

GG Error Budget for EP Testing to 1 part in 10^{17}

Launch beginning of 2002 (close to solar maximum); maximum drag value along the orbit assumed; Q as measured; CMR as tested (better) in GGG

Acceleration (transverse plane) DUE TO:	Formula	Frequency (inertial frame) (Hz)	Frequency (detected by spinning sensors) (Hz)	Phase	Differential acceleration (m/sec^2)	Differential displacement (m)
EP SIGNAL	$\frac{GM_{\oplus}}{a^2} \eta$	$v_{orb} \cong 1.75 \cdot 10^{-4}$	v_{spin} w.r.t. Earth	Test body to center of Earth	$8.38 \cdot 10^{-17}$ $\eta = 10^{-17}$ $h=520 \text{ Km}$	$6.3 \cdot 10^{-13}$ $\omega_{dm} \cong 1.15 \cdot 10^{-2}$ 545 sec diff. period
AIR DRAG	$\frac{1}{2} C_D V_{sc}^2 \frac{A}{M} \rho_{at}$	v_{orb}	v_{spin}	\sim along track	$5.21 \cdot 10^{-17}$ AFTER : $\chi_{FEPP} = \frac{1}{50000}$ $\chi_{CMR} = \frac{1}{100000}$	$3.9 \cdot 10^{-13}$
SOLAR RADIATION PRESSURE	$\frac{A}{M} \frac{\Phi_{\odot}}{c}$	$v_{orb} - v_{\odot}$ $\cong v_{orb}$	v_{spin}	test body to center of Earth component	$9.57 \cdot 10^{-19}$ same χ_{FEPP}, χ_{CMR}	$7.2 \cdot 10^{-15}$
INFRARED RADIATION FROM EARTH	$\alpha_{\oplus} \frac{A}{M} \frac{\Phi_{\oplus}}{c}$	v_{orb}	v_{spin}	test body to center of Earth	$1.44 \cdot 10^{-18}$ same χ_{FEPP}, χ_{CMR}	$1.08 \cdot 10^{-15}$
EARTH COUPLING TO TEST BODIES QUADRUPOLE MOMENTS	$\frac{3 GM_{\oplus} \Delta J}{8 a^2 J_x} \left(\frac{r_1^2 + r_2^2 + l^2 / 3}{a^2} \right)$	v_{orb}	v_{spin}	test body to center of Earth	$2.4 \cdot 10^{-19}$	$1.8 \cdot 10^{-15}$
MECHANICAL THERMAL NOISE	$\sqrt{\frac{4K_B T \omega_{dm}}{mQ}} \frac{1}{\sqrt{T_{in}}}$	$v_{d.m.}$	$v_{spin} \pm v_{d.m.}$	Random	$3.99 \cdot 10^{-17}$ $T_{int} \cong 7 \text{ days}$ $Q = 20000$	$3 \cdot 10^{-13}$
					TOTAL ERROR BUDGET	$3.59 \cdot 10^{-13}$