

DEUTERIUM ARRAY MEMO #047

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886
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Telephone: 978-692-4764
Fax: 781-981-0590

To: Deuterium Array Group

From: Alan E.E. Rogers

Subject: Expected effect of low level CW RFI on the D1 array

1] Level of RFI which can be detected in the spectral average of each array in a 24 hour period
The 6σ sensitivity in the spectral average of the 24 channels of each polarization is 3×10^{-4} in the 244 Hz resolution channels.

2] Level of RFI which can be detected in a single channel of RFI monitor.

In 24 hours the 6σ detected threshold for a single channel is 1×10^{-3} . The active Yagi channels have a gain of 13 dBi and system noise temperature of about 200 K. We hope to get the active dipole horizontal sidelobe sensitivity down to -11 dBi (currently it is about -5 dBi). For a system temperature of 100 K in each active dipole a signal of 1×10^{-3} in the RFI monitor is expected at a level of

$$10^{-3} \times (200/100) - 24 \text{ dB} = 8 \times 10^{-6}.$$

3] Expected level in beam

If all RFI detected by the RFI monitor is excised (see memo 44) then the remaining signals below 1×10^{-3} will contaminate the deuterium line at the level of 8×10^{-6} in 244 Hz. If the data is smoothed to a resolution of 2.4 kHz then the contamination will be diluted to a level of 8×10^{-7} provided that there is only one undetected RFI signal at the 10^{-3} level in the RFI monitor in each 2.4 kHz resolution.

If we use the array data itself to detect weak CW RFI in a 24 period we could reach a 6σ sensitivity of 4×10^{-5} by averaging both polarizations of 25 stations. This sensitivity is not adequate to ensure a sufficiently low level of contamination because when diluted to 2.4 kHz it is comparable to the level of expected from the D1 line. Therefore, we will need to use the RFI monitor data although the array spectral average will provide a useful check.