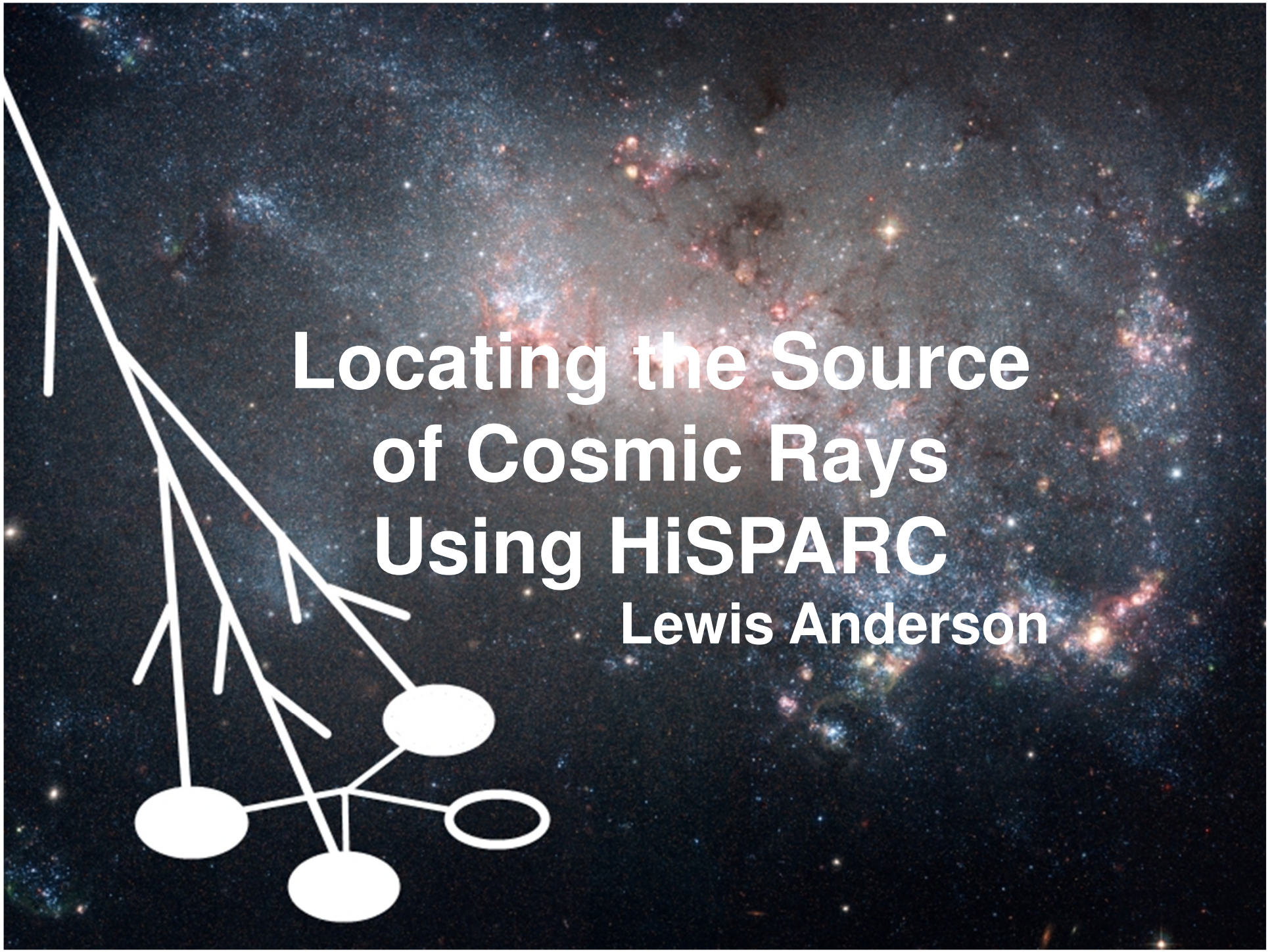
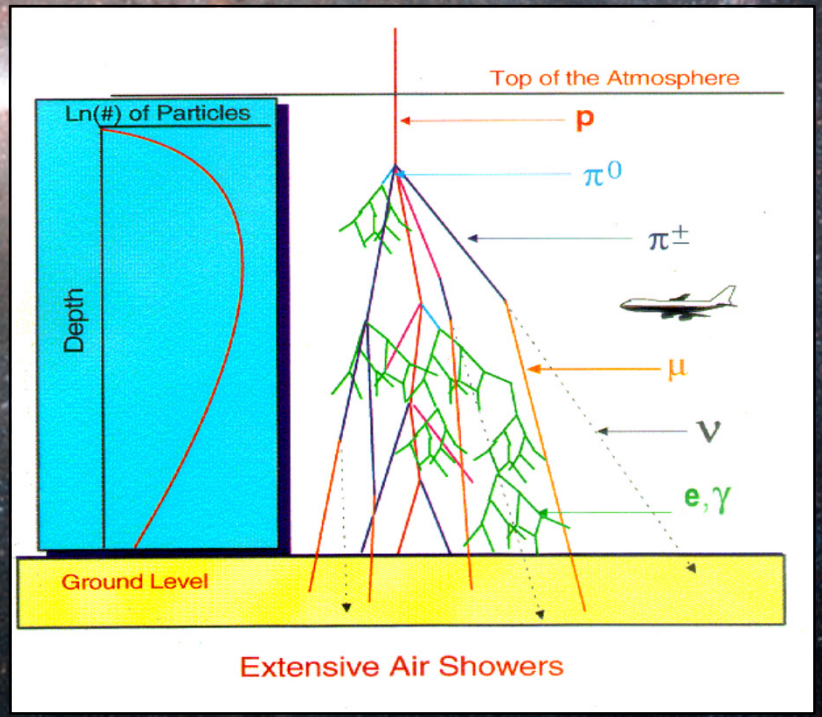

Locating the Source
of Cosmic Rays
Using HiSPARC
Lewis Anderson

Presentation Index

- Introduction to Cosmic Rays
- The HiSPARC Experiment
- Methods and Results
- Conclusions
- Acknowledgements

Cosmic Rays

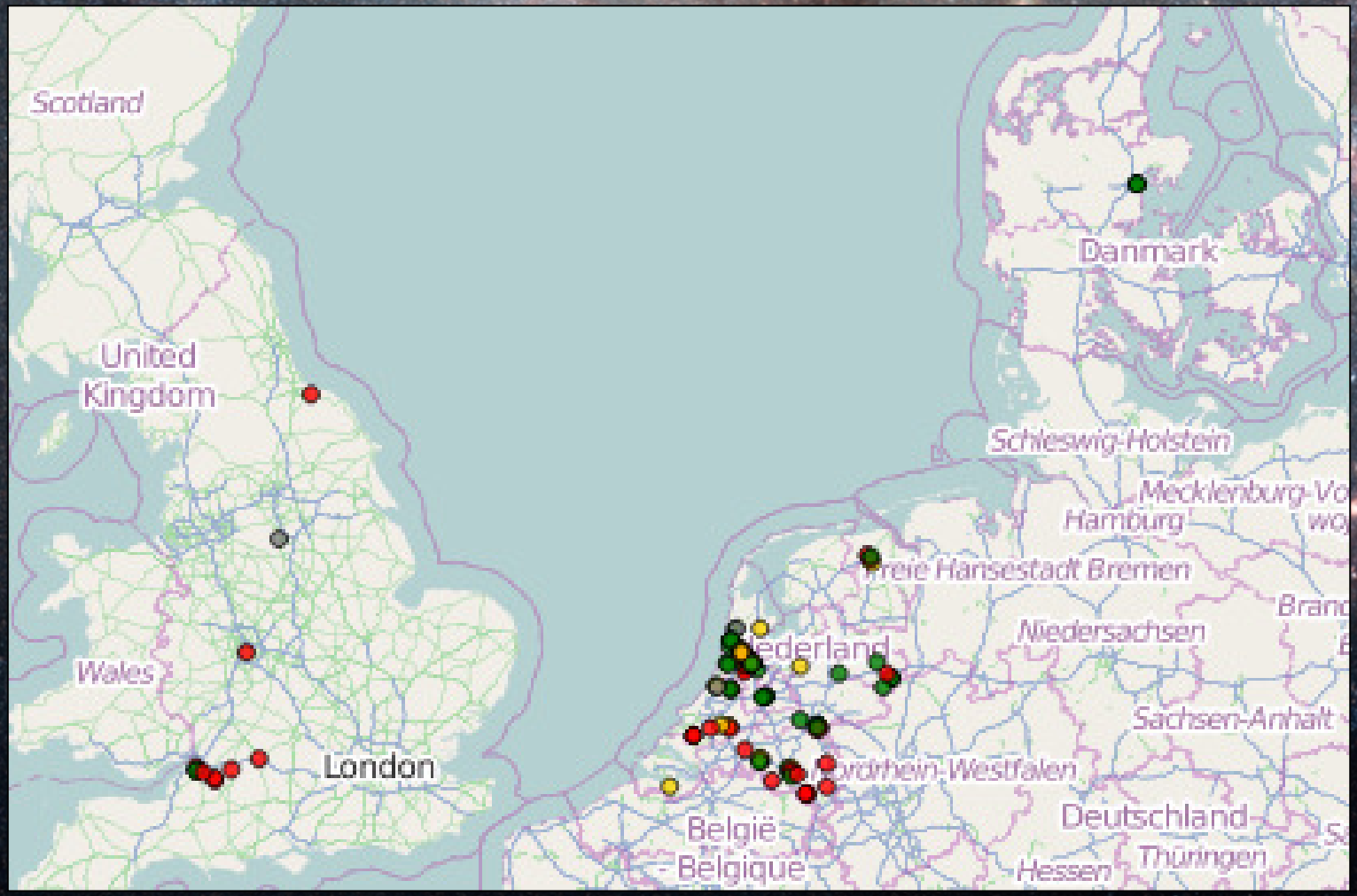
- Fast moving particles
- Protons (85%), alpha particles (12%) and electrons (2%)
- Range of energies, from 10^9eV to 10^{20}eV
- Unknown sources
- Cause air showers



The HiSPARC Experiment

- High School Project on Astrophysics Research with Cosmics
- Recording data since 2002
- Set up in “clusters” – Bristol, Amsterdam & Birmingham

Locations of HiSPARC Detectors



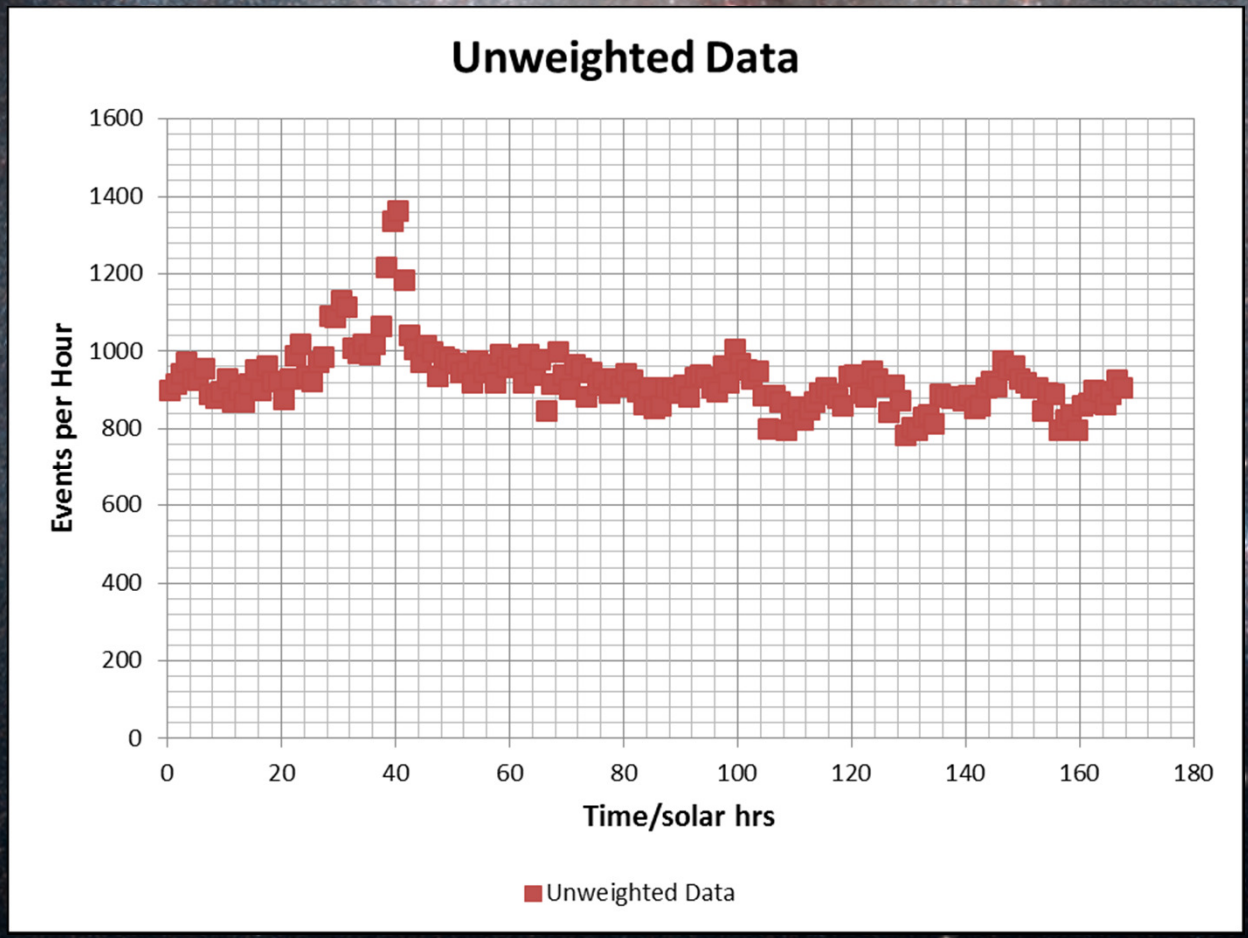
HiSPARC Detectors

- Detectors stations of roofs of schools and academic institutes.
- Two scintillator plates detect Muons
- Data sent to central database in Nikhef

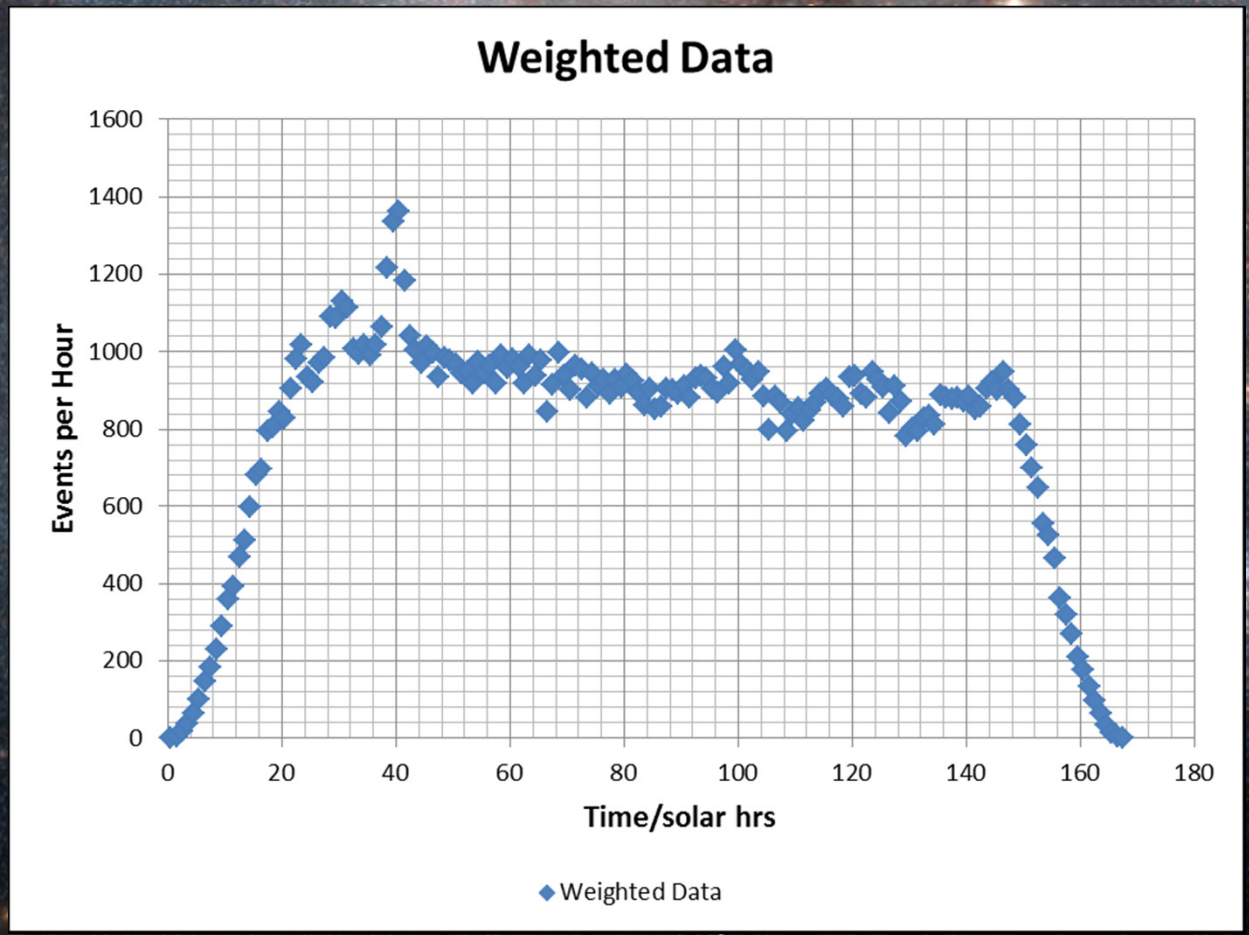
Calculating Angle of Cosmic ray Excess

- Event data taken from HiSPARC public database.
- 3 consecutive weeks, 27 detectors.
- Calculated angle for times throughout observation period.
- Weighted data and x-y components calculated using Fourier transformation.
- Found direction of source and calculated Right Ascension.
- Calculated percentage deviation.

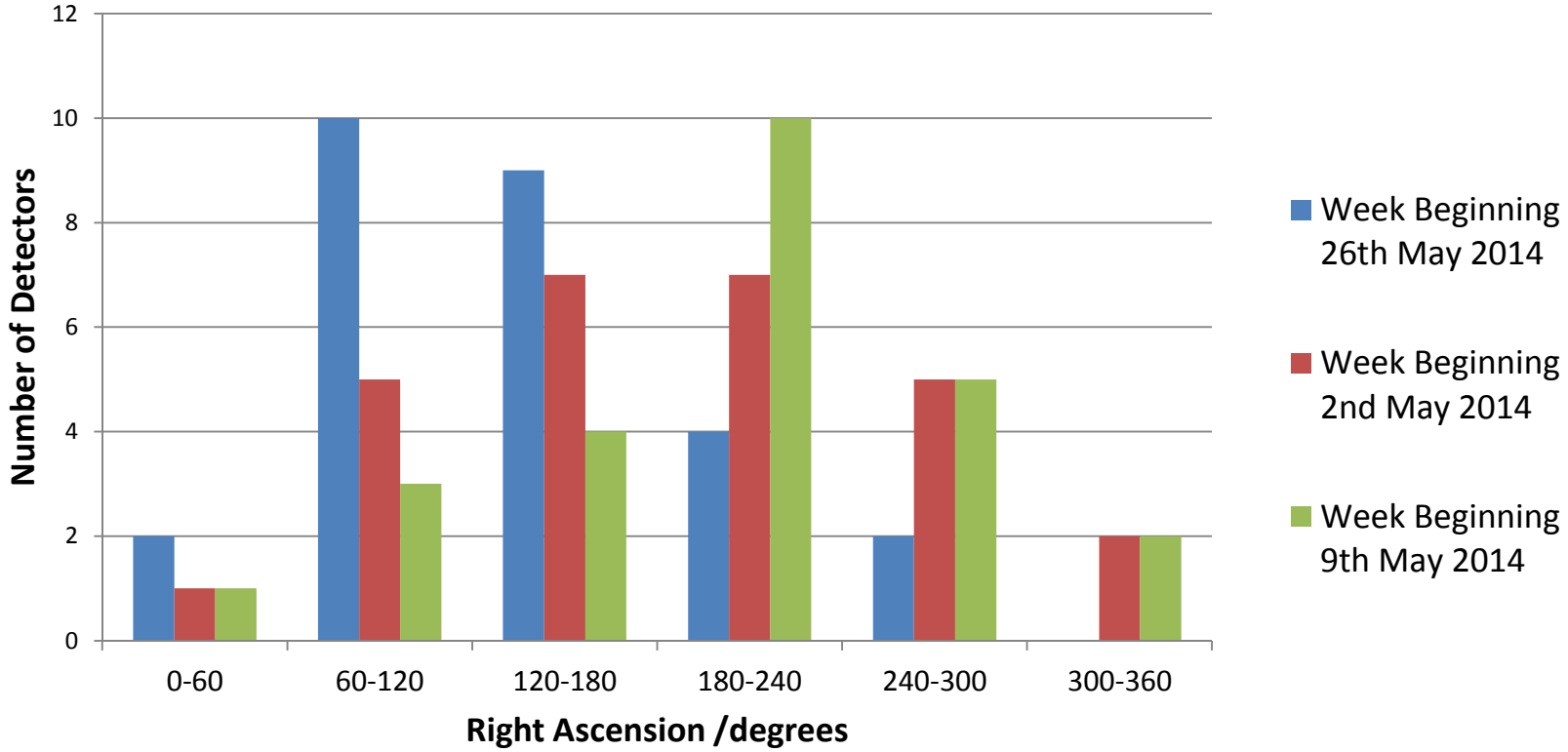
Calculating Angle of Cosmic ray Excess



Calculating Angle of Cosmic ray Excess



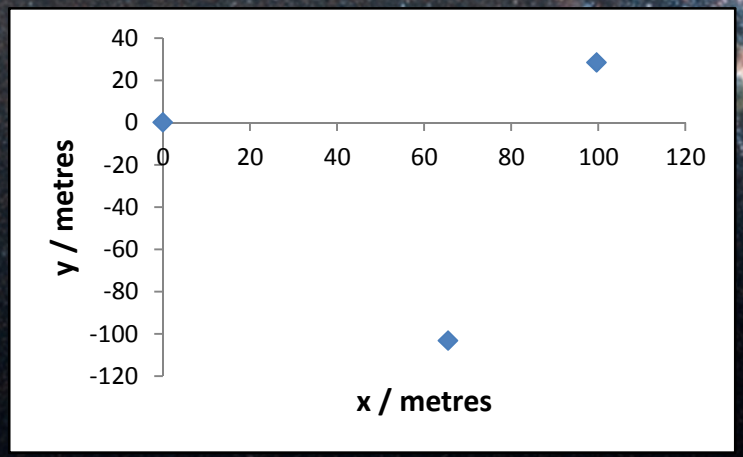
Results



Two different statistically significant peaks.

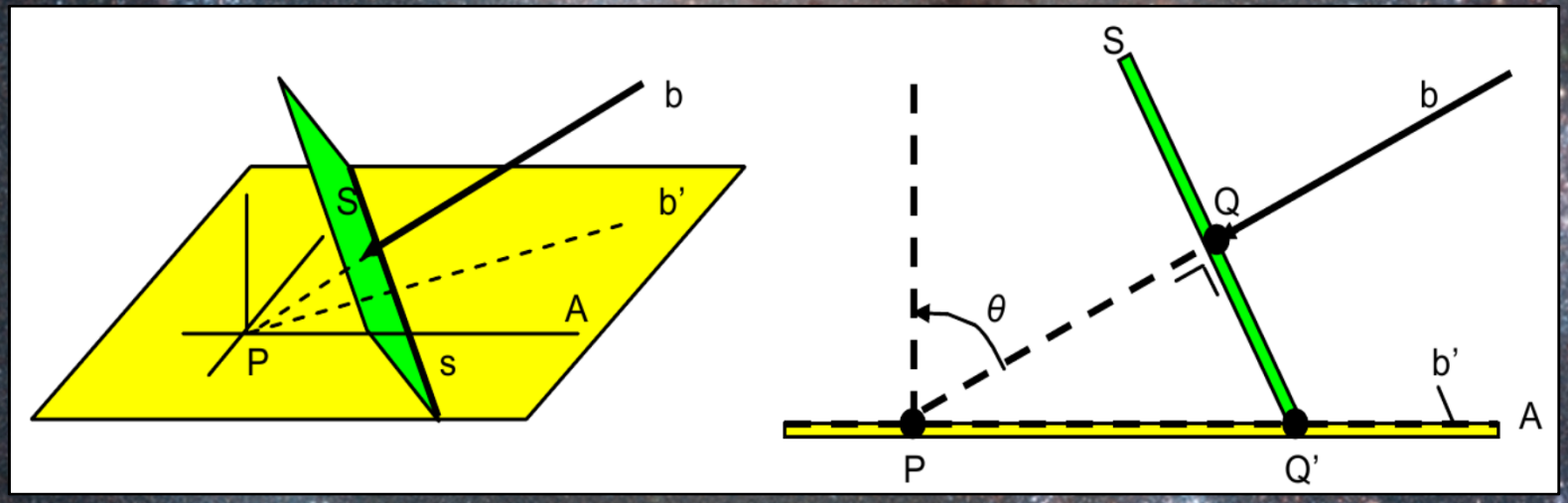
Triangulation of Primary Particle Direction

- Science park cluster.
- Individual coincidence data for events detected by 6 or more detectors over 4 days.
- Relative positions and detection times for first 3 detectors found.



Stations 503, 506, 507

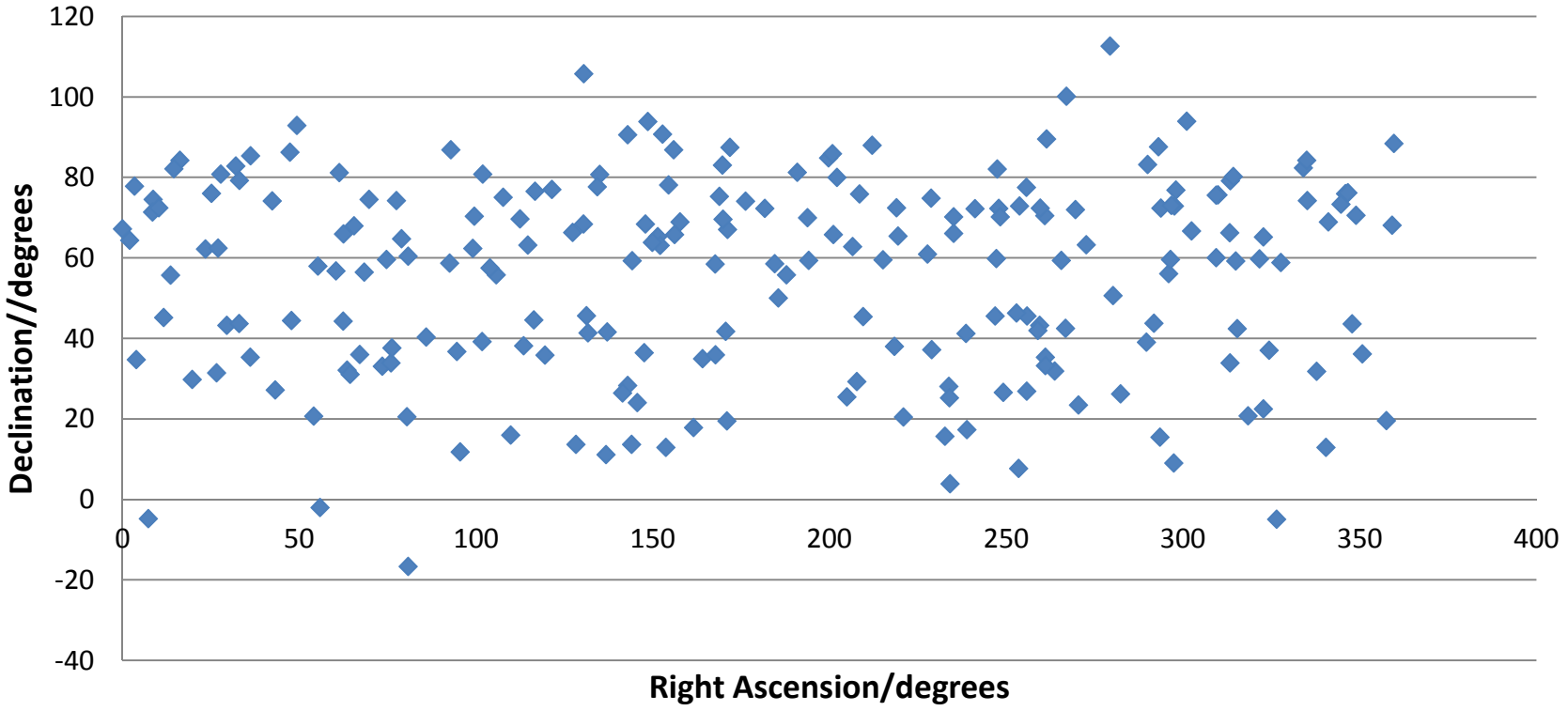
Triangulation of Primary Particle Direction



- Azimuth and Zenith angles for primary particle calculated.
- Used to Calculate right ascension and declination.

Results

Uniform distribution of right ascensions



Conclusions

- First method found angular dependence for 2 of 3 weeks.
- Could not find source at those positions.
- Found no angular variation for second method.
- Improvements could be made to method and become more effective as HiSPARC network grows.

Acknowledgements

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Any Questions?