

DCR Stability Monitoring of IF System

Project TBASErdsn030407

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1 Setup

The DCR was used to record the total power from the IF Rack noise source, as detected in the IF Rack and in the Analog Filter rack. The purpose was for routine health checks of the IF system, and to investigate the results of a couple of recent system mods. The noise source was set to 3000/500MHz mode. Note that ODM1 was out-of-service, so no data could be taken from fiber IF1. Thirty minutes of data through with each of four configurations was taken.

DCR Setup: DCR $\tau = 1s$, $ScanTime = 300s$, $BlankingTime = 2mS$, and switching mode Total Power with Cal were used. M&C version 3.12 was active.

2 Measurements

2.1 Odd Fiber Channels, CM Set 1

The system was configured so that the IF Rack noise source was connected to Optical Driver modules 3, 5, and 7. The corresponding Optical Receiver outputs were then connected through two independent Converter and Sampler/Filter module paths. 3000/320MHz filters were selected in the IF Rack and 200MHz filters in the Sampler/Filter modules. Data from detectors in the ODM and SF modules were recorded by the DCR.

Connections:

NS → ODM3 → OR3 → CM5-6 → SF5-6 → DCR ch13-14

NS → ODM5 → OR5 → CM11-12 → SF3-4 → DCR ch11-12

NS → ODM7 → OR7 → CM15-16 → SF7-8 → DCR ch15-16

DCR channels 1, 3, 5, 7, and 9-16 were recorded.

The GBT was at access and stationary.

Scan 1 st @ 13:25:02 → Scan 6 fi @ 13:55:56.

Discussion: Figures 1-3 plot the total power during these scans. Each plot shows a ODM total power, and the two Analog Filter Rack detectors connected to the associated Optical Receiver. The periodic TP variations visible in the AF Rack data is clearly related to the Equipment Room temperature, plotted in Figure 4 for the same time period. Earlier tests have indicated that the TP temperature sensitivity is centered within the Converter Racks.

2.2 Even Fiber Channels, CM Set 1

The system was reconfigured so that the receiver IFs were connected to Optical Driver modules 2, 4, 6, and 8. The corresponding Optical Receiver outputs were then connected through two independent Converter and Sampler/Filter module paths as above. 3000/320MHz filters were selected in the IF Rack and 200MHz filters in the Sampler/Filter modules. Data from detectors in the ODM and SF modules were recorded by the DCR.

Connections:

NS → ODM2 → OR2 → CM1-2 → SF1-2 → DCR ch9-10

NS → ODM4 → OR4 → CM5-6 → SF5-6 → DCR ch13-14

NS → ODM6 → OR6 → CM11-12 → SF3-4 → DCR ch11-12

NS → ODM8 → OR8 → CM15-16 → SF7-8 → DCR ch15-16

DCR channels 2, 4, 6, 8, and 9-16 were recorded.

The GBT was at access and stationary.

Scan 10 st @ 14:45:04 → Scan 15 fi @ 15:15:36.

Discussion: Figures 5-8 plots the total power during these scans. Each plot shows a ODM total power, and the two Analog Filter Rack detectors connected to the associated Optical Receiver. Again, the AF Rack TP fluctuations are dominated by periodic fluctuations associated with the room temperature. It can be seen also that IF channel 4 exhibits short-term fluctuations significantly worse than the other seven channels. Since the poor performance shows up in all three detectors on that channel, the probable cause is within ODM4 prior to the detector coupler.

2.3 Even Fiber Channels, CM Set 2

The system was reconfigured, still using the even-numbered fiber channels, but alternate Converter Modules by selecting alternate inputs at the SF modules. The purpose is to identify any problems in the alternate set of Converters.

Connections:

NS → ODM2 → OR2 → CM3-4 → SF3-4 → DCR ch11-12

NS → ODM4 → OR4 → CM7-8 → SF7-8 → DCR ch15-16

NS → ODM6 → OR6 → CM9-10 → SF3-4 → DCR ch11-12
NS → ODM8 → OR8 → CM15-16 → SF7-8 → DCR ch15-16

DCR channels 2, 4, 6, 8, and 9-16 were recorded.

The GBT was at access and stationary.

Scan 16 st @ 15:24:07 → Scan 21 fi @ 15:54:39.

Discussion: Figures 9-12 plots the total power during these scans. Each plot shows a ODM total power, and the two Analog Filter Rack detectors connected to the associated Optical Receiver. Again, the AF Rack TP fluctuations are dominated by periodic fluctuations associated with the room temperature, and the problem in channel 4 is again obvious. During the setup for this configuration, no signal could be obtained at SF4 from CM4. Apparently there is a problem in CM4 which needs to be further isolated and addressed.

2.4 Odd Fiber Channels, CM Set 2

The system was reconfigured, using the odd-numbered fiber channels, but alternate Converter Modules by selecting alternate inputs at the SF modules. This completes monitoring of all sixteen Converter Modules.

Connections:

NS → ODM3 → OR3 → CM7-8 → SF7-8 → DCR ch15-16
NS → ODM5 → OR5 → CM9-10 → SF3-4 → DCR ch11-12
NS → ODM7 → OR7 → CM15-16 → SF7-8 → DCR ch15-16

DCR channels 1, 3, 5, 7, and 9-16 were recorded.

The GBT was at access and stationary.

Scan 22 st @ 16:00:44 → Scan 27 fi @ 16:31:16.

Discussion: Figures 13-15 plots the total power during these scans. Each plot shows a ODM total power, and the two Analog Filter Rack detectors connected to the associated Optical Receiver. No problems other those previously discussed were identified.

2.5 Increased Converter Module LO Level

It has been known for some time that the mixers within the Converter Modules are driven about 4dB below the optimum LO level. Recently one of the Gigatronix synthesizers used for LO2 was modified to provide more output power by bypassing the internal ALC circuitry. This modified synthesizer is installed in the G6 position, driving CM10 and CM14. We wondered if the increased LO level would decrease the temperature sensitivity of these two converter modules.

Figure 16, which shows the total power from CM10 and CM14, with CM9 and CM13 for comparison, indicates that CM10 and CM14 exhibit approximately the same sensitivity as CM9 and CM13. Therefore, it appears that increasing the mixer drive level did not significantly decrease the module temperature sensitivity.

2.6 Improved Coax Type

As part of the attempts to improve GBT spectral baselines, a coaxial cable type with improved phase/temperature sensitivity has been identified, and has been installed for evaluation in the OR1/OR2 to CM1 and the OR3/OR4 to CM5 connection path. The testing today provided an opportunity to see if these cables affected the total power stability. Figures 17 and 18 show the total power from CM1 and CM5 with CM2 and CM6 (driven by the same Optical Receivers) for comparison. There is no distinct difference in the total power stability due to the improved cables.

3 Summary

With the exception of Optical Driver Module 1, which was out-of-service, total power testing of all the IF Rack to Sampler/Filter modules was accomplished, including all sixteen Converter Modules. Apparent problems with CM4 (no output power) and ODM4 (poor short-term stability) were noted.

Comparison of Converter Module stability with increased LO2 drive level and with improved interconnecting coax indicated no significant improvements in temperature stability due to these changes.

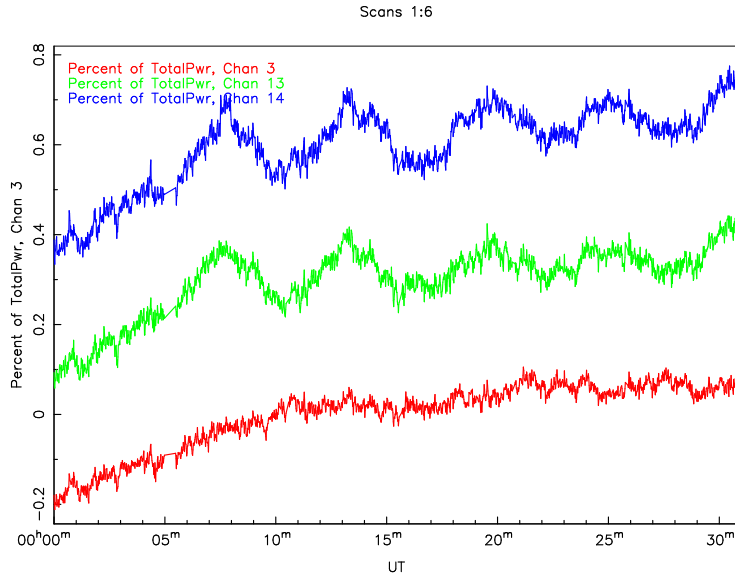


Figure 1: Total Power from ODM3, CM5/SF5, and CM6/SF6 detectors. The traces are offset by 0.3% for clarity.

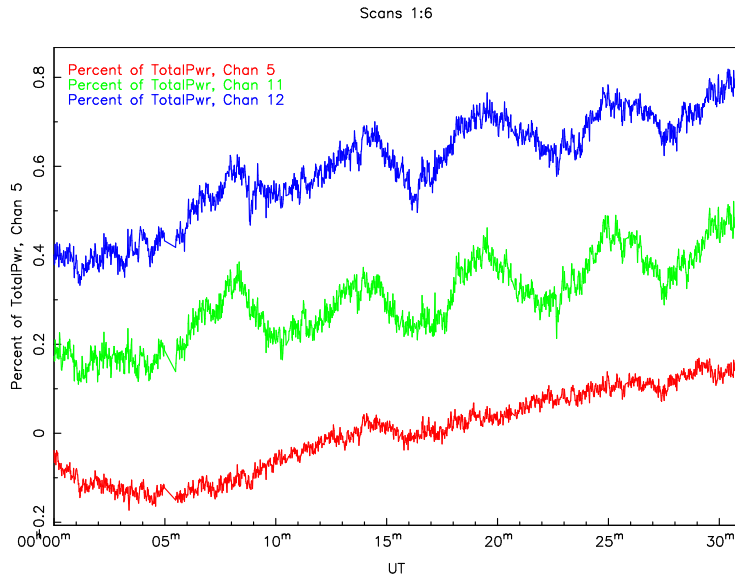


Figure 2: Total Power from ODM5, CM11/SF3, and CM12/SF4 detectors. The traces are offset by 0.3% for clarity.

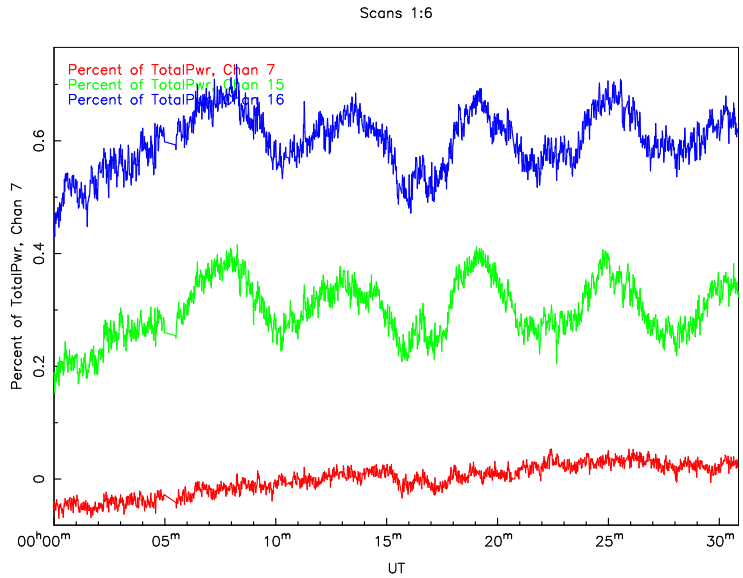


Figure 3: Total Power from ODM7, CM15/SF7, and CM16/SF8 detectors. The traces are offset by 0.3% for clarity.

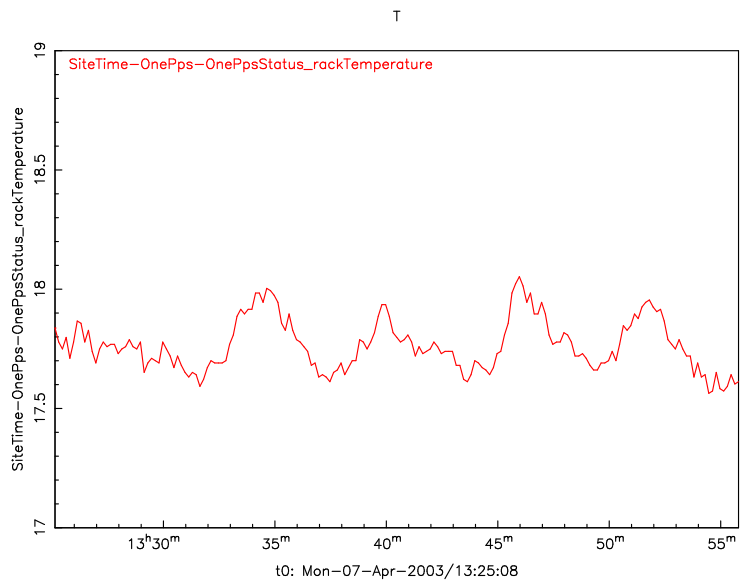


Figure 4: Temperature of the Equipment Room, as sensed in the Converter Rack airflow stream.

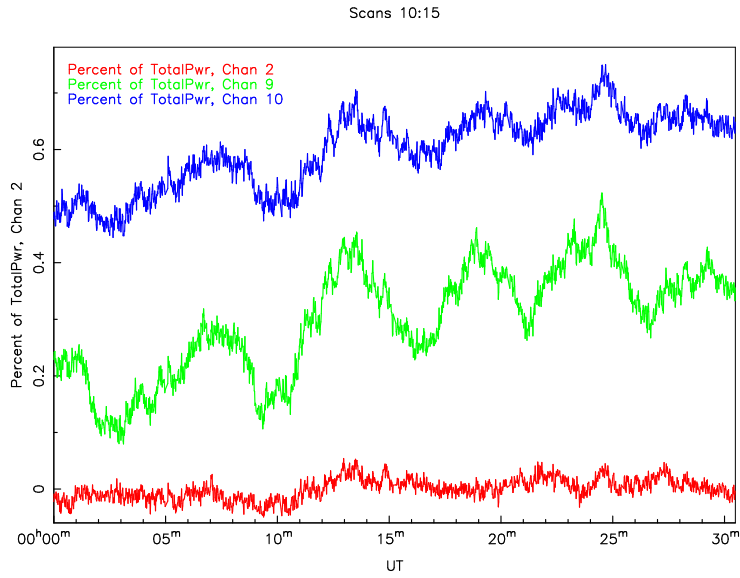


Figure 5: Total Power from ODM2, CM1/SF1, and CM2/SF2 detectors. The traces are offset by 0.3% for clarity.

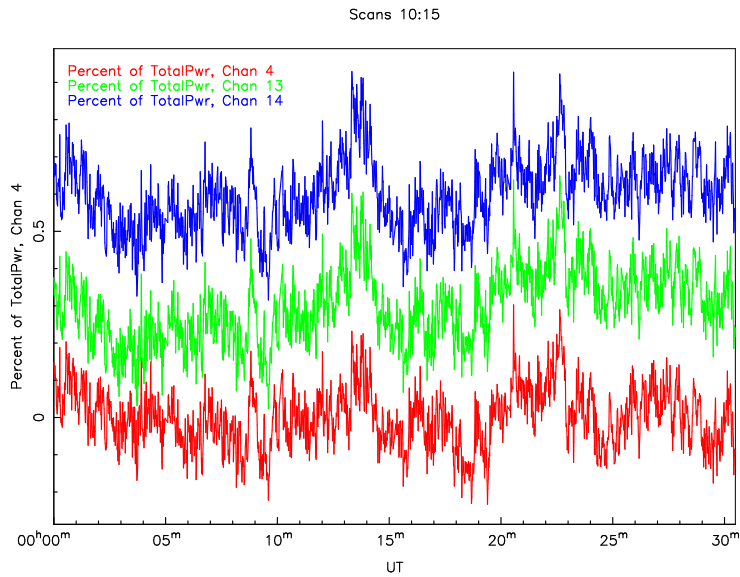


Figure 6: Total Power from ODM4, CM5/SF5, and CM6/SF6 detectors. The traces are offset by 0.3% for clarity.

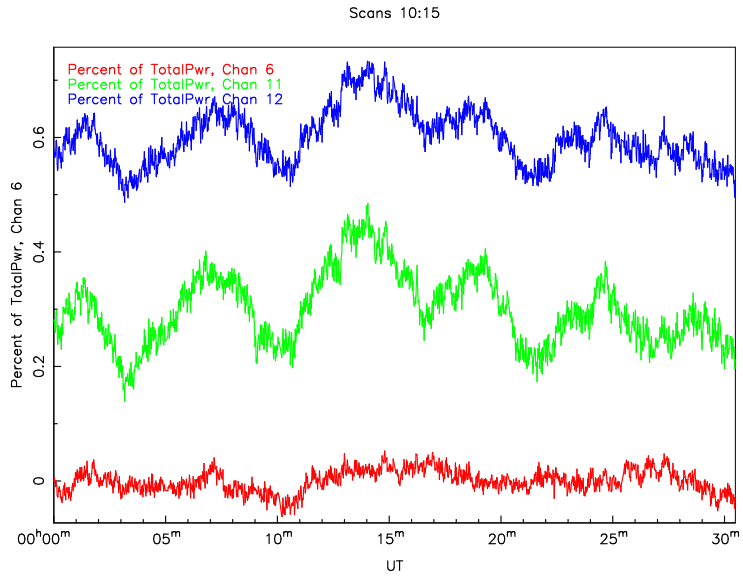


Figure 7: Total Power from ODM6, CM11/SF3, and CM12/SF4 detectors. The traces are offset by 0.3% for clarity.

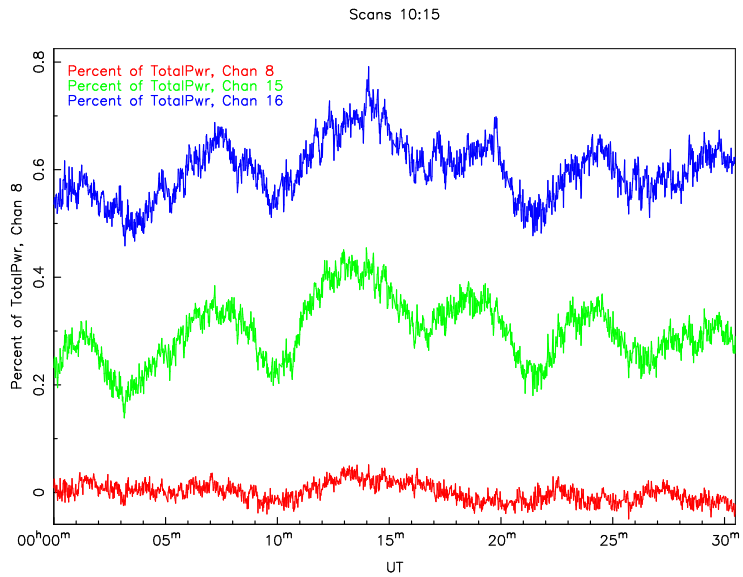


Figure 8: Total Power from ODM8, CM15/SF7, and CM16/SF8 detectors. The traces are offset by 0.3% for clarity.

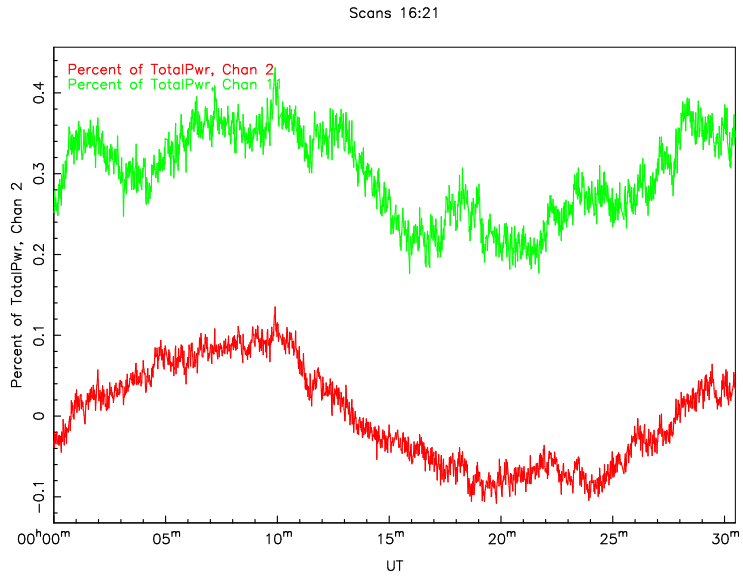


Figure 9: Total Power from ODM2 and CM3/SF3 detectors. The traces are offset by 0.3% for clarity.

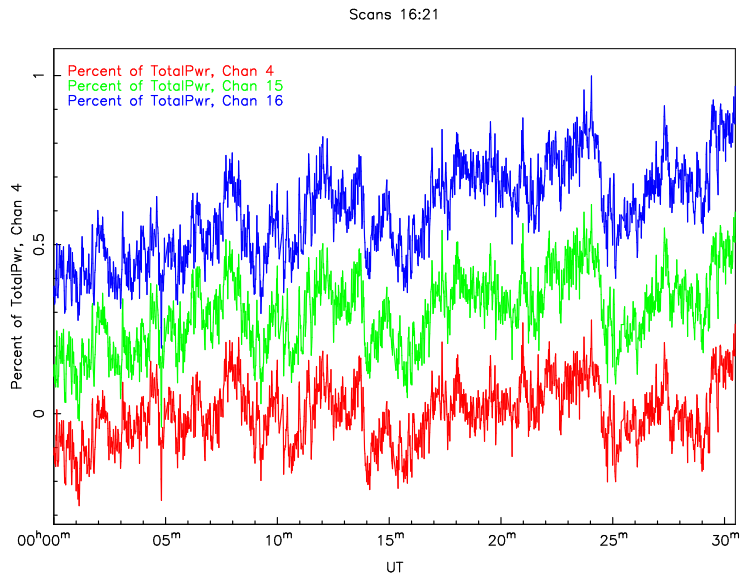


Figure 10: Total Power from ODM4, CM7/SF7, and CM8/SF8 detectors. The traces are offset by 0.3% for clarity.

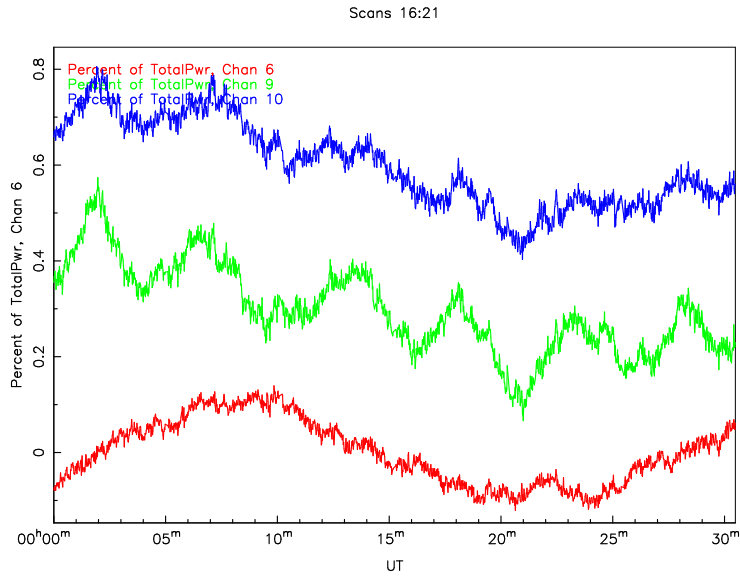


Figure 11: Total Power from ODM6, CM9/SF1, and CM10/SF2 detectors. The traces are offset by 0.3% for clarity.

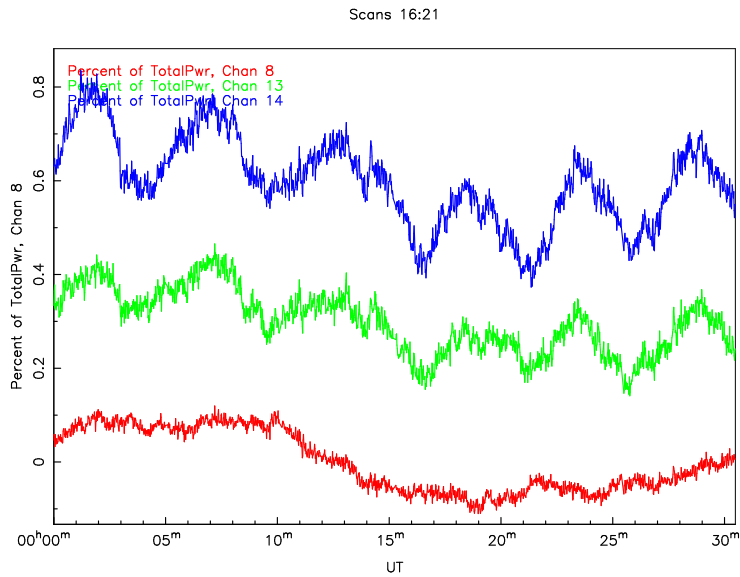


Figure 12: Total Power from ODM8, CM13/SF5, and CM14/SF6 detectors. The traces are offset by 0.3% for clarity.

Scans 22:27

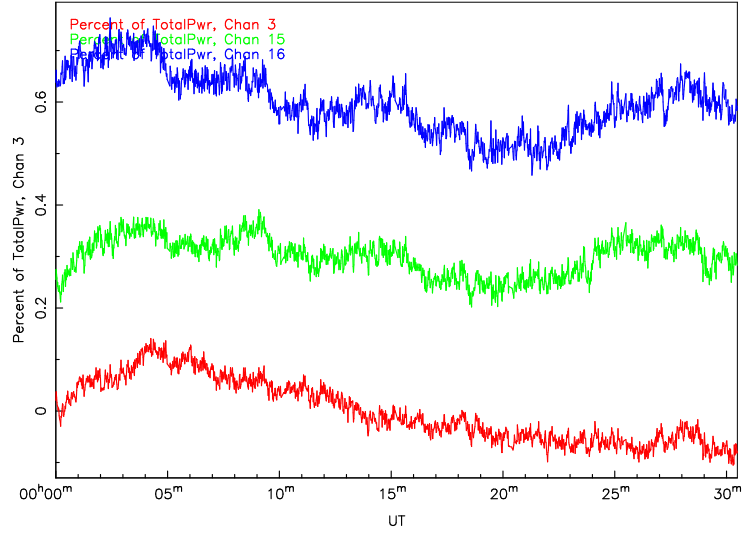


Figure 13: Total Power from ODM3, CM7/SF7, and CM8/SF8 detectors. The traces are offset by 0.3% for clarity.

Scans 22:27

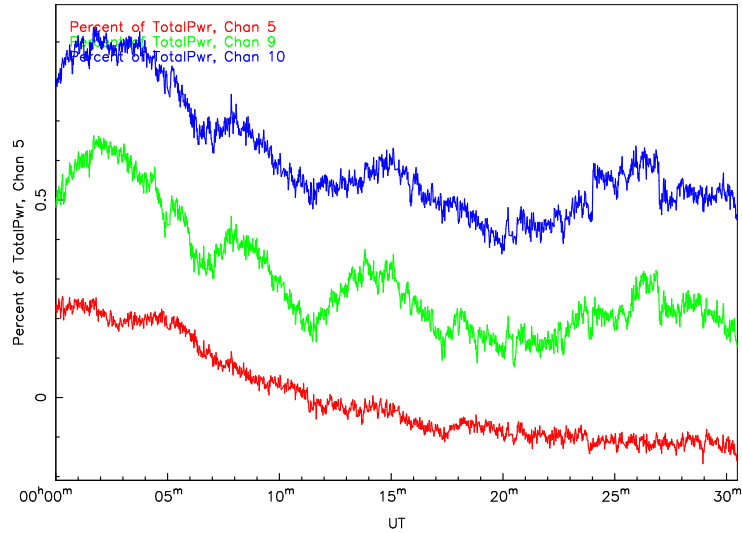


Figure 14: Total Power from ODM5, CM9/SF1, and CM10/SF2 detectors. The traces are offset by 0.3% for clarity.

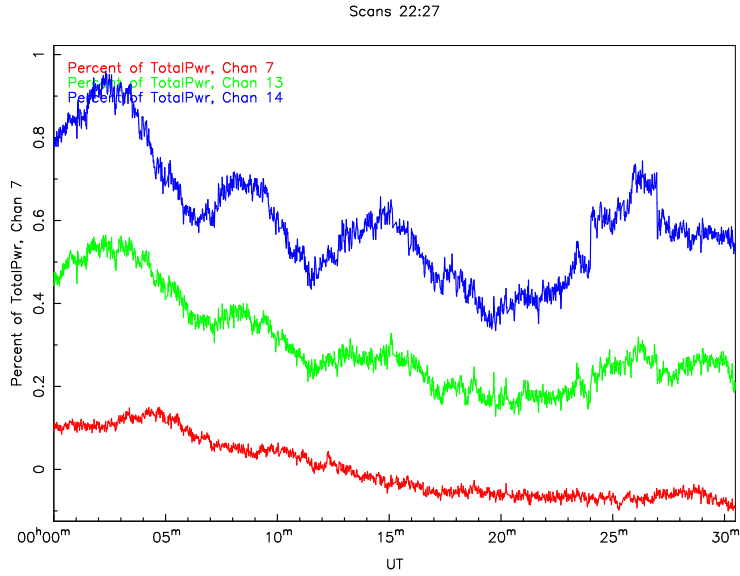


Figure 15: Total Power from ODM7, CM13/SF5, and CM14/SF6 detectors. The traces are offset by 0.3% for clarity.

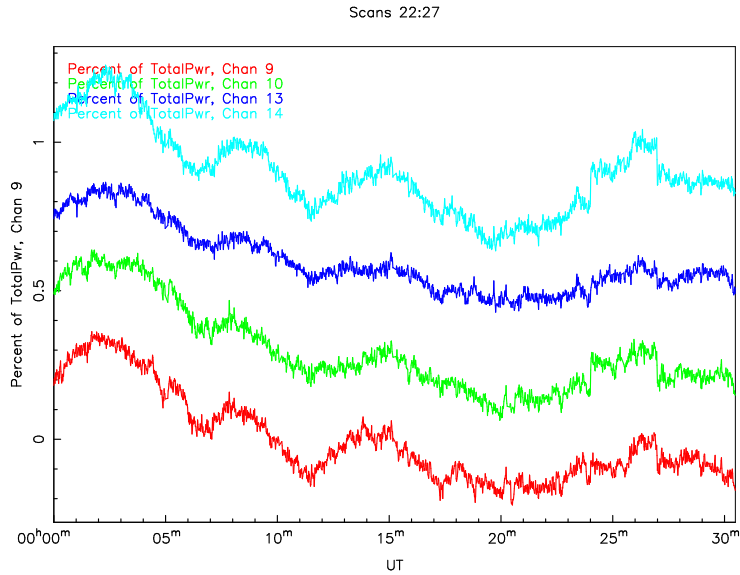


Figure 16: The green and cyan traces are TP from CM10 and 14, driven by a LO2 synthesizer recently modified to supply increased LO power. The red and blue traces are from CM9 and 13 for comparison.

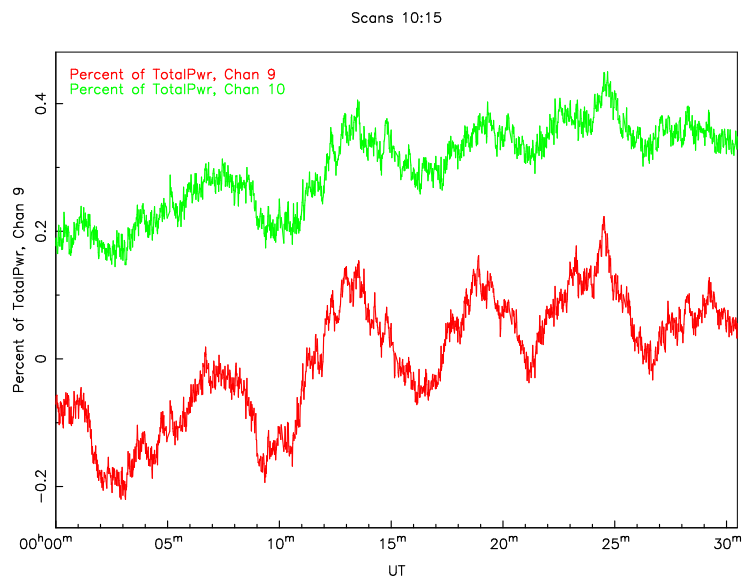


Figure 17: Total power from CM1 (red) and CM2 (green). The connection cables from OR2 to CM1 are a type with improved phase/temperature stability, but evidently this did not significantly improve the total power temperature sensitivity.

Scans 4:6

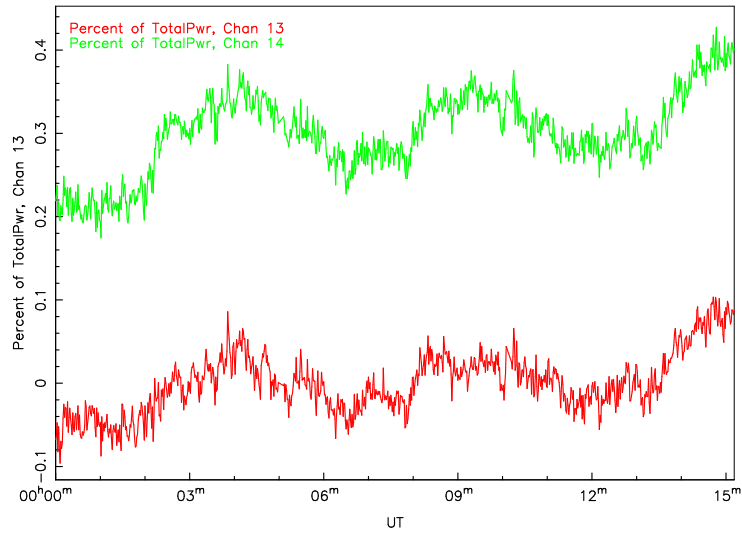


Figure 18: Total power from CM5 (red) and CM6 (green). The connection cables from OR3 to CM5 are a type with improved phase/temperature stability, but evidently this did not significantly improve the total power temperature sensitivity.