Memorandum

To: John Webber

cc: Gene Lauria
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From: A.R. Kerr
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Date: 2005-02-01

Revisions:

2005-02-01	jee	Initial
2005-02-09	jee	Incorporated Tony's recommendations

Subject: Justification for Upgrading the JT-2 Measurement System to Test Wafers for Band 6 Mixers

1. Summary

It is proposed to reconfigure the JT-2 Dewar system to measure mixers for wafer evaluation.

UVA's Band 6 SIS Wafer contract requires delivery of 6 additional Band 6 wafers but terminates on 2005-06-30. It is important to evaluate all these wafers well before the end of their contract so that defective wafers are identified while sufficient time remains for UVA to fabricate replacement wafers during the contract period.

The Mixer Test System is used currently for wafer evaluation as well as testing mixer-preamps for Band 6 Cartridges. Wafer evaluation generally requires testing a minimum of 16 chips, two each from the four tuning sections included in each wafer, which means that typically 8 separate mixer tests are required to evaluate each wafer. (Occasionally, the optimum tuning section is found from the first few tests, but we assume that all 4 tuning sections require testing twice to take account of occasional delinquent chips and variations across the wafer.) This means that wafer evaluation alone requires a minimum of 4 weeks test time or a total of 6 months on the Mixer Test System to evaluate the 6 remaining wafers. Based on experience, test system failures will most likely increase this estimate.

Additionally, to expedite the evaluation of SIS mixer wafers 7 through 12 using the existing Mixer Test System, testing of a particular wafer will be suspended immediately after finding two chips with a given tuning section that meets ALMA specifications. Testing of additional tuning sections on the wafer, as well as other regions of that particular wafer, will be deferred until a later time. Contention for the Mixer Test System caused by these continuing wafer tests is, in itself, valid justification for reconfiguring JT-2 as the wafer evaluation system.

2. Wafer Delivery Schedule

UVA's Band 6 wafer delivery schedule, shown in Table 1, requires an extremely aggressive test schedule to thoroughly test all wafers prior to completion of UVA's contract in June 2005.

Table 1: UVA Delivery Schedule	
Wafer #	**Delivery Date**
7	2004-12-15
8	2005-01-18
9	2005-02-15
10	2005-03-15
11	2005-04-15
12	2005-05-16

3. Mixer-Preamp Production Schedule

Assuming the mixer test set continues to be used for evaluating Band 6 wafers, there will be no time during the next 5 months to test mixers for installation in Band 6 production cartridges.

Fortunately, a number of Band 6 mixer-preamps are already available for installation in cartridges. There are a total of 10 mixer-preamps that essentially meet[1] ALMA specifications and are available for installation in cartridges. This total includes mixer-preamps installed in the prototype cartridge that can be cannibalized after a sufficient number of production cartridges are manufactured to obviate the need for retaining the prototype cartridge as a benchmark.

The present Project Management Control System schedule shows that mixers for the 6th cartridge are required by 18 October 2005.

4. Work Proposed for Wafer Evaluation System

The wafer evaluation system will use the existing CDL JT-2 measurement system. Components from JT-2 taken for ALMA test equipment will need to be replaced and the following modifications made:

- Replacement of Dewar lens with mirror.
- Replacement of YIG filter and amplifiers on the warm IF plate
- Installation of a cold IF amplifier in Dewar. This amplifier will be one of the prototype preamps built for Band 6 mixer development.
- Installation of new computer
- Relocation of cryogenic lines and manifold

5. Wafer Evaluation System Construction Schedule

Assuming that Ron Harris can participate in the construction of the test system, the following schedule is proposed:

Complete ordering of long-lead parts 2005-02-28
Completion of design [1] 2005-02-28
Replacement of JT-2 with JT-1 Dewar 2005-03-15
Completion of parts fabricated by shop 2005-03-30
Completion of Dewar parts installation 2005-04-30

[1] Some mixer-preamps do not meet ALMA sideband isolation and/or noise temperature requirements over parts of the 8 GHz bandwidth but meet requirements over a 4-GHz bandwidth, which is all that is required.

Delivery of long-lead parts for warm IF plate 2005-04-30
Completion of warm IF plate component installation 2005-05-15
Completion of software, including testing..... 2005-05-30

Notes:
[1] Completion of design task includes the following deliverables:
Overall block diagram
Mirror drawings
Software requirements document

6. Risks

Dewar wiring failure – wiring in the JT-2 Dewar is old and wires frequently break. Wiring in the 80K heat sinking is particularly fragile and repairs are virtually impossible. One option is to replace the JT-2 Dewar housing and wiring with components from the JT-1 Dewar that was recently re-wired by Kirk Crady.

JT-system failure – the CDL JT compressors are old and prone tooverheating. Recently we received a more modern compressor from Tucson, which should have better reliability. The cryogenics maintenance group at Greenbank can continue providing routine repair capability, but past experience has shown that they are unable to diagnose some JT-specific problems, such as the inability to cool below 4.5K.

Schedule challenges –Ralph Groves and perhaps Ron Harris can help assemble the hardware, but higher priority ALMA production and non-ALMA tasks may seriously diminish their ability to complete the system in a timely manner.

In addition, the system architecture is sufficiently different from the Mixer Test System that moderate software support is required, which an already overburdened Michael Lacasse will have to provide.