

Software Development for Data Analysis at SRT

Work supported in the frame of the project

"CIR01_00010 - Potenziamento del Sardinia Radio Telescope per lo studio dell'Universo alle alte frequenze radio - rafforzamento del capitale umano"



UNIONE EUROPEA
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*Ministero dell'Istruzione,
dell'Università e della Ricerca*



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OSSERVATORIO ASTRONOMIC DI CAGLIARI

Outline

Quick-Look tool for online data analysis at SRT

Basics Structure Pulsar Webpage Layout

Software for data analysis and RFI excision

Logic Implemented Real Example

Outlook

Quick-Look [Basics]

The application is being developed as a webpage

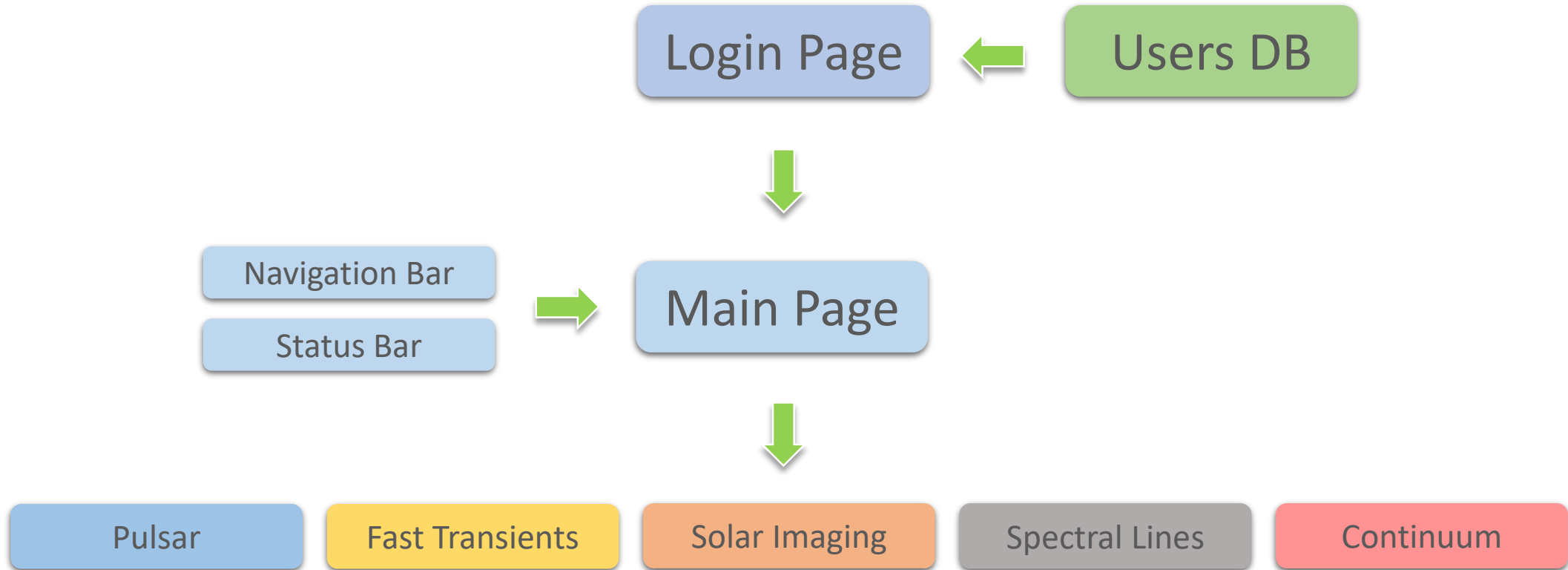
It will allow external users to perform data analysis without being necessarily on site



HTML, CSS, JavaScript, BootStrap

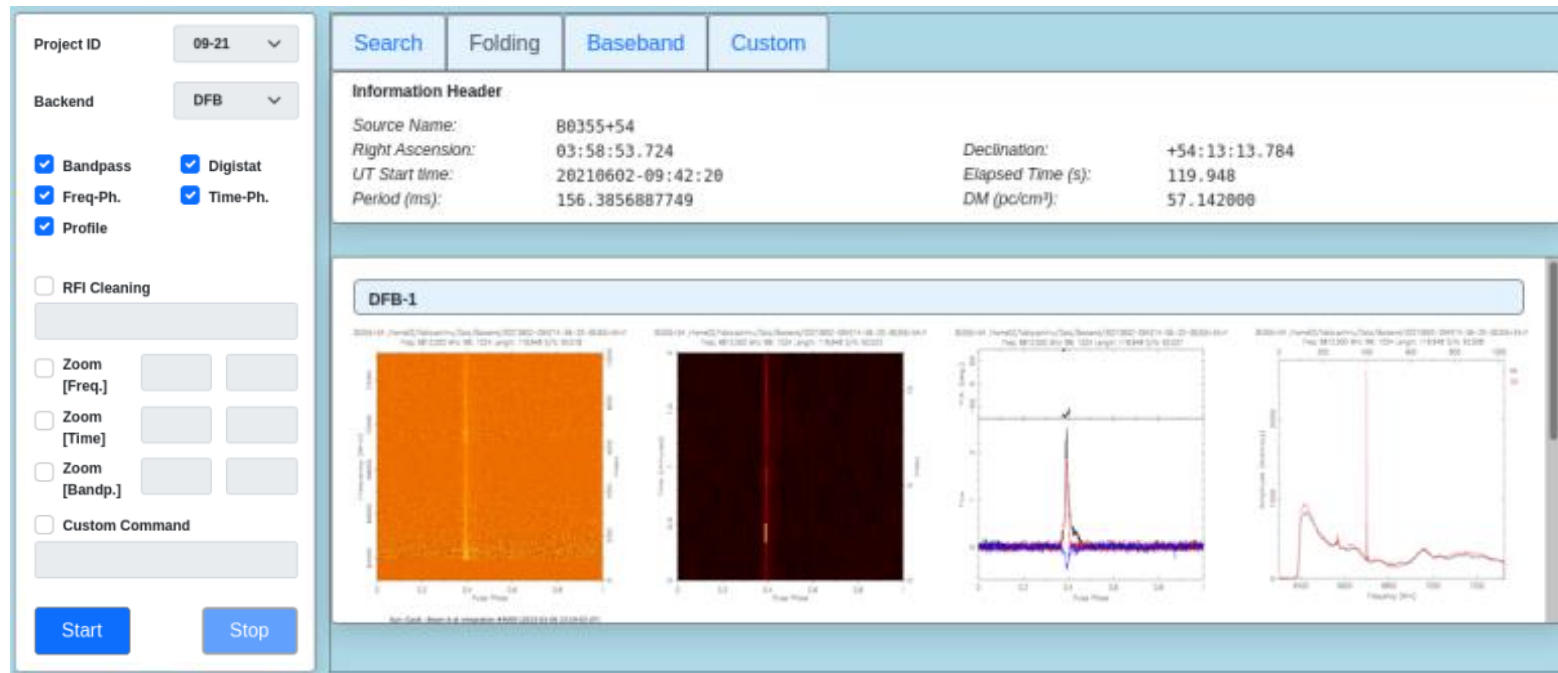
Python (Flask)

Quick-Look [Structure]



Each research theme will have a dedicated GUI

Quick-Look [Pulsar Webpage Layout]



Functions

RFI Cleaning

Zooming

Custom Plots

Working Principle

New file-related events are inspected in a folder specified via the *Project ID* field



Data processing



Graphs are stored and sent back to the user interface

RFI Excision [Logic under Exploration in Freq Domain]

Signal $[A_i(t), \varphi_i(t)]$



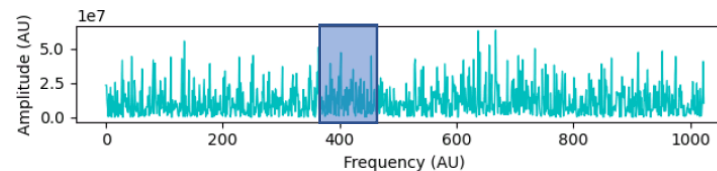
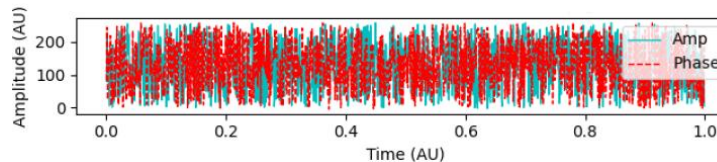
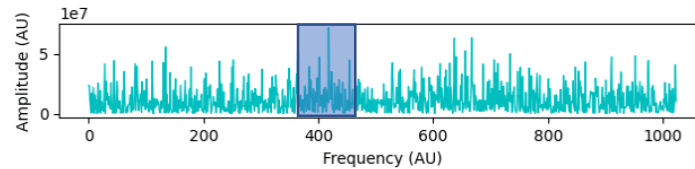
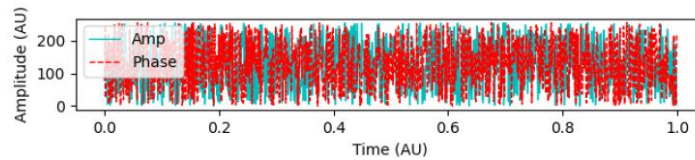
FFT Coefficients



Correction + IFFT



New Spectrum



Unwanted FFT coefficients are replaced by:

$$x = |z|(\cos \varphi + i \cdot \sin \varphi)$$

where:

- $|z|$ corresponds to the RMS of the FFT coefficients (channel 0 excluded)
- φ is the phase of the old FFT coefficient

RFI Excision [Real Case]

RFI peaks are detected with the moving average method which uses two input parameters:

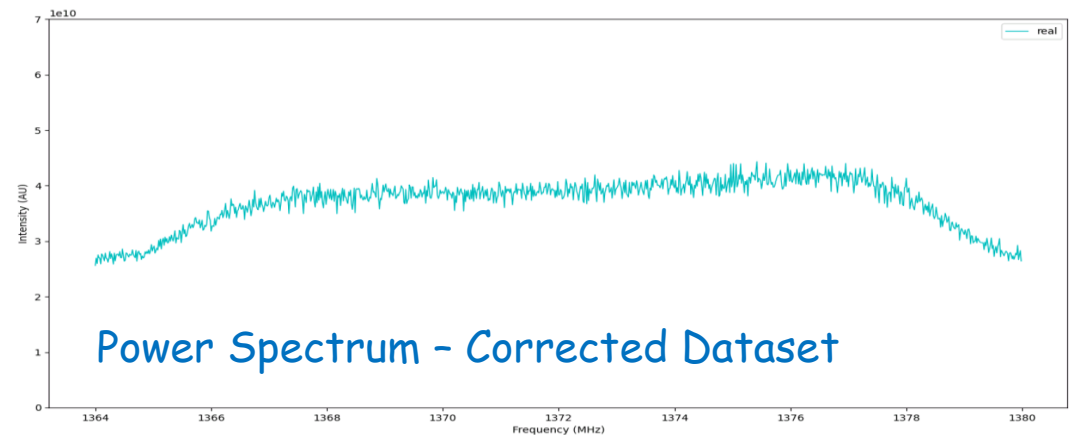
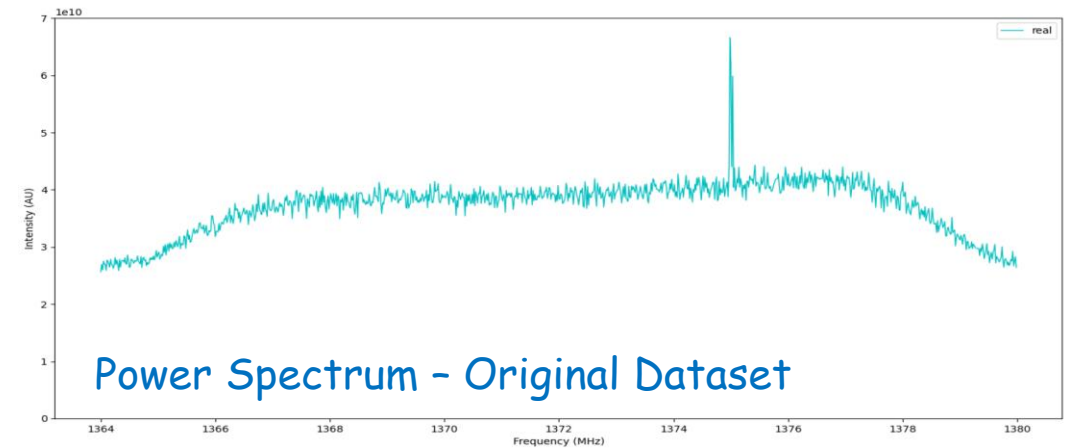
Window-Width

Threshold

$$P_i = \frac{p_i - \mu}{\sigma}$$

The signal, obtained by performing an IFFT on modified FFT coefficients of the original signal, leads to the expected power spectrum.

Issue: unsurprisingly, the signal also exhibits a wider range of amplitudes and phases, outside the range of 8-bit unsigned integers of the original data, requesting an alternate modification scheme of the original data for cleaning the major RFI in the frequency domain.



Outlook

Quick-Look tool for online data analysis at SRT

Finalize the Pulsar webpage (enabling zoomed plots)

Perform real-time acquisition tests

Develop additional webpages dedicated to other scientific themes

Software for data analysis and RFI excision

Implement a user friendly interface for offline analysis

Investigate alternative methods for data handling, also in time domain