ALMA News

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A view of a presentation on the first day of the independent ALMA Cost Review held at Garmisch-Partenkirchen. The total number of attendees was about 80. The chair was Steven Beckwith (STScI) and the vice chair was Thijs de Graauw (SRON).

ALMA Cost Review

An independent international Cost Review of the ALMA project was held in Garmisch-Partenkirchen on October 13–16. The general response of the Cost Review Committee was positive. The three ALMA Project Managers (Tony Beasley, Joint ALMA Office; Adrian Russell, North America; Hans Rykaczewski, Europe) wrote that "The response from the committee is pretty much as good as it could be ..." Massimo Tarenghi, the ALMA Director, added "This excellent outcome reflects the very hard work of many people in the ALMA project, and the conscientious way in which the review was carried out." More details of the review will follow when the final report becomes available.

Milestones

There are a number of milestones for the completion of ALMA. The largest is the contract for antennas, since this contract is more than 30 % of the total cost of the bilateral (North America and Europe) ALMA. Here, we report the news on antenna procurement.

The ESO Council resolution from the meeting of September 30 states that "the ALMA project is affordable and compatible with ESO's strategic priorities". It further states that the ESO Council "requests the Finance Committee to proceed to decide on the proposal to award a contract for the production of the ESO ALMA antennas". The ESO Finance Committee met on October 5, and has approved the negotiation and conclusion of a contract with the selected vendor. At the ALMA Board meeting in Santiago, Chile, on November 1, it was announced that the ALMA Board concurs with the ALMA Director's recommendation that the European Executive proceed with the issuance of a contract to procure its share of the ALMA antennas.

Another important milestone is the Front End Integration Center. The Band 3 (3 millimetres, or 84–116 GHz) and Band 6 (1.3 mm, or 211–275 GHz) Front Ends are built in North America, while Band 7 (0.9 mm, or 275–373 GHz) is built at IRAM Grenoble and Band 9 is built at SRON, Groningen, Netherlands (0.5 mm, or 602–720 GHz). The decision has been made to have two Integration Centres, one in Europe at the Rutherford-Appleton Laboratory in Oxfordshire, UK, the other in North America, at the NRAO in Charlottesville.

With this level of progress, we are now much closer to the beginning of the assembly of individual components to produce a working system.

ALMA software development

It is expected that the ALMA array will be used by a relatively large community of astronomers that are less experienced in using radio interferometers and/or doing science at millimetre and sub-millimetre wavelengths. Therefore, it is of utmost importance to take this into account in development of software products that will eventually be used by the community.

Observing preparation

The ALMA Observing Tool (OT) will be the software tool that supports astronomers in constructing a full Observing Project for the ALMA Observatory. Basically, such Observing Programmes will be submitted to the Observatory in two parts. The first is a Phase I Observing Proposal that will have its emphasis on the scientific justification of the proposed observations. The second part of the project is the Phase II Observing Programme that can be submitted to the ALMA Observatory if observing time has been granted by the Time Allocation Committee (TAC) on the basis of the accepted proposal.

Central in the OT is the creating of a set of Scheduling Blocks (SBs) which are required to drive observing with ALMA. The SB is the smallest (indivisible) unit in ALMA observing that can be scheduled independently. It is self contained and usually provides scientifically meaningful data. The SB contains a full description of how the science target and the calibration targets are to be observed, and sets of SBs can be combined with a description for the post processing of the data, ultimately resulting in an image.

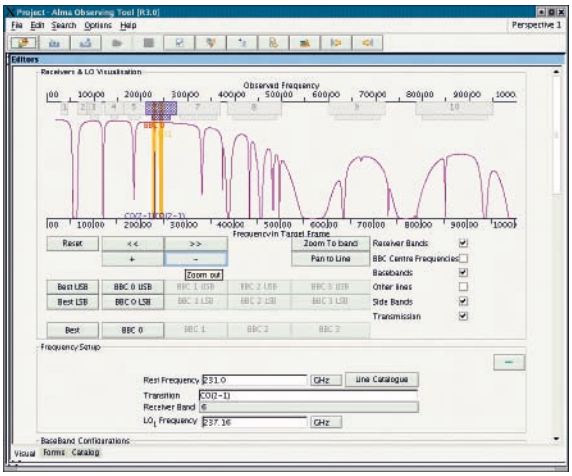
In order to serve both less experienced and experienced astronomers, the OT will be equipped with two so-called "Views" to make Observing Programme preparations. It is intended that the main view on the ALMA system will be the "Science View". As the name indicates, in this view the users can concentrate on inputting the science requirements of their observing programme: the area to be observed for each target, required sensitivity and frequencies. For most observing even experienced users should only need to use this view. The required SBs will be con-

structed by the system and the user will only be bothered with system parameters when this is absolutely necessary, in general detailed parameters will be determined from the science input.

However, it is recognised that for some programmes, and indeed for developing new observing modes, an ALMA-experienced observer will need more. The "System View" (or expert mode) will provide such a user with a complete set of parameter fields that enable a detailed specification of each scheduling block: the observing process of science and calibration targets, including data acquisition and reduction recipes. These parameters include the setting of the local oscillator, the upper and lower side bands, the correlator parameters and the selection of the basebands and subband sets within each baseband. Whichever "View" is used, SBs must be created.

An interesting functionality in the System View that has been added recently is the Visual Spectral Editor. This will help somewhat experienced users to carefully position LO frequency, and the frequency characteristics of the basebands configuration within the ALMA receiver band. In the figure a part of this editor is visible. It shows the upper part of the Visual Editor display with the all ALMA Frequency bands (note that these will not all be available; see also *http://www.eso.org/alma/specifications/FreqBands.html*), the transmission curve of the atmosphere over the full ALMA observable spectrum (note Band 6 has been selected), the setting to the LO frequency and upper and lower side bands, and one baseband selection. A later version of this tool will aid less experienced observers, without subjecting them to the detailed setup.

The development of the Observing Tool is a shared effort between the UK Astronomy Technology Centre in Edinburgh, ESO and the NAOJ, with science advice provided by Osservatorio Astrofisico di Arcetri and the NAOJ. Development is currently focused on the Science and System View of the Phase II Observing Programme definition. Work has been ongoing for two years with a major and a minor release each year. User test cycles immediately follow releases of the software. Currently, it is planned to have four major user test sessions and three minor ones. The major user tests provide important and timely input feedback to the team for possible upgrades in the following releases and are performed by typically eight people. Minor test sessions are follow-ups of the major releases but possibly include further tests and input for the development team toward the next major release. The next major user test will take place this November. It is planned to hold wider "beta testing" in advance of the first release of the tool to the community.



A typical display produced by the Observing Tool (OT) using the Visual Spectral Editor. The graphics shows the ALMA receiver bands and the user-selected positions for the basebands and sidebands. Also, the atmospheric transmission curve is displayed.

Data reduction

All ALMA data will be reduced using the ALMA offline reduction and imaging package. This package is based on the C^{++} code base in AIPS^{++} but the code itself is undergoing some fairly major changes to optimise it for ALMA and the user interface is being redesigned. For many observations the automated calibration and imaging pipelines will produce reference images suitable for analysis.

During the past 1.5 years, ALMA has conducted external user tests every six months to ensure that the reduction software development is adequate for ALMA needs. This is an ongoing process designed to incrementally test functionality as it is developed. To date, three test cycles have been completed. The testing has focused on verifying that the underlying C^{++} code has adequate functionality and is robust enough for ALMA needs (e.g. make sure that users can process datasets from end-to-end using specific ALMA cases). The user interface (both the GUIs and the script language) will change significantly over the next several years and thus, current testing could not yet evaluate the robustness or user-friendliness of the interface. Essentially, if testers could do what was necessary to get a scientifically accurate image and evaluate the image quality (even if the syntax or process was a bit complicated) then the test was considered a success. User interface elements will begin to be tested in early 2006. External testers have been volunteers from the world-wide astronomical community. So far, only expert interferometrists have been asked to test the software. Later, when the new user interface is developed, novice users may be asked to help with the testing. The tests have been successful to date – all testers have been able to fill, edit, calibrate, image, and analyse the test data sets. Based on these tests, it appears that the offline reduction and imaging package is on schedule for meeting ALMA data processing needs at the beginning of early science operations. For more details, see the AIPS^{++} homepage (*http://aips2.nrao.edu/docs/aips++.html*) or the latest test report (*http://aips2.nrao.edu/projectoffice/almatst2.0/Offline.Test3.Report.7july05-final.pdf*). (Based on a contribution by Rein Warmels (ESO) and Debra Shepherd (NRAO).)