Project Scientist Report
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2007 October 15

1) Highlights of Recent Events

ASAC. The ESAC met in Garching on 29 September to discuss the Charges; the EASAC met in Tokyo on 6 October to discuss them. The ASAC held a telecon on 8 October to discuss a draft of its response to the Charges, which was then iterated and transmitted to the Board. Without a complete face-to-face discussion, it was thought, a definitive response was difficult to achieve. The ASAC wishes to discuss its final response to the charge on commissioning and science verification at its next face-to-face meeting, which it proposes to occur sometime in 1-4 Feb 2008 near the ALMA site.

Followup on ASAC Charge No 3, June 2007 on Laboratory Astrophysics: Work (by Remijan, Lovas, Markwick-Kemper and others) has begun on a white paper summarizing molecular data requirements needed for ALMA to optimally produce its transformational science. During this period, a focus has been on spectral line databases. The ALMA Working Group on Spectral Line Frequencies is tasked with compiling the a suitably complete spectral line database for the purpose of identifying and modeling spectral line data. The group has now produced the most complete database publicly available. The database, named Splatalogue, is a comprehensive transition-resolved compilation of observed, measured and calculated spectral lines. A number of additions and improvements have been made since the last Board meeting. In addition to the JPL and CDMS spectral line lists, 229,221 new/updated lines from the Spectral Line Atlas of Interstellar Molecules (SLAIM) were added to the database. In addition, 12,332 lines (or an addition of ~2000 lines) were added to the Lovas/NIST Recommended Rest Frequencies of known astronomical transitions. To all entered spectral line data, diagnostics were developed to identify overlaps in transitions, frequencies, formulae and chemical names among the four databases. A common method has been devised to display and designate each individual species. Splatalogue also contains atomic and recombination lines and template spectra. It is completely VO-compliant, capable of query response under the IVOA SLAP standard. An element of the white paper is to describe the further needs of this database. The details of the database and its use for the ALMA archive, observing tool and data reduction packages will be made available by year's end, when Splatalogue will be available for use and elaboration by observatories worldwide.

Commissioning and Science Verification Vacancy notices for the SCO Commissioning Scientists have been advertised. Vacancy notices for ARC astronomers at both ESO and NRAO have also been advertised. Applications close within the next month.

ALMA Test Facility and AIV Support. Most members of the Science IPT have rotated through the ATF during the period. ALMA achieved another milestone on the path to dynamic fringes on 2 Oct. Stable fringes were achieved on Mercury using a polynomial for the geometric delay provided by Emerson. Fringes were observed for approximately 2 hours with no human interaction. Afterwards, fringes were observed on 3C279. Although the weather was cloudy, the phase stability was quite good. The system included many key ALMA devices. Delays were set in the correlator and Digitizer Clock, and fringe tracking done in the First Local Oscillator Offset Generator.

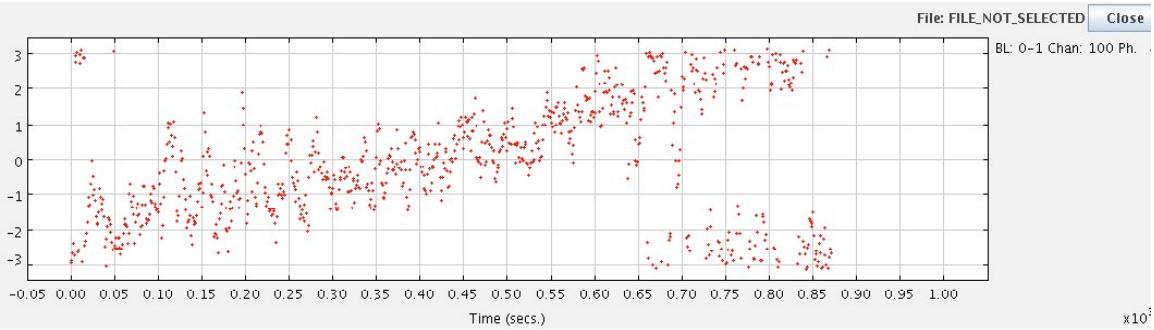

Figure 1 Cross-correlated phase on Mercury. These plots were on Mercury. Darrel explains that this shows a plot of the cross-correlated phase for one of the 256 frequency channels from the spectrum (actually "channel 100") against time. The horizontal axis numbers should be multiplied by 1000 to get seconds, so this plot shows about 870 seconds of data. The vertical axis is in radians. Around 700 seconds (0.7 on the scale), you can see some of the points wrapping round 2-pi radians. The short-term deviations, particularly obvious in the first 300 seconds, are believed to be the atmosphere. I wasn't there, but I believe the weather was not very good at the time. This is just what you'd expect in mediocre weather. The linear slope over the ~850 seconds probably means we haven't got the baseline parameters quite right. I actually went out with a cloth tape measure a couple of weeks ago, and measured the relative heights and separation of the 2 antennas, as well as the approximate offset from an E-W baseline (turns out there's a 1-degree offset from exactly E-W). To compute the predicted relative propagation delay to the antennas, which I was responsible for, although I had put in a height correction, I hadn't put in the deviation from E-W. After the success on Mercury - they followed it phase stably for approximately 2 hours - they decided to try the same on a quasar, 3C279.

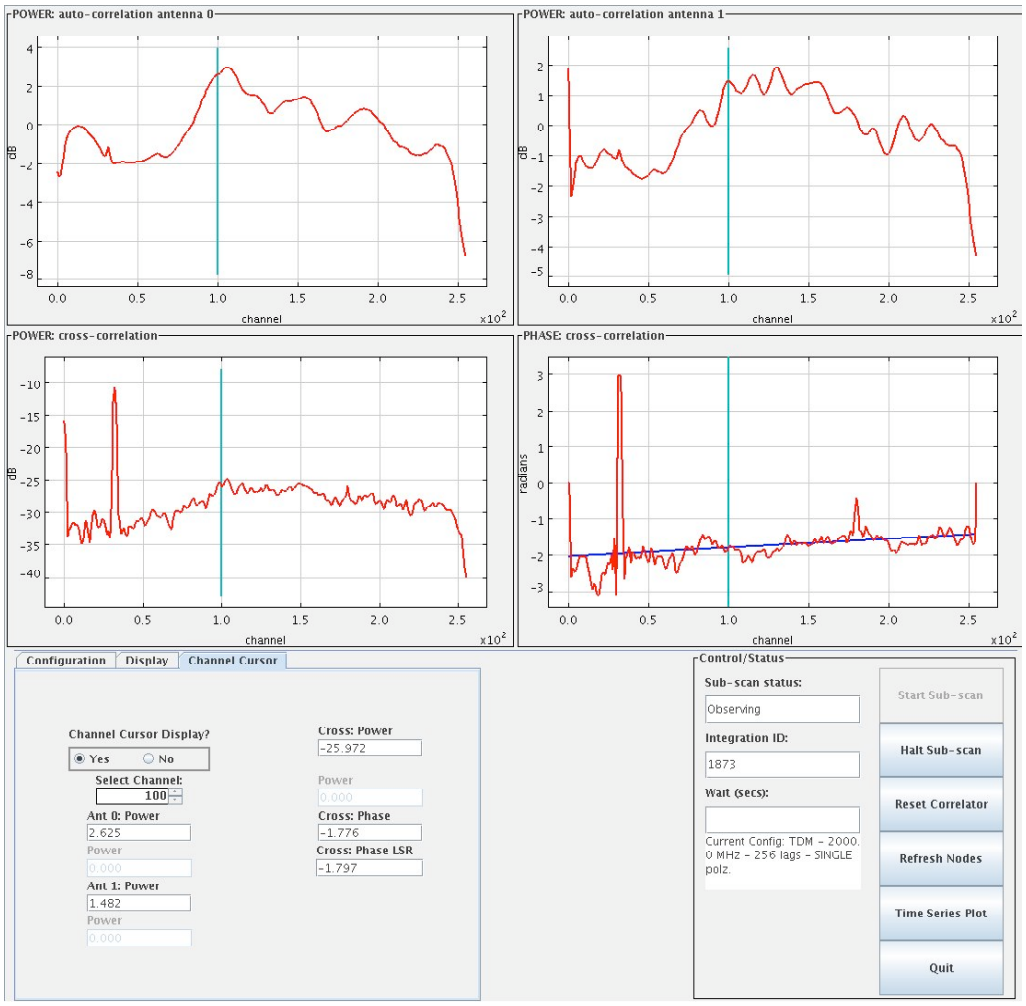

Figure 2 Specrtometer data on Mercury. Darrel explains that this figure shows 4 plots, with the horizontal axes being frequency channel. There are 256 channels shown, across a 2-GHz IF band. This is from just 1 of the available 2-GHz bands in the IF. The top 2 plots are auto-correlations of the two antennas, power against frequency channel, with the vertical scale in dB. There has been no calibration applied; obviously if we were doing real astronomy, the passband shape would be calibrated out. The lower 2 plots are from the cross-correlation function. Horizontal axis the same, frequency channels (256 chans over 2 GHz). Lower left is the cross-correlated amplitude, vertical scale in dB, lower right is the cross-correlated phase, with the vertical axis in radians. The large "blip" on the left is an artificial beacon that's used in testing to help set things up. The slight linear phase slope on the lower right plot just says we haven't got the delays quite perfect, with some small fraction of a nanosecond error.

Configuration Design. Holdaway completed a description of the design of the extended configurations. Reid is assigned to evaluate the performance of the configurations using the methodology established previously by the project but using CASA software.

Calibration. The first weather station equipment for the AOS is being tested at ESO. The Calibration Plan was presented to the various SACs for review.

Imaging. Science IPT personnel participated in support exercises in advance of the limited beta release of CASA.

EPO. ALMA has been represented in several meetings. There were several presentations at the recent meeting Astrophysics in the Next Decade: JWST and Concurrent Facilities held September 24-27, 2007, Tucson Arizona. Peck lectured to 45 students at the IRAM Summer School 'mm Observing in Times of Herschel' at Pradollano, Spain; she also attended the meeting 'The Modern Radio Universe' in Manchester, UK. Zwaan presented ALMA at the ARENA conference in Potsdam "The Astrophysical Science Cases at Dome C."

2) Near-term Actions and Concerns (for Board information)

We identify no near-term Actions and Concerns.

3) Board Decisions Requested

None.