

## The Case for a Test Interferometer - Draft

The discussion of when to close down the ATF has highlighted the question of how we will perform software tests during the remaining period of ALMA construction. Gianni Raffi in particular has been emphasizing that there is still a long development path ahead and that it is essential to do really in depth testing at every stage. This requires planned access to a more or less complete system at regular intervals. While one could have some debate over how much of this should be done by simulation rather than using real hardware, I have no doubt at all that he is right about this. We also have very strong evidence of the importance of real-world from almost everything that has happened at the ATF. It is therefore essential that we make this a key part of our planning of the activities over at least the next couple of years.

I would go further and argue that similar considerations apply to other parts of our work as well. I am sure that there are many parts of the hardware that will benefit from rigorous testing in a system context that can be kept isolated from the main construction, verification and (later) early science activities. I understand that on the VLA a test interferometer was kept going right through the construction phase and that this was found to be essential for working out the bugs and testing both software and hardware modifications.

Now it can be argued that with the planned ability of the ALMA system to run multiple arrays simultaneously, we can take care of these needs anyway without having any equipment in a dedicated test set-up. My suspicion is that this would actually be even worse than simply using the whole system for doing whatever testing is needed. The potential for the different activities fouling each other up seem enormous to me, particularly when one is trying new things.

If one accepts the need for a dedicated interferometer (I would not argue for more than a single baseline), then the next question is whether it should be at the OSF or at the AOS. We have yet to get a real feel for the problems of working with very complicated equipment at the high site but my feeling is that the combination of altitude and distance from support equipment, etc., will have a big effect. I think we should count on it taking several times as long to solve a technical problem with the equipment at the high site as it would at the OSF. I realize that as far as the software testing is concerned the people doing the hard thinking will not be at the summit, but even in that case I suspect that the fact that the equipment is not close at hand will prove to be a big handicap, especially in the coming year, or probably a good deal more, when we are still sorting out interactions between software and hardware.

I am therefore making the case for planning the activities in such a way that we always have two antennas with front-ends, back-ends, etc., at the OSF running as an interferometer for testing, problem solving and development purposes. We will in fact have two single-baseline correlators and, as I understand it, we will have a reasonably complete laser local oscillator system that is not intended to go to the AOS. One obvious concern is that this will delay the availability of equipment at the high site. This is clearly true in terms of early milestones like phase-closure at the AOS, but later on the effect should be small. The production rates indicated in the IPS for the time when Early Science starts for example are such that holding back two antennas implies less than two months delay.

Another advantage of having the test interferometer at the OSF is that we can do interferometric tests on all the antennas before taking them up to the AOS. It should be relatively easy to arrange things at the OSF so that they could be connected up to replace one of the elements of the test interferometer for a set of standard tests.

Of course there are difficulties with this idea. An obvious one is that availability of pads at the OSF. I don't know how practical it would be to add two more. One would also have to find space in the building but that does not look difficult to me. It is also true that there are some things that could not be done in practice at the OSF – astronomical tests involving bands 9 and 10 being the most obvious. It seems to me that the advantages out-weigh these difficulties by a large margin.

I am grateful for the comments I have received on this topic from people that I have talked to about this in the last few days, especially Peter Napier whose experience with the VLA is, I feel, extremely relevant.