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Gravity Probe B Data Analysis Challenges, Insights, and Results

G.M. KEISER, Hansen Experimental Physics Laboratories, Stanford University

Telemetry data were collected from the Gravity Probe B satellite from its launch on April 20, 2004, through the depletion of the superfluid liquid helium on September 29, 2005. This interval included three distinct phases of the mission: the 123 day initialization phase, an eleven month science data collection phase, and a 45 day calibration phase. During the science data collection phase, the satellite rolled about the direction to the guide star, IM Pegasi, at a 77.5 second period. Data from the SQUID readout systems at the satellite roll rate were used to determine the orientation of each of the four gyroscope spin axes relative to the quartz block metrology reference frame. When the guide star, IM Pegasi, was not occulted by the earth, data from redundant readouts of the two axes of the cryogenic telescope were used to determine the orientation of the guide star relative to the quartz block. The SQUID and telescope data were combined to provide the orientation of the gyroscope spin axes relative to the apparent position of the guide star. The 5 arc sec optical aberration of the guide star due to the orbital velocity of the spacecraft was used to determine the gyroscope readout scale factor and to determine the orientation of the pickup loop relative to the measured roll phase of the satellite as provided by two star tracking telescopes. The eleven month data set was used to determine the rate of change of the gyroscope spin axes relative to the guide star. This talk will discuss the first results and sources of statistical and systematic error.