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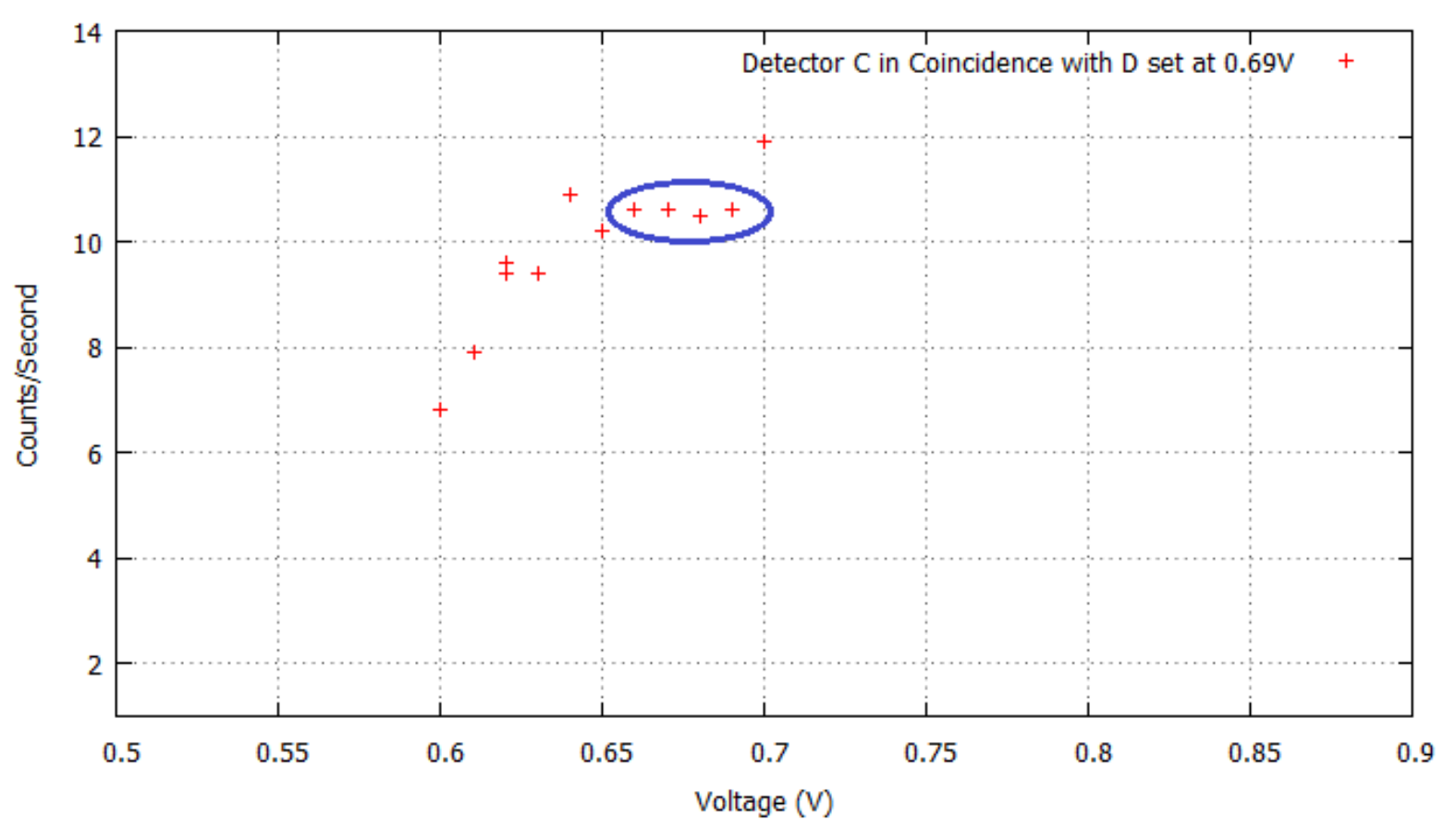
INFLUENCE OF MAGNETIC FIELDS ON MUON TRAVEL

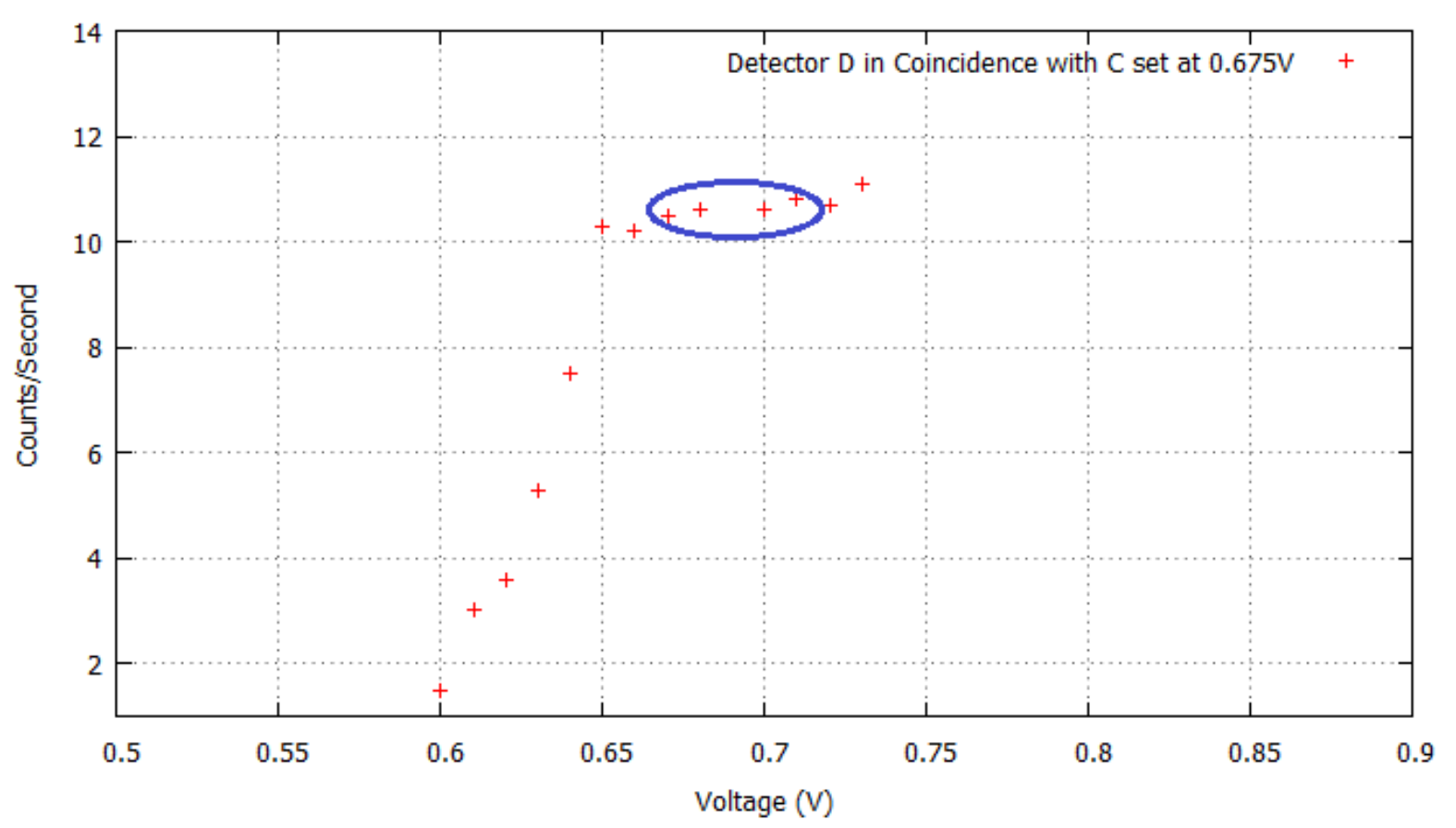
Introduction

- Question: How strongly is a muon affected by a magnetic field as it travels through it?
- Hypothesis: With our 1.2T magnet, we predict a 10 degree curving of the muon’s path, giving us a higher count rate as they are bent towards our scintillators

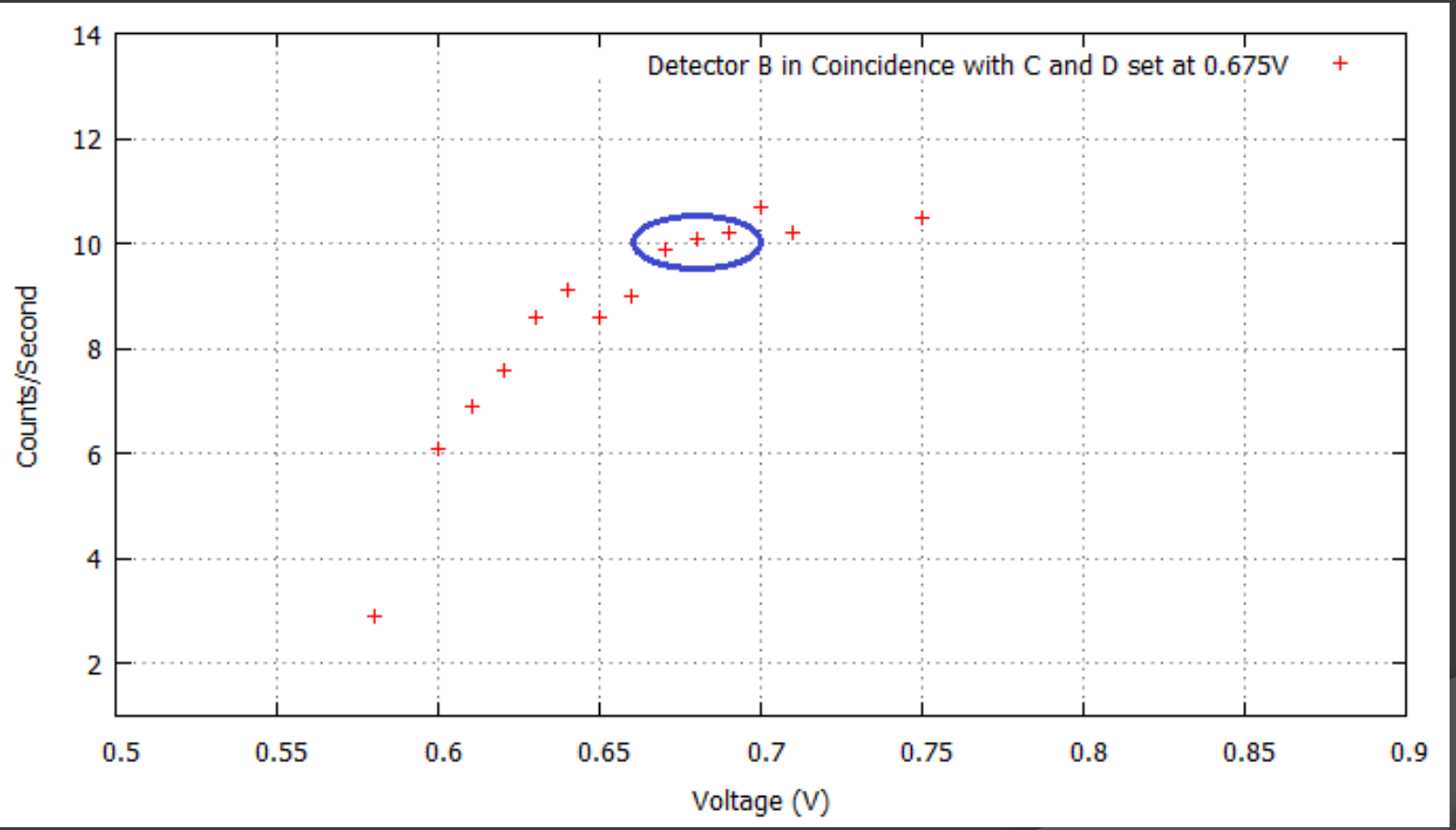
Calibration – Detector D



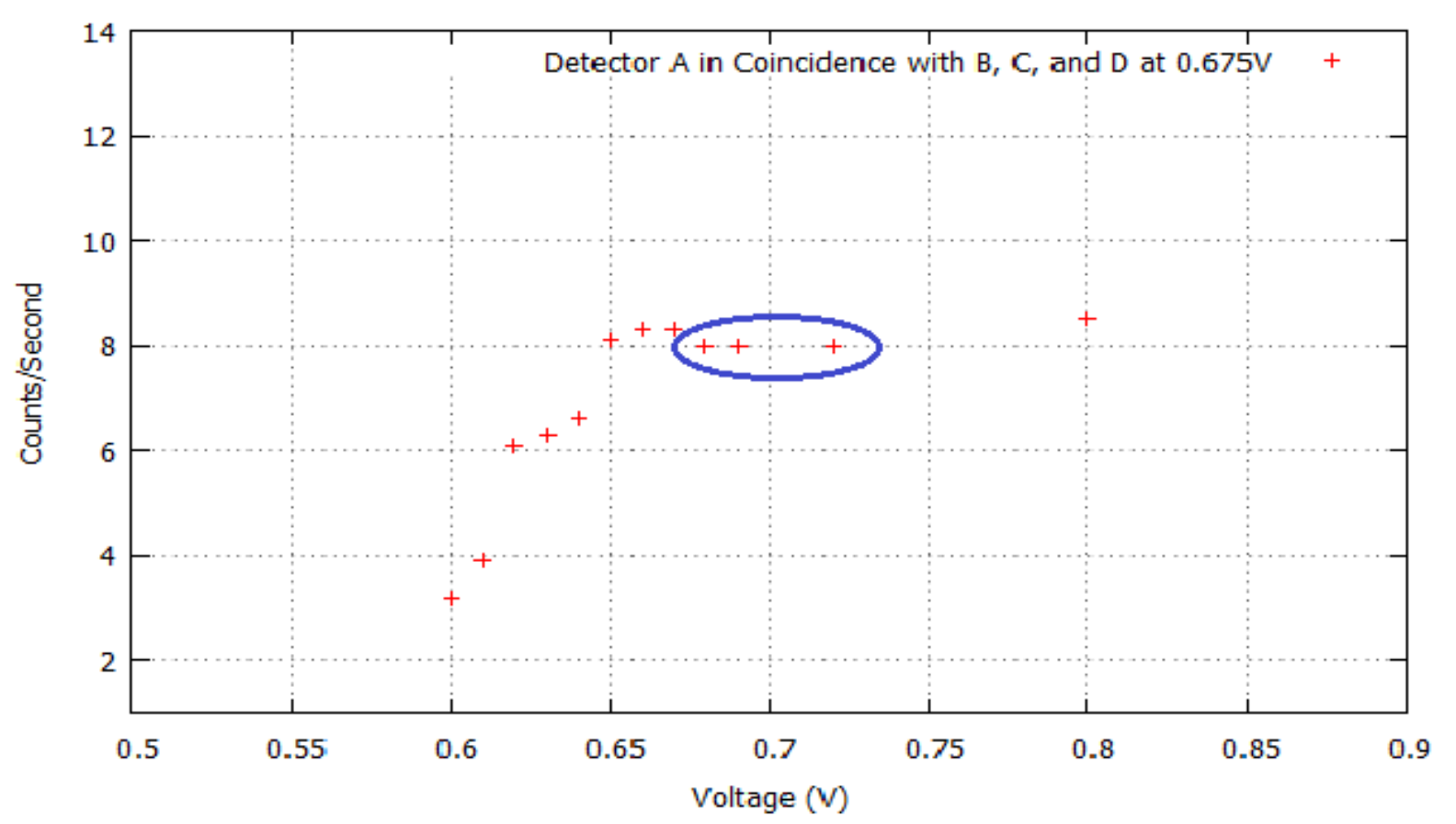
Detector C


Detector D in Coincidence with C set at 0.675V
Counts/Second
Voltage (V)
14
12
10
8
6
4
2
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9

Detector B

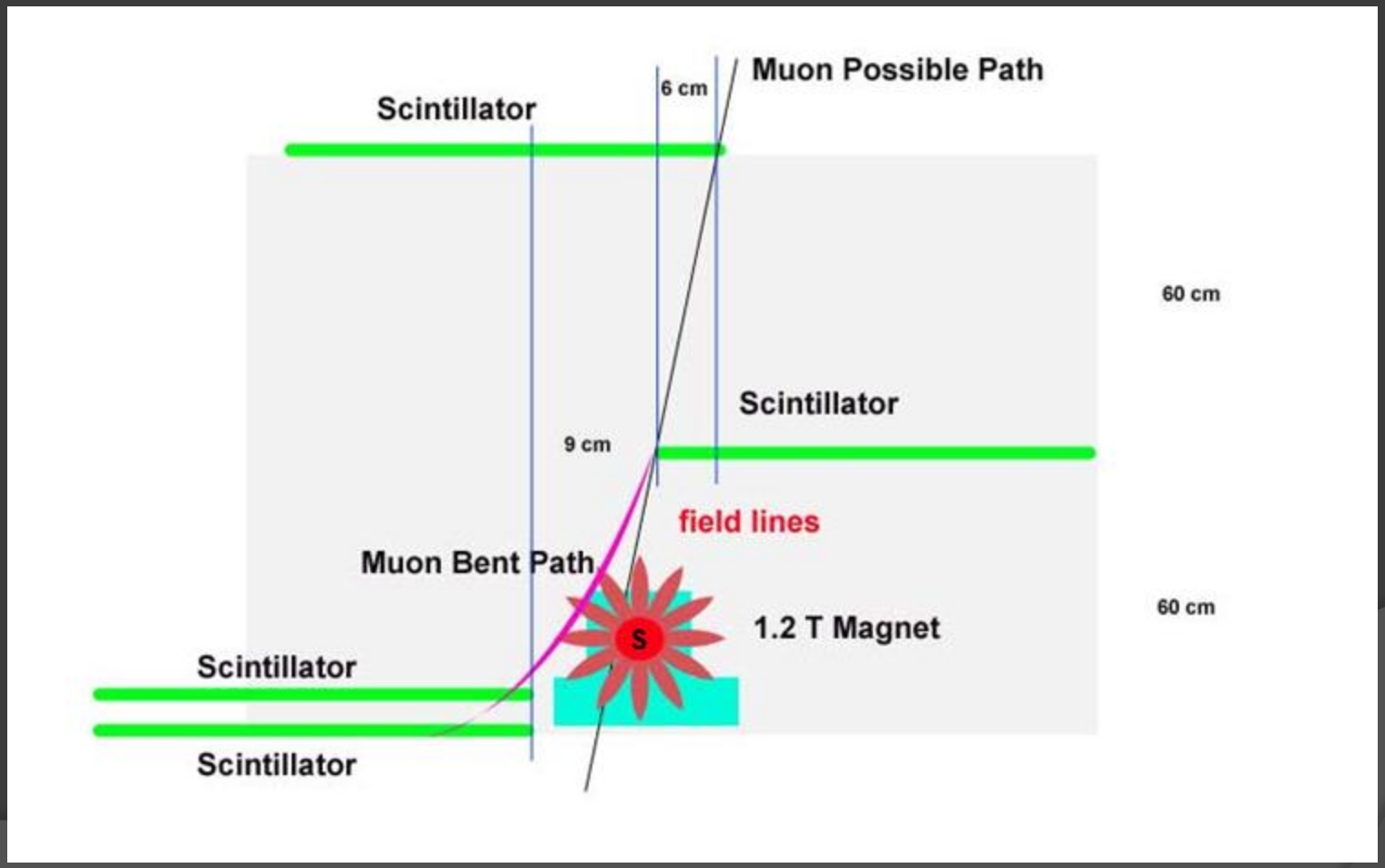

Detector B in Coincidence with C and D set at 0.675V
Counts/Second
Voltage (V)
14
12
10
8
6
4
2
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9

Detector A


Detector A in Coincidence with B, C, and D at 0.675V
Counts/Second
Voltage (V)
14
12
10
8
6
4
2
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9

The Setup

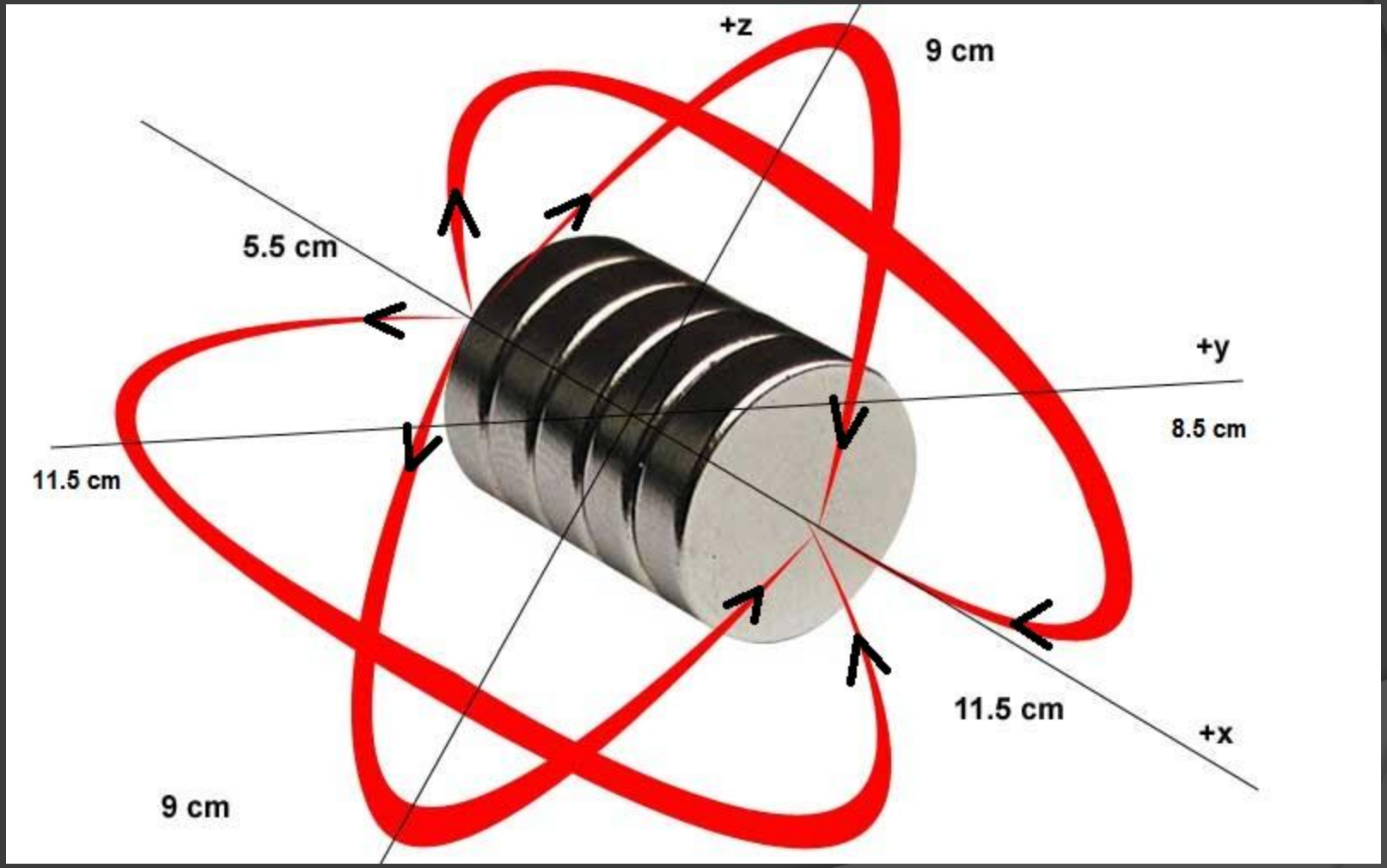
- Angle of acceptance: 0 (Although barely)



Ghost Counts

- Even with our setup, that has a 0 geometric angle of acceptance, we had an unusually high number of counts, when we would expect 0, or near zero, without the magnet. However, we got about 2.17 counts per minute that we could not explain.
- In order to counteract this, we took data to a high precision and used it as a base count rate. If the magnet had an effect, we would see a change in the number of counts per minute.

The Magnet



Data with Standard Field

	Total Counts	Time Tested (Minutes)	Counts/Minute
With Field	5326 (+-73)	2476	2.15 (+-0.03)
Without Field	9532 (+-97)	4391	2.17 (+-0.03)

Data with altered fields

	Counts	Time (Minutes)	Counts/Minute
Field reversed	291 (+-17)	135	2.15 (+-0.13)
Field turned 90 degrees	328 (+-18)	143	2.3 (+-0.12)
Field turned 270 degrees	2468 (+-49)	1055	2.3 (+-0.04)
Field raised 2.5 cm	2616 (+-51)	1196	2.18 (+-0.04)

Results

- Contrary to the last project who did an experiment with magnets, we did not find an increase in the rate of muons with the magnetic field in play versus that without, rather, we found a slight decrease.
- Our precision however, is not high enough to conclude that our data is complete.

Conclusions

- Our count rates neither increased nor decreased much from the control after we added the magnet. The reasons for this could include:
  - The inconsistency of the magnetic field makes it not strong enough in its outer field to curve the muons as much as our calculations suggested.

To the next group…

- If this experiment were to be continued, we'd want to collect more data to increase our precision as well as take more data with different field positions to see more curving effects.
- The next group might also try to create a more uniform field, perhaps through the use of an electromagnet.