CALLISTO status report/newsletter #99

New station in Croatia-Visnjan

Fig. 1: LPDA CLP-5130 with Sun-tracker

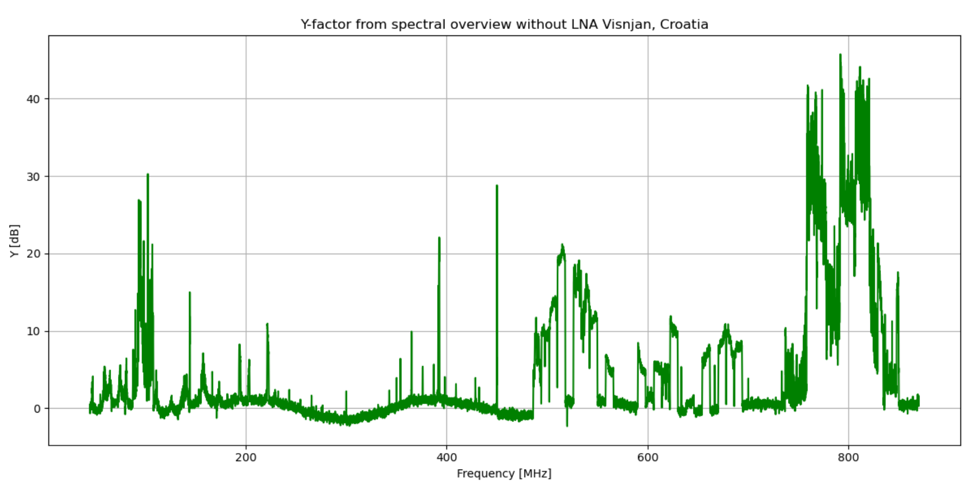

Fig. 2: Spectrum taken without LNA. Strong DVB-T and FM-Radio

Welcome Croatia on the e-Callisto network

New station in Taiwan

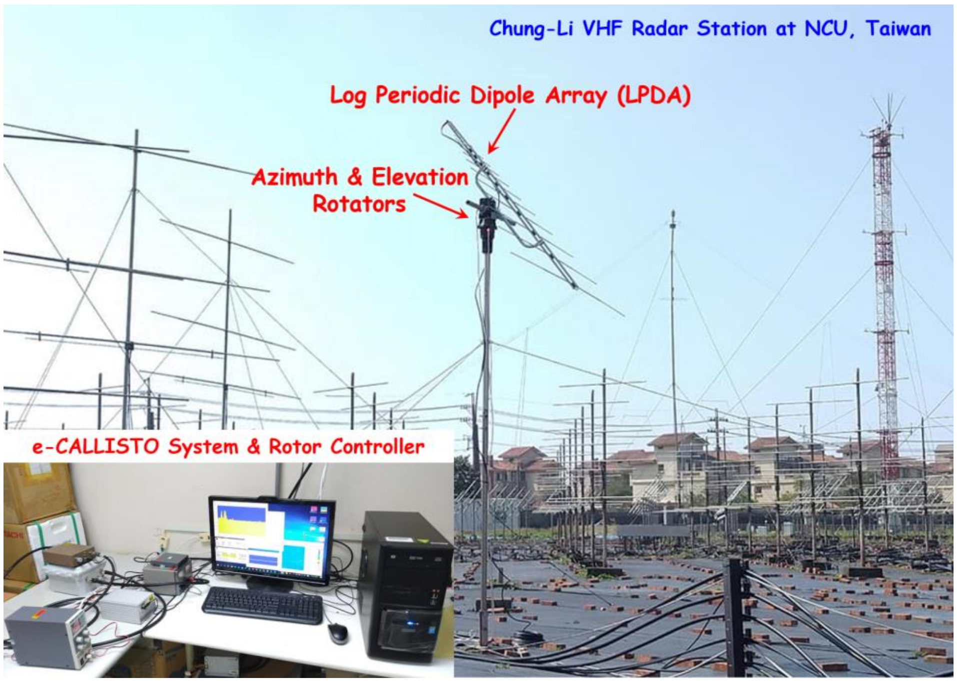

Fig. 3: Antenna farm in Taiwan.

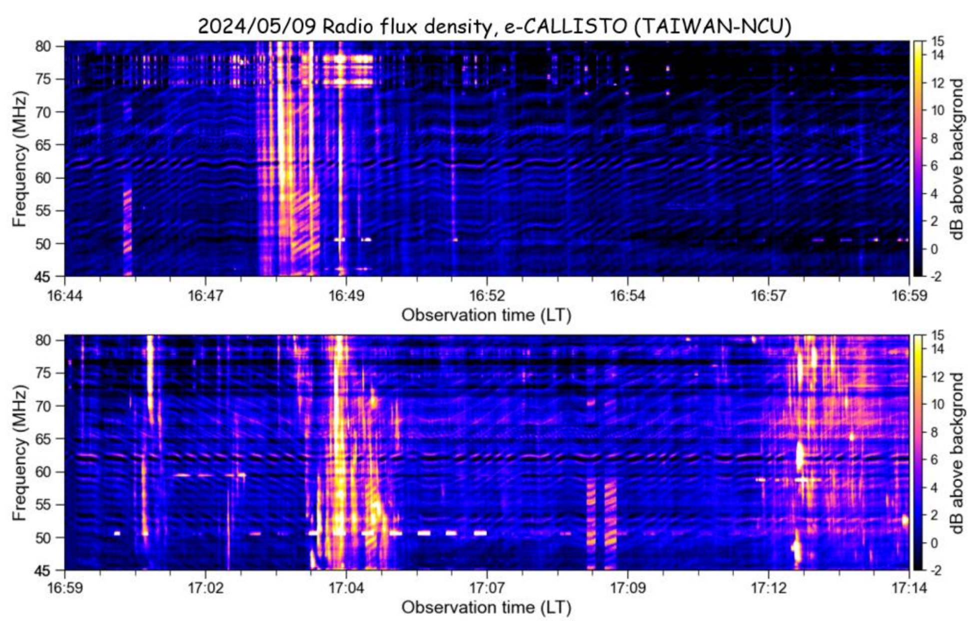

Fig. 4: Type III solar radio burst observed in Taiwan

Welcome Taiwan on the e-Callisto network

New station Italy-Strassolt

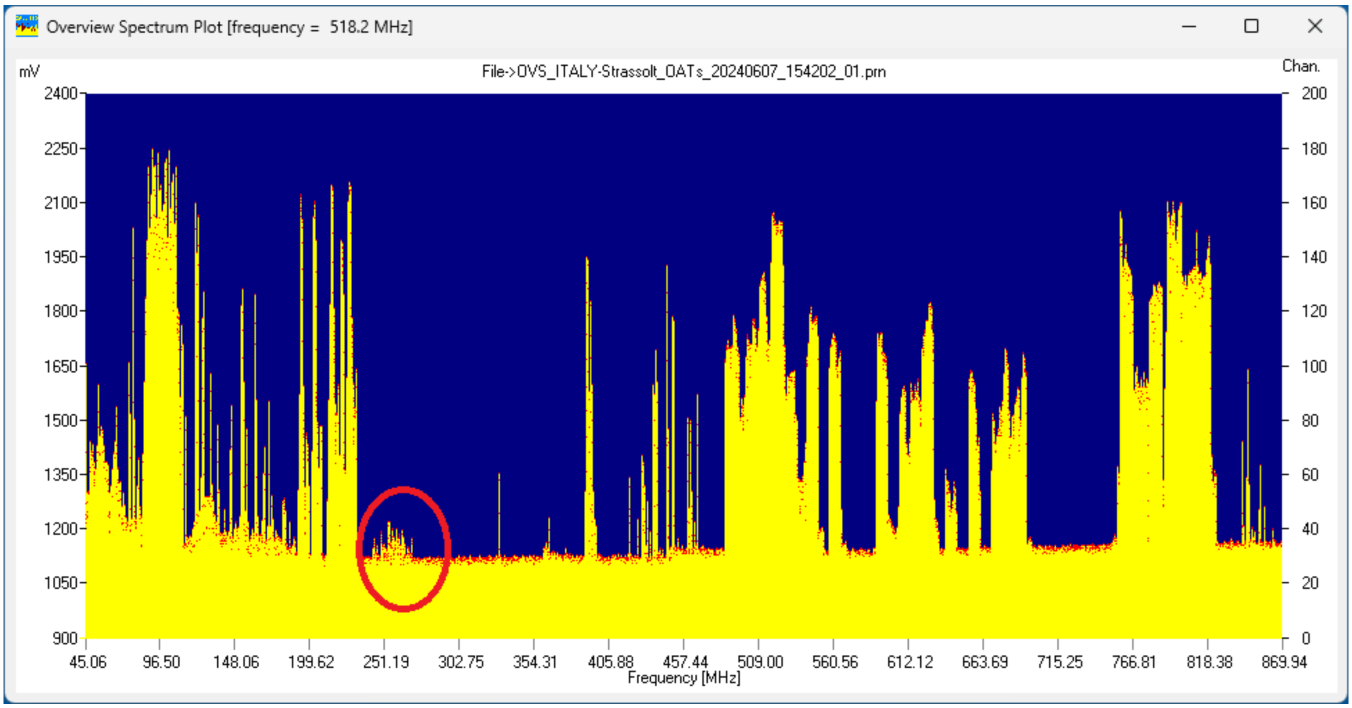

Fig. 5: Spectral overview Strassolt, Italy without LNA. Quite severe level of interference FM-radio, DAB-T and DVB-T. Red circle shows satellite downlinks.

Welcome Italy-Strassolt on the e-Callisto network

Announcement by Jimmy Fitzpatrick, University of Glasgow

SPECTRE - an open-source Python program for recording radio spectrograms

High-level Overview

SPECTRE is a Python-based program, designed to capture, analyse and visualise radio spectrograms. It is composed of three primary components:

- `spectre-host` - a containerized environment (powered by gnuradio) for recording radio spectrograms, which includes an accompanying CLI tool.
- `spectre` - a set of standalone Python modules which form the back end of the program
- `spectre-client` - a web-based application for viewing and analysis (planned for the future)

The software has direct application to radio astronomy. In fact, I am currently using it for daily solar observations; I have attached an example of a group of type-III bursts around 68MHz captured using SPECTRE and my home-brew half-wavelength dipole.

Features

Compared to the current tooling available (e.g. Radio-Sky Spectrograph), my new framework offers several new features.

Simple set-up, simple usage!

- Using Docker, I have successfully containerized `spectre-host`, which handles the radio spectrogram recording. So, installation of the software is simple.
- The `spectre-host` container comes preinstalled with gnuradio, custom OOT modules, my program, and a user-friendly CLI tool for capturing data.
- The CLI tool makes it very simple to start capturing radio spectrograms. As a brief example, to start collecting radio spectrograms using an RSPDuo in single tuner mode using a set of configuration parameters tagged by "sometag", the user only needs to run two commands:

```
spectre capture start-watcher --tag sometag
spectre capture start --receiver RSPDuo --mode tuner_1_fixed --tag sometag
```

Arbitrary receiver support

- Using an abstract framework, SPECTRE can support any radio receiver with a source block in gnuradio.
- Each receiver can support an arbitrary number of "modes" of data capture.
- For example, I have included the RSP1A and RSPDuo receivers from SDRplay into the program, with RSPDuo supporting both single and dual tuner modes.
- For each receiver in the program, and each mode of the receiver, the code supports custom configuration files and validation scripts. The configuration files contain all the required parameters for the data collection, where you can specify e.g. receiver specific and ShortTimeFFT parameters.
- These configuration files can be automatically validated against hardware-specific constraints and other basic checks.

Custom gnuradio OOT module

- I have developed a custom gnuradio sink block in C++ named "Batched File Sink", designed to continuously stream complex data into batched binary files. Each file is named via [start time of first sample] _[user specified tag].bin and organized into a parent directory of choice based on the date.

- These binary files are then continually transformed into radio spectrograms (saved as .fits files) by SPECTRE as they are collected by the receiver.

Cloud-based web application

For the future, I am currently looking at whether the Google Cloud Platform can work as both remote storage (for the daily collected fits files) and to host the web application for remote viewing. This would comprise the third component of the program: `spectre-client`

Making amateur radio astronomy (slightly!) cheaper

With the framework in place to support arbitrary receivers, I am envisioning that SPECTRE will make amateur radio astronomy accessible to more, at a high-quality standard. Minimally, all you need to get going (for e.g. solar radio observations) is any one of the (potentially large number) of supported receivers and a simple wire antenna.

Summary (Going forward)

Imminently, I am working on systems testing (unit testing and analytical verifications) to ensure that `spectre-host` is working exactly as intended. Additionally, over the next month or so, I plan to implement blocks that facilitate software-based frequency sweeping, designed to be compatible with any source receiver.

Once the testing framework is in place, I am hoping to garner some contributors and build an open-source community to help develop the program. For interest, here is the GitHub repository.

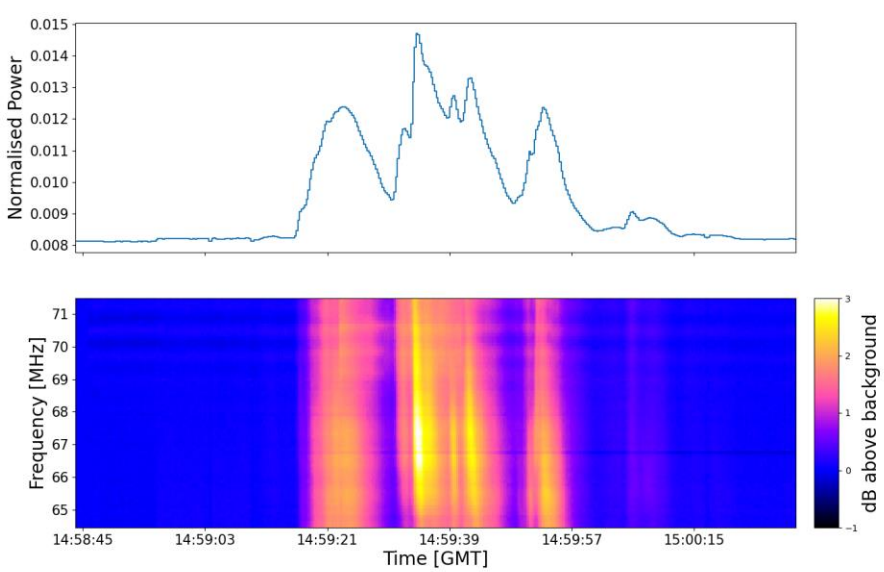

Fig. 6: Dynamic spectrum and light curve of a solar radio burst, observed with SDR and half-wave dipole.

Fig. 7: Half wavelength simple dipole to observe solar radio bursts around 64-72 MHz

e-Callisto burst statistics May 2024

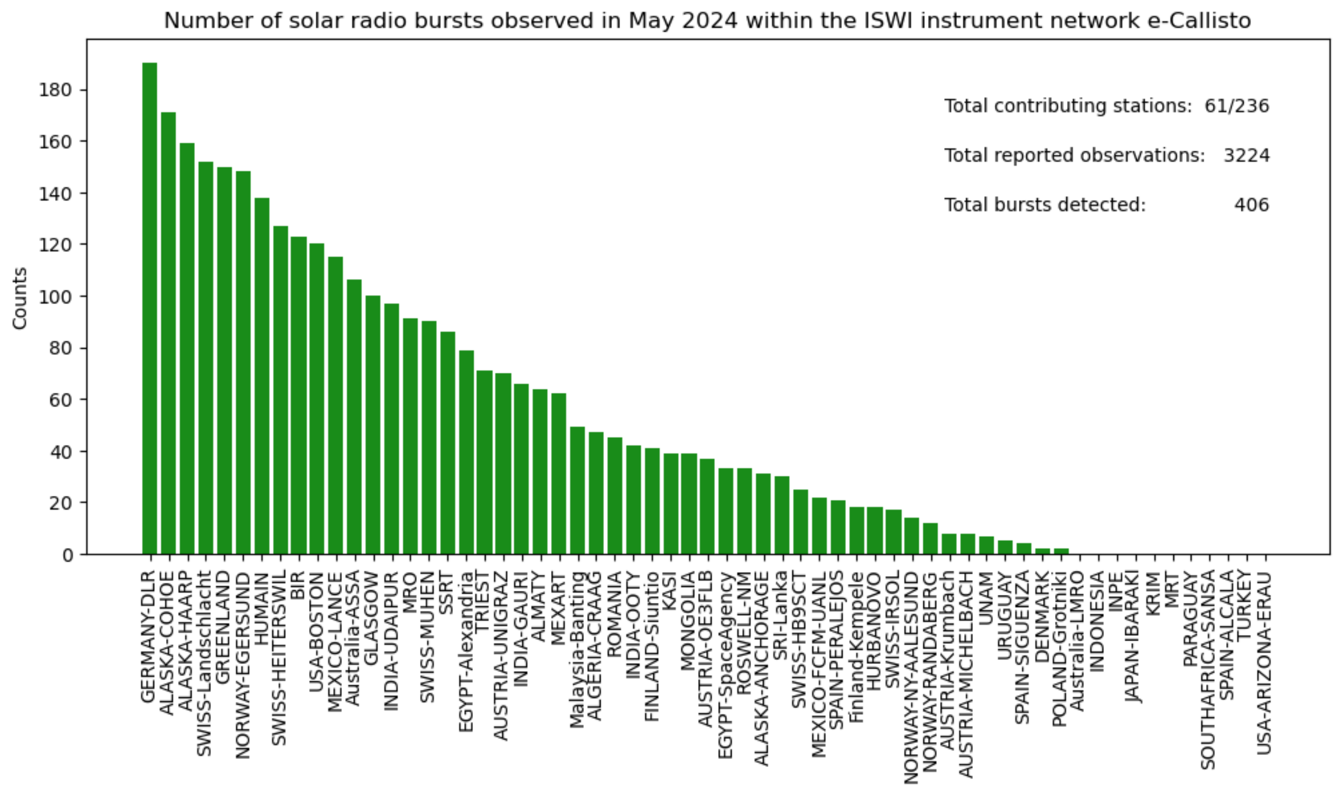

Fig. 7: Compilation of all visually detected bursts from all Callisto-stations which provide data to the e-Callisto network. There are clear 'winners' of the May-'competition', GERMANY-DLR and ALASKA. Still eagerly looking for an AI-solution to automatically generate a burst-list and to save many hours day by day to perform this rather boring job, visual inspection of thousands of FIT-files.

Last 4 burst-plots are always available here: **https://e-callisto.org/Data/data.html**

CESRA NEWS

Solar Microwave Polarization Observed by the Newest and Oldest Solar Radio Telescopes
by Masumi Shimojo
https://www.astro.gla.ac.uk/users/eduard/cesra/?p=3763--

AOB

- If you have some stuff to present to the Callisto community, please let me know
- CALLISTO or Callisto denotes to the spectrometer itself while e-Callisto denotes to the worldwide network.
- General information and data access here: https://e-callisto.org/
- e-Callisto data are hosted at University of Applied Sciences, Institute for Data Science FHNW in Brugg/Windisch, Switzerland. Additionally, data are available at ESA site here: ESA Space Weather Portal (https://swe.ssa.esa.int/).
- University of Alcalá in Spain is also hosting e-Callisto data here: http://212.128.70.189/ From now on Bussons Gordo Javier javier.bussons(at)uah.es from Alcalá is the new Co-PI and will support my activities related to CALLISTO instrument and e-Callisto network.
- In case you (as the responsible person for operating and maintenance of Callisto) are leaving the institute or, if you are retiring, please send me name and email address of the successor.

Please do **NOT** respond to the email-address of the list-server where you have got this document from, it is a computer/robot. This computer will not give you any useful answer…
Respond instead directly to me at: cmonstein(at)swissonline.ch or to the new Co-PI javier.bussons(at)uah.es

If you do not want to receive this newsletter, please send me an email and we will take your address out of the database. On the other hand, if you think someone else might be interested in this kind of info, please let me know his/her email-address to be added to the database.

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