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NRAO's VLBA Data Calibration Pipeline

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Abstract.
The NRAO VLBA Data Calibration Pipeline (VLBApipe) is a 'runfile' (script) which executes in the Astronomical Image Processing System (AIPS) using the VLBAUTIL procedures. The VLBApipe performs basic VLBA data calibration and, to evaluate the calibration, produces plots and images. It is not intended to do complete editing, final calibration, or high-fidelity imaging. The VLBApipe is available in AIPS releases beginning with 31DEC02.

Since July 2002, many VLBA-only, 1-15 GHz continuum and spectral line data sets, correlated with the VLBA correlator, have been run through the VLBApipe. The outputs are made available to the observer. We expect to extend and improve the capabilities gradually.

1. What the VLBA Data Calibration Pipeline does and may do later

The VLBApipe is available in AIPS as the 'runfile' VLBAPIPE. This script uses AIPS VLBAUTIL procedures developed by C. Flatters and A. Mioduszewski. The images and calibration plots it generates are to assess the quality of this initial calibration. They are rarely suitable as final results. It is advisable to run the VLBAPIPE procedure, flag bad data, and run VLBAPIPE again. VLBAPIPE writes single-source, calibrated data sets that are a good starting point for additional editing, self-calibration, and imaging.

Currently, the VLBApipe calibrates VLBA data correlated in Socorro for gain, bandpass, parallactic angle, and instrumental polarization, and applies some coarse flagging and pulse-cal or manual p-cal to align the IF channels. It is robust for frequencies between 1 and 15 GHz. It can apply ionospheric correction as well as phase-referencing for up to 15 reference-target pairs. Calibration can be done for either (pseudo-)continuum or spectral-line data and the pipeline automatically images all sources.

We intend to improve the non-interactive flagging of UV-data and the spectral-line bandpass calibration, and to implement full polarization calibration. Furthermore, methods to include the VLA, GBT, Effelsberg, and other telescopes, as well as manual calibration transfer, are also being investigated.

2. What the VLBA Data Calibration Pipeline may not do

The VLBApipe *cannot* correct for "unfortunate" observing conditions, such as complex source structure in calibrators, loss of phase-coherence while phase-referencing, excessive radio-frequency interference, or non-optimal observing techniques. The VLBApipe also cannot process data from correlators other than the VLBA and is not designed to flag data interactively. Advanced imaging algorithms, such as multi-scale imaging and hybrid mapping self-calibration, are also beyond the scope of the VLBApipe. However, the VLBApipe will provide an initial image for self-calibration.

3. How the VLBA Data Calibration Pipeline worked

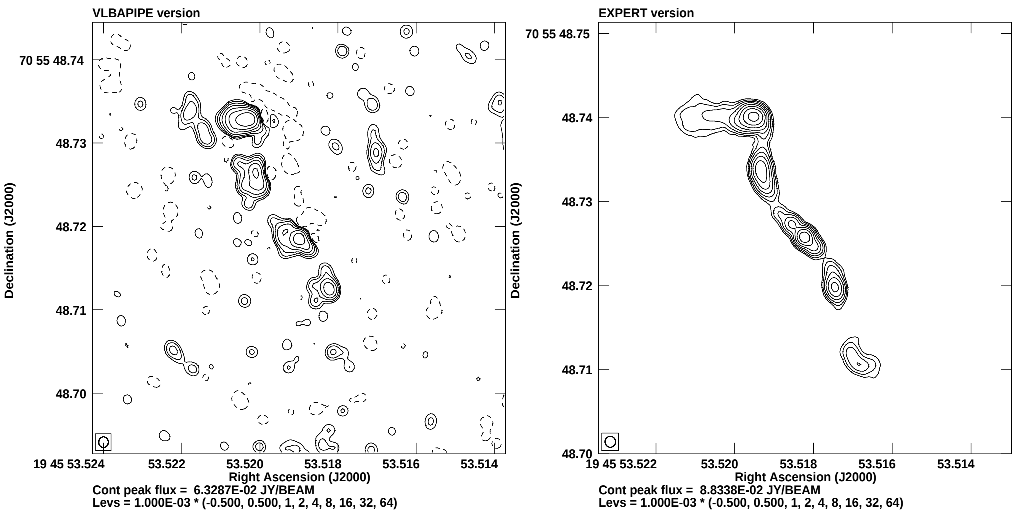

Figure 1. These figures show a VLBAPIPE and subsequent 'expert' image. The pipeline required 10 minutes to make this phase-referenced, but not self-calibrated, image after loading the data; the expert image took an additional few hours. Data loading and fringe-fitting take the most time. This initial pipelined image should give a good starting point for self-calibration. Depending on the computer and the exact details of the observations, typical execution times of the full pipeline range between a few minutes and a handful of hours.

4. How to make the VLBA Data Calibration Pipeline work

For starters, one can check "data calibration service" on the VLBA proposal, or alternatively one may send a request to lsjouwer@nrao.edu. We will then do our best calibration for you to FTP to your home.

However, one can easily run VLBAPIPE at home after installing AIPS (the 31DEC03 or later version), studying "explain VLBAPIPE", and then running it on the data. See also http://www.aoc.nrao.edu/~lsjouwer/vlbapipe for further information, or request help and hints by sending an e-mail to lsjouwer@nrao.edu.

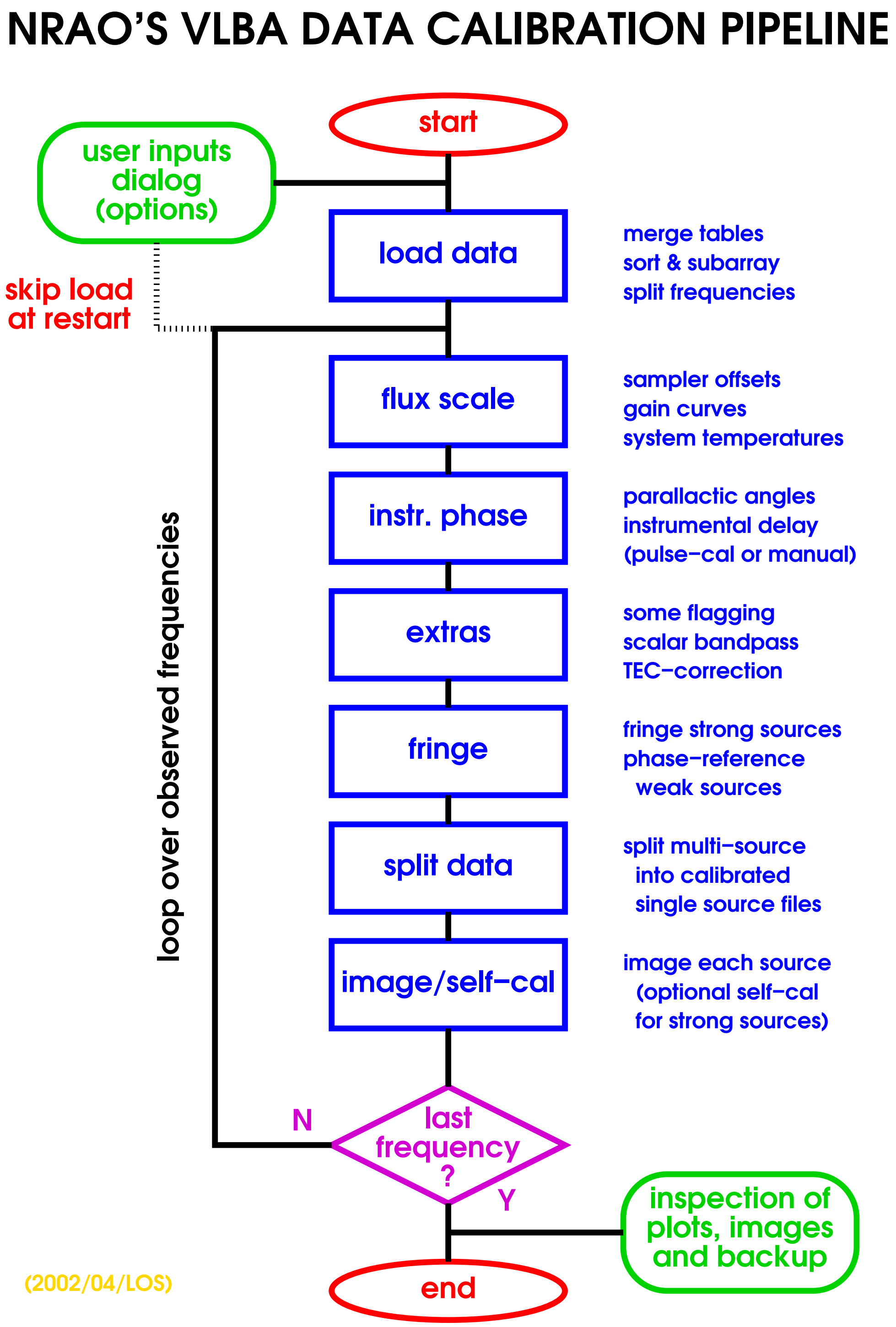

Figure 2. Rough flow-chart of the VLBAPIPE 'runfile' in AIPS.