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Performance of the Gravity Probe B Cryogenic Sub-System[1]
MICHAEL TABER, DAVID MURRAY, Stanford University — The experimental design of Gravity Probe B was based substantially on low temperature technology. In addition to the thermal environment provided by the 2400-liter, 1.8 K super-fluid He dewar, the cryogenic sub-system was responsible for controlling the mechanical, magnetic, vacuum, and optical environments of the Science Instrument Assembly (SIA). A highly stable sub-nT magnetic field region for the SIA is required to limit trapped flux in the superconducting gyro rotors to < 0.9 nT (uniform field equivalent) and to attenuate external field by 240 dB. The magnetic field requirements were satisfied in part by use of an expanded superconducting lead-foil shield installed into the dewar prior to the integration of the cryostat probe housing the SIA. This required that the shield be continuously kept below its transition temperature (7 K) to the end of the science mission, including during integration of a warm probe with the cold dewar. Additional key requirements and the design of the cryogenic sub-system are also described in this poster as well as key flight results including trapped flux in the gyro rotors (0.3 nT uniform field equivalent), and cryogen lifetime (17.3 months).

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