CASA Status Report
Sept 4, 2013
Prepared for ANASAC Face to Face

The CASA package continues to improve in capabilities and performance, and is in routine use for the calibration, editing, imaging, and analysis of ALMA data. During the past year a number of new capabilities have specifically been developed in support of the ALMA project:

Linear Polarized Feeds: Software and procedures to support the calibration of linear polarized feeds has been developed and used to commission polarization observations. This capability is ready to support ALMA's Cycle 2 call for proposals.
Single Dish: The single dish package has been modified and extended to support a CalTable-like interface (necessary for pipeline), sideband separation of Band 9 single dish observations, and support for the Cycle 1 calibration and imaging strategies has been added.
Feathering: Combination of single dish and interferometric imaging through the feathering technique is supported both through a task level interface and through a graphical interface. Commissioning of this capability is ongoing as is development of recommended best practices.
Ephemeris Objects: Support for rapidly moving objects has been added throughout the package, particularly to the imaging subsystem allowing proper handling of solar system objects.
Simulation: The simalma task is being updated to provide a "dry run" capability so that the ramifications of the inputs can be assessed before the time investment of running the actual simulations. Cycle 2 representative configurations have been added. The ability to use more than one 12-m configuration has been added as well as the ability to include more than one 12-m total power antenna. Improved documentation is also being added.
Primary Beam Handling: We are adding the capability to manage the heterogeneous primary beams of the ALMA telescope throughout the imaging process. In a parallel effort Kara Kundert has extended her summer student project and is using simulation to understand the effects of the primary beams on the dynamic range of the final image. Improvements have been made to the deconvolution tool to allow the deconvolution of single dish images, initially with a Gaussian beam approximation and soon a measured or theoretical beam model.
Visualization: Many new capabilities have been added to the viewer allowing interactive exploration of the ALMA data. Some examples are the addition of histogram generation and fitting, improved spectral line capabilities, generation of position-velocity curves, as well as several user interface and usability improvements.

The CASA team is focused not only on providing new functionality but also on increased maintainability and robustness of existing functionality. We have several infrastructure projects that are currently ongoing:

Performance Improvement: For the major tasks we believe CASA has comparable performance to AIPS and Miriad in serial mode, however we are continuing to work with the scientific infrastructure team at NRAO to identify bottlenecks in the serial performance of CASA. Parallel implementations of these tasks have been demonstrated to be much faster, however user interface issues are preventing widespread adoption of parallel implementations of CASA. Virtualization of the scratch columns (Model and Corrected Data) will reduce the on-disk footprint of data by two-thirds, model data is now virtual by default, and a virtual Corrected Data is being developed. The functionality of several data manipulation tasks including split (with spectral and time averaging), cvel, and hanningsmooth are being combined into a single multipurpose task that will allow faster operation and for some operations to run concurrently.

Imager Update (i.e. clean): The imager tool is undergoing an architecture update to allow a more uniform interface, less cross talk between option selections, and a more robust parallel implementation.

Setjy: This task, which sets the absolute flux scale using a know calibrator, has been reorganized for greater clarity and to eventually allow extended functionality.

Imregrid: This task, which can regrid an image to match a template or change the spatial coordinate frame, has been refactored for better ease of use.

Regions: The region format implementation across the image analysis and Viewer tasks has been unified and improved.

A review of the CASA project and the CASA based pipelines was held in March of this year; the Committee report is available online[1]. Based on the recommendations of that committee, we have appointed a CASA Architect to oversee the design of the CASA package as a whole. We have also updated our testing procedures to include a dedicated internal testing position and a more structured science-testing program to validate new capabilities as delivered. NRAO is in the process of defining a new CASA Users Committee to complement the efforts of the CASA Science Steering Committee and provide a more inclusive process for determining CASA capabilities.

A number of CASA related activities have been proposed as part of the NA ALMA development program. From within NRAO (with community involvement), we have proposed a study on the interaction of CASA with astropy. Projects for the implementation of VLBI capabilities in CASA (in support of the ALMA Phasing Project) as well as CASA deployment in supercomputing environments have also been proposed from within NRAO. In addition, two community-led proposals exist, focusing on a next-generation viewer (including remote viewing) and the development of "value added" products to the pipeline and ALMA archive.

[1] https://safe.nrao.edu/wiki/bin/view/Software/CASA/WebHome