SRT Memo #010

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To: SRT Group

From: Alan E.E. Rogers and Larry Kimball

Subject: SRT receiver tests

Objective: Measure the temperature coefficient of gain and calibration stability

Background: Most of the drift in radiometer gain is the result of changes in temperature.

Procedure:

a] Gain stability

Park the antenna at an elevation which has a clear view of the sky. Perform a single calibration and record the radiometer output along with the outside air temperature.

use freq = 1420.0 n = 40 spacing = 0.1

b] Calibration stability

Observe the spectral line calibration region S8 or R7 for a full track. Calibrate every 20 minutes.

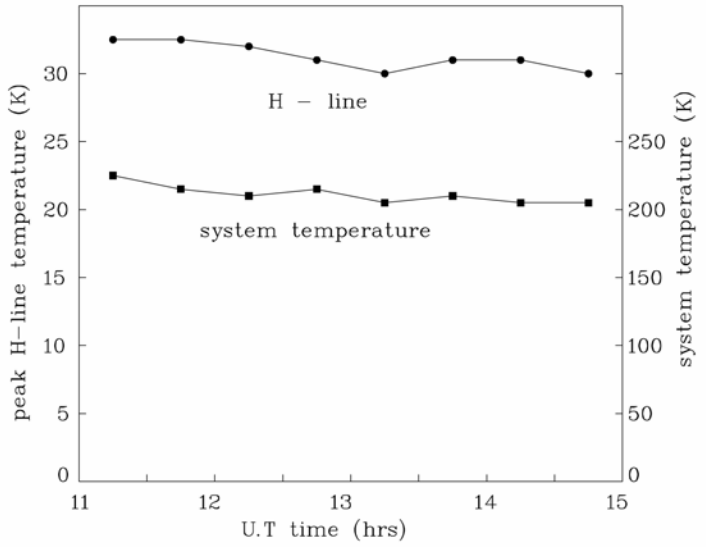
use freq = 1420.4 n = 40 spacing = 0.04

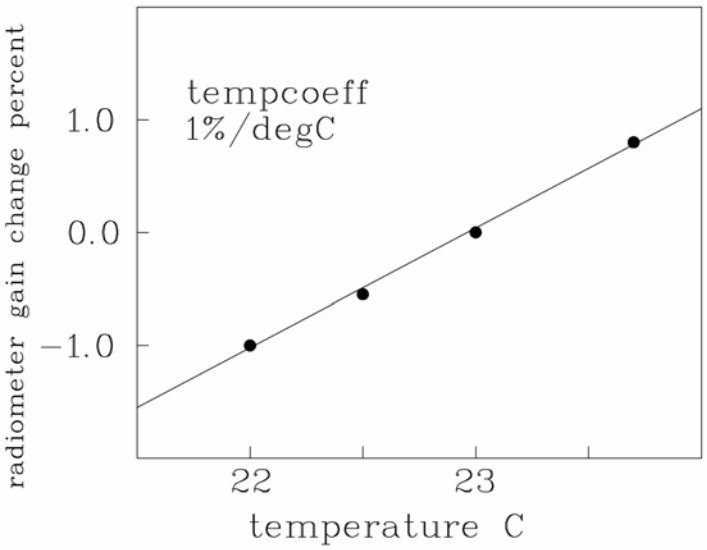
Analysis:

a] Plot the average radiometer output vs. temperature and use least squares to find the best slope.

b] Average the H-line spectra for each 20 minute integration and determine the peak H-line temperature relative to the baseline vs. time sample results.

Sample results:


H − line
system temperature
peak H−line temperature (K)
system temperature (K)
U.T time (hrs)
0
5
10
15
20
25
30
50
100
150
200
250
11
12
13
14
15


tempcoeff
1%/degC
radiometer gain change percent
temperature C
1.0
0.0
−1.0
22
23

Comments:

b] Gain

The gain is quite stable and varies with the ambient air temperature with a coefficient of about 1% per deg C. [With only 4 points the apparently good fit to a straight line is probably fortuitous.] Measurements in the lab gave similar results.

b] Calibration

The system temperature changed about 8% with an almost linear change with time. Most of this drift in calibration is due to the change in spillover with elevation. With an elevation dependent spillover in the system temperature calibration the overall SRT calibration should be accurate to 5%. Alternately the SRT should always be calibrated at the same position (i.e. the zenith) for work requiring higher accuracy. Tests on the region S8 with zenith calibration show less than 5% peak to peak variation.