Updates to the centre of mass corrections in preparation for ITRF2020 products

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Where are we

- For the final run of the PP on systematic errors, and the first batch of REPRO2020 solutions (1993–2020), the CoM version adopted was v200608
- For the ITRF2020 reanalysis, the ASC was asked to deliver solutions for the 1983–1993 period, valuable for the computation of the different global TRF solutions (IGN, DGFI, JPL)
- Given the inferior quality of the observations, and the sparse information available, a coarse approach was followed to provide the corrections for several missing pre-ILRS stations → v210511 adopted for the reanalysis
- The ILRS ASC will soon transition to ITRF2020 standards for their daily and weekly products
- Recent station updates and missing stations motivate the last update of the corrections

Updates

- Christian Schwatke's automatic service emails me every time there is a site log change, with all the details
- If changes do not impact the CoM computation, they are ignored
- Otherwise I archive them for future inspection
- 17 stations were in the list for examination in this update:

  1824, 7080, 7105, 7110, 7124, 7249, 7396, 7701 (new), 7816 (new),

  7821, 7824, 7825, 7838, 7839, 7841, 7941, 8834

- Only the changes in 10 stations required a recomputation:

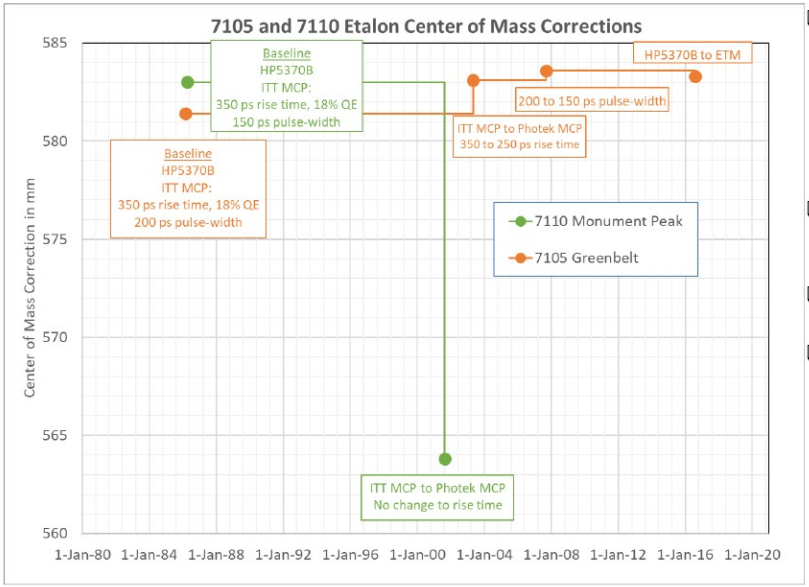
  7110, 7124, 7249, 7396, 7701 (new), 7821, 7824, 7838, 7941, 8834

Updates

- Some stations were contacted for clarifications
  - Replies from 1824 GLSL, 7249 BEIL, 7821 SHA2, 8834 WTZL
  - No reply yet from 7396 JFNL (minor issue)
- The changes detailed in the site logs were very minor, e.g. slight changes in laser pulse widths or detector jitter
- I fixed some minor inconsistencies in my logs, discovered while checking the new changes
- I updated the NP database to estimate return rates for the latest system configurations
- The results are not very exciting *[boo!]*…which means that minor changes don't derail the model *[yay!]*

The interesting case: 7110

7110 and 7105 Etalon CoMs



- This is a time series of 7110 (MOBLAS-4) and 7105 (MOBLAS-7) Etalon CoM corrections. The system configuration changes are annotated inside the boxes. Based on the 7110 MCP-PMT change there was a 20 mm drop in the MOBLAS-4 CoM correction on 19-August-2001
- 7110 and 7105 currently have the same system configuration, but the CoM corrections are quite different
- Did the 20 mm drop in the 7110 Etalon CoM impact the estimated range bias?
- If the CoM correction is in error by 'z', it will induce an apparent range bias = 'z'. For example, if the CoM is too small by 1 mm, it will induce an apparent -1 mm range bias.

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Van Husson. *CoM and SSEM Range Bias Analysis.* QCB presentation

The interesting case: 7110

- Confirmed anomaly in the modelling chain:
  - Single variable that defines the discriminator threshold in multi-photon stations
- This is not computed automatically, but adjusted manually according to the best agreement with the NP RMS
- Set to 1, 2, or 3 photoelectrons. Probably there is no 1:1 equivalent to a tunable accesible by stations (they set voltages)
- Big impact for large targets → Etalon, Ajisai
- Reason for odd value compared to rest of MOBLAS unclear, it seems clear now that it should be the same

The interesting case: 7110

LAGEOS-1 (old/new values)

```
7110 15 08 1983 31 03 1986  com  243.6
7110 31 03 1986 19 08 2001  com  245.6
7110 19 08 2001 01 01 2050  com  244.6
-----------------------------------------
7110 15 08 1983 31 03 1986  com  244.7
7110 31 03 1986 19 08 2001  com  245.8
7110 19 08 2001 01 01 2050  com  245.7
```

LAGEOS-2 (old/new values)

```
7110 31 03 1986 19 08 2001  com  245.4
7110 19 08 2001 01 01 2050  com  243.9
-----------------------------------------
7110 31 03 1986 19 08 2001  com  245.3
7110 19 08 2001 01 01 2050  com  245.2
```

LARES (old/new values)

```
7110 19 08 2001 01 01 2050  com  130.0
-----------------------------------------
7110 19 08 2001 01 01 2050  com  130.1
```

ETALON-1 (old/new values)

```
7110 31 03 1986 19 08 2001  com  583.0
7110 19 08 2001 01 01 2050  com  563.8
-----------------------------------------
7110 31 03 1986 19 08 2001  com  583.3
7110 19 08 2001 01 01 2050  com  583.4
```

STARLETTE (old/new values)

```
7110 15 08 1983 31 03 1986  com   75.5
7110 31 03 1986 19 08 2001  com   76.1
7110 19 08 2001 01 01 2050  com   75.6
-----------------------------------------
7110 15 08 1983 31 03 1986  com   75.8
7110 31 03 1986 19 08 2001  com   76.1
7110 19 08 2001 01 01 2050  com   76.2
```

AJISAI (old/new values)

```
7110 15 08 1983 31 03 1986  com  981.1
7110 31 03 1986 19 08 2001  com  994.5
7110 19 08 2001 01 01 2050  com  983.1
-----------------------------------------
7110 15 08 1983 31 03 1986  com  992.9
7110 31 03 1986 19 08 2001  com  995.0
7110 19 08 2001 01 01 2050  com  996.9
```

The interesting case: 7110

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```

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7110 19 08 2001 01 01 2050  com  243.9
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```

The interesting case: 7110

- Double win:
  - Corrected Etalon 20 mm error (and Ajisai 14 mm)
  - Found out reason for the strange value → other instances lurking in the data?

The rest: boring

- Very small differences (mostly sub-mm), as expected from the modest system changes
- Exception for LAGEOS:
  - 7821 SHAO2 tweaked leading edge filter in 2021
  - ~3.4 mm difference in both LAGEOS and LAGEOS-2
  - Probably too early to tell if correct
- The adoption of this latest udpate should be quite painless
- I will upload it to the Yebes Observatory website soon