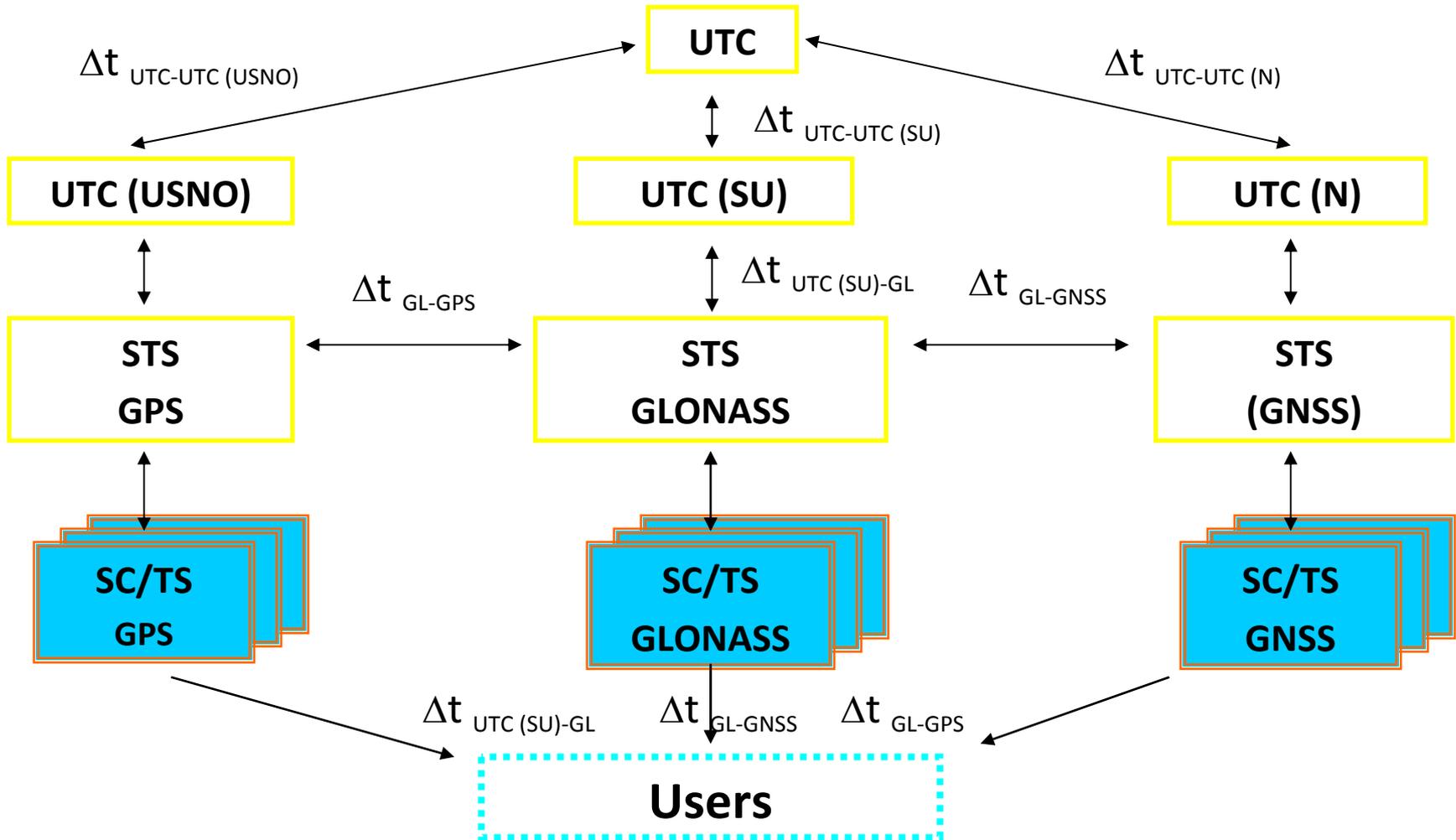


# GNSS Time Interoperability

(Dr. Arcady Tyulyakov & Dr. Alexey Pokhaznikov)

ICG -5, Turin, Italy  
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# Mutual time scales synchronization (current)



**Synchronization system provides solutions for the following functional tasks:**

- generation of the system time scale (STS) and keeping it within specified limits relative to the reference time scale;
- mutual synchronization of spaceborne time scale for a spacecraft (SC) by means of generating corrections for spaceborne time scale offset of each SC relative to STS;
- generation of corrections for GLONASS STS offset relative to a reference time scale;
- generation of corrections for the offset between GLONASS STS and GPS STS.

# Generation of the GLONASS system time scale

- GLONASS STS is generated as a continuous time scale based on the time scale of the Central Synchronizer (CS).
  - Nowadays, STS offset relative to UTC(SU) does not exceed 600 ns.
  - When correcting UTC(SU) by plus or minus 1 second, the corresponding CS time correction is being performed.
- 120 ns by 2011;
- 20 ns by 2015.

# CS Accuracy Parameters

|   |                         |
|---|-------------------------|
| Relative frequency error (no more than)         | $\pm 3 \cdot 10^{-14}$  |
| Daily frequency instability (no more than)      | $2 \cdot 10^{-15}$      |
| Systematic frequency change (drift) (per month) | $(1..3) \cdot 10^{-15}$ |

# **Generation of corrections to the GLONASS STS relative to STRS time**

For generating and subsequent uploading to the SC STS offset relative to STFS time data, the following actions are being supported:

- determination of the CS time scale offset relative to STFS time and transformation of the results obtained to the values of the STS offset relative to STFS time;
- joint processing of the session values of the time scales offset over some observation interval for estimating the parameters of the STS drift and its prediction over specified time interval;
- generation of corrections to the STS relative to STFS time.

# **Determination of CS time scale offset relative to STFS time**

The determination of CS time scale offset relative to STFS time is realized on the base of joint processing of simultaneous RE at CS and STFS measurement results.

The measurements are made on the base of GLONASS and GPS signals.

Error of determining CS TS/STFS offset is no more than 5 ns.

# Generation of corrections for the offset between GLONASS STS and GPS STS

For generating and subsequent uploading to the SCs STS offset data for GLONASS and GPS, the following actions are being supported:

- determination of the CS time scale offset relative to GLONASS STS and GPS STS and transformation of the results obtained to the values of the offset between GLONASS STS and GPS STS;
- joint processing of the session values of the offset between GLONASS STS and GPS STS over some observation interval for estimating the parameters of the offset between GLONASS STS and GPS STS and its subsequent prediction over specified time interval;
- generation of corrections for the offset between GLONASS STS and GPS STS.

# Mutual time scales synchronization (future)

