A Calibration and Mapping Pipeline for the Green Bank Telescope

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Overview

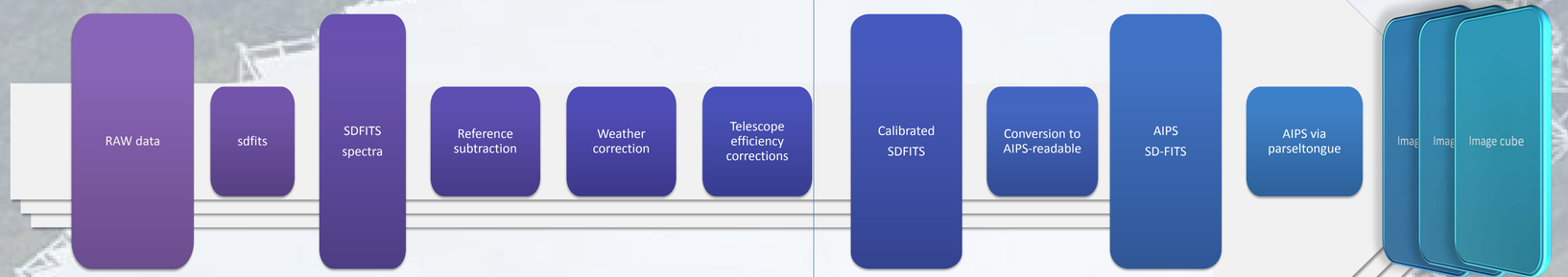
The Robert C. Byrd Green Bank Telescope (GBT), at 100 meters diameter, is the world's largest fully steerable radio telescope, operated by the National Radio Astronomy Observatory in Green Bank, West Virginia.

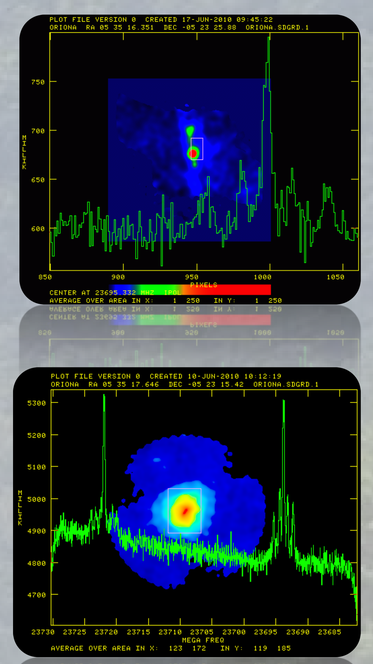
We present a prototype software calibration and mapping pipeline designed for a new receiver on the GBT, the K-band Focal Plane Array (KFPA). Despite its origins in the KFPA project, the pipeline is suitable for general GBT imaging.

Pipeline Implementation

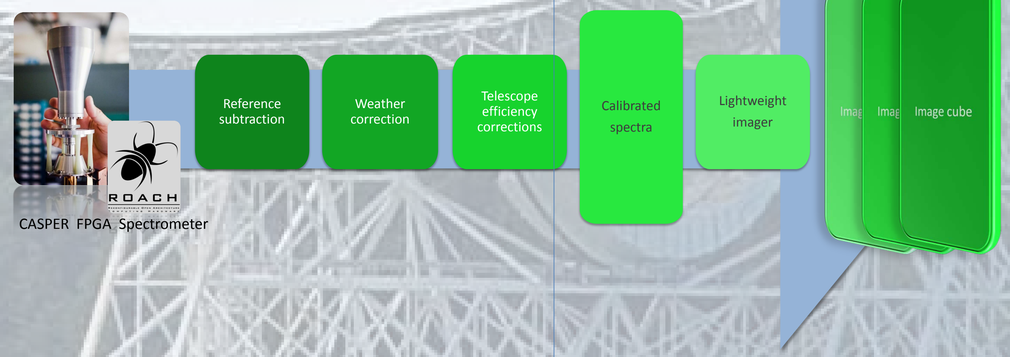
The pipeline is primarily written in Python. The python dependencies are limited to *numpy* and *pyfits*, while taking advantage of many features from the standard library including the *multiprocessing*, *subprocess* and *logging* modules. Additional dependencies are *AIPS* for imaging (with *Obit* and *parseltongue* for python support), a tool for converting NRAO SD-FITS to AIPS-readable data (idlToSdfits) and weather prediction tools for the GBT (in tcl).

Dataflow (current)





Dataflow (future)



Hardware

The K-band Focal Plane Array (KFPA) is a seven pixel receiver operating at 18-26.5 GHz, primarily intended for imaging ammonia (NH_3) and other molecules found within this frequency range. The instrument is a prototype for using Focal Plane Array hardware on the GBT. Future proposals include a 61-pixel K-band receiver and a 100+ pixel W-band receiver, which (combined with a new spectrometer) will greatly increase the volume of data coming from the GBT during a single observation.

Future Plans

The next steps are to:

- operate in near real-time to optimize the pipeline as an automated imaging tool,
- support frequency-switched observations,
- move away from FITS in favor of a HDF5-based container to provide for a more scalable framework,
- eliminate the dependency on AIPS in favor of a lightweight gridding code, and
- provide a full-featured , portable pipeline for off-site use

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