# Evaluation of PPN parameter Gamma as a test of General Relativity using SLR data

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$$\Delta\ddot{\vec{r}} = \frac{GM_E}{c^2 r^3}\left\{[2(\beta+\gamma)\frac{GM_E}{r} - \gamma\dot{\vec{r}}\cdot\dot{\vec{r}}]\vec{r} + 2(1+\gamma)(\vec{r}\cdot\dot{\vec{r}})\dot{\vec{r}}\right\} +$$
$$(1+\gamma)\frac{GM_E}{c^2 r^3}\left[\frac{3}{r^2}(\vec{r}\times\dot{\vec{r}})(\vec{r}\cdot\vec{J}) + (\dot{\vec{r}}\times\vec{J})\right] +$$
$$\left\{(1+2\gamma)\left[\dot{\vec{R}}\times\left(\frac{-GM_S\vec{R}}{c^2R^3}\right)\right]\times\dot{\vec{r}}\right\},$$

$c$ = speed of light,

$\beta, \gamma$ = PPN parameters equal to 1 in General Relativity,

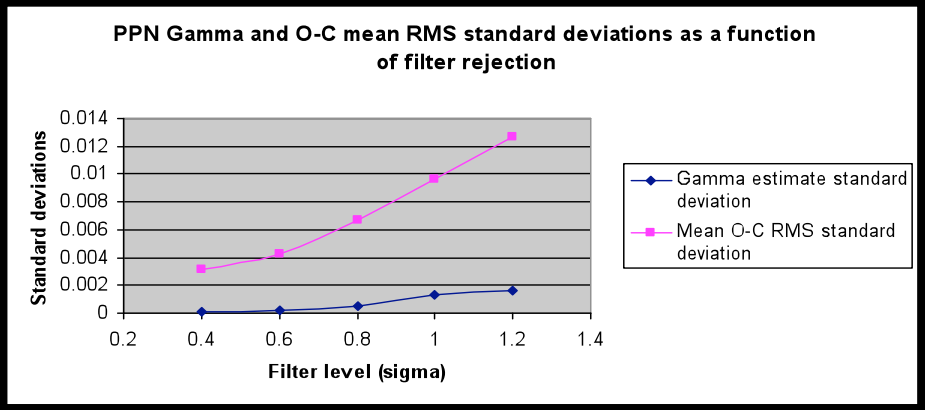
$\vec{r}$ is the position of the satellite with respect to the Earth,

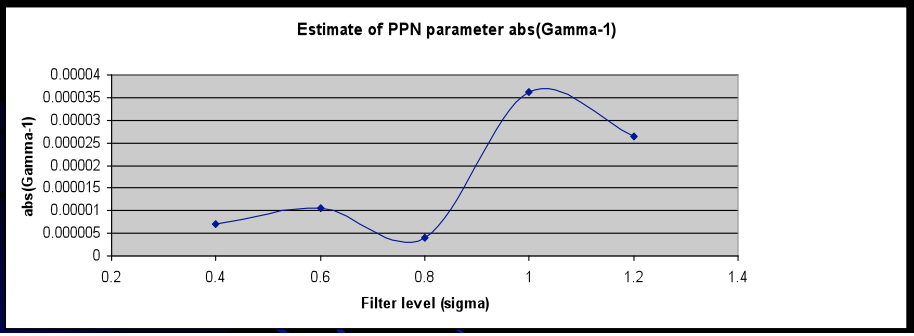
$\vec{R}$ is the position of the Earth with respect to the Sun,

$\vec{J}$ is the Earth's angular momentum per unit mass ($|\vec{J}| \cong 9.8 \times 10^8 \mathrm{m}^2/\mathrm{s}$), and

$GM_E$ and $GM_S$ are the gravitational coefficients of the Earth and Sun, respectively.

- Gamma estimated as a solve-for parameter in least-squares sense
- RMS of O-C used as criteria for filter to reduce effect of mismodelling
- SLR strength is 2-way range,  and GR radial acceleration is mostly radial
- Results preliminary, longer time span, combination of LAGEOS/LAGEOS II and evaluation of different gravity models to follow, effects of modelling improvement should be apparent in errors




| Filter ($\sigma$) | PPN $\lvert\overline{\gamma}-1\rvert$ | $\sigma$ | Mean O-C RMS (m) | $\sigma$ (m) |
|---|---|---|---|---|
| 0.4 | $6.977\times10^{-6}$ | 0.000078014 | 0.005403 | 0.003136 |
| 0.6 | $1.0649\times10^{-5}$ | 0.000183666 | 0.007469 | 0.004251 |
| 0.8 | $3.947\times10^{-6}$ | 0.000525783 | 0.011888 | 0.006701 |
| 1.0 | $3.268\times10^{-5}$ | 0.001324442 | 0.017238 | 0.009609 |
| 1.2 | $2.6428\times10^{-5}$ | 0.001647755 | 0.023074 | 0.012702 |