Report for ALMA Calibration and Imaging
June-July 2003
NA Progress Report

Overview

Science IPT Activities

During June-July, Science Group activities centered around final design for the extended ALMA configuration (submitted), preparation of the ALMA Science Requirements document, preparation of the ALMA Calibration Strategy Plan, initiation of the Design Reference Science Plan, discussions of Operations including how the plan described in Chapter 6 of the Project Plan might be improved, and also how the ALMA Science Center will operate. Responsibilities were shifted to accommodate the surprise departure of the ALMA Interim Project Scientist.

Joint NA/EU Science IPT staff and Calibration Group telecons were held monthly, and the weekly NA Science IPT telecons continued, beginning their sixth year (Agendas and notes for all meetings are available; this period's include telecons on 10 June (Science IPT), 17 June, 1 July, 8 July (Science IPT), 15 July and 29 July. During these telecons, progress on action items is tracked toward meeting milestones and assignments (new action items) are made to assure their timely completion. Level 2 Milestones met during June-July 2003 include:

- Science 9812 9.380.9812 Document on how calibration reqs flow down to instrumental specs 2003-Jun-30 Level 2 Done as modified at ALMA Week.
- Science 9815 9.380.9815 Plan for Y+ configuration submitted 2003-Jun-30 Level 2 Done X

There were eleven level 3 milestones met during the period and five of Level 3 and below were deferred during the shift of responsibilities mentioned above.

Anticipated problems:

The unexpected departure of the Interim Project Scientist, and the subsequent departure of other key players in the development of the calibration strategy could cause delay in the 30 September Level 2 Milestone for delivery of an ALMA Calibration Strategy. The Science IPT has secured promises that the departed members will continue to work on the strategy but its control of the situation is more limited; it has appointed an interim head of the Calibration Group, and it will shortly commence advertising to fill the vacant positions.

ASAC Meeting

In the absence of the Interim Project Scientist, Wootten aided in preparation of the agenda for the meeting in accord with the plans made by ASAC Chair John Richer and Vice Chair Lee Mundy. Wilson handled organization of the meeting, including all local aspects. Wootten, van Dishoeck, Emerson, Butler and Holdaway are expected to contribute presentations to the meeting.

ANASAC Meeting

Wootten prepared the agenda in consultation with Chairman Crutcher, Emerson and Lo. With

advice from Crutcher and help from Rodriguez in Charlottesville he also handled meeting logistics. In consultation with Lo, Carilli and Emerson, he produced revisions of Chapter 6 of the Project Plan, as well as a possible outline of the ALMA Science Center to be located in Charlottesville.

Design Reference Science Project

During July, planning for the Design Reference Science Project culminated with issuance of a call for scientists to submit descriptions of a prototype suite of high-priority ALMA projects that could be carried out in 3 years of full ALMA operations. Many submissions were received during July toward a 15 August deadline for the first phase of this project. An October date for release to the Project is anticipated. This plan serves as a quantitative reference for developing the science operations plan, for performing imaging simulations, for software design, and for other applications within the ALMA project, including:

- allow cross-checking of the ALMA specifications against "real" experiments
- allow a first look at the time distribution for
  - configurations
  - frequencies
  - experimental difficulty (fraction of projects that are pushing ALMA specs)
- start developing observing strategies
- derive "use-cases" for the Computing IPT
- be ready in case some ALMA rescoping is required, or in case some ALMA specifications cannot be met.

Submissions from four major ALMA science themes including twenty-one subtheme topics have been sought.

Configuration

During this period, Configuration team member Holdaway delivered a plan for configurations covering the larger configurations, mated with the inner configurations, to the JAO. Conway worked on sequencing the movements of the antennas between configurations. Wootten made a computer movie for use in presentations to illustrate the motion of antennas to larger configurations.

At present, the inner configuration station positions have been approved by the project. The stations in the larger configuration are submitted to ALMAEDM and are in a comment period.

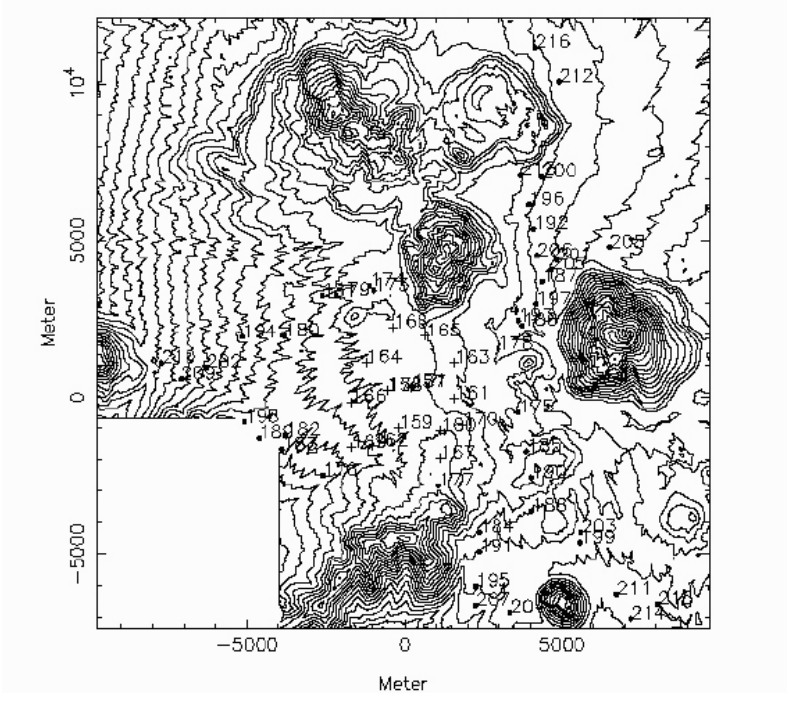

Figure 1 The Extended Array on a contour map (50m contours) of Chajnantor. Plus signs denote reuse of existing pads; dots indicate positions of new pads.

Calibration

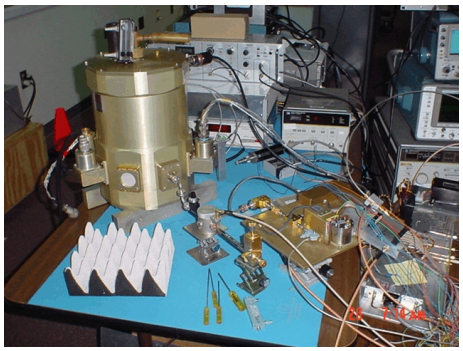

Figure 2 ALMA conventional LO test setup in Green Bank, W. Va.

During this period the Calibration Strategy was discussed during a special session of ALMA Week, where it was well received. Shortly afterward, Butler summarized it to a larger audience at the North American meeting of URSI in Columbus. The amplitude calibration continues to pose problems, as tests with the Berkeley-designed dual load in the secondary have been found to produce unacceptably high standing waves, for poorly understood reasons, and the tests with a semitransparent vane at the IRAM 30m have revealed inconstancy on the order of a few per cent. Tests of the latter system continue; during ALMA Week a modification using either a wire grid or dielectric were discussed. Results will be presented to the ASAC, with a recommendation to set ALMA specifications at a currently achievable achievable level rather than the current goals of 1% calibration at wavelengths longer than 1mm, and 3% for those shorter.

Richer and Hills organized a session on water vapor radiometry at ALMA Week. Particular attention was devoted to the operation of WVRs at the Antenna Test Facility in New Mexico. Although the weather there has been shown to be satisfactory for tests, the baseline available for interferometry at that facility is marginal for meaningful atmospheric tests. System integration tests could, of course, be carried out. It was concluded that postponement of this activity until a prototype interferometer was available in Chile presented some risk to the project, and tests at the ATF were desirable.

Wootten assisted with tests of the ALMA Conventional LO system in Green Bank during the period just before ALMA Week; he is involved in assessment of data taken during that run currently.

Site Characterization

Two site characterization memos appeared during this period. The first (Memo No. 471) consists of a recasting of the ASAC report of last Fall on *Site Properties and Stringency* with aurhors Neal Evans (U. Texas), John Richer (MRAO Cambridge), Seiichi Sakamoto (NRO, Japan), Christine Wilson (McMaster, Canada), Diego Mardones (Universidad de Chile), Simon Radford (NRAO, Tucson), Selby Cull (NRAO, Tucson) and Robert Lucas (IRAM). During the period Mark Holdaway took all site characterization data, extracted half hour averages for the parameters, and made this dataset into a table which can be queried with aips++. Along with a set of tools he developed, this will become the basis for comparison of the Design Reference Science Plan schedule of projects with the conditions on the site, and will be useful for Operations Group discussions as well. The result of a survey conducted last December with Science IPT support, ALMA Memo No. 470, *RFI Survey at the ALMA Site at Chajnantor* by coauthors Carla M. Beaudet, Galen Watts, Jeff Acree, Simon J. E. Radford (NRAO) presents a baseline characterization of the radio frequency interference levels at Chajnantor as the construction project gets under way.

The Science IPT prepared a paper recommending 'ancillary devices' to be available on ALMA during operations to aid in characterization of the atmosphere for dynamic scheduling.

Science Software Requirements

The Science IPT sent a set of recommendations to the SSR on ALMA Data rates. One new element is an additional proposition to lossily compress the data archived on the long term (the full data will be available to the observer). The currently budgeted data rate is still 6/60 Mbyte/s, and no increase proposal has been made at the project level.

Outreach and Public Education

Activities involving the ALMA Community in North America

The Science IPT arranged the agenda, minutes and telecon for the monthly ASAC telecons (held on 3 June and 2 July 2003; agendas and minutes in ALMAEDM). The related ALMA North America Science Advisory Committee (ANASAC) group also held telecons (held on 27 June and 25 July; agendas and minutes available) facilitated by the Science IPT. The Science IPT also planned the face-to-face meeting of the ANASAC to be held 25 August 2003 at the Chicago O'Hare airport. In conjunction with the Science IPT and NRAO, the Science IPT arranged and is planning a town meeting to be held at lunchtime on January 8, 2004 during the American Astronomical Society meeting in Atlanta.

Wootten gave a lecture on ALMA at the Herzberg Institute for Astrophysics during ALMA Week, which was carried to an audience in Penticton over closed circuit televison. He presented a paper on ALMA at a session on Large Millimeter Arrays at the North American URSI meeting in Columbus in June, in connection with a session organized and co-chaired by Bryan Butler. Butler presented a paper on ALMA Calibration; both Welch (UCB) and Gibson (UCB) made presentations on aspects of ALMA calibration.

Butler attended the IAU General Assembly, where he participated in the ALMA activities. One focal point of the meeting was an Invited Discourse by Science IPT Lead van Dishoeck featuring new ALMA graphics.

Wootten gave a lecture on ALMA to the Charlottesville contingent of the NRAO Summer Student Program. A lecture at the Single Dish Imaging School, in Green Bank in early August, will also feature ALMA. He presented a talk featuring ALMA operations planning to the NRAO via closed circuit television in June. In July he traveled to Austin to make a presentation to the University of Texas Astronomy Department featuring ALMA. In early August he visited CalTech, where discussions including ALMA occurred with ASAC Member Jean Turner and ANASAC member Andrew Blain, as well as others.

Science IPT ALMA Papers

See Site Characterization, above. Memos 470 and 471 were issued in July.

Science IPT Meetings during June and July

on 10 June (Science IPT), 17 June, 1 July, 8 July (Science IPT), 15 July and 29 July.

The Science IPT Agenda for 10 June 2003 included discussions of Design Reference Mission, ALMA Week Report, ACA, Ancillary Devices, Milestones.

The NA Science IPT Agenda for 17 June 2003 included discussions of News, Phase Calibration, Large Array, LO Tests, AOB.Operations Discussion
The NA Science IPT Agenda for 1 July 2003 News,
The Science IPT Agenda for 8 July 2003 included discussions of Science Design Reference Plan, Extended configuration, Action items, Milestones
The NA Science IPT Agenda for for 15 July 2003 included discussions of Gain stability, ALMA VLBI, DRSP.

ASAC Meetings during June and July
The ASAC telecon on 4 June, 2003 included discussion of the presentations made to the ALMA Board meeting in late May, and possible charges for further ASAC discussion.
The ASAC telecon held 2 July, 2003 included welcome of the new members of the European delegation to the ASAC, as well as discussion of the possible charges for further ASAC discussion and the Design Reference Science Plan for ALMA.

ANASAC Meetings during June and July
The ANASAC telecon on 27 June, 2003 included discussion of ALMA Computing, the face-to-face meeting, and the plan for the AAS Town Meeting.
The ASAC telecon held 25 July, 2003 focussed on the agenda for the face-to-face meeting, as well as a discussion of the Design Reference Science Plan for ALMA and further plans for the AAS Town Meeting.