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CASA task “importfitsidi” requirements and design


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1 Summary

A new task is to be developed for CASA tentatively scheduled for release 3.1.

The main use case is:

Enable processing of VLBI data coming from the EVN.

Other use cases are: enable processing of VLBI data coming from other networks such as eMERLIN and the VLBA.

Generally, the latest FITS-IDI standard will be supported as described in AIPS memo 114r (Greisen et al. 2009).

2 Overall design and data flow

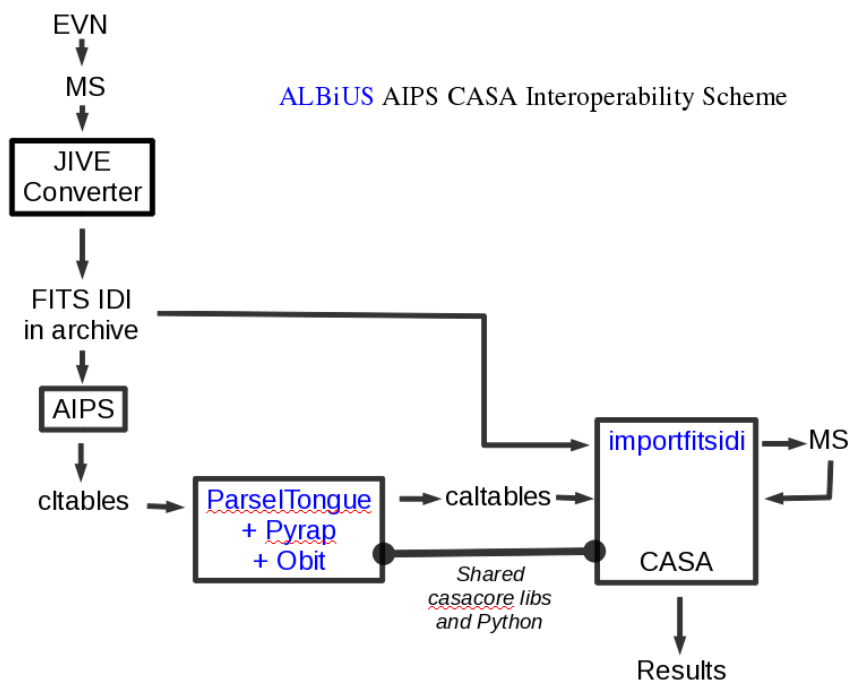



Figure 1: The proposed workflow for EVN data analysis with CASA and external add-ons to be developed at JIVE

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The task “importfitsidi” will read the FITS IDI archive format of the EVN and convert it into a CASA Measurement Set on disk. This is where its scope ends. As illustrated in figure 1, this, together with the CASA caltables generated by an application to be developed at JIVE, will enable CASA to process EVN data.

This workflow is a prototype. The intention is ultimately to also include the calibration branch of it in CASA. But whether or not this is achieved does not influence the requirements for importfitsidi.

VLBA data provides several tables in addition to the minimal set required by the EVN. It may be that the ability to read arbitrary VLBA data will be achieved in a later version of importfitsidi, i.e. not in CASA release 3.1. But already reading the basic tables from VLBA data will permit some useful analysis.

3 Task User Interface

The CASA task importfitsidi will use the same nomenclature as other similar tasks, e.g. importuvfits. The short description given by `help importfitsidi` in `casapy` will be as follows:

```
Convert FITS-IDI visibility file into a CASA visibility file (MS).
```

```
Keyword arguments:
```

```
fitsidifile -- name of the input file
              default: none
```

```
vis    -- MS name,
          default: none
```

```
async -- Run asynchronously
          default = false; do not run asynchronously
```

4 Implementation

The outdated FITS-IDI classes already contained in `casacore` will be updated to follow AIPS Memo 114r (see references). Where necessary, the convention will be relaxed in order to accommodate idiosyncracies of the EVN and eMERLIN data. Most of the additional C++ code will go into the class `FitsIDtoMS`.

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The implementation will then follow the standard CASA scheme. The class `casa::MSFitsIDI` presently in `casacore/msfits/MSFits` will form the interface to the tool and task level of CASA. In the `ms` tool, a new method `fromfitsidi` will be created which will use the `MSFitsIDI::fillMS()` method. Then the task `importfitsidi` will be created based on the `ms.fromfitsidi()` method.

The parameters of the `fromfitsidi` method will be:

```
ms.fromfitsidi(...)
    Create a measurement set from a fits-idi file
    --- --- --- --- --- --- Parameters --- --- --- --- ---
    msfile:  Filename for the newly created measurement set
    fitsidifile: fits-idi file to read
    nomodify: open for read access only - true
    lock:    lock the table for exclusive use - false
    obstype: specify the observation type: 0=standard,
        1=fastmosaic
```

The `obstype` parameter permits a choice between different setups of the tiling of the data manager for the newly created MS (as in the corresponding task `importuvfits`).

The method will report an error if there is an MS already attached to the `ms` tool.

4.1 Minimal requirement Tables


The following tables shall be read by CASA `importfitsidi`: `UV_DATA`, `ARRAY_GEOMETRY`, `ANTENNA`, `FREQUENCY`, `SOURCE` (these are the ones used by the EVN).

Furthermore, the reading of the following tables will be implemented to accomodate eMERLIN data: `FLAG`, `INTERFEROMETER_MODEL`.

4.2 Additional tables

If sufficient development time is available (see timeline section of this document), additional (optional) FITS-IDI tables used in VLBA archive format will also be read and interpreted (in the order of priority):

`BASELINE`, `MODEL_COMPS`, `PHASE-CAL`, `GAINCURVE`.

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5 Testing

JIVE shall provide a set of at least five test cases each with the necessary input data (two have already been provided), eMERLIN at least two datasets.

The developer will create a unit test script for the tool method and the task based on these example cases and perform testing until he is convinced that the tool performs as expected.

After first unit testing, the developer will hand over the software to JIVE who will perform tests as they see fit to confirm the correctness of the code.

6 Timeline

- 5 May 10: Finish initial design and Python coding. Start implementation of C++ code.
- 6 May 10: Meet with Steve Bourke (JIVE) to discuss possible problems of the implementation.
- 11 May 10: Meet with Kumar Golap and Tak Tsutsumi to discuss possible problems of the implementation. Also discuss VLBA-specific issues.
- 1 June 10: Finish preliminary implementation. Start unit testing.
- 15 June 10: Hand over task to people at JIVE for testing.
- July 10: Release of importfitsidi as part of CASA 3.1.

References

Greisen, E.W., 2009, “The FITS Interferometry Data Interchange Convention -- Revised (AIPS Memo 114r)”, <http://fits.gsfc.nasa.gov/registry/fitsidi/AIPSMEM114.PDF>

Kemball, A.J. & Wieringa, M.H., 2000, “MeasurementSet definition version 2.0”, <http://aips2.nrao.edu/docs/notes/229.ps.gz>