



BRAMS :

the Belgian RAdio Meteor Stations

A Pro-Am collaboration

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Belgian Institute for Space Aeronomy



The BRAMS team

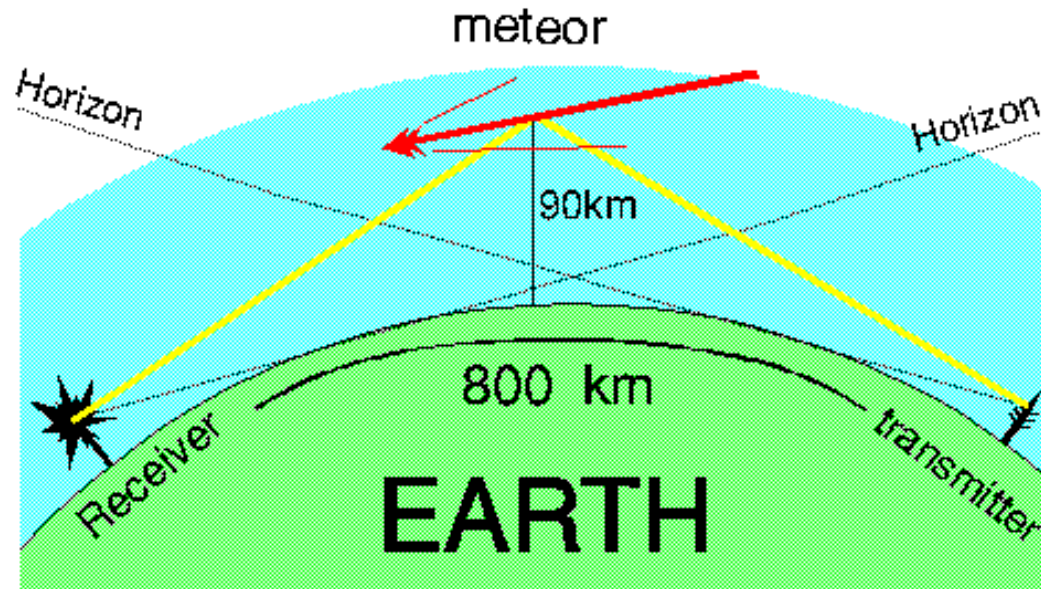
- Hervé Lamy
 - Sylvain Ranvier
 - Johan De Keyser
 - Emmanuel Gamby
 - Stijn Calders
-
- Collaboration with many radioamateurs from VVS and other groups of amateur astronomers in Belgium (SAL, GAS, Redu, LAC, etc...)



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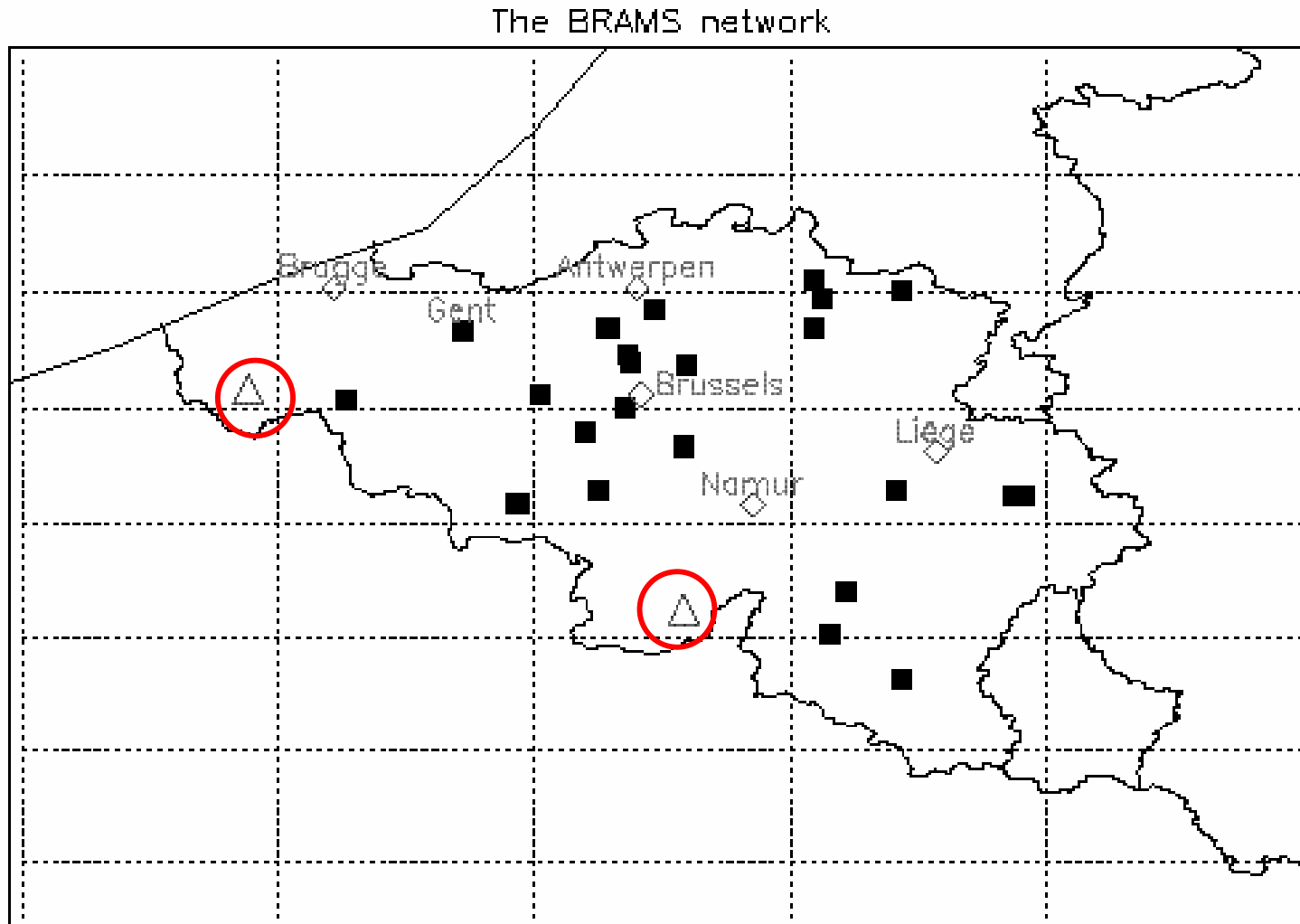
Radio forward-scattering observations



- BRAMS = network of radio receiving stations located in Belgium using radio forward scattering techniques
- Transmitter = dedicated beacons emitting at specific frequencies



The BRAMS network



The beacon in Dourbes



Geophysical center of the RMI in South of Belgium

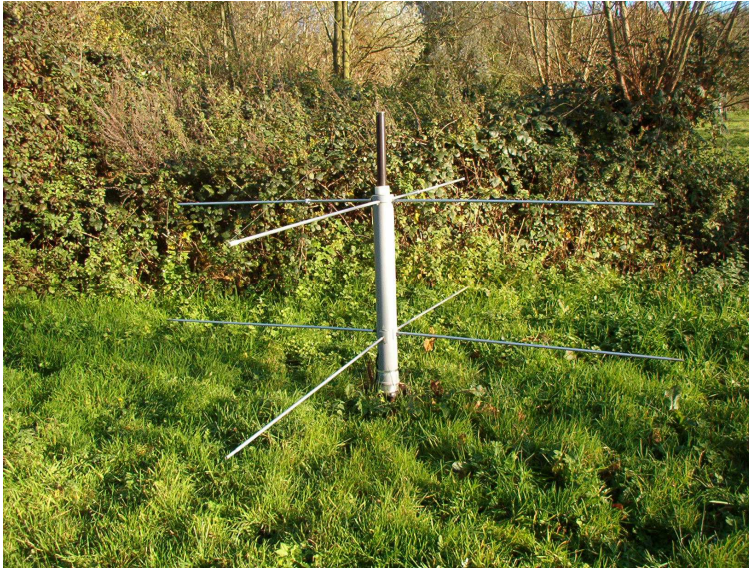
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Two beacons in Ieper and Dourbes



IEPER



- ✓ 49.99 MHz
- ✓ 50 W
- ✓ pure sine wave with circular polarization

DOURBES



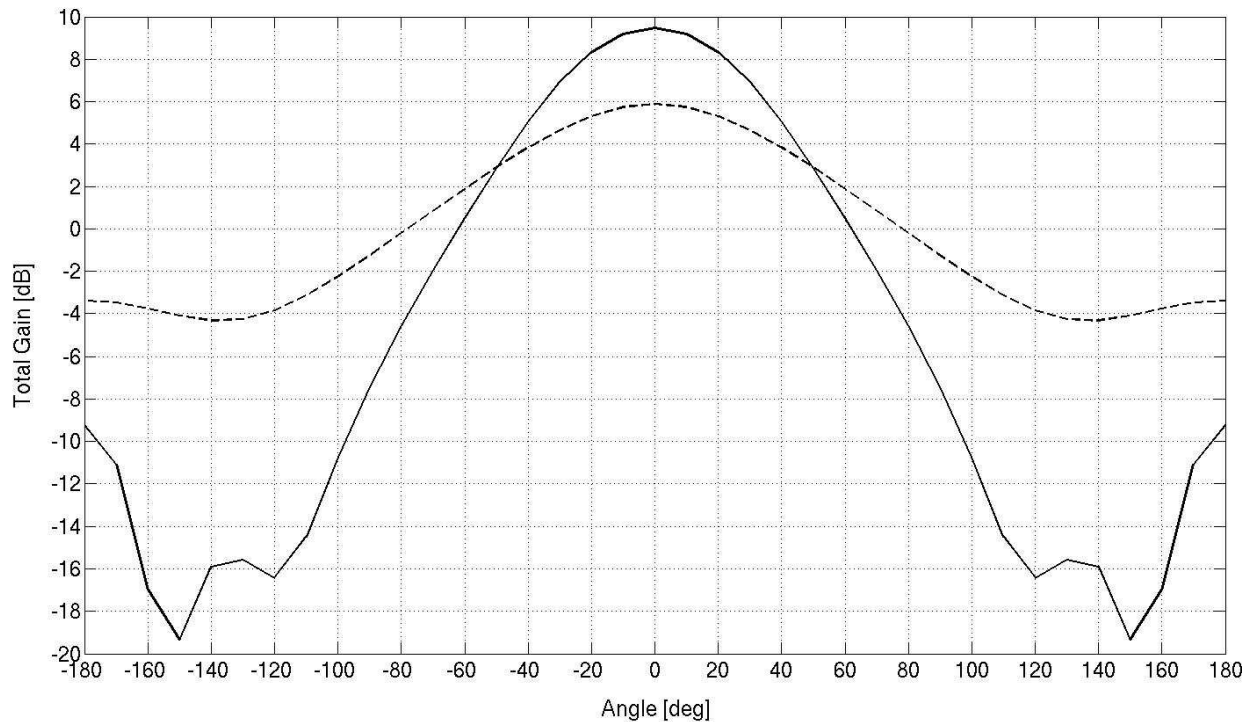
- ✓ 49.97 MHz
- ✓ 150 W (initial)
- ✓ pure sine wave with circular polarization



The beacon in Dourbes



- Same antenna but we will use a $8\text{m} \times 8\text{m}$ grid as a mass plane for the reflector since it improves substantially the gain and strongly removes the emission at 90°



Our receiving station in BISA



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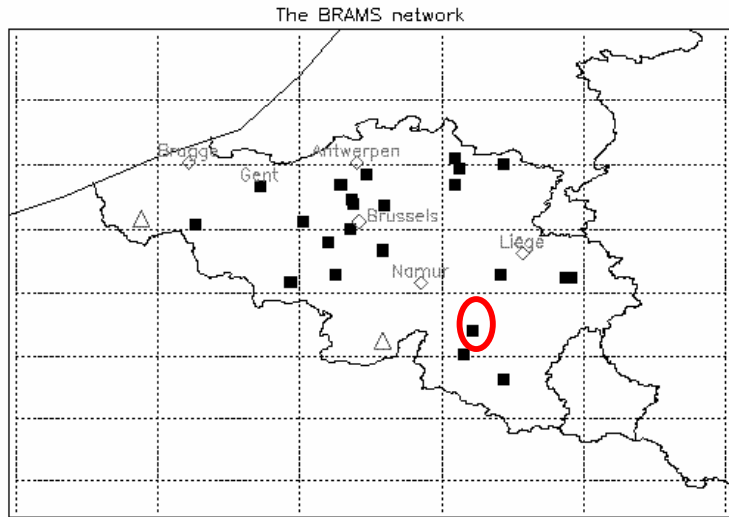


Other future stations of BRAMS

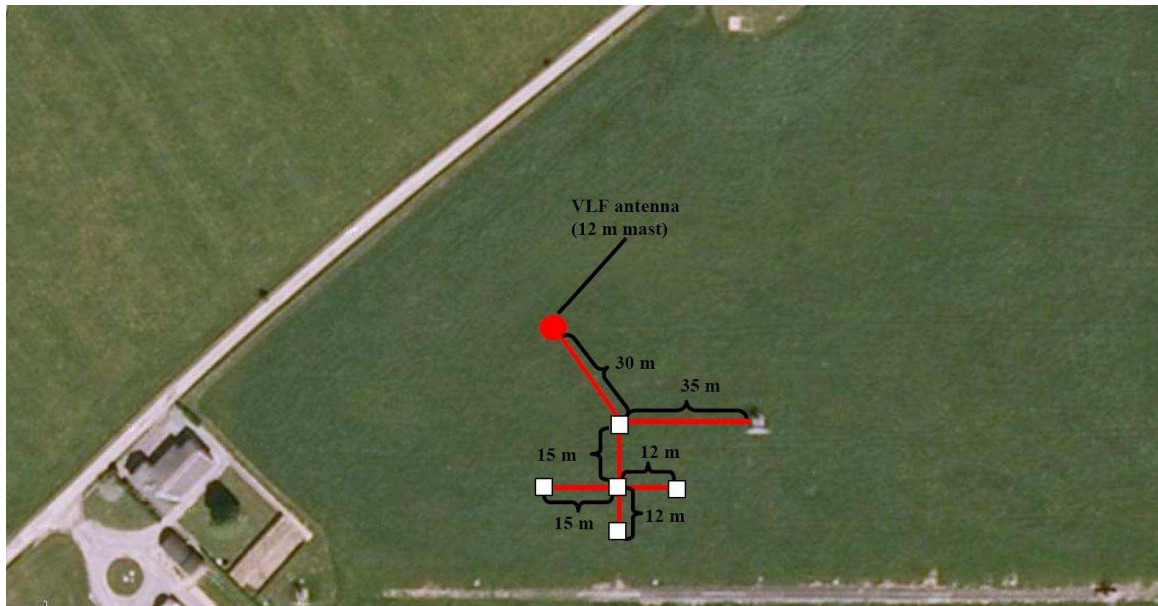
- BISA will provide a commercial receiver (ICOM R75) + coaxial cables + antenna + GPS clock to each radioamateur or groups willing to participate to the project. This material will be used to listen to the new beacon in Dourbes. All material should be the same to facilitate calibrations.
- The participant should only provide a PC to sample, store and possibly analyze the data
- In return we just ask each participant responsible for the experiment to regularly check that the system is working correctly (no shutdown of the PC for example).
- Data will be locally stored on hard disks (also provided by BISA) which will be collected regularly. Archiving of the data in BISA (1 GB/day/station).



Interferometric station in Humain



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Based on the method proposed by Jones et al (1998)

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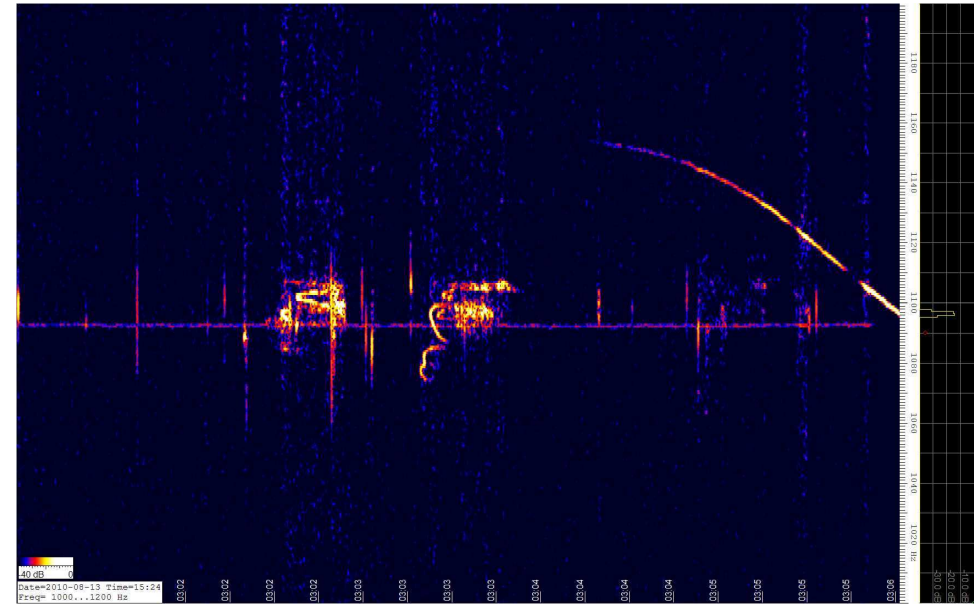
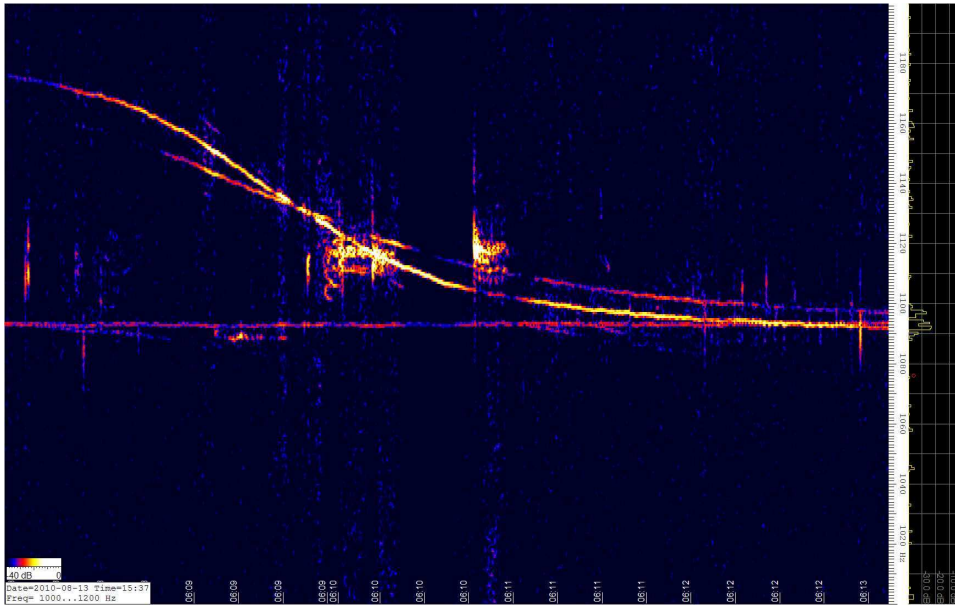


Goals of the BRAMS project

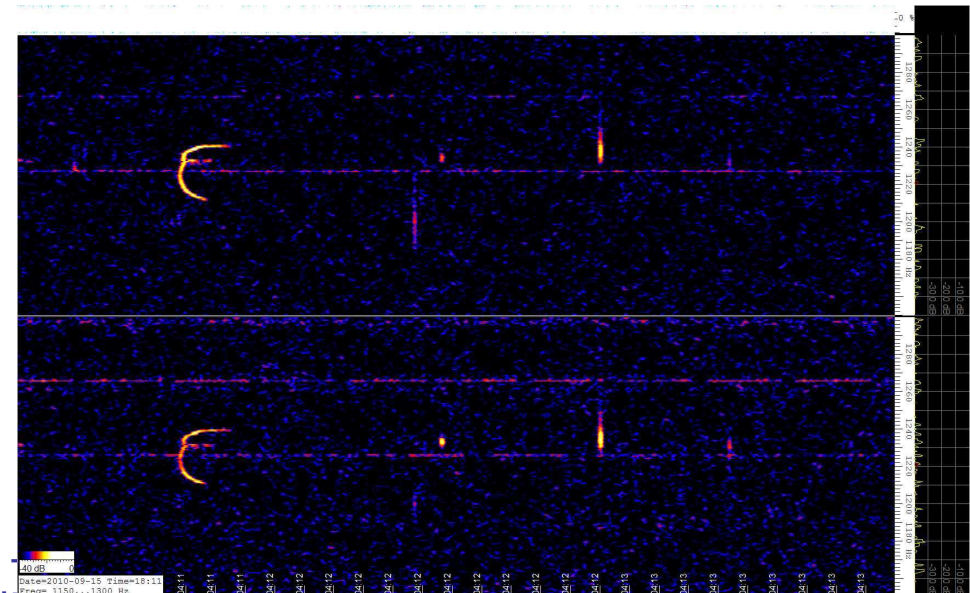
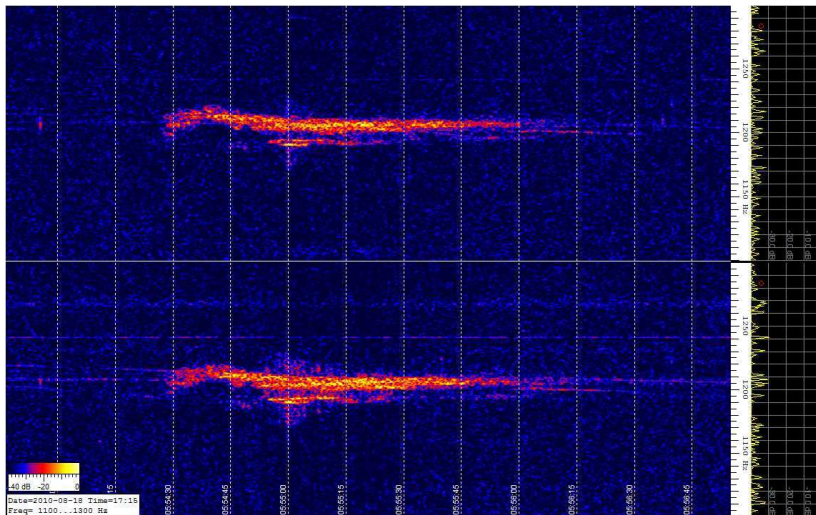
- Collection and archiving of the data from all stations
- Computation of meteoroid flux densities and mass index
- Determine trajectories of individual meteoroids from multi-stations observations + orbital parameters
- Analysis of meteor profiles \Rightarrow speed, deceleration, ionization, mass, possibly some ionospheric parameters such as mesospheric wind speed and temperatures.
- Study of epsilon echoes, head echoes, strange echoes
- Support outreach activities (meteor, radioastronomy)



Examples (Perseids 2010)



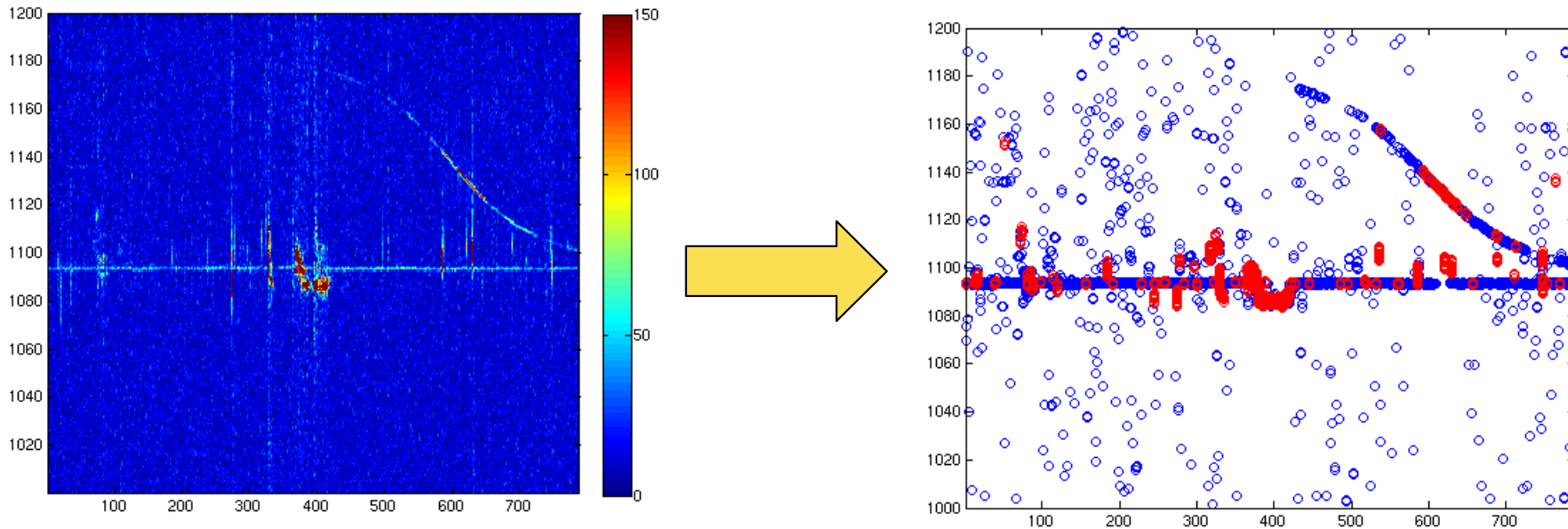
$\Delta f = 150\text{-}200\text{Hz} - \Delta t = 5\text{-}15\text{ sec}$



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Automatic detection of meteor echoes



More sophisticated tools to remove plane echoes



BRAMS : the website



BRAMS Listen to the meteors
Belgian Institute for Space Aeronomy

What is BRAMS?

BRAMS (Belgian RADIO Meteor Stations) is a set of radio receiving stations using forward scattering techniques to study the meteoroid population. The project is coordinated by the Belgian Institute for Space Aeronomy (BISA), in the frame of the Solar-terrestrial Centre of Excellence (STCE). Most stations will be run by Belgian radioamateurs or groups of amateur astronomers. Two dedicated beacons located in Ieper (Western Belgium) and Dourbes (Southern Belgium) act as transmitters.

The main goals of this project are:

- To collect and standardise the meteor observations of all the stations.
- To write codes for **automatic detection** of underdense/overdense meteor echoes.
- To compute **meteoroid flux densities** for meteor showers and **mass indexes** for meteor showers and sporadic meteors.
- To determine **individual meteor trajectories** from observations of the same meteor by multiple stations (both shower meteors and sporadic ones)
- To determine **orbital parameters** of multi-station meteoroids
- To analyse meteor profiles in order to retrieve physical parameters such as **ionization, speed and mass** of the meteoroids
- To study **head echoes** and the so-called "**epsilon**" **echoes**
- To promote radio-observation of meteors.

Currently, most of the BRAMS receiving stations belong to the radioamateur network of the **VVS** with about 15 receiving stations mainly spread over the Flemish region. They listen to **the beacon located in Ieper** which emits a cw circularly polarized signal at a frequency of 49.99 MHz with a constant power of 50W.

In September 2010, we will add a second beacon in the **Geophysical Center of Dourbes** which is part of the Royal Meteorological Institute of Belgium (RMI). It will emit a cw circularly polarized signal at a frequency of 49.97 MHz with a constant power of 150W.



By the end of 2010/begin of 2011, we would like to provide all existing stations with new hardware material to listen to this new beacon. The material will be identical for each station, allowing an easier comparison of the data. We also plan to extend the network by setting up new stations, first in the South of Belgium. The following groups of amateur astronomers have already expressed their interest to host a receiving station and to join our effort:

- the **GAS** in Spa, the **SAL** in Nadrin
- the group "**Astronomie Centre Ardenne**" in Neufchateau
- the **Eurospace Center** in Redu

If you are interested to join our effort and present radio-observation of meteors to your visitors, please contact us.

One of our receiving stations will be located in the **radioastronomical site of Humain** which belongs to the Royal Observatory of Belgium (ROB). This station will have interferometric capabilities using the 5-antenna design described in Jones & Jones, Radio Science, 33, 55-65, 1998.



<http://brams.aeronomy.be>

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THANKS!



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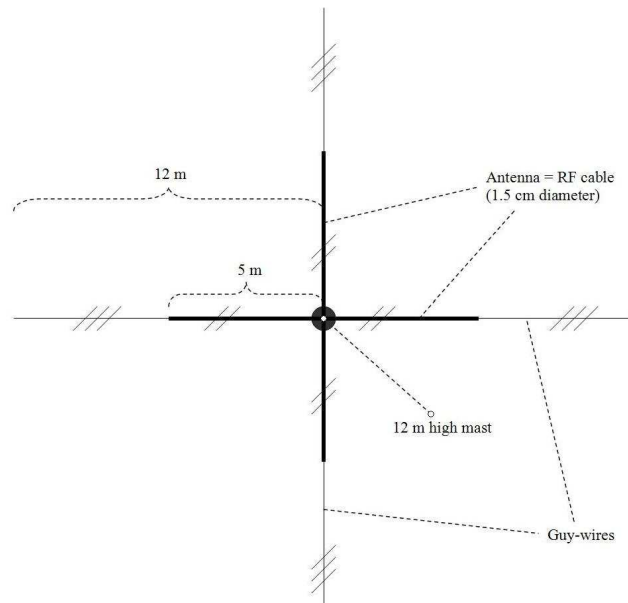


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Measurements of meteor VLF emissions



Top view :



Side view :

