ALMA Weekly Progress Report
8th August 2003

Name: Bill Brundage
IPT: Back End

The spare ATF total power module was returned from Tucson for measurements of gain stability. Blocks of detector data of several minutes duration each will be accumulated by an ABM computer and then analyzed in LabView for Allan deviation. Mike LeBlanc has started setting up for this measurement. Aubry Erickson completed pcb layout of the amplifier for the detector test set. I requisitioned parts for the test set, and Don Jenkins and Mike continued writing LabView controls and data processing. The RFQ for the proto down converter integrated assembly finally went to vendors on July 25 with the addition of evaluation criteria and the usual purchasing boiler plate. Bids are due September 9. The RFQ is in EDM. Sent out more RFQs and requisitions for the remaining parts for the in-house connectorized proto downconverters. Put some part specifications into EDM. Reviewed and commented on several system and back end draft documents.

Name: John Effland
IPT: Front End

Continued testing various equipment configurations for mixer-preamp saturation measurements. We are checking the measurements made in April because those measurements used signal levels that may have been too high.

Wrote-up our predictions of total power variation at the samplers for the Band 6 cartridge. This is background material for the Band 6 Cartridge to IF Switch Sub System ICD.

Interviewed candidates for the Band 6 manager position.

Name: Eugene Lauria
IPT: Front End

4-12 GHz IF amplifiers:
We have received another 12 mixer bodies from the machine shop. Mike Lambeth is going to build another 6 amplifiers, and another 6 will be built by Advanced Control Components (ACC) which is the commercial outfit who is interested in building the amplifiers for us. For the 6 amplifiers that ACC will build for us, we will provide all of the parts, and we have assembled all of the documentation which describes the amplifier

(both electrically and mechanically). A visit is arranged for Tuesday of this week to go over the final details so we can place the order.

Mixer/Amplifier Test Dewar:

The JT-1 test Dewar (This is a Joule-Thompson test Dewar which is intended for development work) has been removed from its cart, and the mixer/amplifier test Dewar has been put in its place. The cryogenic wiring of the Dewar is continuing, and should be finished in a month's time. The ellipsoidal mirror has been installed, and we are ready to work on the bracket that will hold the mixer/amplifier assembly in the Dewar. The compressor has also arrived, and has been partly installed, but we need an additional 3-phase power outlet and a lengthened power cable between the compressor control unit and the refrigerator cold head. We have ordered the wire to make the power cable, and we have contacted the building management about the installation of the outlet. Once the wiring and the power cables are made, we can start cooling the Dewar down.

Name: Jeff Mangum

ATF:

(1) Continued characterization of VertexRSI antenna positioning system.
(2) Optical Pointing: Some minor changes to information written to tpoint file by Stauffer. Not tested yet.

Name: Scott Rankin

IPT: Computing

Progress:

- Released ALMA GUI Guidelines for review.
- Requested GUI conventions data from VLT developers.
- Requested GUI usability data from VLA and VLBA operators.
- Removed garbage files from the CVS server.
- Started preparing for ALMA high level system tests.

Issues:

- None

Activities:

- Develop supporting software for ALMA GUI guidelines
- Develop ALMA 3rd Party Library Collection
- Document Linux Dynamic linking mechanism

Name: George Reiland
IPT: Front End

I spent almost the entire week working on the ATF RX 1st LO system, primarily evaluating the control software that Andrea Vaccari has just completed. Also, I worked on the Ferrite Modulator Driver PCB used to stabilize the SIS current on Band 6 for the ATF. Something is preventing the circuit from driving the SIS current all the way to the desired set point. Small residual error exists after closing the loop. I 'm going to increase the gain drastically and see what happens.

In addition, I placed an order for 4 pieces of the new prototype Band 6 OMT. Delivery is scheduled for Oct. 1st.

Name: Kamaljeet Saini
IPT: Front End (Local Oscillator)

I) ALMA Work Element Sheet WBS: 4.255.1800:
(1) A meeting was held on Monday to discuss the frequency multiplier development as well as arrive at a course of action for procurement of frequency multipliers for ALMA Bands-6, 7 and 9. (A. Perfetto, C. Cunningham, J. Payne, J. Webber, M. Rafal, S. Thacker, and K. Saini in attendance.) The following were agreed upon:

Request a quote from Virginia Diodes Inc. for supplying the frequency multipliers in quantity required for the first eight cartridges (Phase-I). Also get a quotation for the remaining quantity for full production (Phase-II).

Not to commit any funds for a collaborative effort between NRAO (CDL)/JPL for frequency multiplier development at this time, since in a short run, VDI multipliers may meet the requirement. Saini pointed out that JPL would need NRAO support soon in order to make a competitive proposal to secure funding for their part of the contribution to the collaborative effort.

Hold off decision on whether to accept the five Band-9 prototype quintuplers from VDI until after the actual LO power requirement for the Band-9 mixer is known. Though the units do not meet the purchase order specification, they might still be usable since the actual required LO power might be lower than that.

John Payne pointed out that the current Band-9 receiver prototype used a single-junction SIS mixer and not the two-junction kind as recorded in the project book. Saini to reevaluate the "theoretical" LO power requirement based on this modification.

(2) Reviewed the LO power requirement numbers presented in the Project Book. The conclusions, specifically for Band-9, are summarized below:

The power requirement for Band-9 as presented in the Project Book is lower by a factor of 2 than what it should be for a two-junction SIS mixer case.

Calculations based on the relation derived from Tucker and Feldman theory show that the actual power required to pump a 2 junction SIS mixer would be 0.87 uW. If a coupling arrangement equivalent to a 20 dB coupler is used, then that translates to a requirement of 86 uW, which on adding margin of 50% becomes 129uW. (Project book has 63 uW in the corresponding column.) The 129uW figure also includes the effect arising out of the increased LO frequency range due to the 8 GHz IF restriction, something also not reflected in the table in the project book.

However, as John Payne pointed out the other day, Andrey is using a single junction mixer. The corresponding mixer LO power requirement for this case works out to be 0.22 uW. The corresponding requirement at coupler input is then 22 uW, which becomes 33 uW on including a 50% margin.

As stated earlier, all this is based on the theory of Tucker and Feldman, which Geoff Ediss pointed out in course of discussions, is valid only for operation at frequencies that correspond to less than the band-gap energy. Band-9 and 10 are beyond this frequency range, with Band-9 being marginally more. So presumably, we need to put in a factor of 2 to compensate, which makes the overall requirement in the single junction case to be 66 uW.

This number happens to be close to the 63 uW currently called for by the project book and which we have been using all along! It is also close to the "ball-park" figure of about 50 uW quoted by Andrey to Charles.

(3) A meeting was held with Virginia Diodes Inc to lay the groundwork for a request for quote for the supply of frequency multipliers for Band-6 (WR3.7x3), Band-7 (WR2.8x3), and Band-9 (WR1.2x5) (In attendance - NRAO: A. Perfetto, J. Payne, S. Thacker, K. Saini, VDI: J. Hesler, and T. Crowe.) The following guidelines were agreed upon:

(A) Deliverable Quantities:

Band-6: (18 total for Phase-I, immediate requirement) (112 total for Phase-II)
Band-7: Similar to Band-6, but still under consideration. (TBD)
Band-9: (13 total for Phase-I) (112 total for Phase-II)
Phase-I quantity will go up to 18 if there are any improvements made to the existing prototype design.

(*B) Phase-I Delivery Schedule:*

Band-6: First 2 by October 2003. Next 2 by December 2003. Remaining 14 by December 2004.
Band-7: All by December 2004.
Band-9: First 2 by December 2003. Remaining 11 by December 2004.

(C) Input/Output Power Specifications:

Band-6: Similar to the delivered prototypes. 250 uW output from 200 - 300 GHz with 20 mW input pump power.

Band-7: Similar to the delivered prototypes. 150 uW output from 275 - 370 GHz with 20 mW input pump power.

Band-9: This requirement is currently under review. It could be anywhere in the range of 20 - 60 uW output from 600 -720 GHz with an input pump power in the range of 20 - 30 mW with a single chip amplifier option or, 32 - 50 mW with the power combined type amplifier option. (Final specification to be known by the time the RFQ is finalized.)

(D) Input Return Loss Specifications:

For Phase-I these should be goals and not specifications, since VDI has never made return loss measurements in the past. For Phase-II these could be actual specifications.

(E) Test data:

VDI will supply room temperature measurements for output power and input return loss, at a frequency resolution specified by NRAO. VDI are not willing to bid on an option that includes cryogenic measurements on the multiplier units.

(4) *To Do:* The computer for the stand alone cold multiplier evaluation test platform was received this week. The test and measurement hardware was purchased earlier. Waiting for the delivery of LabView software to begin configuring the new setup. Order was sent out to the software vendor last week.

(II) ALMA Work Element Sheet WBS: 4.250.1740:

(1) The internal memo titled, "Frequency Multiplier Research and Development at CDL", was circulated last week and discussed in the meeting summarized above.
To Do: Need to discuss with Dr. Webber as to how to proceed with this proposal.

(III) Other/Miscellaneous Tasks:

(1) To Do: Repeat measurements on the LO driver band-pass filters for Bands-3, 6, 6 (testing), 7, and 9. The rework on the top covers of the housing assemblies of some of the units (explained in last weeks' summary) has been completed by the shop.

(2) As per discussion with John Payne and Charles Cunningham, loaned to Andrey (SRON) one Band-9 quintupler and a Gunn oscillator (122 - 142 GHz) to drive it with. The Gunn oscillator is a unit that is on loan to NRAO from UVA. This is needed in order for Andrey to estimate the LO power requirements for the Band-9 cartridge. As per a note from Skip Thacker, the Band-9 LO driver chain will not be available for another 3 - 4 weeks, and Andrey needs to perform the measurements urgently to be able to provide a specification for the required LO power.

Name: Chip Scott
IPT: Computing

DYTO:
I got the Digitally Tuned YIG Oscillators (DYTO) working on the bench. The DYTO is tuned manually using DIP switches to pull the bit control lines to ground (they float high). The DYTO was incorporated into the synthesizer, replacing the analog tuned YTO. The EVLA regulator board was incorporated into the bench top prototype. The synthesizer was checked for locking at most of the lock frequencies (30 MHz below the comb lines) using the formula (F-8000)/6000 x 2^12 to set the DYTO course tuning. The synthesizer locks at the correct frequencies, as before, with no sign of false locks. There is still a minor problem with the lock detector itself that can indicate locking when the synthesizer is not locked. This seems to happen when the synthesizer tries to lock close to the edges of the pull-in range. This is still being investigated.

Regulator board needs some minor modifications to provide for the voltages the LO2 needs. The EVLA LOs need only one –15V supply. The ALMA LO2 needs two additional –15V spigots: one for DYTO digital driver circuit and one for DYTO heater (which is driven by ±15V as it is done in EVLA).

ICD:
The LO2 to Computing ICD was modified. The original and updated versions were posted on ALMA EDM.

2nd LO Synthesizer Bench Test Plan:
Previously, a test plan for the 2nd LO Synthesizer bench tests prior to back end integration was written and not reported. The test plan was uploaded to ALMA EDM and can be found at:
http://almaedm.tuc.nrao.edu/forums/alma/dispatch.cgi/GenRepsDocs/showFile/100395/d20030723203414/No/BEND-50.03.06.00-006-A-PLA.pdf