Gamma Spectroscopy: Lab Notes

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1 Wednesday 10/30

1.1 Experimental Progress

The lab met as a group to discuss the Rutherford back scattering (RBS) experiment. The scheduled plan is provided in Table 1.

Date	Goal	Description
Monday (11/4)	Angular Study	Run at multiple (12) angles + fixed angle detector to get 13 total spectra at 2.2 MeV
Wednesday (11/7)	Energy Study	Run at energies [2,3,4,5,6] MeV

Table 1: The proposed schedule for the RBS experiment.

The experimental group will divide into two subgroups so that half of the group will work on the Angular Study while the other half work on the Energy Study. Both groups will use a high energy run for composition analysis. Group 2 (this group), is part of the Energy Study team.

The nominal experimental settings are provided in Table 2.

Type	Name	Description
RBS	Distance	6.700 ± 0.035 cm
	Diameter	4.01 mm
	Angle (left)	$[225°, 335°]$
	Angle (right)	$[25°, 155°]$
PRD	Distance	6.075 ± 0.035 cm
	Diameter	3.69 mm
	Angle (fixed)	$168°$

Table 2: The nominal experimental settings. The RBS is the movable detector. The PRD is the fixed detector. All angles are calculated clockwise relative to the direction of the beam line.

1.2 Experimental outlook

No data was collected today; however, the experimental apparatus was explored and the nominal experimental settings were determined. The choice of angles for the 12 measured angles have not been determined. Offline analysis is needed before the lab time on Monday (11/4) to select the desired angles. This will be done by inspecting the rates at different angles from previous experiments. Once the desired angles have been selected, we will be in an excellent position to start collecting data for the Angular Study on Monday (11/4).
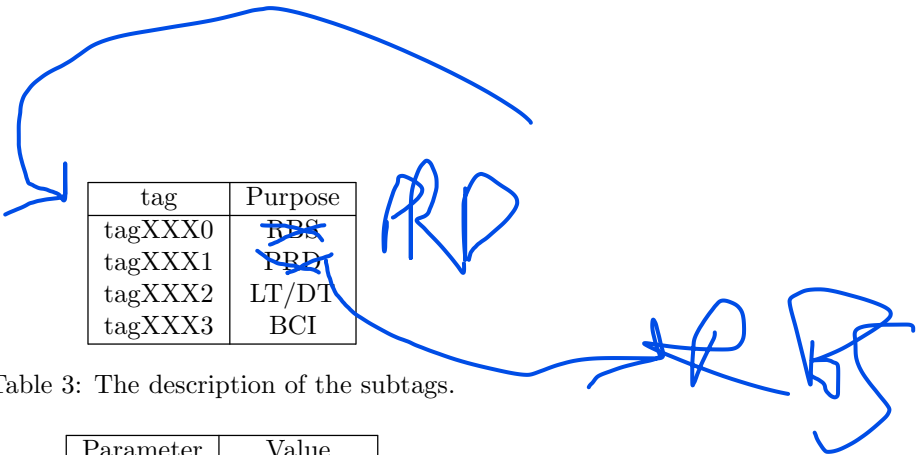
2 Monday 11/4

2.1 Experimental Progress

The angle study was performed today. The disk was 100. The tag number increased by 10 for each run. The scheme for the tags is given in Table 3.
The nominal settings for the angle study are given in Table 4.
The data runs are provided in Table 5.

tag	Purpose
tagXXX0	~~RBS~~
tagXXX1	~~PRD~~
tagXXX2	LT/DT
tagXXX3	BCI

Table 3: The description of the subtags.

Parameter	Value
E_{beam}	2.50 [MeV]
BCI Scale	10^{-8}
θ_{PRD}	168°

Table 4: Angle Study nominal settings.

Tag	$\theta_{\text{Det.}}$ [deg]	$\theta_{\text{targ.}}$ [deg]	I [nA]	BCI	DTL [%]	DTR [%]	Time [sec]
20	154.9	0	6	5000	1.0465	1.1628	86
30	60	30	6	5000	1.8391	1.3793	87
40	50	25	6	5000	5.4118	1.2941	85
50	40	20	6	5000	7.6136	1.25	88
60	-45 (215)	-22.5 (337.5)	6	5000	25.053	1.2629	95
70	-55 (305)	-27.5 (332.5)	6	5000	14.286	1.3187	91
80	-65 (295)	-32.5 (327.5)	6	5000	8.4043	1.276	94
90	-90 (270)	-45 (315)	6	5000	3.2673	1.2871	107
100	-90 (270)	-45 (315)	6	5000	3.8043	1.4130	92
110	-115 (245)	0	6	5000	1.5217	1.1957	92
120	-135 (225)	0	6	5000	1.1224	1.1224	98
130*	-35 (325)	-17.5 (342.5)	.6	5000	8.1818	0.56818	88
140*	30	15	.6	5000	10.28670	0.57143	105

Table 5: The angle study runs. DTR = Deadtime right. DTL = Deadtime left. Note that tag130 and tag140 had their BCI full scale changed from the nominal 10^{-8} to 10^{-9}.

2.2 Experimental Outlook

All desired angles were obtained and the angle study is completed. On Wednesday (11/6), we will decided what angle to used for the variable energy study. The lab is in a good place to obtain the necessary data to complete the lab objectives.

3 Wednesday 11/06

3.1 Experimental Progress

With the angular study completed on 11/04, we chose two angles to take runs at several different energy. The angle selected are given in Table 6.

Type	Setting 1	Setting 2
θ_{PRD}	168°	168°
θ_{RBS}	50°	155°
θ_{Targ}	25°	0°

Table 6: The angles that were selected for the energy study.

The run parameters are provided in Table 7.

Tag	E [MeV]	Θ_{RBS}	Θ_{Targ}	I [nA]	BCI	Scale $[10^{-x}]$	DTL [%]	DTR [%]	Time [sec]
1010	3.5	50.0 (1)	25.0 (5)	3	5000	8	1.9417	0.72816	206
1020	3.5	155.0 (1)	0.0 (1)	3	5000	8	0.46875	0.72917	192
1030	4.5	155.0 (1)	0.0 (1)	1.5	5000	8	0.34853	0.61662	373
1040	4.5	50.0 (1)	25.0 (1)	1.3	5000	8	0.96685	0.60773	373
1050*	6.5	50.0 (1)	25.0 (1)	1.5	10000	8	1.1679	0.024331	822
1060*	6.5	155.0 (1)	0.0 (1)	1.25	15000	8	0.027027	0.027027	1110

Table 7: List Of runs for the energy study. *Pulser was turned off.

3.2 Experimental Outlook

All data has been collected to complete the lab objectives. All that is left is to conduct the offline analysis.

References