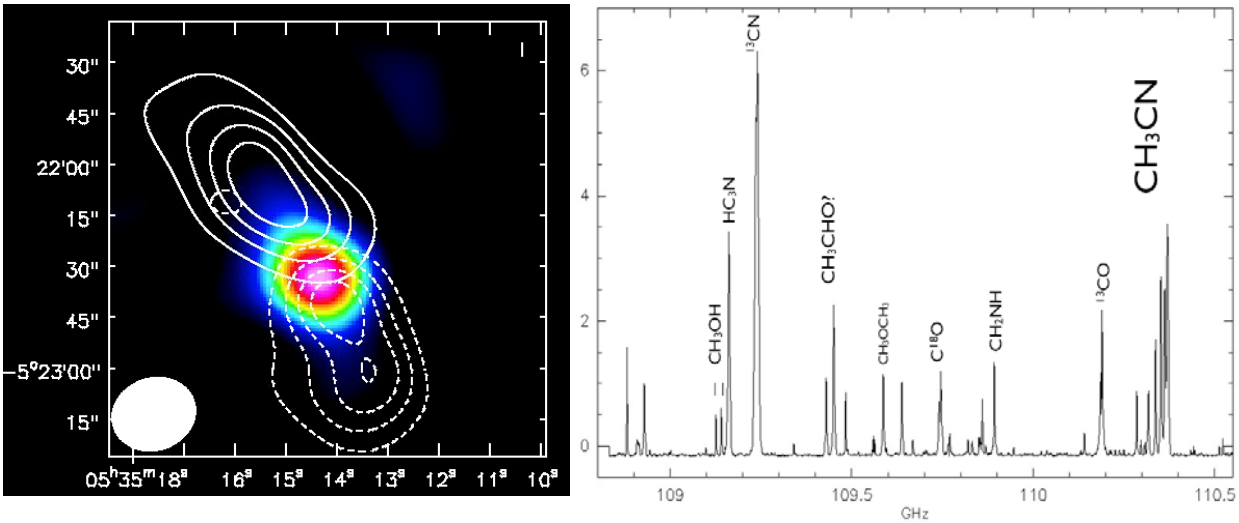
9. SCIENCE IPT

9.1 Commissioning and Science Verification

December was a very mixed month from our point of view. The observing conditions were good for the first 10 days or so but then started to deteriorate and it became very wet towards the end of the month. It appears that the "altiplanic winter" has started early this year. This may reflect the fact that conditions in the equatorial Pacific are still in the La Niña phase (colder surface waters than average). Despite the increased number of antennas at the high site, the availability remained marginal with respect to the goal of having at least sixteen 12m antennas operational at a time. Faults occurred across all antenna types and were mainly in familiar areas such as uninterruptable power supplies (UPS's), subreflector drive mechanisms (hexapods) and receiver-cabin air-conditioning (HVAC). Faults in the electronics also contributed to down time. The largest single loss of time was however caused by the unintended discharge of the fire extinguisher system in the correlator room.

Our work also continued to be hampered by software issues that have been described in previous reports – in particular the notification channel problems, the control of the phase of the third local oscillators (TFBLO) and, perhaps to a lesser extent, archive-related issues. At the time of writing, however, it is believed that the notification channel problem has been solved and a great deal of progress has been made on the TFBLO issue, although occasional phase jumps are still being seen and the adoption of R8.1 for scheduled observing is still on hold while these are investigated.

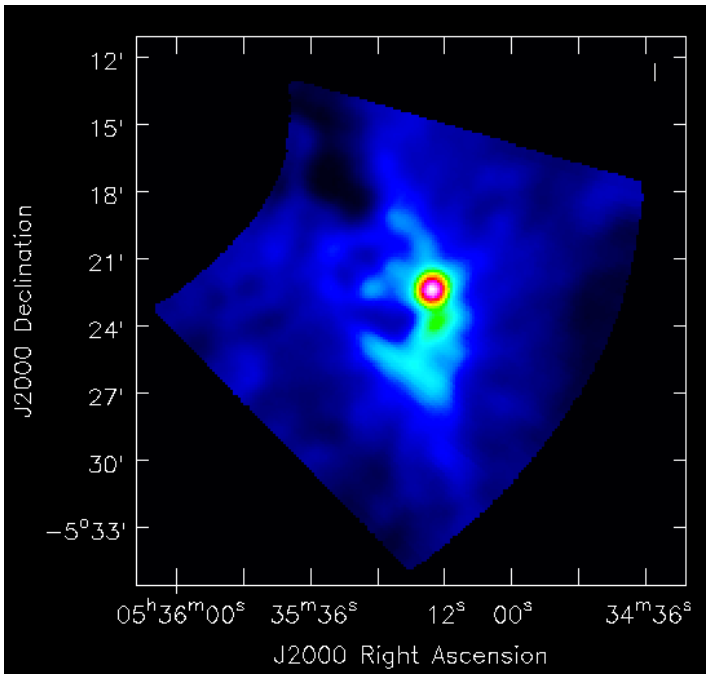
There was nevertheless important progress on many topics during the month. The fourth and fifth 7m antennas came into operation during the month and we worked hard to get them integrated and tested. The only major difficulty was a problem with the location of a cable that prevented operation of the calibration devices. We were (just) able to achieve our goal of taking imaging data with five 7m antennas and the ACA correlator by the end of the month. Here is a very preliminary reduction (not for circulation!) showing the Orion A region at 3mm wavelength. On the left is the continuum image (in false colour) with the ^{13}CO at positive and negative velocities overlaid as contours, while a small part of the spectrum from the core is on the right. These data was taken with about 7mm of water vapour at zenith and the UV coverage is poor, so we will certainly have much better results to show soon.



The second solar observing campaign was carried out from the 1st to 8th Dec. The initial batch of solar filters of the new design had been delivered and installed (well ahead of schedule) and so it was possible to test these. The attenuation values were as predicted and the beam patterns appear to be good. Unfortunately new features that had been introduced in software upgrades were incompatible with the use of the filters, so we were not

able to make as much progress towards interferometric imaging of solar features as we had hoped. We have taken on board the obvious lessons-to-be-learnt from this for our software testing processes and the way in which we prepare for such targeted test campaigns.

We were able to make and process some larger "zero-spacing" (single-dish) maps. Here is an example of a scan, again of the Orion nebula but this time in ^{12}CO J = 1-0, covering an area of about 400 square arc-minutes. The well-known bar shows up very well.



There was also good progress on performing calibration surveys – both measuring the fluxes of standard sources around the sky and also conducting searches for suitable phase calibrators near astronomical targets. Tests of the "mixed" correlator modes were essentially completed. This allows different spectral set-ups to be used for the different basebands, providing a great deal of additional flexibility.

The main items in the "diagnosis" area (which is carried out in close collaboration with System Engineering) were as follows. An explanation was found for occasional large changes in the delays of the signals arriving from certain antennas following a full system restart was found and we believe that this problem is now fixed. We are however still seeing smaller persistent delay changes (of usually 1 or 2 ns). These were investigated and a probable cause has been found. Further instances of oscillations in the Band 6 IF amplifiers have been found and possible ways of suppressing them are being checked. The problem of instabilities arising in the IF attenuators is being assessed.

Science IPT staff from the executives continued to play a key role in the pre-acceptance testing of the antennas and preparations for the acceptance reviews.

9.3 Staffing

We again benefitted greatly from the presence of Masumi Shimojo for the solar campaign and Pavel Yagobov provided much help with the solar filter testing (as well as making improvements to receiver performance). Jean Turner completed her three-month visit during which she contributed very strongly to observing, data analysis and scientific activities.

We are very sorry to be losing Stuartt Corder, who has played an enormously important role in the CSV effort over a period of more than three years, during which he made major contributions in almost every area of our work, as well as being the leader of the Calibration Group. We look forward to his continued involvement in ALMA from his new position at the NAASC.