STATE SCIENTIFIC CENTER
OF THE RUSSIAN
FEDERATION

VNIIFTRI

NATIONAL RESEARCH INSTITUTE FOR
PHYSICAL-TECHNICAL AND RADIO ENGINEERING MEASUREMENTS

"GLONASS characteristics control and validation system"

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CONTENT

- Development of GLONASS characteristics control and validation system
- Authorities in charge of the GNSS certification
- GLONASS characteristics to be controlled
- Ensuring the uniformity of measurements for the GLONASS characteristics

Main tasks of the GLONASS characteristics control and validation system

- independent monitoring and prediction of the main characteristics of GLONASS
- definition of consumer characteristics of GLONASS
- calculation of the initial data for the certification of GLONASS

System development stages

Stage 1 – Implementation of the control and validation in aposterior mode	Stage 2 – Implementation of the control and validation in real-time mode and development of the signal characteristics monitoring equipment	Stage 3 – Development of the information, required for the international certification of GLONASS
Evaluation of the characteristics to be controlled, development of methods	Confirmation of the GLONASS characteristics control and validation system precision characteristics	International recognition of the results of GLONASS certification

GLONASS characteristics control and validation system

Measurement stations

Signal characteristics **monitoring equipment**

Complex of the initial data development

- data collection and preprocessing subsystem
- basis reference station

GLONASS and other GNSS characteristics control complex

- functional and accuracy characteristics control center
- analysis and prediction system
- data distribution system

GLONASS characteristics to be controlled

Functional characteristics

-availability of navigation in open terrain at any point of the earth's surface

-number of satellites in the system

-time to alarm (integrity of the system)

-mean Position Dilution of Precision

- mean Time Dilution of Precision

-navigation signal's power, received by consumers

Accuracy characteristics

-Signal-in-space user range error

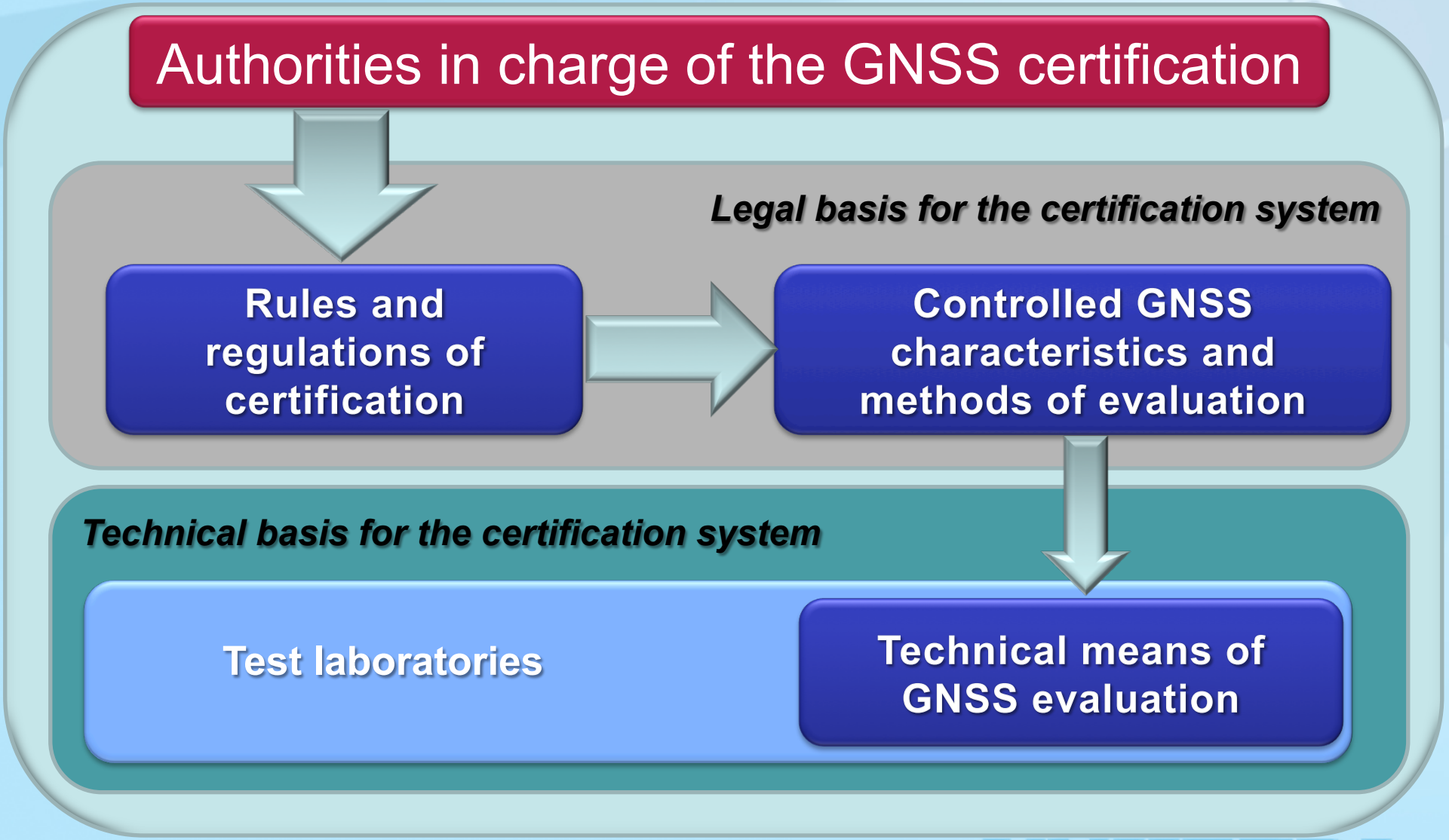
-onboard clock performance

-time scale difference estimates for the system time scale and UTC(SU)

-time scale difference estimates for UTC and UTC(SU)

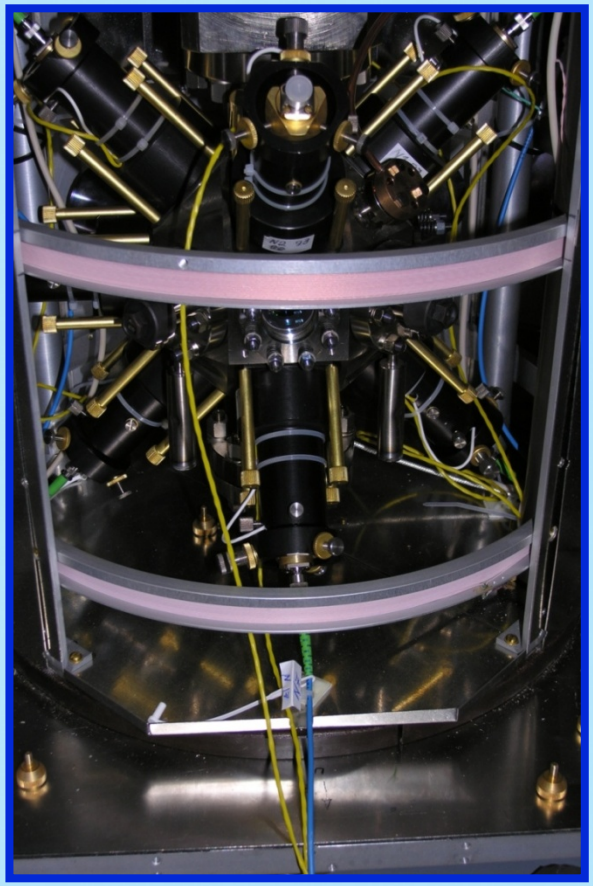
- geodesy reference difference estimates

International system of GNSS certification



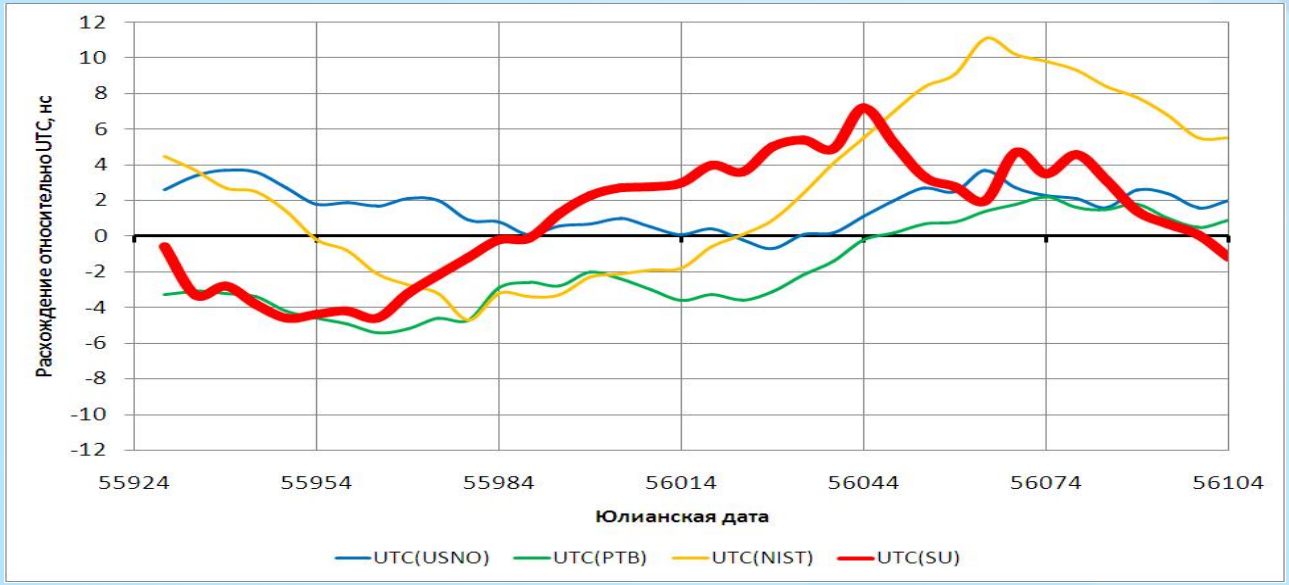
Ensuring the uniformity of measurements for the GLONASS characteristics (1/3)

Russian cesium fountain with an uncertainty **5·E-16**



Uncertainties for cesium fountains

	SYRTE-F01	SYRTE-F02	SYRTE-F0M	NIST-F1	PTB-CsF1	IEN-CsF1	NPL-CsF1
Uncertainty (in units ·E-16)	7.2	6.5	7.7	3.3	9	16	10



Time scale differences IUTC(i) – UTCI < 10 ns

Ensuring the uniformity of measurements for the GLONASS characteristics (2/3)

Two-Way Satellite Time and Frequency Transfer equipment

time scale difference estimate uncertainty
± 2 ns for the distances up to thousands km

Mobile station

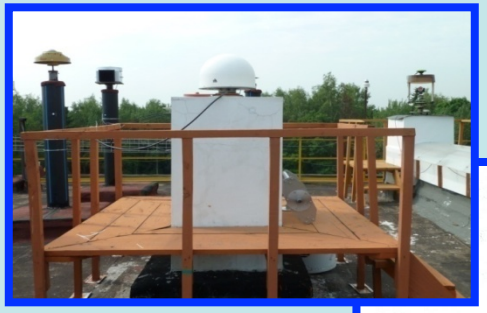
Stationary equipment

Mobile time-transfer standard

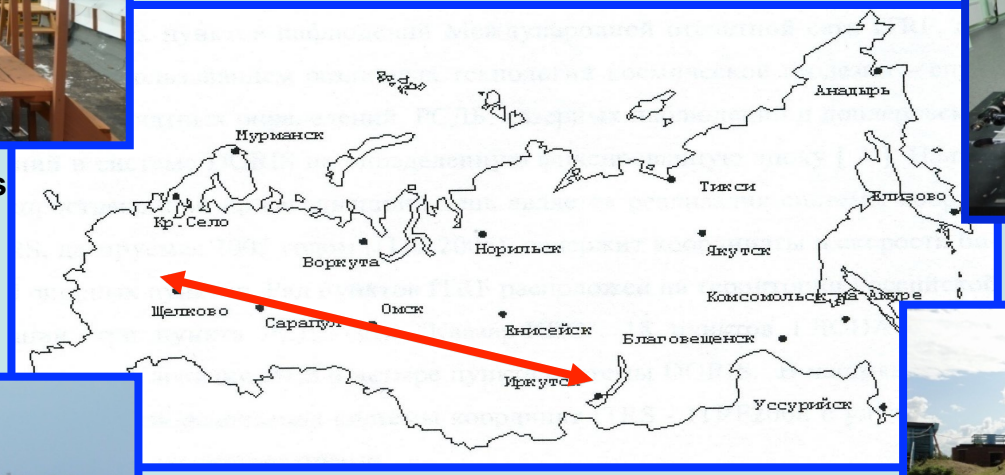
error less than 2 ns per 24 hours

Ensuring the uniformity of measurements for the GLONASS characteristics (3/3)

State special standard of length in the range from 24 m up to 4000 km



Reference basis points «Mendeleevo»



Reference basis points «Irkutsk»

Up to 60 м:
Uncertainty < 40 мкм
Up to 3 км:
Uncertainty < 1 мм.
«Big length» up to 4000 км:
Uncertainty ≤ 2 см.

Conclusion

By the year 2020 the system being developed will assure:

- independent monitoring and prediction of the main characteristics of GLONASS (according to the list developed during the stage 1)
- calculation of the initial data for the certification of GLONASS

Thank you for your attention!