

Comments on the memo
On the Scientific Benefits of Cross Correlating the 12m Array and the ACA
Ed Fomalont - 2006 March 01

There is no doubt that Combined array observations will be very important for a significant fraction of the ALMA operations, and that the technical problems (in hardware and software) associated with combined operations have been largely solved. There may be some differences among the several reasons and priorities for using the Combined array or the separate arrays, but these are minimal. In the end, it will take experience with ALMA (unexpected calibration problems, the nature of mm-radio emission) to decide on the optimum strategy concerning independent or combine array use.

I have a few suggestions and comments:

- There is no doubt that the main goal of the ACA is to provide the short spacings (when necessary) that are missing from the 12-m array alone. My question is that when a scientific program needs this (u-v) range of observations, why not observe them always with the combined array mode rather than coordinated mode? The advantages are:
 - Better signal to noise, mainly through the 12x7m baselines.
 - Natural cross-calibration between the ACA and 12m arrays.
 - Easier to schedule
 - Easier to reduce

What are the scientific disadvantages? I suppose there are some, and these should be mentioned.

- The Combined array usage ONLY to increase the SNR (the short (u-v) spacings are not needed) is not so strong a motivation. The estimate is that about 10% of the time ALMA projects require a well-defined high sensitivity that is not limited by dynamic range, is probably about right. For other projects where the needed rms noise is not known very well, Combined array usage is probably not the optimum use of the ACA.
- ACA calibration. There are some calibrations which are signal to noise limited that will need the participation of the Combine array. But, many calibrations are not SNR limited and can be done using strong sources by the ACA alone. Hence the 4 to 9 times in the observing time factor is not relevant for all calibrations since it takes only a few seconds of observing to reach the accuracy needed for many calibration processes. The two most crucial calibrations are the bandpass (plus sideband) calibration and the temporal complex gain calibration and you discuss these. Again, until we start observing and determine some of the instrumental, temporal and spatial properties of the array in general, optimum calibration strategies and combinations are now guesses.
- I believe that at high frequencies the optimum resolution for some sources will be the ACA plus the part of the 12-m array which is closest to the ACA. Should this be mentioned? In more general terms, a more arbitrary splitting between the ACA and some, but not all of the 12-m array may be very scientifically useful. During these periods, the longer-spacings of the 12-m array can be used for small-diameter source observations which are not signal-to-noise limited.