Galileo HAS and OSNMA

ICG-17

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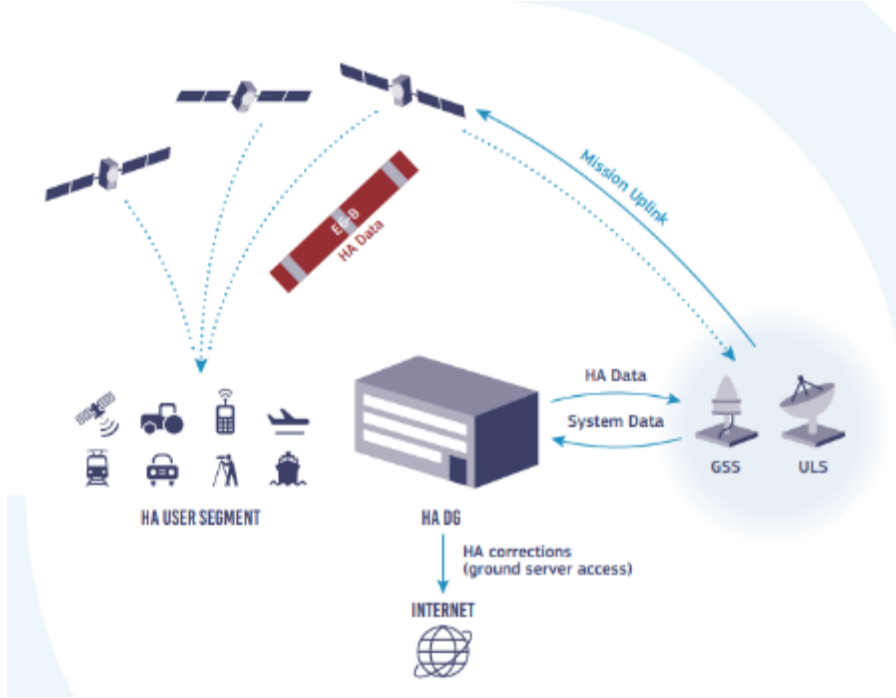
What is Galileo HAS

- Galileo HAS provides precise corrections for Galileo/GPS satellite orbit, clock and signal biases
- Galileo HAS corrections distributed via
  - Galileo satellites, E6-B signal (1278.75 MHz)
  - Internet
- Typical user accuracy in the decimetre level (after convergence), with Precise Point Positioning (PPP) receivers
- (Almost) global coverage and free

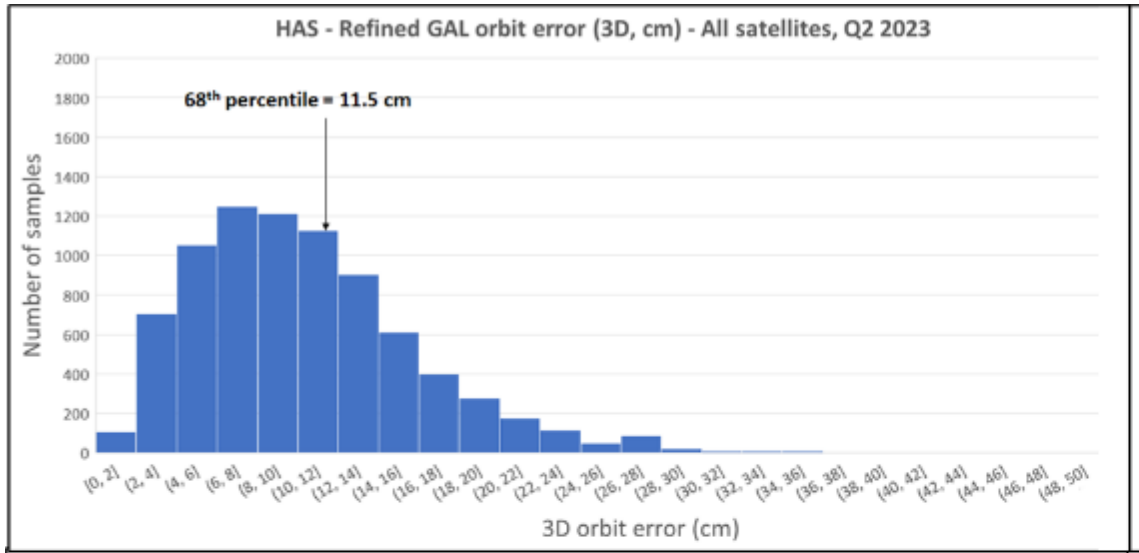


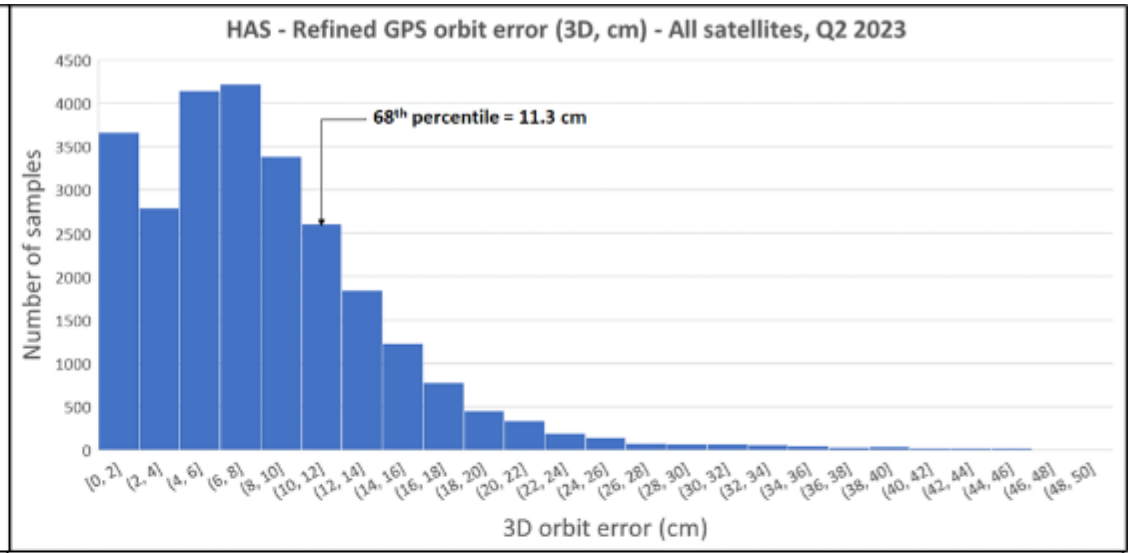
Galileo HAS performance

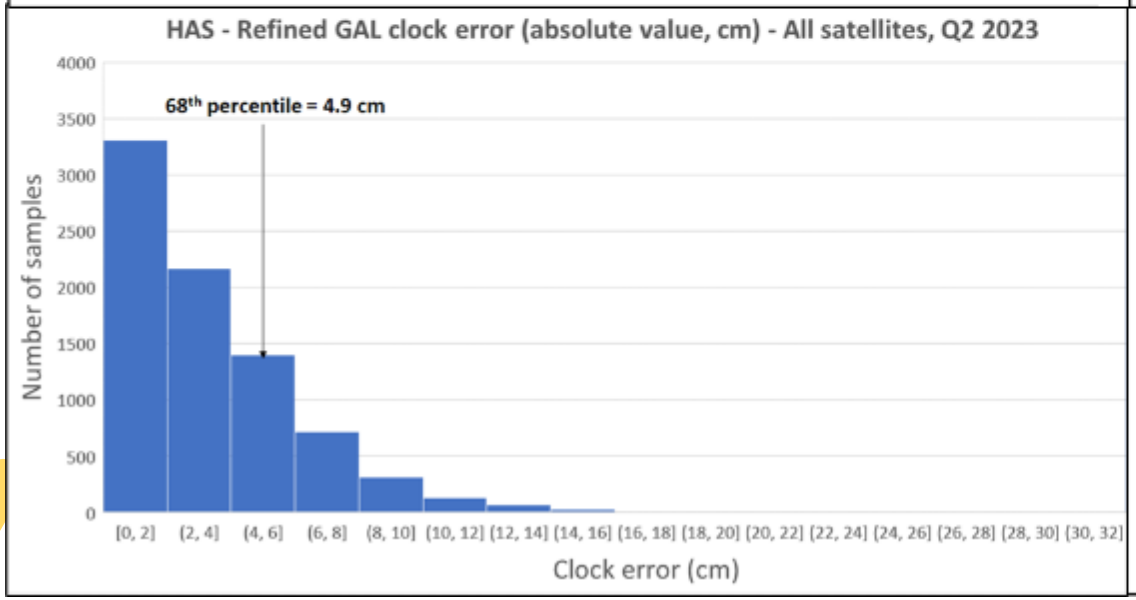
HAS	SERVICE LEVEL 1	SERVICE LEVEL 2
COVERAGE	Global	European Coverage Area (ECA)
TYPE OF CORRECTIONS	PPP - Orbit, clock, biases (code and phase)	PPP - Orbit, clock, biases (code and phase) incl. atmospheric corrections
CORRECTIONS DISSEMINATION	SIS (Galileo E6-B) and IDD (Ntrip)	SIS (Galileo E6-B) and IDD (Ntrip)
SUPPORTED CONSTELLATIONS & FREQUENCIES	Galileo E1/E5a/E5b/E6; E5 AltBOC GPS L1/L5; L2C	Galileo E1/E5a/E5b/E6; E5 AltBOC GPS L1/L5; L2C
HORIZONTAL ACCURACY 95%	<20 cm	<20cm
VERTICAL ACCURACY 95%	<40cm	<40cm
CONVERGENCE TIME	<300 s	<100 s
USER HELPDESK	24/7	24/7

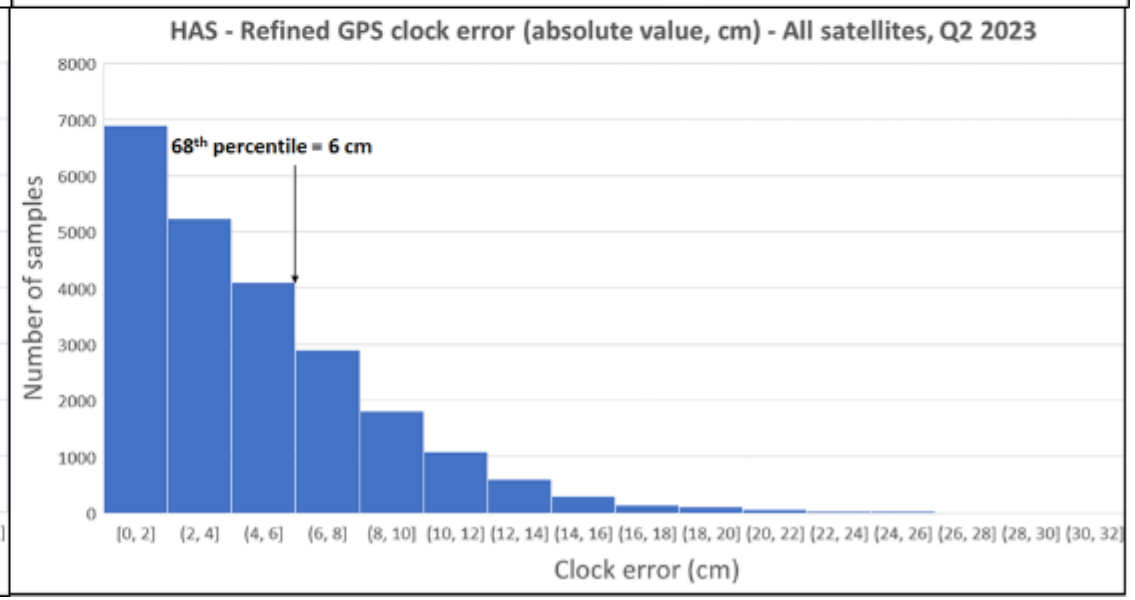
https://www.gsc-europa.eu/electronic-library/programme-reference-documents#ACCURACY

Galileo HAS performance – product accuracy



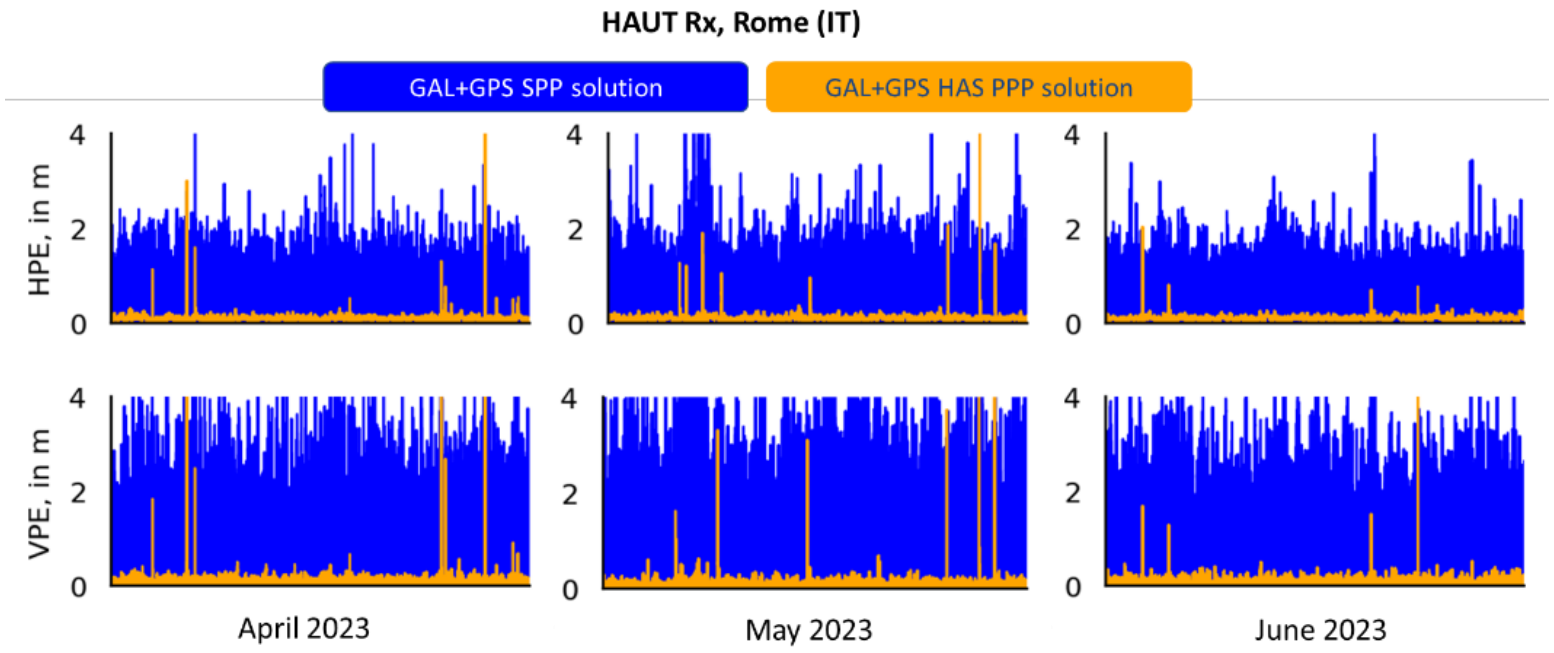


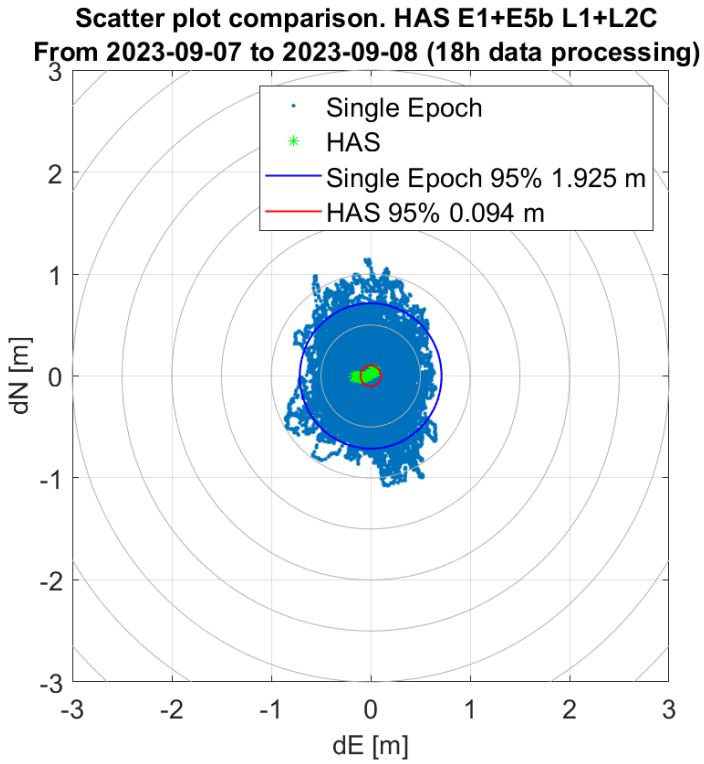




http://www.gsc-europa.eu/electronic-library/performance-reports/galileo-high-accuracy-service-has

Galileo HAS performance – user accuracy

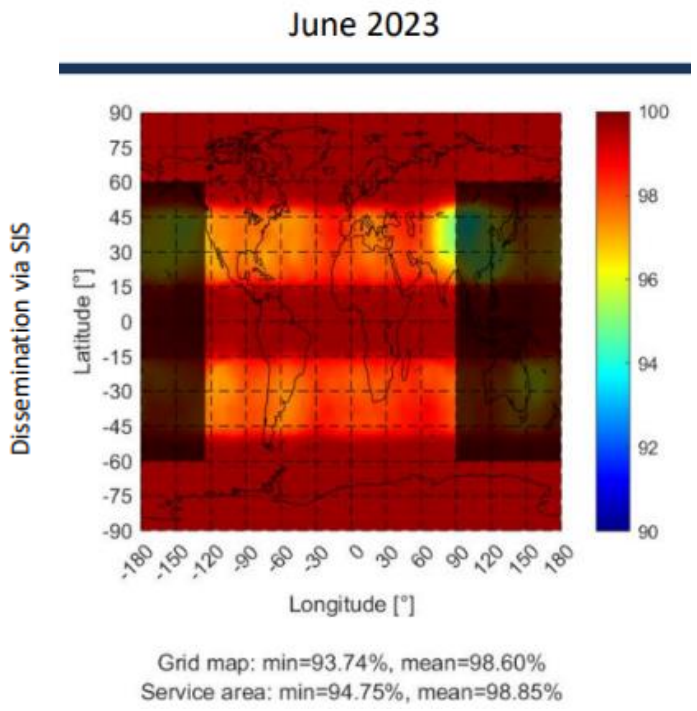




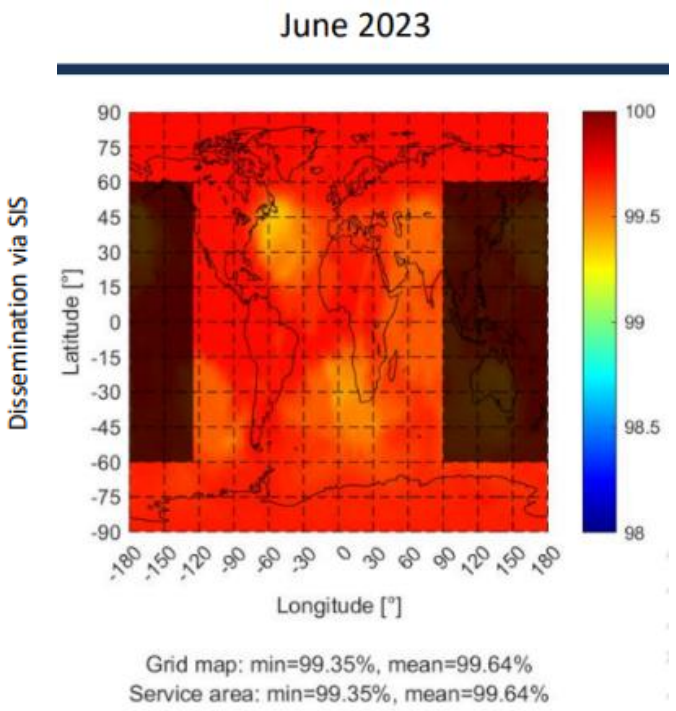
Source: EUSPA/JRC

Galileo HAS performance – availability

- availability of at least 5 corrected Galileo satellites in view

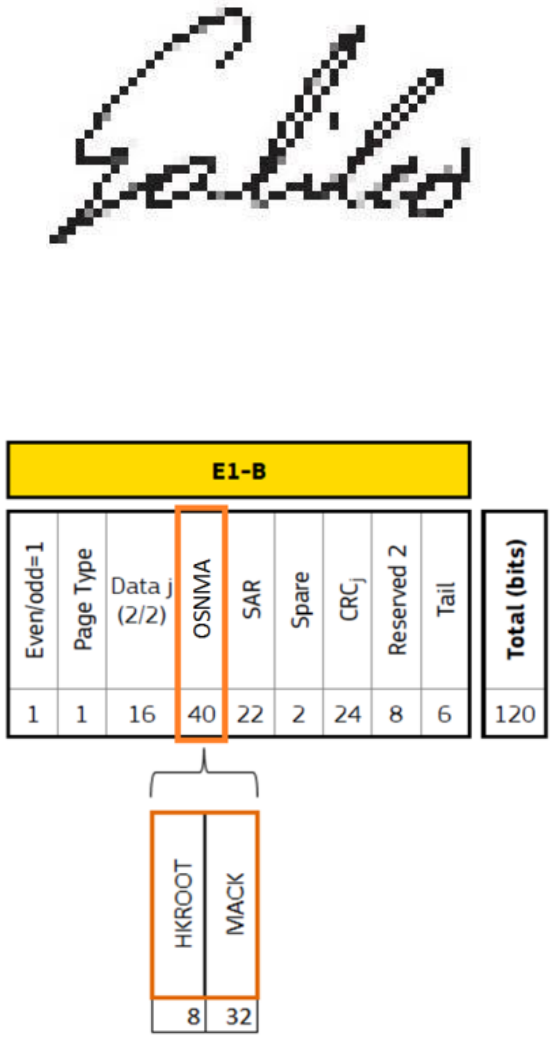


- availability of at least 8 Galileo and/or GPS satellites in view.

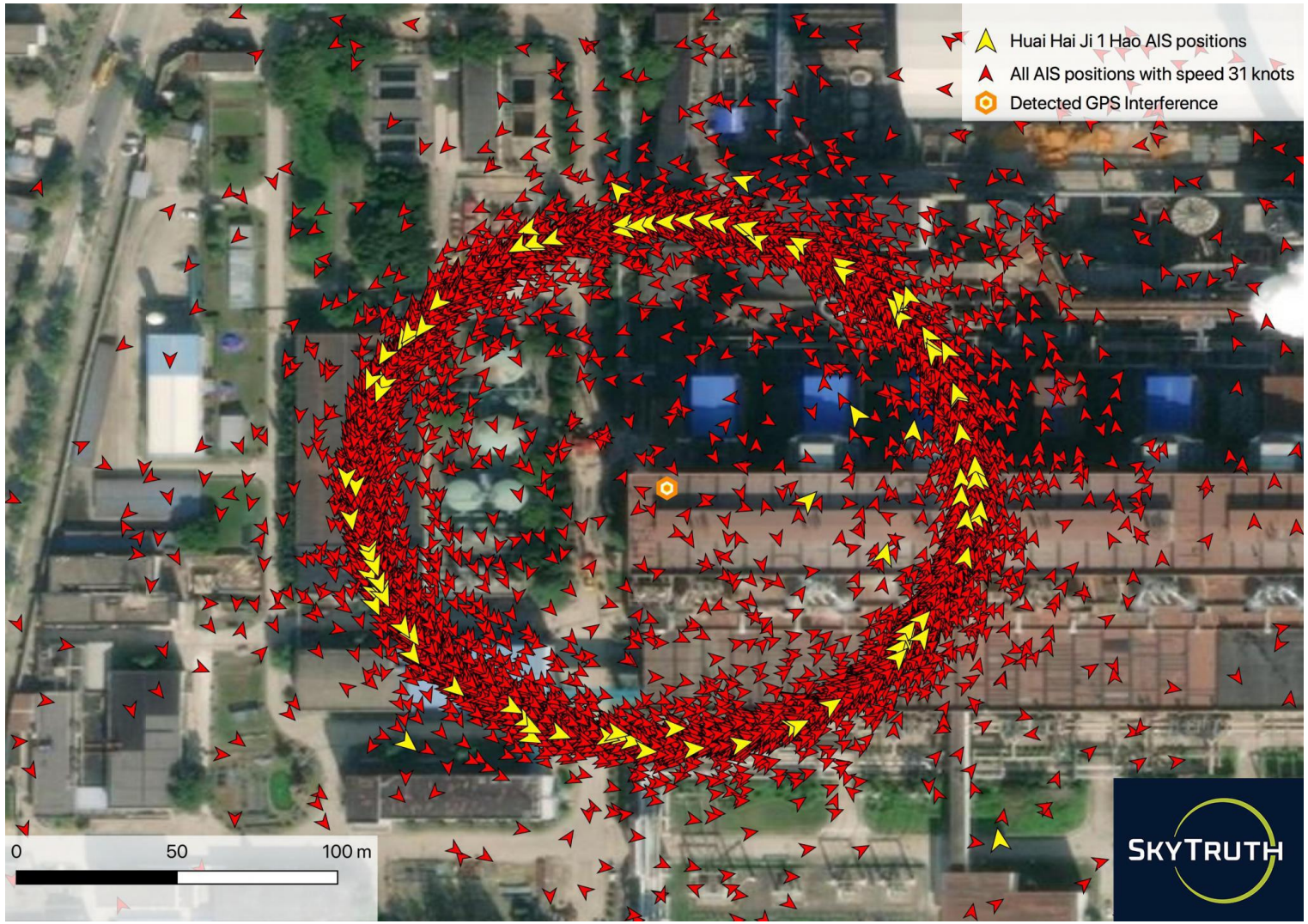


What is Galileo OSNMA

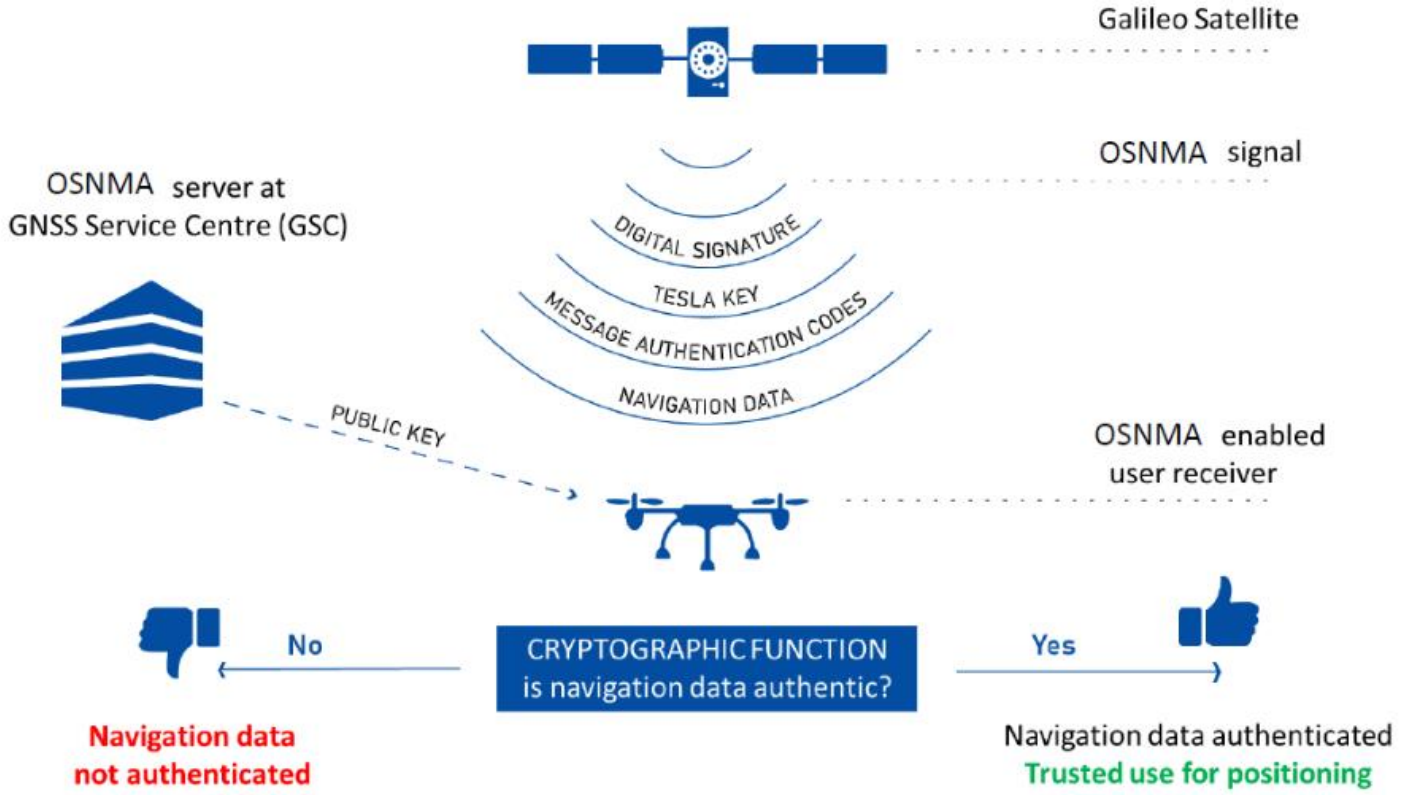
- Mechanism to authenticate the Galileo data used to calculate a position: satellite orbits and clocks, status flags, time, biases, ionospheric model.
- Equivalent to a Galileo “digital signature”
- Transmitted in 40 bits every other second in the Galileo I/NAV message, E1B component, 1575.42 MHz
- Makes the signal unpredictable



Why OSNMA


Huai Hai Ji 1 Hao AIS positions
All AIS positions with speed 31 knots
Detected GPS Interference
0
50
100 m
SkyTruth

OSNMA protocol

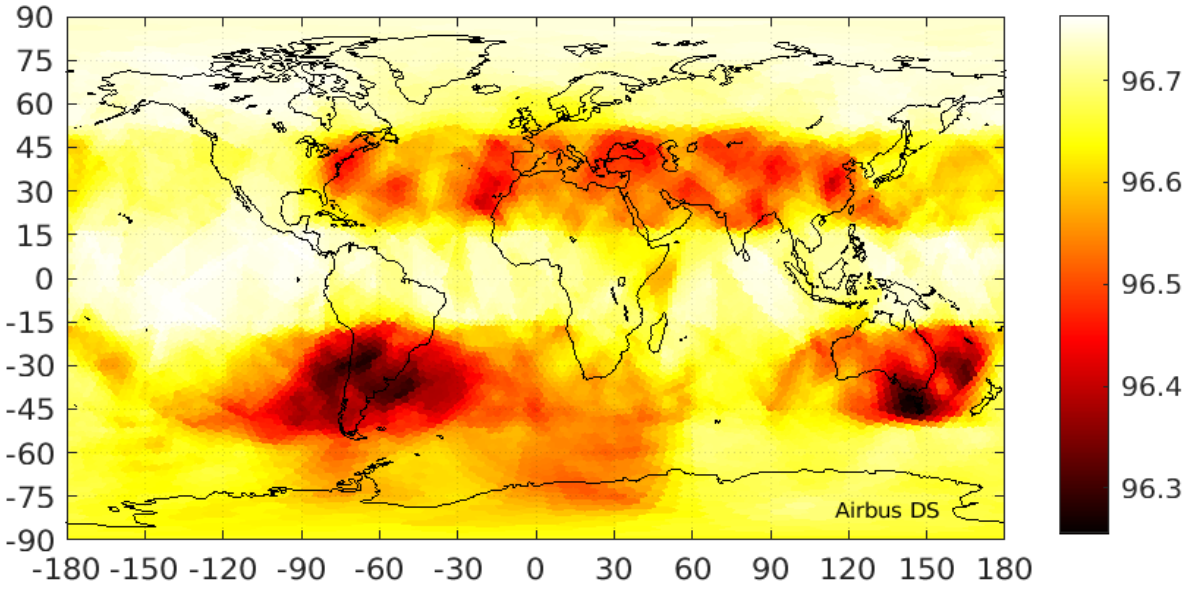


https://www.gsc-europa.eu/electronic-library/programme-reference-documents#OSNMA

OSNMA performance

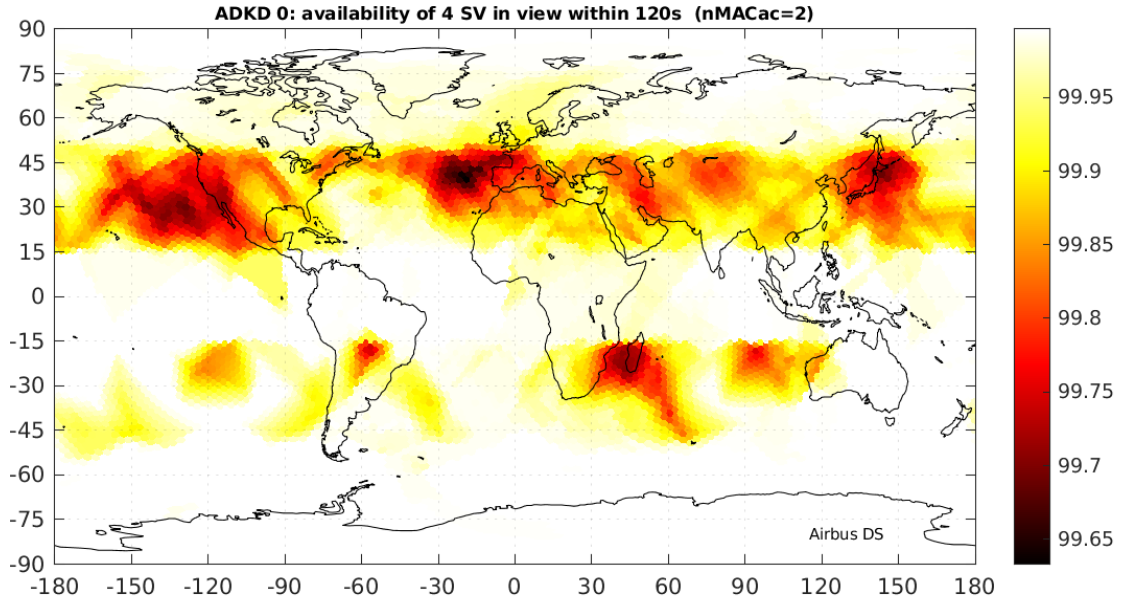
- TTFAF (time to first authenticated fix): <100s
- Accuracy: very similar to OS
- Availability: >99% worldwide, and improving

Aug'22



Min: 96.25% - Mean: 96.64% - Max: 96.76%

Jun'23



min: **99.63**% | mean: **99.95**% | max: **100.00**%

Availability of tags for Galileo I/NAV orbit & clock data (ADKD0), for target security level (80 bits; foreseen 40 bits) and for at least 4 Space Vehicles in view (120 [s] accumulation window)

Summary and next steps

- Galileo HAS:
  - Provides free orbit/clock/bias corrections worldwide for Galileo and GPS through E6B SIS and internet
  - Allows dm-level accuracy with PPP algorithms
  - In service since Jan’23
  - Next steps: provision of phase biases, data authentication, error confidence levels, ionospheric corrections over Europe, and better performance over next years, with major upgrade in 2025/26

- Galileo OSNMA:
  - Provides authentication of Galileo data and makes signal unpredictable
  - In “public testing” since 2021. Service declaration in Q1’24
  - Next steps: Galileo signal authentication (ACAS/SAS*) initial capability in 2024. GPS data authentication, ACAS/SAS initial service and other enhancements in 2025/26

*Assisted Commercial Authentication Service/Signal Authentication Service

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