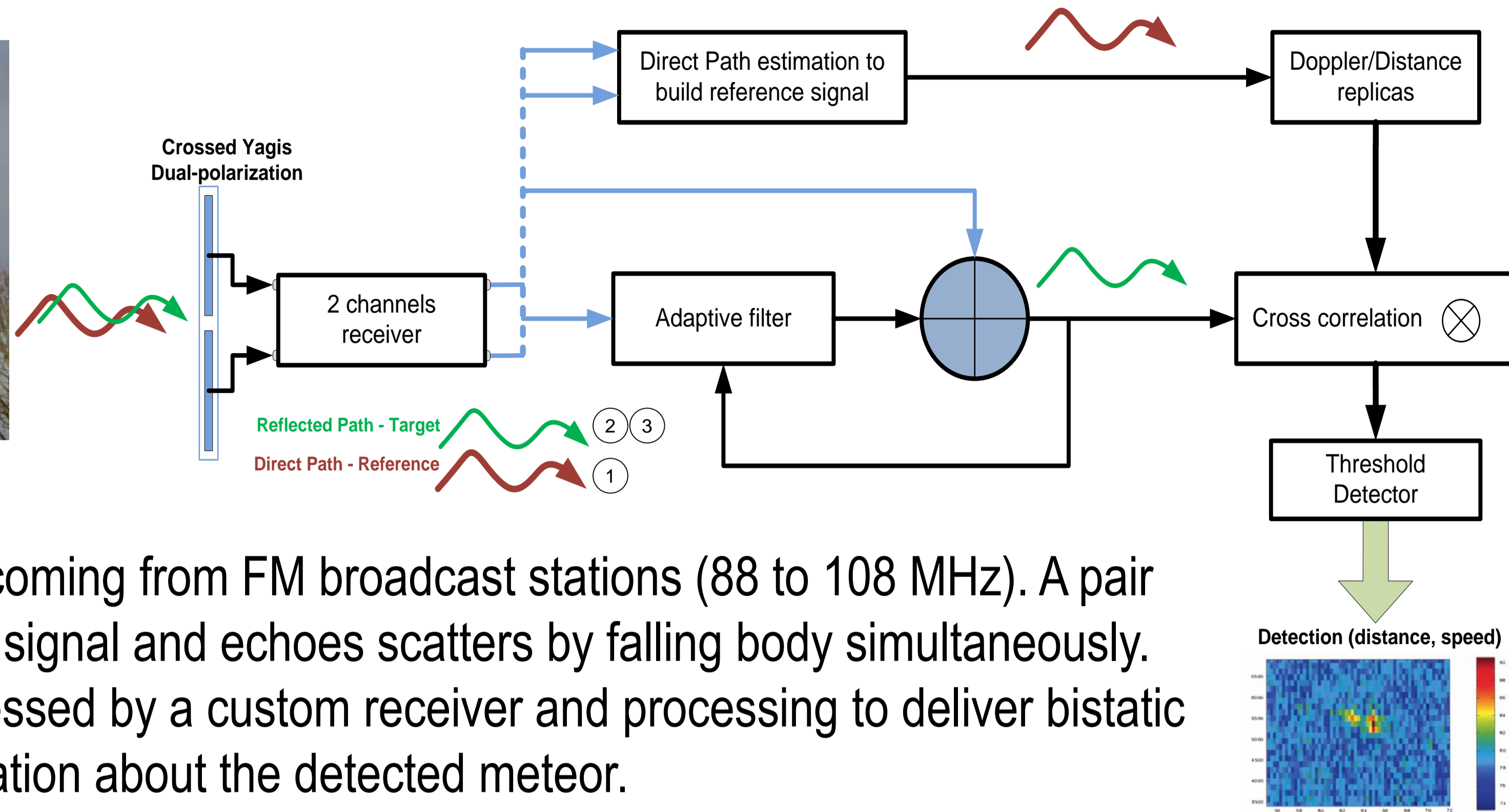
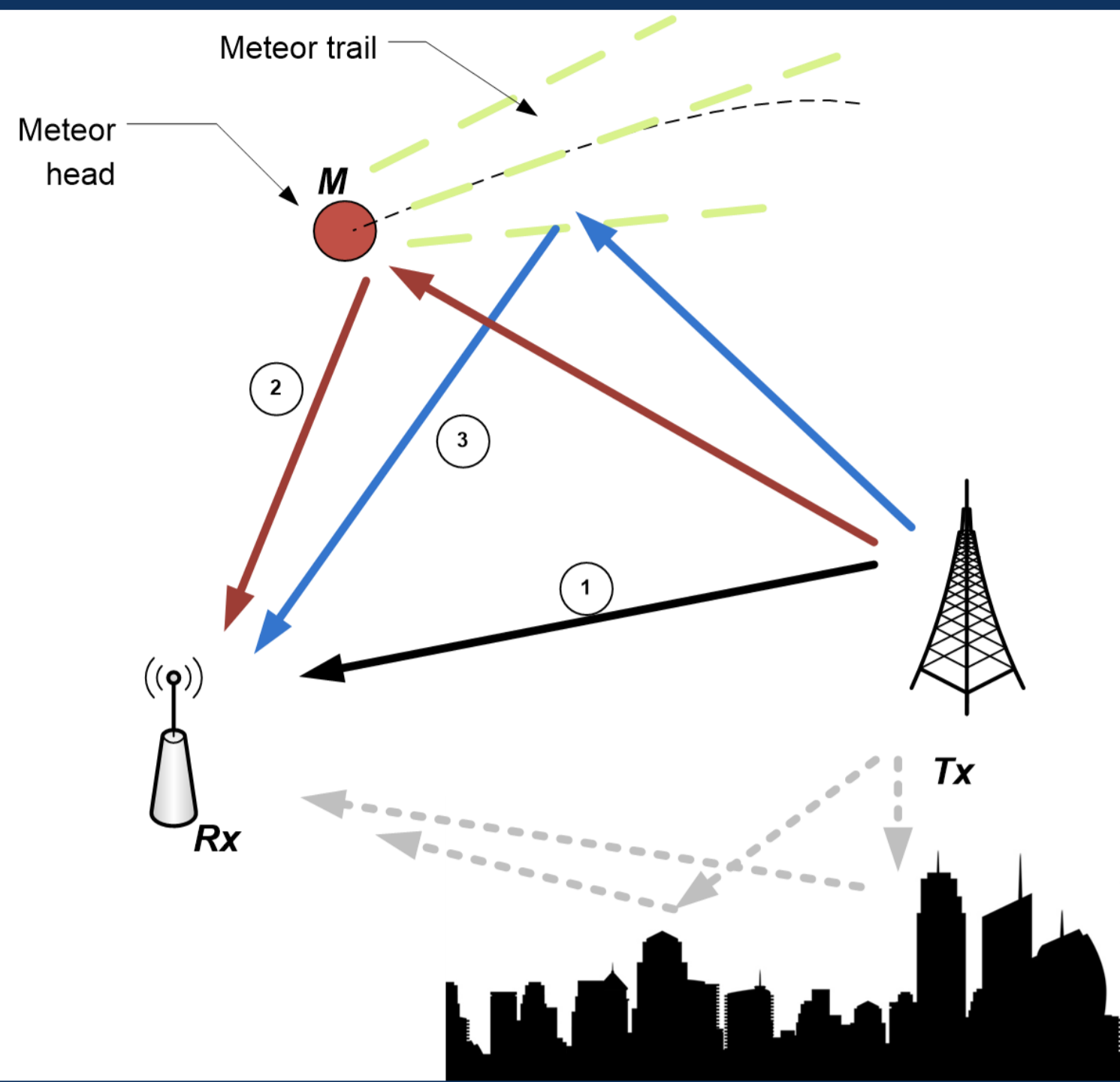


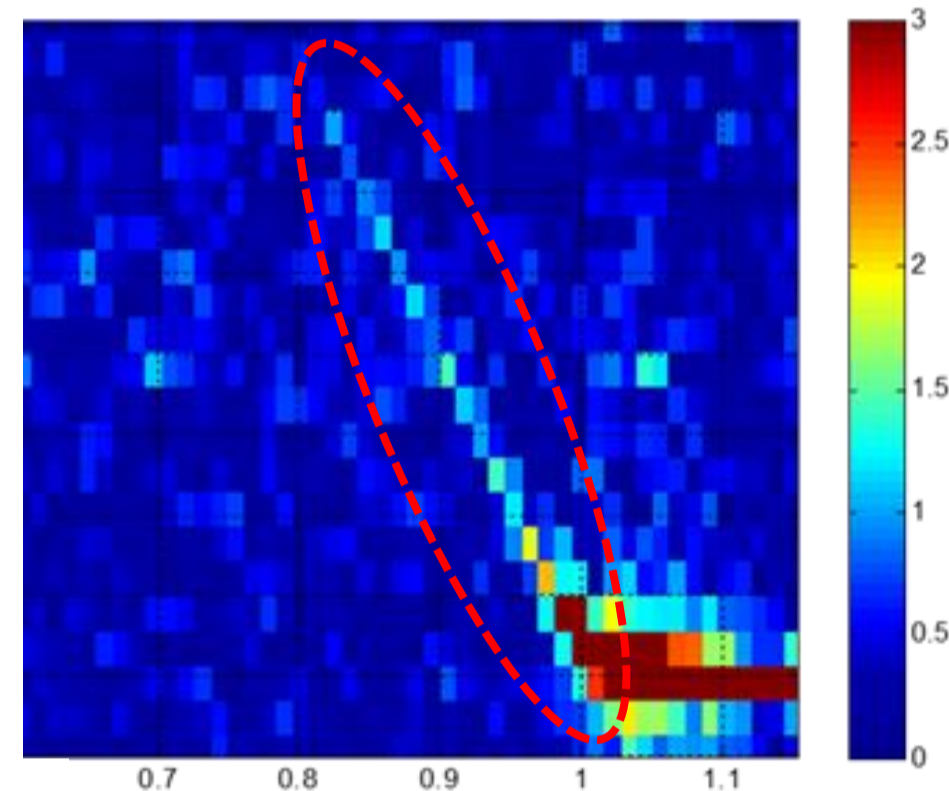
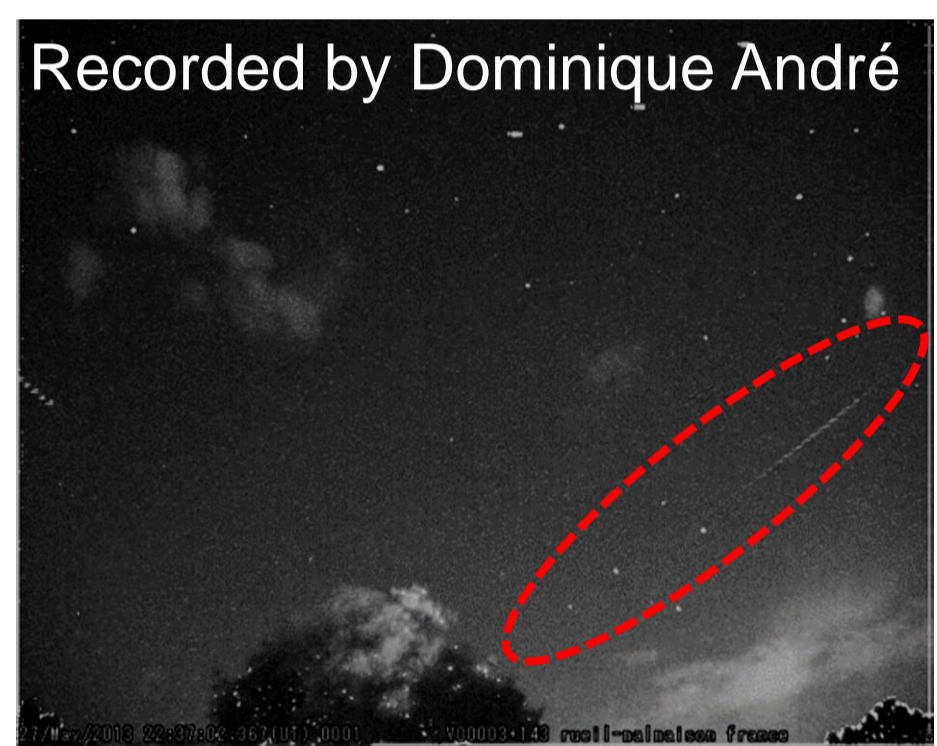
## RETRAM : A network of passive radars to detect and track meteors to help in fireball recovery

### System setup and processing



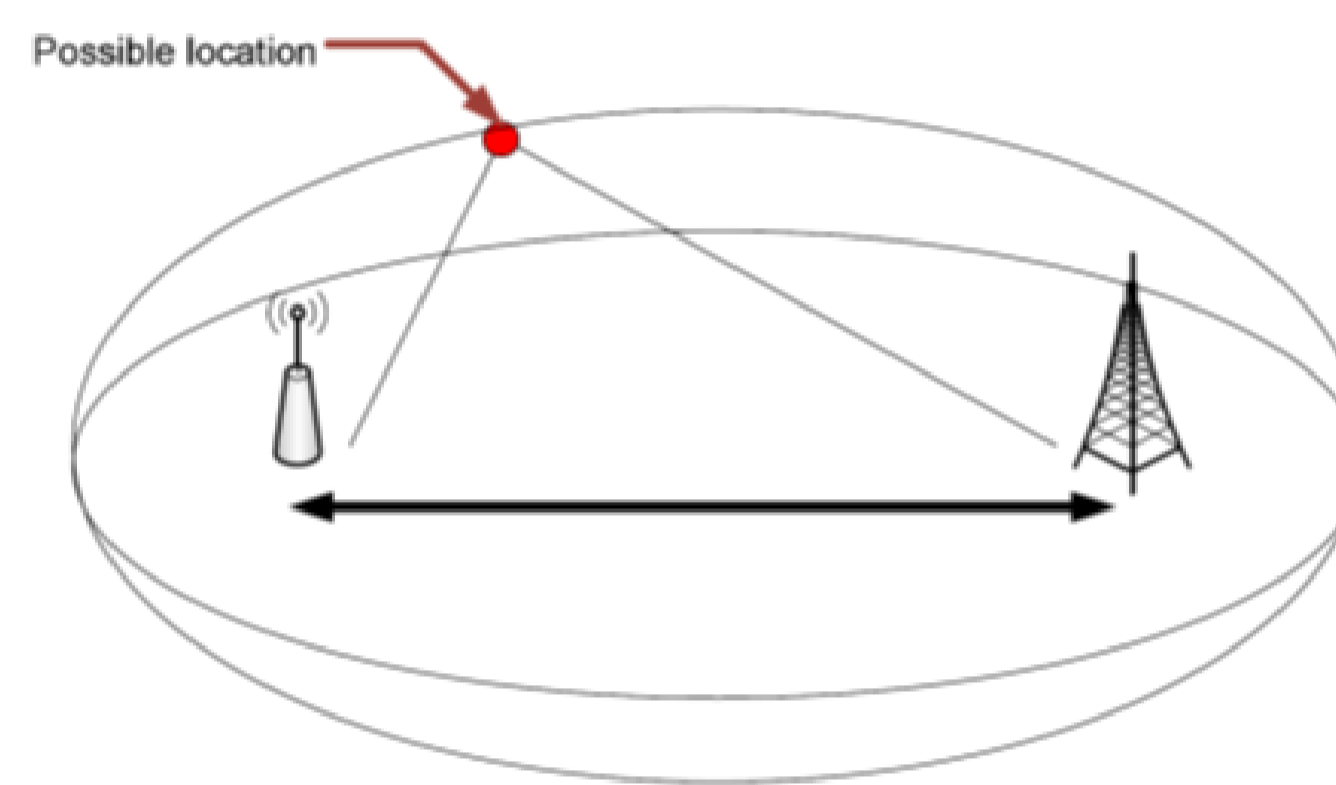
Meteor and trail reflect radio signals coming from FM broadcast stations (88 to 108 MHz). A pair of Yagi antennas collect broadcasted signal and echoes scatters by falling body simultaneously. These signals are digitized and processed by a custom receiver and processing to deliver bistatic distance and speed (Doppler) information about the detected meteor.

### Meteors signals and bistatic measurements

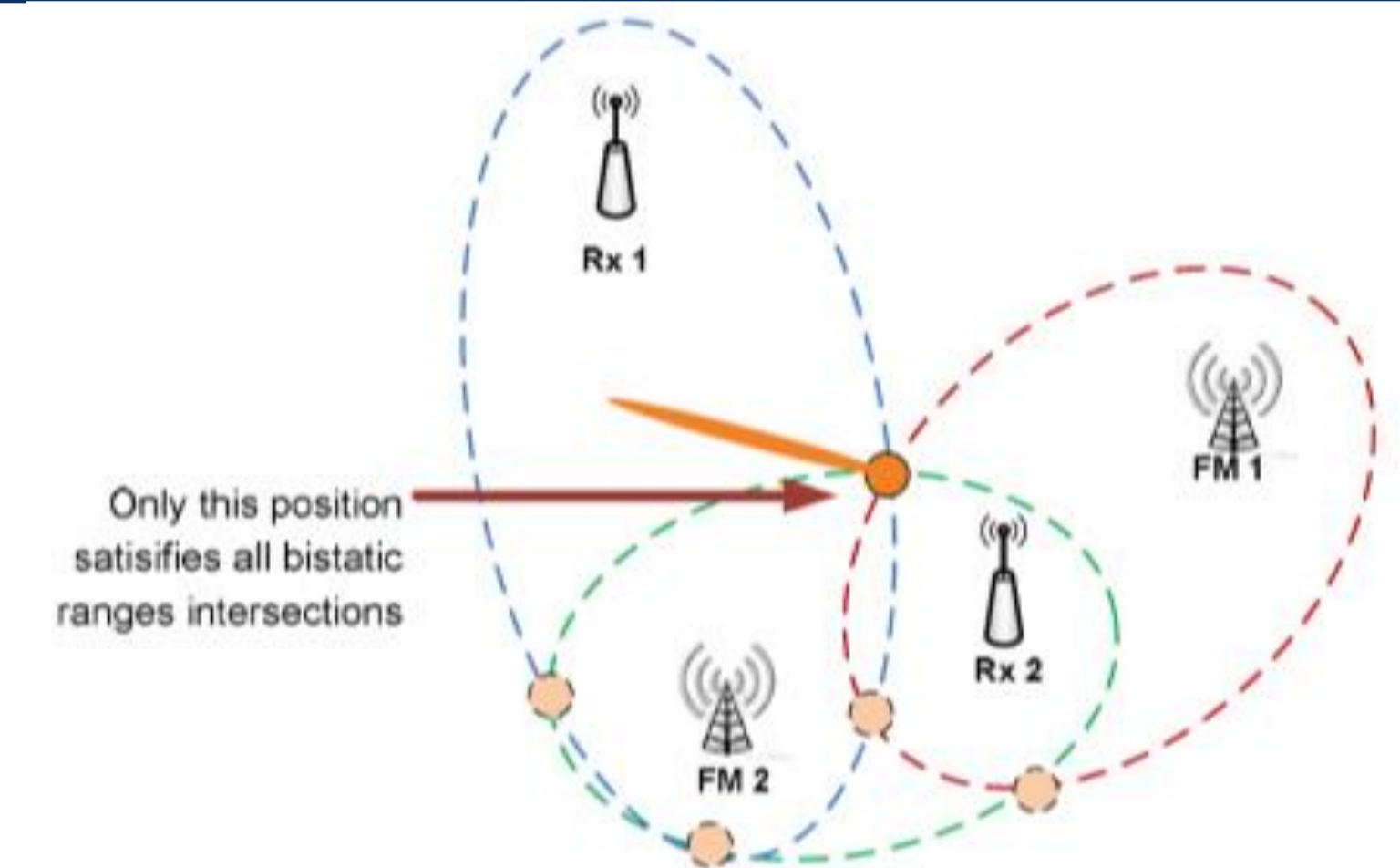


Optical trail is correlated (in time) with the radio head echo of the meteor (characterized by a fast Doppler shifting (or high penetrating speed in atmosphere) is red circled. Then the head echo is followed by the meteor train, sometime not visible in optic.

Bistatic distance sets the possible position for the detected meteor to be an ellipsoid whose foci are the transmitter and the receiver.

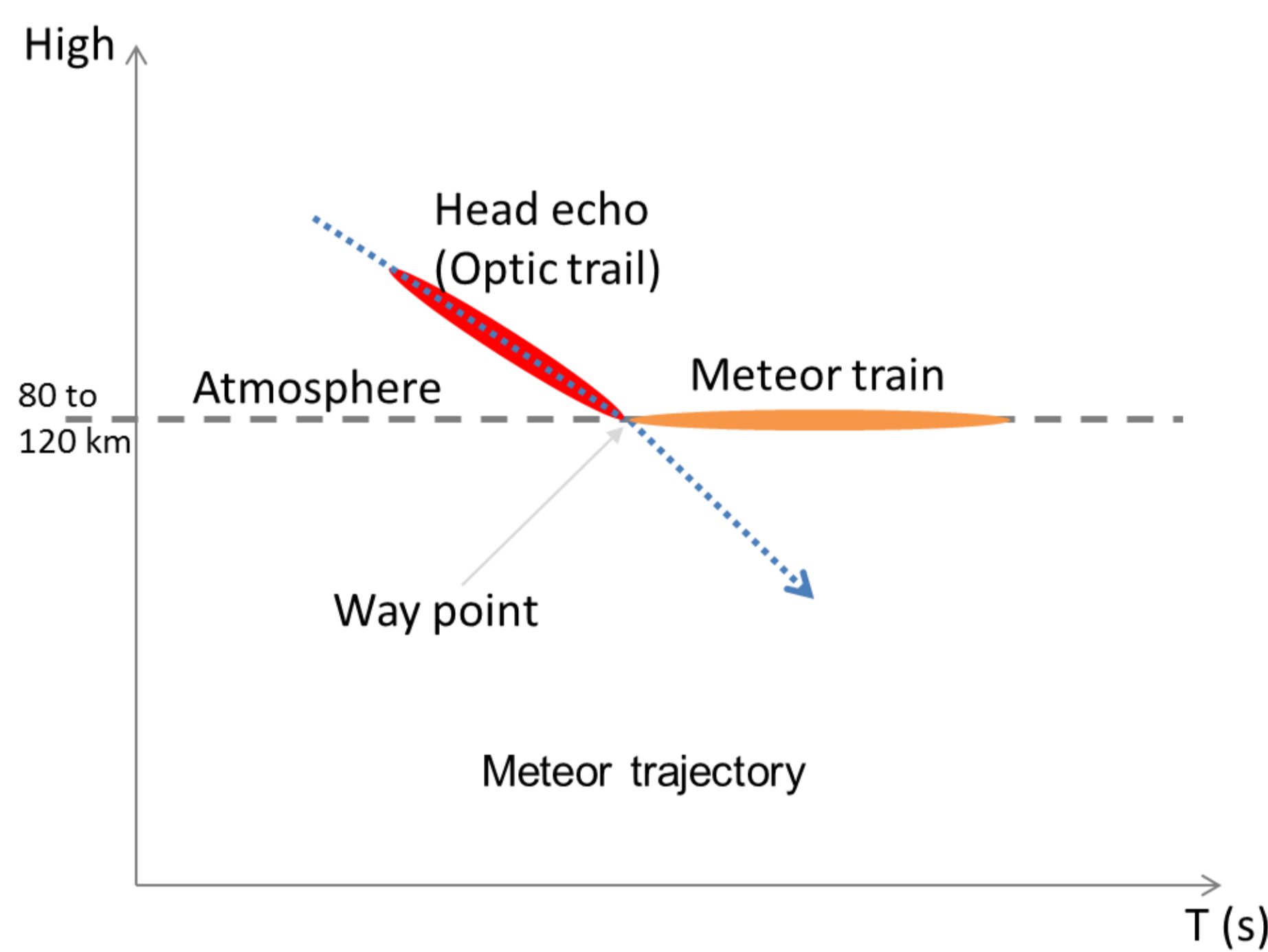


To find the right position of the meteor, more than one couple Transmitter/Receiver must be used.



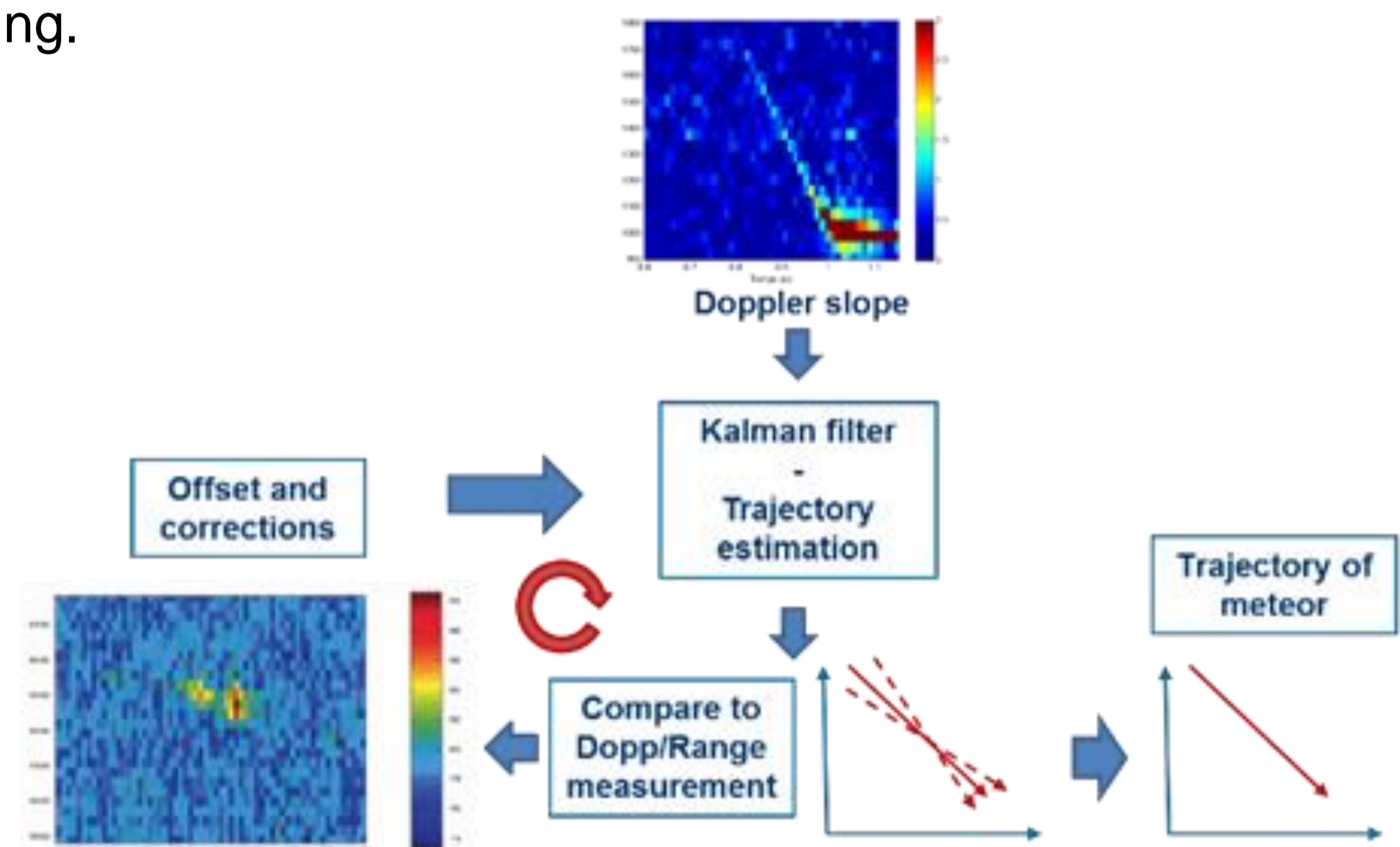
By using 3 or more couple Transmitter/Receiver the intersections of these ellipsoids give the possible target position

### RETRAM principle



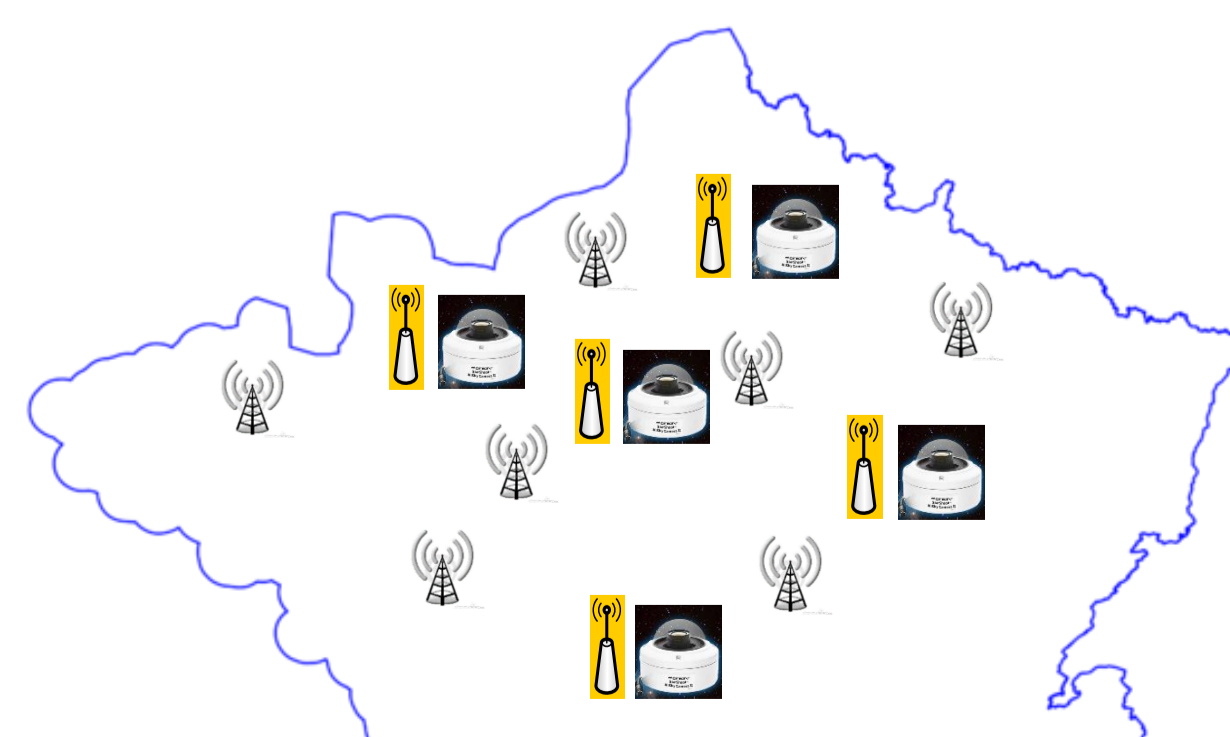
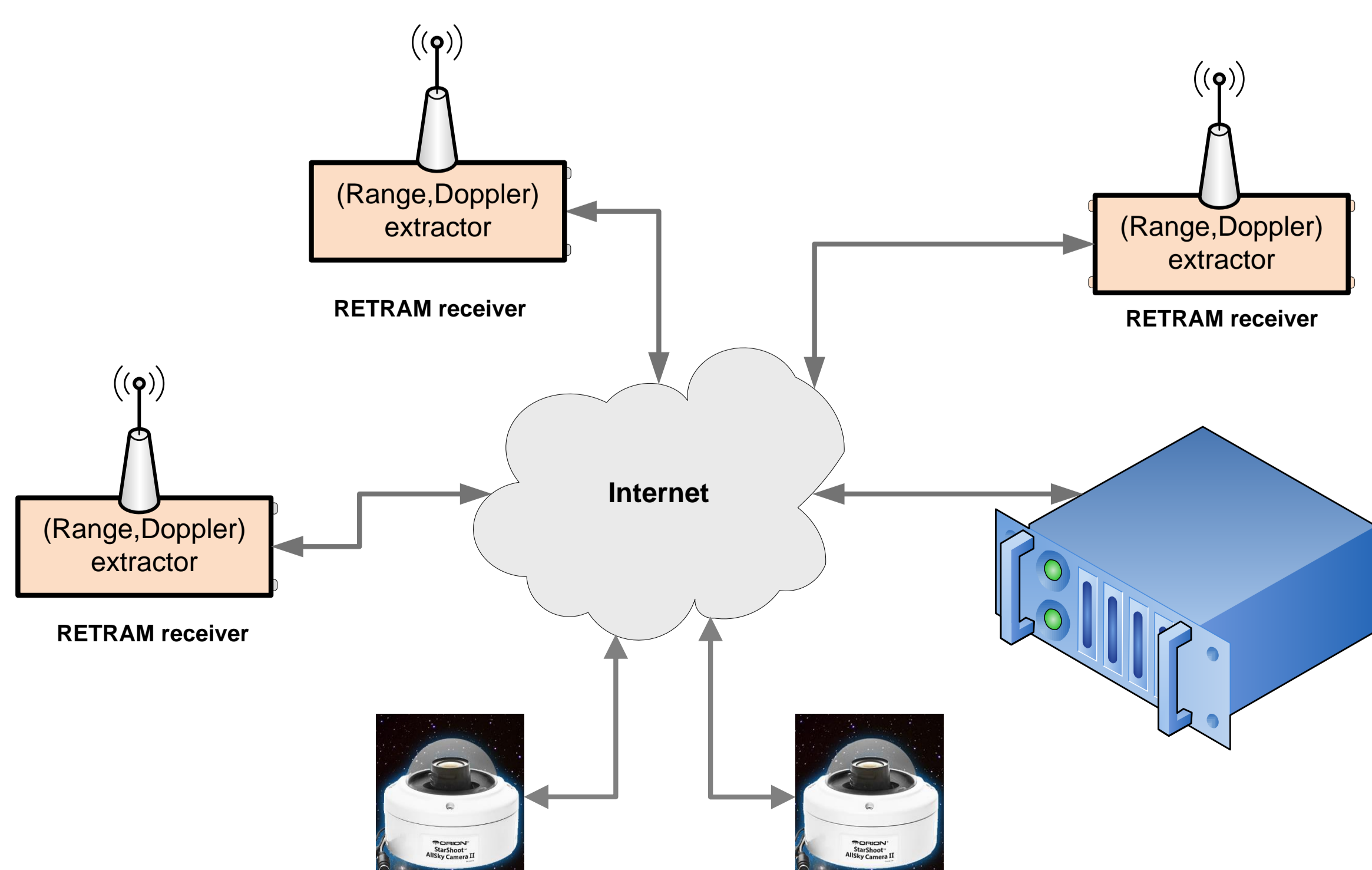
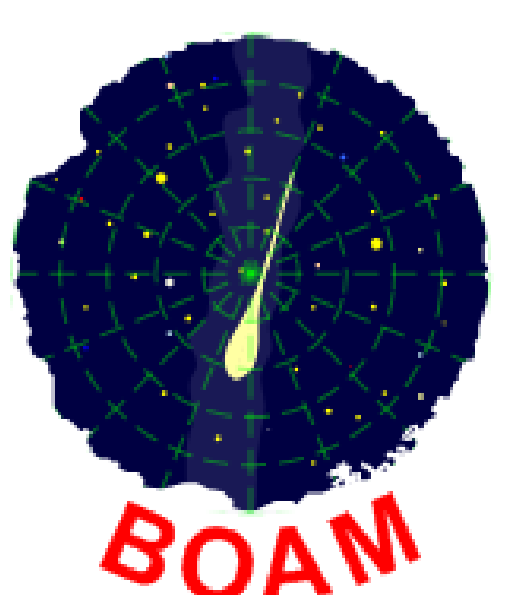
- The first step consists on :
- Detecting the beginning of the meteor train, to localize a way point of the meteor trajectory
  - Measuring Doppler slope of the head echo.

Then the process is completed by the projection of the Doppler slope in the 3D bistatic domain and comparison to the Doppler / Range measurement of the way point to find the right trajectory of the meteor during its atmosphere penetrating.



### RETRAM forthcoming : Connect multiple stations to cover an extended area and have more efficiency

Using different receivers tuned to process different FM transmitters, the effective position of the object is found at the interception of the different ellipsoids. The RETRAM receivers will send their detections to a central consolidation system using Internet. Radio detection can be completed with optical detection and first tests was done with the BOAM team. First result gives an hopeful performance of the system. A second step will study low cost receiving system for a broader deployment.



**BOAM** <http://www.boam.fr>  
 French meteor observer database

- Tioga Gulon
- Jean Brunet
- Stephane Jouin

