VSRT MEMO #027

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To: VSRT Group
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Subject: Measurement of solar diameter with single baseline VSRT interferometer

A pair of VSRT's were set-up on tracking mounts using the geometry illustrated in Figure 1. The geometry is quite complex owing to the presence of both feed and axis offsets. More details of the effects of these offsets are discussed in VSRT memo #22. These offsets result in a baseline which changes with antenna pointing. Figure 1 gives the geometry at the line of the first null. In summary for this time

Frequency	12.825 GHz (set by IF Filter)
Baseline length	3.85 m
Baseline azimuth	82 degrees
Baseline elevation	0 degrees
Sun azimuth	217 deg. 2007:305:18:45
Sun elevation	25 deg. 1 Nov 2007
Projected baseline in the direction of the Sun	2.955

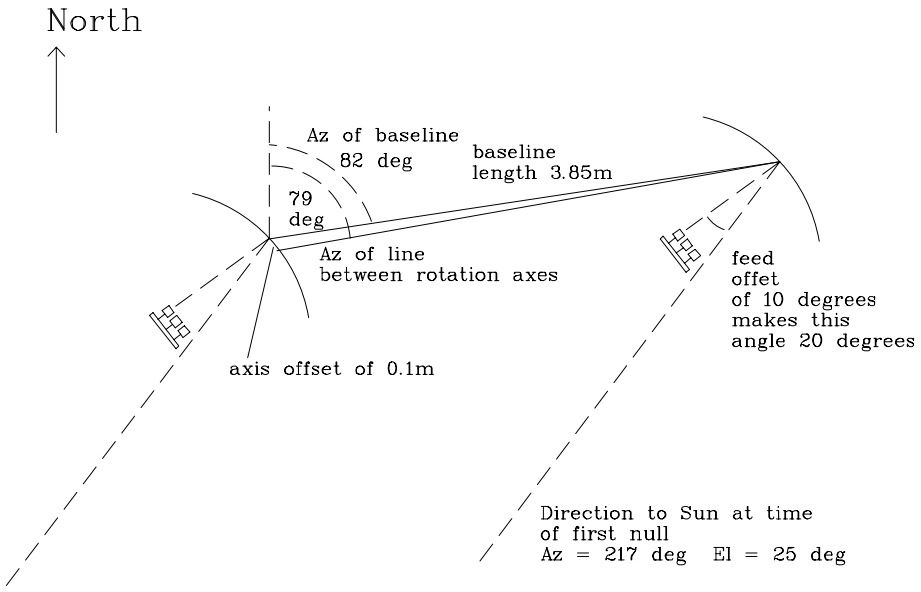

Figure 1. Geometry of VSRT interferometer

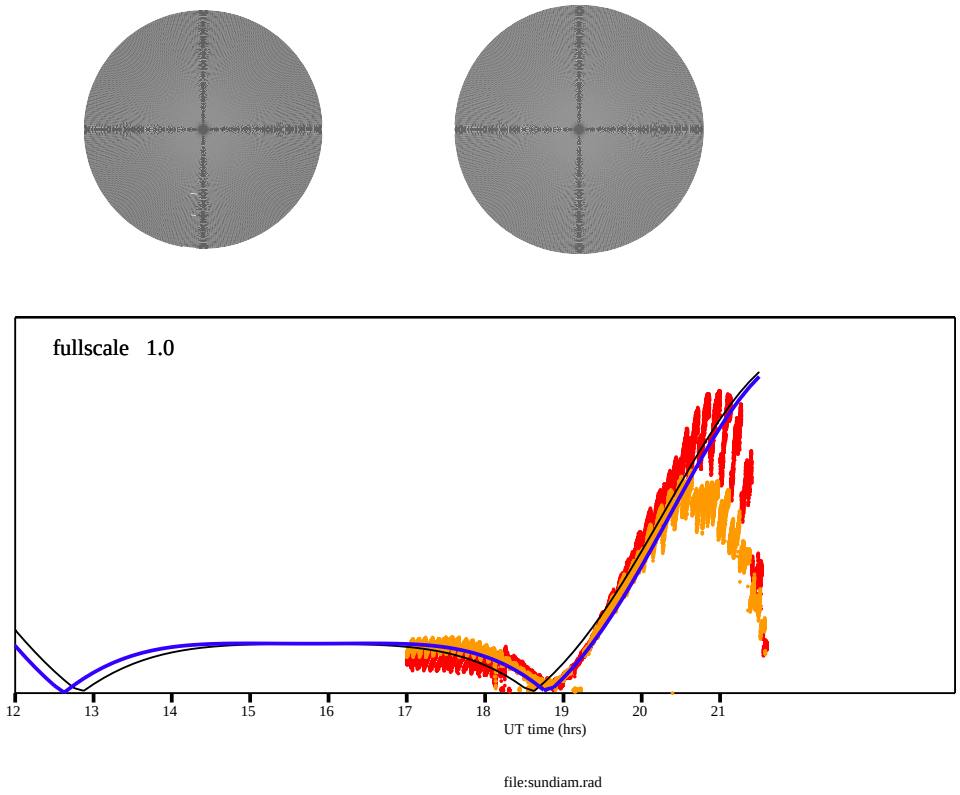

Figure 2 is a plot of the interferometer correlation amplitude vs UT for 31 October (in red) and 1 November (in orange). Also shown on the figure are curves for the expected amplitude for a uniform disk on 0.54 degrees diameter* (in black) and for a uniform dish of 0.56 (in blue). Clearly the larger diameter is the better fit which shows that the Sun appears to be about 12% larger than the optical disk at 12 GHz.

Some of the low points in the plot are from occasions when the dishes were moved off the Sun for various tests. Also the data prior to the 18^h on 31 October is low because the pointing had not yet been optimized. On the second day the amplitude falls off more severely towards sunset. This was probably the result of greater opacity due to heavy rain clouds on 1 November. The Sun was at about 5 deg. Elevation at 21^h U.T.. At this elevation the loss in the atmosphere is typically about 1 dB but varies considerably with the amount of water vapor in the atmosphere.

The interferometer bandwidth was set at about 60 MHz by a filter in the I.F.. The cable lengths were adjusted to have an equal signal delay at about 19^{hr}. With this bandwidth data taken prior to 17^{hr} was ignored because the differential signal delay is sufficient to

* Thanks to a correction from Prof. J.M. Moran of Harvard

significantly reduce the correlation amplitude. With 60 MHz bandwidth the half power points on the delay are at ± 10 nanoseconds.

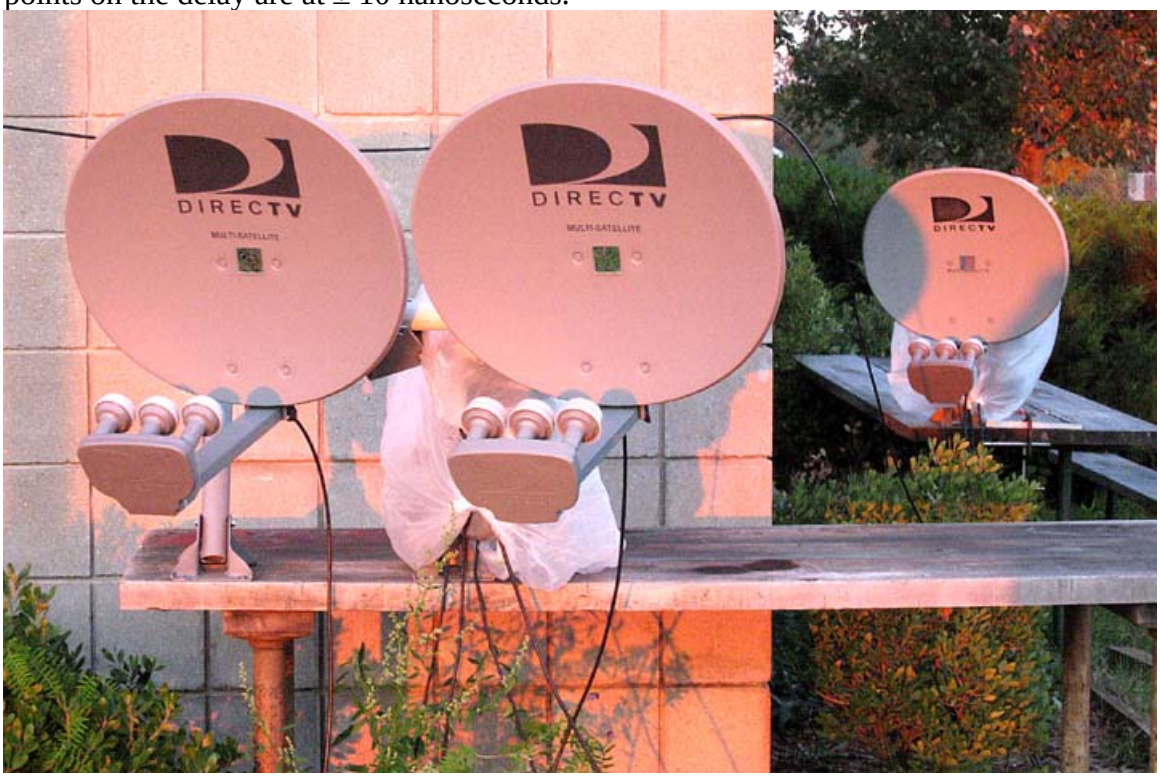

Figure 3 shows the interferometer at sunset on 31 October. The foreshortening on the projected baseline is quite evident. Only the left dish of the 2 dishes in the foreground was used.