SPECTROGRAPH STEP CAL REPORTS

Dave Typinski, July, 2013

This is a description of the procedure used to create the plots in the spectropgraph step cal reports. If anyone wants to roll their own analysis, this will be a good place to start.

Use of the Excel File

In the "Calibration" worksheet, alter the color gain and color offset values in rows 225 and 269 to make two custom calibrations. You can also overwrite the Solar and Jupiter gains and offsets in rows 137 and 181 – but why would anyone want to do that?

In general, there are no user serviceable parts inside. Changing the values of any other cells within this workbook may void your warranty; however, it's not rocket science, so have at it. It's possible you may make it more useful.

Procedure Used to Make the Excel File:

1) Receive information and data files from observer as outlined in the Spectrograph Step Calibration Procedure document. Save the observer's material in a directory named <**`yyyymmdd observatoryname`**> .

2) Process the SPS file(s) in RSS.
    a) Select the proper radio in RSS; the setting must match the observer's spectrograph hardware type.
    b) Open the SPS file in a version of RSS greater than or equal to the RSS version used to create the data. (RSS data files are not backwards compatible).
    c) Set RSS to display a number of sweeps that allows a 30 to 50 second window on the horizontal axis.
    d) Display the entire SPS file in one screen to ensure all step cal steps exist in the file.
    e) Set the color gain and offset to show clearly all divisions between all steps.
    f) Manually enter start and stop times to show 30 to 50 seconds of the first step.
    g) Save an RSS snippet of the displayed data, naming as <**`nn.sps`**> where nn is in the range from 00 to the number of steps used. NOTE: Step 00 corresponds to 0 dB attenuation, step 01 corresponds to 3 dB attenuation, 02 corresponds to 6 dB attenuation, etcetera.
    h) Repeat steps f & g for all remaining steps within the SPS data file.

3) Configure the RSS Step Cal Data File Utilities (Mathematica file) and create PDF reports and a CSV data file.
    a) Set the path variable to the location of the observer's data files.
    b) Set the number of files to be read (usually 17).
    c) Set the receiver noise figure (usually 6 dB).
    d) Set the feed line loss in dB between the antenna terminals and calibration plane.
    e) Set the number of bits of ADC resolution in the observer's machine (usually 10 or 12).
    f) Set the noise source temperature in kK and device name (e.g., 74800 and "HP 461A").
    g) Set the step size in dB (usually 3).
    h) Set the name of the calibration plane (e.g., "Spectro Input" or "Multicoupler Input").
    i) Set the ADC reference voltage (usually 5 V or 4.096 V).
    j) Set the number of de-rotations needed to reverse channel rotation bug (usually 1 or 2).
    k) Run the routine.

4) Import the CSV file created in step 3 into the RSS Step Cal Analysis Excel workbook.
    a) Open the CSV, select all, copy to clipboard.
    b) Using Paste SPecial -> Values, paste the data into the "RSS Step cal data" worksheet.

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5) In the "Calibration" worksheet, perform the following steps.
    a) Rename the worksheet for the observatory under analysis.
    b) Adjust color offset and color gain values in rows 137, 181, 225, and 269.
        i) Solar should have 10 kK at one division above 0 and max out at 1,000 MK.
        i) Jupiter should have 10 kK one division above 0 and max out at 10 MK.
    c) Save the worksheet as a PDF.

Mathematica Processing Description

The Mathematica processing is described below.

Using the noise gen temp, feed line loss, and receiver noise figure, create an array of step cal attenuations and associated cal plane and antenna temperatures.

For each RSS snippet, do the following:

Read the file header info and format the data for printing

Read one sweep

de-rotate the data

add the sweep to the average array

repeat until end of file

Create an average continuum array from all the sweep arrays

Output header info and create a continuum plot

Save as a PDF

Repeat until no more files

Create and export the CSV data file from all the continuum arrays, prepending the analysis metadata along with the antenna temp and cal plane temp for each step's attenuation.