



EU SPACE

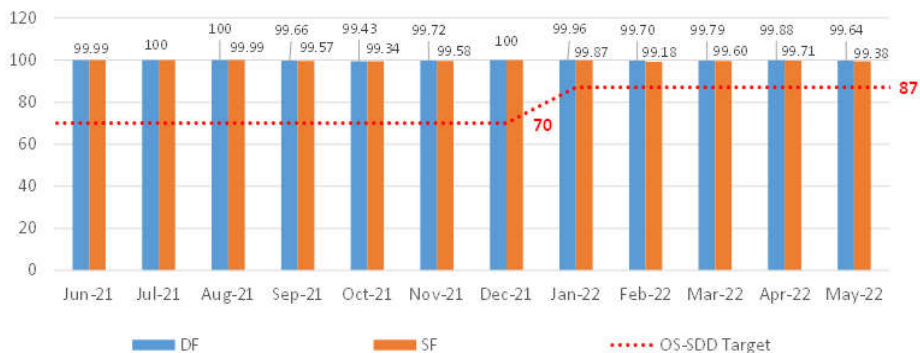
Galileo Programme Status

ICG-16 2022

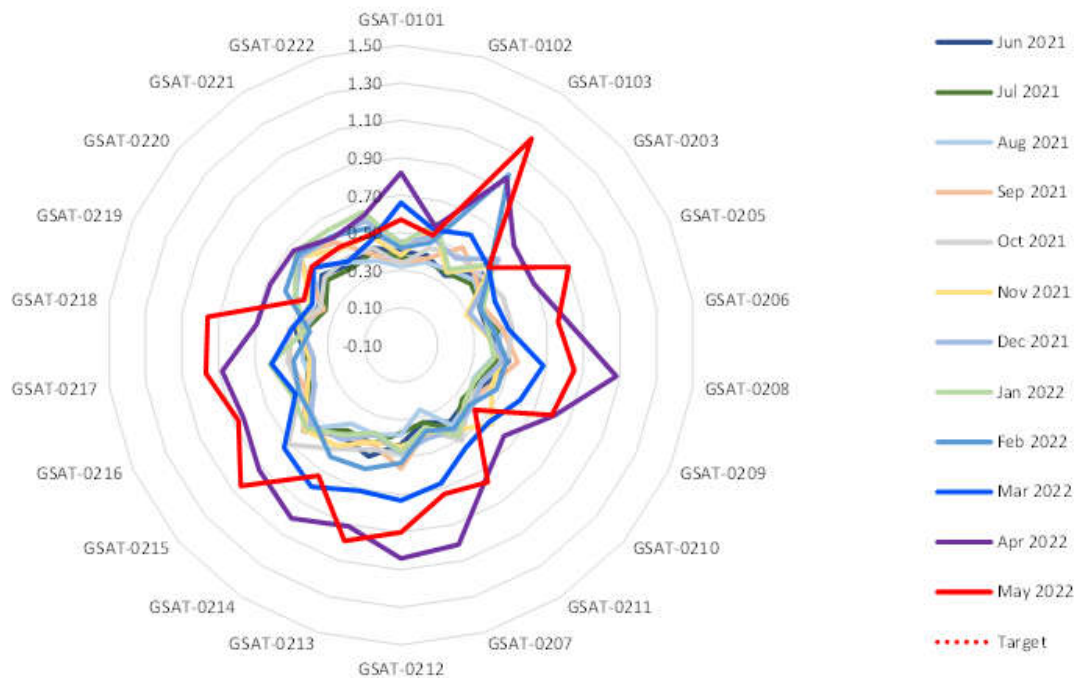
Abu Dhabi

*European Commission (EC)
European Space Agency (ESA)
European Union Agency for the Space Programme (EUSPA)*

Availability of Positioning with 95% HPE ≤ 7.5 m and 95% VPE ≤ 15 m at WUL



Single Frequency Ranging Accuracy [m] - Worst Case of monthly 95%



Visit the GNSS Service Centre website www.gsc-europa.eu
 For more details on Galileo Services performance

- Roadmap to Open Service Full Operational Capability
- Two additional launches required (L12/L13) to ensure one spare satellite per plane, initially planned using Soyuz Launcher
- Consolidation of launch plan on-going with Arianespace based on development plan for Ariane 6-2 Launcher
- Service availability already 98-99%
- New ground segment deployed
- New satellite software to bring INAV message improvements (Faster acquisition and data robustness)
- Improvements do not depend on completion of the constellation
- Target Q1 2023 for New OS Service Definition Document including extended operation mode, faster incident notification and other improvements



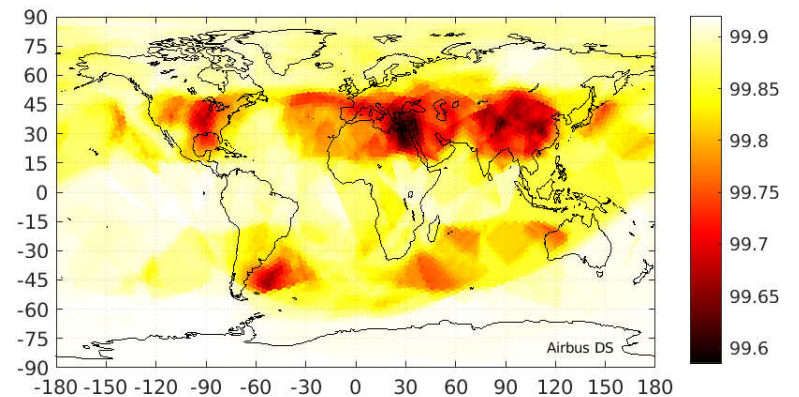
- Long awaited GNSS feature becoming a reality !
- OSNMA SIS ICD and receiver guidelines for Public Observation ready since Nov'21
- OSNMA stably transmitted worldwide in E1B for almost one year
- Initial Service declaration foreseen for first half of 2023
- First OSNMA receivers in the market available



OSNMA-transmitting satellites

	1 sat. over 30°	1 sat. over 20°	2 sat. over 10°	4 sat. over 5°
Jun. 2022	96.7 %	99.5 %	98.8 %	96.0 %
May 2022	98.4 %	99.5 %	98.3 %	80.9%
Apr. 2022	98.5 %	99.2 %	98.6 %	83.3 %
Mar. 2022	97.4 %	98.7 %	97.3 %	79.0 %
Feb. 2022	98.9 %	99.7 %	99.1 %	85.9 %
Jan. 2022	99.0 %	99.4 %	98.1 %	82.2 %
Dec. 2021	98.9 %	99.4 %	98.7 %	83.4 %
Nov. 2021	97.4 %	97.8 %	97.3 %	80.7 %

Results in EU; NB: less than 4 sats allow OSNMA PVT; source: JRC

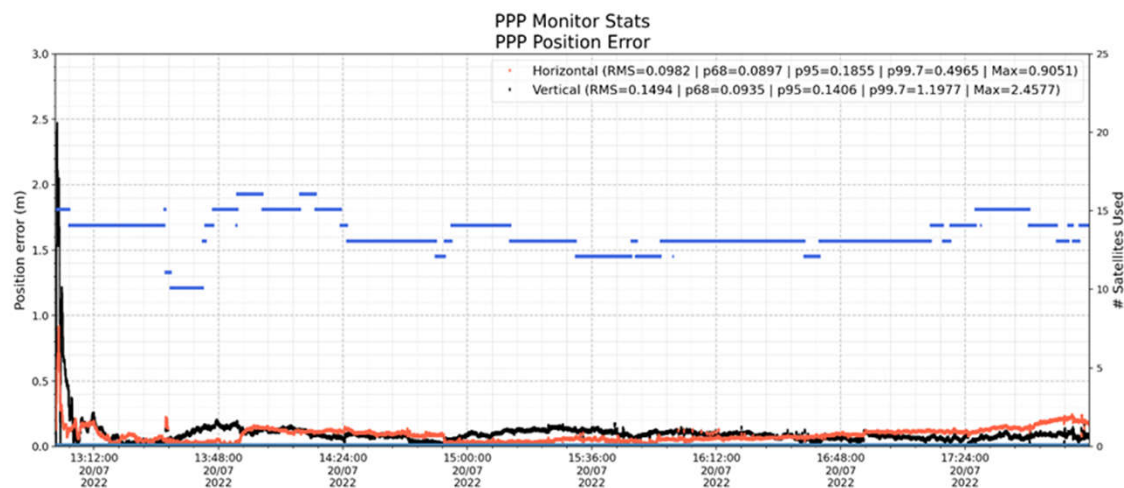


High Accuracy Service

NEW
GALILEO
HAS SIS ICD
PUBLISHED



- HAS SIS ICD available since May '22
- Since July '22, HAS signal also available worldwide with orbit and clock corrections and biases for Galileo (E1, E5a/b, E6) and GPS (L1C/A, L2C)
- **Still in validation phase, but very high performance already!**
- Initial Service declaration foreseen for end '22, including an internet-based correction distribution service

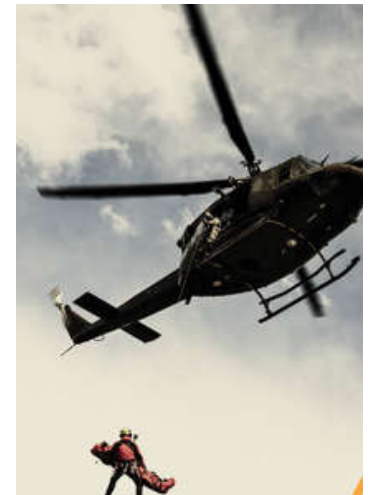


Initial HAS Galileo+GPS, 2f iono-free, float, open sky, static. Based on MagicPPP/PAULA project

- Service performing extremely well
 - *forward link* (since Dec 2016)
 - *return link* (since Jan 2021)
- EU Coverage with 3 MEOLUT
- Extension to Indian Ocean with 4th MEOLUT in Q1 2023 (Reunion Island)

New features coming:

- EUROCAE approved **remote beacon activation** from 2023
- Quicker rescues enabled via **distress beacon position sharing**
- **Two-way communication** possible using return link feature



Galileo
SAR/Remote
Beacon
Activation



- On-demand broadcast (L1 band) of alerts and guidance to population at risk
- Alert activation decided by national civil protection
- Public demonstration phase Q1 2023 to Q3 2023
- Service declaration 2024



Galileo
Emergency
Warning
Service



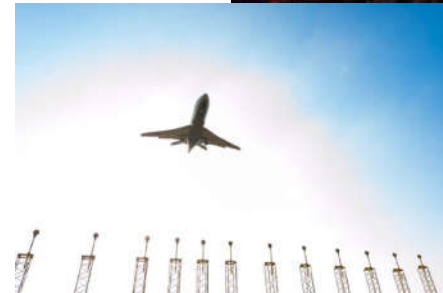
Advantage of Galileo EWS:

- Reaches population at large scale in ~ 1 minute
- No specific equipment needed. Simply a user terminal with Galileo chipset in it
- Available also when terrestrial alert systems are down (collapsed or saturated)

COMMON STANDARD NOW AGREED WITH JAPAN

Other Services coming

- Advanced timing service
- Space Service Volume
- ARAIM for safety of life application
- Contribution to ionosphere prediction



Support to Users



Performance monitoring and reporting

- Galileo Reference Centre

Service notice, NAGUs, Helpdesk, training, support to startups

- Galileo Service Centre

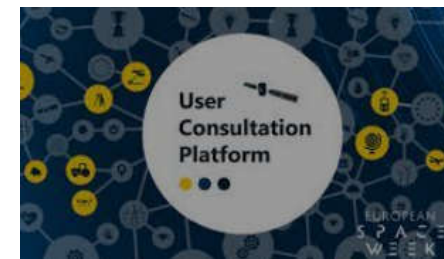
Market development & User Consultation EUSPA

Testing lab for new features

- Joint Research Centre

Receiver developments

- Fundamental elements programme
- Bilateral agreements with manufacturers



G2G and Beyond

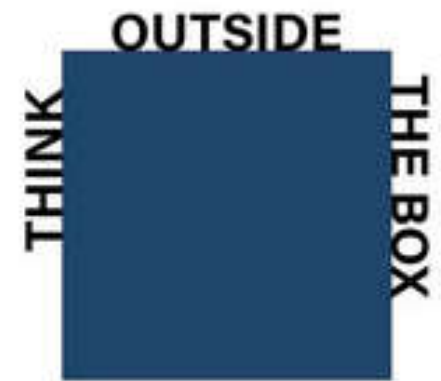
- Legal basis and requirements baseline in place
- Budget available
- Fast Track towards Galileo 2nd Generation
- R&D activity in parallel to maintain security of supply and study emerging concepts for GNSS (LEO-PNT)

From R&D....



...to launch and exploitation !

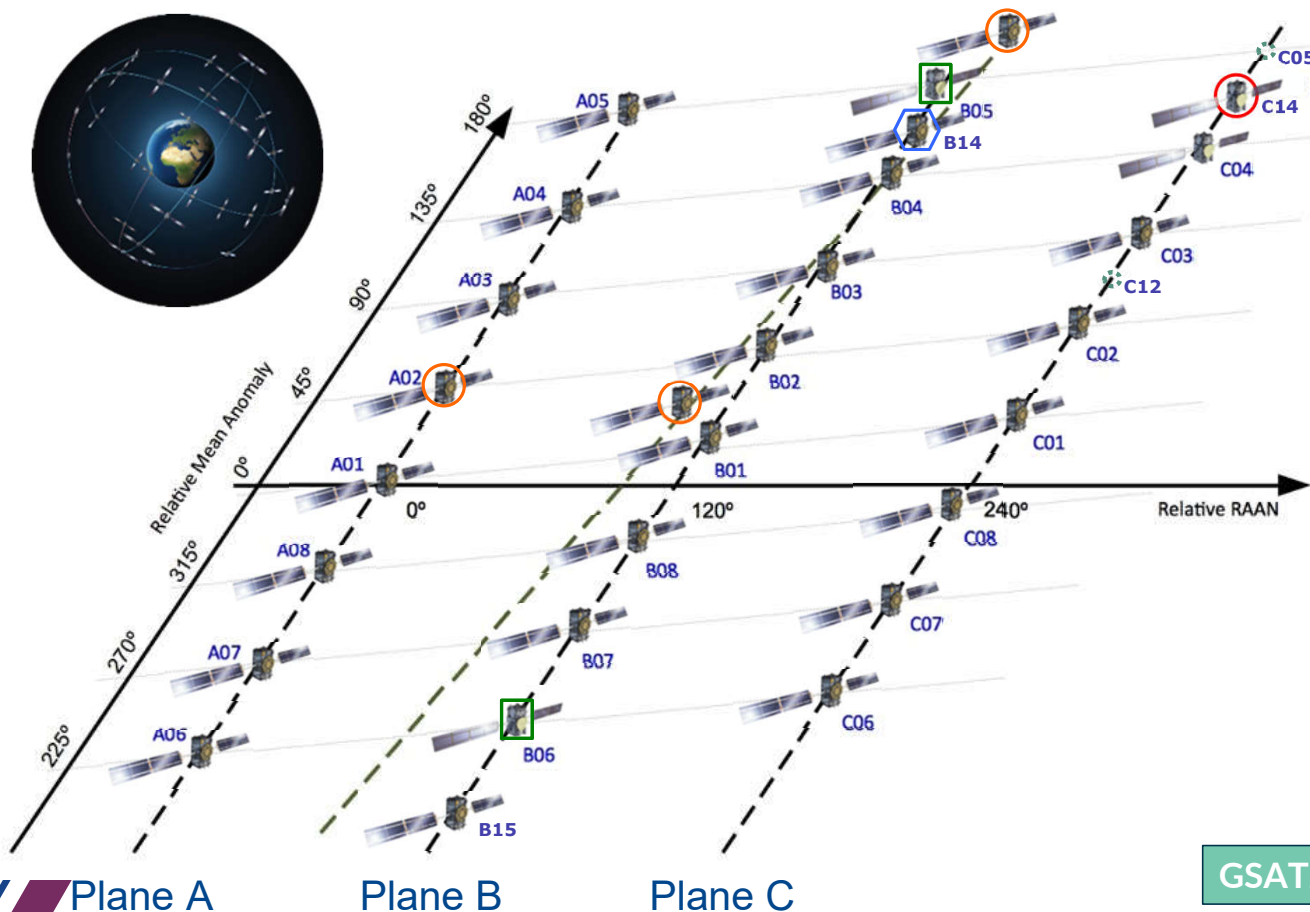
- GNSS applications are ubiquitous and need additional resilience
 - Resiliency of GNSS (signals modulation/power, authentication, receivers, antenna, ..)
 - Interference / Spoofing detection capability (on ground, inside receiver, through space)



- LEO PNT -> target new missions and exploit synergies with EU Secure Connectivity initiative
- Alt PNT -> Testing and Demo Day in Joint Research Centre
- New version of European Radio Navigation Plan
- Regulatory actions in Europe and at ITU



Galileo Constellation Status:



Navigation (23 in service)
Search and Rescue (25 in service)

- 28 satellites in orbit
- 3 not usable
- 1 spare
- 1 unavailable
- 2 no SAR (by design)

GSAT 104 (Spare, NAVANT failure), relocation from C05 to C14 completed on 12/05/2021

GSAT 204 (Spare, SAR off), relocation from B03 to B14 completed on 06/05/2021 (NAGU 2017045)

GSAT 201/202 (set to unhealthy)

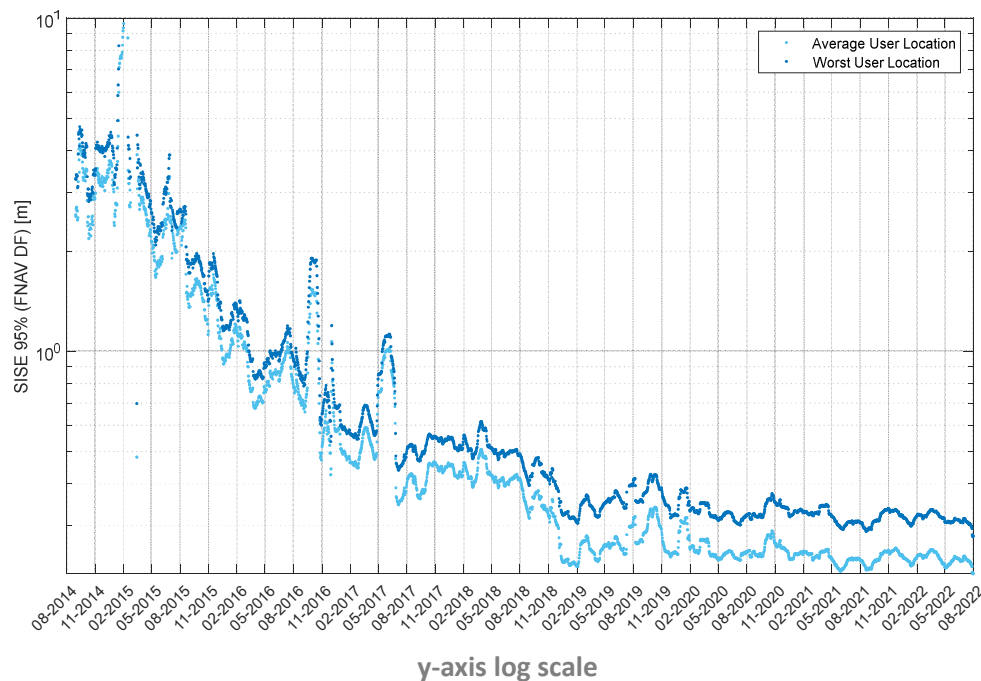
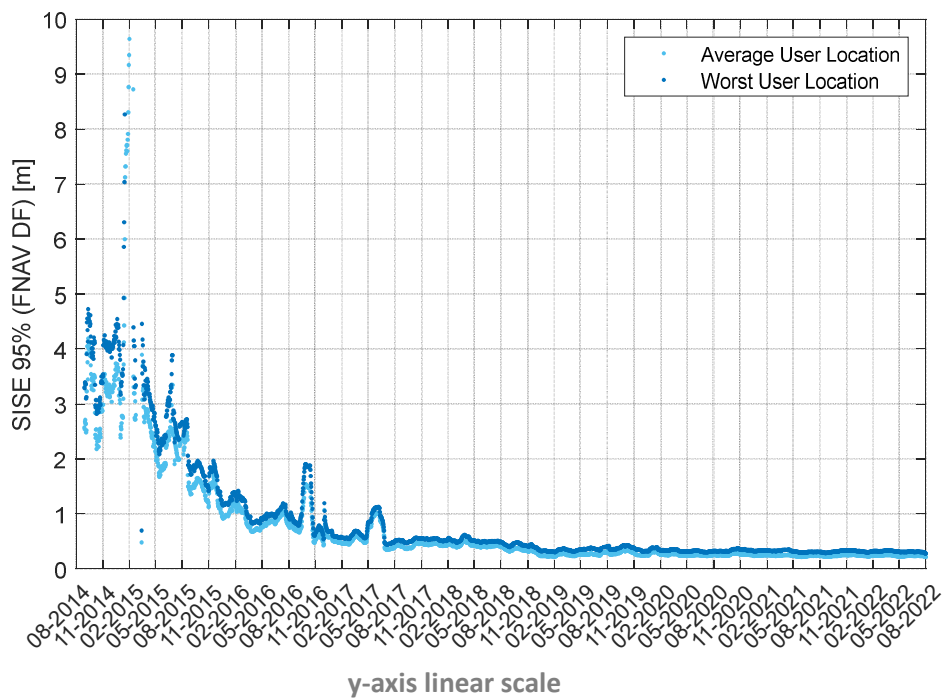
GSAT 210 currently **Not Usable** ((DVS=WWG), NAGU2022035)

L11 slots on Plane B: B03, B15

GSAT223/224 entered into Service on 29 August

As-observed Ranging Performance

STABLE

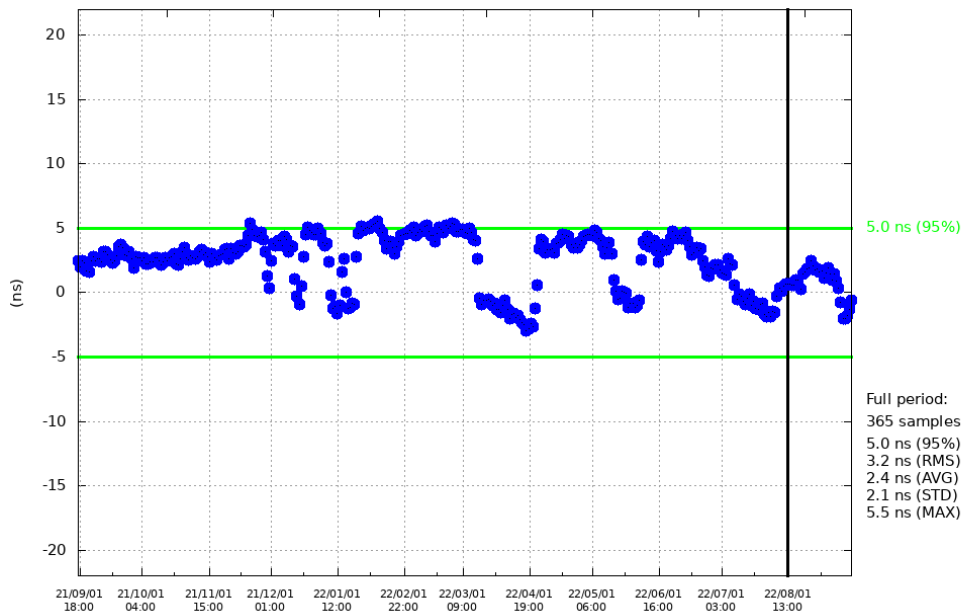


- **Very stable Signal In Space Ranging Error (SISE) trend → 0.22m (95%)** all satellites, in July (FNAV)

Galileo Timing Accuracy

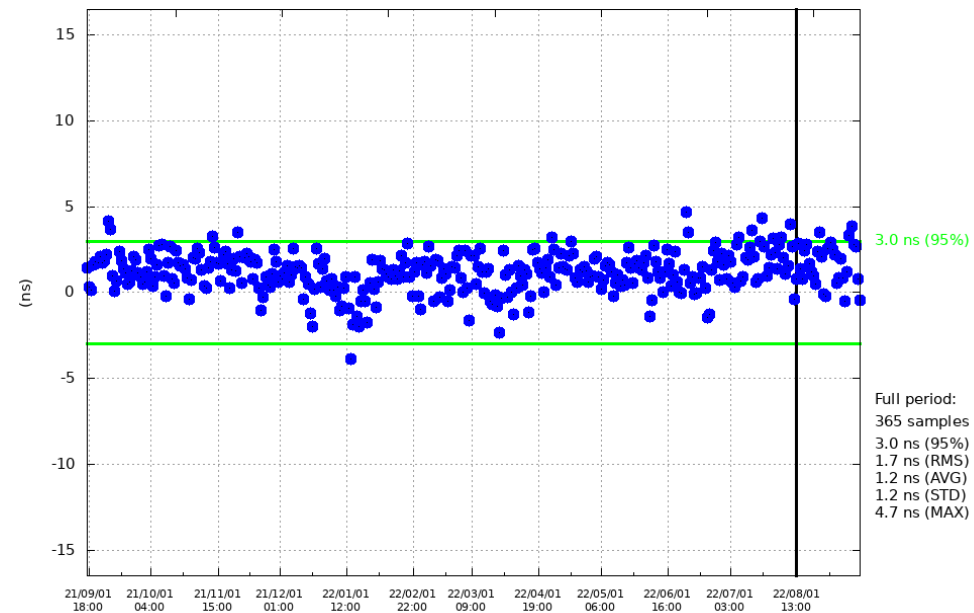
STABLE

Broadcast UTC offset



5.0ns (95%) < 30ns IS target

GGTO accuracy



3.0ns (95%) < 20ns IS target

- Evaluated with calibrated timing GPS/Galileo receiver operated in UTC(k) laboratory (PTB, INRIM)

Working together as a team

