



STATE SCIENTIFIC CENTER  
OF THE RUSSIAN  
FEDERATION



*NATIONAL RESEARCH INSTITUTE FOR  
PHYSICAL-TECHNICAL AND RADIO ENGINEERING MEASUREMENTS*

# “GLONASS characteristics control and validation system”

Oleg Denisenko  
Deputy Director General –  
Head of Research Department



# 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 3

- 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

4

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

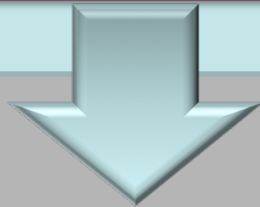
## Accuracy characteristics

- 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

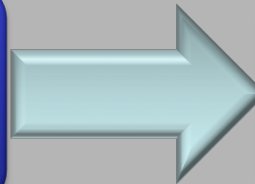
7

Authorities in charge of the GNSS certification



*Legal basis for the certification system*

Rules and regulations of certification



Controlled GNSS characteristics and methods of evaluation



*Technical basis for the certification system*

Test laboratories

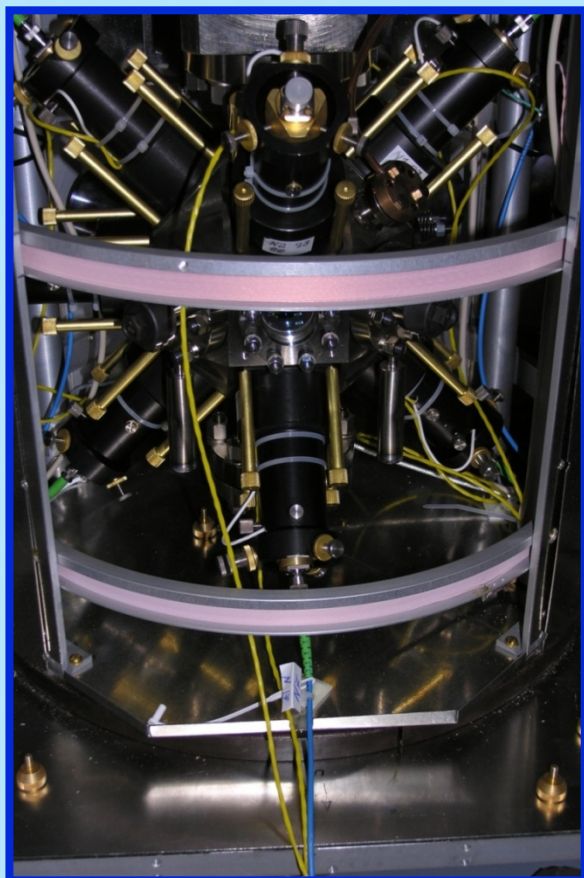
Technical means of GNSS evaluation

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

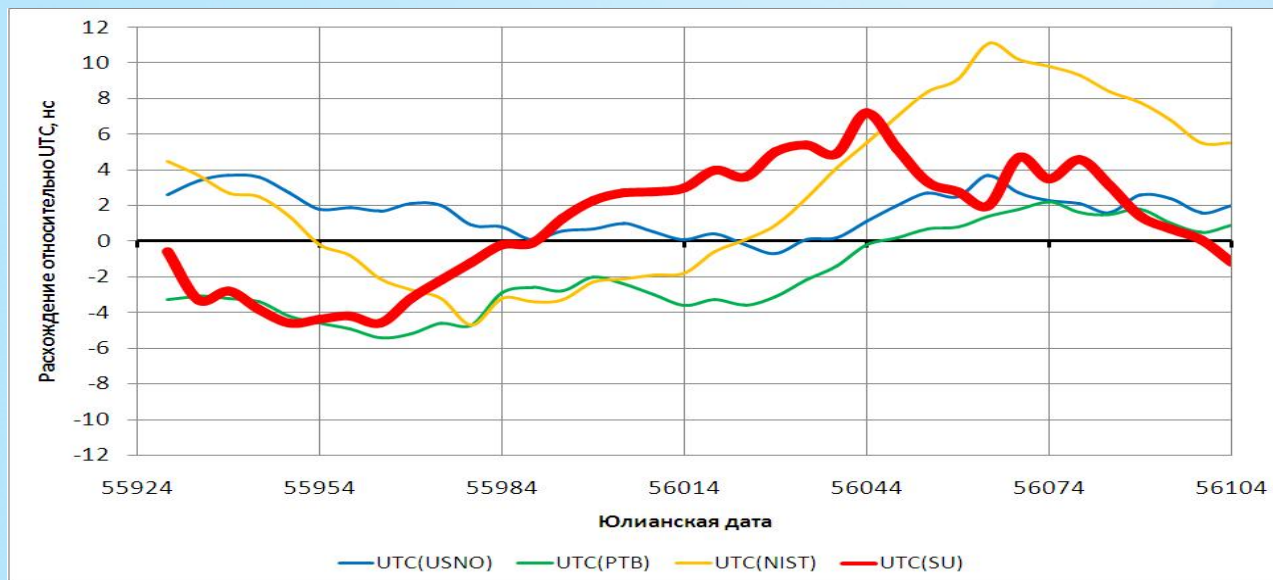
Russian cesium fountain with an uncertainty  $5 \cdot E-16$



Uncertainties for cesium fountains



	SYRTE-F01	SYRTE-F02	SYRTE-F0M	NIST-F1	PTB-CsF1	IEN-CsF1	NPL-CsF1
Uncertainty (in units $\cdot E-16$ )	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  
 $\pm 2$  ns for the distances up to thousands km



Mobile station



Stationary  
equipment

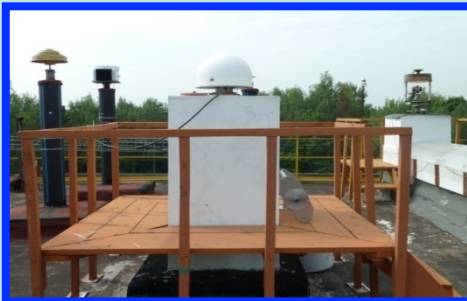
Mobile time-transfer standard  
error less than 2 ns per 24 hours



VNIIFTRI

# 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 m:  
Uncertainty < 40 мкм  
Up to 3 km:  
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!



**STATE SCIENTIFIC CENTER  
OF THE RUSSIAN FEDERATION**

**FEDERAL AGENCY  
ON TECHNICAL REGULATION AND METROLOGY**

**NATIONAL RESEARCH INSTITUTE  
OF PHYSICOTECHNICAL  
AND RADIO ENGINEERING MEASUREMENTS**



**VNIIFTRI**

**Oleg Denisenko**  
**Deputy Director General –**  
**Head of Research Department for development and operation of means of**  
**metrological assurance for coordinate-temporal and navigation systems**

**Doctor of Engineering Sciences**

**141570, MENDELEEVO,  
MOSCOW REGION,  
RUSSIA  
[WWW.VNIIFTRI.RU](http://WWW.VNIIFTRI.RU)**

**tel./fax: +7 (495) 744-81-73 ext. 93-22**  
**tel.: +7 (906) 713-44-43**  
**e-mail: [denisenko@vniiftri.ru](mailto:denisenko@vniiftri.ru), [denol2000@mail.ru](mailto:denol2000@mail.ru)**

VNIIFTRI