ALMA Development Program

J. Anand Crossley
CASA Project Manager
NRAO
Outline

• Complete
  – ADMIT
  – CARTA

• On going
  – XCLASS
  – Topological Analysis (see Paul’s talk this afternoon)
  – Cleaning Up Interactive Clean
  – Total Power Map to Visibilities

• Preparing Proposal
  – Pipeline Weblog Optimization
ALMA Development Goals

• Identify and support community science priorities, identifying critical drivers.
• Use community strengths in hardware, software, and techniques to fund studies to define and enable a science-driven upgrade plan for ALMA.
• Identify those community science priorities which can produce transformational results at the horizon and plan for their realization.
ALMA Data Mining Toolkit (ADMIT)

Schedule

PI
Lee Mundy, U. of Maryland

Collaborators
Peter Teuben, Mark Pound, Jeff Kern, Anthony Remijan, John Hibbard, Pam Ford

Current status:
• Completing verification testing and acceptance test design
• Writing final reports
• Project closes formally on Sept 30.
ADMIT – Key Features

• Generates enhanced data products using image pipeline output
  – Input: FITS cube
  – Output: Line cubes, peak profiles, moment 0, 1, and 2 maps, line identification

• Designed for integration in ALMA data delivery process

• User interface allows for parameter tweaking and rerun
ADMIT – Integration Plan

• Software
    • Allows flexibility in release schedule.
  – Stored in GitHub for continued community contributions.

• Archive Integration
  – NAASC will perform QA test
  – JAO will perform QA test
  – ADMIT generated tar balls will be added to archive in Cycle 5.
  – When imaging pipeline enters automated operation, ADMIT will run automatically after pipeline processing at JAO.
ADMIT – Future Initiatives

- ADMIT Team is preparing a proposal for ADMIT 2.0 that will include
  - Integration with CARTA
  - Integration with XCLASS
  - More enhanced products
CARTA

Cube Analysis and Rendering Tool for Astronomy (CARTA)

<table>
<thead>
<tr>
<th>Schedule</th>
<th>March 2014 – Sept 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>Erik Rosolowsky, U. of Alberta</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Jeff Kern, Gregory Sivakoff, A. Russ Taylor, Jeff Taylor, Alex Strilets, Susan Loveland, Jim Jacobs, Pavol Federl</td>
</tr>
</tbody>
</table>

- Project closed September 1st
- ASIAA CASA Development Center will focus on CARTA for next year
  - Improve performance
  - Make it more user friendly
- Schedule
  - CARTA will be in the 4.7 release.
  - Replacement of viewer: TBD, needs interactive clean capability
CARTA – Key Features

- Replace current CASA viewer (eventually)
- Provide application client, browser client, and scripted client
- Browser client allows for archive integration
- Handles big data (50GB to 1TB image cubes)
- Most features of viewer
Cleaning up Interactive Cleaning

Accepted study to develop interactive cleaning plugin for CARTA.

<table>
<thead>
<tr>
<th>Schedule</th>
<th>August 2016 – July 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>Erik Rosolowsky, U. of Alberta</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Jeff Kern, Pavol Federl</td>
</tr>
</tbody>
</table>
Cleaning up Interactive Cleaning – Key Features

- Clean mask visualization in CARTA
- Interactive cleaning tool displays dirty image, residual model, and/or dirty beam
- Uses CASA’s current cleaning interface (dbus)

- Improvements beyond CASA’s current interactive clean capabilities are desired but are not core deliverables.
eXtended CASA Line Analysis Software Suite (XCLASS)

<table>
<thead>
<tr>
<th>Schedule</th>
<th>November 2014 – mid-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>Peter Schilke</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Thomas Möller, Justo Antonio González Villalba</td>
</tr>
</tbody>
</table>

- Study will conclude middle of next year.
- External package can be downloaded.
- Proposal under development to incorporate XCLASS within ADMIT.
XCLASS – Key Features

- Produces physical parameter fits for molecular emission
- Fits all lines of a species simultaneously
- Uses variety of algorithms to fit data (MAGIX model optimizer)
- Allows for fitting
  - Multiple frequency ranges
  - From multiple files
  - From multiple telescopes

**HIFI data of Sgr B2(M) fit with SO$_2$, SO, and HNO**
Total Power Map to Visibilities (TP2VIS)

Accepted Study, Start Oct 2017

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Study start October 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>Jin Koda (Stony Brook, NAOJ, JAO)</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Peter Teuben, Tsuyoshi Sawada, Adele Plunkett, Crystal Brogan</td>
</tr>
</tbody>
</table>

- Develop CASA-based TP2VIS tool.
  - Already implemented in MIRIAD
- Develop visibility weight visualization tool
- Benchmark simulation data
- Validate using simulation data and ALMA archival data
Total Power Map to Visibilities (TP2VIS)

- Background

• Combination of data from different ALMA arrays is needed for many science cases.
• Converting TP data to visibilities allows joint deconvolution of all arrays.
• Results in fewer negative sidelobes.
Pipeline Weblog Optimization – Background

• Human review of the weblog is part of the ALMA data delivery process.
• The weblog design currently favors commissioning and PI use cases rather than review by pipeline operators.

• We need to rethink the weblog interface with a focus on pipeline operators and data delivery process.
• **Goal:** Reduce time needed by human to review weblog
Pipeline Weblog Optimization – Plan

- Collaborate with researchers in visualization and user interface design.
- Proposed methodology:
  - Observe pipeline operations.
  - Work with operators and users to design and implement interface improvements.
- Tightly couple development project and pipeline team to minimize time to delivery of improvements.
NA ALMA Development – Next Call

• Proposal types
  – **Project**: Large-scale (typically >$1M), multi-year initiative involving relatively mature technology. May lead to full implementation.
  – **Strategic study**: Mid-scale (< $0.4M), two-year investigation of an emerging technology of specific, strategic interest. May lead to a project.
  – **General study**: Small-scale (< $0.2M), one-year investigation of an emerging technology of general interest. May lead to a project.

• Award Pool
  – **Projects**: $11M total. Sufficient for approx. 3 projects.
  – **Studies**: $3M total. Sufficient for approx. 8 studies.
# NA ALMA Development Schedule

<table>
<thead>
<tr>
<th>Projects</th>
<th>FY2016</th>
<th>FY2017</th>
<th>FY2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apr</td>
<td>May</td>
<td>Jun</td>
</tr>
<tr>
<td>Cycle 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cycle 5</strong></td>
<td><strong>Call for Proposals</strong></td>
<td><strong>Review and Select Study or Project</strong></td>
<td><strong>Conduct Study or Project</strong></td>
</tr>
</tbody>
</table>