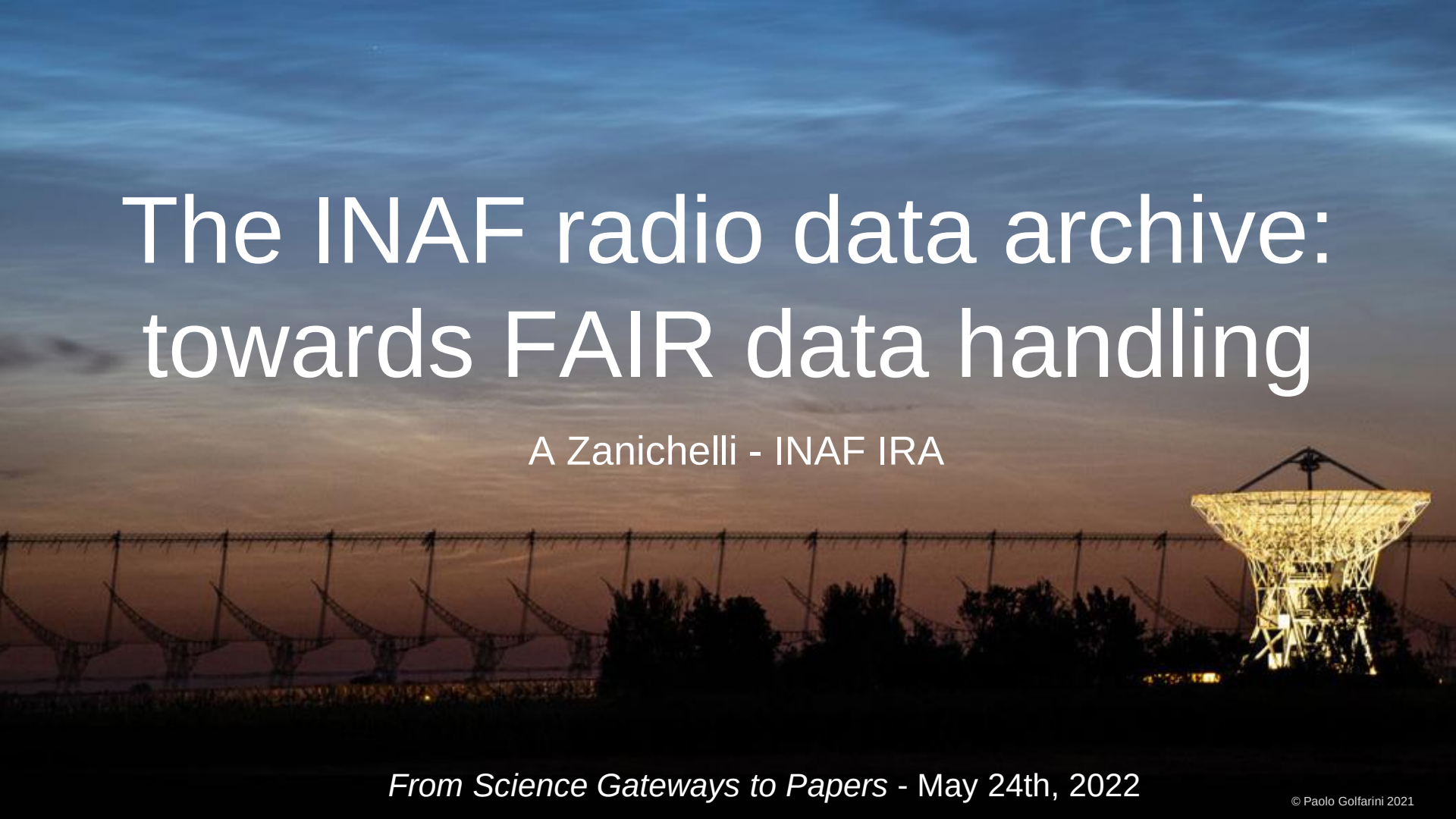
The INAF radio data archive: towards FAIR data handling

A Zanichelli - INAF IRA



From Science Gateways to Papers - May 24th, 2022

The INAF radio telescopes

Observing modes:

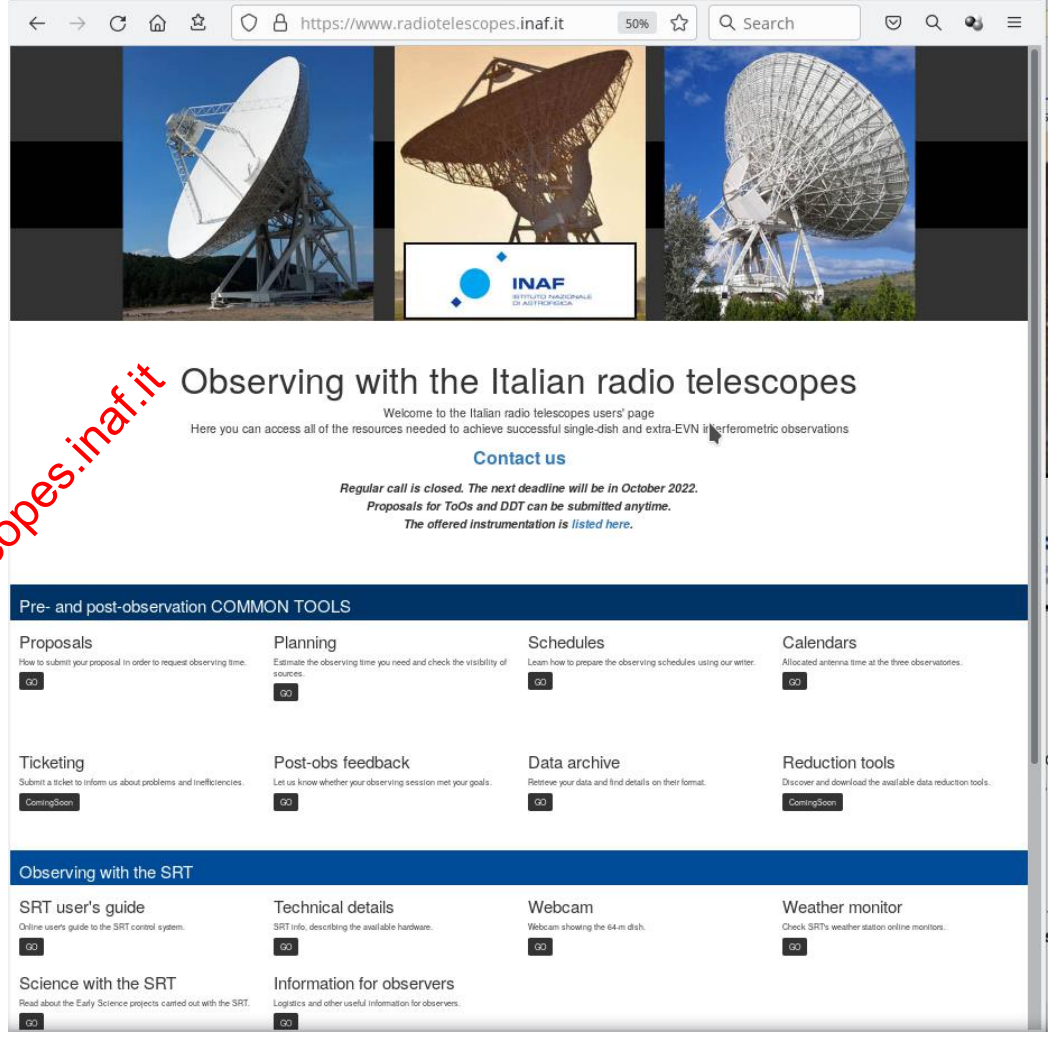
SD

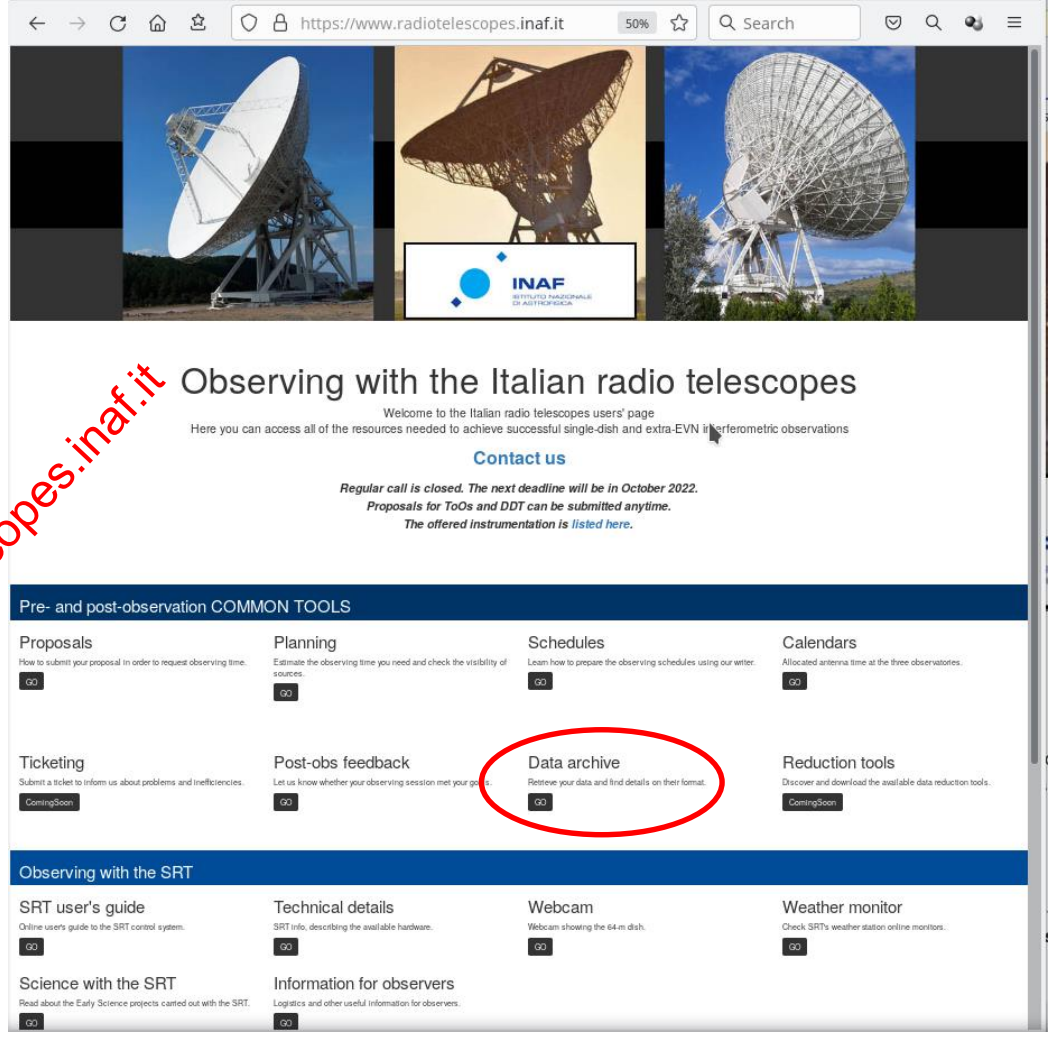
Pulsar

VLBI

Share the same control software and data format

In operation: 300 MHz – 26(+) GHz
Total intensity, spectropolarimetry





The INAF radio archive Working Group

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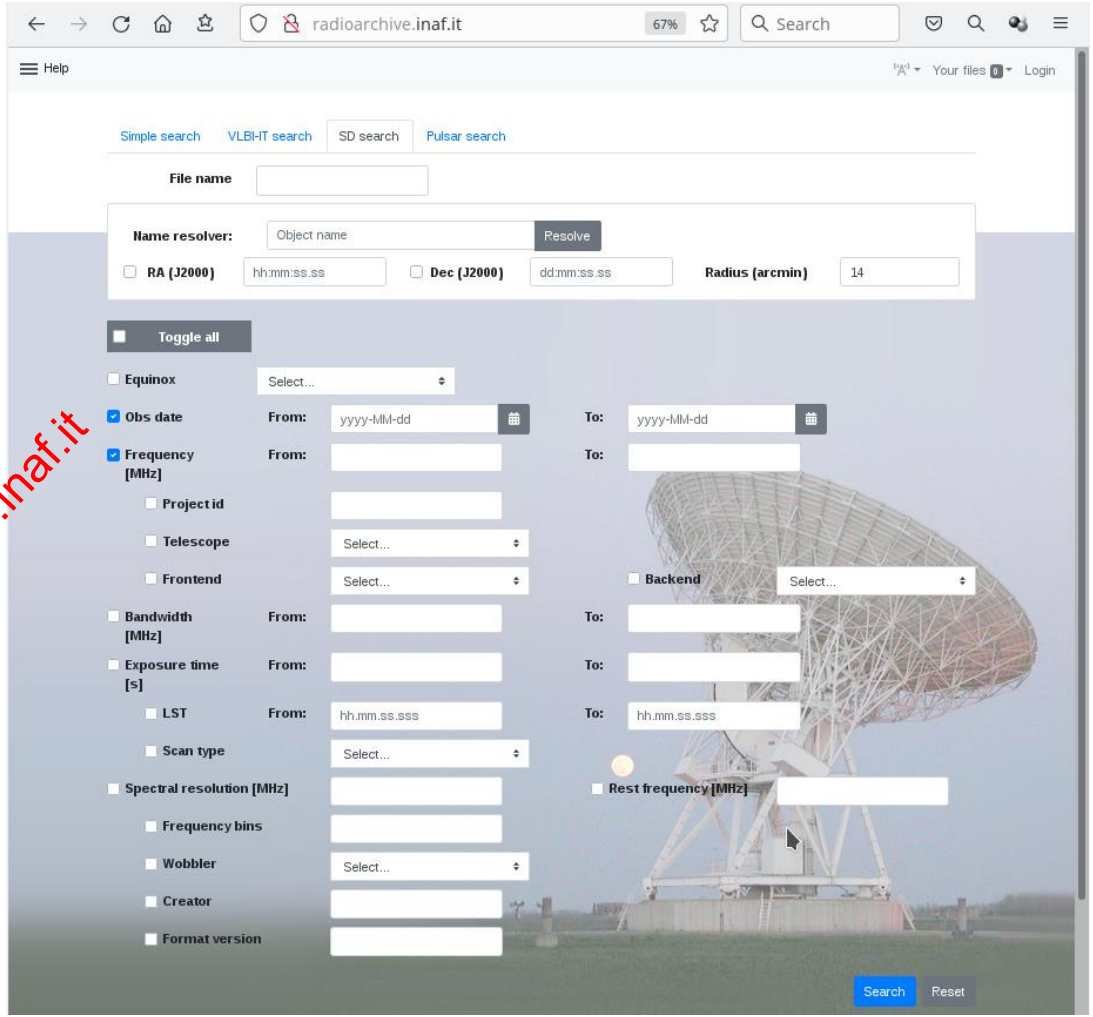
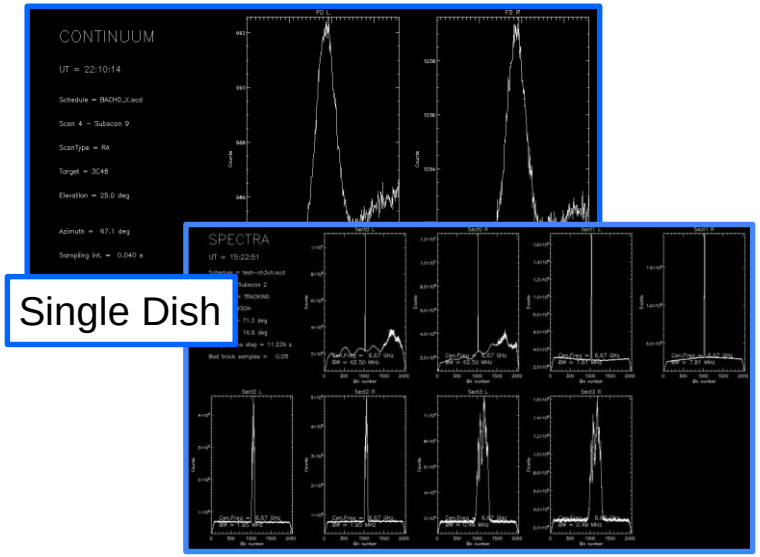
WARNING!
Only raw data, at the moment

http://radioarchive.inaf.it

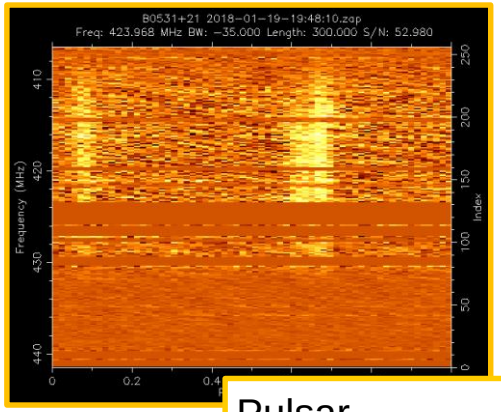


Progressively being populated with SD, pulsar and VLBI-IT data (VLBI-IT = software correlated in Bologna)

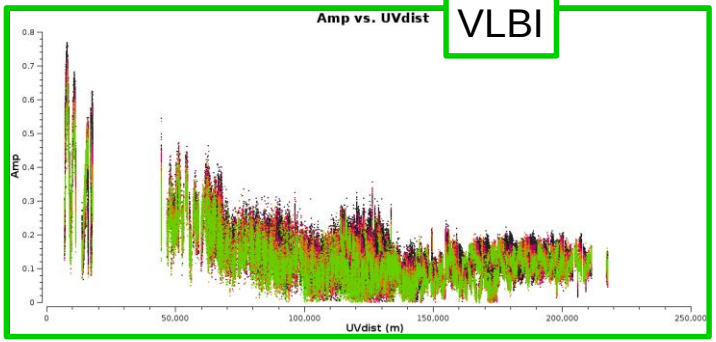
Variety of data types



Single Dish



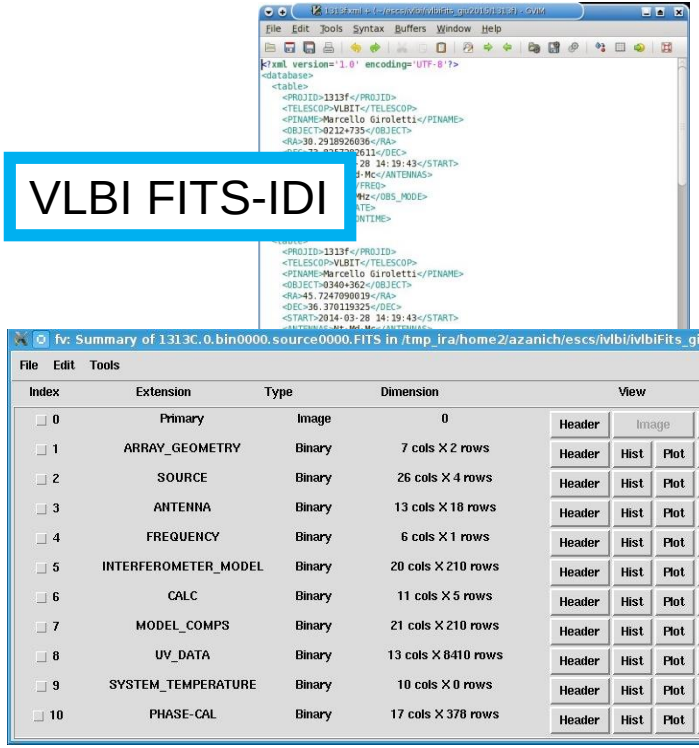
Pulsar
Single Dish/VLBI

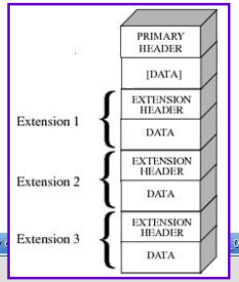


VLBI

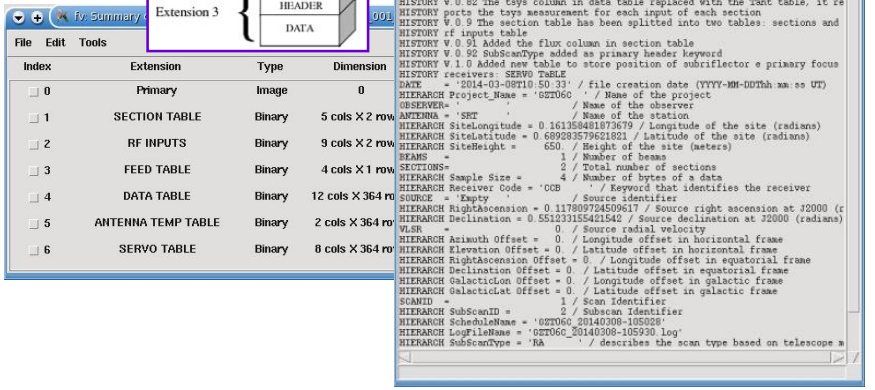
Data formats

VLBI FITS-IDI





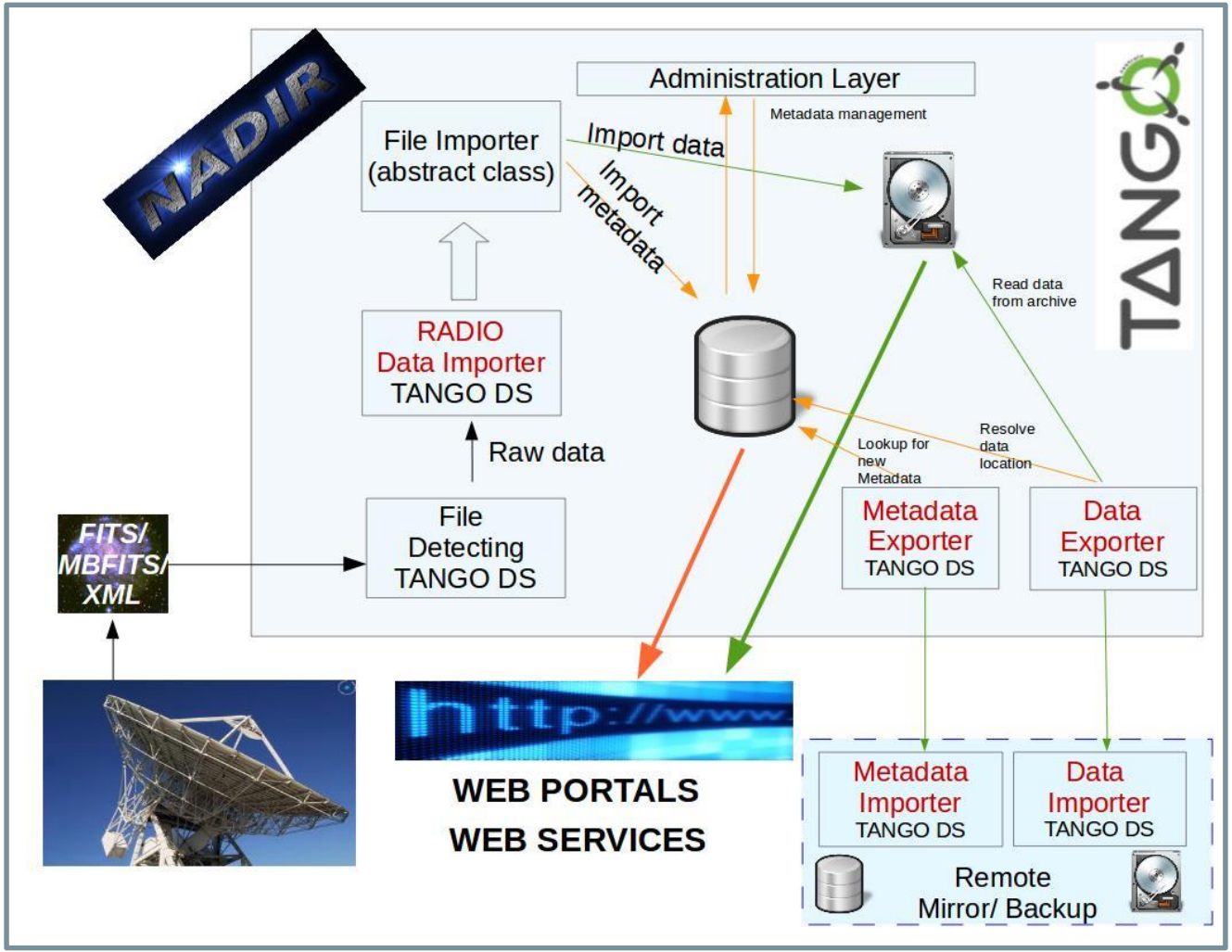
Single-dish FITS



Pulsar data
(PSRFITS, Filterbank)

The radio archive architecture

New
Archiving
Distributed
Infrastructu**R**e



Towards FAIRness

- Archived raw data must be discoverable and (re)usable

- Variety of observing projects and heterogeneity of the data:

  accurate characterisation ⇒ scientific exploitation of the Archive

- General users must be able to address
  - ✓ if the data are suitable their own research
  - ✓ if all the necessary information for data exploitation is available

- Global data discovery and access requires to expose a uniform, standard data model

The IVOA Radio Interest Group

“Enhancing interoperable data access to radio data has become a science priority within the International Virtual Observatory Alliance (IVOA). This lead to the foundation of the IVOA Radio astronomy Interest Group…Together they are paving the way to a better integration of their services in the virtual observatory (VO) infrastructure and propose extension of IVOA standards to help achieving this goal. ” (Louys et al 2020)

Main tasks:

- development of use cases for data discovery, access and visualization
- identification of metadata concepts needed by radio astronomy data that are not currently supported by the VO

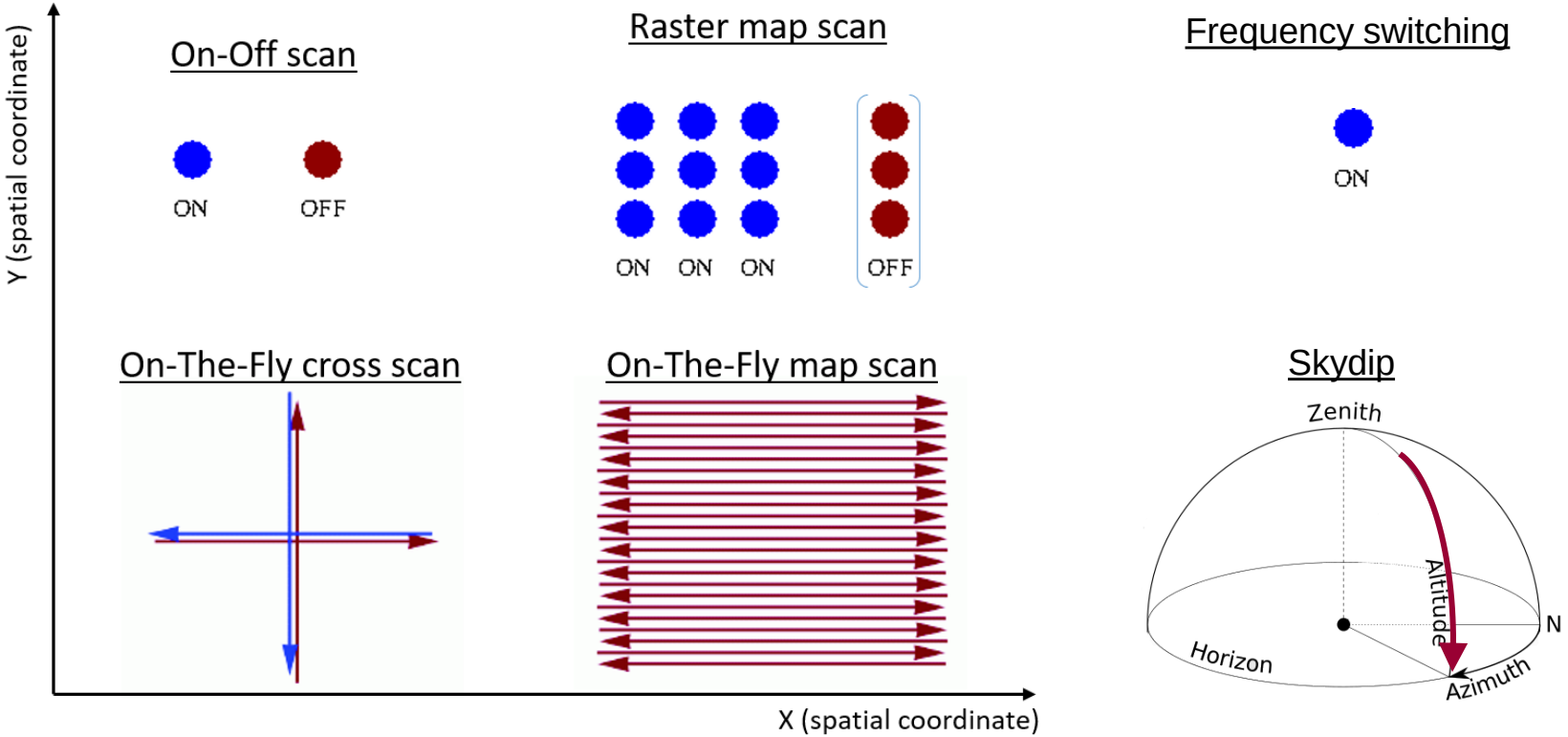
Mapping INAF radio data into VO data models

- INAF radio data are compliant with the mandatory components of the VO ObsCore Data Model for discovery purposes

- However, to improve the discoverability some peculiarities have to be accounted for and better described (especially for SD and VLBI data)

- Example: spatial (geometrical) properties, frequency setup, time domain, UV coverage & c.

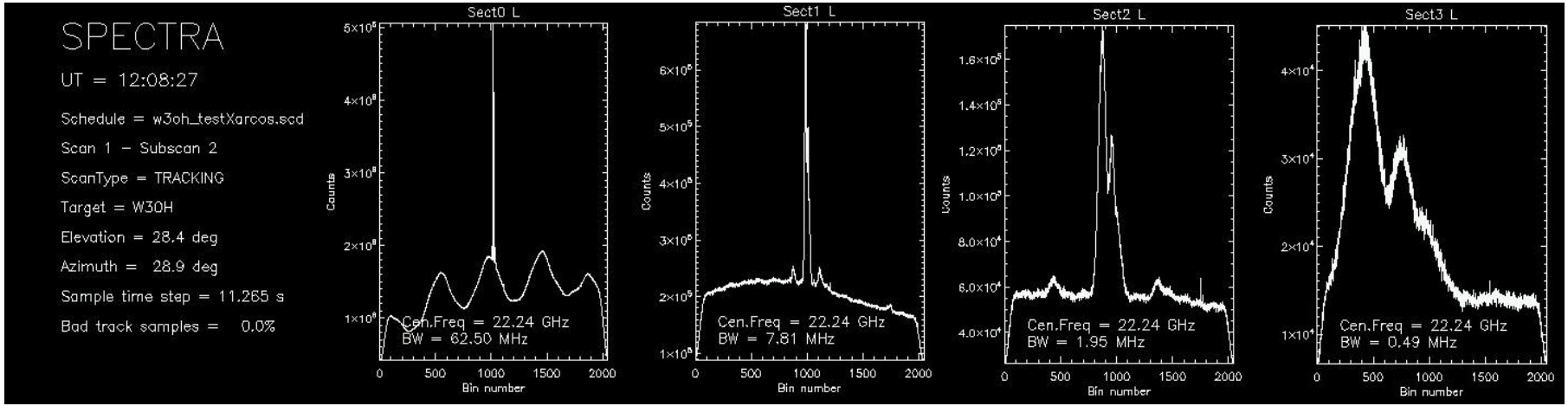
Some examples: single dish & geometry



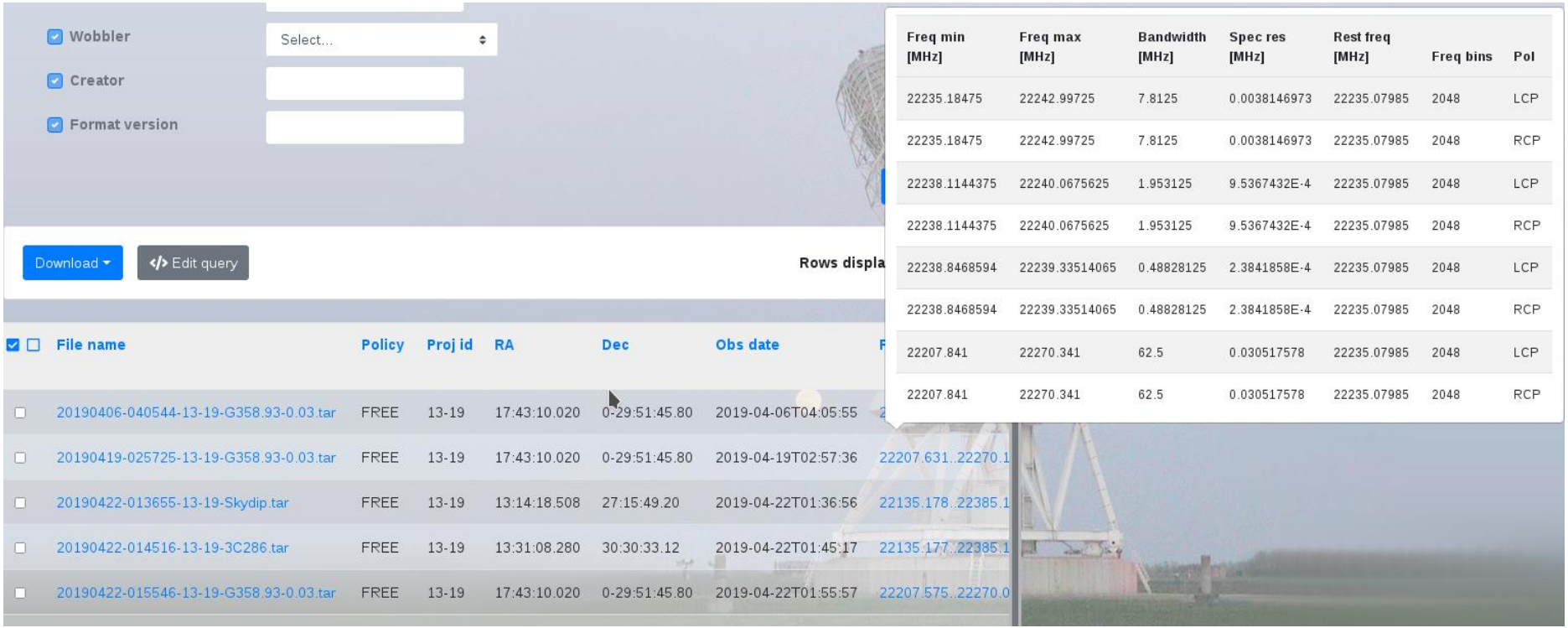
Some examples: single dish & frequency setup(s)

It is possible to have more than one spectral window in the same scan, differing in bandwidth and spectral resolution. Examples:

- each spectral window is centered at a different frequency
- spectral windows at same frequency with increasing resolution (“zoom mode”)



Multifrequency setup



Freq min [MHz]	Freq max [MHz]	Bandwidth [MHz]	Spec res [MHz]	Rest freq [MHz]	Freq bins	Pol
22235.18475	22242.99725	7.8125	0.0038146973	22235.07985	2048	LCP
22235.18475	22242.99725	7.8125	0.0038146973	22235.07985	2048	RCP
22238.1144375	22240.0675625	1.953125	9.5367432E-4	22235.07985	2048	LCP
22238.1144375	22240.0675625	1.953125	9.5367432E-4	22235.07985	2048	RCP
22238.8468594	22239.33514065	0.48828125	2.3841858E-4	22235.07985	2048	LCP
22238.8468594	22239.33514065	0.48828125	2.3841858E-4	22235.07985	2048	RCP
22207.841	22270.341	62.5	0.030517578	22235.07985	2048	LCP
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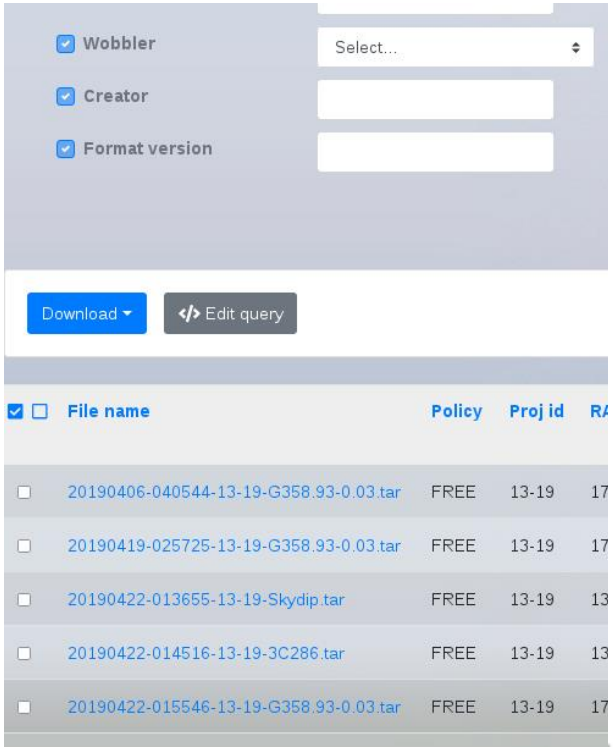
Multifrequency setup



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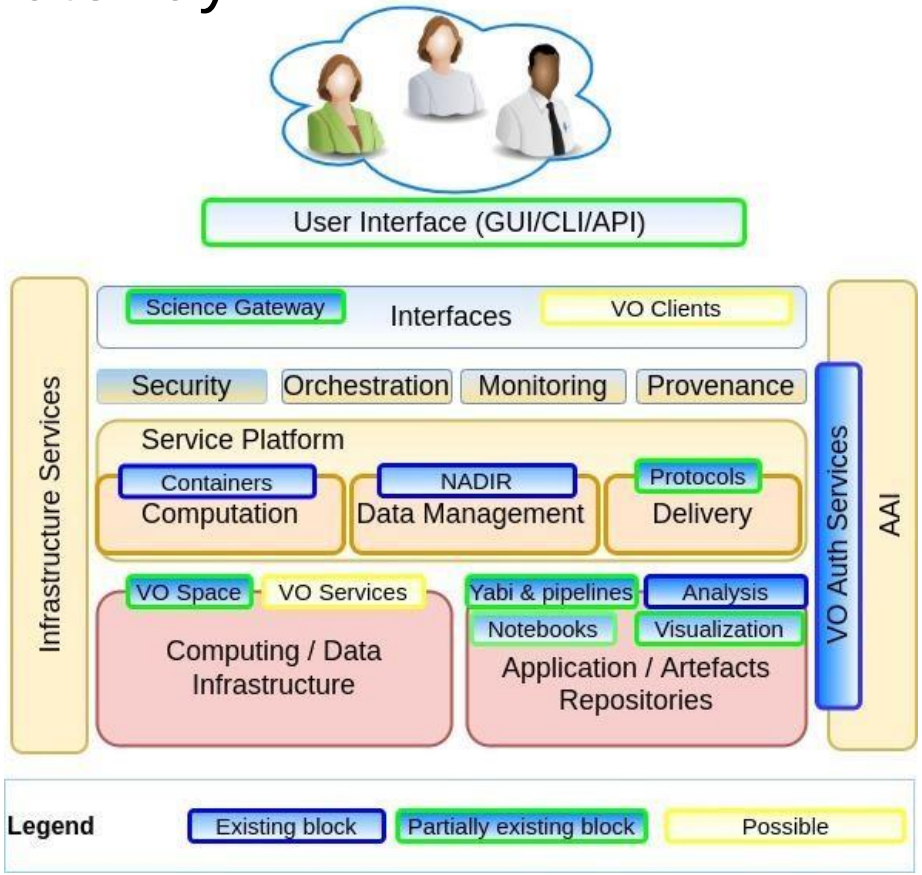
An Italian radio Science Gateway

- Processing pipelines, quality metrics etc.
- Visualisation & graphical information
- Definition of additional metadata to describe the process (reproducibility)
- Build on SKA DC experience/infrastructure



Summary

- Data from INAF radio telescopes discoverable and accessible in a public, web-based archive.
- Almost ready to be discoverable in the VO: publishing coming soon
- Enhance interoperability: the VO RadioIG
- Further steps towards FAIRness
- Towards an infrastructure for discoverability and usability of data: first prototype of Italian Science Gateway