



# Memorandum

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**To:** Attendees (See below)

**cc:** Antonio Perfetto      Dan Koller      Neil Horner

**From:** John Effland

**Date:** 2007-02-15

**Revisions:** 2007-02-15      jee      Initial

**Subject:** Meeting Minutes, Revised Action Plan, and Schedule to Investigate and Resolve Out-of-Spec Beam Patterns in Band 6 Cartridges

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## 1. Introduction and Summary

A meeting was held on Thu 2007-02-15 to review problems with the Band 6 beam patterns and to develop a plan for their resolution. The agenda is here<sup>1</sup>. Attendees and their initials (used below) are shown in Table 1.

Because analysis and some pattern preparation work can occur coincidentally with actual pattern measurements, tasks were organized accordingly. Table 2 lists the non-measurement tasks and assignments and Table 3 gives actual measurement tasks and assignments.

The project schedule GANTT chart provides a better indication of task sequences, durations, and dates, and the latest version is here:

<http://www.cv.nrao.edu/~jeffland/Patrnsched.pdf>

The first column of the chart corresponds to task numbers shown in Table 2 and Table 3. Calendar durations are given by the left side of each task bar and account for weekends and holidays. The schedule will most likely change after consultation with DFS and Neil, but the latest version will continue to be at the link above.

**Table 1: Meeting Attendees**

|                    |                      |                      |                   |
|--------------------|----------------------|----------------------|-------------------|
| Geoff Ediss (GE)   | Michael Lacasse (ML) | Kamaljeet Saini (KS) | Sri Srikanth (SS) |
| John Effland (JEE) | Matt Morgan (MM)     | Dave Schmitt (DFS)   | John Webber (JCW) |
| Tony Kerr (ARK)    |                      |                      |                   |

## 2. Discussion Notes

JEE reviewed the current design and measurements obtained to date.

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<sup>1</sup> Meeting Agenda is <http://www.cv.nrao.edu/~jeffland/Meeting2007-02-15.pdf>

GE showed single frequency contour plots from recent FEIC measurements that basically confirm the sidelobe observed in nearfield patterns measured with the Cartridge Test System. Unfortunately, the farfield data obtained using Nearfield Systems (NSI) software contained several artifacts:

1. Two sidelobes located along the x axis symmetrically from the main beam are apparently anomalous.
2. Phantom sidelobes exist along the x and y axis of the patterns and one of those was at a power level greater than the main beam and affected pattern normalization.

GE is working with NSI to correct these problems. Despite these artifacts, Geoff reported that the Band 6 beam is irregularly shaped.

GE also stated that his previous optical analysis, where the mirrors are tilted, simply scans the beam but never generates sidelobes above 30 dB from beam peak.

There was discussion about measuring the cartridge warm in the RAL cryostat, but JCW thought such discussions are premature.

GE asked what is different in the construction of B6-001 and B6-004 because the latter's patterns are much better. He recommended that they be compared when both removed from their cryostats.

DFS wondered about the ribbon cables on B6-001 and thinks they might not be as carefully routed as those on later cartridges. In a private conversation after the meeting, GE concurred and thinks that cable intrusion into the beam could explain the differences between IRAM's measurements and ours.

DFS also questioned if the mirror surfaces change as the cartridge cools because the backup structure for Mirror 2 contains a cut-out. JCW said the entire surface uniformly shrinks when cooled.

It was clear that a jig should be designed and used to confirm components aren't blocking the beam in current and future cartridges.

GE says that Greg Morris should have drawings showing the beam waists along with the mechanical components.

ARK recommended removing and replacing the mirrors from the cartridge and measuring the repeatability of mirror positions.

SS suggested swapping mirrors and feedhorns in the cartridges.

It was agreed by many that the warm measurements should begin with the Cartridge Test Dewar configured to use IRAM filters and window orientations.

SS and ARK recommended adding metal on the flat of the horn mounting ring and remeasuring patterns.

ARK, based on discussions with Roger Norrod, said that flange leakage might cause problems. It was concluded that covering the mixer-preamps with absorber would also test that theory.

JCW stated that if the mirror surfaces were machined incorrectly, the sidelobes wouldn't be such a strong function of frequency.

KS reports that VDI has a number of options for warm mixers, but that some engineering is required to determine the optimum configuration for their equipment. Just before the meeting, Bernard Lazareff provided a detailed

block diagram showing how IRAM mixers might be used to perform complex field measurements. KS and JEE will meet tomorrow, Fri 2007-02-16, and determine which organization's equipment provides the best way to measure warm patterns.

ARK recommended that SS be consulted frequently during all phases of this effort. JEE agreed.

**Table 2: Band 6 Sidelobe Analysis and Non-Measurement Effort – Tasks and Assignments**

| Number    | Task   | Notes   | Personnel Assigned | Date Due                    |
|-----------|--|---|--------------------|-----------------------------|
| Table 2-1 | How far out of spec are current beam patterns?   | What is the beam efficiency at the subreflector for both Band 6 and Band 7? | Ediss              | Thu 2007-02-22 <sup>2</sup> |
| Table 2-2 | Determine which hardware configuration to use for warm pattern measurements  | Decide between IRAM and VDI configurations.                                 | Saini and Effland  | Fri 2007-02-16              |
| Table 2-3 | Research Pacific Millimeter balanced mixers  |   | Effland            | Tue 2007-02-20              |
| Table 2-4 | Obtain drawings from Greg Morris of beam and mechanical components and include in Cartridge Design Document          |   | Effland            | Fri 2007-02-16              |
| Table 2-5 | Look for differences between B6-001 and B6-004, paying particular attention to cables intruding into the beam space. |   | Schmitt and Horner |                             |
| Table 2-6 | Design a jig to be used during cartridge assembly to confirm that cables, <i>etc.</i> don't block the beam           |   | Horner             |                             |
| Table 2-7 | Remove and replace mirrors in cartridge and measure mechanical repeatability   |   | Schmitt and Horner | Wed 2007-02-21              |

<sup>2</sup> GE needs a software update from NSI prior to starting the analysis, and he's not sure when that will occur, so this date is tentative.

**Table 3: Band 6 Sidelobe Measurement Effort – Tasks and Assignments**

| <b>Number</b> | <b>Task</b>  | <b>Notes</b>  | <b>Personnel Assigned</b>                          | <b>Date Due</b> |
|---------------|--|---|--|-----------------|
| Table 3-1     | Warm up B6-004, remove from cartridge, and check for cable intrusion into beam space               | Also, reconfigure CTS for IRAM filters and windows. If cable intrusion found, measure patterns later for Step 2 below.  | Schmitt  | Tue 2007-02-20  |
| Table 3-2     | Add thin (~1mm) shim of metal on the flat of the horn mounting ring and remeasure patterns.        | Do this coincidentally with Step 1 above.   | Schmitt  | Tue 2007-02-20  |
| Table 3-3     | Swap mirrors and feed-horns in cartridges and re-measure beam patterns.                            |   | Schmitt  |                 |
| Table 3-4     | Prepare brackets <i>etc.</i> for installation in a Band 6 cartridge of horn and single-pol adapter |   | Horner   |                 |
| Table 3-5     | Confirm Cartridge Test System pattern software is working  | Make sure software is ready   | Lacasse  |                 |
| Table 3-6     | Ready Cartridge Test System for warm measurements  | Install IRAM vacuum window and IR filters.  | Schmitt  |                 |
| Table 3-7     | Measure beam patterns warm   |   | Schmitt  |                 |
| Table 3-8     | Measure patterns of Cartridge B6-004 in FEIC   | FEIC has scheduled warm-up beginning Fri, 23 Feb so this is an opportune time to replace Cartridge B6-001 with B6-004.<br><br>RAL will work with cryostat for some time afterwards. | Schmitt – Installation<br><br>Ediss – measurements | Wed 2007-03-07  |