



## **Assessment of accuracy of adopted centre of mass corrections for the Etalon geodetic satellites**

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Accurate centre-of-mass corrections are key parameters in the analysis of satellite laser ranging observations. In order to meet current accuracy requirements, the vector from the reflection point of a laser retroreflector array to the centre of mass of the orbiting spacecraft must be known with mm-level accuracy. In general, the centre-of-mass correction will be dependent on the characteristics of the target (geometry, construction materials, type of retroreflectors), the hardware employed by the tracking station (laser system, detector type), the intensity of the returned laser pulses, and the post-processing strategy employed to reduce the observations [1]. For the geodetic targets used by the ILRS to produce the SLR contribution to the ITRF, the LAGEOS and Etalon satellite pairs, there are centre-of-mass correction tables available for each tracking station [2]. These values are based on theoretical considerations, empirical determination of the optical response functions of each satellite, and knowledge of the tracking technology and return intensity employed [1]. Here we present results that put into question the accuracy of some of the current values for the centre-of-mass corrections of the Etalon satellites. We have computed weekly reference frame solutions using LAGEOS and Etalon observations for the period 1996-2014, estimating range bias parameters for each satellite type along with station coordinates. Analysis of the range bias time series reveals an unexplained, cm-level positive bias for the Etalon satellites in the case of most stations operating at high energy return levels. The time series of tracking stations that have undergone a transition from different modes of operation provide the evidence pointing to an inadequate centre-of-mass modelling.

[1] Otsubo, T., and G.M. Appleby, System-dependent centre-of-mass correction for spherical geodetic satellites, *J Geophys. Res.*, 108(B4), 2201, 2003

[2] Appleby, G.M., and T. Otsubo, Centre of Mass corrections for precise analysis of LAGEOS, Etalon and Ajisai data, *proc. 18th Int. Workshop on Laser Ranging*, Fujiyoshida, Japan, 2013