

12th March 2013: PANG and JRC's IPSC Institute Perform a Complete Navigation Solution using only Galileo

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12th of March 2013 the teams of the PARthenope Navigation Group (PANG) at the Università degli Studi di Napoli Parthenope and the Institute for the Protection and Security of the Citizen (IPSC) of the European Commission Joint Research Centre, based in Ispra (Italy) have carried out the position and the velocity of a receiver using only Galileo measurements.

Since 19th January 2013, a monitoring station equipped with multi-frequency multi-constellation choke-ring antenna JAVAD RINGANT G3T antenna has been deployed on the roof of a building at the JRC Ispra site (Italy). A Septentrio PolaRxS PRO receiver has been used to track simultaneously navigation signals from the Galileo, GPS and GLONASS satellite constellations. The first two Galileo satellites were launched in October 2011, the next two space vehicles were launched on October 2012, completing the IOV (In-Orbit Validation) quartet usable for positioning, and started to transmit ranging signals since December 2012.

The broadcast navigation messages received 12th March contained valid ephemerides and parameters for satellite clock corrections, making possible the position/velocity computation.

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Around 10 AM CET for about two hours, all four Galileo satellites have been visible from Ispra and the navigation solution has been obtained with 10 meter of accuracy.

Below the horizontal and vertical errors, obtained using pseudorange measurements, are plotted showing the aforesaid accuracy.

Horizontal Position Error Galileo Only

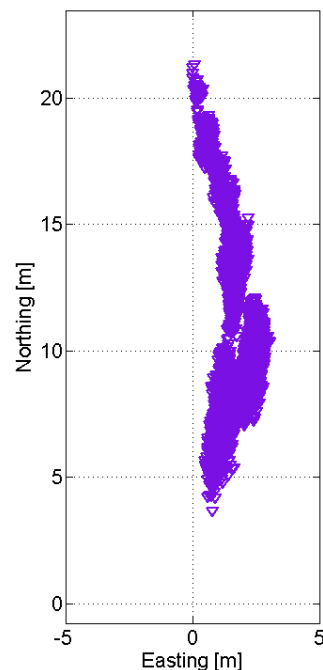


Figure 1 – Horizontal Position Error

The vertical error shows a jump around 10:50 am, concurrently with a change in the ephemeris set used to compute satellite position.

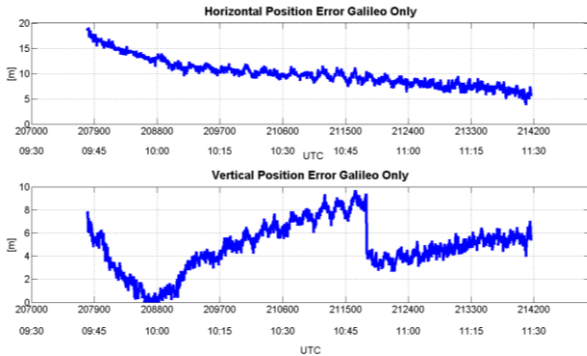


Figure 2 – Horizontal/Vertical Position Error versus time

Even the velocity errors, obtained processing Doppler observables, are shown, demonstrating dm/s accuracy.

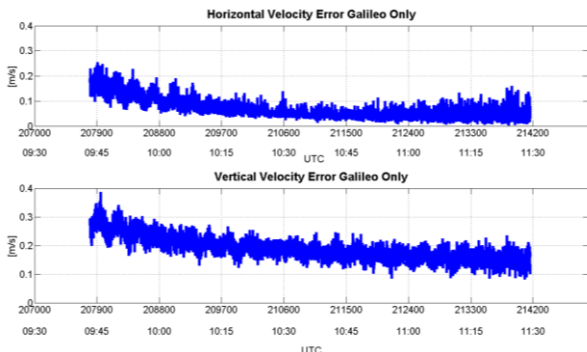


Figure 3 – Horizontal/Vertical Velocity Error versus time

With only four satellites available, the constellation geometry influences significantly the navigation performance, hence the DOP (Dilution Of Precision) values are displayed too.

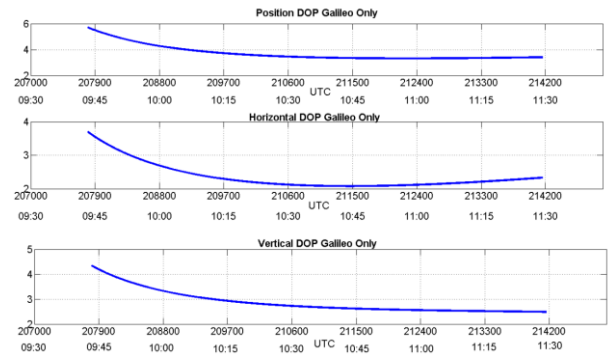


Figure 4 – PDOP/HDOP/VDOP versus time

A sky-plot for a single epoch is shown below.

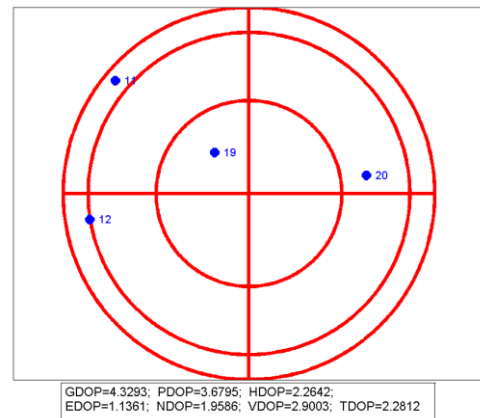


Figure 5 – Galileo satellite sky-plot