nomon

Tina Dufke, Åse Marie Erklev, I. Smolić, S. Beriša, N. Vojvodić

Abstract

NOMON network of high sensitivity video camera was deployed for automatic and simultaneous monitoring of approximately 40000 square kilometers of the atmosphere on the height of 100 km over southern Norway. Analysis of recorded data during the maximum of Geminid meteor shower (over 700 meteor detections on 4 cameras) indicates that it is possible to classify detected meteors to parent meteor showers. Statistical error of radiant determination for particular meteors is a few angular degrees and 5 km/s for meteor velocities. Because of small ground distances of video cameras (around 6 km), obtained data are good enough for educational purposes. In order to get data with scientific value for meteor astronomy, it is necessary to spread camera network to larger distances (50 - 150 km).

A web application based on rating was developed for classifying meteor from non-meteor videos/data. This process will be automatized in future by implementing a machine learning algorithm.

The System

Each observation spot consisted of 2 high sensitivity video cameras equipped with appropriate lenses. This equipment was protected by waterproof casing with heaters. It was connected to a PC via USB video capture cards. Each computer is equipped with UFOCapture, the automatic meteor detection application.

The network

Cameras are located in 3 different locations. The exact locations can be seen in the table below. The distance between each two schools is around 6 km.

Geminids meteor shower

Maximum activity for Geminids meteor shower in 2016 was expected on the night between 13th and 14th of December. During the whole night 4 cameras were recording. They were oriented so that at least 2 cameras from different locations observe the same part of the sky. Those observed areas are marked on the picture below, as well as the locations themselves. (H - Havlimyra, G – Grim, T – Torridal, N i W – Markings for north or west orientation of the cameras)
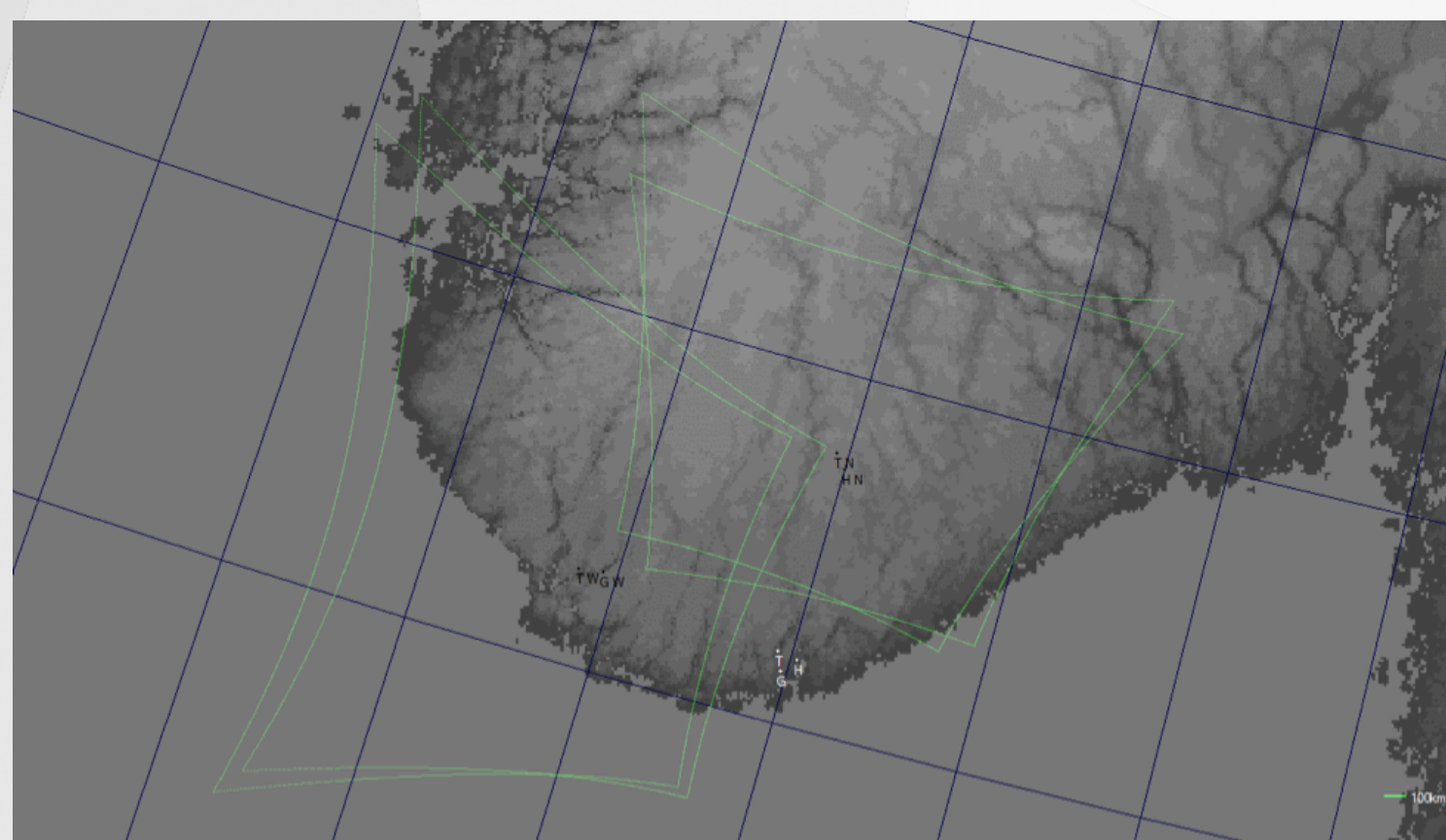
During the night each camera recorded over 150 meteors. It is worth mentioning that the Moon was full and over the horizon for larger part of the night. Using UFOAnalyzer, trajectory and motion parameters were determined (coordinates, direction, trail and apparent speed). Detected meteors by each of the camera can be seen on the pictures below:
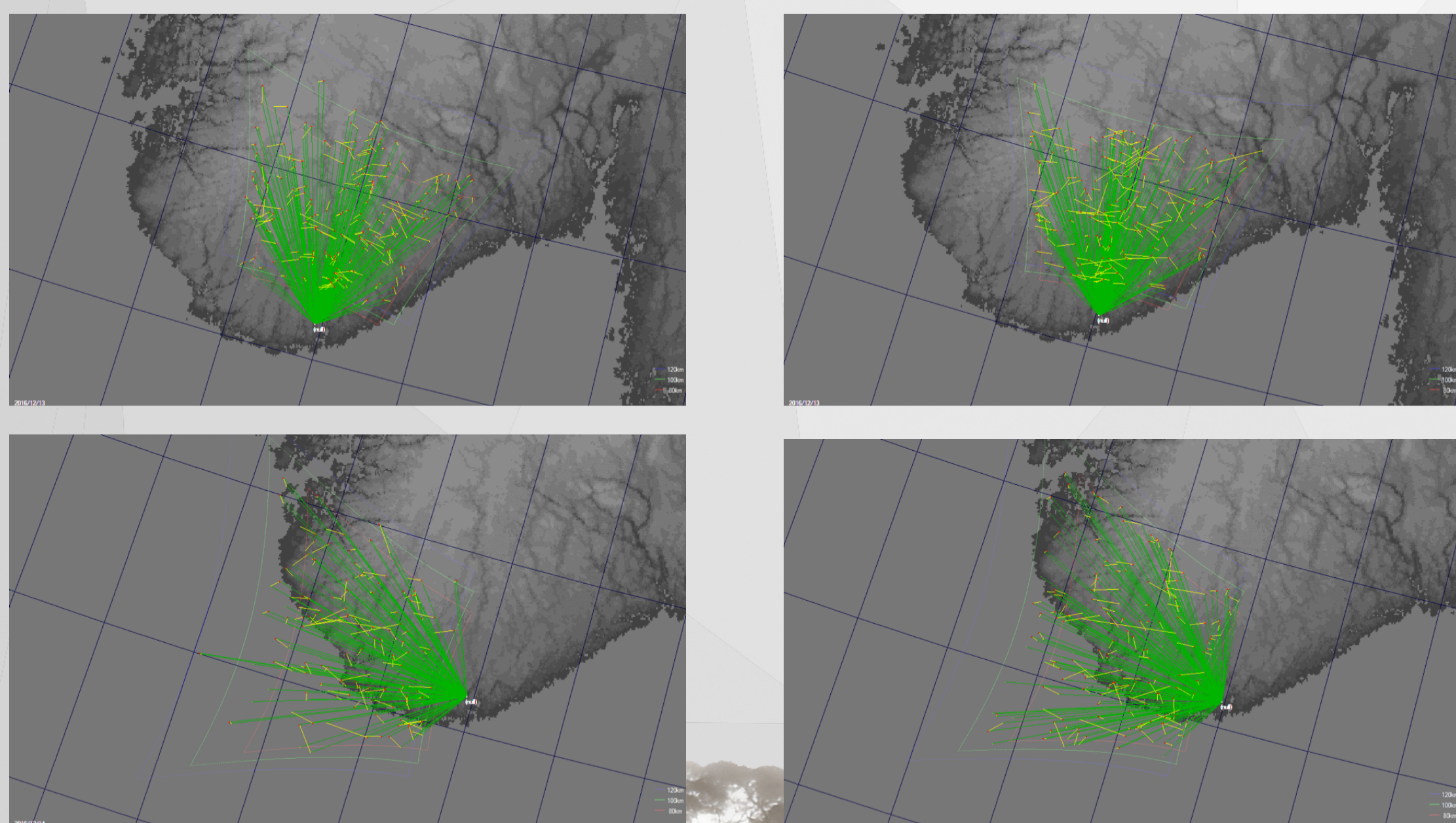

Celestial projection of all detected meteors can be seen on images below. Red lines represent the observed meteor trails and green represent the extrapolated trajectories. Radiant of Geminidis meteor shower is easy to spot, as most of the trajectories overlap there.
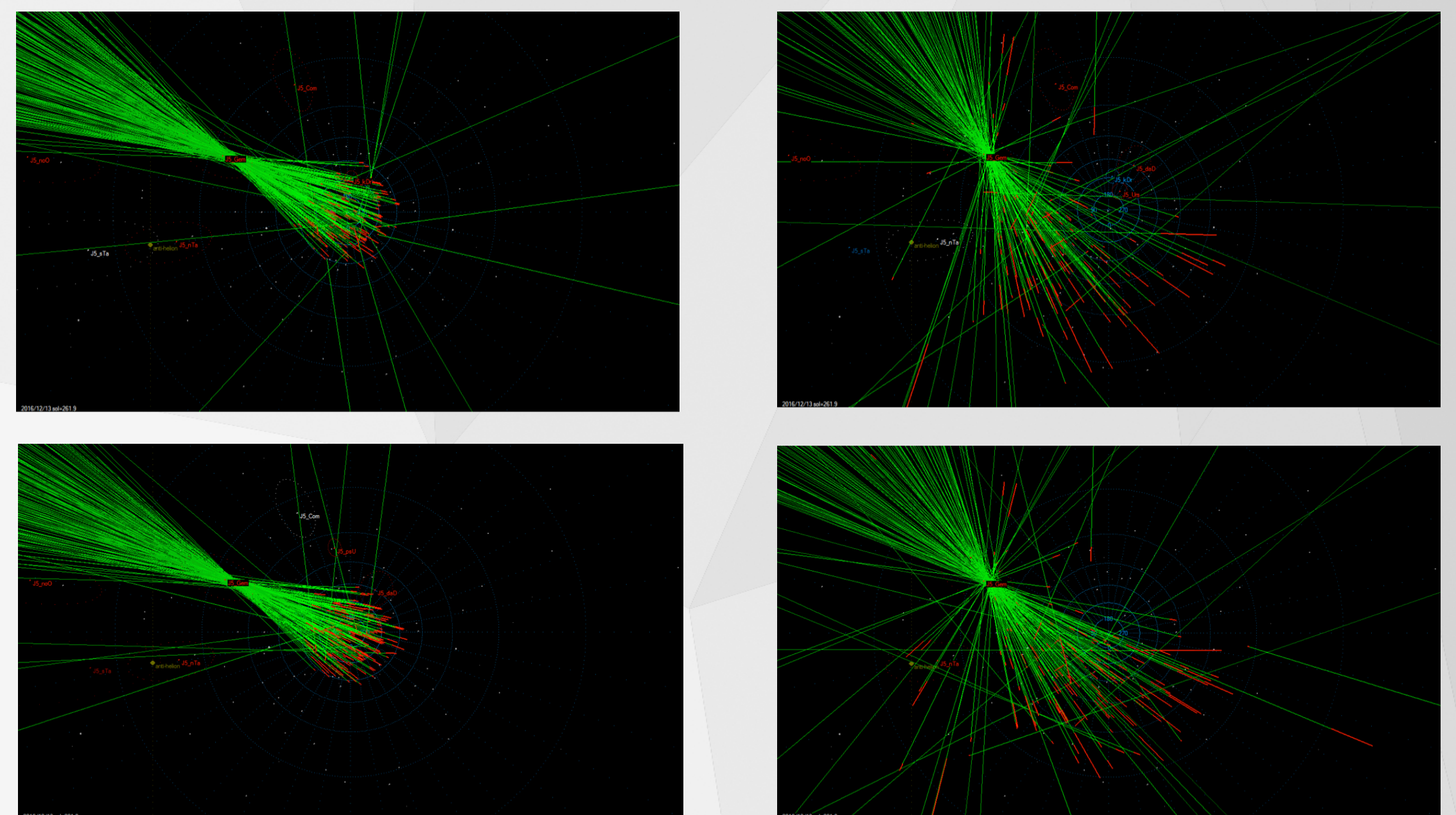

UFOOrbit and metrics from UFOAnalyzer orbital elements for each meteor that was observed by at least 2 cameras were determined. As a result, radiant point was determined for 204 meteors.
On the images below you can see radiant and geocentric speeds of all particles that caused the observed meteors.
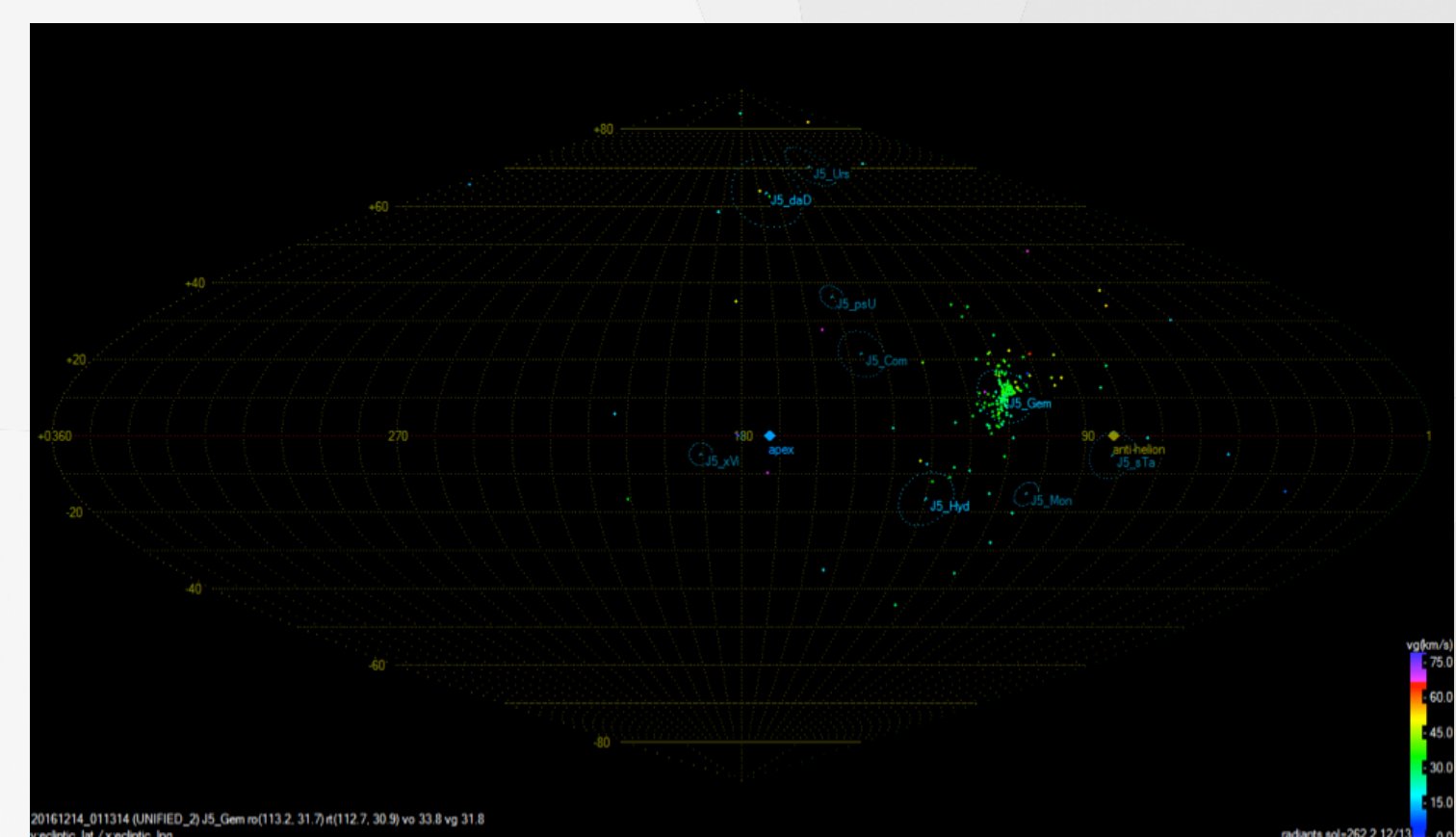
As it can be seen, most of them were (as expected) part of Geminids meteor shower. Error for determining coordinates of individual radiant was around 5 angular degrees. It is also worth mentioning that average calculated geocentric speed for Geminids is 35 km/s with an error of 5 km/s.
Prior orbits in Solar system for all the particles responsible for observed meteors during the aforementioned night can be seen on image below:
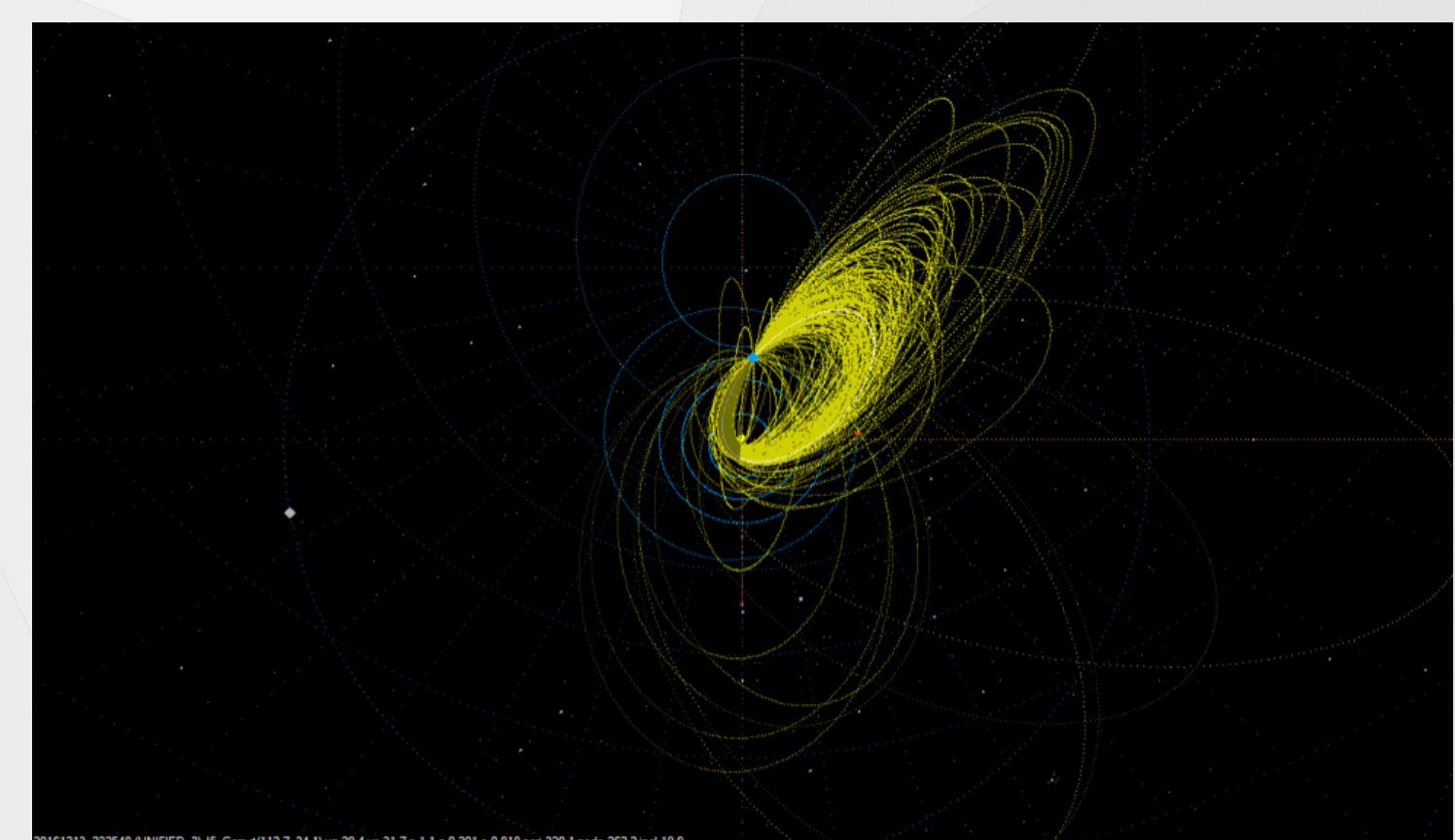
Conclusion

Network was set up so the distance between camera locations was only 6 kilometers. That is far less than optimal distance of 100 kilometers. Even with that big limitation, the data gained from this network was accurate enough to classify meteors to their corresponding meteor showers. Errors for determining meteoroid orbit parameters were significantly greater than expected (for a network with optimal distances).

ntgruppen.no   Havlimyra Skole   Torridal Skole   Grim Skole