Galileo Terrestrial Reference Frame (GTRF) - Status update
GRTF is provided under a contract with Spaceopal

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ICG-16 Meeting, 09 – 14 October 2022, Abu Dhabi, UAE
The GTRF22v01 was obtained by accumulating (rigorously stacking) all the weekly GTRF combined solutions since 2006 (598 weeks spanning 15 years).

GTRF22v01 is aligned to ITRF2014 (through IGS14) using the minimum constrains approach over a set of 49 IGS/ITRF sites:
- 32 in the northern and 17 in the southern hemisphere.

The GTRF22v01 combination process makes use of:
1. annual and semi-annual signals present in the station position time series were estimated during the stacking, and
2. Post Deformation (PSD) parametric models were applied to the coordinates of IGS stations that are subject to major earthquakes before stacking the time series.
Latest GTRF Realisation: GTRF22v01 includes 159 sites
Red squares: ITRF/IGS stations including 49 reference frame sites
Green/blue: GSS/GESS sites
GTRF Velocity Field

GTRF Velocity Field: GTRF22v01 includes 159 sites
Red squares: ITRF/IGS stations including 49 reference frame sites
Green/blue: GSS/GESS sites
GTRF Weekly Weighted RMS

GTRF Weekly WRMS (mm)

North  East  Up

Weekly station coordinate WRMS for the PF’s and the combined solution (CS)
Orbit Combination

Final Orbits (PFs vs. CO_Final)

Weighted RMS [mm]

Time [GPS weeks]

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Clock Combination

Final Clock SDEV (PFs vs. CO_Final)

Clock SDEV [ns]

Time [GPS weeks]

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The SLR residuals are confirming the overall orbit accuracy (3D – 1 Sigma) of 10 – 20 cm
Notice improvement thanks to improved modelling starting week 1873
Validation

• Validation is carried out on a weekly basis when the last reference product is available (in general, the IGS troposphere solution)
• Validation result is a weekly summary file (vf_www7.sum)
• High quality, demonstrated by the RMS of Helmert-transformation (see table below) of the weekly solution vs different RFs

<table>
<thead>
<tr>
<th>#sites</th>
<th>North [mm]</th>
<th>East [mm]</th>
<th>Up [mm]</th>
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<tr>
<td>IGS14</td>
<td>80</td>
<td>2.73</td>
<td>2.59</td>
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<td>IGS22P37</td>
<td>121</td>
<td>2.41</td>
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<tr>
<td>GTRF22v01</td>
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<td>2.73</td>
<td>1.91</td>
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</tbody>
</table>
Conclusions

– GTRF is a state of the art realisation of the ITRS for Galileo
– GTRF is rigorously aligned to ITRF2014
  – No scale offset nor rotation w.r.t. ITRF2014
– GTRF updated on a yearly basis considering the latest plate tectonics
– GTRF has the same high accuracy as the ITRF
  – But more frequently updated!