

Balloon Assisted Stratospheric Experiments

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BASE

- The BASE project is operated under the Physics and Astronomy Department at DePauw University
- Presently, the program uses helium filled weather balloons to carry scientific experiments into the stratosphere. We are looking at flying a hydrogen-helium mix later this summer.
- The communications and support system was purchased from StratoStar Systems of Upland, Indiana.

Cosmic Radiation

- Cosmic rays are continually bombarding the stratosphere and produce energetic particles
- Geiger counters record the number of particles detected
- Number of particles is positively related to density of air molecules and intensity of cosmic rays

Summer 2011

This summer we are flying a triple Geiger Counter array in a triangular formation to measure coincidences between all three Geiger Counters. We aim to measure how the rate of these coincidences is affected by altitude and the presence of lead shielding.

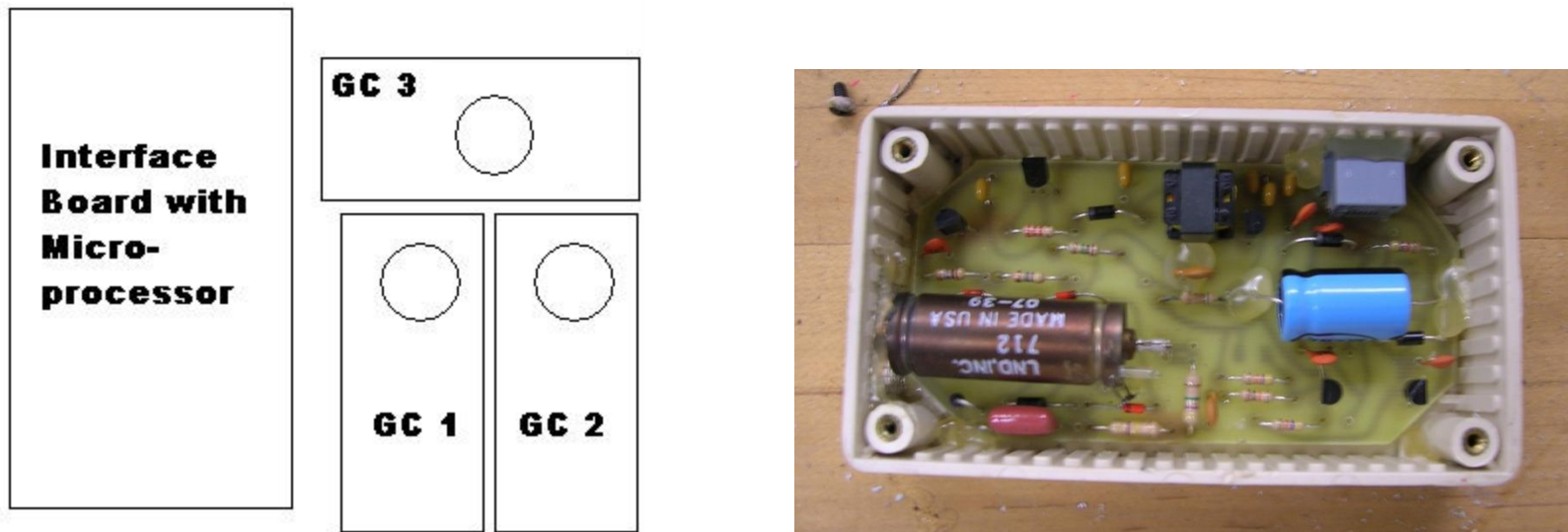
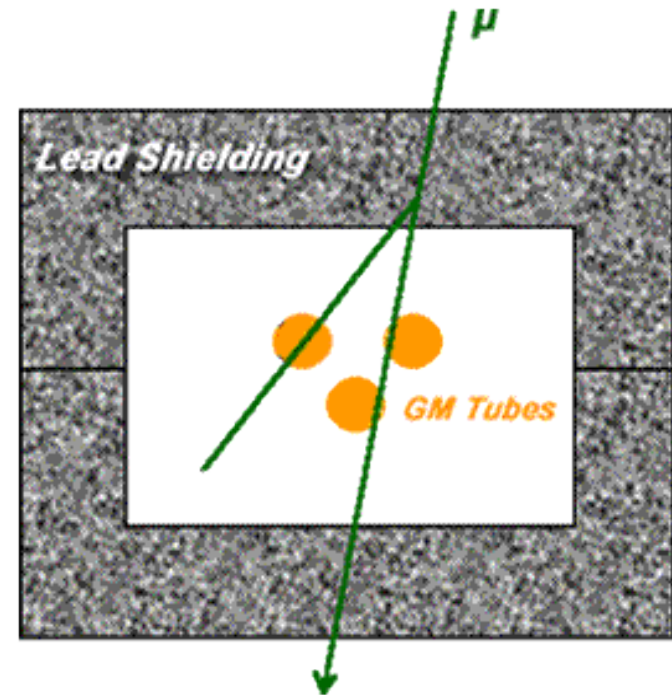
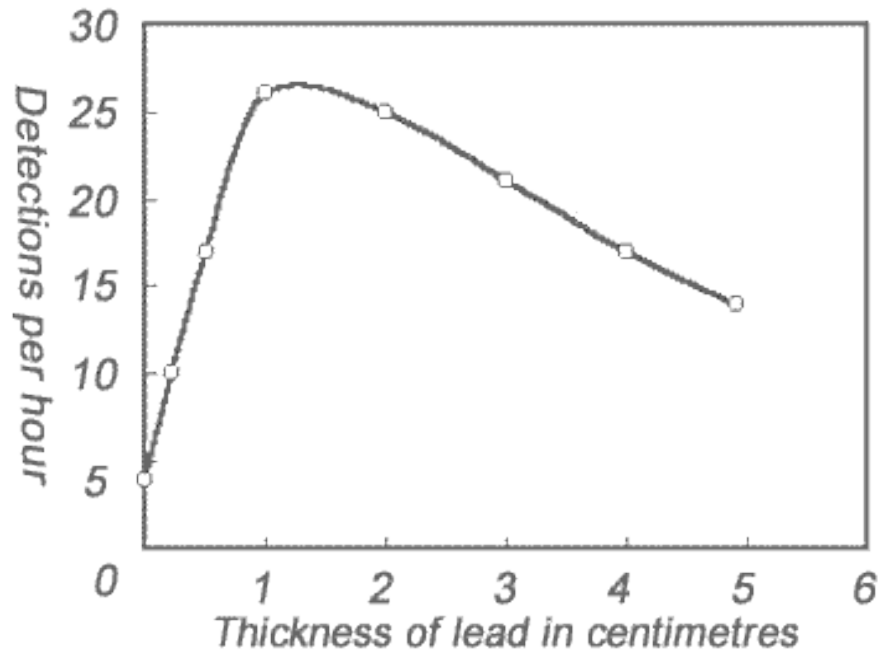


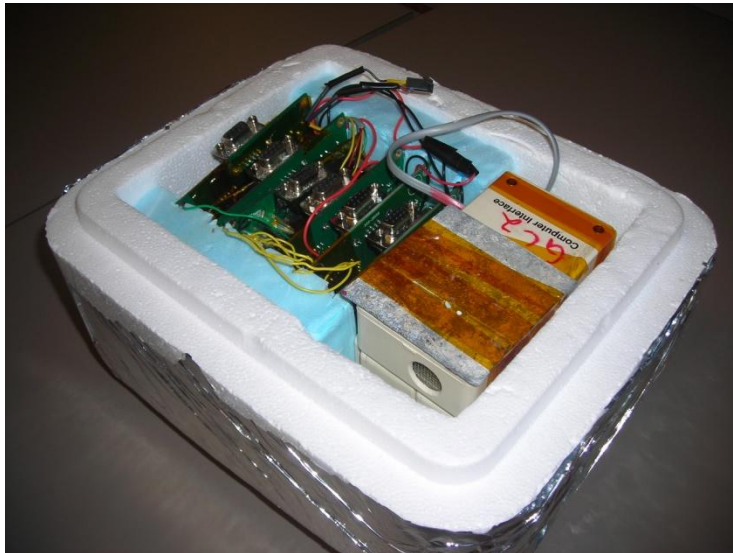
Figure 3. Triple Geiger Counter Array for studying showers. Block diagram of three Geiger counters in non-orthogonal alignment.

Rossi's Ground Experiment



Counting Mechanism

- Geiger Counters connected to Stamp boards
- 555 one shot circuit



Counting Mechanism

- On the ground the Geiger Counters record incidences every 7.5 minutes over a period of five days
- The programs run during flight record incidences every minute for the duration of the flight

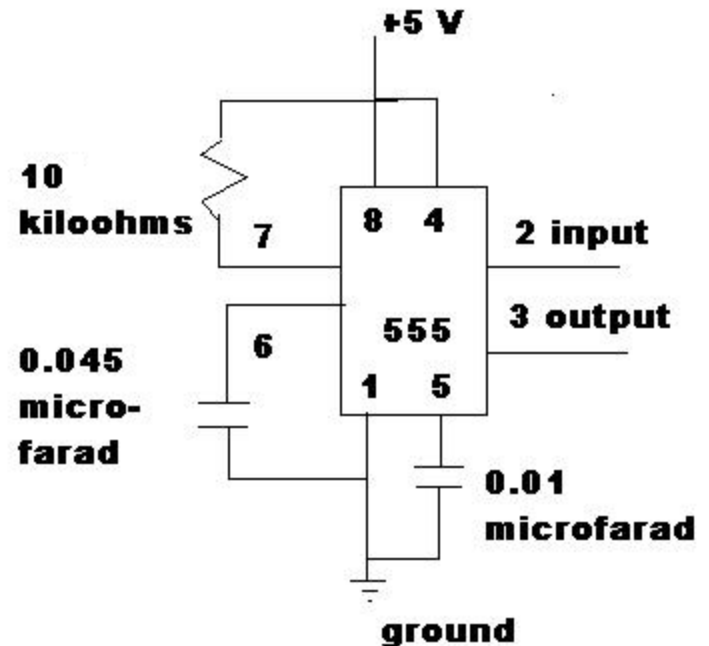
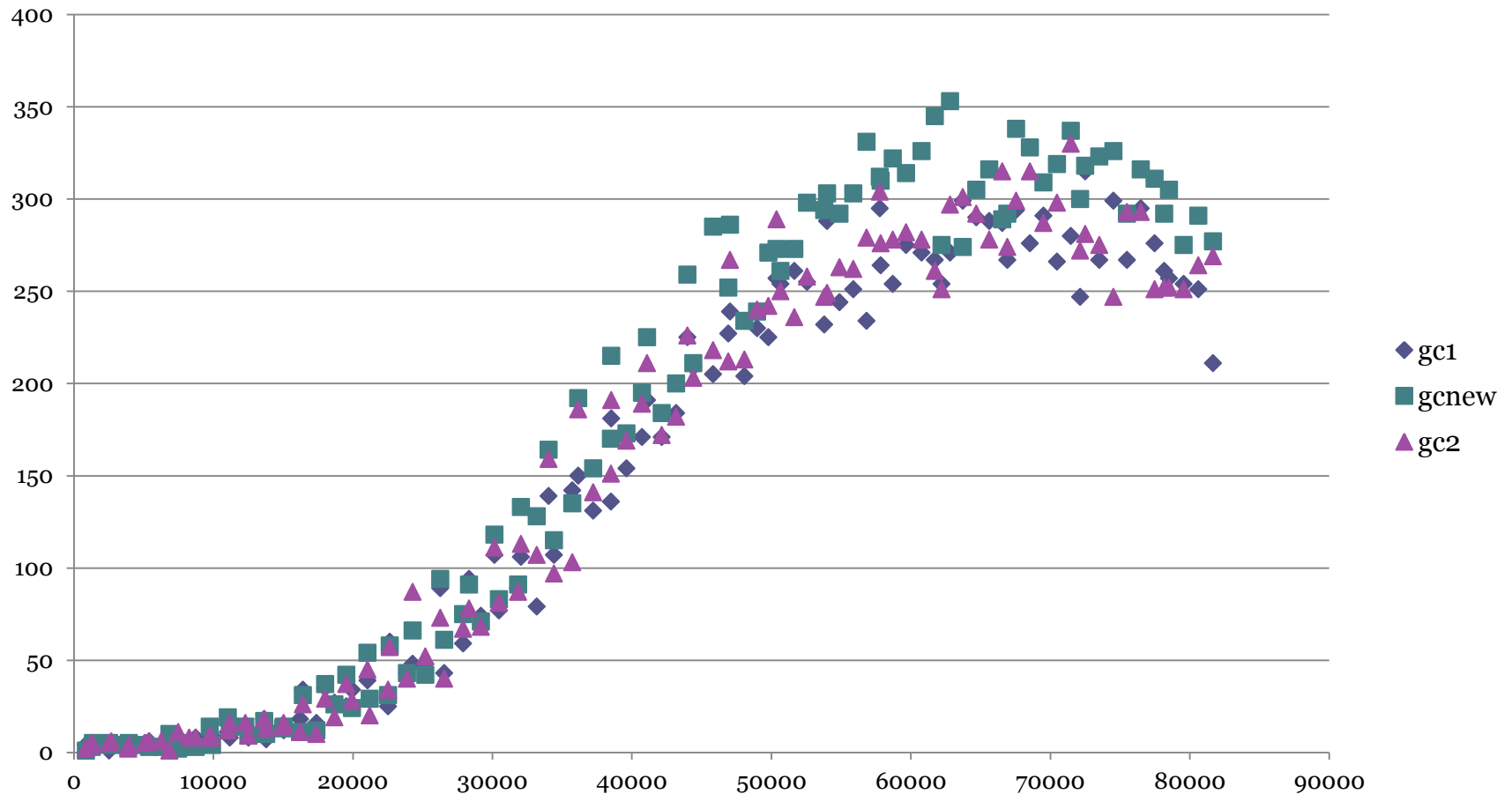


Figure 4. 555 One-Shot Timing Circuit Schematic diagram of 555 timing circuit. Input from Geiger counter goes into pin 2 and output to counting program comes out on pin 3. The RC time constant is determined by the resistor on pin 7 and the capacitor on pin 6.

BASE 56-a

No lead

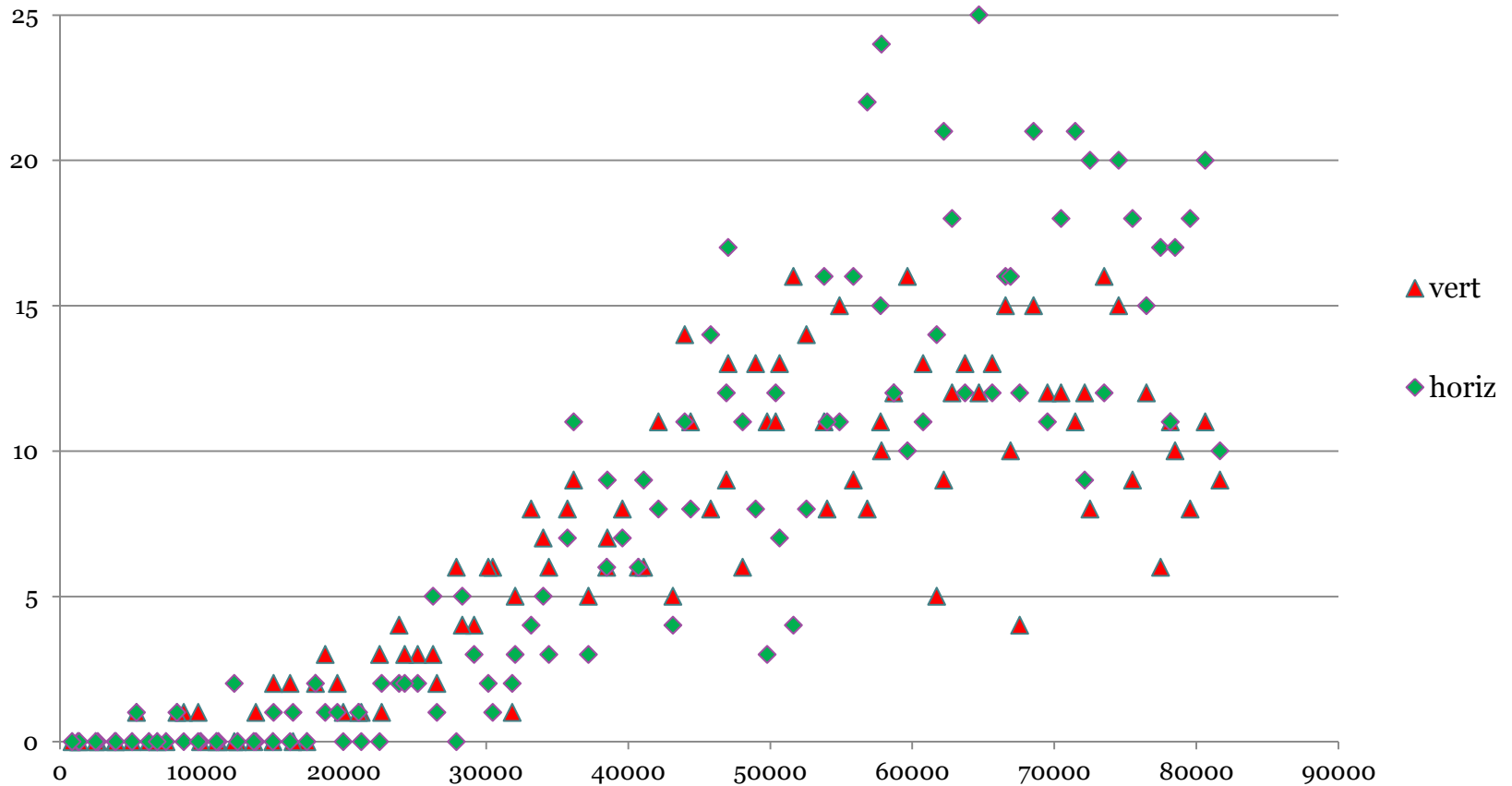
Counts per Minute vs Altitude (ft)



BASE 56-a

No lead

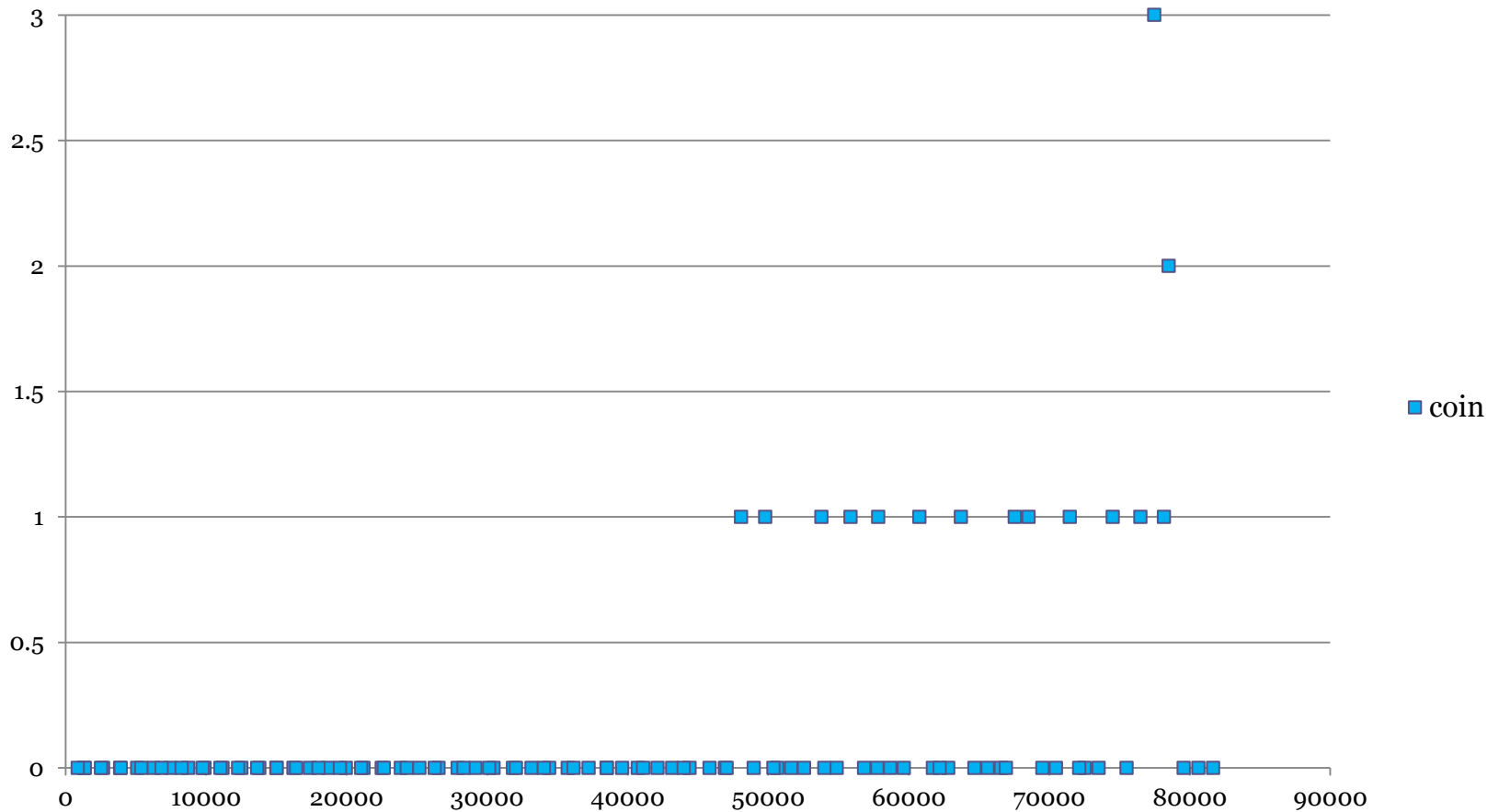
Counts per Minute vs Altitude (ft)



BASE 56-a

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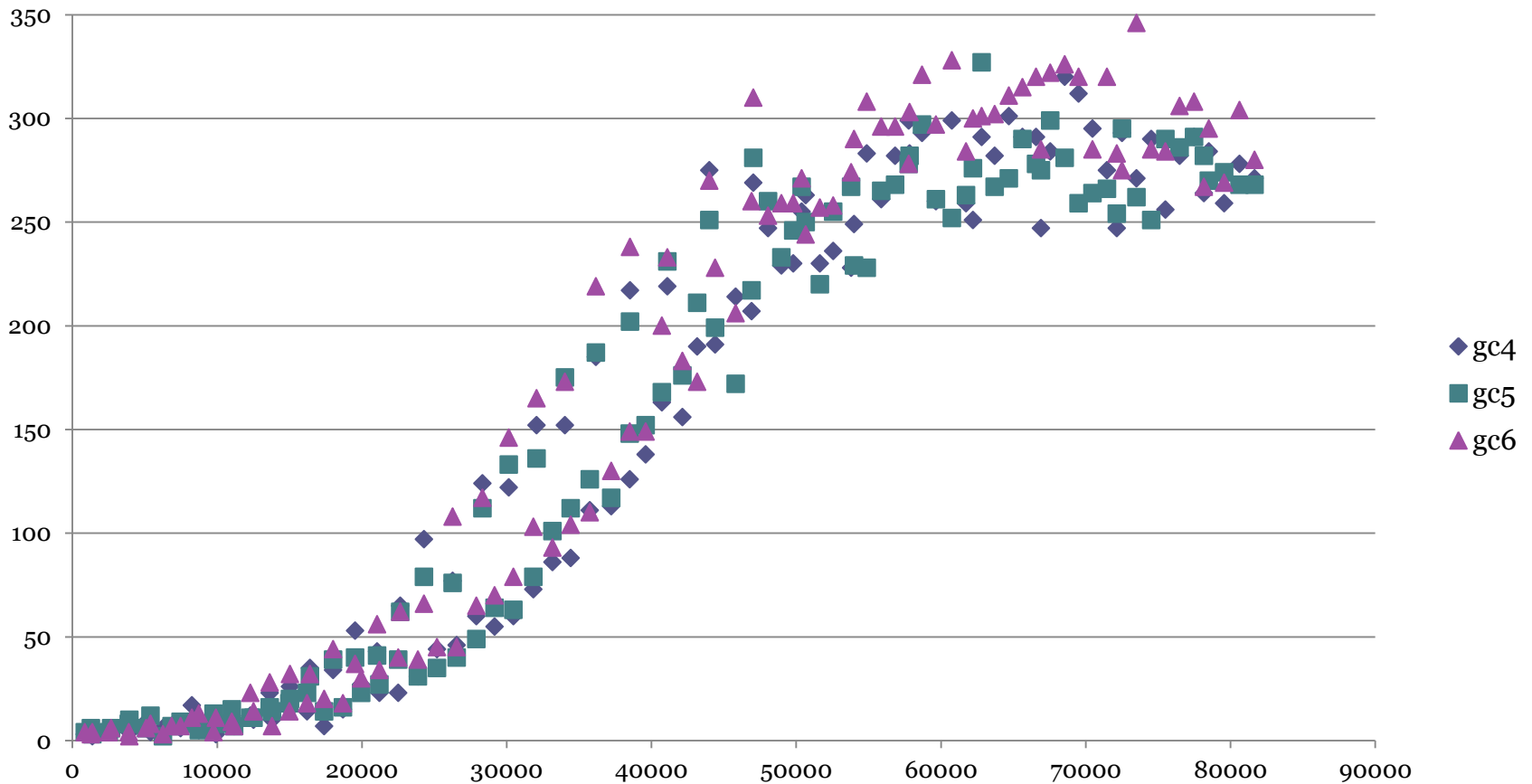
Counts per Minute vs Altitude (ft)



BASE 56-b

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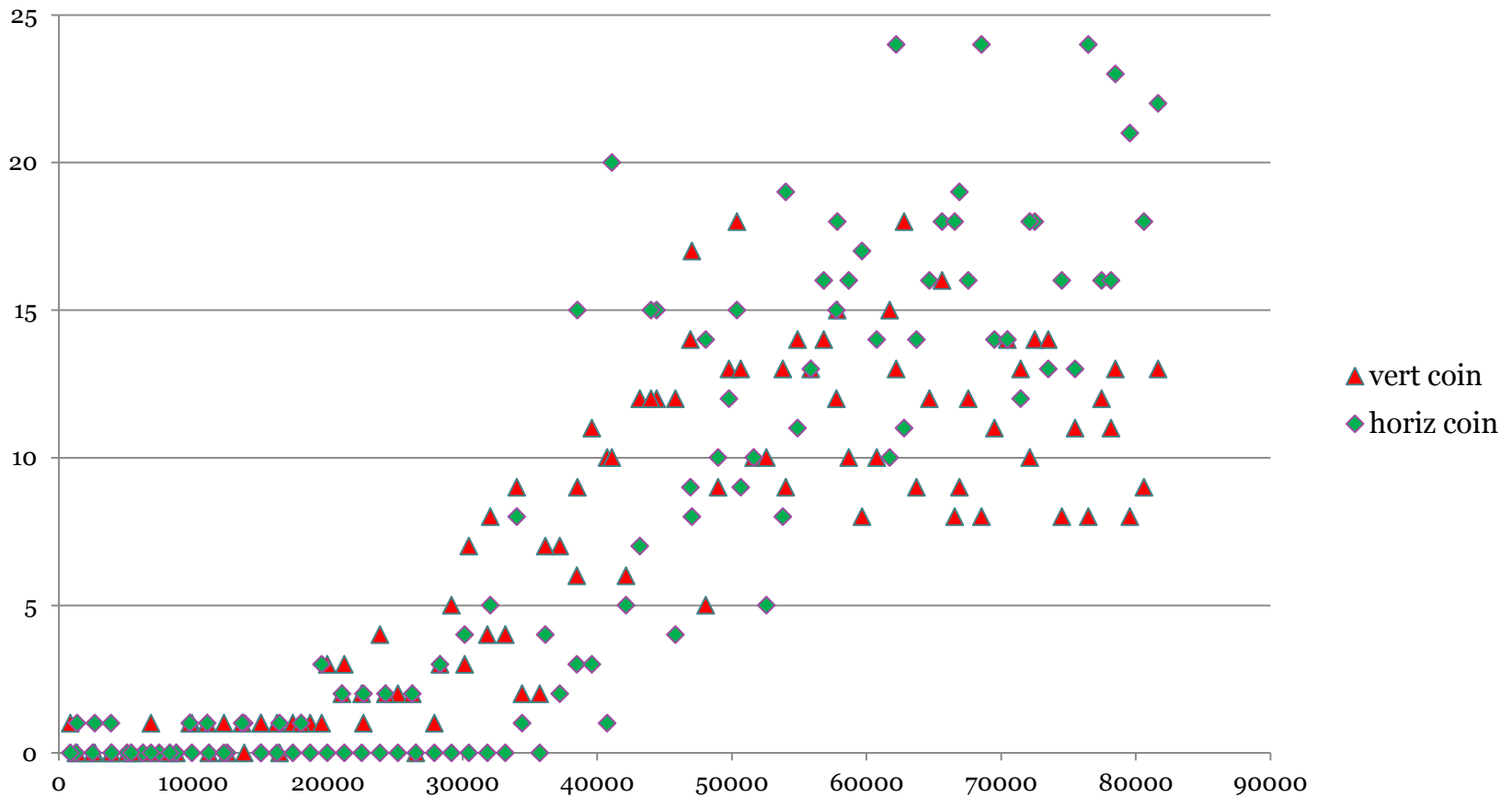
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BASE 56-b

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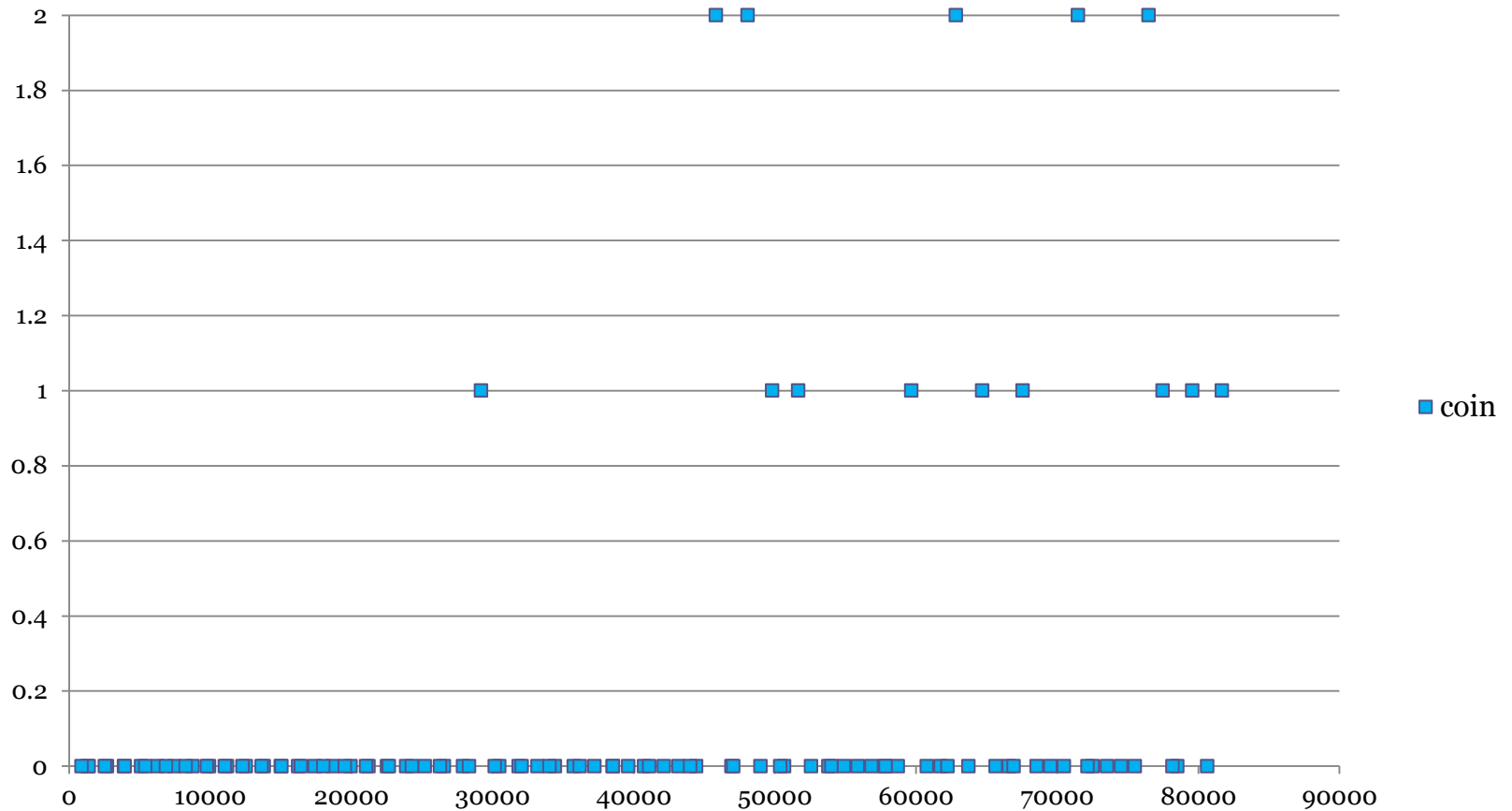
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BASE 56-b

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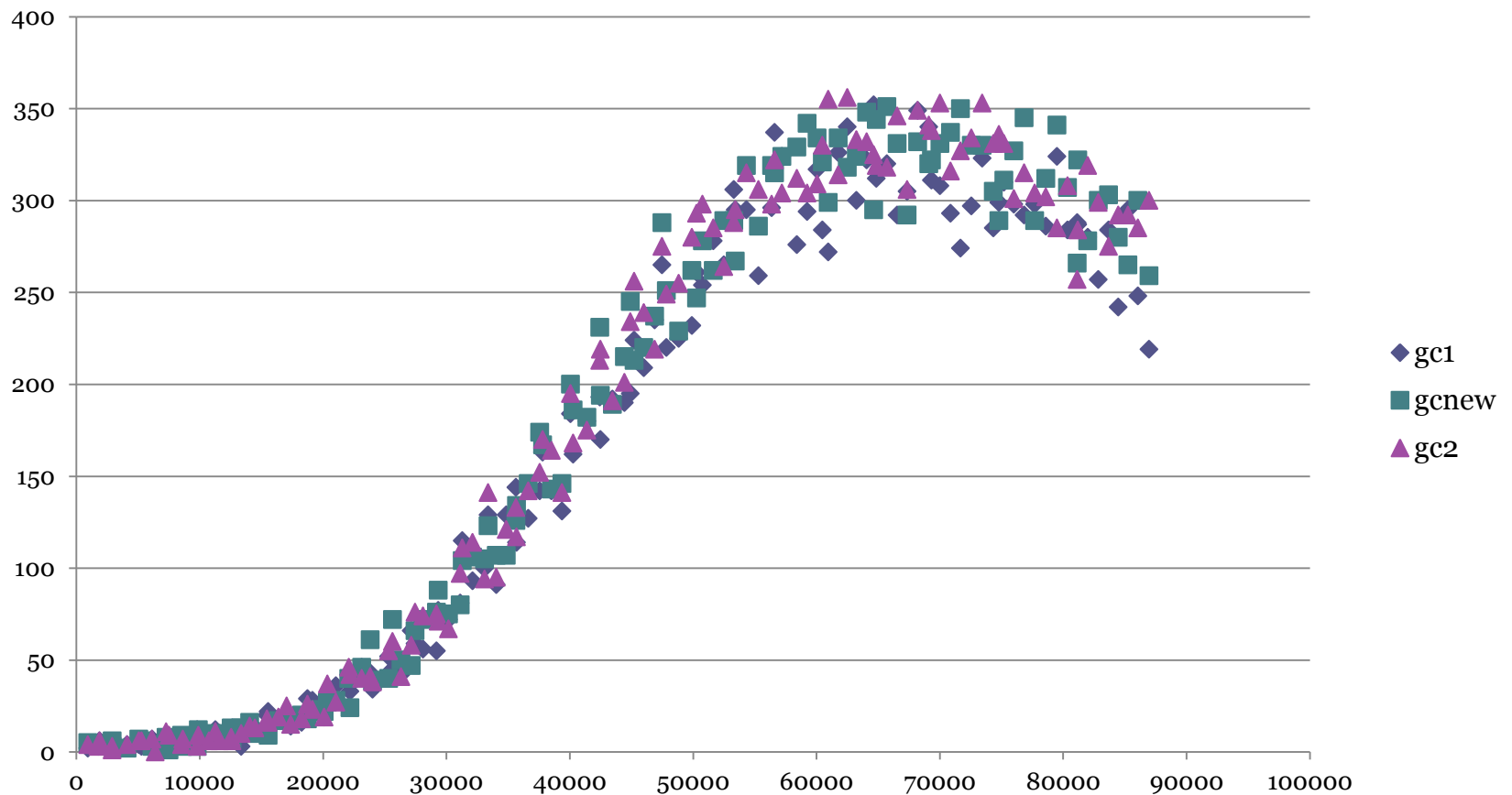
Counts per Minute vs Altitude (ft)



BASE 57-a

1cm lead

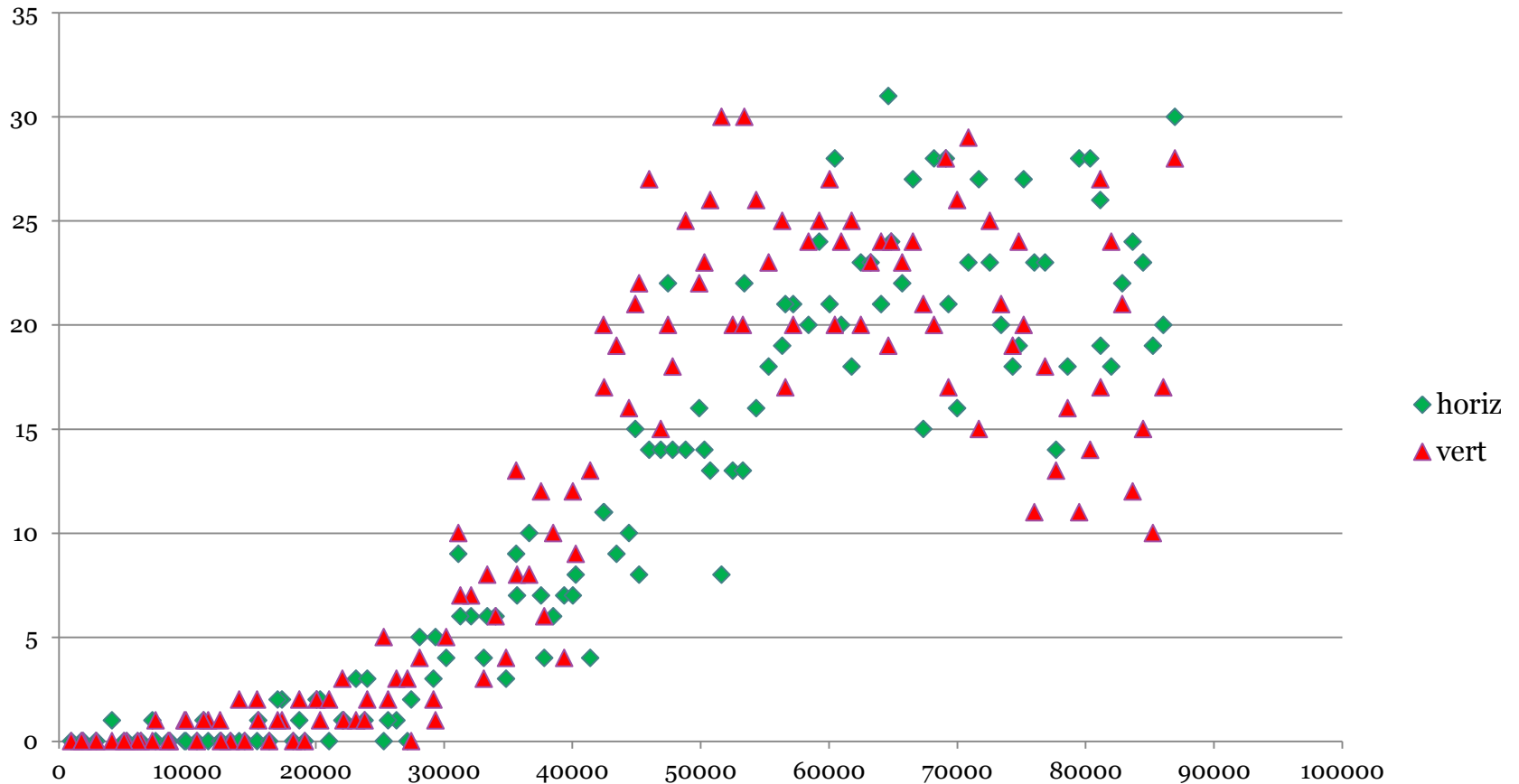
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BASE 57-a

1cm lead

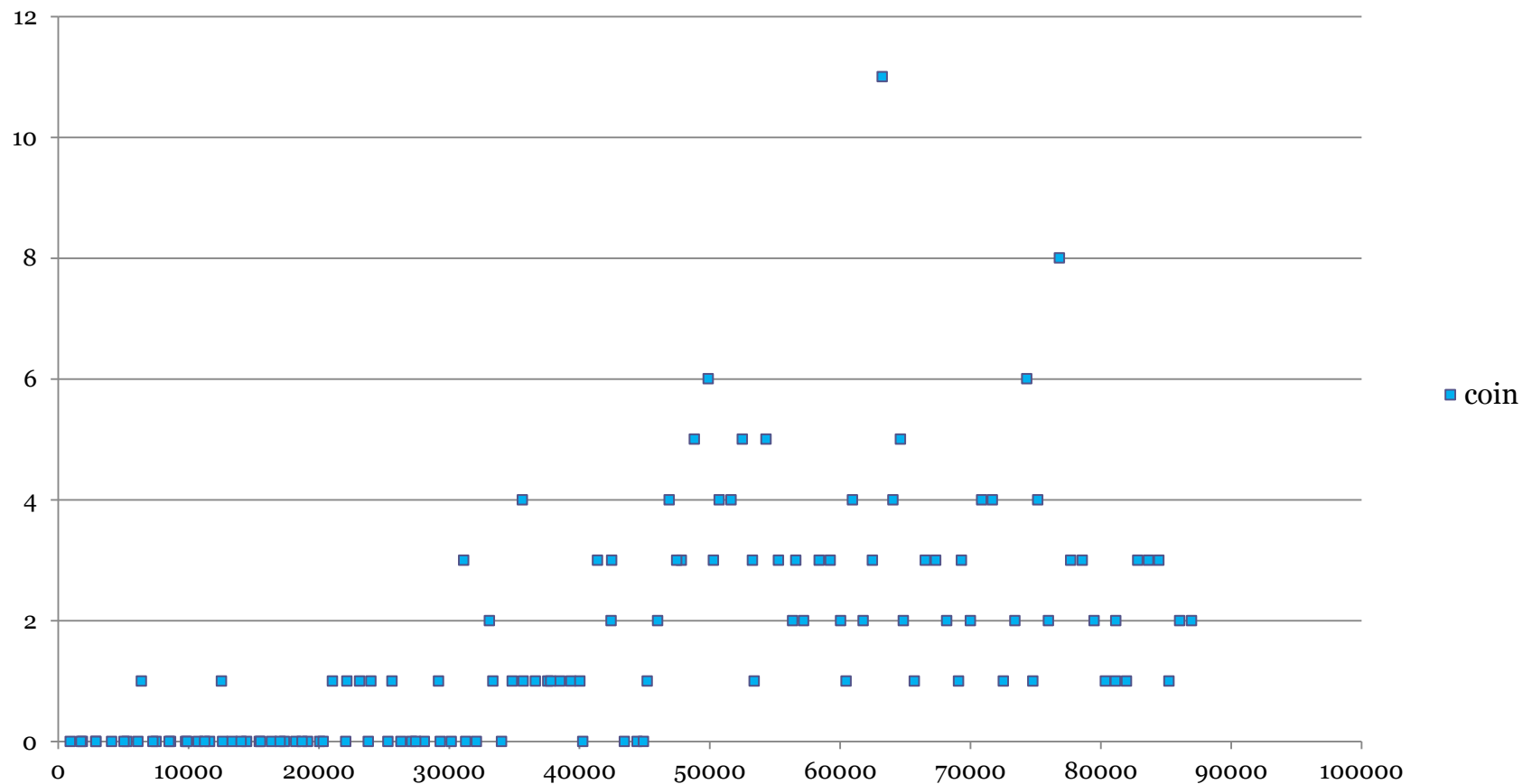
Counts per Minute vs Altitude (ft)



BASE 57-a

1cm lead

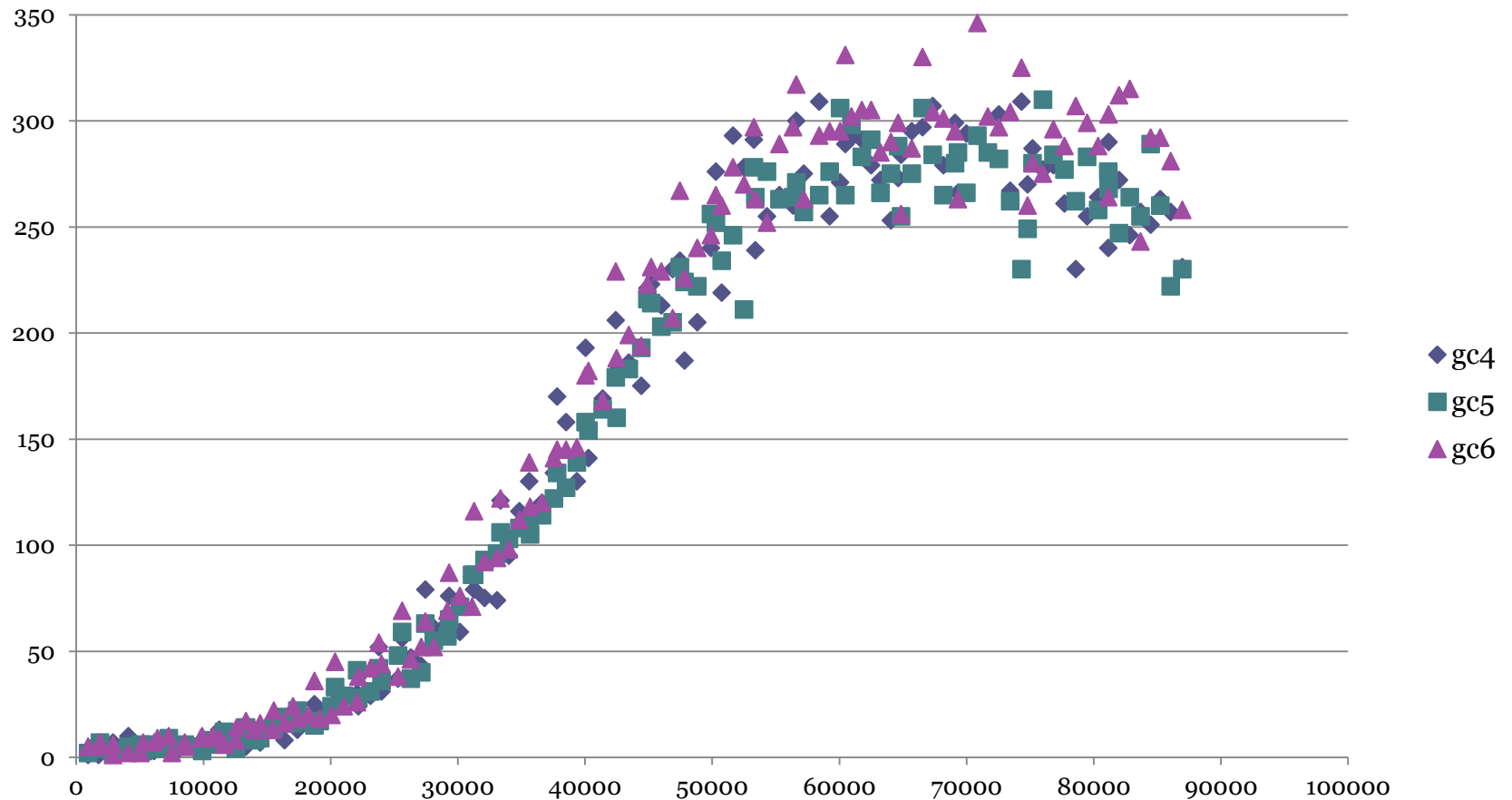
Counts per Minute vs Altitude (ft)



BASE 57-b

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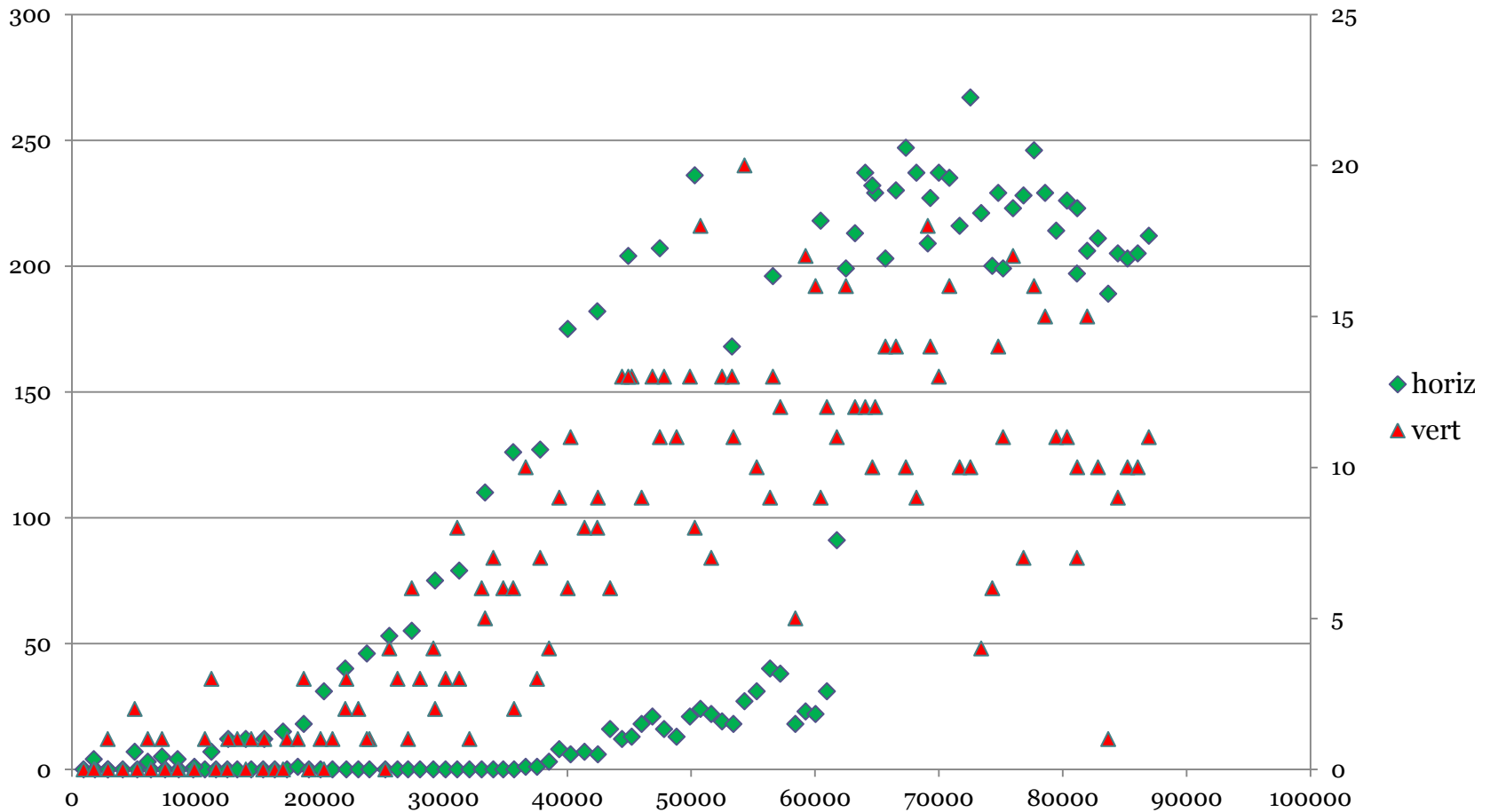
Counts per Minute vs Altitude (ft)



BASE 57-b

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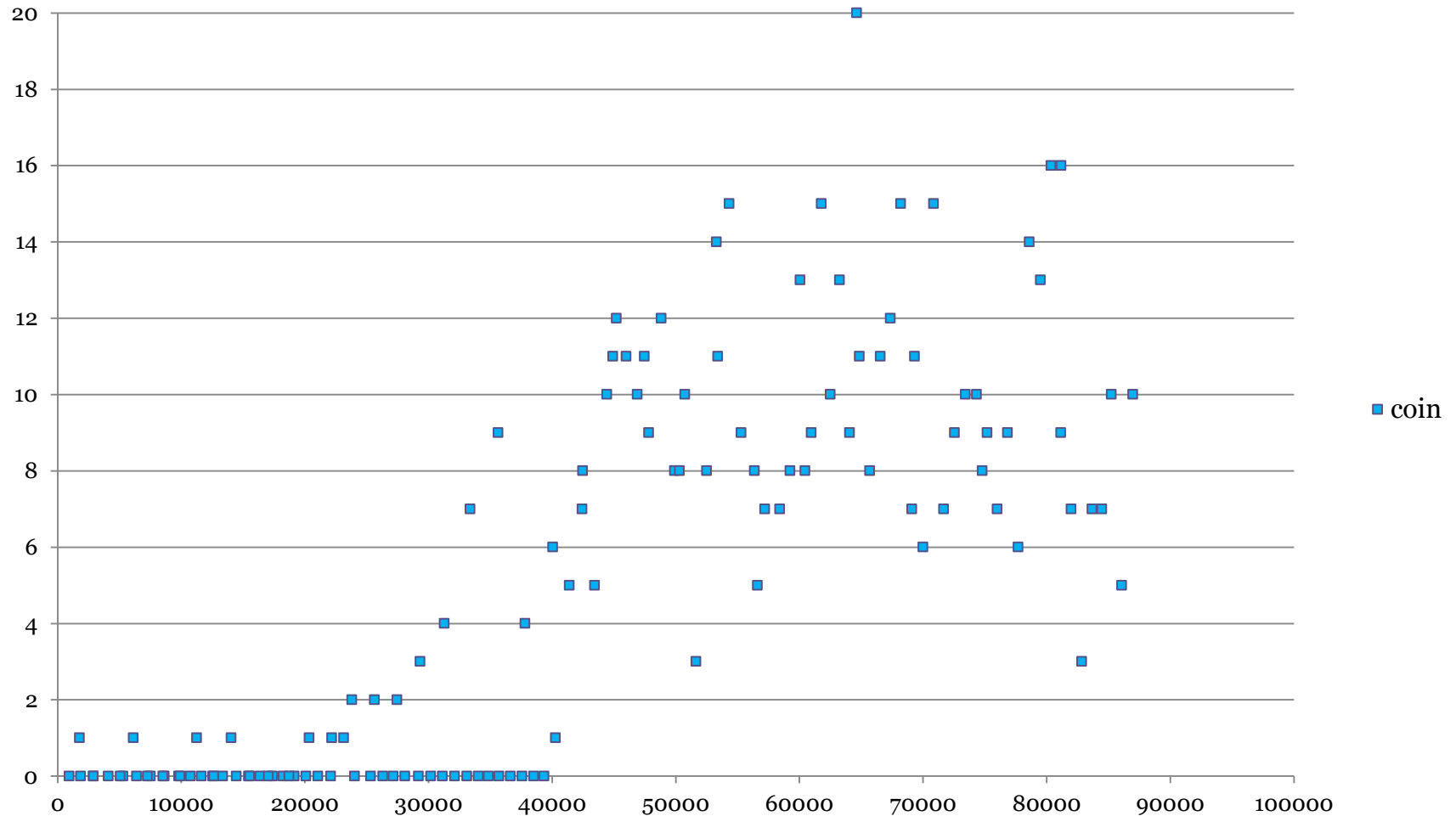
Counts per Minute vs Altitude (ft)



BASE 57-b

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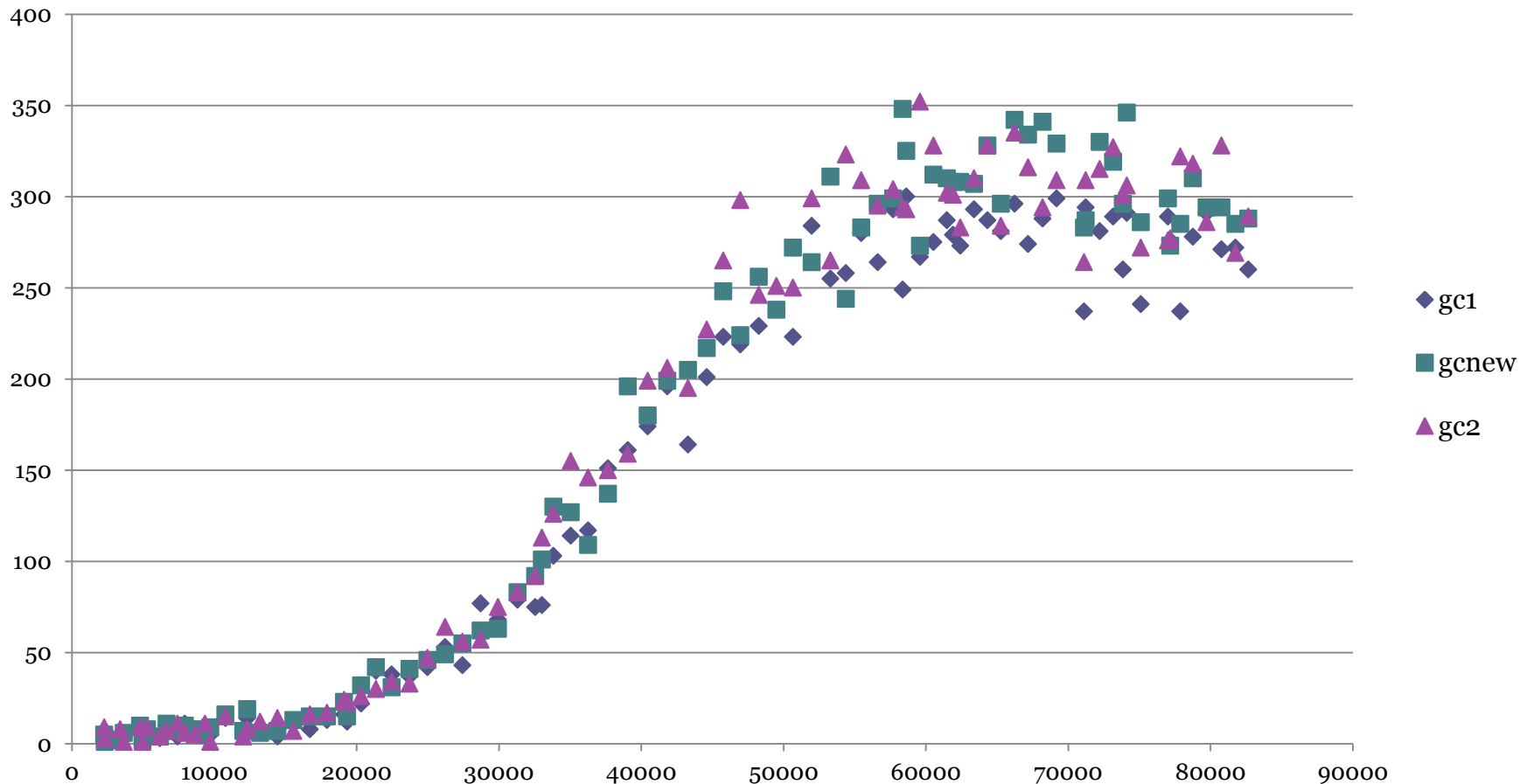
Counts per Minute vs Altitude (ft)



BASE 58-a

0.25cm lead

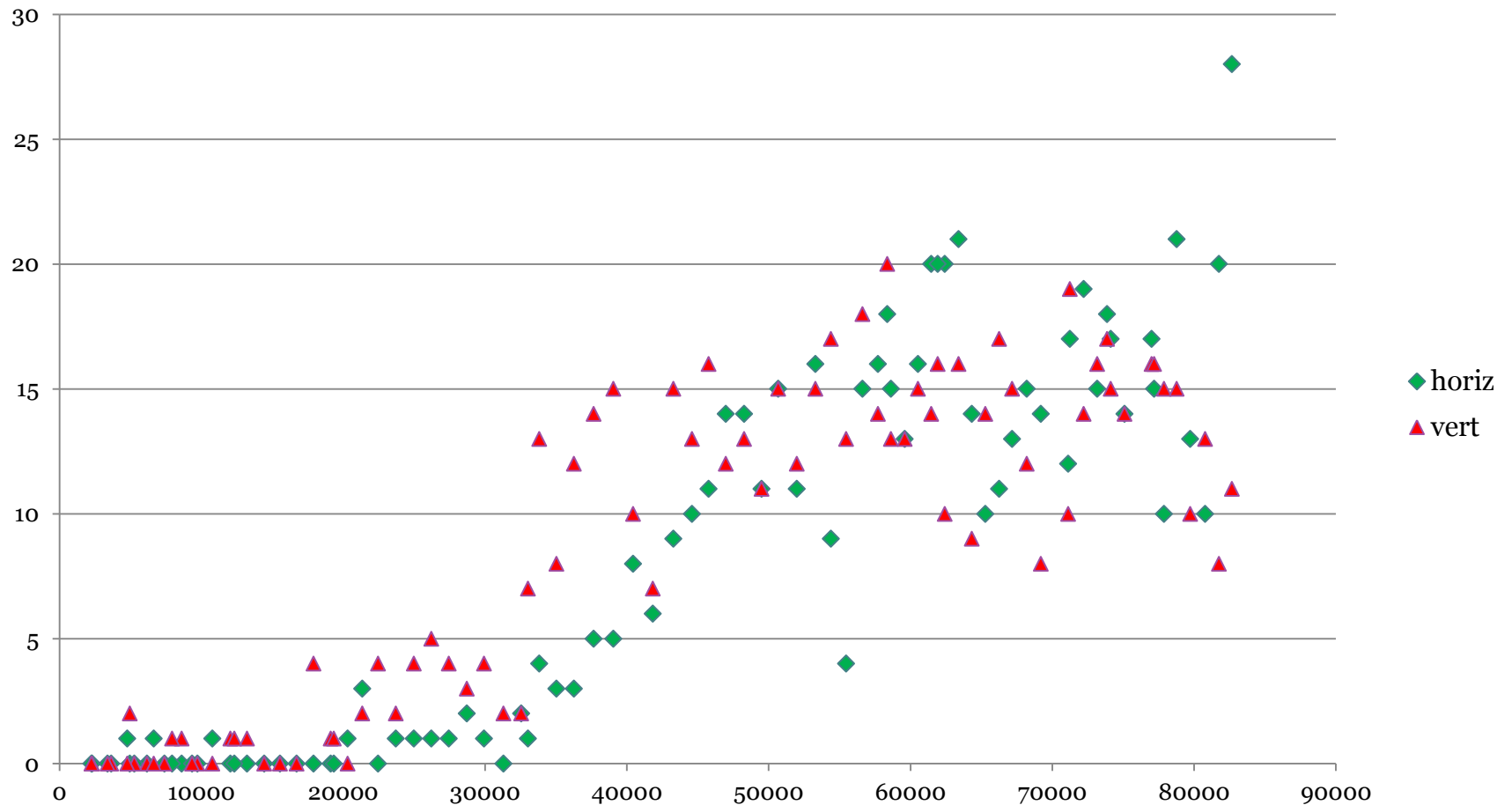
Counts per Minute vs Altitude (ft)



BASE 58-a

0.25cm lead

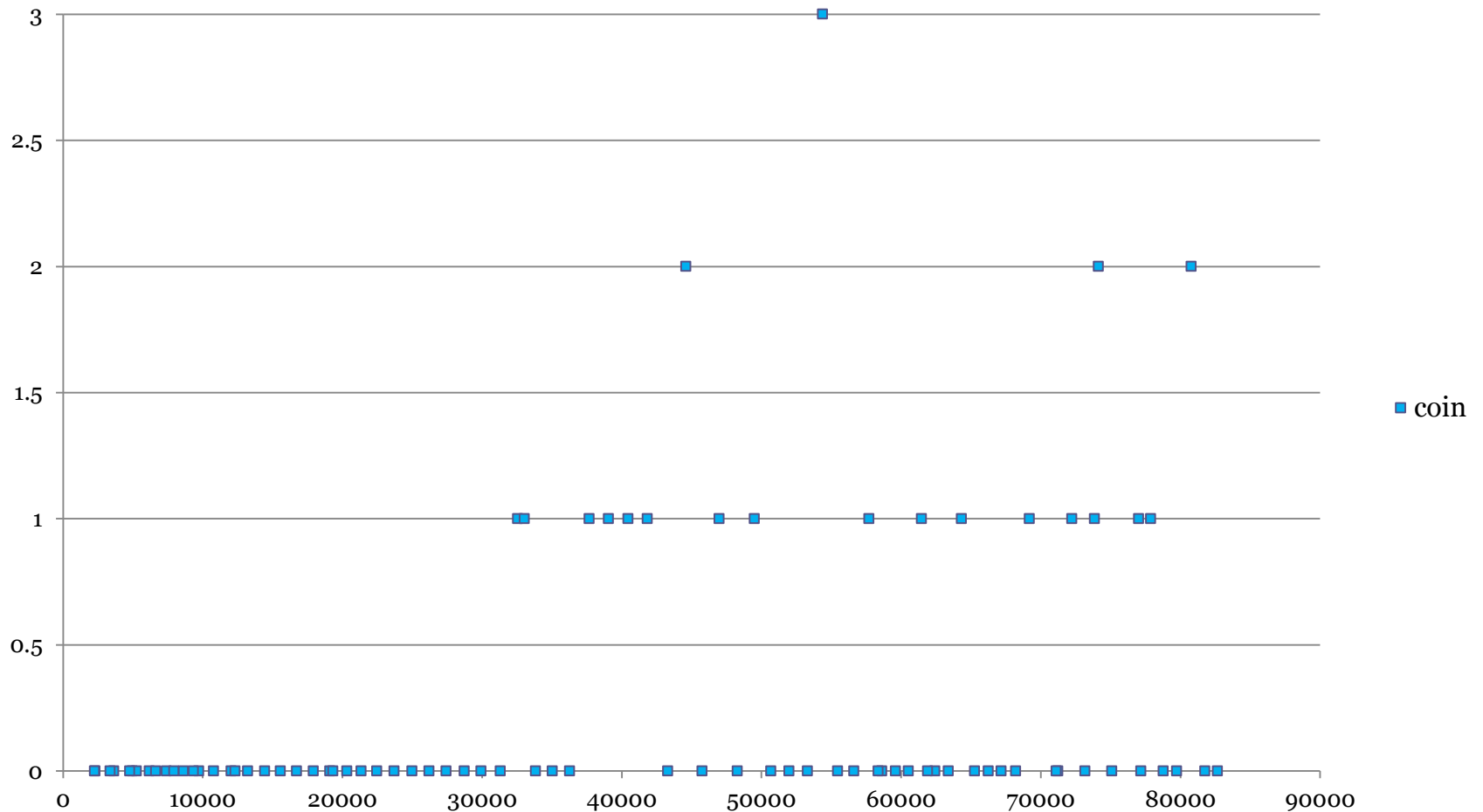
Counts per Minute vs Altitude (ft)



BASE 58-a

0.25cm lead

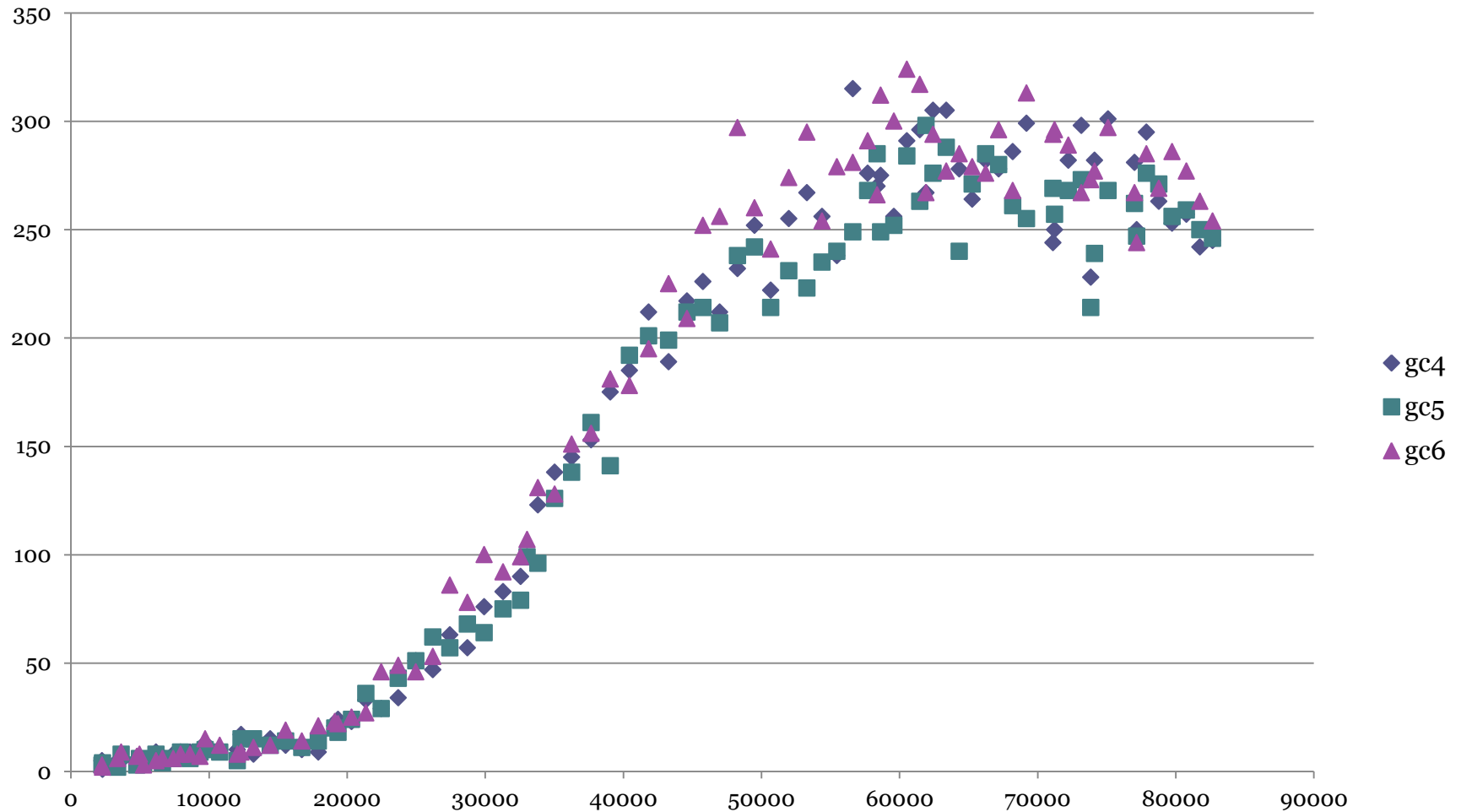
Counts per Minute vs Altitude (ft)



BASE 58-b

No lead

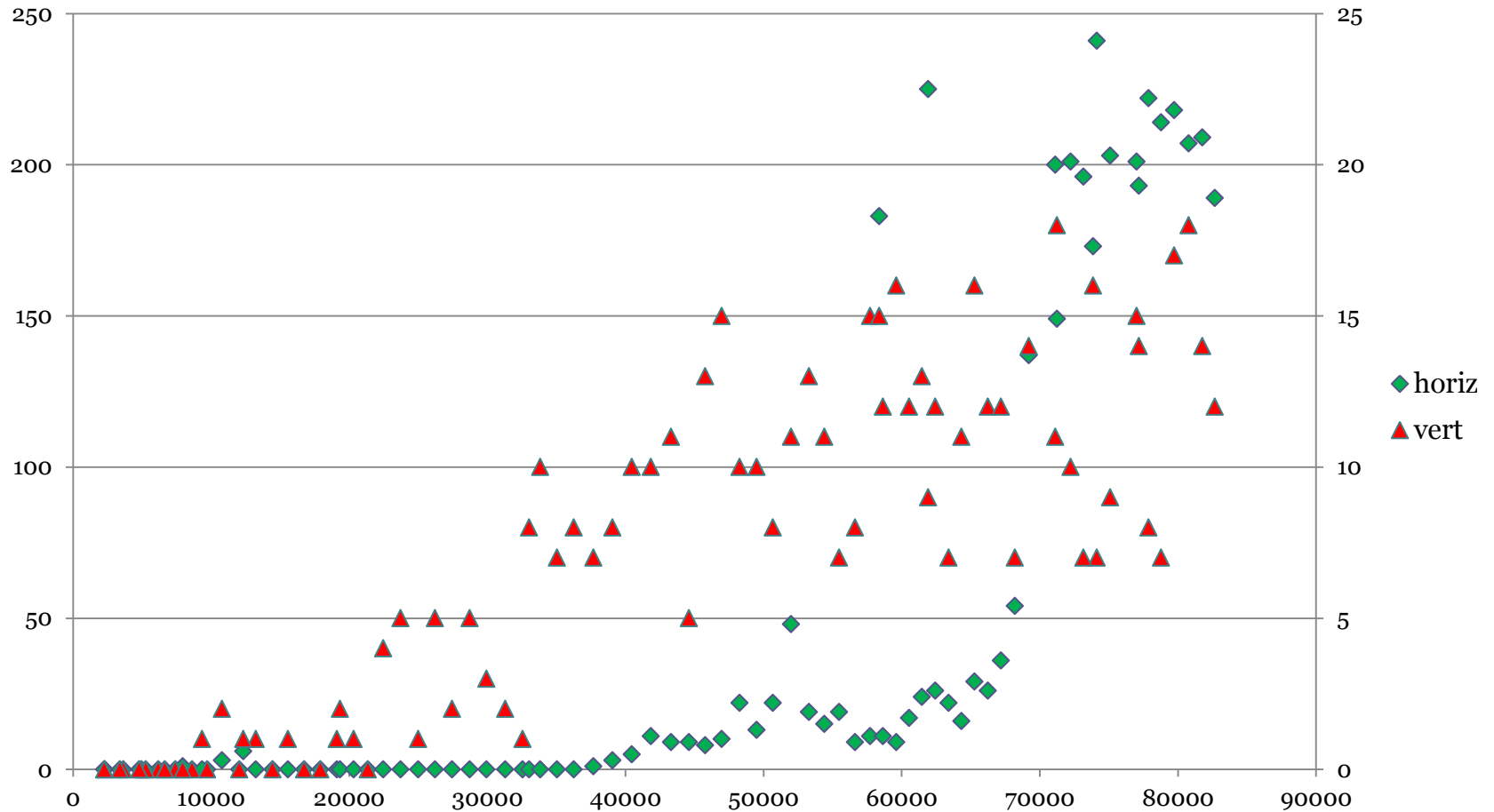
Counts per Minute vs Altitude (ft)



BASE 58-b

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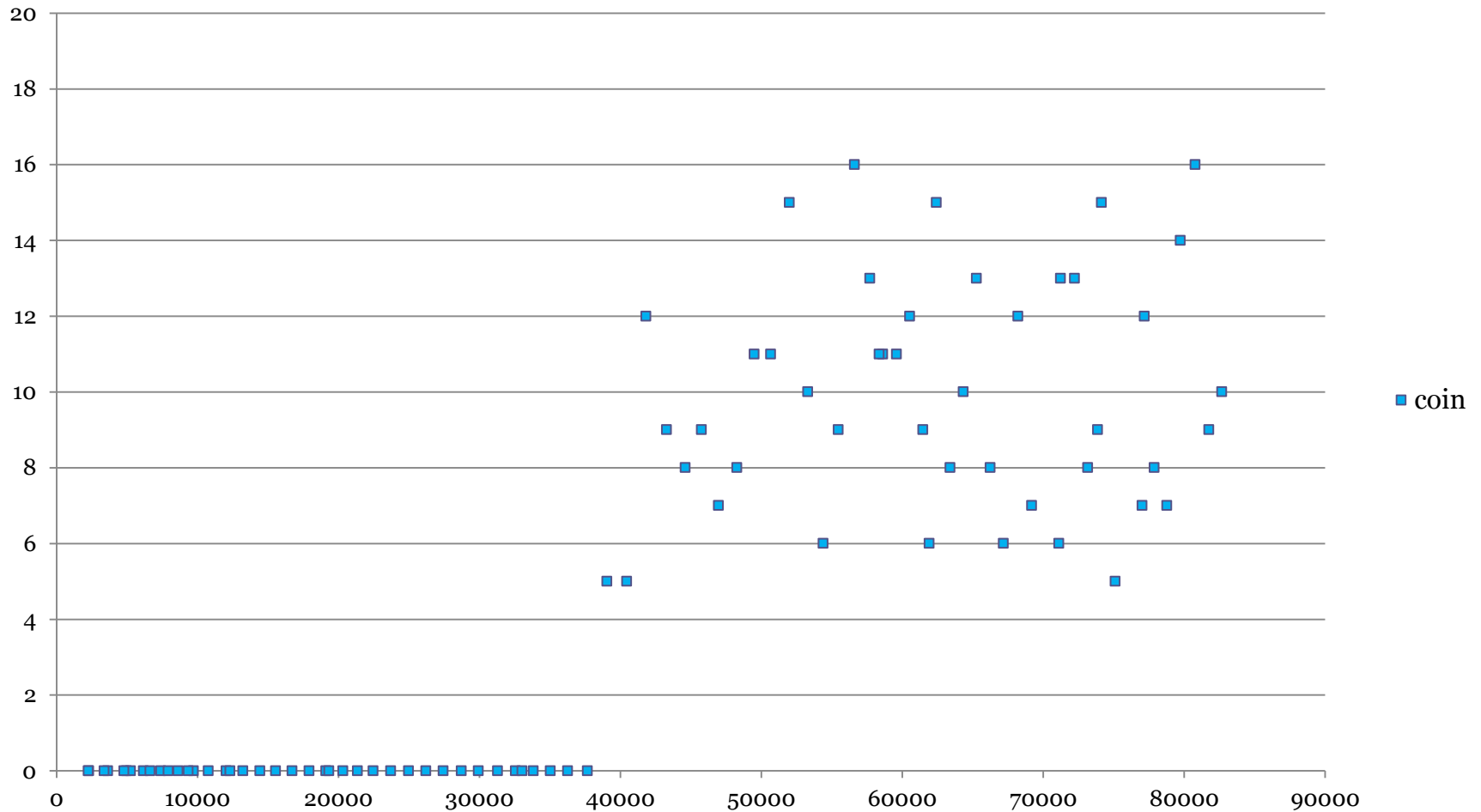
Counts per Minute vs Altitude (ft)



BASE 58-b

No lead

Counts per Minute vs Altitude (ft)



Flight Data

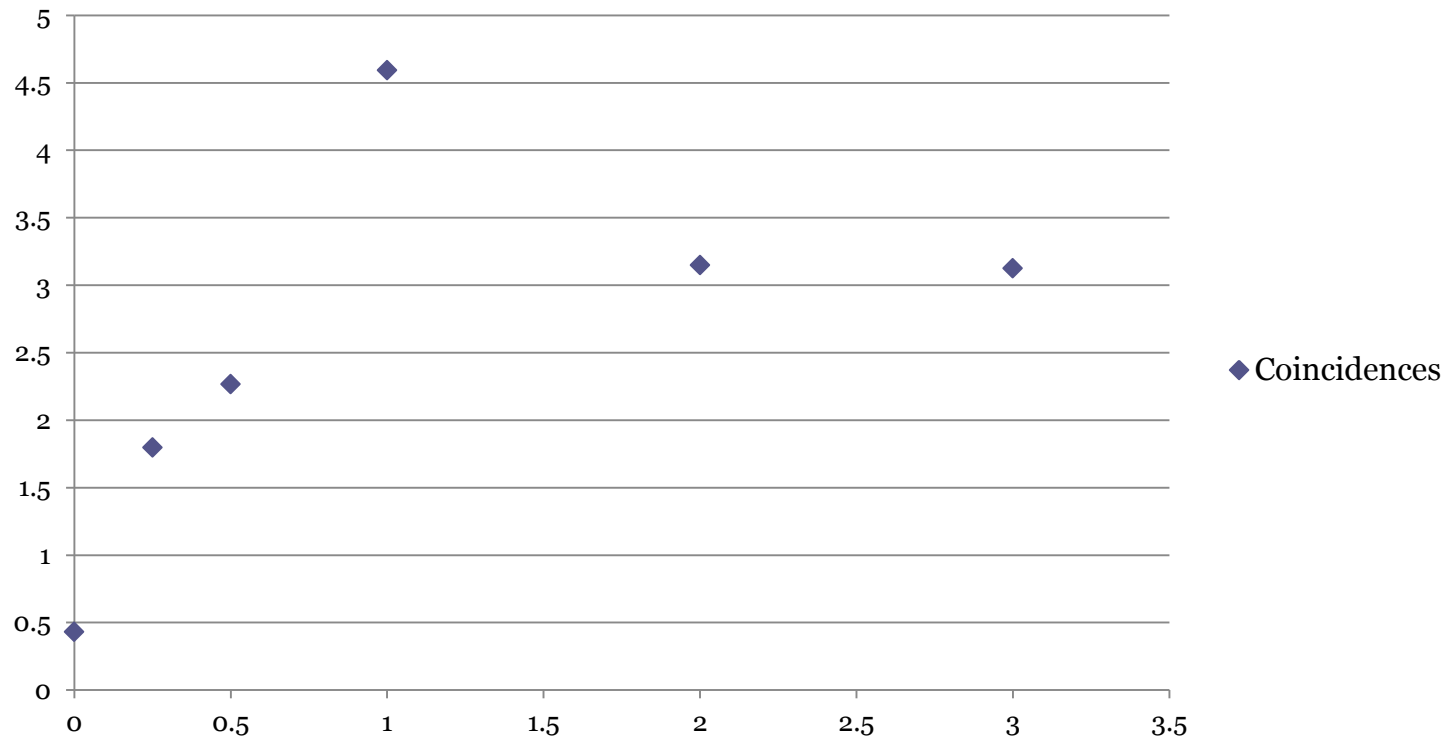
Lead Thickness (Flight)	Avg Triple Coin per minute	Avg Horiz Coin per Minute	Avg Vert Coin per Minute
0cm (56a)	0.168224	7.383178	6.392523
0cm (56b)	0.17757	7.495327	6.663551
0cm (57b) *	5.147287	81.23256	6.806202
0cm (58b) *	5.02913	54.748	7.495327
0.25cm (58a)	0.31068	7.893204	8.184466
1cm (57a)	1.604651	10.77519	11.75194

Ground Data

Lead Thickness (cm)	Avg Coincidences per Day
0	0.43
0.25	1.80
0.5	2.26
1	4.59
2	3.15
3	3.12

Ground Data

Coincidences per Day vs Lead Thickness



Conclusions

- Horizontal, vertical, and triple coincidences all occur at a higher rate in the upper atmosphere.
- Horizontal coincidences are drastically less likely than vertical coincidences at ground level, but seem to overtake vertical coincidences at altitude.

Conclusions

- So far our ground data is consistent with the historical experiments by Rossi and others.
- Our flight data is so far consistent with prior ground results, but we have not yet taken enough data to determine whether the critical thickness of the shielding is affected by the greater number of more energetic particles higher in the atmosphere.

Further Work

- More flights to expand our data set. We have 9 flights planned for the rest of the summer, including multiple flights with 0.5 cm, 2cm, and 4cm of lead to expand both our width and depth of data.
- More ground tests to increase certainty in our data and gather more data on horizontal/vertical coincidence rates.