IF Baseline Experiments
Project TBASERDN030423, April 23, 2003

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Introduction

Over the past few weeks, baseline ripples with periods of about 60 MHz have been isolated to the Converter Racks. Attempts to isolate the cause continued today.

The Spectrometer was used in an four-bank, eight sampler, 800MHz mode, with 10 second records, and 60 second scan times. All eight modules in Converter Rack A were used. Hardware connections are shown in Table 1.

Baseline Ripple and Cable Lengths

On April 17, tests indicated that the baseline ripple we are pursuing is related to temperature fluctuations in or around the Converter Racks, but was not directly related to the cables which connect the Optical Receivers and Converter Modules. Today, we do a further test to confirm the earlier conclusions.

Scans 1-12 were run with the system undisturbed. Then about 18 inches of coaxial cable was added to the existing connection between OR1 and CM2. Then scans 13-24 were run. Figures 1 and 2 show the baselines before and after the change in cable, and figure 3 shows the FFT of baselines before and after the change. If the 58MHz ripple which comes and goes with time is due to a standing wave in the OR-CM cable, the frequency should have changed drastically. (The total cable electrical length changed from about 72 inches to

Table 1: Hardware Connection Map

ACSBank	Sampler	SF	CM	OR
1	0	1	1	1
1	1	5	5	4
2	2	2	2	1
2	3	6	6	4
3	4	3	3	1
3	5	7	7	4
4	6	4	4	1
4	7	8	8	4

about 98 inches.) Therefore, we must look elsewhere. Of course, there is a drastic change in the bandpass between scans 12 and 13. Figure 4 shows the baselines for scans 11-14. There are obviously several frequency components in the baseline ripple in scans 12-13, and Figure 5 shows the FFT of this ripple.

In light of previous results, it is not surprising that baselines between scans 12 and 13 are also disturbed in the CM1 channel, Figure 6, presumably due to crosstalk through the 4-way splitter in OR1. (Unfortunately, no data is available from samplers 4 and 6 due to a setup error, so we cannot see what happened in CM3 and 4.) However, it is surprising that the channel going through CM6, which is on a different Optical Receiver, also shows a large baseline pertubation between scans 12 and 13, Figure 7. This might be totally unrelated to the cable change in the CM2 channel, but if not indicates a crosstalk mechanism not related to the Optical Receivers. CM2 and CM6 do share the LO2 synthesizer, which could be a crosstalk path. The other three modules connected to OR3 with CM6 show smaller but perhaps significant baseline structure in the scan 12-13 baseline, Figures 8-10.

Summary

The test today seemed to confirm that the baseline ripple we pursue is not directly related to a standing wave in the cables connecting the Optical Receivers and the Converter Modules. We also noted possible crosstalk between CM2 and CM6.

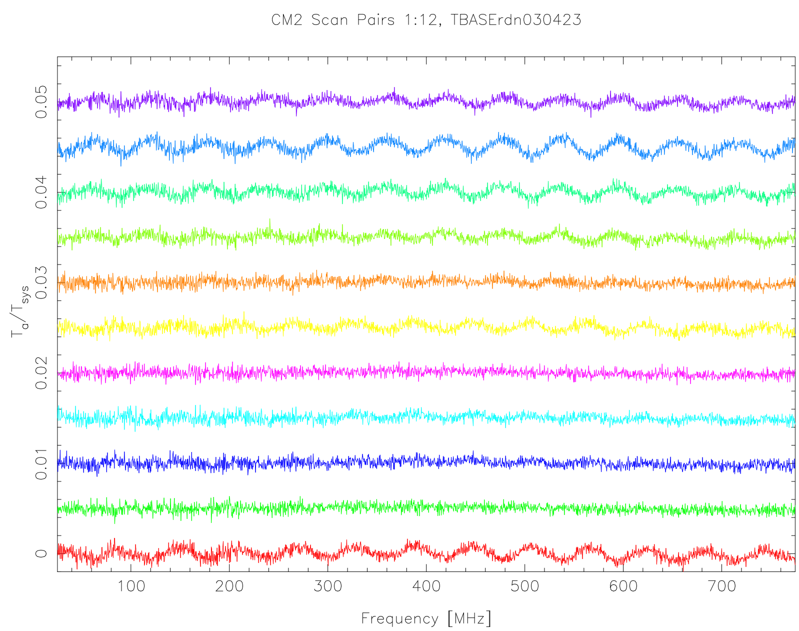

Figure 1: $(sig - ref)/ref$, for the OR1/CM2/SF2 IF path, taking each of scans 1-11 as the reference, and the following scan as the signal. The system was undisturbed during this time.

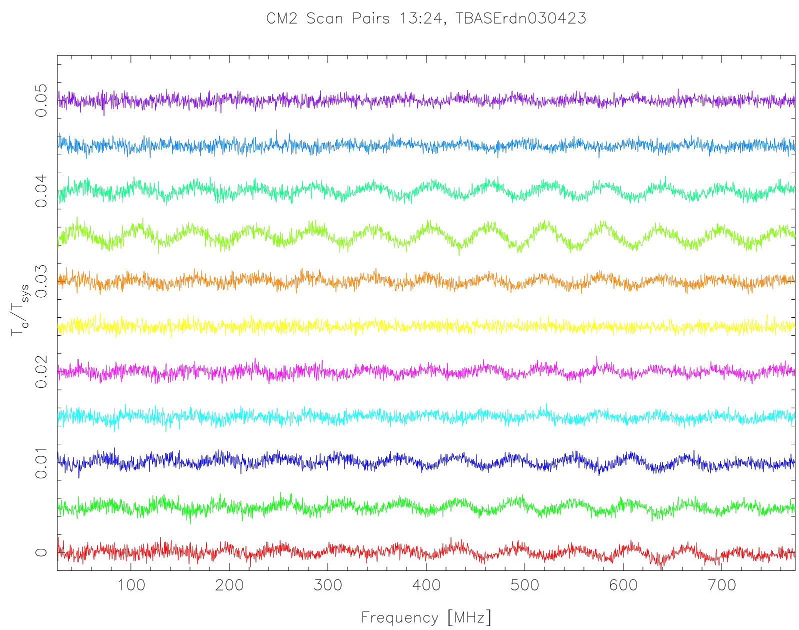

Figure 2: $(sig - ref)/ref$, for the OR1/CM2/SF2 IF path, taking each of scans 13-23 as the reference, and the following scan as the signal. The system was undisturbed during this time, but between scans 12 and 13, the cable length connecting OR1 and CM2 was increased by 18 inches.

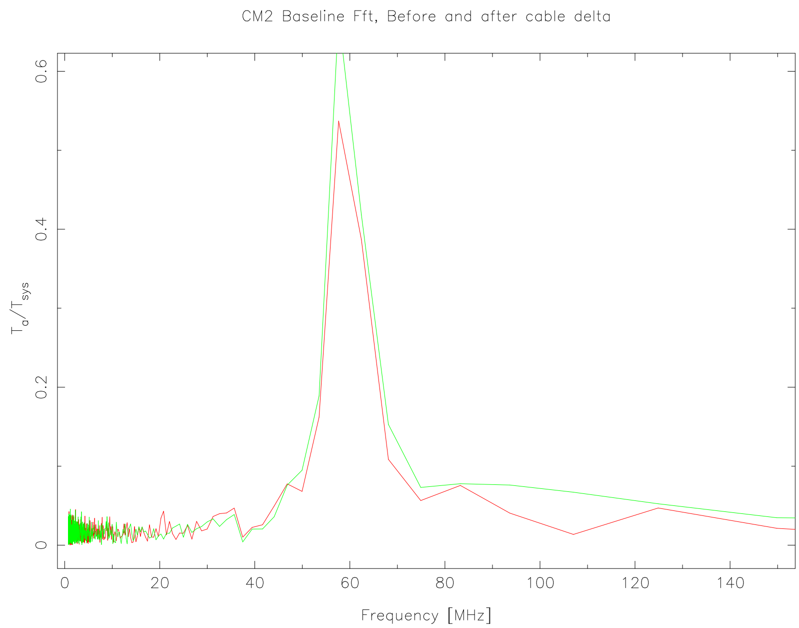

Figure 3: FFT of the baseline traces for scans 10-11 (red), and for scans 20-21 (green), before and after the cable length was changed.

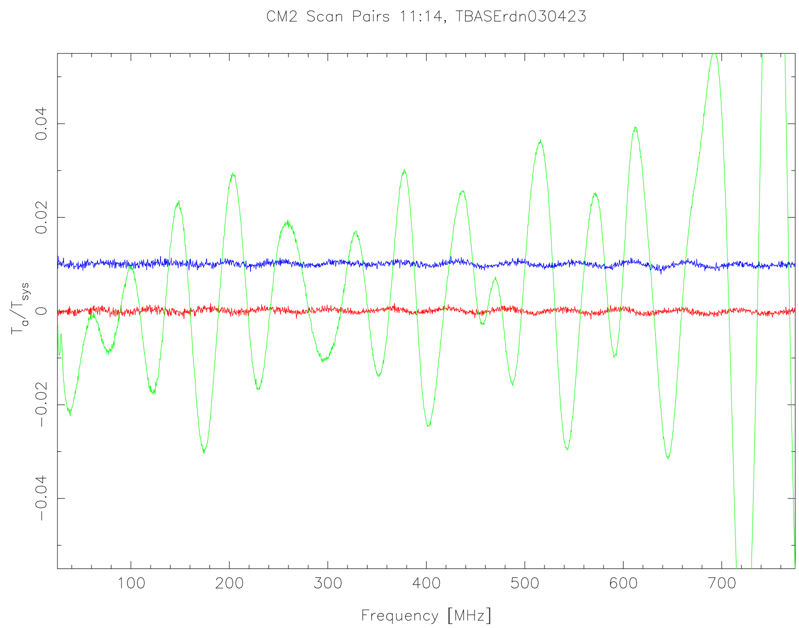

Figure 4: $(sig - ref)/ref$, for the OR1/CM2/SF2 IF path, taking each of scans 11-14 as the reference, and the following scan as the signal. The large ripple is due to insertion of the 18 inch cable between OR1 and CM2 between scans 12 and 13.

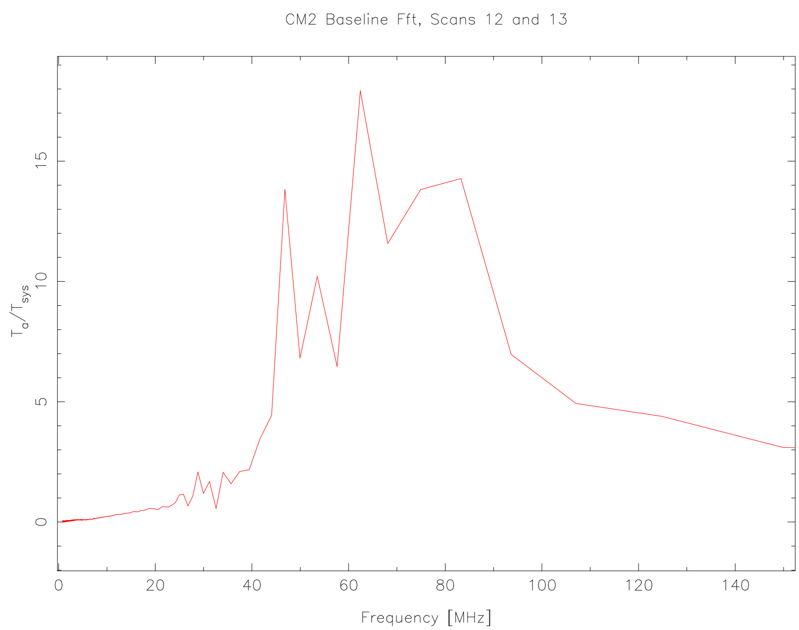

Figure 5: FFT of the baseline trace for scans 12 and 13 shown in the previous figure.

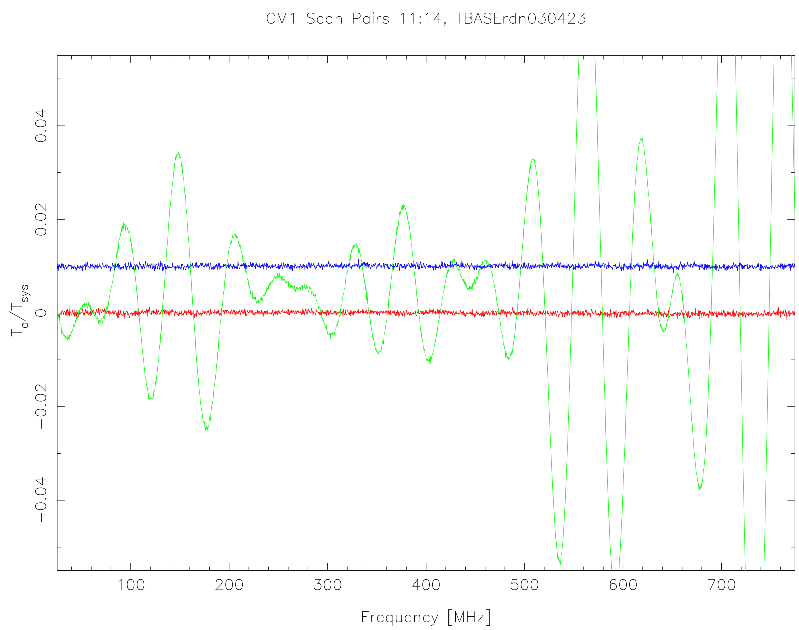

Figure 6: $(sig - ref)/ref$, for the OR1/CM1/SF1 IF path, taking each of scans 11-13 as the reference, and the following scan as the signal. The cause of the large ripple in the scan 12-13 baseline is probably due to crosstalk with the CM2 channel via the OR1 power divider.

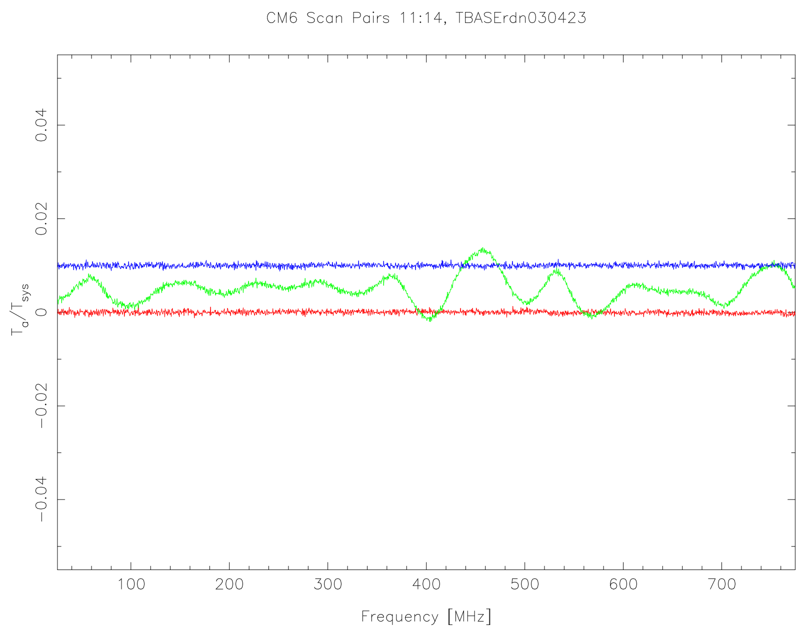

Figure 7: $(sig - ref)/ref$, for the OR3/CM6/SF6 IF path, taking each of scans 11-13 as the reference, and the following scan as the signal. The cause of the large ripple in the scan 12-13 baseline is unknown, but may be due to some crosstalk mechanism with the CM2 channel.

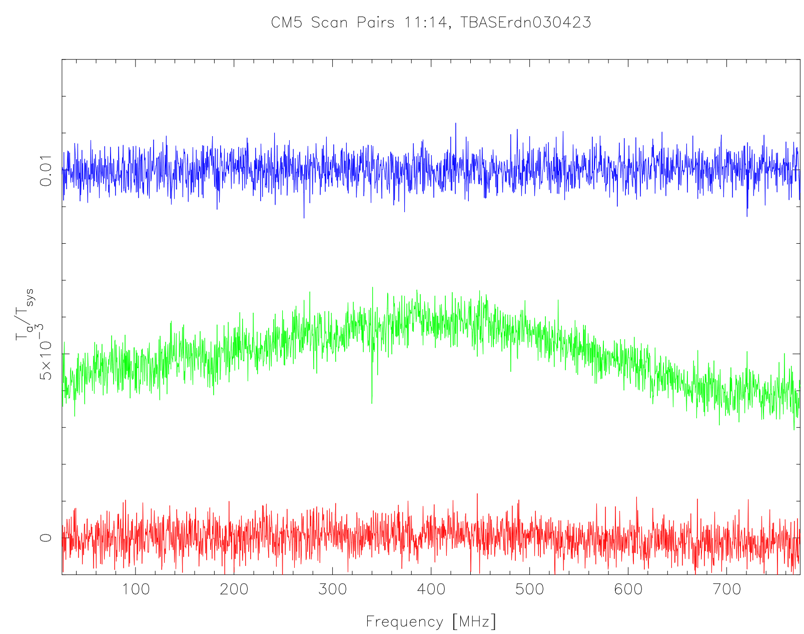

Figure 8: $(sig - ref)/ref$, for the OR3/CM5/SF5 IF path, taking each of scans 11-13 as the reference, and the following scan as the signal. Note the baseline curvature in the scan 12-13 baseline.

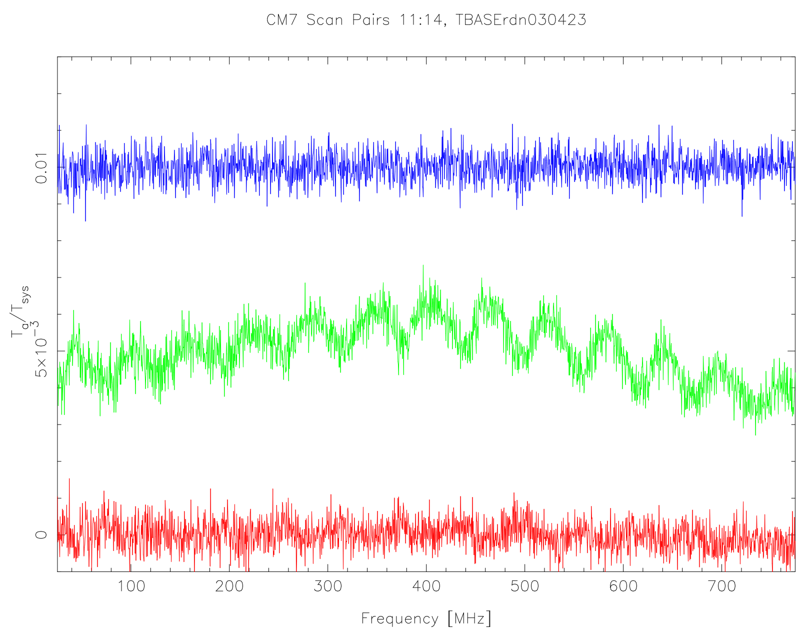

Figure 9: $(sig-ref)/ref$, for the OR3/CM7/SF7 IF path, taking each of scans 11-13 as the reference, and the following scan as the signal. Note the curvature and ripple in the scan 12-13 baseline.

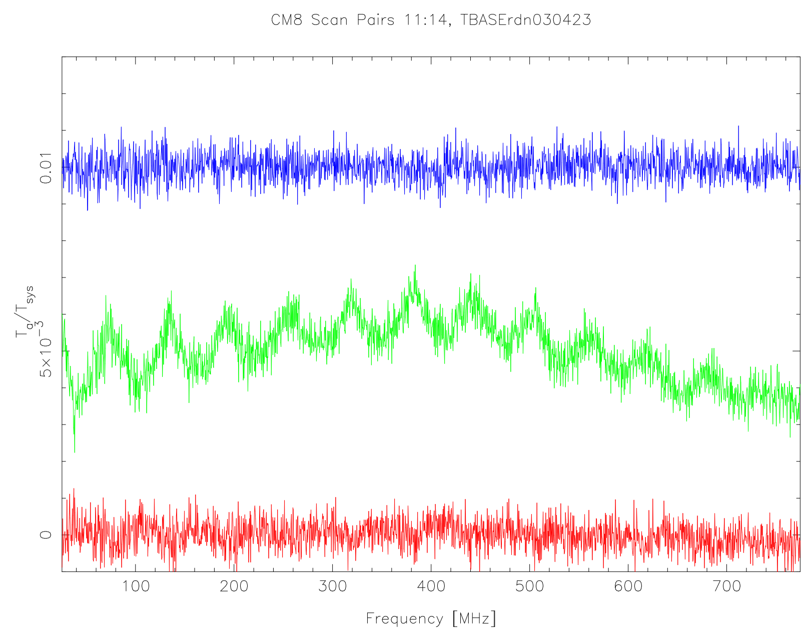

Figure 10: $(sig-ref)/ref$, for the OR3/CM8/SF8 IF path, taking each of scans 11-13 as the reference, and the following scan as the signal. Note the curvature and ripple in the scan 12-13 baseline.