

**Subject:** [Fwd: Re: FE #1 test report]  
**From:** Antonio Perfetto <aperfett@nrao.edu>  
**Date:** Wed, 09 Jul 2008 13:16:46 -0400  
**To:** Darrel Emerson <demerson@nrao.edu>  
**CC:** Geoff Ediss <gediss@nrao.edu>

Bernard's comments on the FE#1 test data.

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**Subject:** Re: FE #1 test report  
**From:** Bernard Lazareff <lazareff@iram.fr>  
**Date:** Wed, 20 Feb 2008 18:37:44 +0100  
**To:** Gie Han Tan <ghtan@eso.org>, Antonio Perfetto <aperfett@nrao.edu>, Kamaljeet S Saini <ksaini@nrao.edu>, Morgan McLeod <mmcleod@nrao.edu>, "G. Ediss" <gediss@nrao.edu>  
**CC:** "S. Mahieu" <mahieu@iram.fr>, "D. Maier" <maier@iram.fr>

Dear Gie Han, Antonio, Saini, Morgan, and Geoff,

Following Antonio's message and Gie Han's request I have read section 3.3 "Optics Requirements" of the document:

***Front-End Sub-System for the 12 m-Antenna Array  
Acceptance Verification Results***

(what is the problem with ALMA? four-letter word? )

Reference version if not otherwise stated: **"last"** version at time of writing,  
Modified by Geoff Ediss on **2008-02-14 12:29**

Following your suggestion, I also looked at the followint, denoted **"11-Feb"**:  
Morgan McLeod **2008-02-11 19:44**

Comments (minor and major without distinction)

1. No test procedure, either in the AD/RD or in the body of text. Therefore difficult to comment on some results.
2. Page 48, bottom: "Several of the requirements in this category are verified by numerically computing the relevant quantities based on the 2D beam pattern measurements". Not detailed enough to assess the derived quantities.
3. Figures 57-66. Both Xpol and Cpol are normalized to 0dB peak. Not usable to evaluate Xpol quantitatively. Structure of XPol pattern is what is expected since the mirror symmetry plane of the cartridge optics, which is horizontal in the Alt-Az frame, is also a symmetry axis for the Xpol diagram.
4. Aperture efficiencies, page 71. Concentrate on B7/317GHz/P1/Tilt0  
24.74% is seen to result mostly from a similar value for the taper efficiency 24.91%, page 72.
5. Taper efficiency 24.91%, page 72. Hard to believe!. Most probable explanation: the integrals for the computation of the taper efficiency have been computed with either the phase origin left at the origin of the scanning plane, or at the nominal Cass focus position at Z=0 (front face of cryostat. Before computing the taper efficiency, the phase origin should be (numerically) set to the "best-focus" position. Otherwise, the rapid rotation of phase across the aperture degrades the efficiency. It is not clear why the two numbers given for Band 7 are so different, but in the absence of detailed documentation of the data processing performed, it is not worthwhile to speculate further.
6. Spillover efficiency. PP. 73-74. Numbers of order 96% are a bit in the high side. The value for

317/P1/Tilt0: 99.5% is outside the range of plausibility. It could be obtained only with a very narrow beam from tertiary optics, which is precluded just from the limited aperture of the signal window.

7. Polarization efficiency. P.75. 317/P0/Tilt45. -14.45dB. We never measured such a bad value through 8 cartridges, two polarizations, 3 frequencies. No other comment is possible from just reading the number in the report.
8. Beam squint. [side note: this was not an applicable specification at the time we committed to or delivered the cartridges] The text just under the heading 3.3.2.6, page 77, clearly states that this is on the sky (or via suitable conversion, in the focal plane). But "On secondary" below each band number heading hints at the opposite (pupil plane) and is confusing.  
Page 79, the offsets in the screen shot are several 10's of mm, much too large in the focal plane (of order of one beam width or more). In what plane are the offsets drawn in the screen shot? Going up (previous page) one finds the aforementioned "On secondary"; offsets in that plane (pupil) are totally decoupled from offsets in the sky/focal plane. What is the intention of the three circles at 36mm, 47mm, and 58mm radius? Can't comment more without more information.
9. "11-Feb" version, PP. 73-75. Clearly the far-field (far-field of the tertiary optics) patterns have not been corrected to be at optimum focus. Which might explain the low taper efficiencies, as noted above. And provides a meaning for a (so far cryptic) sentence from Antonio "The measurements at the integration center show a narrow phase response". However, noting that the phase rotation to the edge of the secondary is 3x larger for B9 as for B7, the degradation of taper efficiency should be much worse for B9. But the numbers in the "last" version, Pp 72-73, are in the same ball park for B9 as for B7. Which does not quite fit. Again, without more detailed information, it is not possible to comment further.

The issues with correcting the tertiary optics' far-field to an appropriate phase origin were already discussed and documented in my response 2008-02-12 to Antonio, with copy to Gie Han and Geoff; I had no feedback following that.

Hope this helps,  
Bernard

Antoni Perfetto wrote:

Dear Bernard,

We want to compare the beam measurements made at SRON and FEIC. Our beam efficiency calculations using the measured data is worse than predicted and we are trying to sort it out.

It would be very helpful to have two orthogonal cuts of the far field pattern plots showing the amplitude and phase response across the main beam.

The measurements at the integration center show a narrow phase response and it could explain the low efficiency numbers. Thanks in advance.

Regards,  
Antonio

Gie Han Tan wrote:

Dear Bernard,

If you follow this link you will get to the test report of FE #1:

<http://edm.alma.cl/forums/alma/dispatch.cgi/iptfedocs/docProfile/104861/d20080214152926/No>

Besides looking at the latest version, dated 2008-02-13, it might be useful to look at the version of 2008-02-11. This version contains some interesting plots of the beam phase pattern, see pages 72 - 75, which are missing in the later version. I think that the assumptions for calculating the efficiency made here are not correct.

Best regards,

Gie Han

Bernard Lazareff <[lazareff@iram.fr](mailto:lazareff@iram.fr)>

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**Re: FE #1 test report**

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