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First Interferometric Spectrum at the ALMA Test Facility

We have obtained the first interferometric spectrum at the ALMA Test Facility. Todd Hunter, Robert Laing and ALMA operators Hector Alarcon & Roberto Aviles obtained a spectrum of the Orion Hot Core centered on the CS(2-1) line at 98 GHz on 19 January 2008 (see figure below).

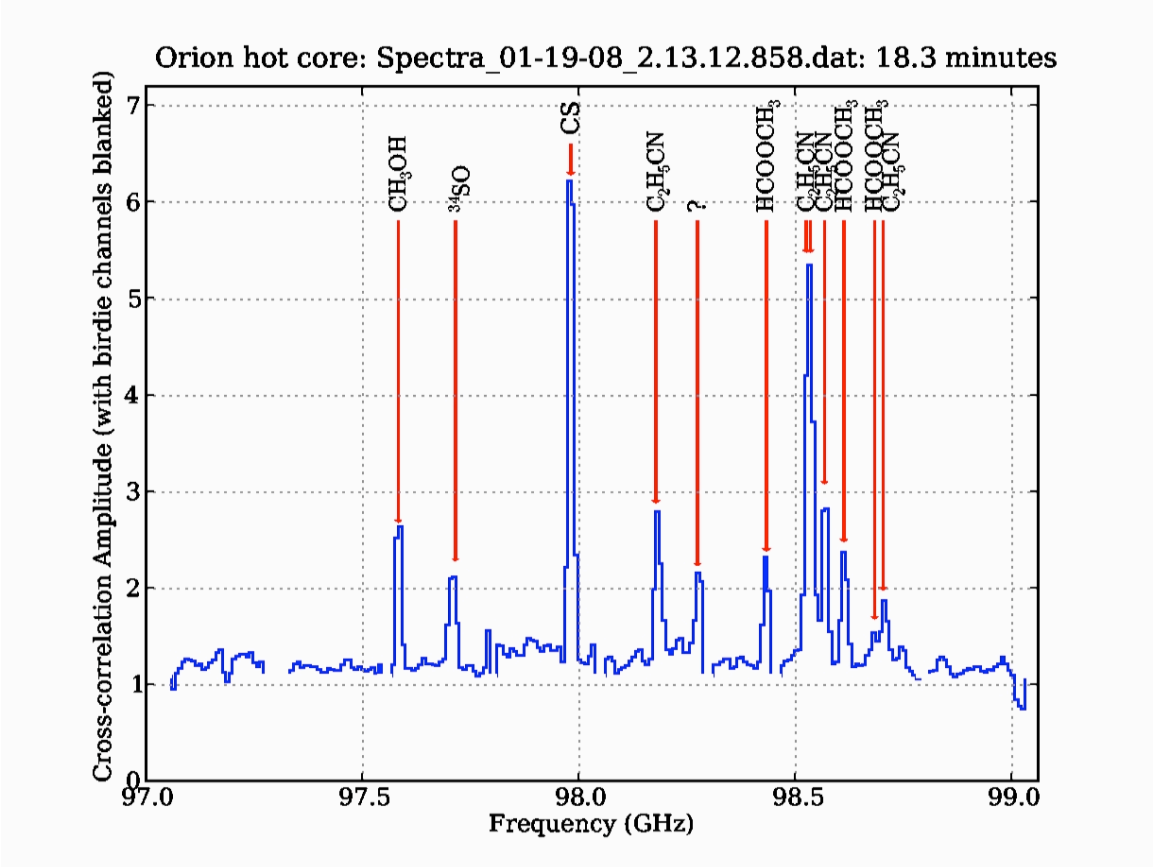

Figure 1: The first spectrum obtained with ALMA proto-type antennas at the ALMA Test Facility using the evaluation front-end receivers and production back end equipment. Blanked channels are seen as missing data.

Interferometric fringes have become routine at the ATF and developers, scientists and engineers are now able to obtain fringes on bright quasars in a matter of minutes. The acquisition of a molecular line spectrum was the next step – achieved the first time it was tried.

Todd and Robert first obtained fringes on a quasar at the standard frequency of 103.833 GHz. They then moved the LO down by 5.8 GHz in order to place the CS(2-1) line near the center of the correlator band. They immediately got fringes on a quasar and then moved on to the Orion hot core. Evidence for spectral line emission was obvious in the raw GUI display plots with a 4 second dump rate. Data were written to disk (not the archive yet). A total of 18 minutes on-source integration was obtained. A similar exposure time was obtained off-source (1 deg south). The off-source spectrum was used to identify problem channels. These channels were then blanked in the on-source spectrum. The bandpass shape was removed by using a smoothed version of the off-source spectrum but preserving the average continuum level.

Processing of the ASCII file containing the cross-correlation data was done with the CASA software. The data were first filled into a CASA table. A CASA (python) script was then developed to read the tables, flag the channels containing spurious internal signals, apply a scalar time average to the data, perform a boxcar smoothing of the off-source spectrum and remove this shape from the on-source spectrum, generate the approximate frequency scale, plot the spectrum, and label the molecular line frequencies with appropriate subscripts and superscripts.

The origin of many of the bad channels is known to be due to electronics synchronization errors, leakage problems or software issues that are being actively investigated at the ATF. Also under investigation is the origin of an Antenna Bus Master (ABM) software crash that hampered this effort but did not prevent acquisition of this spectrum.

Thanks to everyone at the ATF in the Science IPT, Computing IPT, Operations and PSI/AIV for helping to achieve this significant goal. I'd particularly like to thank:

- Todd Hunter and Robert Laing for making the observations and doing the data processing;
- Members of the Science IPT for developing the CASA scripts to read and process the cross-correlation data;
- Hector Alarcon and Roberto Aviles for operating the system; and
- Jeff Kern and the ATF support team for implementing the software needed to obtain fringes relatively easily.