SRT Memo #005

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To: SRT Group

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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:

$$P_{AV} = \sum_{0}^{N-1} P_k / N$$

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

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

$$\sigma = 2x10^{-1/2} x200x \left(40x10^3 x40x0.1x10\right)^{-1/2}$$
$$= 0.1K$$

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