Media Calibration in The Deep Space Network – A Status Report

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ABSTRACT:

A new media calibration system (MCS) has been implemented at the Goldstone complex of the DSN. It is intended to calibrate the delay of radio signals imposed by the neutral atmosphere. The system provides periodic measurements of both the static dry and fluctuating wet components of this delay. In particular, the system will calibrate the fluctuations in path delay due to atmospheric water vapor that we believe will dominate the error budget for several radio science and radio astronomy experiments. We have compared two of these media calibration systems with a connected element interferometer on a 21 km baseline. In this report we describe a total of 30 observations in which a radio source was tracked for an hour or more and the delay residuals then calibrated using the MCS. Our data indicate that the MCS calibration system can meet or exceed the Allan Standard Deviation specification of 2.1×10^{-15} on time scales of 1,000 – 10,000 sec, as required by the Cassini GWE for two way Doppler tracking. The performance appears to be limited by systematic errors in the interferometer and are currently under investigation.

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