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Gravity Probe B Science Data Analysis: Filtering Strategy[1] MICHAEL HEIFETZ, THOMAS HOLMES, DAVID HIPKINS, ALEX SILBERGLEIT, VLADIMIR SOLOMONIK, Stanford University — Nonlinear filtering provides one component of the data analysis strategy to determine the relativistic precession of GP-B science gyroscopes. The filtering methodology is based on: 1) models of the gyroscope motion, 2) models of the science signal readout electronics and 3) numerical filtering techniques. A "two-floor" process has been developed. The first floor focuses on modeling of the readout system: gyroscopes' scale factor polhode variations, telescope signals, matching of the gyroscope and telescope scale factors/bias, and SQUID calibration signal modeling. Nonlinear parameter estimation is performed for a set of independent batches that generates state vector covariance matrices for each batch. The second floor separates the relativistic precessions from the torque-induced motion of the science gyroscopes. Batch-based estimates from the first-floor filter are treated as "measurements" of the second floor state vector and connected through the torque model and other constraints. Estimates of relativistic precession and its covariance are obtained from the "second-floor" filters. Supporting validation tools such as spectral and statistical analyses of the filter residuals were developed to interface with the filter outputs for multiple sensitivity analyses.

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