Recent advances in the BRAMS network

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Belgian Institute for Space Aeronomy (BISA)

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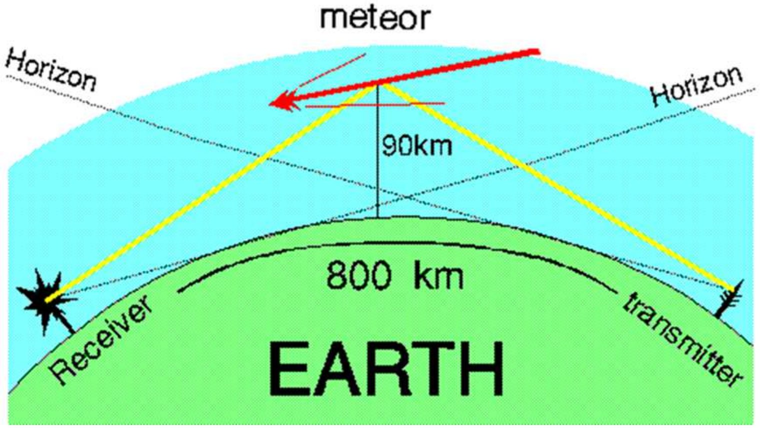
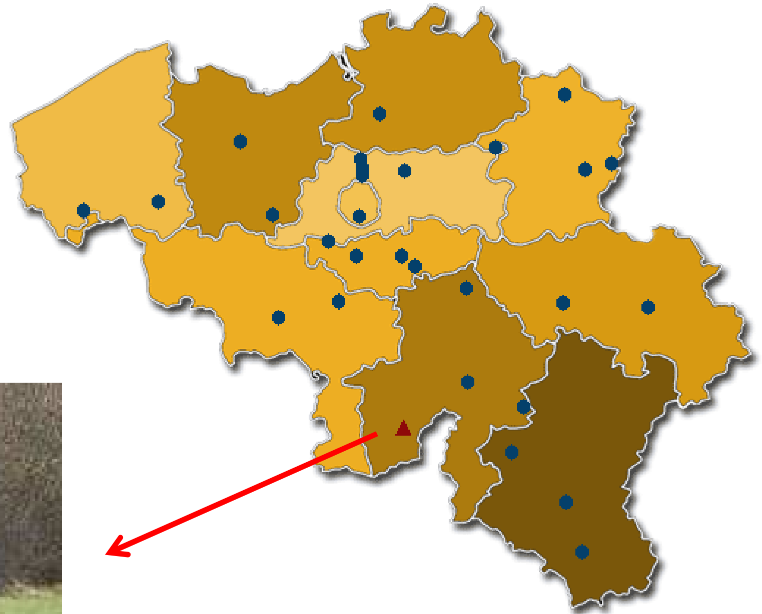
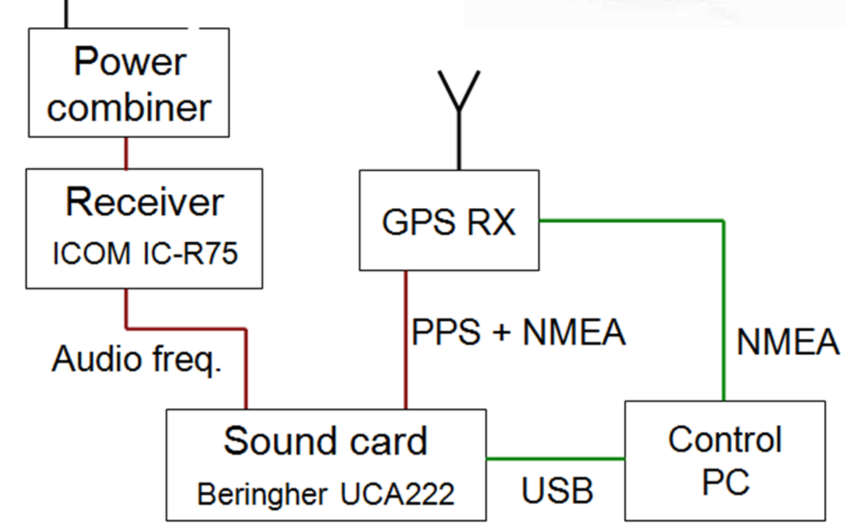
The BRAMS network

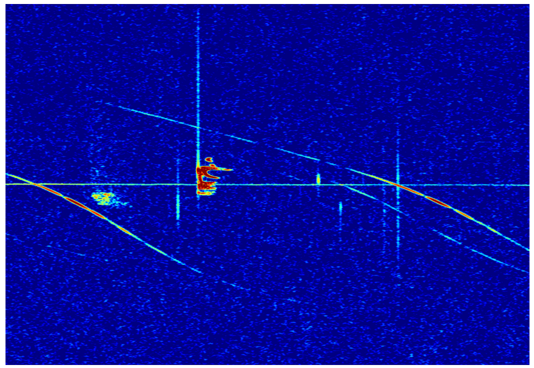




- ✓ 49.97 MHz
- ✓ 150 W
- ✓ pure sine wave

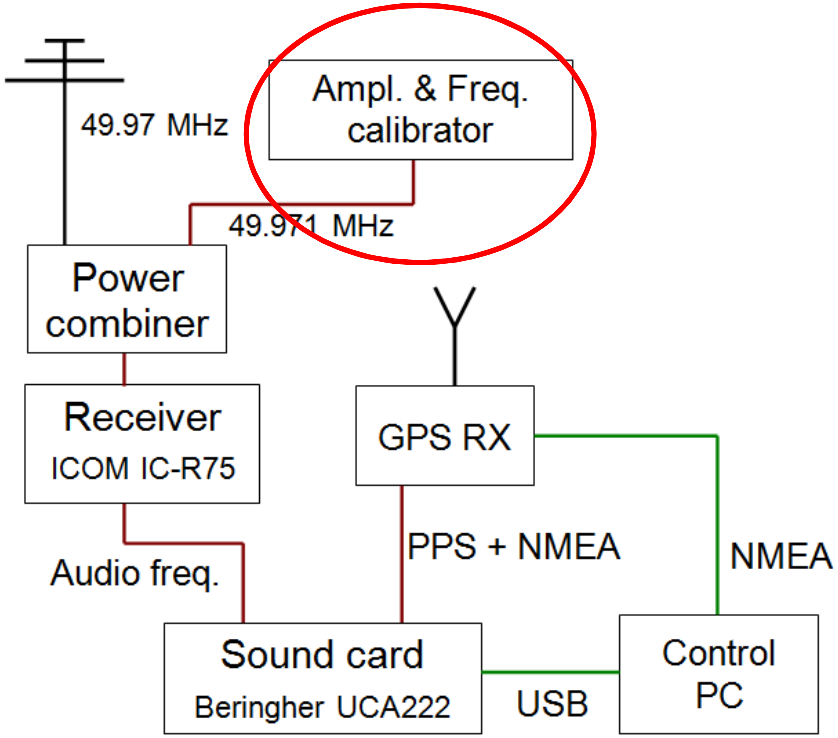
Typical BRAMS receiving station

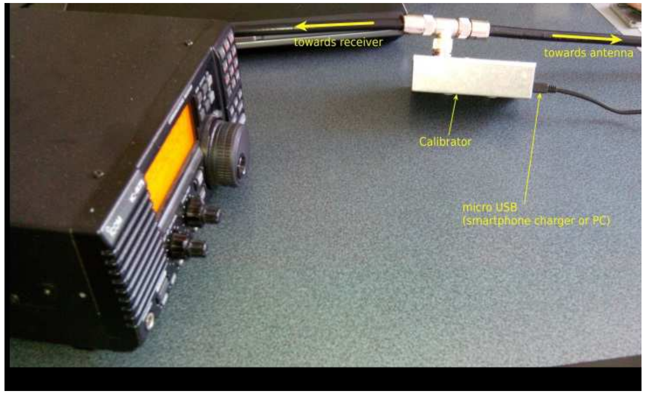




BRAMS calibrator

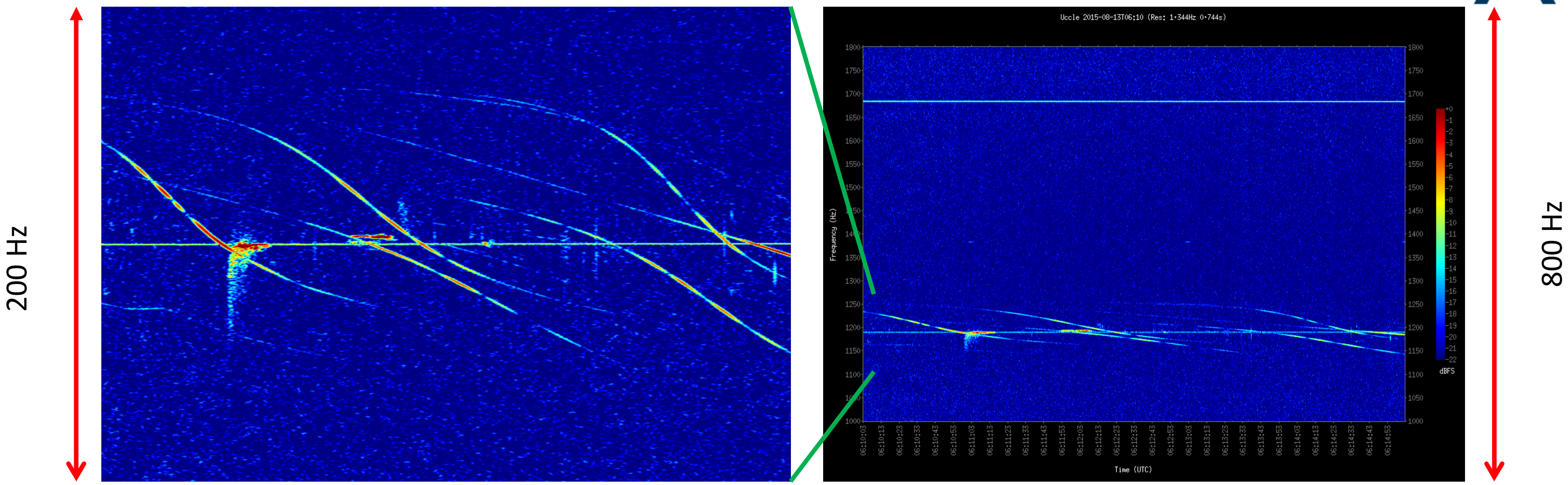
Goal : Monitor gain and frequency offset/drift at every station





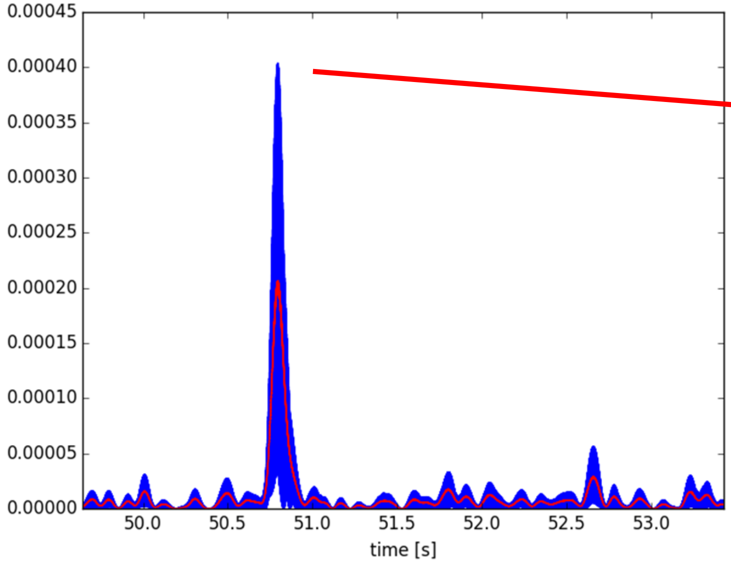
- Power level : -130 dBm (10^{-16} W)
- Frequency 49.97050 Mhz => 1.5 kHz in audio band

BRAMS calibrator



The frequency of the BRAMS calibrator is very stable (~few Hz) which is much better than the one of the LO of the receiver (that can drift up to 200 Hz depending on temperature). Frequency drifts of LO will affect beacon and calibrator frequencies in the same way such that the frequency range between them ~ 500 Hz.

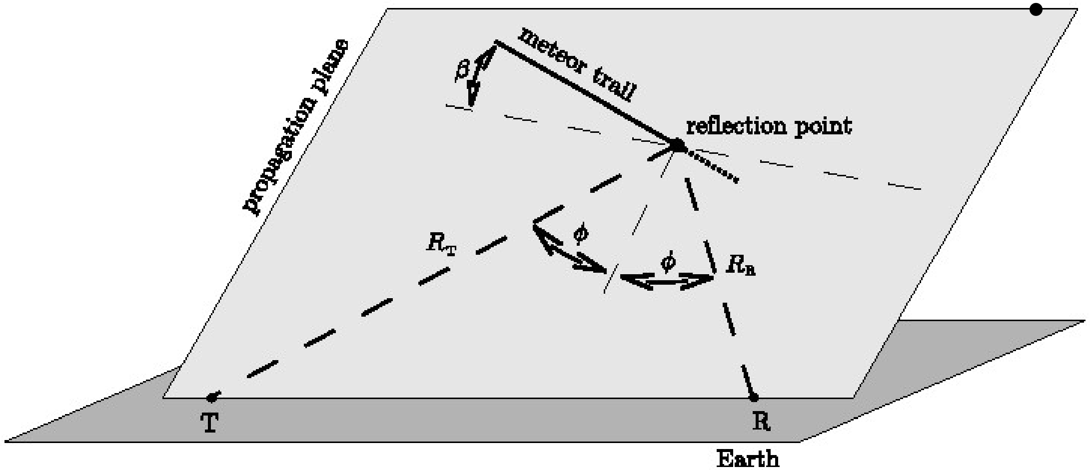
Importance of BRAMS calibrator



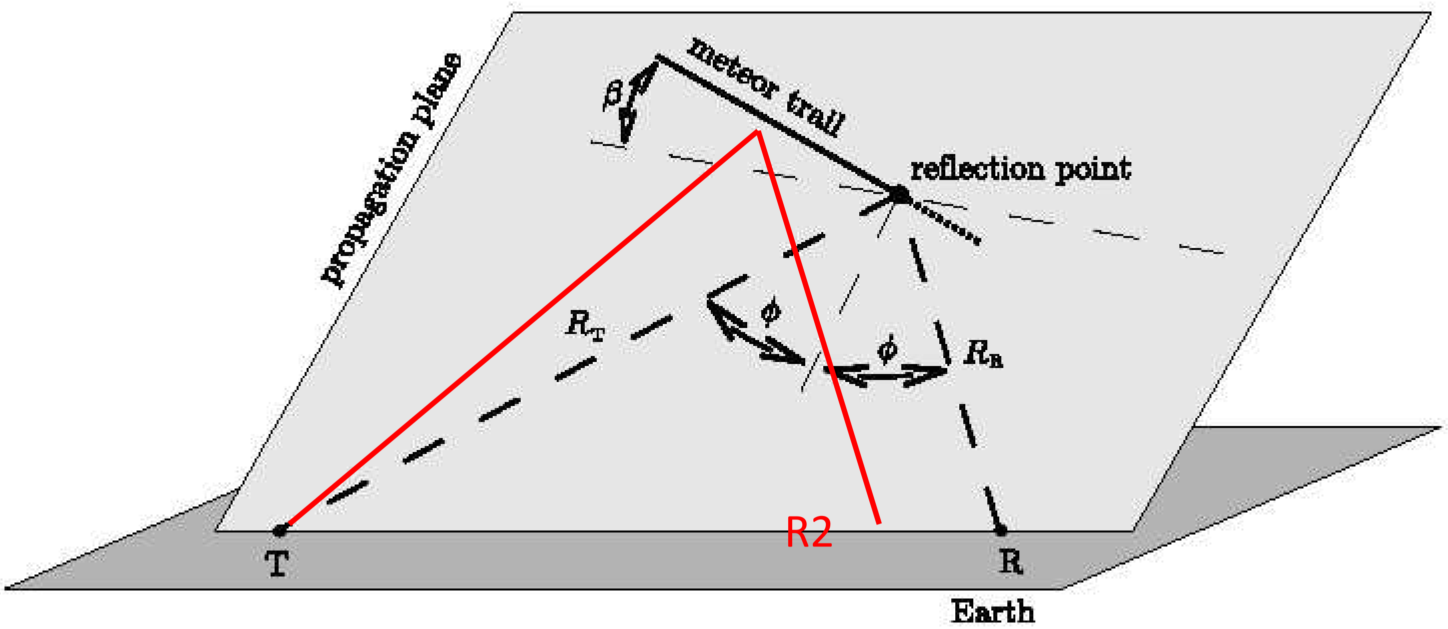
$$\frac{P_T G_T G_R \lambda^3 r_e^2 \alpha^2 \sin^2\gamma}{16\pi^2 R_T R_R (R_T + R_R)(1-\sin^2\phi\cos^2\beta)},$$

4 type of parameters :

- Geometry parameters (R_T,R_R,ϕ,β)
- Technical parameters (P_T,G_T,G_R,λ)
- Polarisation of the wave γ
- Ionisation at the reflection point α

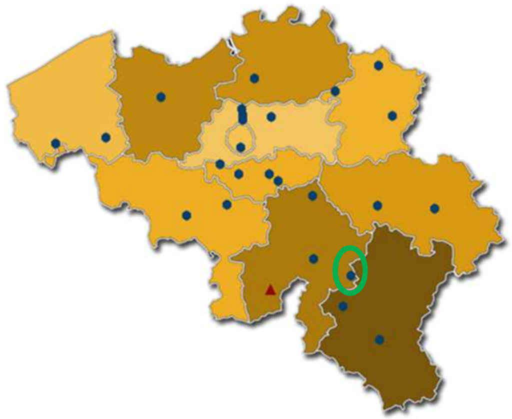


Importance of BRAMS calibrator

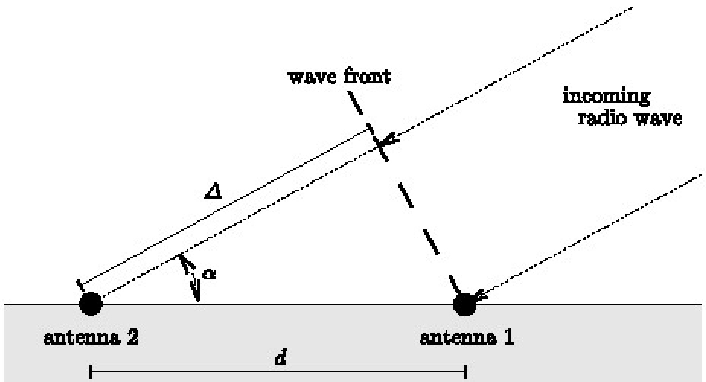


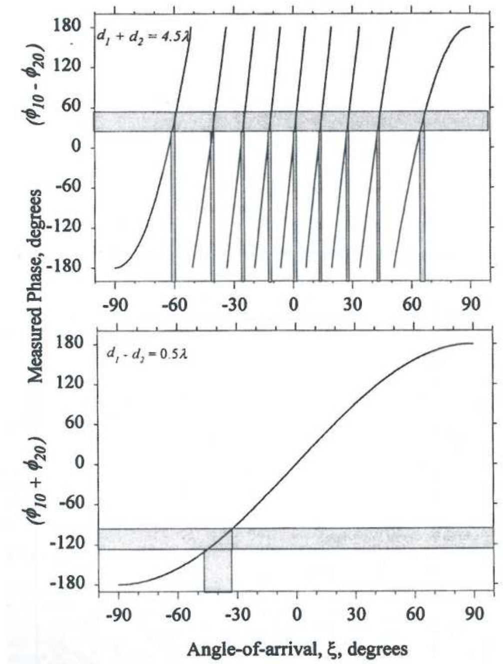
Ionisation in several points → estimate of mass of meteoroid using ablation model (complex inverse problem, collaboration with VKI)

Interferometric station in Humain



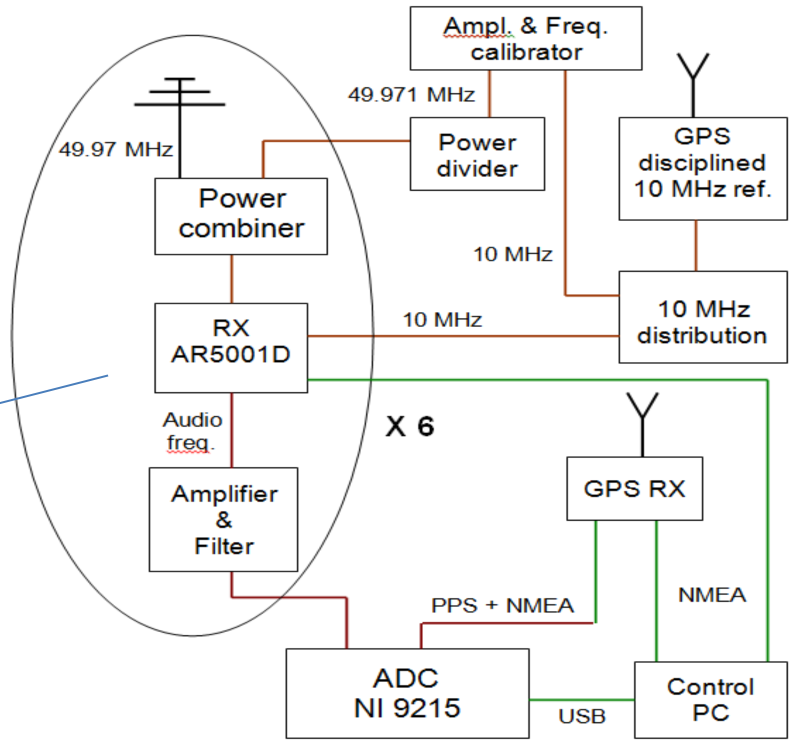
Jones et al (1998)





Interferometric station in Humain

Goal : to obtain accurate direction of reflection point (~1°) & help retrieve individual trajectories from multi-stations observations



More sensitive receivers that can accept a 10 MHz reference

A/D converter replacing the USB sound-card

Phase measurements are possible

Next?

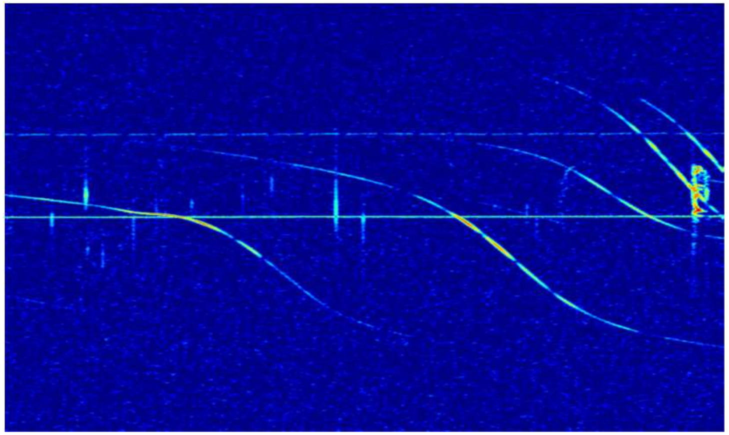
Using the BRAMS calibrator as Tx (payload) to test the direction retrieval algorithm

Automatic detection of meteor echoes

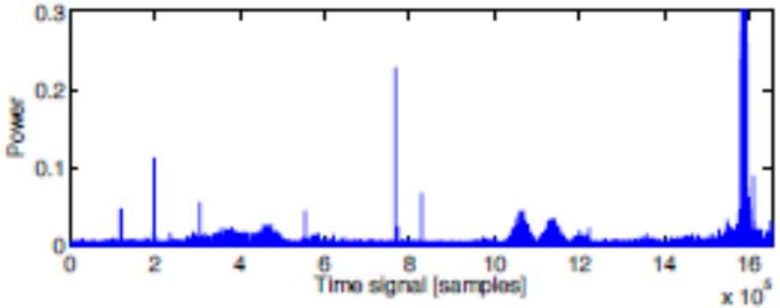
- 30 receiving stations
- 288 files of 5 minutes per day and per station
- 1500-2000 meteor echoes per day

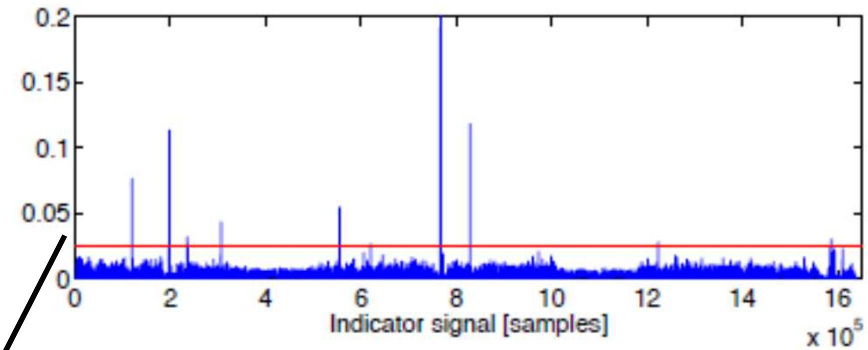
Method using the time signal

See Roelandts (2014)



$$I[n] \equiv \frac{E_S[n]}{E_L[n]}.$$

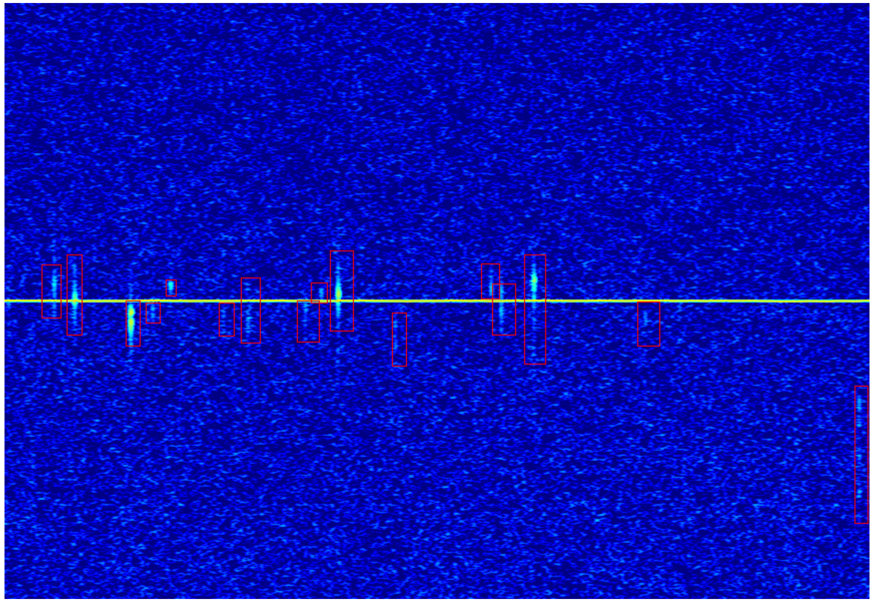


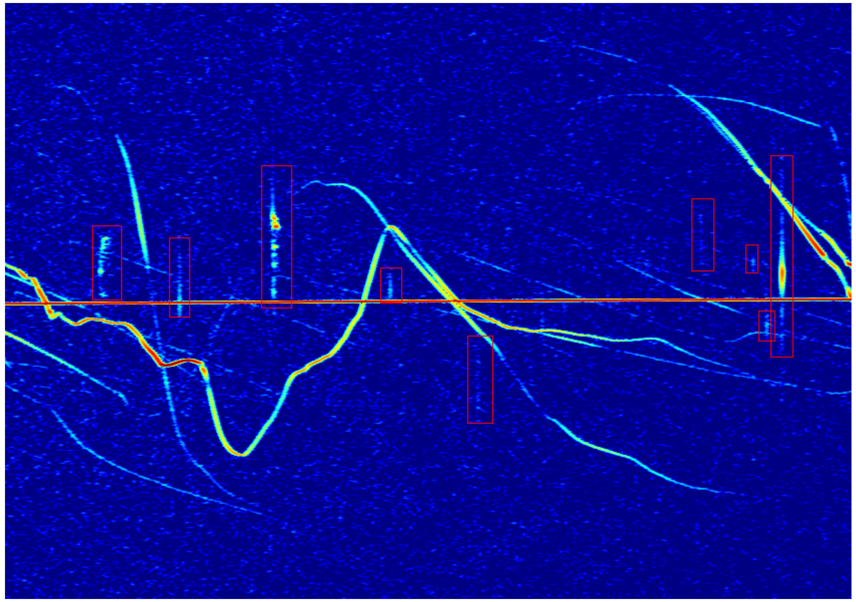


Threshold (1 of 3 parameters)

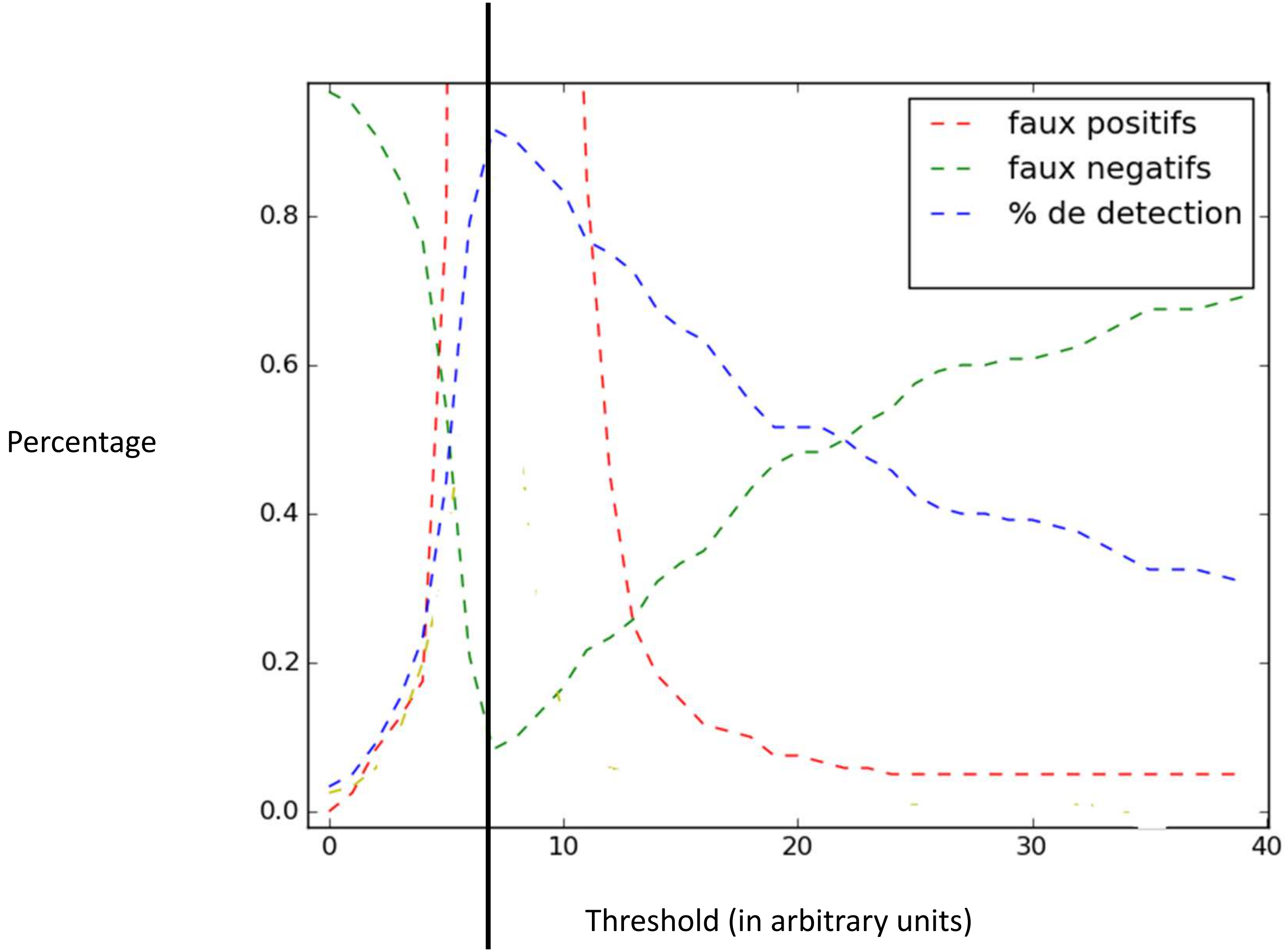
Test of the method : data

- 1h of data (12 spectrograms) for 2 stations :
  - one “simple” at night (no planes)
  - one complex with “crazy” plane echoes
- Careful manual counts by several users

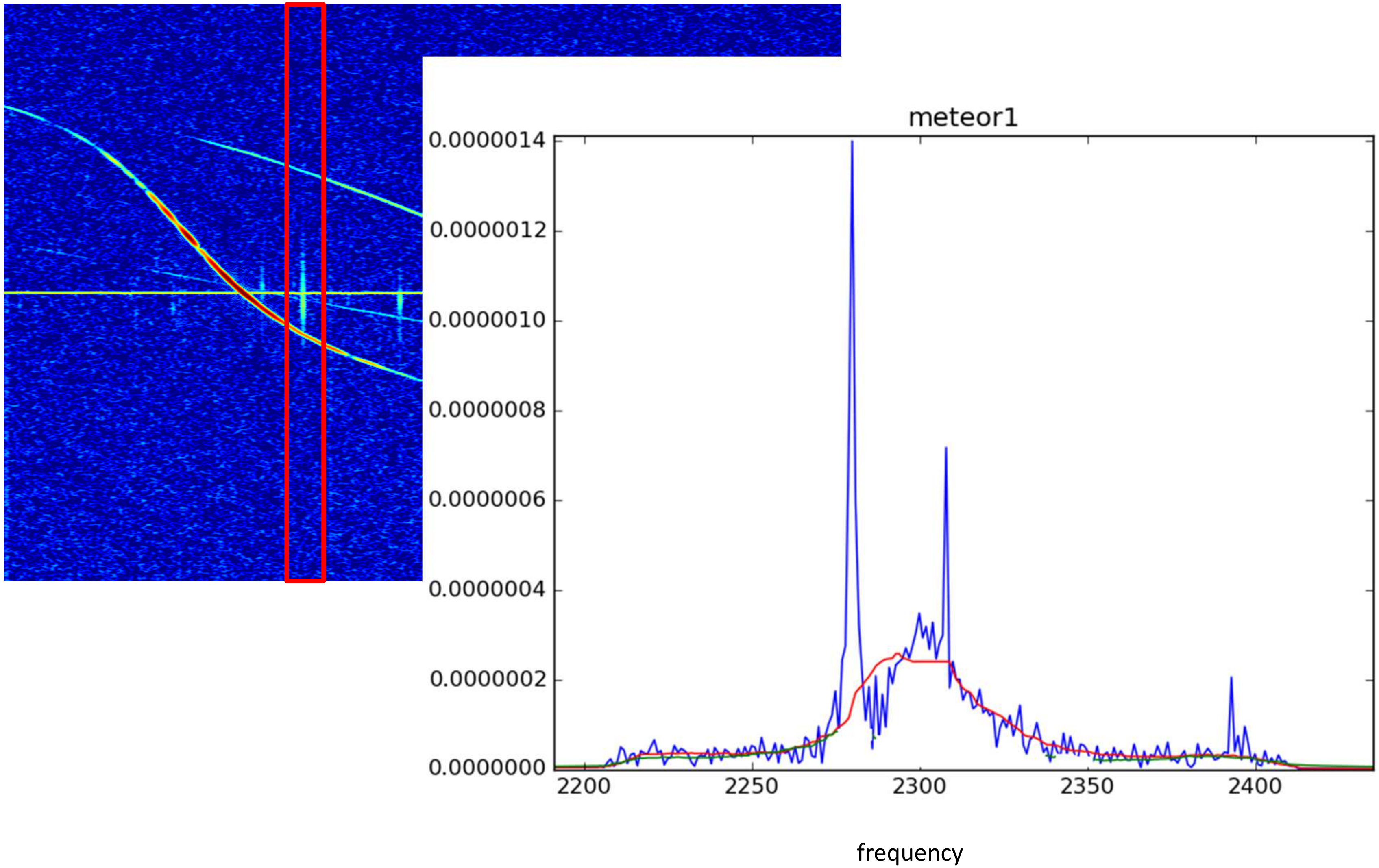




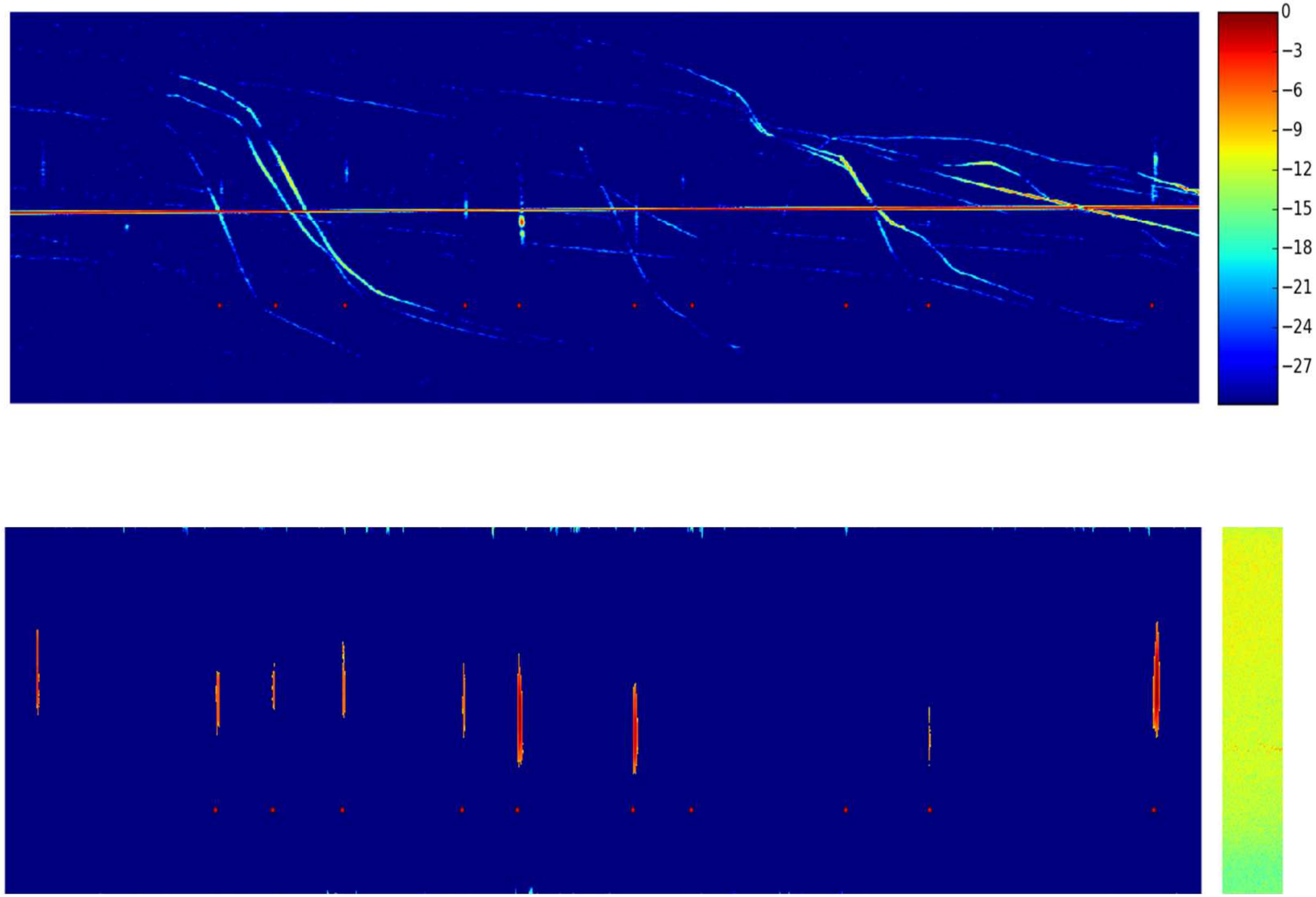
Test of the method : results



Automatic detection : new idea



Example of results



Other activities

1. BRAMS Zoo (see talk by Stijn Calders)

2. Measurements of radiation pattern of BRAMS antennas
   (see talk by Antonio Martinez Picar)

3. Meteroids trajectories retrieval : project funded by Belgian Scientific Policy called METRO (started 2 months ago, duration : 4 years)

Thank you

brams.aeronomy.be