Minutes of Teleconference on ALMA ATF & OSF Holography Planning

Thursday, November 2nd 2006, 16:30 UTC.

Minutes by DTE, last changed 2006-11-06

Participants: Beasley, Brito, Cesaro, Emerson, Glendenning, Krady, Mangum, Marson, Murowinski, Perfetto, Ramirez, Ridgeway, Seichi, Shepherd, Sramek & Wootten

All future meetings will use the same call-in details:
From USA: 866-814-1347
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Minutes of our last (2006-10-19) meeting are at:

http://www.tuc.nrao.edu/~demerson/osfholo/mins2006-10-19_1.pdf

AGENDA.

I. Status at the ATF

II. Current Action Items

III. Schedule

IV. AOB

I, Status at the ATF

Darrel reported the results of tests this week at the ATF. Several problems had been identified.

1. The differential drift between transmitter and receiver is excessive, meaning that the receiver has to be retuned at frequent intervals. The receiver passband is 10 kHz wide, but the drifts experienced are often many kHz. In earlier tests (2005 and earlier) the

transmitter and receiver had been using the same frequency standard, but that is no longer the case – the original laser synthesizer has been replaced by an Agilent frequency synthesizer in an enclosure at the base of the holography transmitter mast, which drives amplifiers before the coax to the top of the tower. At the top of the tower, there is a times-6 multiplier which feeds the transmitter horn. The enclosure experiences large temperature excursions (more than 20 centigrade degrees), but even without temperature changes it seems the Agilent synthesizer does not have sufficient stability. Antonio confirmed that a better understanding of the published Agilent specifications, after contacting Agilent, are consistent with the excessive drift.

Possible solutions: one solution is to provide higher stability frequency standards, i.e. compact rubidium standards, for both the transmitter and the receiver. Antonio reported that 4 rubidium standards (enough for two complete holography tx & rx systems) with associated 25 MHz locked oscillators could be obtained for a total of about $9 to 10k. The delivery time is 6 to 8 weeks. The stability of these oscillators would reduce the current several kHz of drift down to a few Hz, which is certainly adequate.

Another possible solution is to run a coax cable, or fiber, between the receiver at the antenna and the transmitter. This would also require a 25 MHz locked oscillator – the receiver requires a 25 MHz frequency reference, while the Agilent synthesizers requires 10 MHz. There may be some problems routing the cable into the antenna, especially at the OSF.

It was agreed that we would work simultaneously on a short-term solution (bring a cable or fiber between the antenna and the tx) and a long-term solution (probably eventually providing high precision frequency standards at antenna and transmitter.) The short-term solution should be implemented within a few days. Antonio would place an order asap for two of the rubidium standards, and in about 2 months we would decide whether to place an order for a 2nd pair, or whether the cable solution would have proved a good solution instead – both at the OSF and the ATF.

2. DSP instability. The signal from the receiver, as displayed on the Labview interface, sometimes degenerated into random numbers between +1/-1. This applies to all of the S*S, R*R and Q*Q channels. In normal operation, the signal on this display appears at a level of (say) 0.01 units, and should always be positive. This fault condition may only occur once or twice a day, and is always fixed by performing a "DSP reset" at the Labview GUI. After appearing and being corrected, it sometimes occurs again, perhaps 3 or 4 times within one hour period, but then does not reappear for 24 hours. It is not understood whether this is a DSP firmware, or a communications problem. Because it is easy to fix (the DSP reset) it is not preventing further testing, but the problem should be fixed before shipping the receiver system to Chile.

In the course of investigating this problem, it was discovered that pushing the "DSP reset" GUI button several times in succession would induce a similar fault, with random numbers between 0 and -1 appearing instead of the signal. No way of fixing this problem was found other than powering down the systems. Again, this may be a communications synchronization problem or it might be something within the DSP.

These DSP problems require further investigation, and something should be done to make the system more robust.

3. Receiver saturation. It is found easy to saturate the receiver with too powerful a transmitter signal. An indication of saturation is that the output of (e.g.) the reference signal as displayed on the Labview GUI starts DECREASING even though the input (e.g. by varying transmitter power) is increased. However, this is not seen as a problem. It is just a matter of operating both transmitter and receiver at reasonable levels, and being aware that incorrect signal levels can lead to this problem. Some time will be spent over the next few days characterizing the recommended levels. No other action is required.

4. Transmitter power stability. It had been noted that the output power of the transmitter was sometimes unstable. A drift of 20% in power had been noted in the receiver over just 2 minutes, although usually the drift is more gradual than that. (It was verified that this amplitude drift was not caused by differential frequency drifts.)

5. Software. Although high level software to make holography measurements using Scheduling Blocks etc. has been provided, at this stage of testing the high level software gets in the way. Most testing will continue in the coming week by submitting observing scripts directly, bypassing the high level software. Various components of the software are still unstable, in part caused by inexperience of the testers. The software CIPT is providing a good deal of very welcome help in this area. It is not yet possible to analyse holography data taken at the ATF other than by shipping the data over to Europe for Robert Lucas to analyse, but it is expected that this will be rectified very quickly (and may already have been by the time these minutes are distributed.)
When more confidence in the low-level performance of hardware and software is obtained, the emphasis of testing will switch to the higher level software tools.

II. Current Action Items:

The main outstanding issue is documentation.

1. Antonio will provide the remaining hardware user manuals and a template of the Users' Manual.
   This is still pending.
2. Continuing AI: ICD update on temperature monitors, no later than one month before shipment of receiver #2. Some minor items from Ralph to be corrected in the next ICD issue.
   Still pending.
3. Continuing: Holography feeds from Antonio.
   Pending, but agreed to be of very low priority
4. Schedule: Rick will continue to keep updated as necessary.
   In progress. See http://www.nrao.edu/~demerson/osfholo/schedule/
5. Robert will compare s/n of the new and old (2005) data sets.

Robert has done this, finding that the new data are much noisier than the earlier data. Investigations in progress (see above) are addressing this.

6. The current known problems need to be fixed: signal-to-noise, transmitter pointing, receiver saturation and (lower priority) timing problems. Investigations continue (see above).
7. Documentation, in particular block diagrams and DSP algorithms, needs to be disseminated. This is still true.

III. Schedule

Rick will distribute an updated schedule, which will be made available at: http://www.nrao.edu/~demerson/osfholo/schedule/ .

IV. New Action Items

In addition to the AI mentioned above under *Current Action Items,*

8. Short term and long term solutions to the rx-tx drift need to be investigated. This involves Antonio, Robert R. and Kirk.
9. Testing of hardware and software continues at the ATF.

10. Next Meeting

Darrel will organize the next teleconference for November 9th at 16:30 UTC.