Angular dependence of background radiation detected by Timepix

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Overview

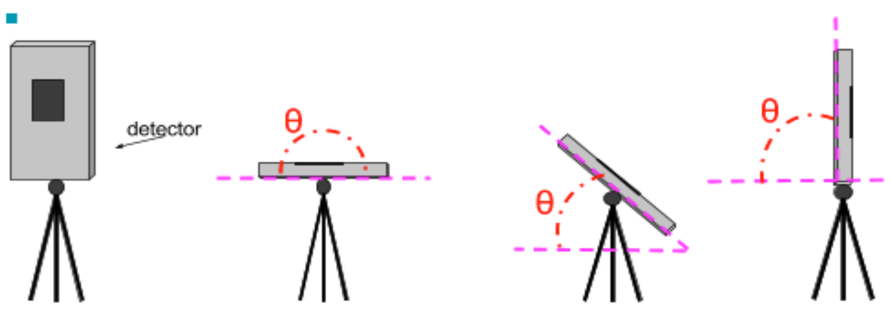
Using a Timepix detector, we measured the relative energy distribution in a series of tests with the detector at different angles. Our results demonstrate that the recorded energy per pixel is highest when the angle of the detector is in the region of 40 degrees from the horizontal.

Aims

We aimed to determine the effect of varying the angle of the detector on the energy of radiation detected. Our hypothesis was that we should detect highre energy from muon tracks with the detector vertical whereas background radiation should not be affected by detector angle.

Background information

The Timepix chip consists of an array of 256 by 256 pixels covered by silicon and aluminium layers. When ionising radiation hits the detector, its energy is deposited in the silicon layer as it comes to rest or passes through. An electrical signal is generated in the pixels struck and is then amplified. The pixels are read by the software and a picture of the radiation strikes is produced.

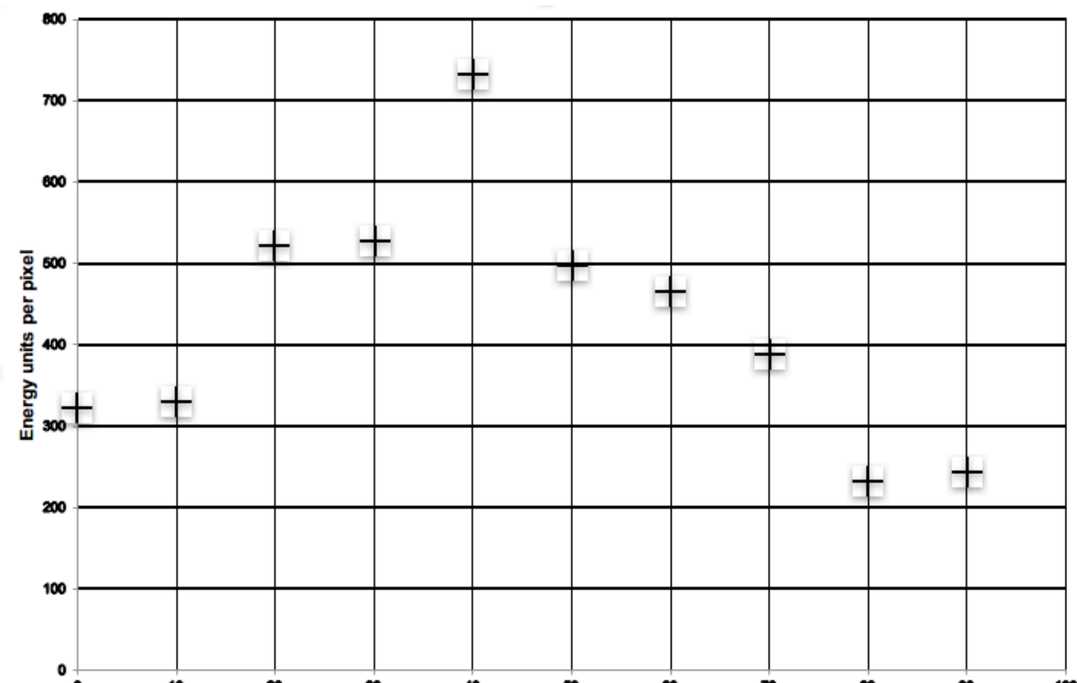


Methodology

The detector was set to a 95V bias, and there was no cover on the detector. The experiment was run in the same location. A ten minute sample of data for each angle was collected and this was repeated three times each (angles used in the experiment: θ = 0◦ , 10◦ , 20◦ , 30◦ , 40◦ , 50◦ , 60◦ , 70◦ , 80◦ , 90◦).

Results

Our graph shows that there is an angular asymmetry of radiation detected. Despite the fact that the number of pixels which were triggered remained fairly constant, the mean relative energy per pixel was greatest at 40 degrees, with the value gradually decreasing for greater and lesser angles. This trend was confirmed by the three repeats that were carried out for each angle.



Conclusion

There is clear proof of the angular dependence in our results, but this is hard to explain. Simple mathematical models we have tried show this is possible if the radiation has a preferred angle around 40-50^{o}. This needs further investigation.

Evaluation

We are still in the analysis stages, and so far our results are inconclusive. We plan on looking further into angular dependence by testing the detector with a radioactive source so we can control the direction of incident radiation.

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