Etalon and Ajisai Observations from NASA's SLR Network

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LAGEOS defines the SLR reference frame

The eight NASA systems influence SLR Scale

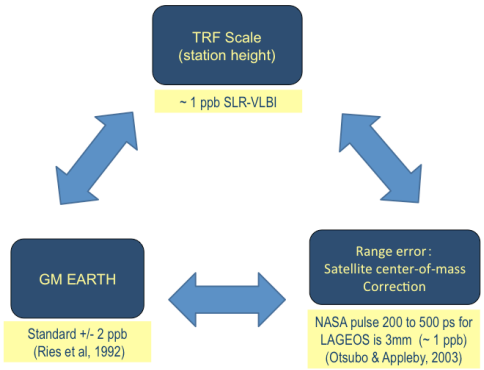
The NASA network shows a strong signal in the ranges to AJISAI and ETALON 1,2 in the Hitotsubashi University Analysis

AJISAI and ETALON are sensitive to the satellite center-of mass (CoM) offset model

The signal in the NASA ranges can be accommodated if we assume that the width of the pulses received are more than twice that of those transmitted and currently modeled

Refinement of the LAGEOS CoM correction for the NASA systems with a longer received pulse width would lead to a significant change in SLR Scale

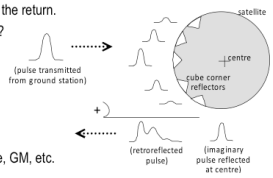
It would be closer to VLBI



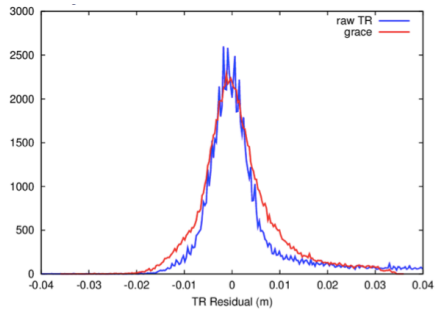
Satellite signature

Transmitted pulse NOT equal to Return pulse

- Multiple CCRs contributing to the return.
- Where is the detection timing?



- Key error factor for TRF scale, GM, etc.



The return pulse from a simple satellite target is wider than that from a flat, signature-free target board for the Herstmonceux System

CoM sensitivity to PMT pulse width(cf 200ps):

LAGEOS 2mm@400ps
3mm@500ps
4mm@600ps

AJISAI 8mm@400ps
11mm@500ps
16mm@600ps

ETALON 9mm@400ps
15mm@500ps
18mm@600ps

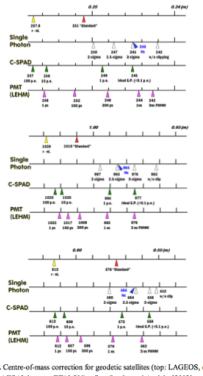
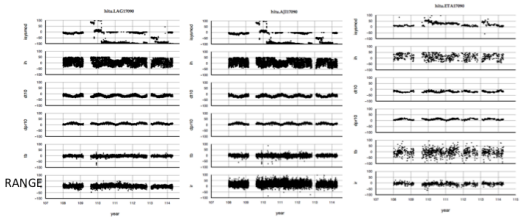


Figure 1. Centre-of-mass correction for geodetic satellites (top: LAGEOS, centre: AJISAI, bottom: ETALON). See *Otsubo and Appleby* [2003].

Implied pulse width in standard CoM correction for NASA systems:
LAGEOS 150 ps
Ajisai 250 ps
Etalon > 1 ns
Starlette > 1 ns

In this study we have normalized the NASA CoM corrections to correspond to 200psec returns (which we claim is too short)

Hitotsubashi-U Analysis Summaries for Yarragadee data from LAGEOS-1, AJISAI and ETALON-1

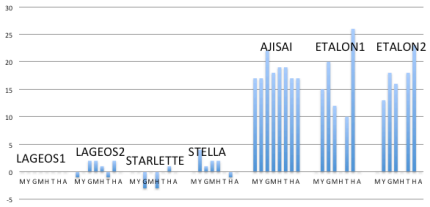


LAGEOS-1 ranges show an offset due to ITRF2008 height error
Subtract the offset from all YAR ranges

AJISAI standard CoM correction has a difference of +3 mm for 200ps pulses
Subtract +3 mm from YAR AJISAI ranges

ETALON standard CoM correction has a difference of -27 mm for 200ps pulses
Subtract –27 mm from YAR ETALON ranges

Range Bias in mm for 8 NASA stations tracking 7 satellites



If we assume 200 psec return pulse width
AJISAI and ETALON ranges are 1 or 2 cm long

CONCLUSIONS

The standard CoM corrections do not accurately model individual SLR systems: their use will produce stress in orbital solutions

That stress can be partly accommodated in an adjusted station position, mostly in the height, and distorts the Scale defined by LAGEOS

In ITRF2013 the standard CoM correction for LAGEOS has been replaced by individual system values, but the NASA systems have an assumed return pulse width of 200 psec

Ajisai and Etalon results in ITRF2008 show consistently long ranges from 200 psec NASA systems, and indicate a CoM correction for pulse widths closer to 500 psec

The Hit-U Analysis gives mixed results for the diverse non-NASA systems:
CoM error in their ranges may cancel out in Scale definition

If 500 psec return pulse width is assumed for the NASA systems tracking LAGEOS, the ranges will be longer by about 3mm in ITRF2013

This would affect their contribution to
SLR Scale by ~+1 ppb and GM by ~-1 ppb