

MM-VLBI MEMO #004

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To: Millimeter-wave VLBI Group
From: ^{SD}Shep Doeleman and Alan E.E. Rogers ^{AER}
Subject: Measured performance of 86 Ghz circular polarizer

With the help of Joe Crowley we measured the performance of the circular polarizer needed for 3 mm VLBI (see Memos 1 and 2). The method used was to make system temperature (using vane cal.) and DSS measurements with and without the polarizer. The average measurements from 4 sets can be summarized as follows:

	T_s	SiO Line Strength	SNR
POL IN	275.7 ± 2.5	12.47 ± 0.7	0.045
POL OUT	249.4 ± 6.6	13.22 ± 0.8	0.053

The polarizer ohmic loss is estimated to be 4.4% from the system temperature measurements assuming

$$T_{\text{revr}} = 100^\circ\text{K}$$
$$T_{\text{ambient}} = 290^\circ\text{K}$$

If all the polarizer loss is ohmic (and/or wide angle scatter) and the SiO line is unpolarized the line strength should not have changed since the vane is in front of the polarizer and should correctly recalibrate the line strength. The decreased line strength could be the result of

- 1] Polarization in the line.
- 2] Variation of antenna efficiency with polarization.
- 3] Scattering from the polarizer.

The last possibility seems most likely since variations in the vane spacing may produce scattering that is within the angle of the vane so that the vane calibration signal is not reduced while the signal from the subreflector is reduced.

The overall loss in SNR with the polarizer in place is $17 \pm 5\%$ and is somewhat disappointing - but good enough for initial VLBI experiments. We hope that the new polarizer (Shep is making) will perform better.