Divergence Estimation Procedure and Calculation

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Link budgets for many of the ILRS sites are estimated using divergence values that are derived from the site logs. Actual data for calculating the station divergence is often incomplete or very optimistic and based on diffraction theory from the full size of the primary mirror for monostatic systems or the full size of the Coude path and beam expander for bistatic systems.

Accurate divergence measurements and a standard method of measuring the divergence is needed by the ILRS for several reasons, including GNSS array requirements and performance prediction and reliable prediction of the energy density delivered on target for the entire ILRS network to deal with requests for information for potential new satellites.

A procedure was developed and presented at the last ILRS meeting for scanning over azimuth and elevation on satellites and using a graphical procedure to estimate the divergence. In this presentation, an equation has been derived from the laser radar equation for the number of photoelectrons detected which allows calculation of the $1/e^2$ divergence from the scan data directly without estimating from graphs. This method will reduce the subjectivity in the estimation and will also allow the measurement to be automated. Data from several stations which responded last year with divergence scan data has been used to test this method and results will be presented.