Table 12.1 Coincidence Data for the Annihilation Experiment

Run No.	± degrees	C_1 counts/s	C_2 counts/sec	C_3 counts/sec
1	0			
2	1			
3	2			
4	3			
5	4			
6	5			
7	6			
8	7			
9	8			
10	9			
11	10			
12	12			
13	15			
14	20			

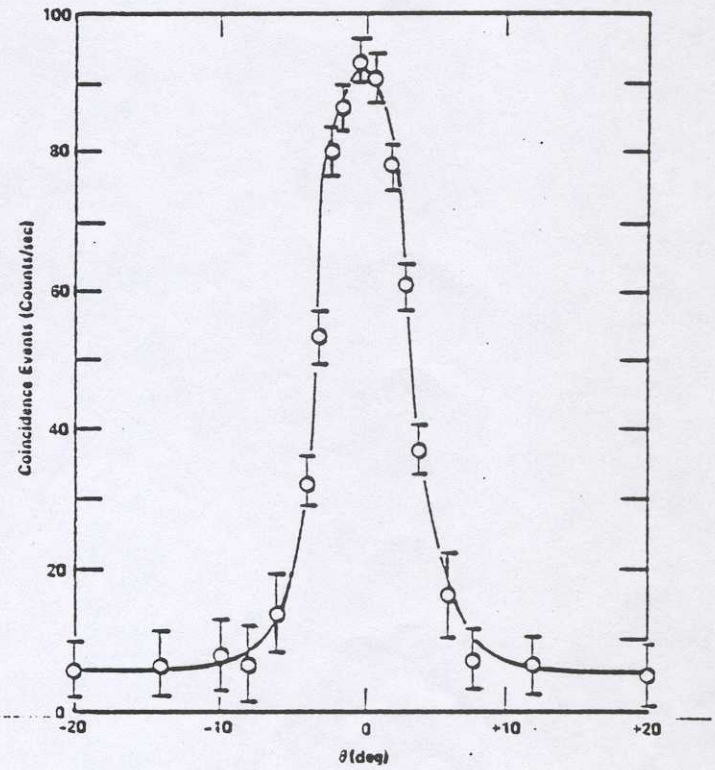

Fig. 12.5. Coincidence Data.

Experimental Procedure

1. Place the copper converter foils on either side of the 10 μCi ^{22}Na source and secure the foils with tape. Place the source in the center pivot of the angular correlation table. Adjust the high voltage on each NaI(Tℓ) detector to its recommended value. Set each amplifier on 1 μsec peaking time. Use the bipolar output of each amplifier into the SCAs. Adjust the gain of each amplifier so that the 1.274 MeV gammas are about 5 volts in amplitude.

2. Remove the source and turn on the pulse generator. Adjust the pulser so that the output pulses from each amplifier are about 3.5 volts. Set each timing SCA in the integral mode with the lower level set at 50/1000. Set the delays at minimum. Use a BNC Tee on the +5 volt logic pulse from each SCA. For each SCA, one output logic pulse goes into the multipurpose coincidence input and the other goes into the counter as shown in fig. 12.4.

3. For the coincidence circuit, set the resolving time at 250 nsec. 2 coincidence requirements, use A and B inputs, and route the F output into counter C_3.

4. Set the timer for 300 sec and start all counters. If the timing is correct, C_1, C_2, and C_3 should all give Σ/t = 0 Hz. If this is not the case, adjust the delays on the SCAs until the timing is correct.

5. Turn off the pulse generator and place the ^{22}Na source in its position on the angular correlation table.

Set the SCAs LL and UL discriminators in order to isolate the 511 KeV annihilation peak. Set the angle at 0 degrees and the timer at 300 sec. For each counter, determine Σ/t in counts/sec and fill in the first entry in Table 12.1. Continue for the other angular settings in the table. Repeat this whole data table for negative angles ($-\theta$) with the same absolute values as the positive angles in Table 12.1. Of course, the counting time will have to be increased for the larger angles to get reasonable statistics. If the system is lined up properly, the counting rates in counters C_1 and C_2 should remain about the same because, without the coincident requirement, we are simply looking at an isotropic source of gammas.

Exercise Plot the number of coincidence counts/sec vs θ from your data. Your angular distribution should be similar to fig. 12.5.