Background studies

Ciprian Gal UVa

Yuxiang analysis output

		Moller		e-p Elastic		e-p Inelastic					
		A [ppb]	d(A) [ppb]	A [ppb]	d(A) [ppb]	A [ppb]	d(A) [ppb]	stat uncert [ppb]	syst Elastic [ppb]	syst Inelastic [ppb]	A measured [ppb]
1	0	-30.40	0.54	-202.06	6.10	2,056.03	69.24	1,061.40	253.34	34.50	-171.91
1	1	-23.98	0.42	-210.10	6.35	2,116.25	71.26	4,814.46	4,048.48	1,741.59	-124.13
1	2	-11.22	0.20	-43.91	1.33	1,220.29	41.09	3,793.40	1,950.08	726.14	-28.88
2	0	-10.11	0.18	-211.94	6.40	1,977.95	66.61	3,067.56	1,768.28	3,280.27	118.99
2	1	-20.56	0.36	-120.73	3.65	1,547.92	52.13	4,226.10	5,880.75	6,026.93	-9.11
2	2	-12.62	0.22	-56.75	1.71	846.55	28.51	4,020.96	5,028.49	3,237.85	-23.08
3	0	-20.40	0.36	-115.91	3.50	1,386.86	46.70	742.89	202.69	432.08	89.50
3	1	-16.12	0.28	-87.85	2.65	1,042.67	35.11	442.85	313.86	463.39	25.30
3	2	-16.24	0.29	-37.99	1.15	684.11	23.04	20.85	12.09	10.98	-7.54
4	0	-30.16	0.53	-75.07	2.27	1,041.40	35.07	106.36	19.40	28.22	15.98
4	1	-35.88	0.63	-58.12	1.76	808.10	27.21	37.17	13.99	16.15	-2.05
4	2	-29.28	0.52	-29.02	0.88	496.35	16.71	2.40	0.53	0.46	-20.33
5	0	-29.82	0.53	-27.62	0.83	882.55	29.72	5.30	0.51	0.38	-21.83
5	1	-32.27	0.57	-26.42	0.80	536.50	18.07	1.47	0.14	0.08	-29.39
5	2	-34.89	0.62	-20.46	0.62	446.47	15.03	0.70	0.06	0.03	-32.83
6	0	-21.14	0.37	-7.09	0.21	346.25	11.66	19.17	0.38	0.16	-10.43
6	1	-16.27	0.29	-8.54	0.26	363.97	12.26	5.08	0.36	0.14	-10.04
6	2	-16.11	0.28	-5.30	0.16	274.06	9.23	2.27	0.17	0.07	-9.50

A_m (ppb)
-282.1
-278.2
-50.92
-411.9
-203.7
-68.49
-281.7
-174.0
-59.58
-115.8
-86.81
-32.68
-30.54
-33.76
-33.61
-16.10
-13.24
-10.22

- run 1e6 events and the analysis seems to run smoothly
- $A_{measured}$ is the rate weighted sum of the Moller, ep Elastic, and ep Inelastic (as suggested in the tech note)
- comparing with the tech note (http://129.49.57.128/note/contamination_study_note_Nov_3.pdf) it seems there are some significant differences in magnitude and in sign
  - could they be due to Al contributions? (only looked at 3 processes so far)

Yuxiang analysis output

		Moller		e-p Elastic		e-p Inelastic					
		A [ppb]	d(A) [ppb]	A [ppb]	d(A) [ppb]	A [ppb]	d(A) [ppb]	stat uncert [ppb]	syst Elastic [ppb]	syst Inelastic [ppb]	A measured [ppb]
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https://ace.phys.virginia.edu:80/MollerSpectrometer/358 :

---------- overall ----------

A(ee) error: 0.624294 ppb

A(ep elastic) error : 0.652743 ppb

A(ep inelastic) error: 12.1381 ppb

========== in the selected bin ==========

statistic ee: 0.907301 ppb

sys_ep_elastic: 0.0962669 ppb (10.6% of ee error, 0.15% of ee asy)

sys_ep_inelastic: 0.0481598 ppb (5.3% of ee error, 0.08% of ee asy)

- Comparing to a presentation from YZ it seems the output from the analysis is close (at least in for ring 5 sector 2/open)
- Will contact YZ to make sure I understand what he did

Yuxiang analysis

https://ace.phys.virginia.edu:80/MollerSpectrometer/358 :

- $A_{ee} = \frac{N_{tot}}{N_{ee}} A_m - \frac{N_{ep\ elastic}}{N_{ee}} A_{ep\ elastic} - \frac{N_{ep\ inelastic}}{N_{ee}} A_{ep\ inelastic}$

- Statistic error: $\frac{N_{tot}}{N_{ee}} \sigma_{Am}$

- Systematic error due to contamination:

$\frac{N_{ep\ elastic}}{N_{ee}} \sigma_{A_{ep\ elastic}}$, $\frac{N_{ep\ inelastic}}{N_{ee}} \sigma_{A_{ep\ inelastic}}$

YZ analysis code:

```
double sys_epelastic=rate0_epelastic/rate0_ee * sigma_epelastic;
double sys_epinelastic=rate0_epinelastic/rate0_ee * sigma_epinelastic;
double rate0_tot=rate0_ee + rate0_epelastic + rate0_epinelastic;

double stat_ee=rate0_tot/rate0_ee * 1.0/sqrt(rate0_tot)/0.8/sqrt((235+95+14)*24.0*60*60);
```

My A_m calculation:

```
double am = (A0_ee * rate0_ee +
             A0_epelastic * rate0_epelastic +
             A0_epinelastic * rate0_epinelastic)
  /rate0_tot;
```

- The analysis code implementation seems fine, but it does not calculate A measured