Data management system of the **Bolidozor** network

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Bolidozor

Bolidozor is network of meteor radio detection stations (*figure 1*), where each station produces a large amout of data that must be stored on a shared storage for simple access for processing. This poster shows, how measured data are managed and stored in Bolidozor network.

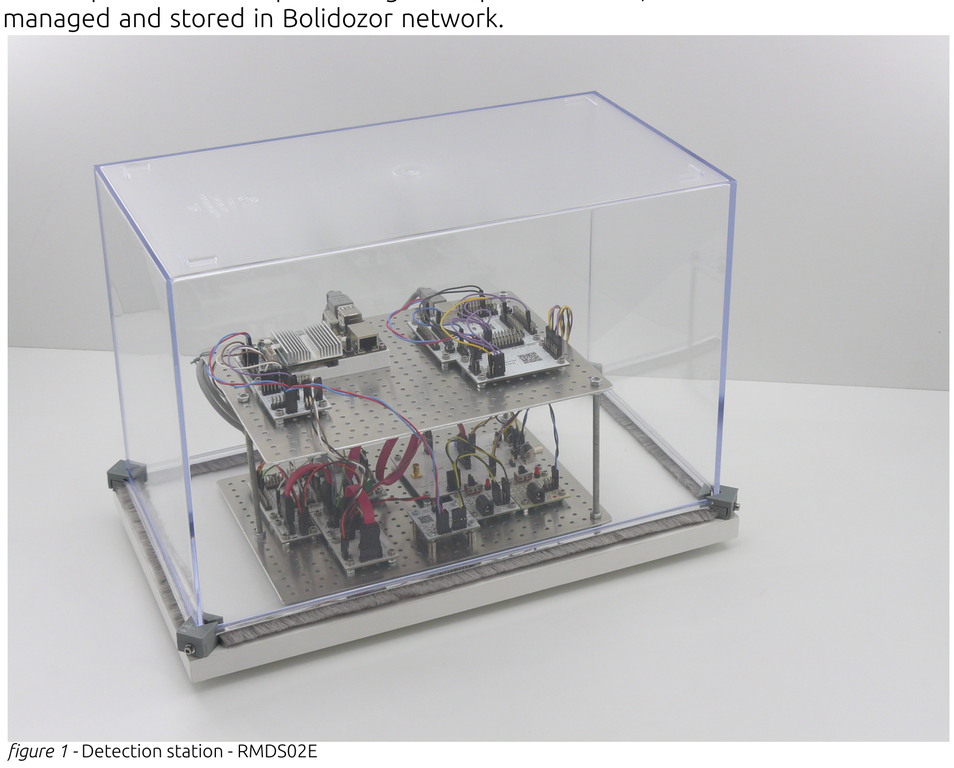

figure 1 - Detection station - RMDS02E

Each station produces approximately 2 GB of data per day on average. For data recording stations use radio-observer software which produces several types of output data.

Metadata

CSV files containing informations about every generated files. In case of RAW file (meteor detection) it contains properties as duration, peak frequecy, radio-magnitude or noise level of background.

Snapshots

A snapshot .FITS images contains continual spectrogram of one minute per file with narrow band of frequencies around Graves radar transmission frequency. In snapshots are included meteors that have not been detected. This files are useful for determining status of the station because in them is possible see e.g. interference noise.

RAW files

When radio-observer software detects some meteor a RAW .FITS file is created. This file contains unprocessed samples from an analog-digital converter. This file is intended for post-processing. In additional is created preview .FITS image (spectogram) of RAW file.

figure 2 - Meteor preview and corresponding snapshot of bolid

Data transmission

Measured data are immediately transferred to central data storage server (space.astro.cz) with data-uploader software which contains almost 7 TB of space for measured data. Because it is not enought for saving all historical data, old data are backuped up to magnetic tapes of CESNET servers and deleted from space.astro.cz server.

Stations produces real-time data streams.

Data streams

Station produces two types of UDP/IP data streams. This streams is possible to use with PySDR or Freya visualisation software. First data stream is uncompressed and contains all AD converter data. This stream is intended for debuging purposes. Second data stream contains compressed data and is suitable for visualization purposes.

Meteor events

When a meteor is detected, station makes TCP/IP request with some basic properties of event. This stream is used for real-time visualisation on station map.

Standardized data access

Although the data are available from central storage server via HTTP web page it is not suitable for browsing and searching for required data programmatically. Old backuped-up data are not accessible in real-time and they must be requested.

Therefore stored data are indexed in MLABvo database. MLABvo API provides us simple access to data based on parameters such as station, type of data (snapshots, meteors, multibolids), time, meteor duration, etc.

MLABvo can also obtain and provide backuped data from magnetic tapes. It is based on 'jobs model' where client send query for data and gets a 'job-id'. Server required data collect and prepare them for fast access. Client download data based on obtained job-id.

Python access

Because most of the processing software we have written in python, we have prepared a python library for easy access to measured data on storage serveres and MLABvo databases.

Several processing scripts are prepaced in Jupyter python notebooks.

RTbolidozor

RTbolidozor (Real-Time Bolidozor) is web interface for simple visualisation of measured data. RTbolidozor provides several types of outputs.

http://rtbolidozor.astro.cz/

Multicount

Multicount is colorgram like graph, which shows count of detection per one time period. It shows number of detections from all stations in one chart. Each station has own position within one time rectangle. Position is visualised on gray square. Click on the station name displays the data for selected station (*figure 3*).

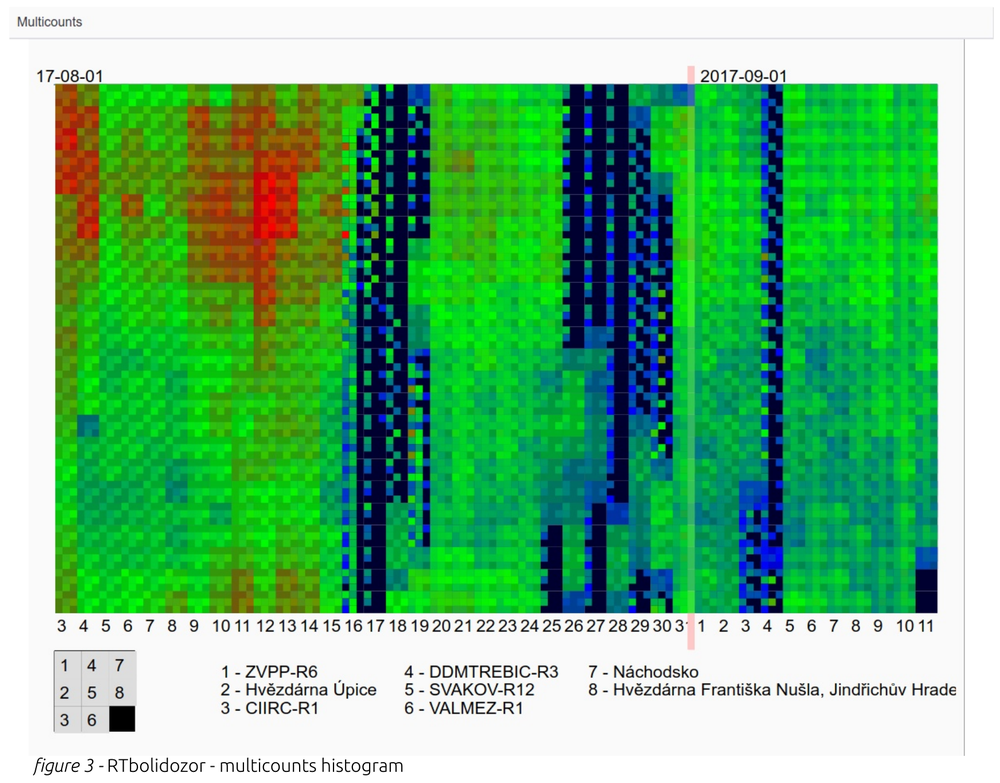

figure 3 - RTbolidozor - multicounts histogram

Real-time map

Real-time map show radio-meteor detections in real-time on map of stations. When some meteor is detected, source station blinks and sound is played. Next to the map is possible to see last detected meteors.

Multibolid

Multibolid part contains list of multi-station bolids. Match is detected by time of event and lenght of record. Every multi-station event is marked with unique id for simple access with MLABvo tools. It is useful for choosing interesing bolides for future processing. In web interface are links to easy access to the corresponding snapshots.

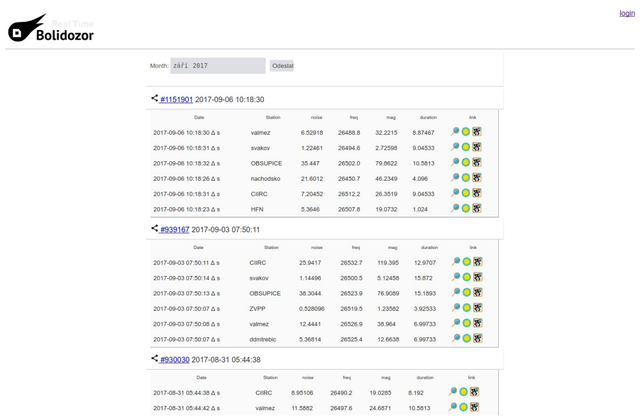

figure 4 - RTbolidozor - multibolid

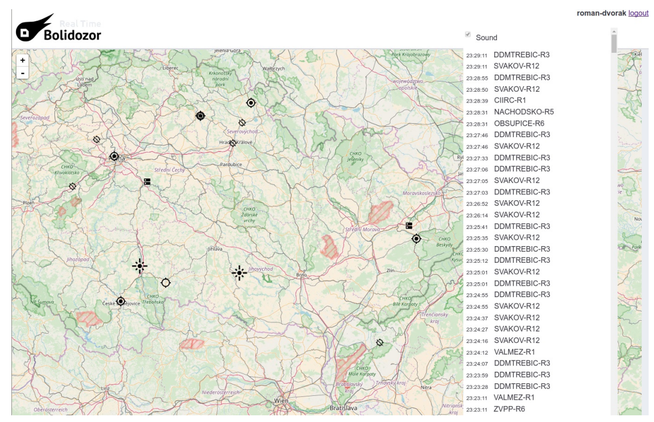

figure 5 - RTbolidozor - real-time map of meteor detections

space.astro.cz

Data on main storage server are browsable with file index web page or with javastript JS9 fits viewer.

http://space.astro.cz/bolidozor

Bolidozor RMOBmultigen

RMOB histograms are generated centrally from data on the storage server (space.astro.cz) on processing server meteor1.astrozor.cz. It provides us simple updates of program and smaller detecting computers usage.

PySDR

PySDR is python software for live 2D waterfall display of measured data.

Freya

Freya is another python 3D visualisation software which uses reduced data stream. Next to the video representation it generates sound in which is possible to hear meteors as whiste. Freya uses reduced data-stream, so it is suitable for permanent presentation (e.g. on observatories for visitors) or for streaming trought internet. It can be run on Linux OS as well as on Windows OS.

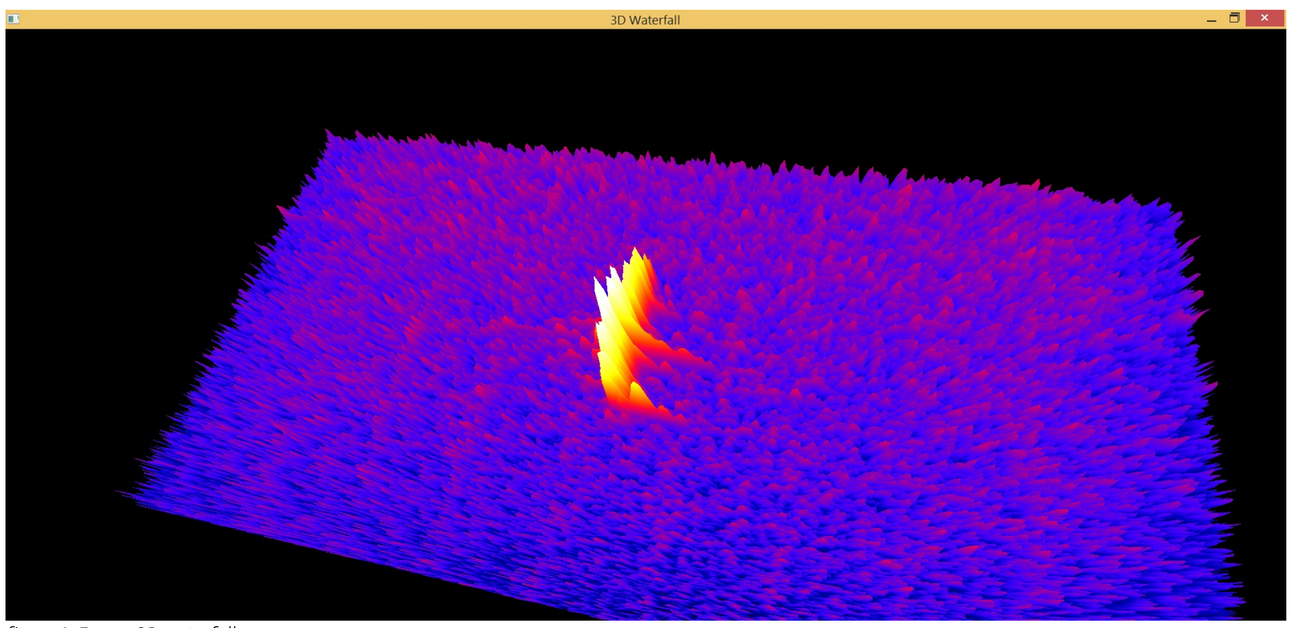

figure 6 - Freya - 3D waterfall