DEUTERIUM ARRAY MEMO #029

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To: Deuterium Array Group

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Subject: Array sensitivity calibration

All the standard flux sources, like Cas A, are to weak to provide a reliable calibration of each 5×5 array. The quiet Sun is very strong source and ideal for checking the element phasing but the flux is variable on all time scales. Perhaps the best calibrator is the continuum from the galactic plane.

A] Observations

A 24 hour observation was made using the prototype array populated with 4×4 single polarization elements. The array, which was located at Haystack, was pointed at

Az = 120°
El = 53°

The orientation of the dipoles was at an azimuth of 45° relative to the tope of the ground plane viewed from the front. The upper plot in Figure 1 shows the output of a fixed beam pointed normal to the ground plane. In this case the beam is not normalized and was obtained by multiplying the normalized beam (see memo #10) by the average power from all 16 elements. The lower plot shows the power variation from element number 15 (without plastic pipes over the elements) with second stage noise. The second stage noise being obtained from the total power with the active antenna disconnected.

B] Model fits

The active antenna noise was estimated by fitting the modeled sky noise (see memo #10). For the lower plot the following parameters were obtained.

$T_{active} = 20 \pm 5K$
$T_{second\text{-}stage} = 30 \pm 5K$ (from values subtracted)

Model:
$T_{sky\_max} = 116$ K
$T_{sky\_min} = 60$ K

From the upper plot:

$T_{active} + T_{second_stage} = 60 \pm 10K$_

model: $T_{sky\_max} = 140$ K
$T_{sky\_min} = 37K$

Comments:

The second stage noise is currently large because an additional filter with about 4 dB loss is needed when the array is located in an exposed location. The large signal around 1.5 LST is the Sun.