



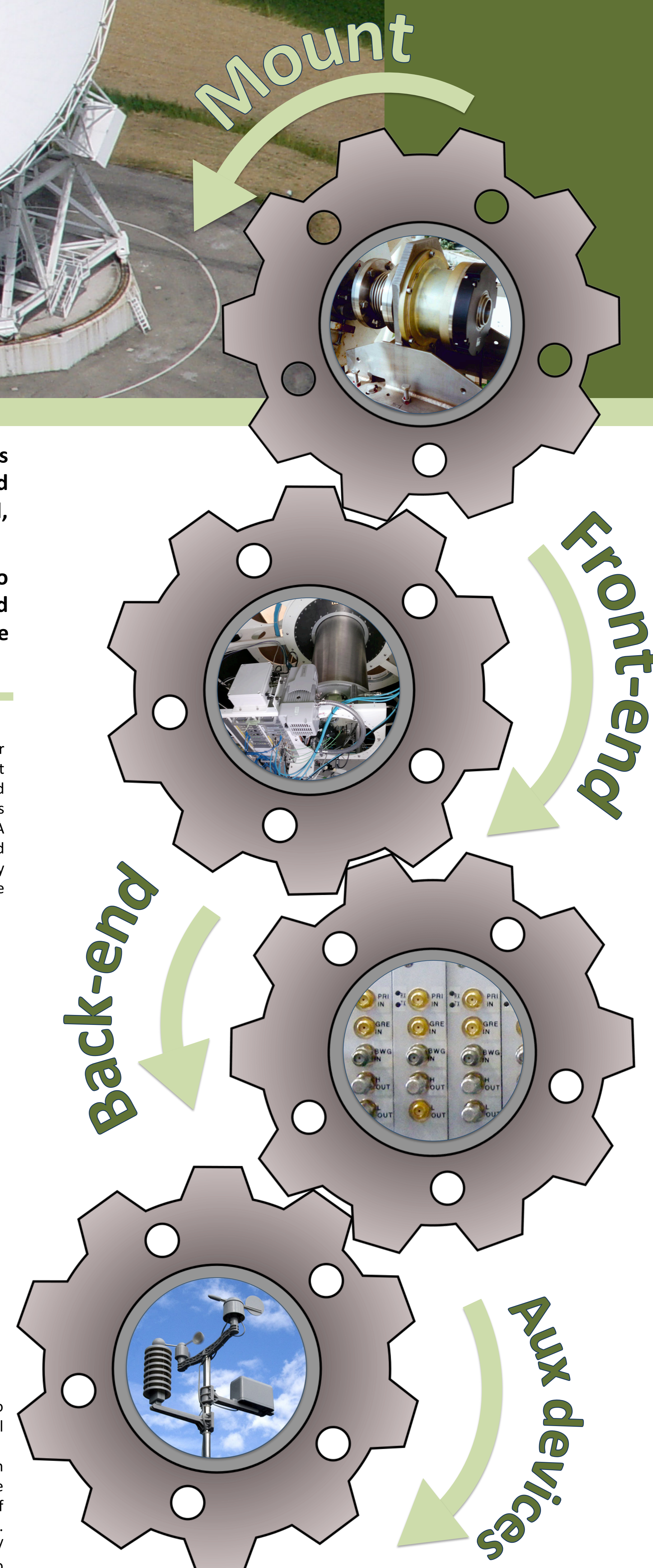
Medicina, Noto and VLBI-IT Radio Archive: modelling data for Radioastronomy

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Radio astronomical data models have become very complex, due to the wide possible range of instrumental configurations available with modern radio telescopes. What in the past was the last frontier for data formats in terms of efficiency and flexibility, is now evolving with new strategies and methodologies enabling the persistence of very complex, hierarchical, and multi-purpose information.

Our goal is to define a *Radio Data Model* and build a *Radio Archive*, common to the antennas located in Medicina and Noto (managed by INAF – National Institute for Astrophysics), in order to properly serve the different observing techniques and scientific projects involving these instruments, both when exploiting them as single-dish telescopes and when employing the antennas in an Italian interferometric network (VLBI-IT).

Handling single-dish and VLBI-IT observations

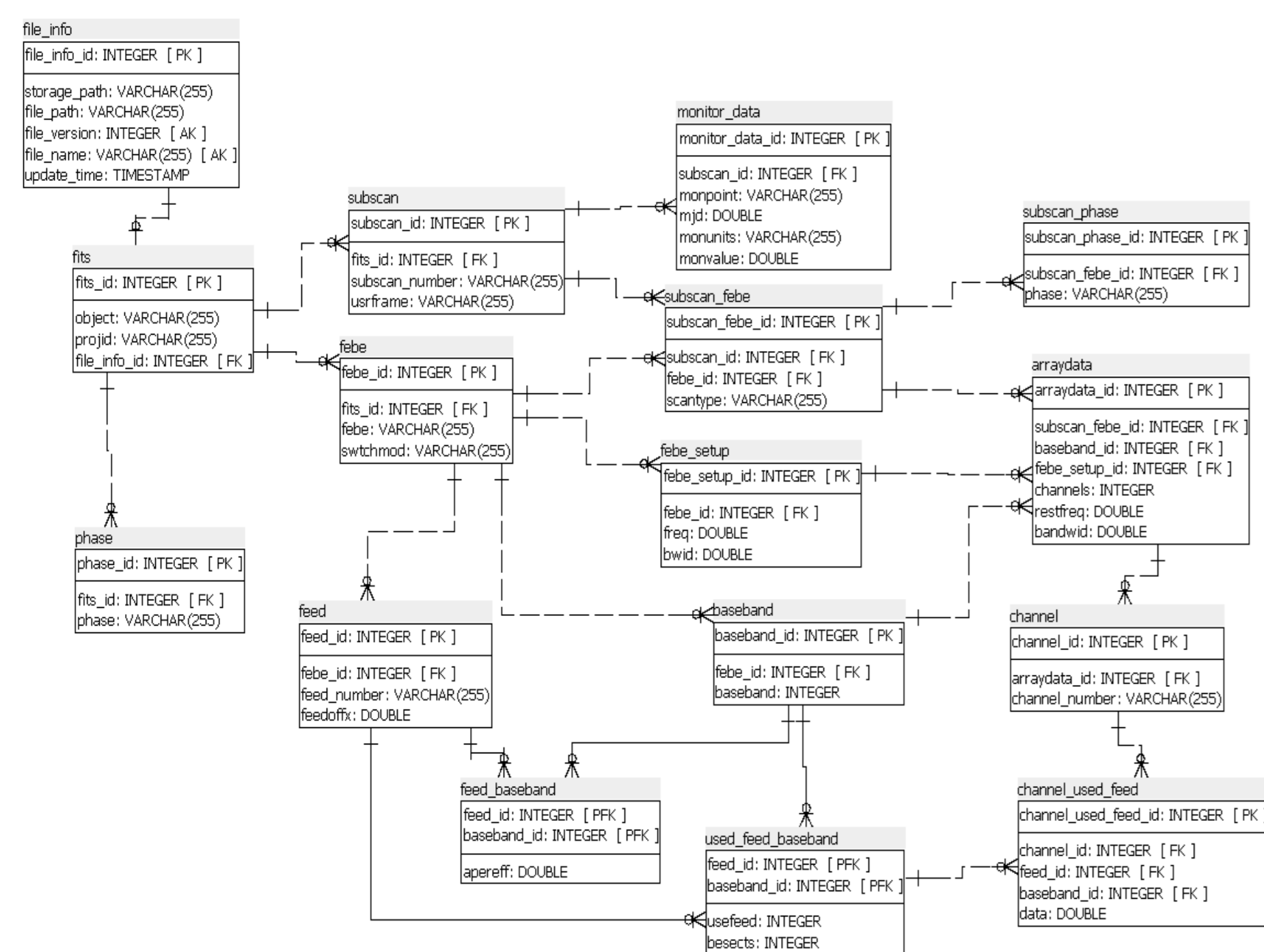
Single-dish (SD) observing modes and acquisition techniques are described by a vast number of instrumental **configuration parameters**. This requires the design and implementation of a Radio Data Model able to store all the information needed to fully characterize the various observations. The developed Radio Data Model was built on top of the data/metadata structure defined in the MBFITS standard (APEX-MPI-ICD-0002 by Dirk Muders), produced for the Atacama Pathfinder Experiment (APEX) and then adopted in other observatories. Our model is capable of handling radio data written in non-hierarchical FITS format as well, in order to serve a vaster range of users. The Italian antennas, including the Sardinia Radio Telescope (SRT), are provided with a common control system, thus their integrated back-ends are all able to produce output files in the same format (for SD in total power or spectro-polarimetry observations).

For the VLBI-IT acquisition mode, a customized XML summary file stores the main configuration parameters for interferometric observations. Such summary is a subset of the previously mentioned Radio Data Model.

This aims at **enhancing the archiving system performance**, maintenance and behavior, providing the (inter)national community with a state-of-the-art archive for radio astronomical data. The archive will also be provided with **Virtual-Observatory-compliant services** to increase the interoperability of data. The archiving system itself is equipped with an internal data model in order to transparently handle all the various radio raw data formats mentioned above.

Data Models / Formats / ER Diagrams

A general **MBFITS database** is used as a baseline for the creation of the radio archive database. The radio archive database is then used to store data from the source files on the basis of the configuration stored in the data-model database. The configuration enables to select, from the source files, the subset of data that has to be stored in the radio archive database. To do this, the radio archive database itself consists of a subset of MBFITS database tables containing subsets of MBFITS database data. In any case, the structure of the radio archive database tables must comply with the data structure in the MBFITS database and in the FITS/MBFITS/XML files.



Radio Archive Web Interface

The Medicina and Noto Radio Archive will be accessed in two modes: privately or publicly. Public data follows the INAF policy and are available for download without any requirement of registration. Private data are available, in the time frame allowed by the “proprietary time” policy, to the Principal Investigator or authorized persons already registered into the local Authentication and Authorization environment. A Single Sign-On mechanism is foreseen but not yet implemented. Authentication and Authorization are based on PI (or delegated) username and password, directly connected to INAF’s registry. In both public or private cases, a query form will be presented to the user.



A **Web User Interface** allows for easy and user-friendly access to the data. Querying functions and column indexes have been implemented into the database to optimize the investigation over the hierarchical database structure, returning information organized in a table on the output web page.

A first release of the web interface is now being tested using Medicina and Noto data, both in SD and VLBI-IT mode. Due to the existence of the common control system, it might accept data even from the SRT.

Its appearance is presented in the figure above. The Radio Archive users can perform dedicated queries over the archive, depending on the telescope features and on the employed observing mode. SD and VLBI-IT observations share a generic subset of parameters but are specialized in terms of selection parameters and query outputs. **Common features** are (for example): the user authentication page, the object/coordinates fields, the observed frequency range field. **Specific fields** are related to the observing mode, the front-end-backend configuration, etc.

Specific queries are performed enabling a hidden section, depending on the observation mode (SD or VLBI). Once the selection parameters are set and the “Search” button is pressed, results are presented to the user. Additional information is available by means of check boxes, allowing to retrieve further documents such as the observation schedule and logfile.

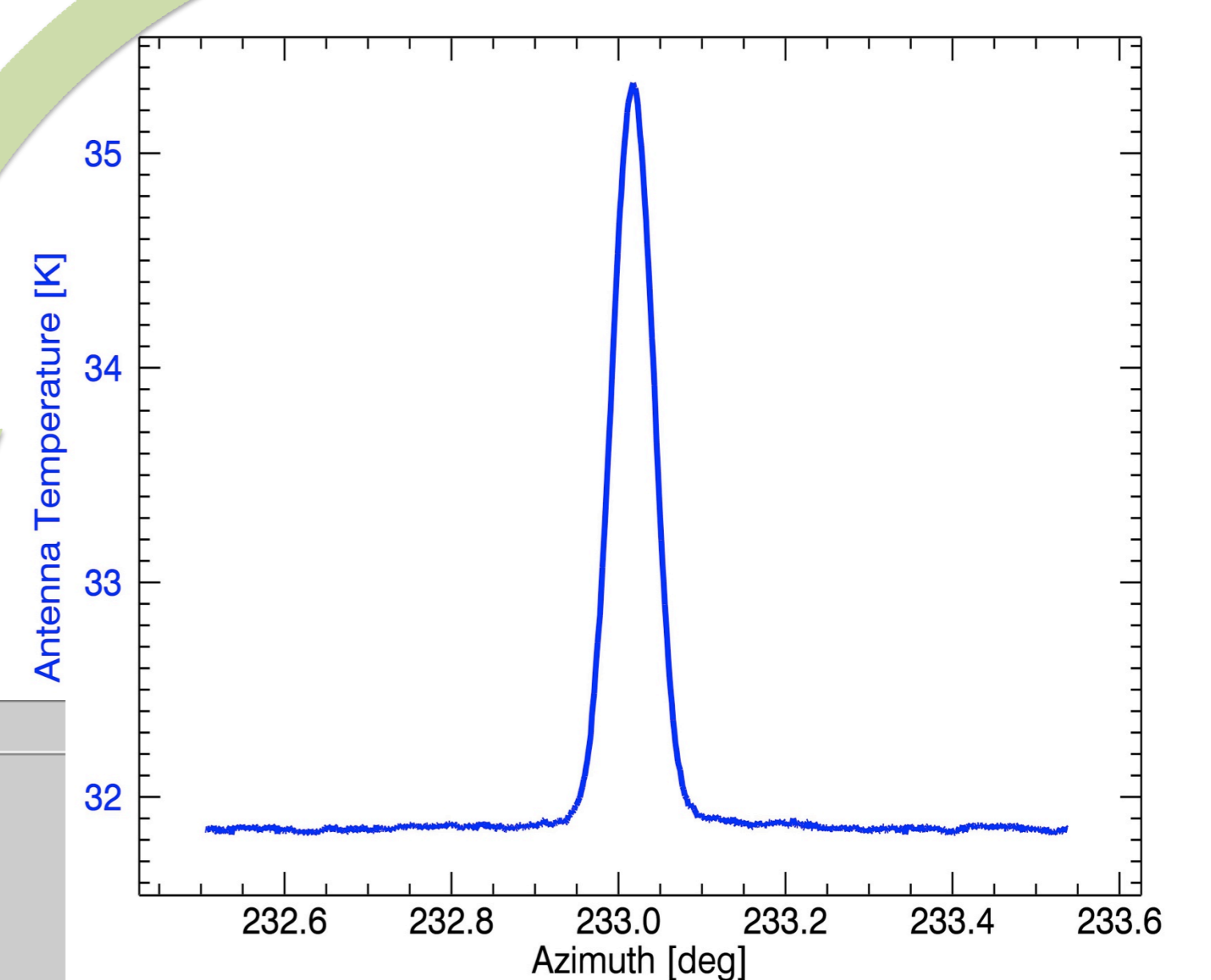
Result sets populate dedicated tables; columns are enabled via check boxes corresponding to the searchable parameters. Filters are applied once the parameter value or range is specified inside dedicated text fields. A list of data descriptors (metadata) that satisfy the query is returned.

For details on our antennas and all the related facilities, including the Archive, visit our webpage devoted to the observers:



Archiving

Extension	Type
Primary	Image
SECTION TABLE	Binary
RF INPUTS	Binary
FEED TABLE	Binary
DATA TABLE	Binary
ANTENNA TEMP TABLE	Binary
SERVO TABLE	Binary



5 GHz single-dish raw acquisition on a point-like source