Radio ObsCore Extension

JIVE
Joint Institute for VLBI
ERIC

Mark Kettenis, 29 April 2025

IVOA Radio IG

Formed in October 2019, official IG since 2020?

Charter:

The group shall define requirements for the representation of radio astronomy data in the VO through:

- 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
- the group will provide a well identified point of contact for radio projects with IVOA, and actively encourage their use of VO standards and protocols
- the group will organize sessions focused on radio astronomy data at IVOA meetings

A short history of the ObsCore extension

- Kicked off at Groningen interop in 2019
  - With many major stakeholders in a single room
- Development of search use cases
- Further development in running meetings
- working draft started in 2021
- first more-or-less complete draft in 2023
- Implementation of Working Draft in DAS in 2023
- Attempt to move towards Proposed Recommendation mid 2024
- Formation of HEIG at Malta interop in 2024
- DM WG reconsidering extensions
- Working towards updating ObsCore “core” + reduced Radio extension
  - First step: convert to note

ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructures

eosc

New 2025-04-25 draft
(Thanks Francois & Mireille)

Structure of the Radio document

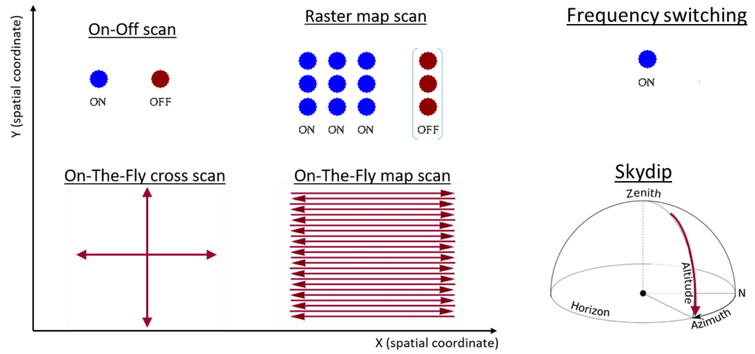
- Explanation of Radio data concepts important for discovery
  - separate sections for single-dish and visibility data
- Discussion of existing ObsCore parameters relevant for Radio
- Definition of new extension parameters
  - Includes formulas for calculating more complex parameters
- Registry considerations (finding TAP services with the new table)
- Appendix A: Use cases

What makes Radio special?

- Single-Pixel “camera”
- Produce images through:
  - Scanning (single-dish)
  - Interferometry (arrays)
- Digital sampling:
  - Easy to add frequency axis
  - Inherently introduces time dimension

Maps instead of Images

Cubes instead of images



ObsCore for Radio

- Some Radio support already included in ObsCore “core”:
  - “radio” mentioned 14 times in the Obscore document
  - **visibility** included as *dataproduct_type*
  - some radio-specific clarification is provided for some concepts (e.g. *s_fov*)
- Large variations of concepts within datasets not addressed
  - For example *s_fov* can vary an order to magnitude
  - Especially true for more recent instruments

New attributes

- Definitely:
  - min/max or existing ObsCore properties: e.g. *s_fov_min/max, s_resolution_min/max*
- Maybe:
  - instrument parameters: e.g. *instr_tel_xxx*
  - single-dish modes: e.g *scan_mode, tracking_type*
    - CTA uses dishes!
- Probably not:
  - UV-plane characterisation: e.g. *uv_distribution_fill*, *uv_distribution_ecc*

Use Cases

- Mostly centred about combining parameters to limit results
  - Calibrater observations are not always useful for science

Give me high-resolution data on possible persistent radio sources within an arc second of FRB 121102:

```
SELECT * FROM ivoa.obscore NATURAL JOIN ivoa.obscore-radio
WHERE CONTAINS(POINT(s_ra,s_dec),CIRCLE(82.99458,33.14794,0.0003)) = 1
AND s_resolution_max < 0.001
```

- Cart behind the horse?
  - Some of the use cases were written down to cover specific parameters
- Some parameters still lack a “science case”

Controversies

- wavelength vs. frequency
  - Radio Astronomers are sloppy themselves (C-band, 4 GHz, 5cm)
  - Spectral resolution is typically defined by a constant frequency delta
- separate extension table vs. extending existing table
  - ADQL join statements
  - Compromise: provide a joined view?
- “VO should only be concerned with science-ready data”
  - No real agreement on what science-ready data is
  - Not FAIR

What did go well

- Managed to engage many of the data providers in the community
- Consensus on parameters

What did not go well

- Decoupled from DM working group
- Use cases are formulated as examples
- Not so much engagement from scientists