SRT Memo #002

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

March 9, 1999

Telephone: 978-692-4764
Fax: 781-981-0590

To: SRT Group

From: Alan E.E. Rogers

Subject: Pointing corrections due to azimuth axis tilt and lack of orthogonality of elevation axis

The SRT is set-up with the azimuth rotation axis vertical and the elevation axis horizontal. Any residual errors in alignment can be corrected in software by scanning the sun and measuring the pointing errors over for a full track throughout the day. The pointing corrections are approximately given by

$$\Delta el = T_{AZ} \cos (A_Z - A_T)$$
$$\Delta az = \tan^{-1}(\tan EL\ (Taz \sin(A_z - A_T) + T_{el})$$

where Δel and Δaz are the corrections that need to be added to the calculated coordinates to point correctly

T_{AZ} = tilt of azimuth axis
A_T = azimuth of rotation axis projected onto the sky
T_{el} = tilt of the elevation axis - relative to the azimuth platform i.e. a lack of axis orthogonality
A_Z, El = azimuth and elevation

For example, if the azimuth platform is tilted up by 1 degrees the antenna is pointed north and there is no lack of axis orthogonality:

$T_{AZ} = 1°$
$A_T = 180°$
$T_{el} = 0$

And the corrections are approximately

Direction	ΔA_Z	ΔEL
North	0	-1
South	0	+1
East at 45° elev.	-0.8	0
West at 45° elev.	0.8	0

The observed pointing errors can be used to estimate T_{AZ}, A_T and T_{el} plus a constant pointing errors in azimuth and elevation. The constant errors are corrected by changing the azimuth and elevation limits in the srt.cat file while T_{AZ}, A_T and T_{el} can be entered in srt.cat using the layword AXISTILT followed by the 3 parameters. To avoid interaction between the limits and the tilt parameter the software tilt corrections are zero at the azimuth and elevation of the limits. That is

$$\Delta EL = T_{AZ} (\cos(A_Z - A_T) - \cos (A_{ZLIM} - A_T))$$
$$\Delta az = \tan^{-1} (\tan EL(T_{AZ} \sin (A_Z - A_T) + Tel))$$
$$-\tan^{-1} (\tan EL_{LIM} (T_{AZ} \sin (A_{ZLIM} - A_T) + Tel))$$