

The Radio Meteor Zoo : a world-wide effort to hunt for BRAMS radio meteor echoes

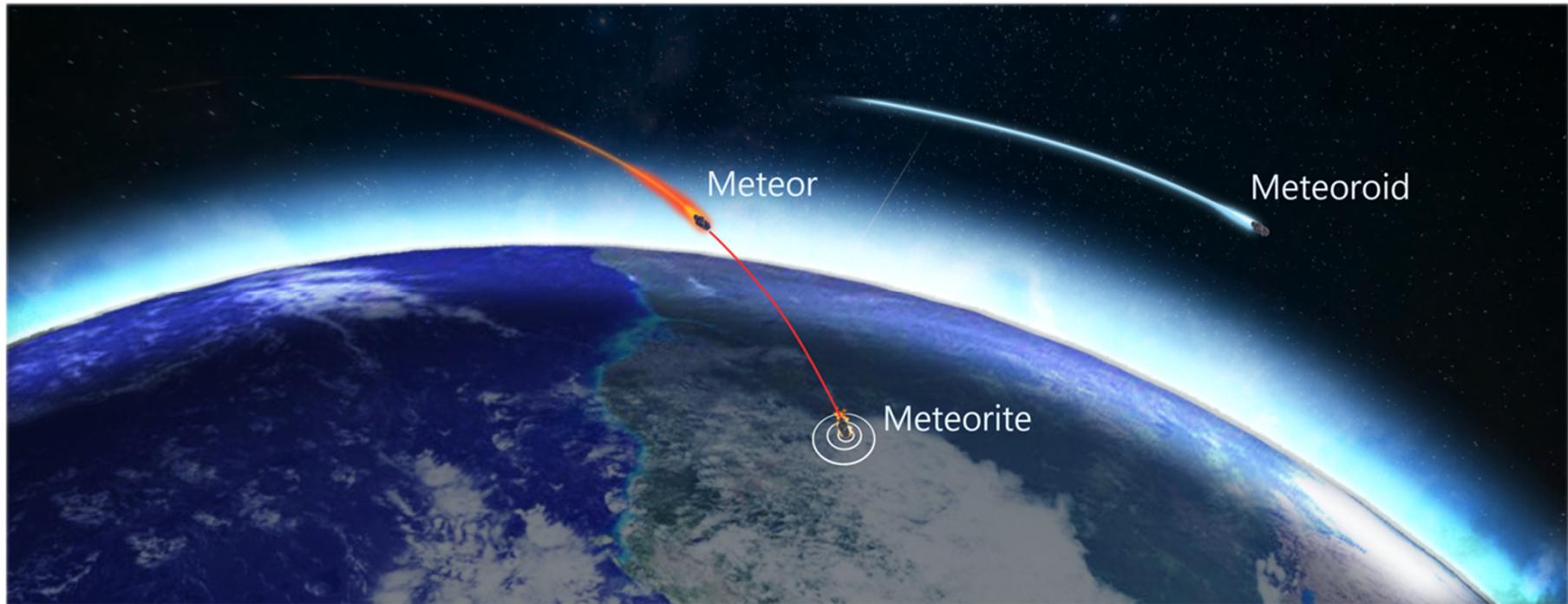
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¹ BIRA-IASB

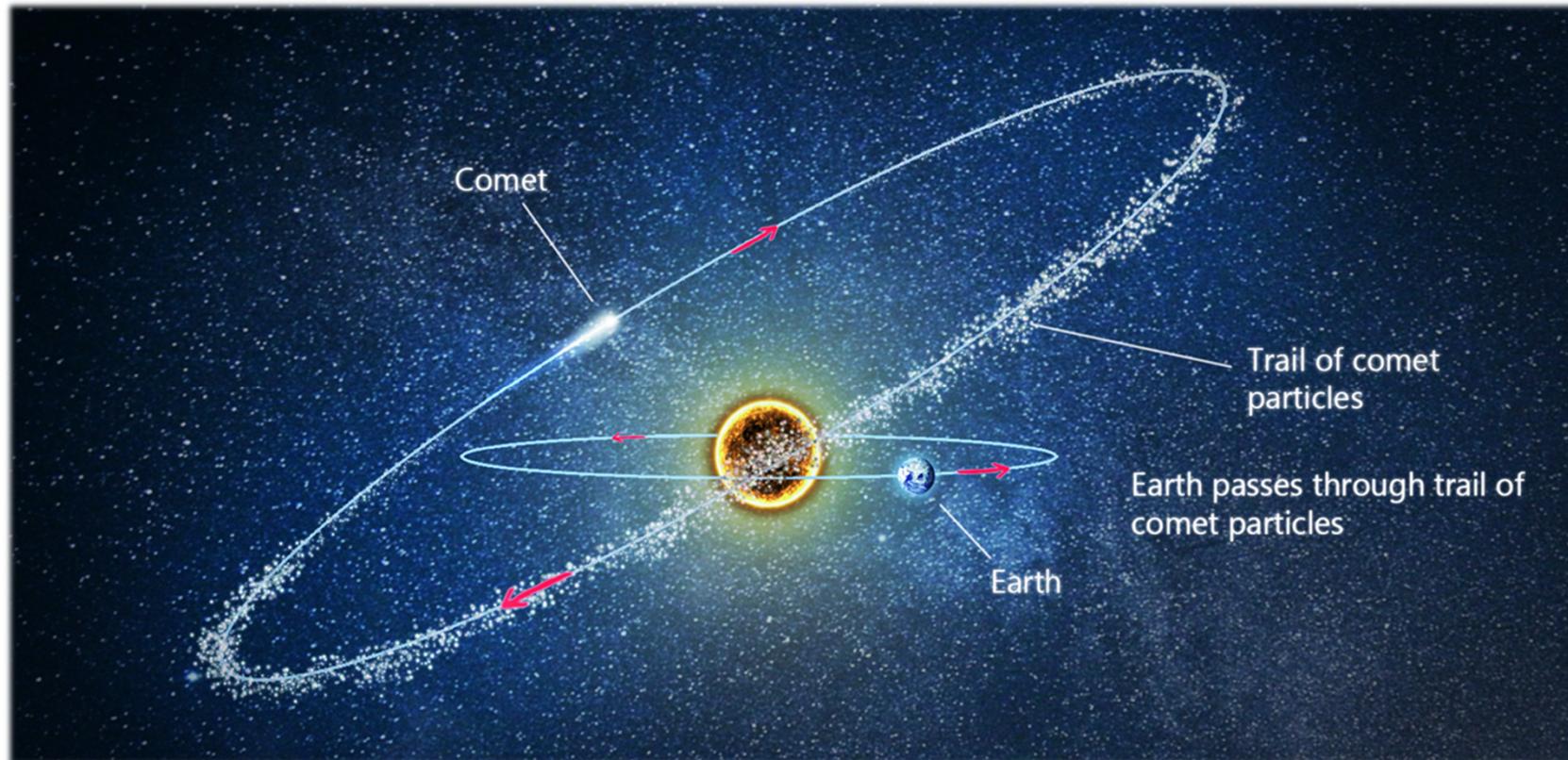
² KSB-ORB



Meteoroid/Meteor/Meteorite



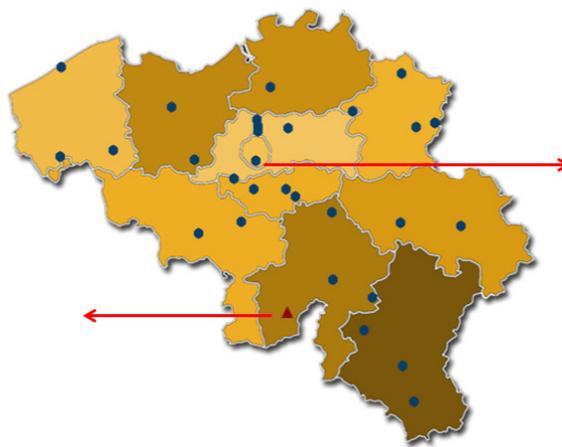
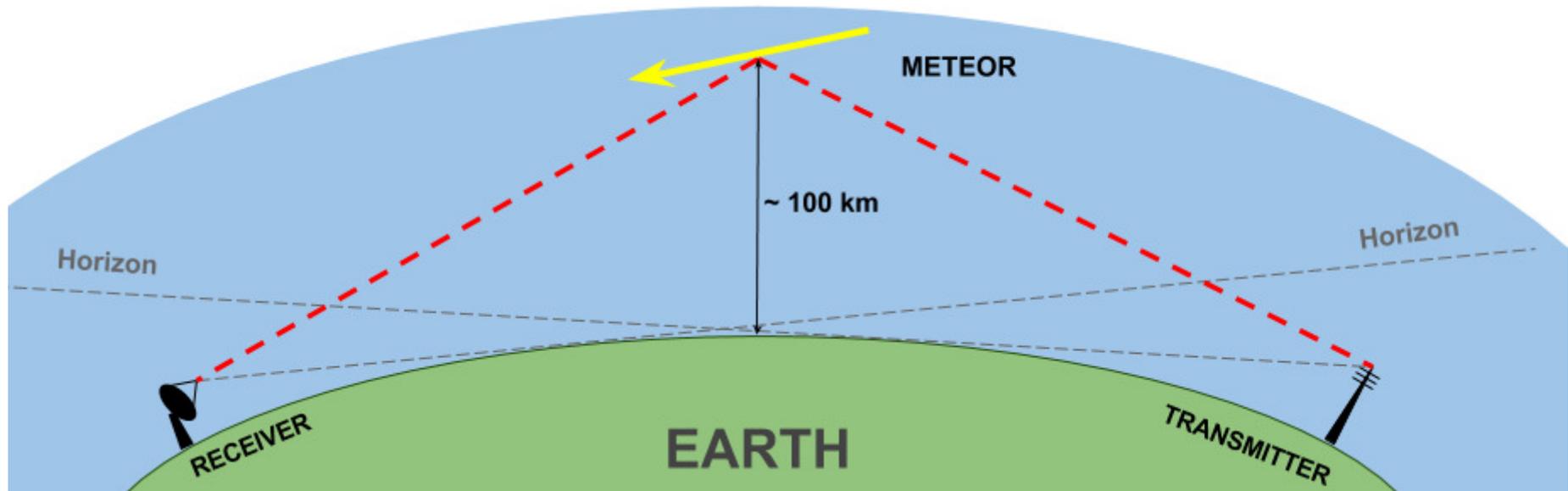
Sporadic meteor vs meteor shower



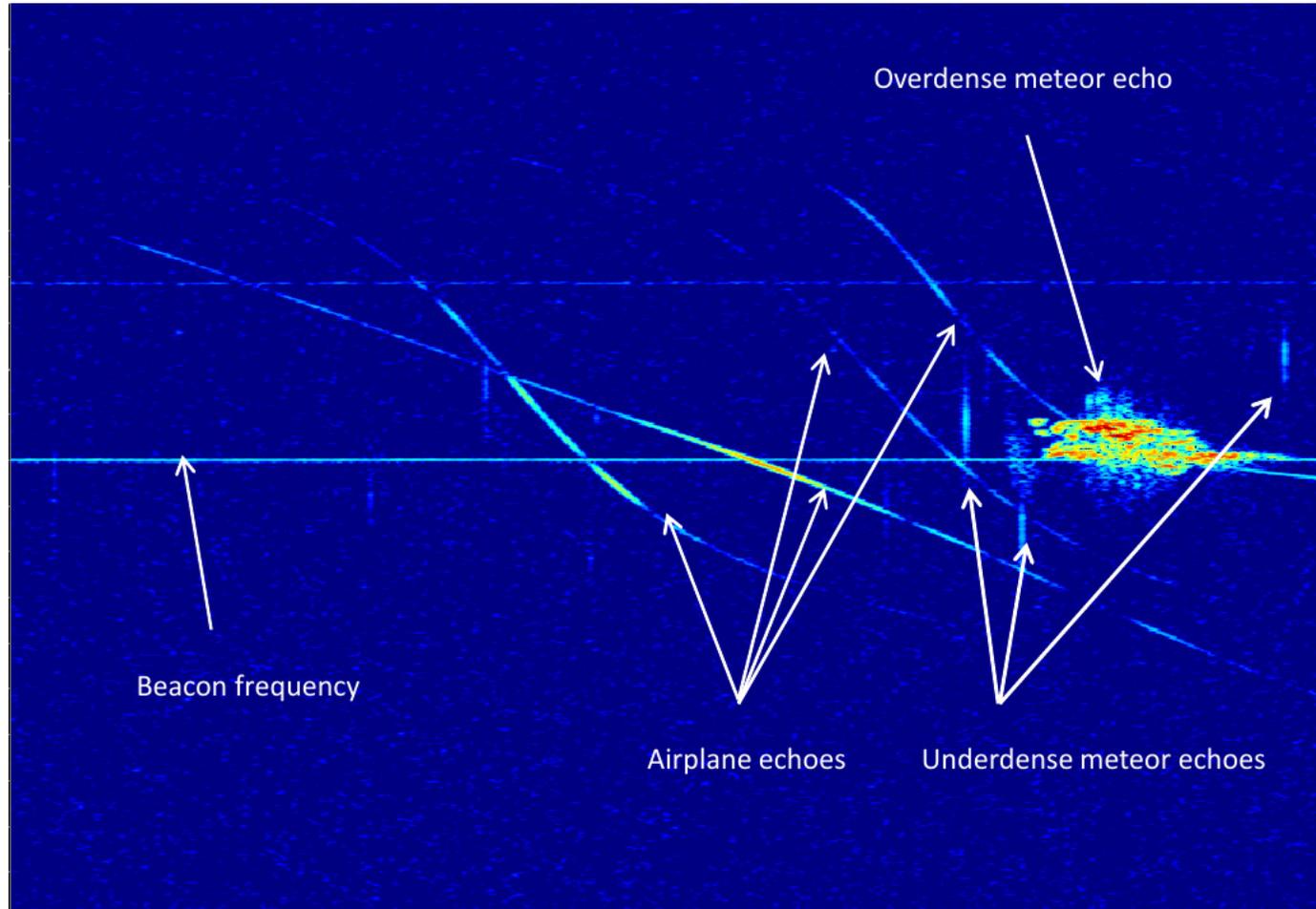
Radiant of a meteor shower



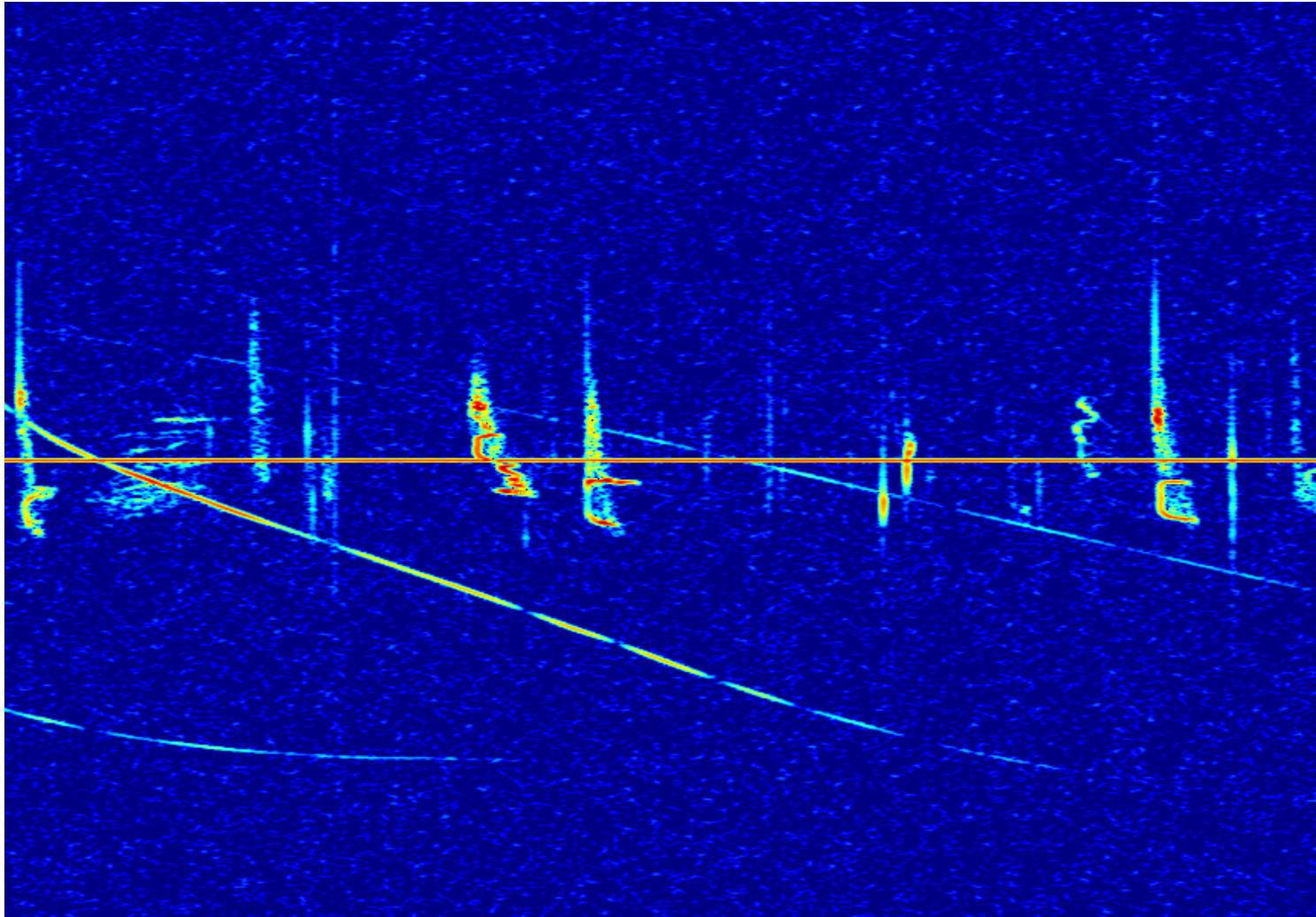
The BRAMS network



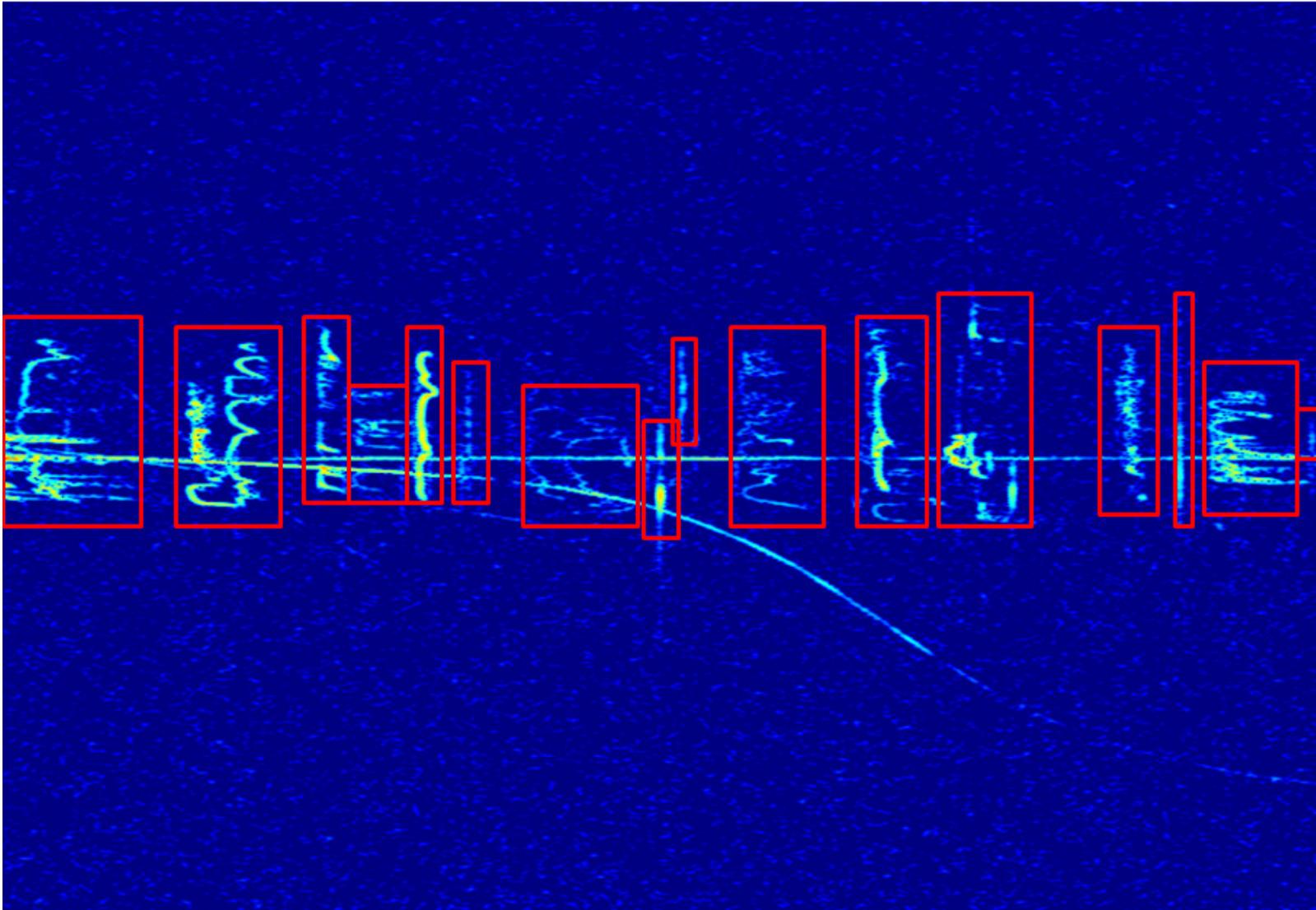
The BRAMS data



During a meteor shower...



The eye stays the best detector



Hence ... the Radio Meteor Zoo

The screenshot shows the homepage of the Radio Meteor Zoo website. At the top, there is a navigation bar with the following links: RADIO METEOR ZOO, ABOUT, CLASSIFY, TALK, COLLECT, PROJECT WEBSITE, and RESULTS. On the right side of the navigation bar, there is a user profile for Hervé Lamy with icons for a message and a notification. Below the navigation bar, a blue banner contains the text: "We keep uploading data from the **Quadrantids 2017** but also from the recent **Lyrids 2017** and so we still need your help to hunt for radio meteor echoes. Many results available soon! Thanks for your constant support". The main content area features a background image of a large tree at night. The text "Help us identify meteors in radio data" is centered on the page. Below this text are two buttons: "Learn more" and "Get started". At the bottom of the page, there are three panels showing radio meteor data: a spectrogram on the left, a spectrogram with overlaid lines in the middle, and a spectrogram with overlaid lines and a yellow dot on the right. To the right of these panels, there is a social media widget that says "0 people are talking about Radio Meteor Zoo right now." and a "Join in" button.

RADIO METEOR ZOO

ABOUT CLASSIFY TALK COLLECT PROJECT WEBSITE RESULTS

Hervé Lamy

We keep uploading data from the **Quadrantids 2017** but also from the recent **Lyrids 2017** and so we still need your help to hunt for radio meteor echoes. Many results available soon! Thanks for your constant support

Help us identify meteors in radio data

Learn more Get started

0 people are talking about **Radio Meteor Zoo** right now.

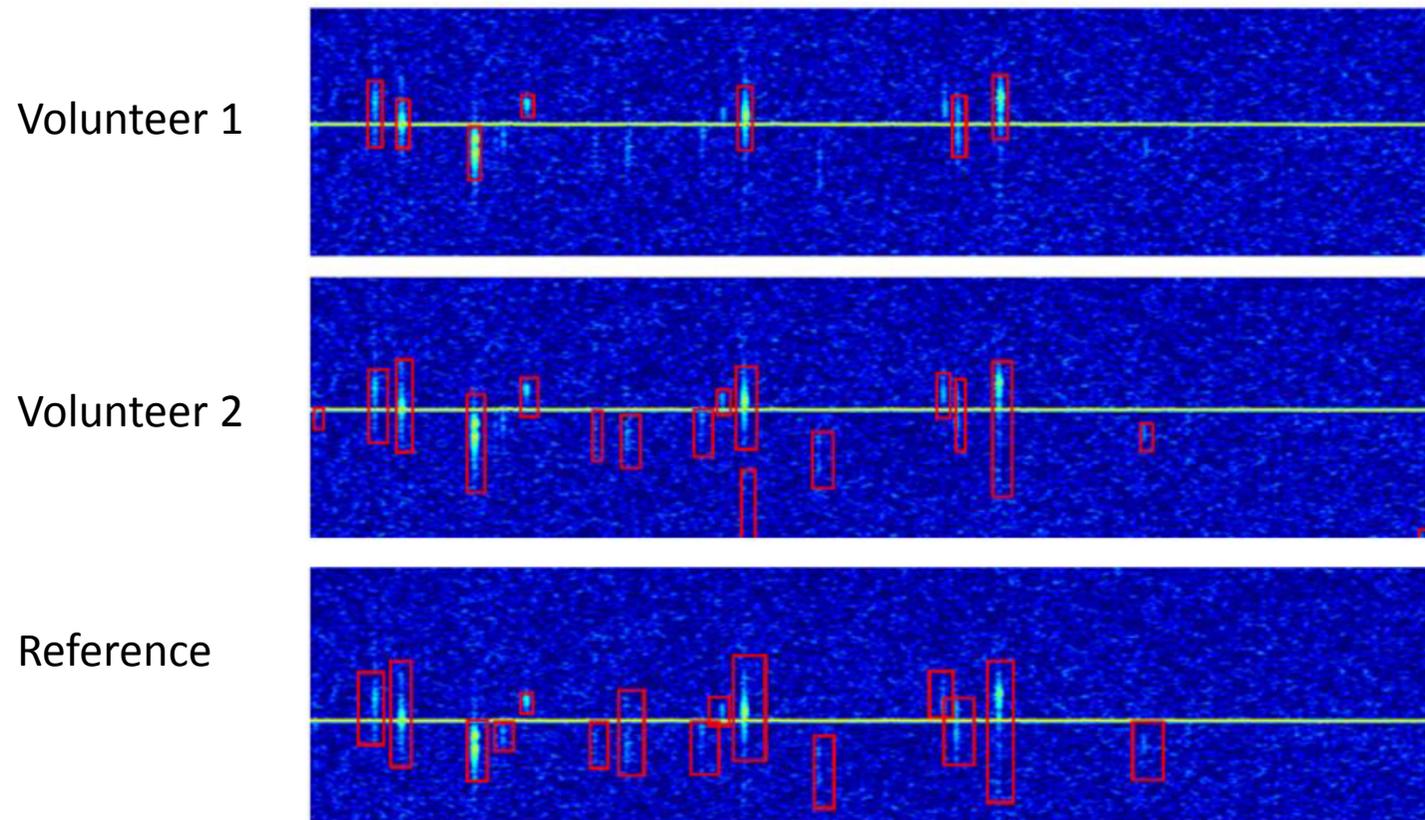
Join in

Two questions

1. What is the minimum number of volunteers we need to inspect a given spectrogram?
2. In a given spectrogram, how can we accurately derive the number and position of meteor echoes based on individual contributions?

Small-scale test last year

12 spectrograms and n=35 volunteers



Small-scale test last year

Binary version of
the reference
spectrogram with
each pixel=1
when identified
by us

Binary version of
spectrogram with
each pixel =1
identified by at
least i volunteers

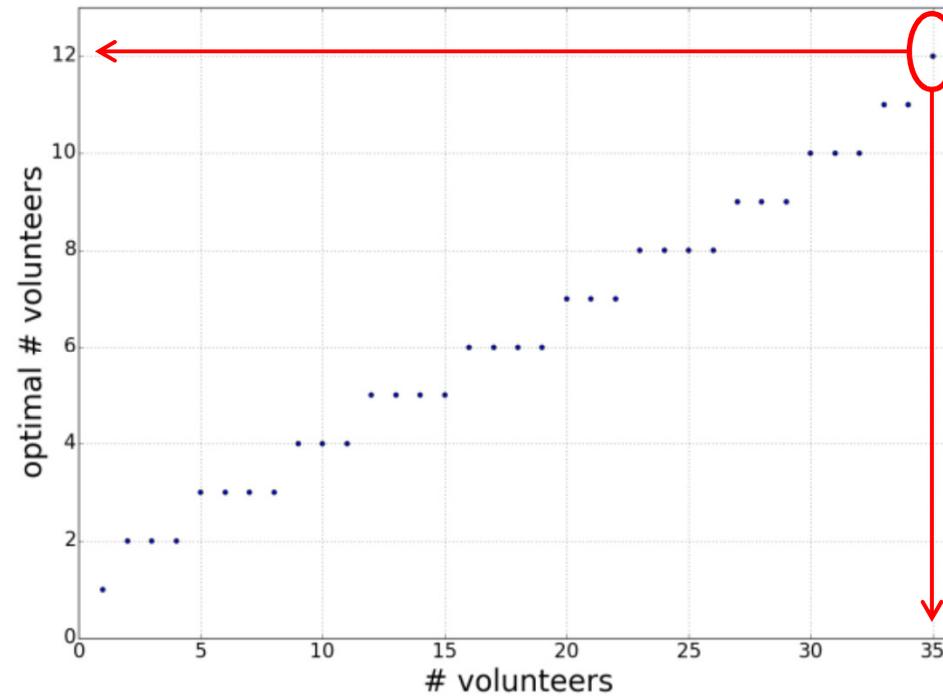
- Calculate $D(i)$ = number of different pixels from the 2 images
- Search for value of i which makes $D(i)$ minimum

$i = 12$ for $n=35$ users

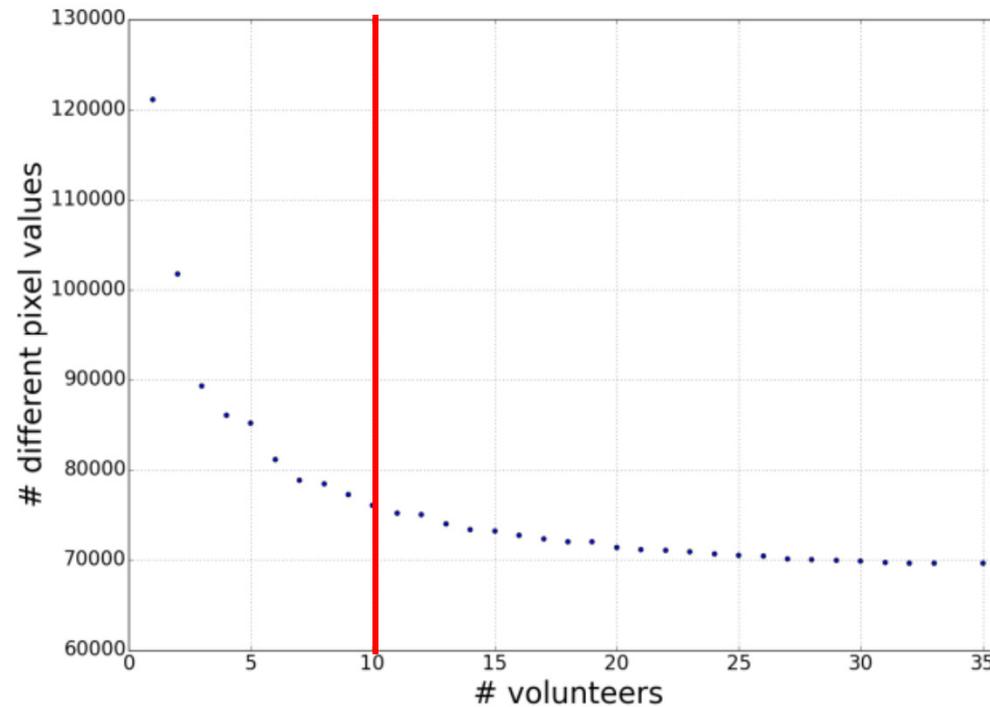
But we can't have 35 users...



Same tests with $n=1, 2, \dots, 35$. For each n , 1000 random combinations of n users among 35



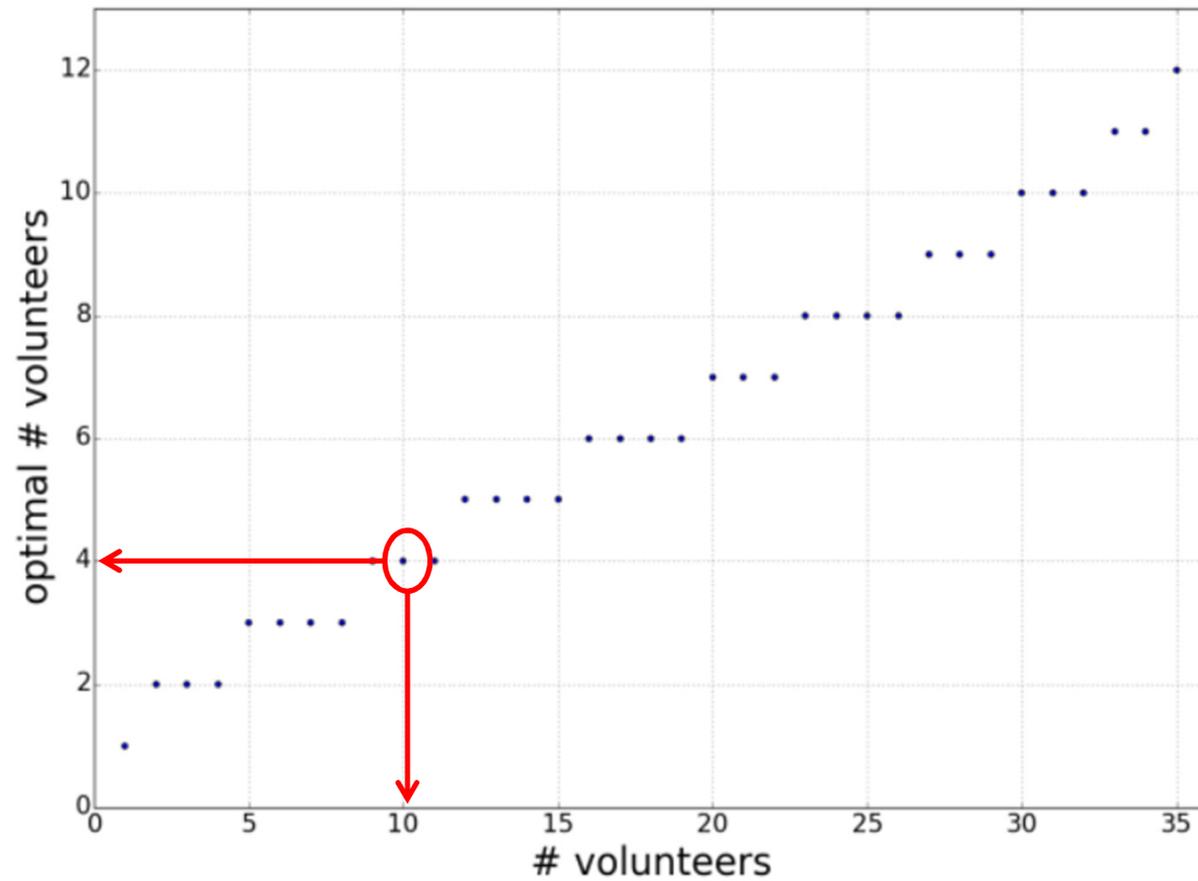
« Optimal » spectrograms



$n = 10$

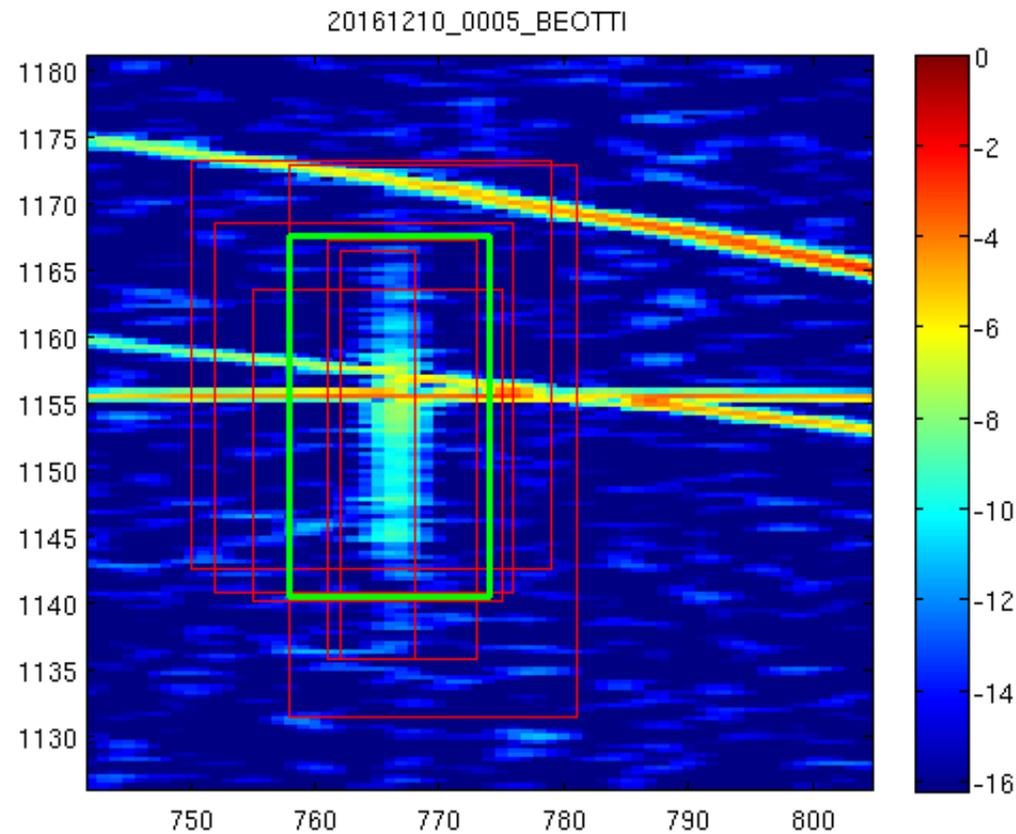
Size of a spectrogram = 595×864 pixels
 \Rightarrow nb of pixels for 12 spectrograms $\sim 6 \times 10^6$

« Optimal » spectrograms

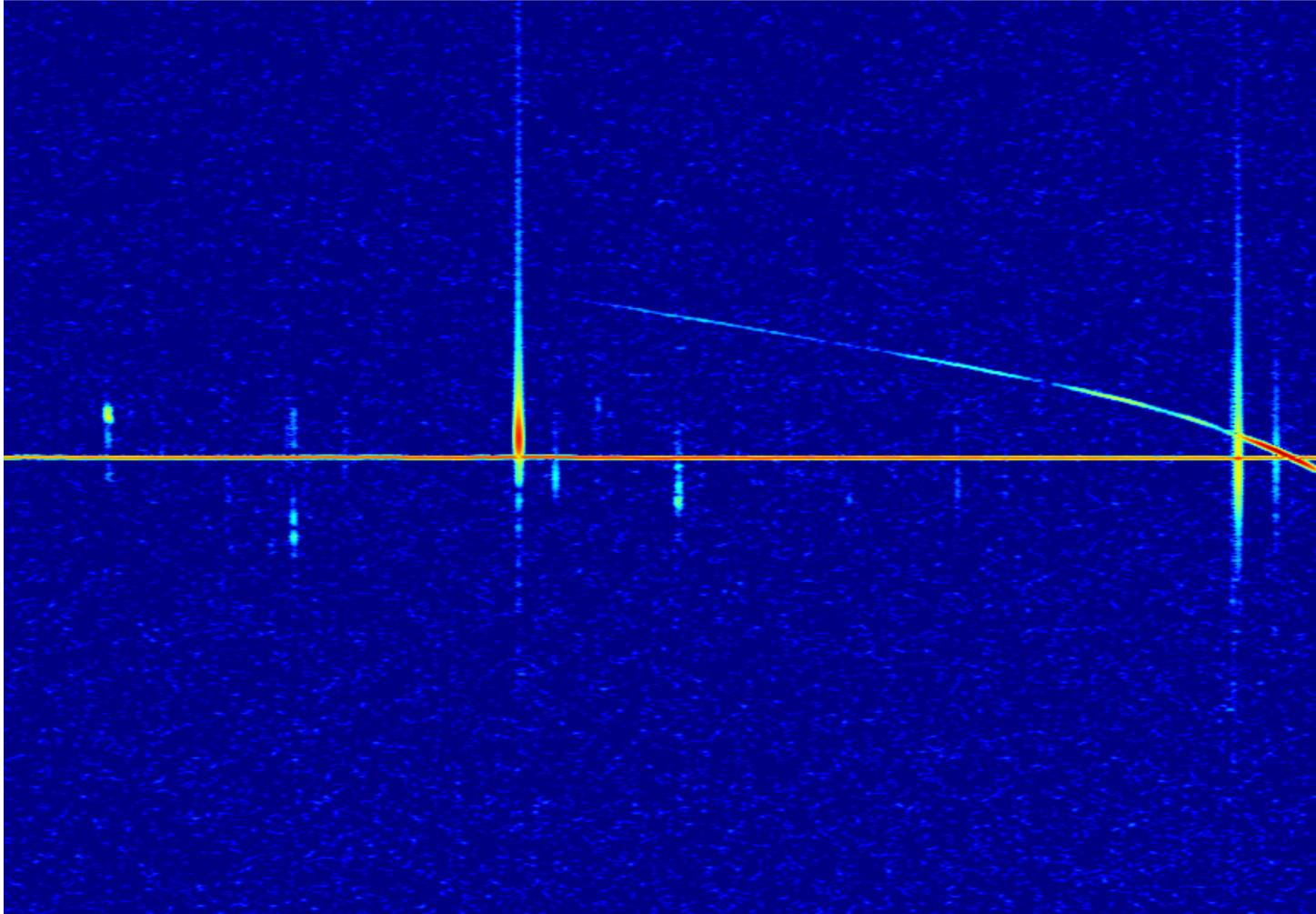


Aggregation of individual pixels

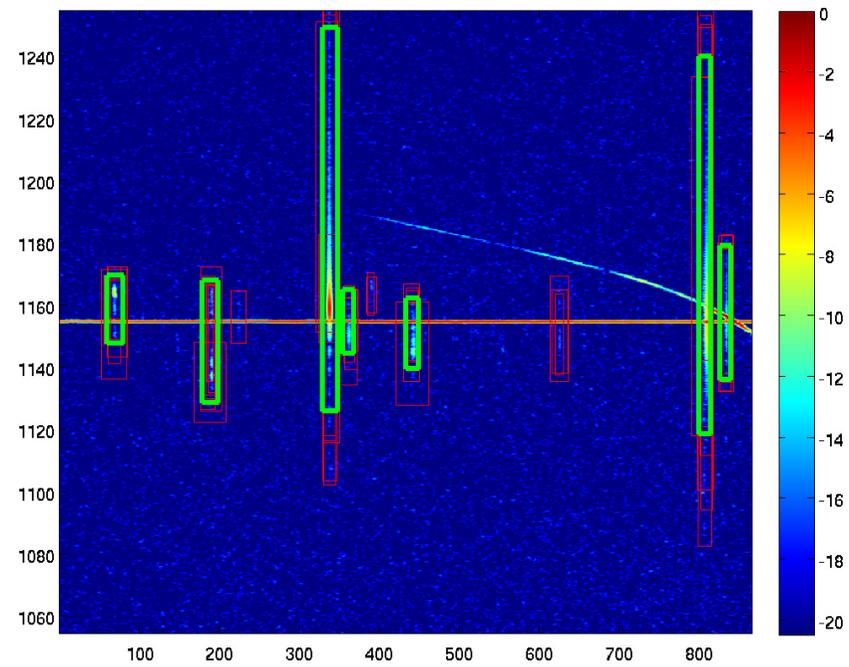
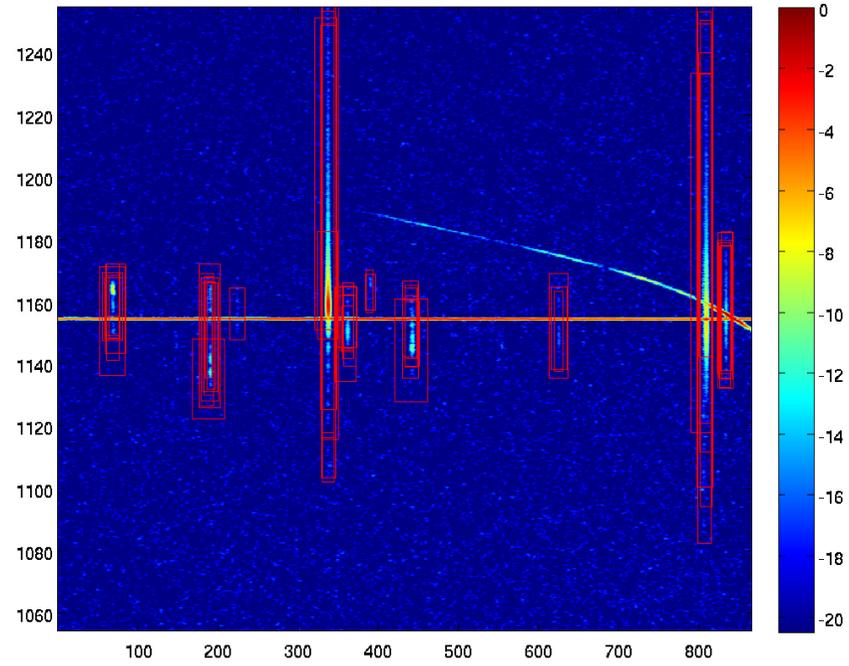
We use the largest common rectangle (that includes all individual pixels)

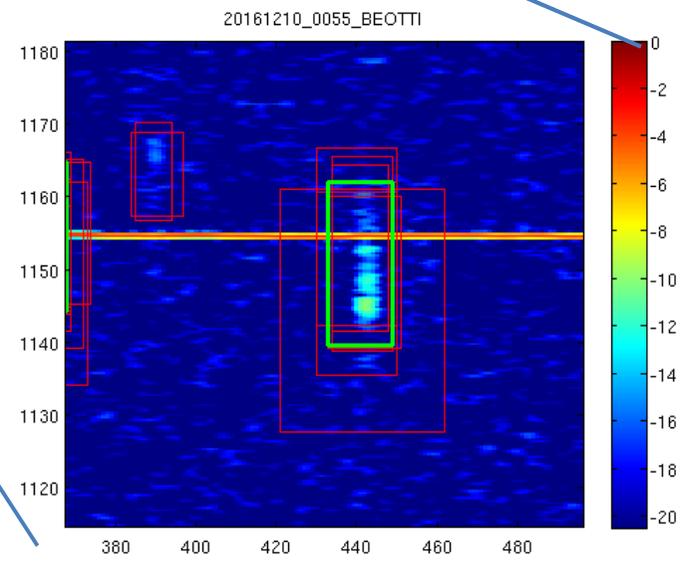
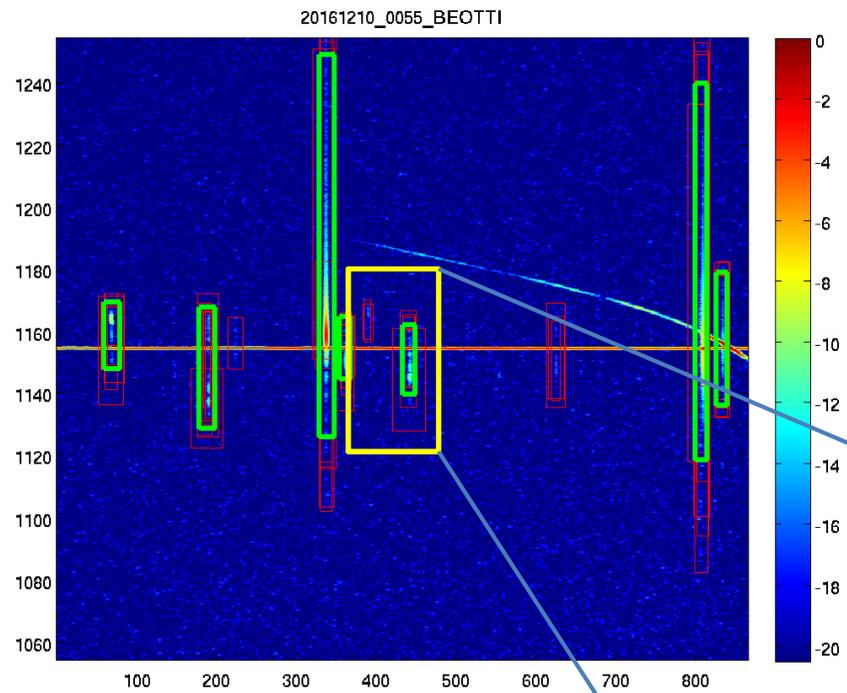


Example 1

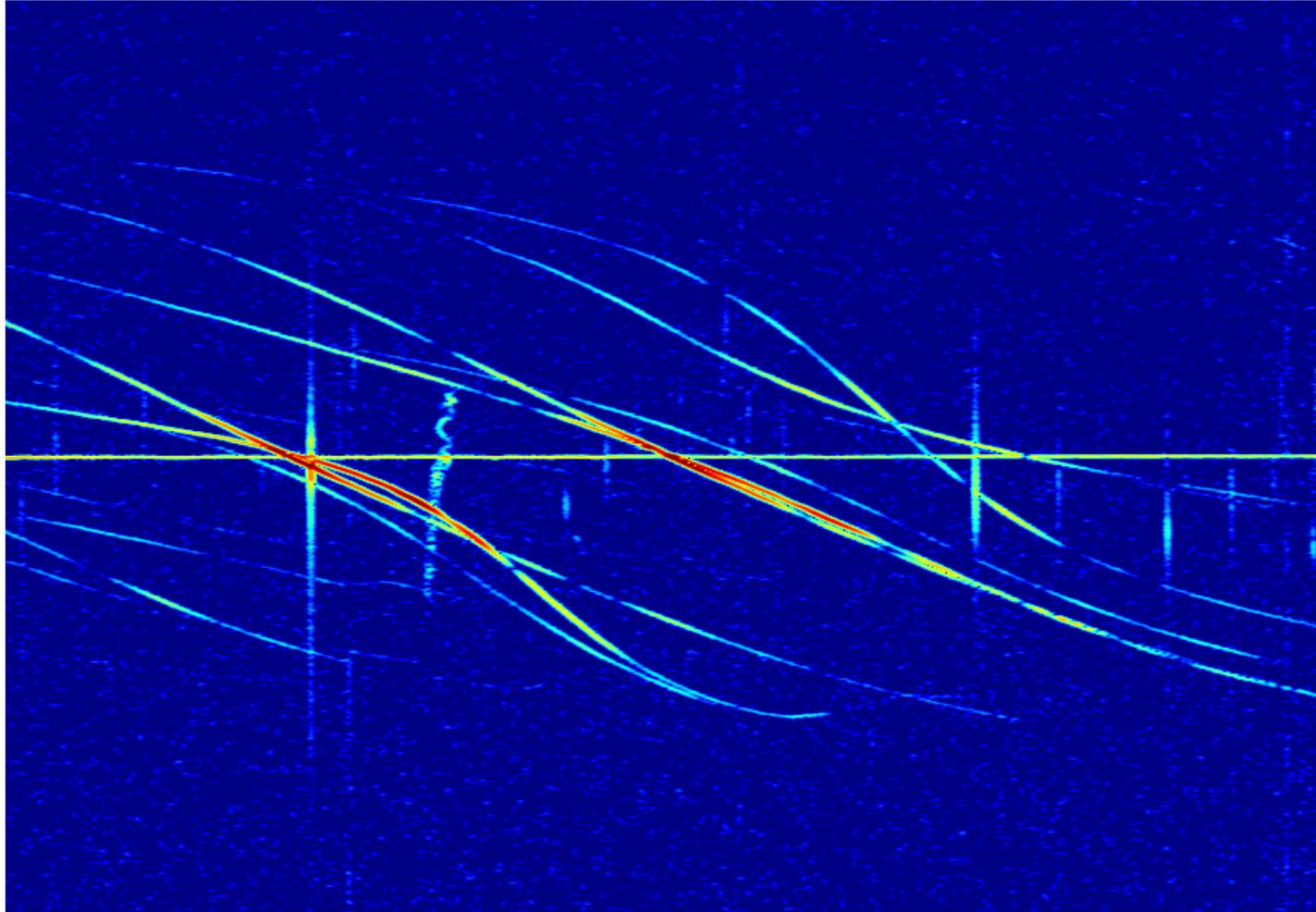


20161210_0055_BEOTTI

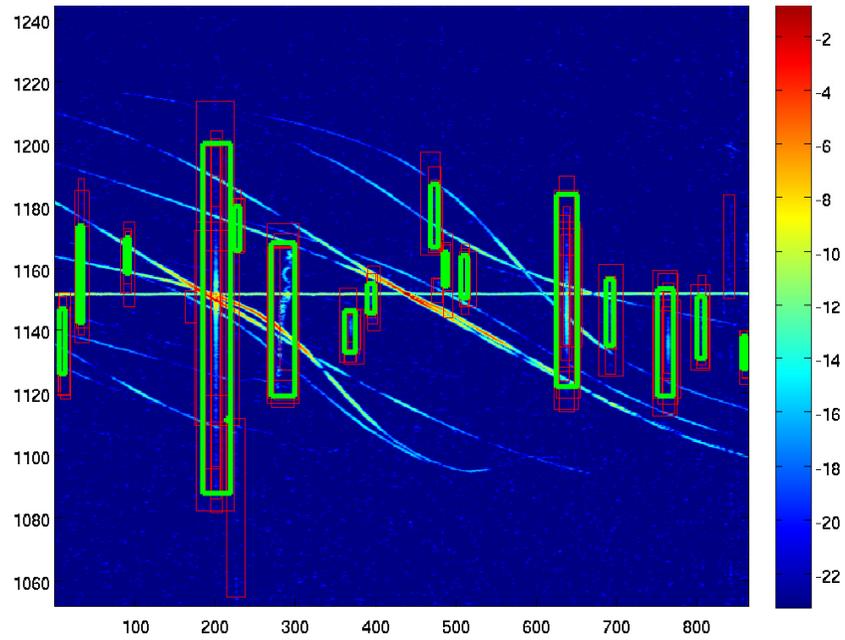
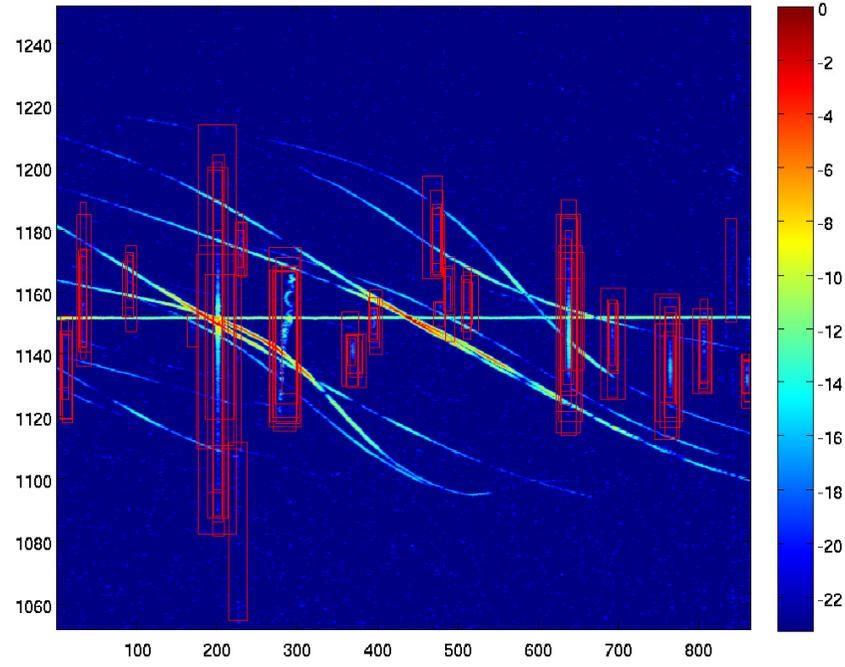


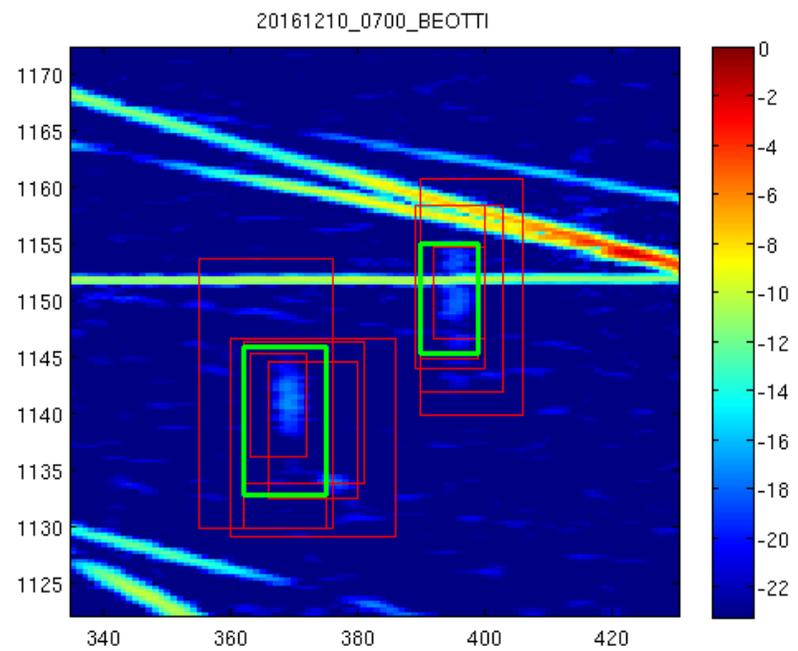
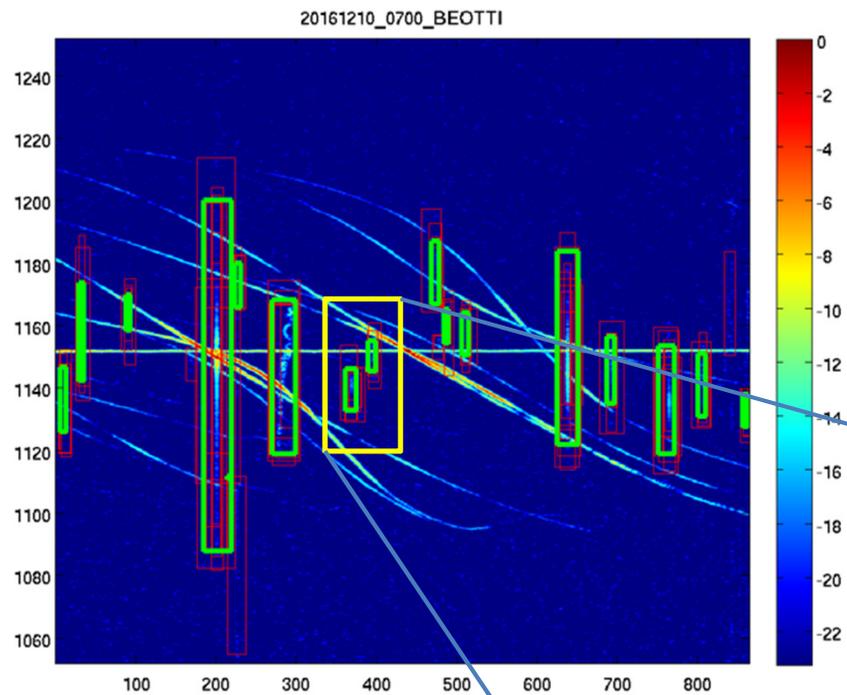


Example 2

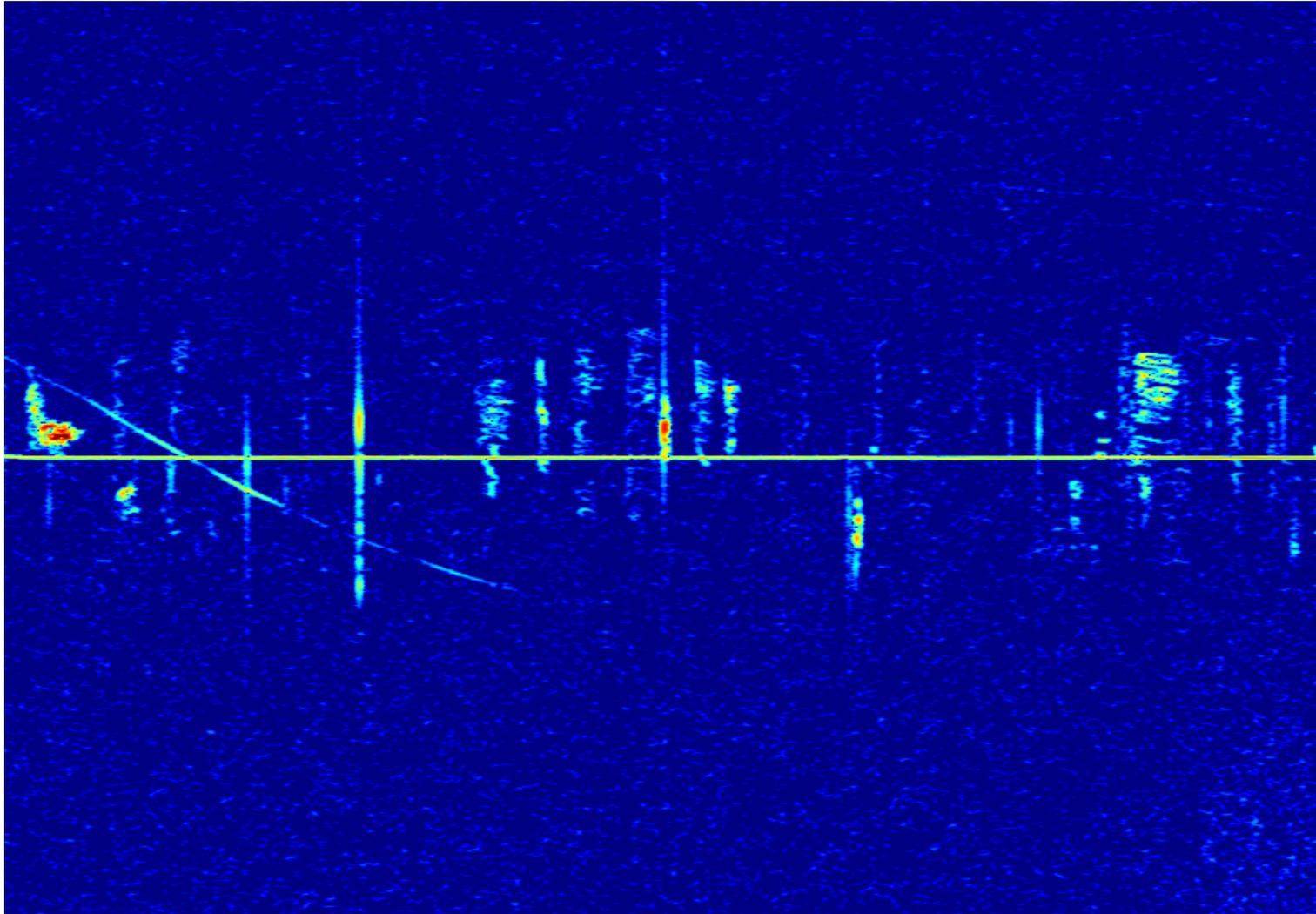


20161210_0700_BEOTTI

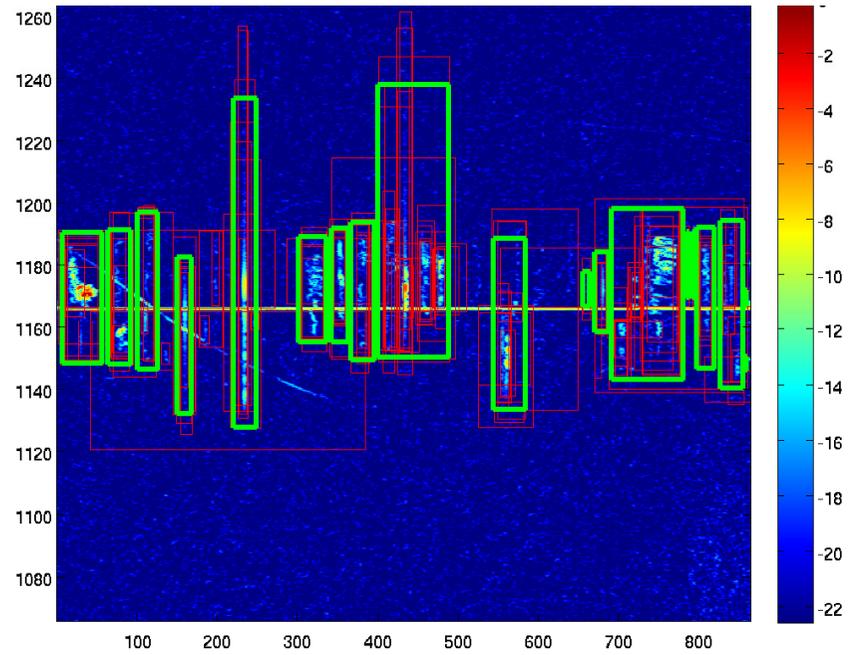
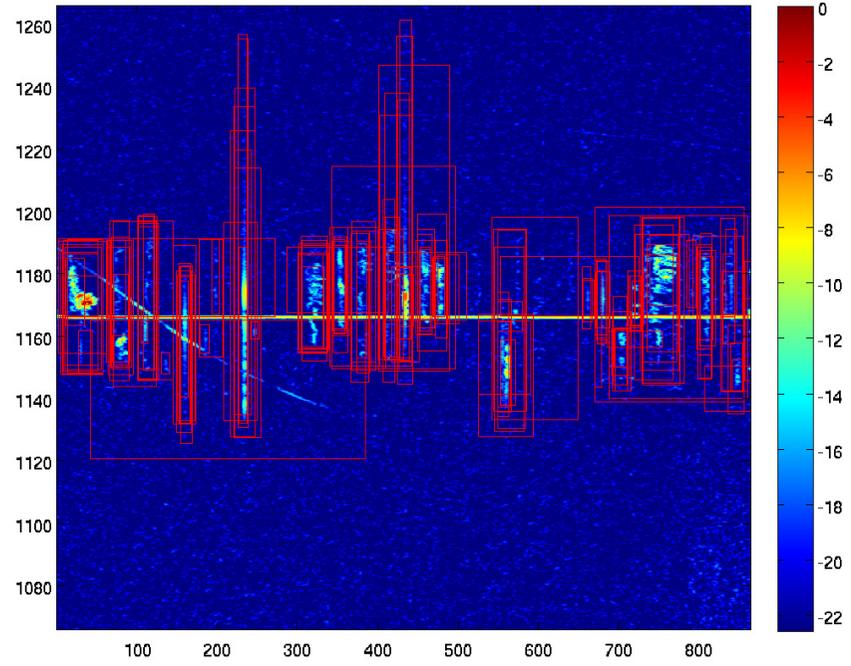


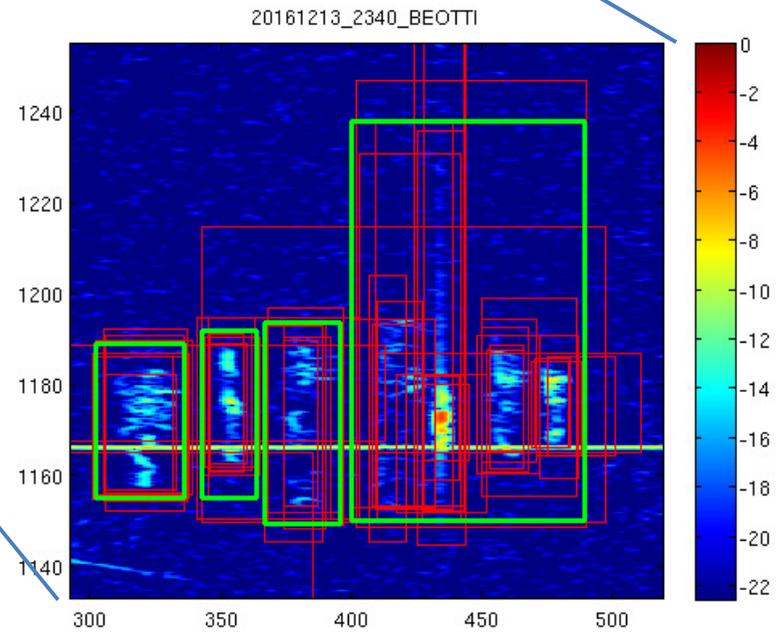
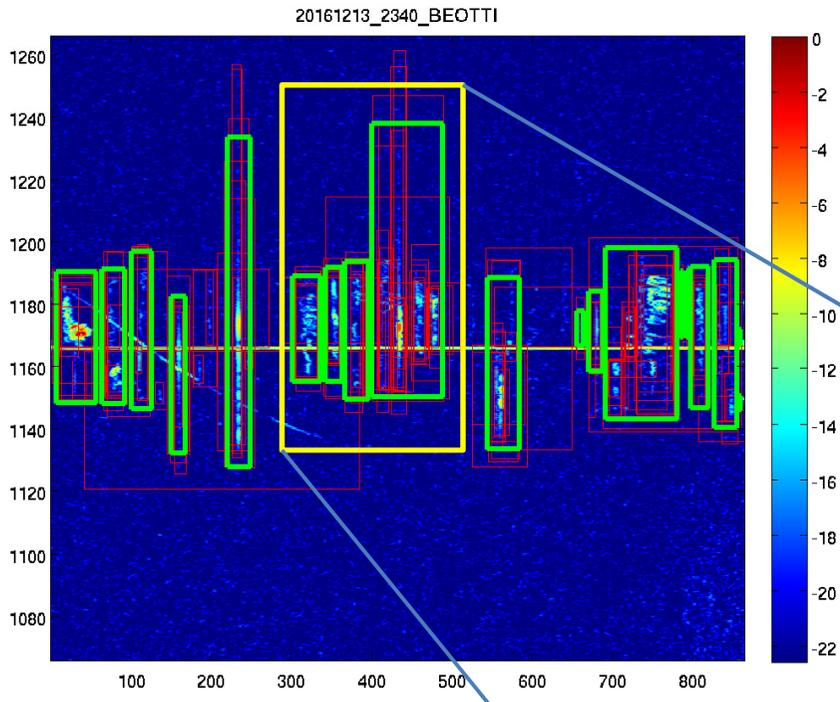


Example 3

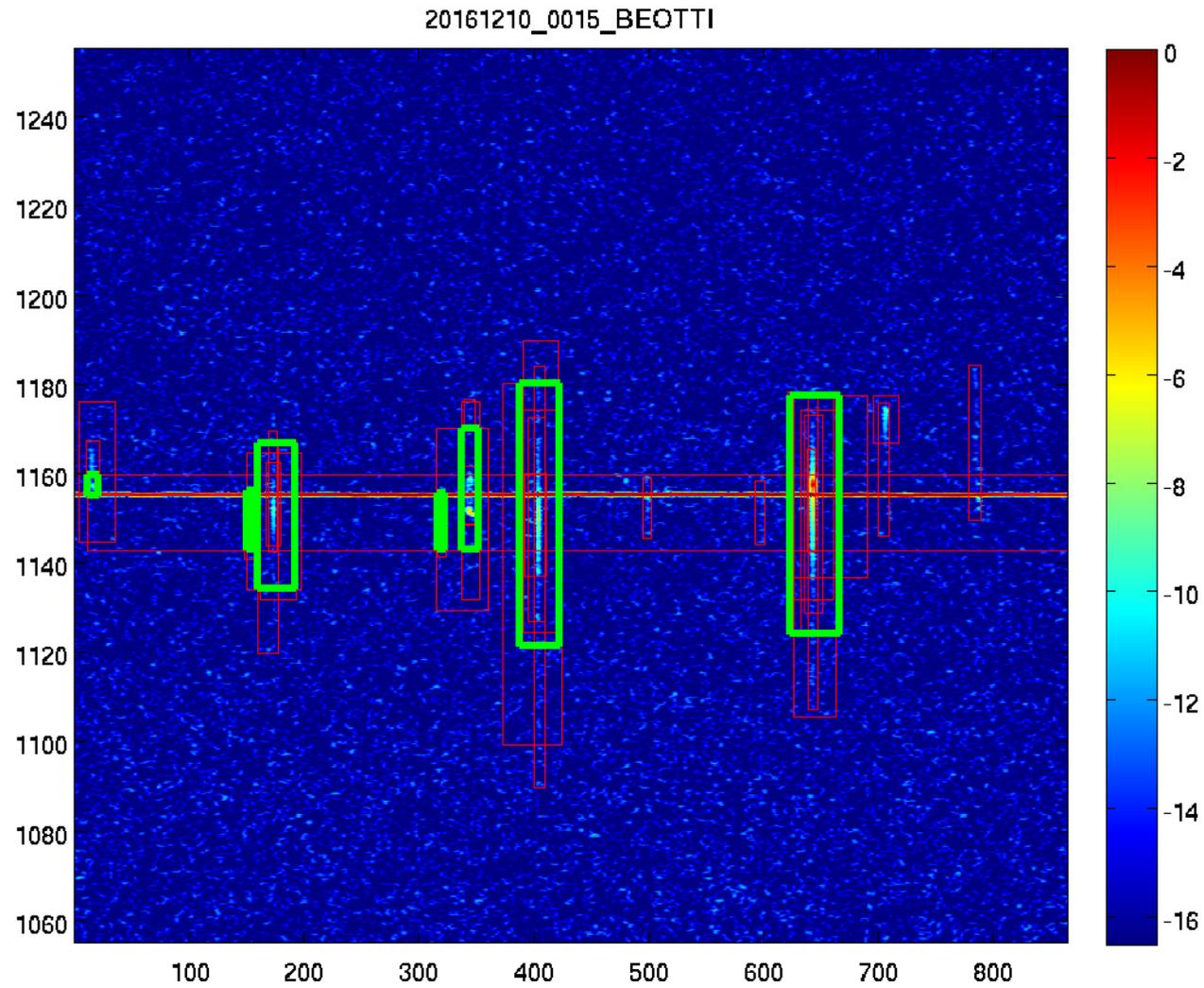


20161213_Z340_DEUT11





Example 4

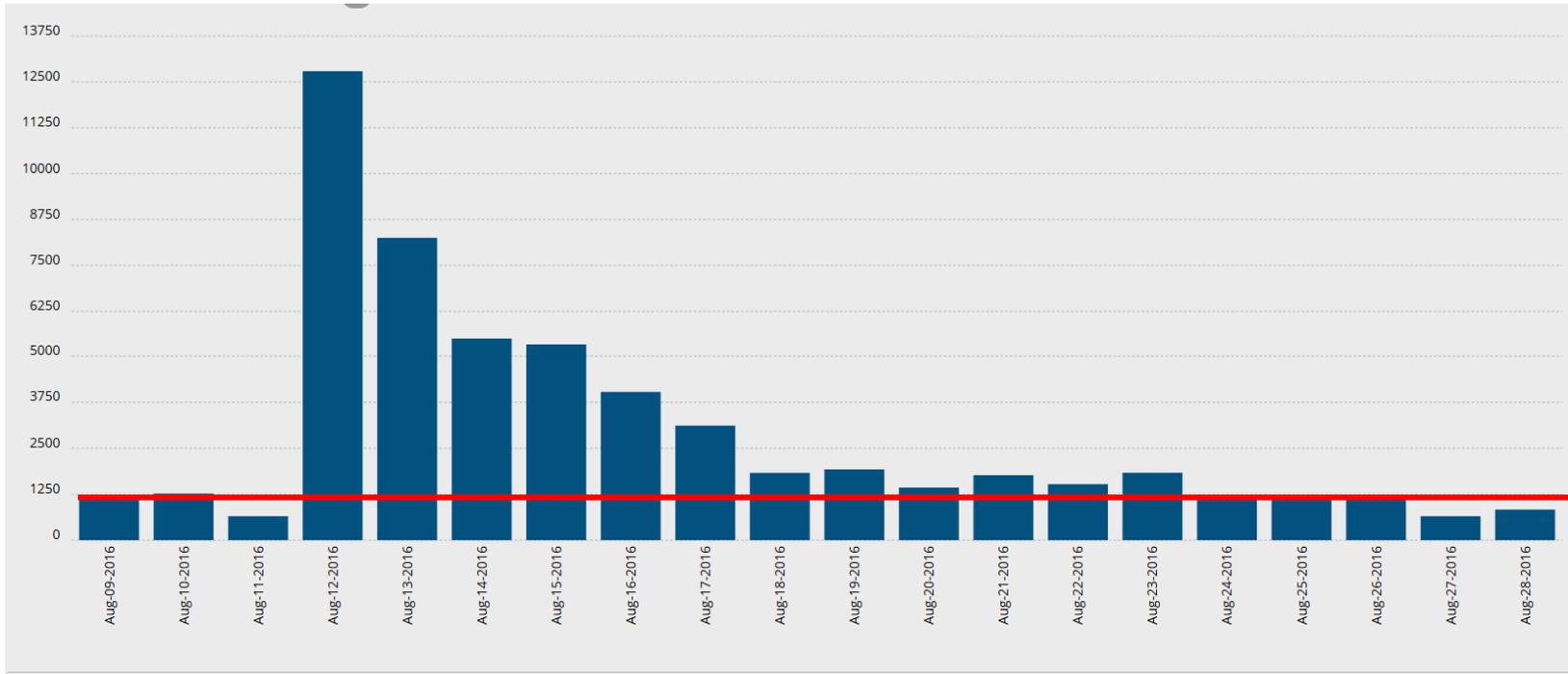


Possible improvements

- Improved aggregation of individual rectangles? Use values of 4-10 instead of simply 0 and 1?
- Assess the quality of users
 - Simplest : remove big rectangles spanning a too large area
 - Compare results of users with ours (either on RMZ or on images previously manually counted)
 - Golden Standard (advantage: users can « improve »)
 - Difficulty : you don't need to be registered to participate

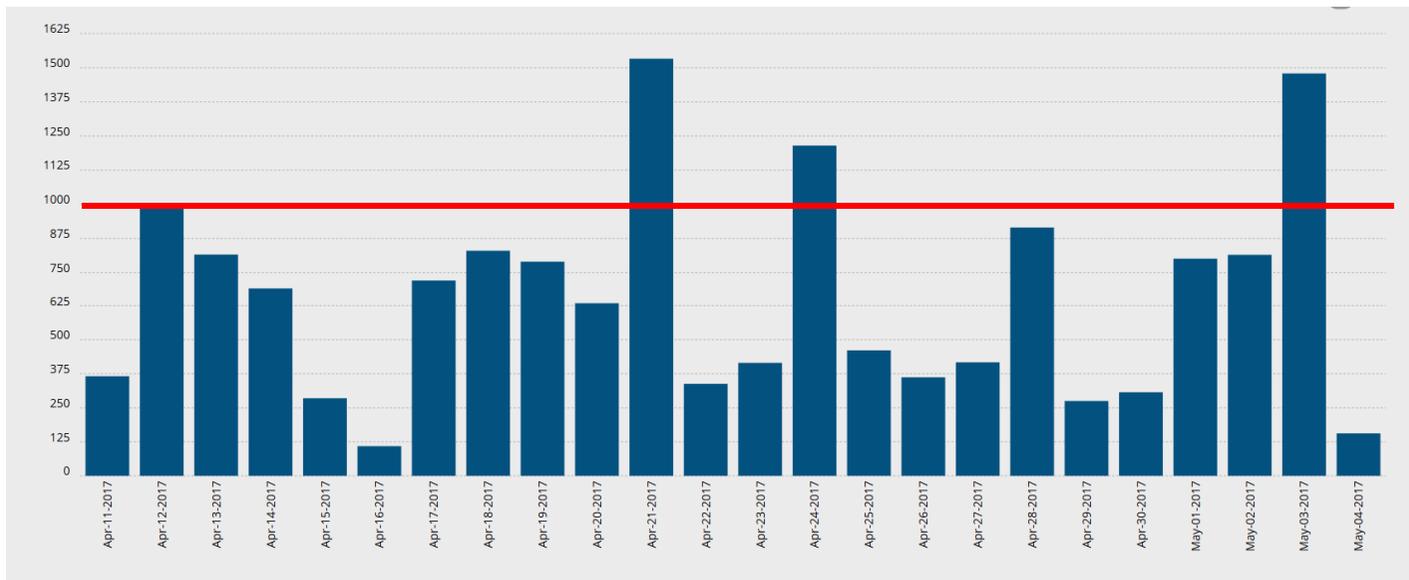
Preliminary results

The launch ...

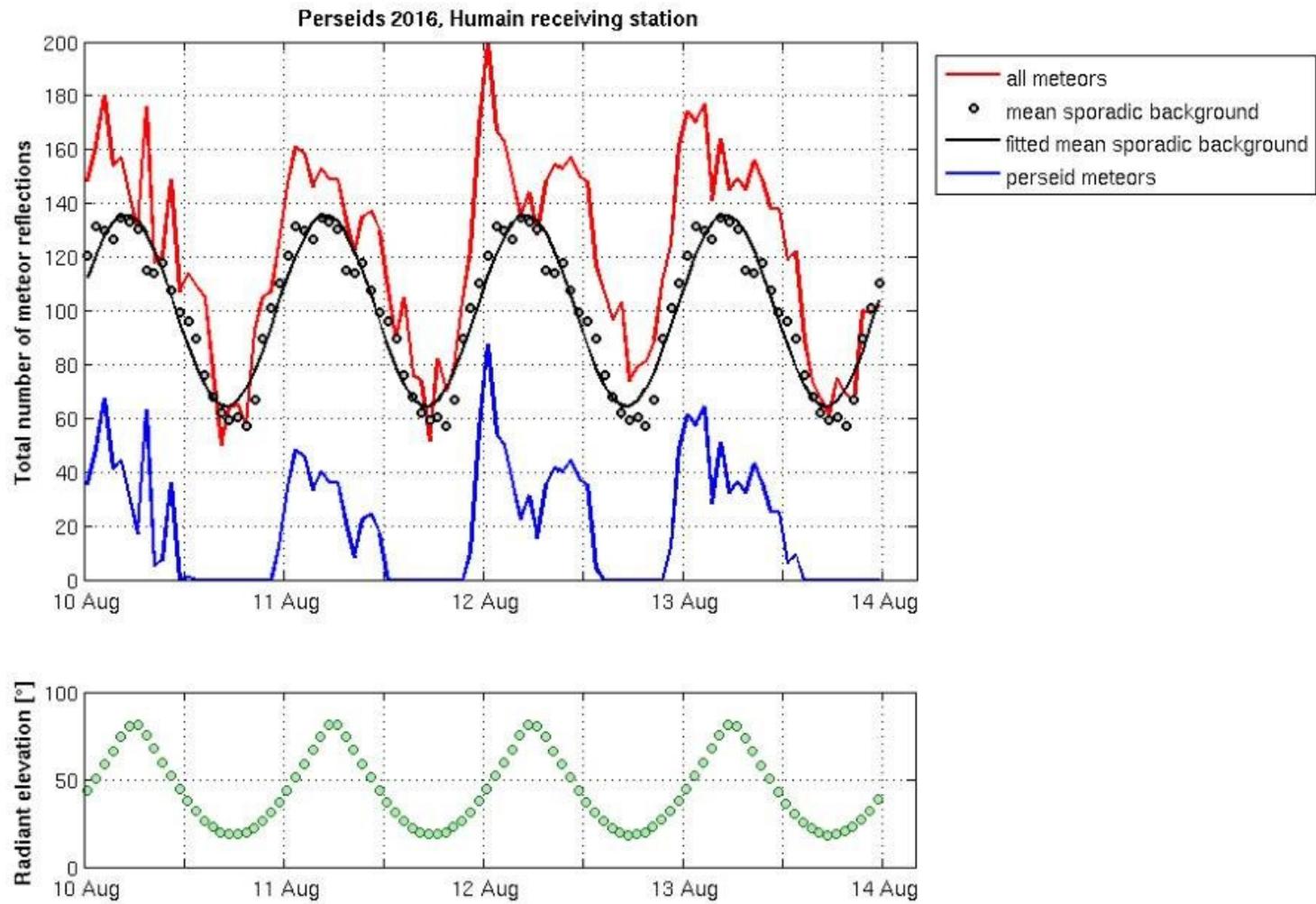


A few stats

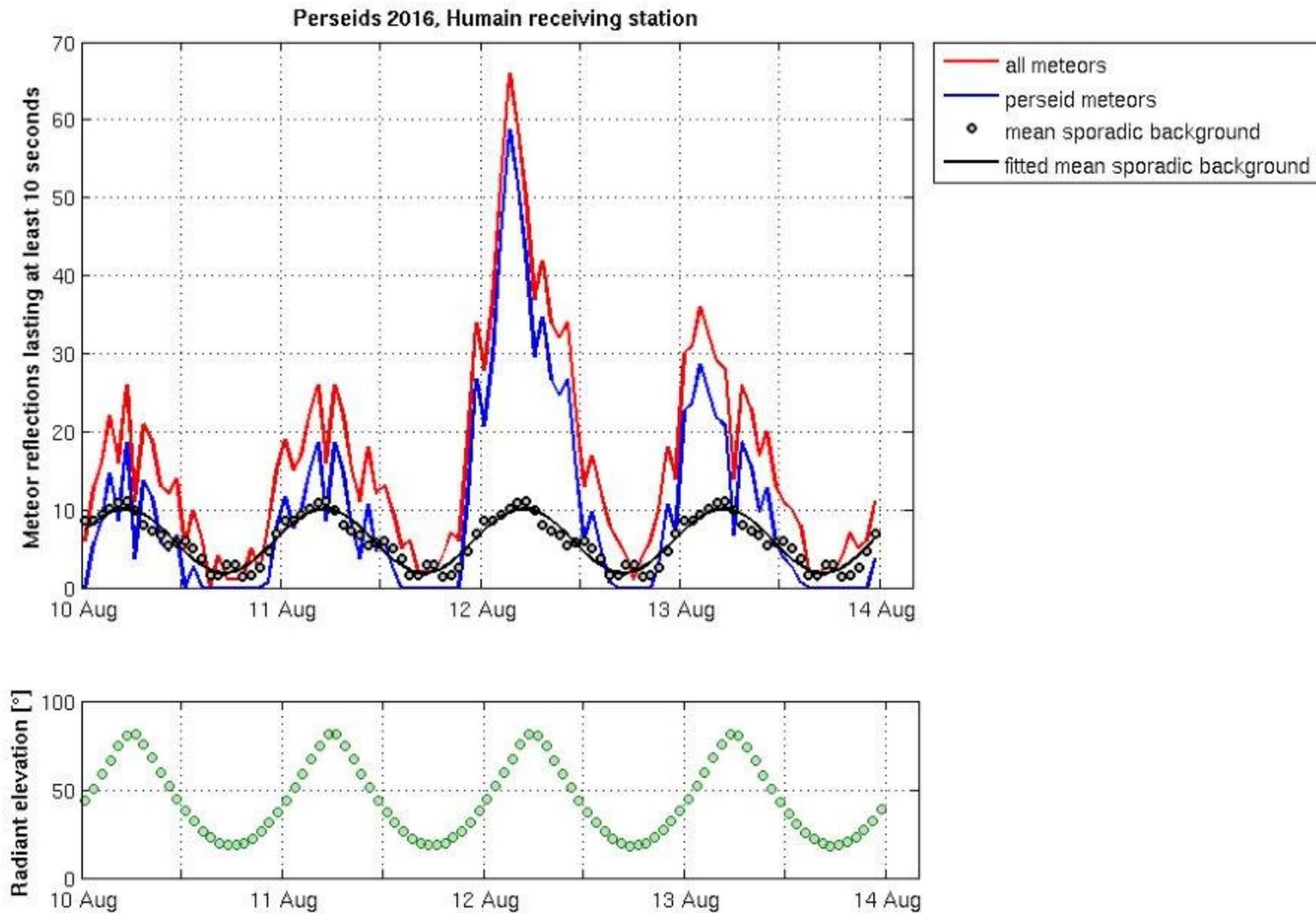
- About 22000 spectrograms analyzed so far
→ ~ 220 000 classifications
- More than 4600 registered users ... and many more unregistered



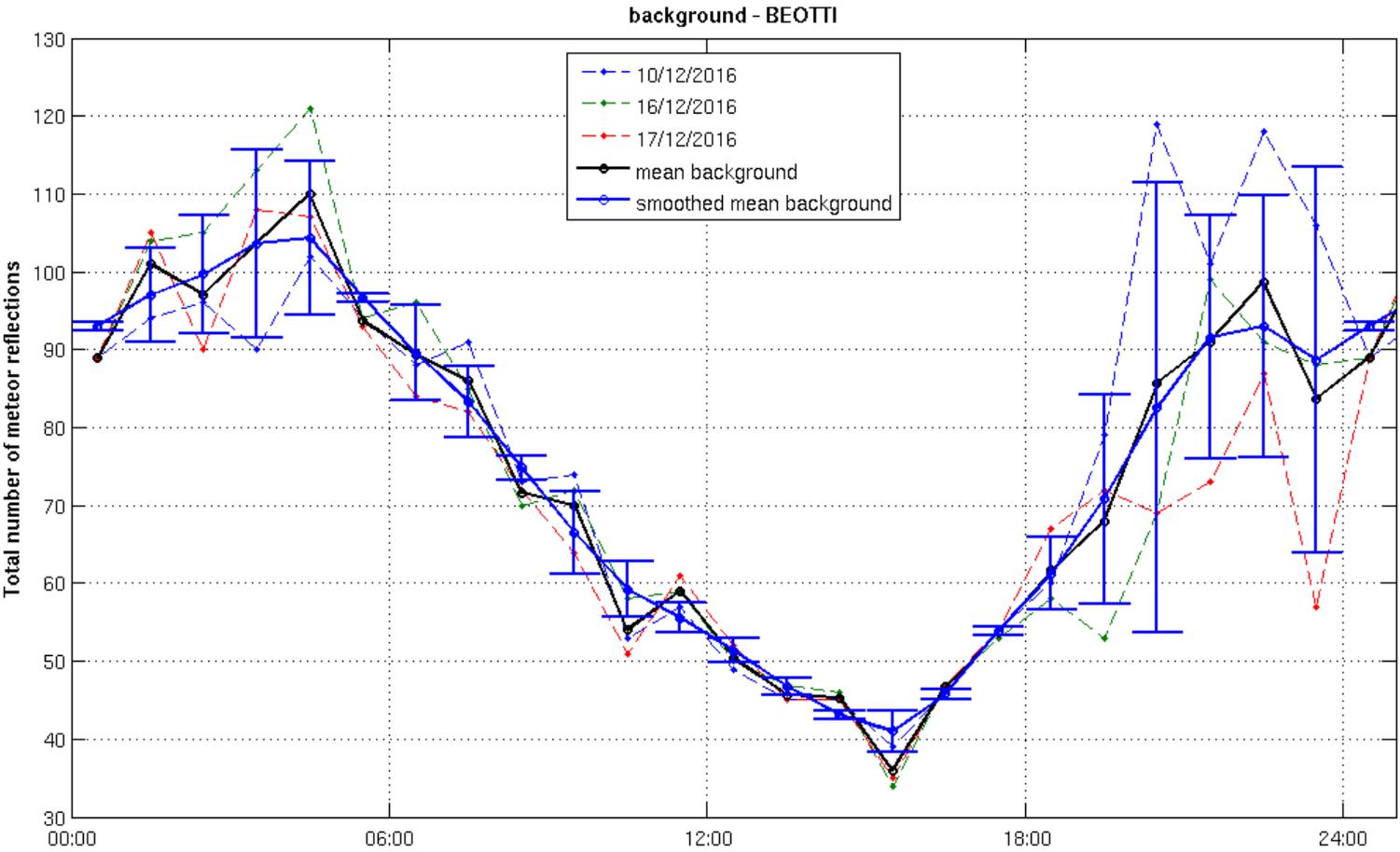
Perseids 2016



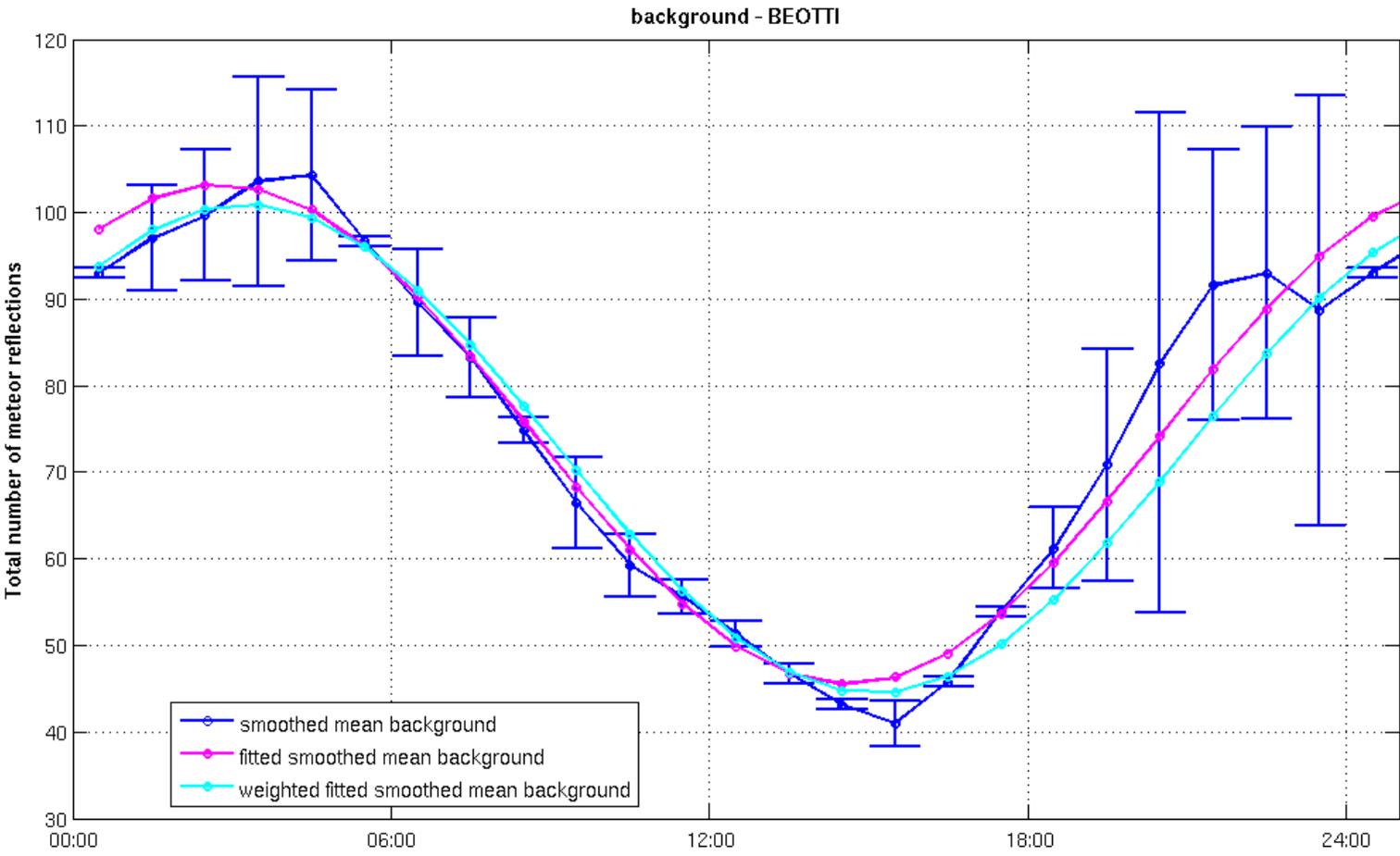
Perseids 2016



Background



Background



What's next?

- More meteor showers (Geminids 2016, currently Quadrantids 2017, Lyrids 2017)
- Raw counts corrected by Observability Function
- Tests and improvements of automatic detection algorithms
- Tests for interferometer (in Humain) and trajectories retrieval
-

Conclusions

- Big success in terms of outreach
- Scientific return still needs development of more sophisticated tools
- Both a scientific and a social experiment
- Goal for Perseids 2017 : get one activity curve in a couple of days