Enhancing description of radio data in VO standards

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Discovering Interferometry data – science data

- ObsTap, SIA, and SODA well adapted for 2D-images (continuum) and cubes.
  - may miss frequency ranges in ObsCore
  - LOFAR, APERTIF, ASKAP, ALMA, CGPS, VGPS, etc …
- Also for velocity maps and rotation measures
  - change o_ucd
- HiPS for images and cubes
  - CGPS, TGSSADR, Apertif, etc..

Discovering Interferometry data – visibility data

- Method 1 : DataLink response attached to science data / progenitor (see Alma)

→no actual description

→indirect (2-step) discovery

- Method 2 : ObsTAP (or SIAP2) service. Metadata for description used for discovery.
    - ATCA, ASKAP, MWA, and many others coming
    - → Not that obvious.

ObsCore description of visibility data : issues

- Frequency better adapted than wl for spectral axis description
  - f_min, f_max, char level 2
- Observations may contain
  - several fields
  - various spectral resolutions
  - complex structure of spectral axis
- ->Observation splitted into several datasets.
  - Same obs_id, different obs_publisher_did
  - Several possible « point of view » according to data and scientific requirements will drive different splitting choices

ObsCore description of visibility data : issues

- From visibility data to science cubes : no unique solution. ->
  - Spatial, time, spectral characterization are ranges not fixed values
    - For example there is a fov dependancy to the frequency
    - Could be also affected by a sensitivity / resolution compromise
  - Attempt to give typical rough values
  - More accurate min / max (fov, resolution)
  - Access to sensitivity / response maps and plots
  - Better « characterization » of spatial axis, characterisation of uv axis required.

ObsCore description of visibility data : issues

- Attempt to characterize the Fourier space uvw ?
  - In practice only uv
  - Instrumental details / may give an idea of uv coverage
  - Typical numbers summarizing uv coverage ?
    - Ranges ?
  - Maps and plots
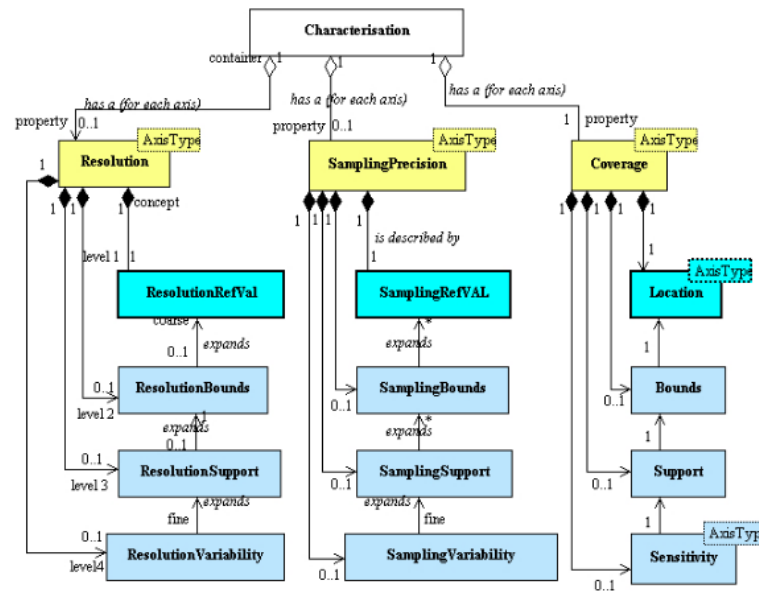
Characterization data model
4 levels

Figure 4: *The layered structure of Characterisation: This diagram synthesises the Property/Axis/Layer approach. The concepts are represented in yellow. The coarse description is designed by the first level (blue boxes), while the pale blue ones represent the complementary metadata. The Bounds, Support and Sensitivity classes are nested levels of detail to add knowledge about the Coverage of an Observation. Symmetrically, Resolution and Sampling may also have the 4-level structure of description. The complete Characterisation for one observation is obtained by filling the tree for each relevant axis: spatial, spectral, temporal, etc.*
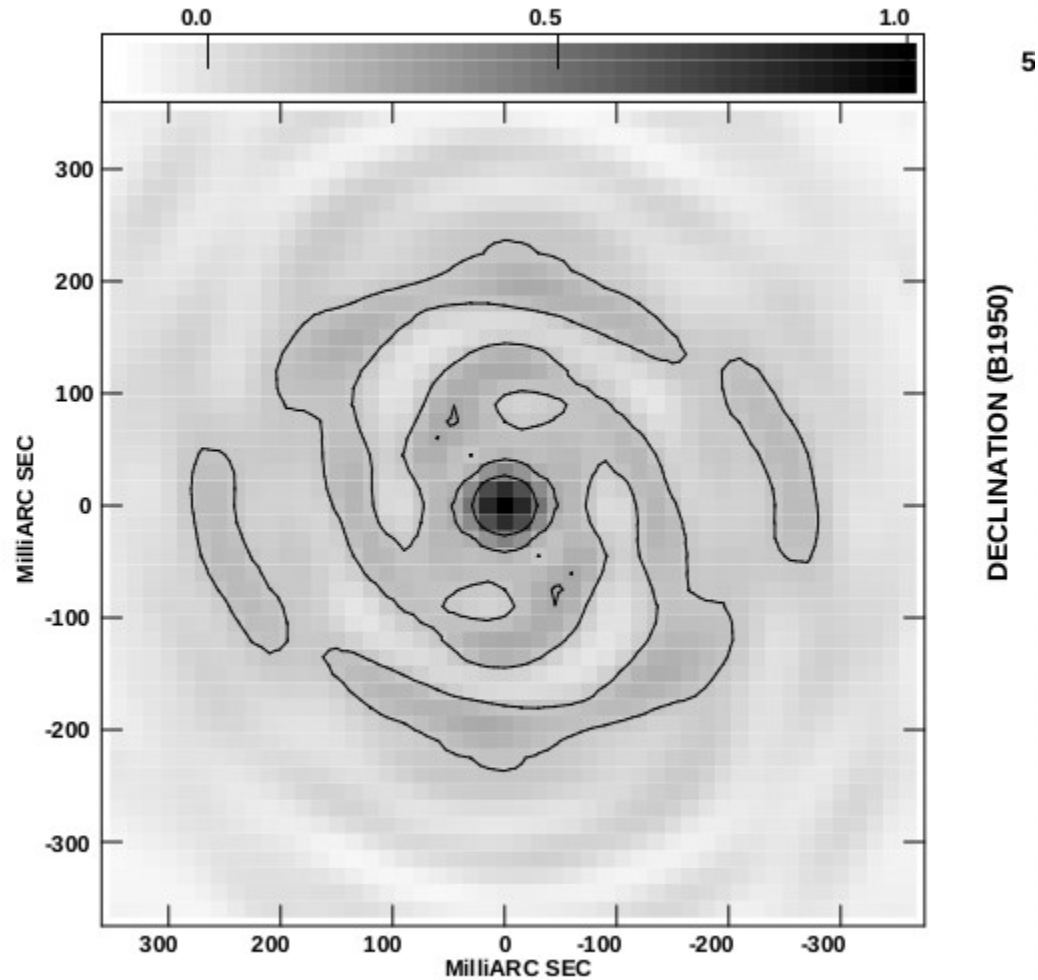
ObsCore description of visibility data : proposals with additions

- Spatial axis :
  - s_fov typical value as lambda/D *(char level 1)*
  - Ranges : s_fov_min, s_fov_max *(char level 2)*
  - s_resolution estimated from longest baseline ? *(char level 1)*
    - s_resolution_min, s_resolution_max *(char level 2)*
  - Beside s_resolution, add s_max_angular_scale (estimated from shortest baseline – *char level 1*)
  - Access to Primary beam and synthesized beam, dirty beam (sensitivity maps : *char level 4*)
    - Non queryable but help for choosing datasets

# Dirty beam : « resolution » level 4

ObsCore description of visibility data : proposals with additions

- instrumental :
  - Telescope/antennae location(s) (data_link?)
  - Number of antennae (instrument_ant_number)
  - Distances between antennae (instrument_max_dist, instrument_min_disc)
- Uv plane characterization
  - uv_distance_min, uv_distance_max *(parametrisation of uv coverage representation : char level 2)*
  - uv_distribution_exc, uv_distribution_fill *(prametrisation of uv coverage representation : char level 3)*
    - → proposal Astron, Mattia Mancini
  - Acces to uv coverage maps or plots (*char level 4*)
    - *Not queryable*

- ***Do we need both intrumental and uv characterization ?***
- ***Are those additions a complement or an alternative to spatial additions ?***

UV coverage plot
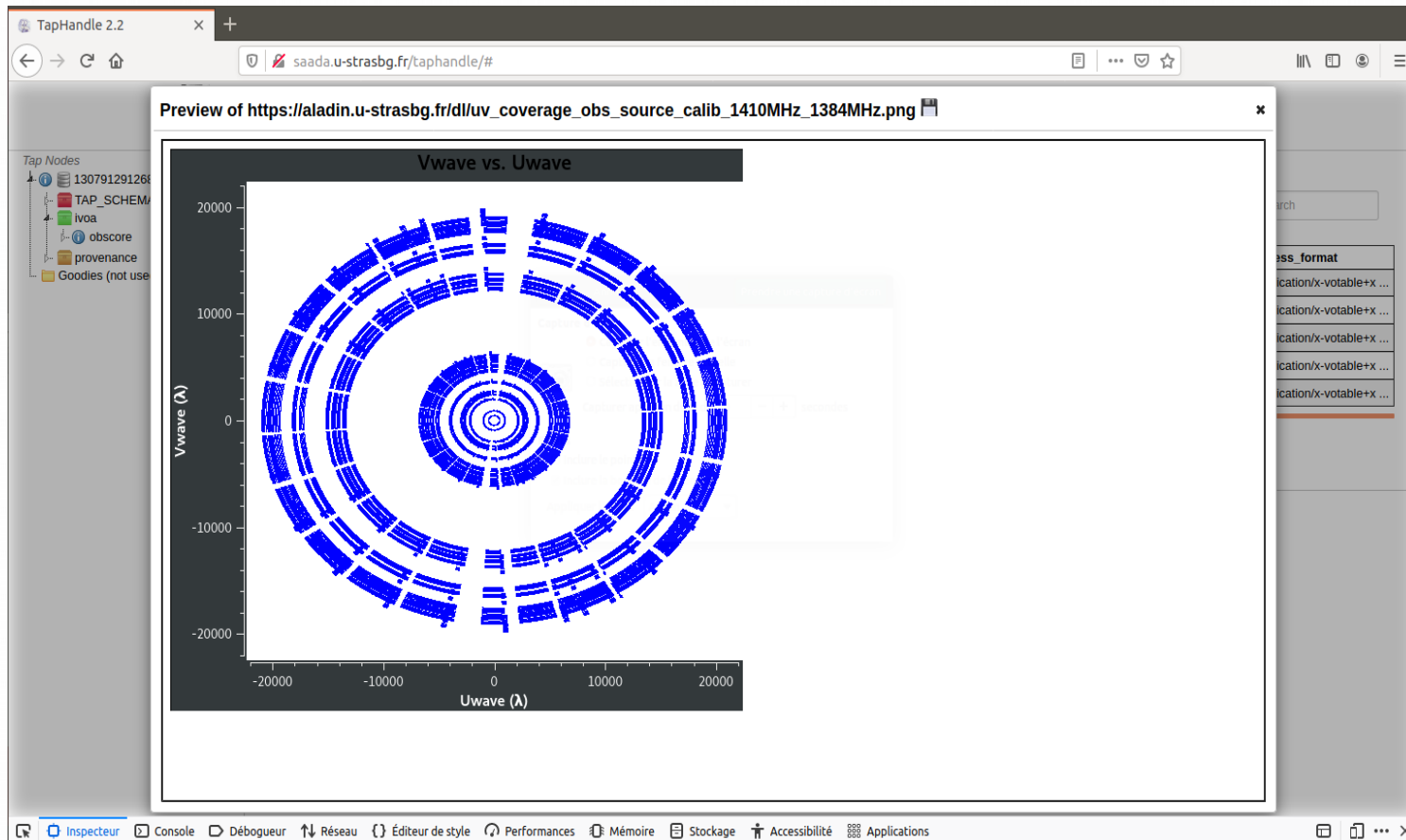
ObsCore description of visibility data : what to do next ?

- Do we need new attribute(s) for characterizing sensitivity ?

- If some of these new attributes are retained :
  - Define new dm_roles in reviewed characterization datamodel for that (for interoperability)
  - Create an extension of ObsCore managed as a secondary table in ivoa schema
    - Radio ? Interferometry?
    - Extensions to Obscore exists (see CADC)
    - See also proposal of an extension for Time Domain (M.Louys, DM, November 18th)