Overview: ALMA User Software

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ALMA User Software

- **Common Astronomy Software Applications (CASA)**
  - ALMA and eVLA data reduction package and platform for pipeline processing

- **ALMA Observing Tool (OT)**
  - Phase I and II preparation in same unified tool

- **ALMA Science Archive**
  - In technical development mode

- **Splatalogue**
  - NAASC effort to provide unified, up to date spectral line database and tools for ALMA
What is it?
- Suite of applications for the reduction and analysis of radio-astronomical data (derived from the former AIPS++ package)
- Algorithms written in C++
- Interface python/ipython
- Plotting in matplotlib
- Qt based Viewer
- Java based tablebrowser
- North American deliverable

Key Differences from aips++
- Python/ipython interface provides powerful and well known scripting language
- Task interface to functionality
- Full in-line help
- Smaller package size
- Faster startup time
- Performance improvements
- Smaller memory footprint
- Expanded functionality
- Scientist-written documentation
CASA Functionality

**Tasks**
- Easy navigation within the package (help, inp)
- Exploits IPython (tab completion, shell access, etc)
- Most often used functionality
- Initial set derived from most used tasks in AIPS (statistics gathered from 5 years)
- Documentation = Cookbook

**Tools:**
- Full functionality represented; tasks are a layer on top of this to enable easier access to the most often used applications
- Underneath for fine adjustment, manipulation, prototyping
- Documentation = User Reference Manual
CASA People and Schedule

- North American deliverable
  - Group leader: Joe McMullin
    - soon to be System Integration Lead in Chile, Job ad out for replacement
  - ALMA Subsystem scientist: Crystal Brogan
    - formerly Debra Shepherd who is now coordinator of ATF
    - ACA CASA subsystem scientist Matsatoshi Ohishi
- Limited Beta Release Oct. 1 2007
  - Focus current limited user support capacity on:
    - ARC staff training in preparation for user support; training for ALMA project members who require CASA for AIV and Commissioning; as well as testing/implementation of calibration schemes (WVR etc)
    - Initial community input from ALMA and NRAO science advisory committees
  - Quarterly major release cycle
  - Release strategy balances user support requirements with need for community input
- Public Release @Fall 2008
Testing in the Last Year

- Transition at end of 2006
  - Move from strict requirements check-out to usability, general functionality, filling the ‘gap between the requirement and the expectation’
    - EVLA Test Dec 2006
    - ALMA external test 5 Mar 2007
    - ESO ARC Tutorials July 2007
  - Frequent use/testing by NAUG (NRAO Application Users Group) members (made up of both ALMA and eVLA staff)
CASA Labo(u)r Camp
Beta Release Scope:

- **Data Import:**
  - VLA archive (except high res. Low freq/widefield)
  - UVFITS (BIMA, CARMA, SMA etc.)
  - ASDM (mainly PdBI)

- **Calibration:**
  - Standard VLA like (not polarization)
  - Spline fitting (PdBI)
  - VLA calibrator model images

- **Modes:**
  - Single Field
  - Basic Mosaics

- **Operating Systems**
  - RHE4.x
  - OSX 10.x
  - Fedora Core 6
  - (64 bit Linux)
Functionality/Demo

- Interface
  - Python/Ipynb
    - Shell access
    - <TAB> completion
    - Autoparenthesis
    - History/Search
    - Macros
    - Session logging
  - CASA Interface
    - Help system
    - Task environment
      - Globals
      - Error handling
      - Expandable params
      - Task execution
      - Save/restore

- Functionality
  - Example script execution
  - Data import
  - Data examination/flagging
  - Calibration
  - Imaging
  - Displaying images
  - Image analysis
    - Statistics
    - Profiles
    - Moments
Observing Tool…
ALMA Observing Tool (OT)

- Phase I and II preparation
  - Should not assume detailed knowledge of millimeter astronomy or ALMA hardware
  - User shall enter “science goals” which will then be interpreted into required command and control language
    - Source coordinates, angular resolution and largest structure, source flux and S/N or rms, line frequencies, velocity resolution, desired dynamic range
  - Shall contain ability to do required calculations like integration time for desired rms noise and projected data rate
  - Easy extraction of targets from standard catalogues (NED, CDS etc)
  - Shall provide easy selection of standard observing modes
- Expert mode which can be used for commissioning and testing new observing modes and interactive observing
OT People and Schedule

- European deliverable
  - Group leader: Alan Bridger
  - Subsystem scientist: Leonardo Testi
  - ACA observation preparation Toshihiro Handa

- Tests of new functionality twice a year (summer/winter schedule)
  - Current development cycle R 4.1
  - Testers derived mostly from ALMA Scientific Software Requirements ITP
  - Starting R7 there will be a Beta release (Q3 2009) with testers derived from the community

- Optical pointing and holography acceptance tests at the ATF were all done using the OT to create scheduling blocks
Splatalogue…
• First public release (alpha release) February 2007
• The Splatalogue is NOT A WEB SITE, and it’s also not a tool, it’s a database and web service
• The Splatalogue database currently holds the following information:
  ➢ Over 3.9 million transitions of over 850 molecular species
  ➢ Information on each transition of whether it is a calculated or measured frequency and where the transition information of each molecular species was obtained.
  ➢ Every molecular transition detected in astronomical environments (Updated Lovas/NIST list – 12333 transitions)
  ➢ A complete list of H, He and C recombination line frequencies
  ➢ NRAO Recommended Rest Frequencies for known/highly probable astronomical molecules
• The Splatalogue website was updated and revised in July 2007 to reflect the diverse search capabilities available in the database. These include:
  ➢ Search filters for atmospheric, potential (unlikely), and probable astronomical molecules
  ➢ Various units of line strengths, energy levels, resolved QNs.
• Group leader: Anthony Remijan

• July 2007: ‘additional’ transition data compiled – Lovas SLAIM
  - Added >229,000 lines to the database including transitions NOT included in JPL or CDMS as well as new, more accurate fits to existing molecules.

• November 2007: provide an implementation of Splatalogue including
  - observational template data and synthetic spectra calculation.
  - Additional query/return formats will also be provided/supported (eg. SLiSE application).

• December 2007: version ‘1.0’ released to the public for general use including the limited functionality of observational template data and synthetic spectra calculation.

• 2008: Will provide the data for the ALMA Archive Spectral Line Catalogue and the OT. Can easily be adapted to be included in the data reduction tools or observing tools of telescopes worldwide.
  - Access via the http/php Simple Line Access Protocol (SLAP) (see SLAP documentation)
  - Data returned in SLDM XML format