CoM values for LAGEOS and Etalon 1980-2012

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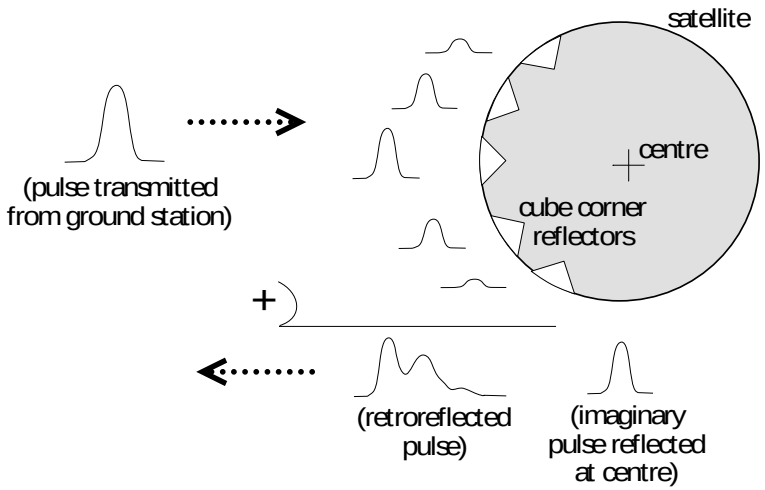
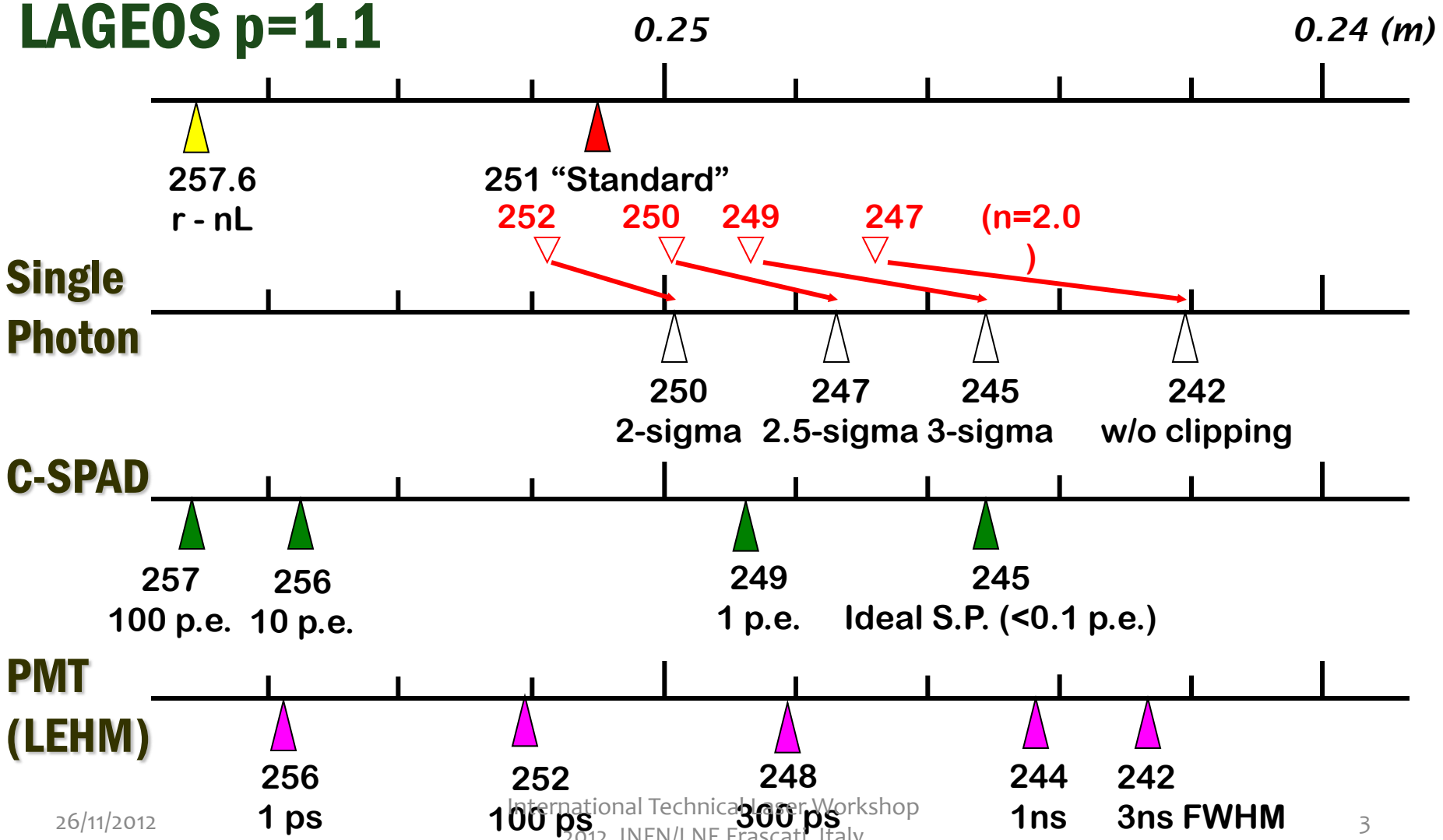
Station- and epoch-dependent CoM values



- Appropriate CoM value **and its accuracy** depends upon:
- System detection hardware (SPAD, MCP, PMT)
- Return energy level (multi-, single- or mix-)

Otsubo & Appleby, LW13, Washington, 2002. (later published in JGR, 2003)

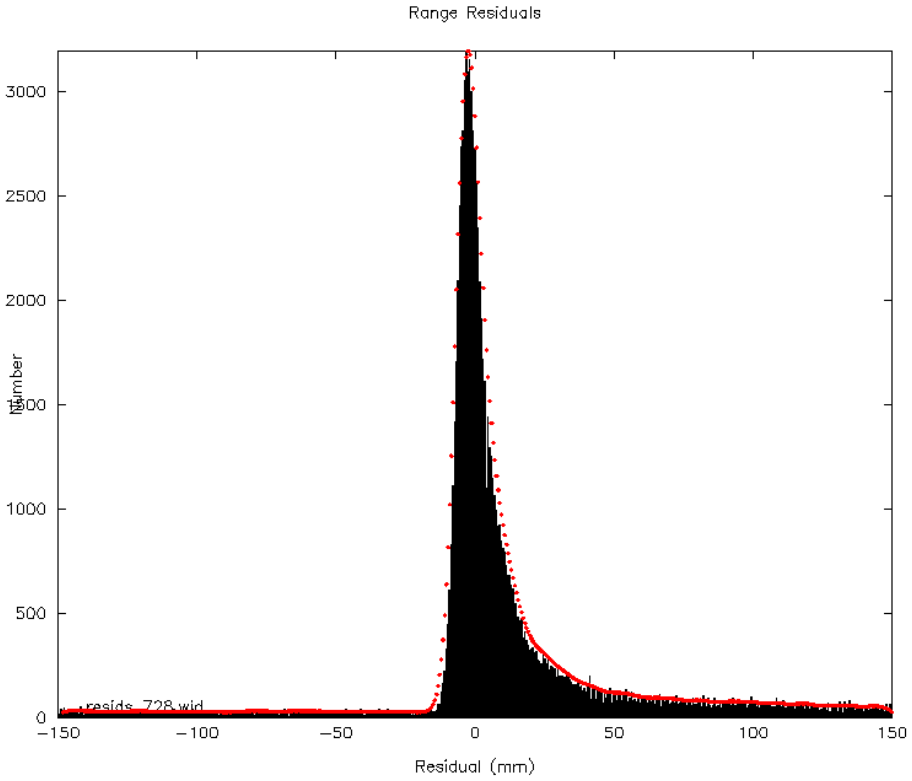
Centre of mass correction



Station- and epoch-dependent CoM values

- Taking these generic, system-dependent results from Otsubo & Appleby (2003);
- Using up-to-date Site-log information for all stations from ~1980 onwards as a **critical resource**
- Estimated CoM values and error estimates:
- In general, single-photon return delivers most **accurate** CoM value, **even if** single-shot precision is low(er)

e.g. High-precision and accuracy from LAGEOS



Real single-photon data from a LAGEOS kHz pass.
Model (red) fits very well.
Implied CoM value 245 ± 1 mm

Station- and epoch-dependent CoM values

- For the multi-photon MCP (e.g., NASA) systems, model implies value of ~250mm, close to ground-measured, ‘standard’ 251
- However:
  - If logfile suggests that return energy variable or even unknown,
  - Larger (~10mm) uncertainty placed on model CoM value.

Detail from CoM table for LAGEOS

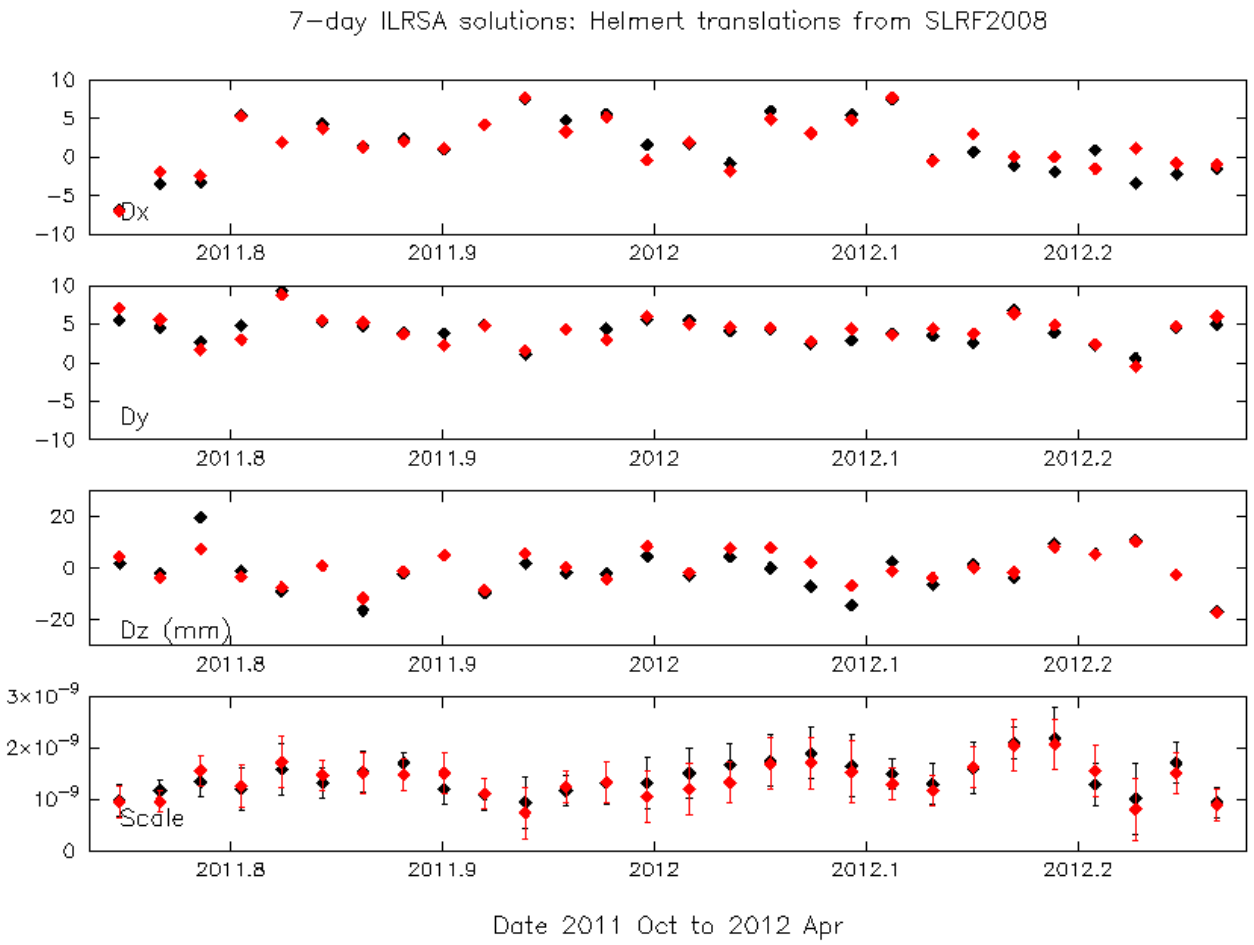
Station	Time-span		detector info	CoM min, max, adopted (mm)					
7838	01 04 2008	31 12 2050	20	MCP CSM	3.0	6	15	252	248	**250**
7838	01 07 1990	01 04 2008	100	MCP CSM	3.0	20	40	252	248	**250**
7839	01 01 1983	31 12 2000	300	PMT NC	3.0	120	150	245	241	**243**
7839	01 11 1981	08 10 2003	35	CSP NCM	2.2	3	9	255	250	**252**
7839	09 10 2003	31 12 2050	10	CSP NSF	2.2	3	9	255	250	**252**
7840	01 02 2007	31 12 2050	10	CSP CS	2.5	3	9	245	245	**245**
7840	31 03 1983	31 03 1992	100	PMT NCF	3.0	35	45	252	244	**248**
7840	31 03 1992	31 12 2050	100	CSP CS	3.0	6	15	246	244	**245**
7841	20 07 2001	31 12 2050	50	PMT CSF	2.5	10	18	254	248	**251**

Data files for LAGEOS and Etalon and Fortran code are available to select CoM for analyses

Testing the CoM tables

- In common with all ACs, we carried out weekly solutions from October 2011 for six months:
  - Used LAGEOS and Etalon ILRS data combined
- One (v30) the standard reference frame soln;
- Two (v35) using the new CoM correction tables, epoch- and station-dependent
- Then Helmert (7-parameter) mapping of each weekly solution onto SLRF2008

Differences between v30 and v35 solutions



Summary of v30-v35 differences

- V30 mean scale difference from SLRF2008:
  - -0.13±0.05ppb
- V35 mean scale difference from SLRF2008:
  - -0.16±0.05ppb
- Thus difference in scale, driven by more careful use of CoM values, is only 0.03ppb

LAGEOS/Etalon CoM conclusions

- Not major issue?... But important to model as well as possible;
- Must consider CoM effects in context with those of poor site-ties and range measurement error issues
  - Can we really say that some sites are range-error free?
- To do: a more comprehensive comparison for 1980 onwards:
  - Big changes in network hardware in early decades
  - Important to track CoM changes - systematic