

# Bolidozor radio meteor detection network

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## Detection Method

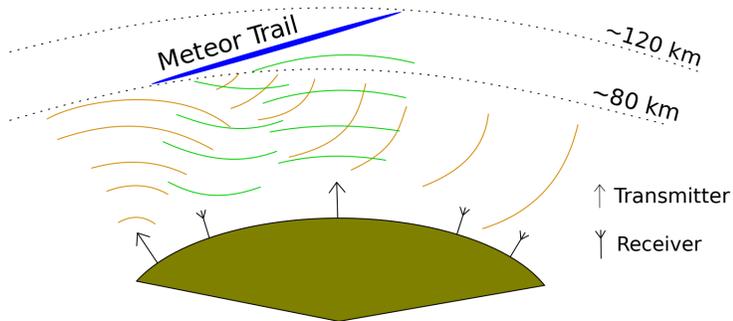


Figure 1 – General principle of meteor observing by forward scattering of radio waves from ionized trails.

The general principle of meteor observing by forward scattering of radio waves off their trails is illustrated in Figure 1. A lower VHF range radio receiver (30–200 MHz) is located at a large distance (about 500–2000 km) from a transmitter at the same frequency. Direct radio contact is impossible due to the curvature of the Earth. When a meteoroid enters the atmosphere, its meteor trail may reflect the radio waves from the transmitter to the receiver. At the receiver, where the signal of the transmitter is normally not received, the signal can then be received for a moment, as long as the meteor trail is present. Such reflections can last from a tenth of a second to a few minutes. The received signal characteristics are related to physical parameters of the meteoric event.

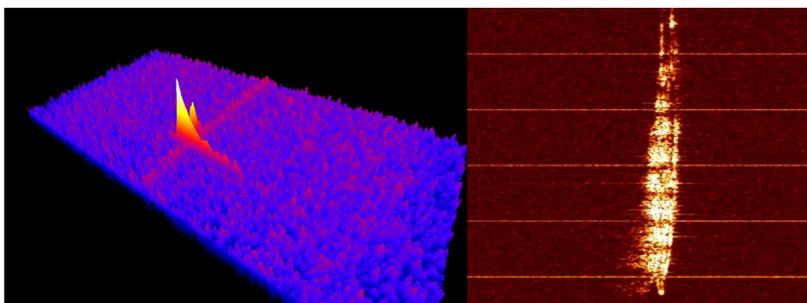


Figure 2 – Freya Software screenshot (on the left) and FITS of radio bolide event

## Station Hardware

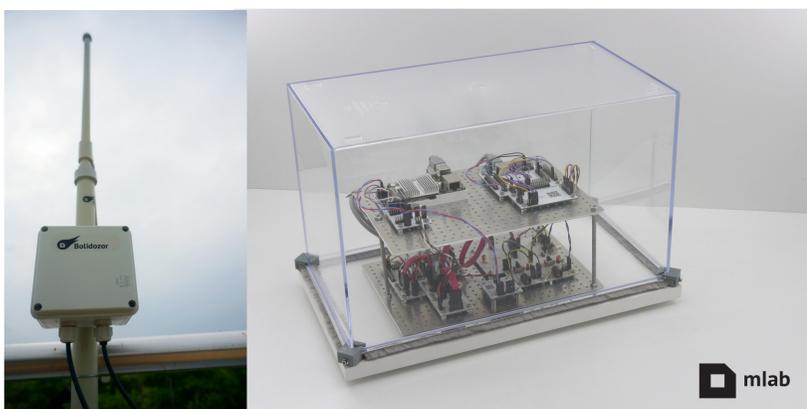


Figure 3 – Ground plane antenna of Bolidozor node (on the left) and the receiver in version RMDS02D (on the right).

Reception station is made from MLAB open source electronic prototyping system. Therefore the whole station is *open hardware design*.

## RT Bolidozor

Detection stations produce a lot of data every day and they are sent to the data storage server space.astro.cz. RT Bolidozor is a platform for simple visualization of measured data in the web browser on every OS.



meteor1.astroz.cz:5252

RT Bolidozor is divided into several parts. The first part *Real time map*. It shows a map with stations and upon detection of a radio meteor the station will blink.

In the next part *Multi-station bolid finder* (Figure 5) is a list of automatically detected matches of meteor detection on multiple stations. Each match can be viewed in detail. It shows previews of every record from all stations within 5 minutes before and after the event. It is useful for finding undetected meteors.

The third part are *Counts* (Figure 6). It shows histograms with hourly counts of detections in the last 90 days. The second graph shows daily meteor counts per one year. It contains also the hourly and daily count graphs from all stations together.

The last section *DB reader* provides a list of all data from all stations. Data can be filtered by date range, data type or event duration.

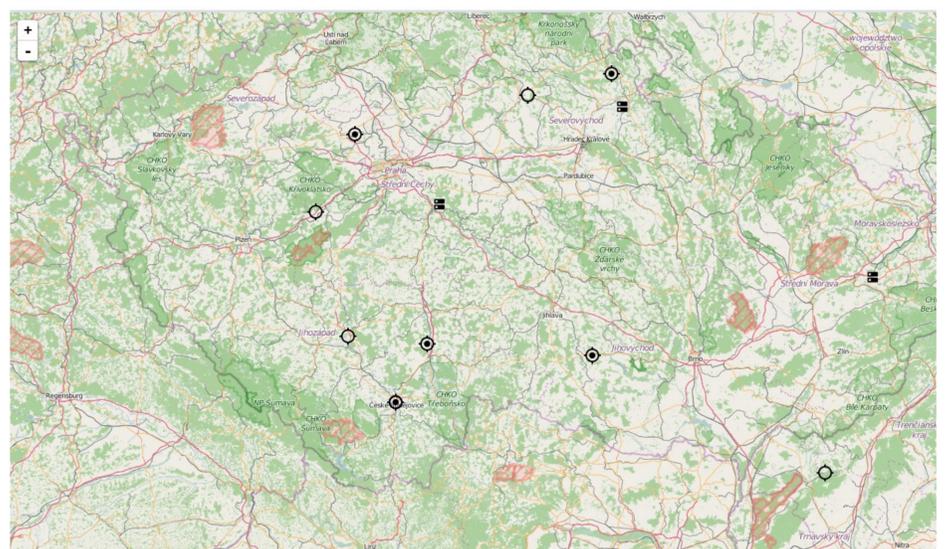


Figure 5 – RTbolidozor – Real time map

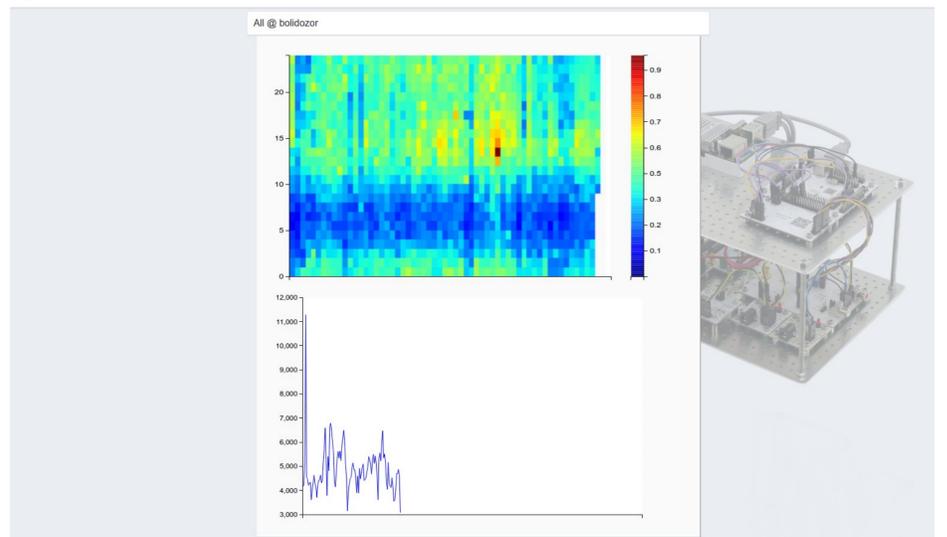


Figure 6 – RTbolidozor – Counts

## Measured Data

We currently have a large database of meteor reflections from several stations. Some meteors are received on multiple stations as in figure 7 for example. Unfortunately, we currently have not enough number of stations and suitable network geometry to obtain meteor trail vector. To overcome this issue, the Bolidozor network *needs more stations* abroad from the Czech Republic.

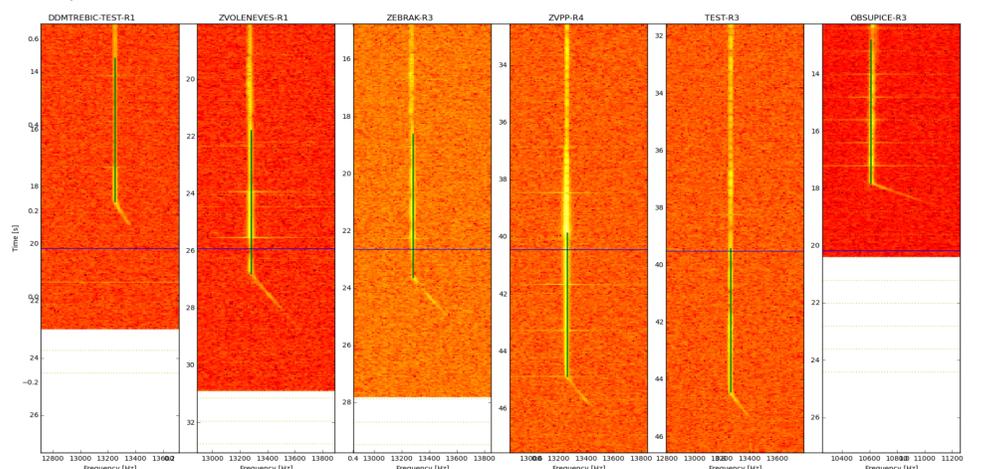


Figure 7 – An example of head echo from a radio bolide received on multiple stations. Pictures are aligned by time.



## RMDS02D blocks diagram

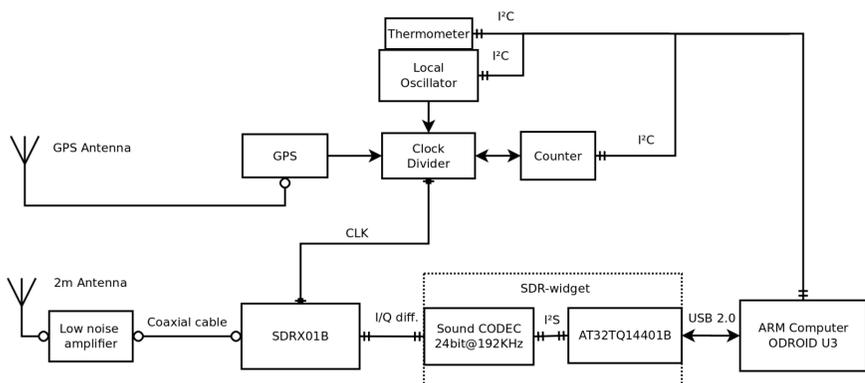


Figure 4 – Interconnection of MLAB modules in Bolidozor RMDS02D station.