (3He+N2+Be+GE180, perp)	1.298e+09
$A_{raw}(\text{par})$ (A_{charge} included)	-0.00835 ± 0.000271
$A_{raw}(\text{perp})$ (A_{charge} included)	$0.00101 \pm 7.105\text{e-}05$
$A_{phys}(\text{par})$	-0.0551 ± 0.00310
$A_{phys}(\text{perp})$	0.00522 ± 0.000518

2. HMS: Kinematics B

TABLE 5. Results for kinematics B.

# of bins	1
E' [GeV]	4.305
Q^2 [GeV ²]	3.643
x_{Bj}	0.318
W [GeV]	2.948
Temp. corrected effective density [amg]	9.35
Pion rate [Hz]	100.3
total electron rate [Hz]	179.0
π/e^- ratio	0.560
e^+/e^- ratio (π^0 decay only)	0.011
He3 electron rate [Hz]	140.4
N electron rate [Hz]	38.6
Be window electron rate [Hz]	0
GE180 windows electron rate [Hz]	0
Optimum time T_{\parallel} [hrs]	9.6
Optimum time T_{\perp} [hrs]	115.4
Total number of good electrons (par)	4.878e+06
Total number of good electrons (perp)	5.831e+07
Total number of electrons (3He+N2+Be+GE180, par)	6.219e+06
Total number of electrons (3He+N2+Be+GE180, perp)	7.434e+07
$A_{raw}(\text{par})$ (A_{charge} included)	-0.007122 ± 0.000448
$A_{raw}(\text{perp})$ (A_{charge} included)	0.001512 ± 0.0001297
$A_{phys}(\text{par})$	-0.0431 ± 0.00332
$A_{phys}(\text{perp})$	0.00773 ± 0.000844

3. HMS: Kinematics C

TABLE 6. Results for kinematics C.

# of bins	1
E' [GeV]	4.305
Q^2 [GeV ²]	3.643
x_{Bj}	0.318
W [GeV]	2.948
Temp. corrected effective density [amg]	7.72
Pion rate [Hz]	13.9
total electron rate [Hz]	39.0
π/e^- ratio	0.358
e^+/e^- ratio (π^0 decay only)	0.0055
He3 electron rate [Hz]	30.5
N electron rate [Hz]	8.5
Be window electron rate [Hz]	0
GE180 windows electron rate [Hz]	0
Optimum time T_{\parallel} [hrs]	11.2
Optimum time T_{\perp} [hrs]	113.8
Total number of good electrons (par)	1.231e+06
Total number of good electrons (perp)	1.249e+07
Total number of electrons (3He+N2+Be+GE180, par)	1.574e+06
Total number of electrons (3He+N2+Be+GE180, perp)	1.597e+07
$A_{raw}(\text{par})$ (A_{charge} included)	-0.00205 ± 0.000891
$A_{raw}(\text{perp})$ (A_{charge} included)	0.001067 ± 0.000280
$A_{phys}(\text{par})$	$-0.0128 \pm 0.00509.$
$A_{phys}(\text{perp})$	0.00492 ± 0.00161

4. HMS: Kinematics A'

TABLE 7. Results for kinematics A'.

# of bins	1
E' [GeV]	4.402
Q ² [GeV ²]	2.530
x_{Bj}	0.225
W [GeV]	3.102
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	2,512
total electron rate [Hz]	3,116
π/e^- ratio	0.806
e^+/e^- ratio (π^0 decay only)	0.023
He3 electron rate [Hz]	468.1
N electron rate [Hz]	124.5
Be window electron rate [Hz]	472
GE180 windows electron rate [Hz]	2051
Optimum time T [hrs]	8.2
Optimum time T _⊥ [hrs]	116.8
Total number of good electrons (par)	1.378e+07
Total number of good electrons (perp)	1.969e+08
Total number of electrons (3He+N2+Be+GE180, par)	9.173e+07
Total number of electrons (3He+N2+Be+GE180, perp)	1.31e+09
$A_{raw}(\text{par})$ (A_{charge} included)	-0.00820 ± 0.000268
$A_{raw}(\text{perp})$ (A_{charge} included)	$0.00107 \pm 7.08e-05$
$A_{phys}(\text{par})$	-0.0536 ± 0.00302
$A_{phys}(\text{perp})$	0.00559 ± 0.000521

5. HMS: Kinematics B'

TABLE 8. Results for kinematics B'.

# of bins	1
E' [GeV]	5.187
Q^2 [GeV ²]	4.389
x_{Bj}	0.251
W [GeV]	2.508
Temp. corrected effective density [amg]	9.35
Pion rate [Hz]	11.1
total electron rate [Hz]	135.1
π/e^- ratio	0.082
e^+/e^- ratio (π^0 decay only)	0.0011
He3 electron rate [Hz]	105.6
N electron rate [Hz]	29.5
Be window electron rate [Hz]	0
GE180 windows electron rate [Hz]	0
Optimum time T_{\parallel} [hrs]	10.9
Optimum time T_{\perp} [hrs]	114.1
Total number of good electrons (par)	4.133e+06
Total number of good electrons (perp)	4.339e+07
Total number of electrons (3He+N2+Be+GE180, par)	5.288e+06
Total number of electrons (3He+N2+Be+GE180, perp)	5.552e+07
$A_{raw}(\text{par})$ (A_{charge} included)	-0.00105 ± 0.000486
$A_{raw}(\text{perp})$ (A_{charge} included)	0.00095 ± 0.00015
$A_{phys}(\text{par})$	-0.00708 ± 0.00277
$A_{phys}(\text{perp})$	0.00425 ± 0.000873

6. HMS: Kinematics C' TABLE 9. Results for kinematics C' .

# of bins	1
E' [GeV]	3.625
Q^2 [GeV ²]	4.547
x_{Bj}	0.357
W [GeV]	3.011
Temp. corrected effective density [amg]	7.72
Pion rate [Hz]	56.4
total electron rate [Hz]	48.2
π/e^- ratio	1.17
e^+/e^- ratio (π^0 decay only)	0.023
He3 electron rate [Hz]	37.8
N electron rate [Hz]	10.5
Be window electron rate [Hz]	0
GE180 windows electron rate [Hz]	0
Optimum time T_{\parallel} [hrs]	10.3
Optimum time T_{\perp} [hrs]	114.7
Total number of good electrons (par)	1.400e+06
Total number of good electrons (perp)	1.559e+07
Total number of electrons (3He+N2+Be+GE180, par)	1.787e+06
Total number of electrons (3He+N2+Be+GE180, perp)	1.990e+07
$A_{raw}(\text{par})$ (A_{charge} included)	-0.00652 ± 0.000836
$A_{raw}(\text{perp})$ (A_{charge} included)	0.00147 ± 0.000251
$A_{phys}(\text{par})$	-0.0389 ± 0.00516
$A_{phys}(\text{perp})$	0.00733 ± 0.00149

7. Kinematics X, X'

TABLE 10. Results for kinematics X, X'.

# of bins	1
E' [GeV]	7.933
Q ² [GeV ²]	3.03
x_{Bj}	0.654
W [GeV]	1.577
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	5.29
total electron rate [Hz]	3153
π/e^- ratio	0.0092
e^+/e^- ratio (π^0 decay only)	2.00
He3 electron rate [Hz]	449.2
N electron rate [Hz]	126.1
Be window electron rate [Hz]	484.7
GE180 windows electron rate [Hz]	2,093
Optimum time T [hrs]	9.60
Optimum time T _⊥ [hrs]	115.40
Total number of good electrons (par)	1.553e+07
Total number of good electrons (perp)	1.866e+08
Total number of electrons (3He+N2+Be+GE180, par)	1.09e+08
Total number of electrons (3He+N2+Be+GE180, perp)	1.31e+09
$A_{raw}(\text{par})$ (A_{charge} included)	0.00711 ± 0.000251
$A_{raw}(\text{perp})$ (A_{charge} included)	$-0.00332 \pm 7.23e-05$
$A_{phys}(\text{par})$	0.0387 ± 0.00229
$A_{phys}(\text{perp})$	-0.0197 ± 0.00100

8. Kinematics Y

TABLE 11. Results for kinematics Y.

# of bins	1
E' [GeV]	6.788
Q^2 [GeV ²]	4.497
x_{Bj}	0.663
W [GeV]	1.781
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	5.62
total electron rate [Hz]	528.2
π/e^- ratio	0.011
e^+/e^- ratio (π^0 decay only)	0.00011
He3 electron rate [Hz]	75.3
N electron rate [Hz]	21.13
Be window electron rate [Hz]	81.19
GE180 windows electron rate [Hz]	350.6
Optimum time T_{\parallel} [hrs]	11.38
Optimum time T_{\perp} [hrs]	113.6
Total number of good electrons (par)	3.084e+06
Total number of good electrons (perp)	3.08e+07
Total number of electrons (3He+N2+Be+GE180, par)	2.164e+07
Total number of electrons (3He+N2+Be+GE180, perp)	2.161e+08
$A_{raw}(\text{par})$ (A_{charge} included)	0.0105 ± 0.000563
$A_{raw}(\text{perp})$ (A_{charge} included)	-0.003894 ± 0.000178
$A_{phys}(\text{par})$	0.0578 ± 0.00415
$A_{phys}(\text{perp})$	-0.0230 ± 0.00146

9. Kinematics Z

TABLE 12. Results for kinematics Z.

# of bins	1
E' [GeV]	5.957
Q^2 [GeV ²]	6.065
x_{Bj}	0.727
W [GeV]	1.779
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	1.06
total electron rate [Hz]	80.82
π/e^- ratio	0.013
e^+/e^- ratio (π^0 decay only)	0.00015
He3 electron rate [Hz]	11.52
N electron rate [Hz]	3.23
Be window electron rate [Hz]	12.4
GE180 windows electron rate [Hz]	53.7
Optimum time T_{\parallel} [hrs]	12.85
Optimum time T_{\perp} [hrs]	112.1
Total number of good electrons (par)	5.329e+05
Total number of good electrons (perp)	4.651e+06
Total number of electrons (3He+N2+Be+GE180, par)	3.739e+06
Total number of electrons (3He+N2+Be+GE180, perp)	3.263e+07
$A_{raw}(\text{par})$ (A_{charge} included)	0.0183 ± 0.00135
$A_{raw}(\text{perp})$ (A_{charge} included)	-0.006602 ± 0.000458
$A_{phys}(\text{par})$	0.102 ± 0.00895
$A_{phys}(\text{perp})$	-0.0382 ± 0.00312

10. Kinematics Y' TABLE 13. Results for kinematics Y' .

# of bins	1
E' [GeV]	7.412
Q^2 [GeV ²]	4.135
x_{Bj}	0.737
W [GeV]	1.537
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	5.06
total electron rate [Hz]	462.6
π/e^- ratio	0.011
e^+/e^- ratio (π^0 decay only)	4.44e-05
He3 electron rate [Hz]	65.9
N electron rate [Hz]	18.5
Be window electron rate [Hz]	71.1
GE180 windows electron rate [Hz]	307.1
Optimum time T_{\parallel} [hrs]	11.03
Optimum time T_{\perp} [hrs]	114
Total number of good electrons (par)	2.617e+06
Total number of good electrons (perp)	2.703e+07
Total number of electrons (3He+N2+Be+GE180, par)	1.837e+07
Total number of electrons (3He+N2+Be+GE180, perp)	1.898e+08
$A_{raw}(\text{par})$ (A_{charge} included)	0.0134 ± 0.000611
$A_{raw}(\text{perp})$ (A_{charge} included)	-0.00661 ± 0.00019
$A_{phys}(\text{par})$	0.0738 ± 0.00485
$A_{phys}(\text{perp})$	-0.0382 ± 0.00207

11. Kinematics Z' TABLE 14. Results for kinematics Z' .

# of bins	1
E' [GeV]	6.684
Q^2 [GeV ²]	5.056
x_{Bj}	0.725
W [GeV]	1.676
Temp. corrected effective density [amg]	10.56
Pion rate [Hz]	2.22
total electron rate [Hz]	203.4
π/e^- ratio	0.011
e^+/e^- ratio (π^0 decay only)	8.17e-05
He3 electron rate [Hz]	29.0
N electron rate [Hz]	8.13
Be window electron rate [Hz]	31.3
GE180 windows electron rate [Hz]	135
Optimum time T_{\parallel} [hrs]	11.99
Optimum time T_{\perp} [hrs]	113
Total number of good electrons (par)	1.251e+06
Total number of good electrons (perp)	1.179e+07
Total number of electrons (3He+N2+Be+GE180, par)	8.776e+06
Total number of electrons (3He+N2+Be+GE180, perp)	8.275e+07
$A_{raw}(\text{par})$ (A_{charge} included)	0.0153 ± 0.000883
$A_{raw}(\text{perp})$ (A_{charge} included)	-0.00635 ± 0.000288
$A_{phys}(\text{par})$	0.0848 ± 0.00633
$A_{phys}(\text{perp})$	-0.0367 ± 0.00235