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To: SRT Group

From: Alan E.E. Rogers

Subject: Position switching on the moon and other weak continuum sources

The SRT position switches in the “bmsw” mode between an “on” source position  $P_{on}$  and 2 “off” source positions  $P_{off}$  which are on alternate azimuths offsets of 1 beamwidth (set by the BEAMWIDTH in the catalog. At each position it is desirable to take about 40 data samples (40 data samples can be taken at the same frequency by setting the frequency separation to zero). The program calculates the average radiometric temperature for each point takes differences and then performs statistics on the averages as follows:

$$P_k = P_{on} - P_{off}$$

Where  $k$ = cycle numbers

For  $k = 0, 2, 4$  etc  $- P_{off} +$  previous  $P_{on}$   
 $= 1, 3, 5$  etc.  $P_{on} -$  previous  $P_{off}$

for  $N$  cycles:

$$P_{AV} = \sum_0^{N-1} P_k / N$$

$$P_{SD} = \left( \sum P_k^2 - NP_{AV}^2 \right)^{1/2} (N-1)^{-1/2} \text{ for } N > 1$$

where  $P_{SD}$  is the measured standard deviation.

The expected 1 sigma noise in the final measurement is

$$\sigma = P_{SD} N^{-1/2}$$

For a 200 K system, 40 100 ms integrations per point and 10 cycles i.e. about 5 minutes observing

$$\sigma = 2 \times 10^{-1/2} \times 200 \times (40 \times 10^3 \times 40 \times 0.1 \times 10)^{-1/2}$$

$$= 0.1K$$

where the factor of 2 comes from taking the difference. In practice the observed  $\sigma$  will be dominated by radiometer drifts and the change of spill-over with angle.