

State Scientific Center  
of the Russian  
Federation



National Research Institute for  
Physical-Technical and Radio Engineering Measurements

# METROLOGICAL PROVISION OF UNIFORMITY OF MEASUREMENTS OF TIME AND FREQUENCY IN THE SATELLITES LASER RANGING SYSTEM

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National Research Institute for Physical-Technical and Radio Engineering Measurements (VNIIFTRI) has a working SLR station “Mendeleevo-1874” and SLR station “Irkutsk-1891” in the East-Siberian Branch of VNIIFTRI



SLR-stations “Mendeleevo” and “Irkutsk” include Main metrological center of the State service of time, frequency and the Earth rotation parameters determination of Russian Federation

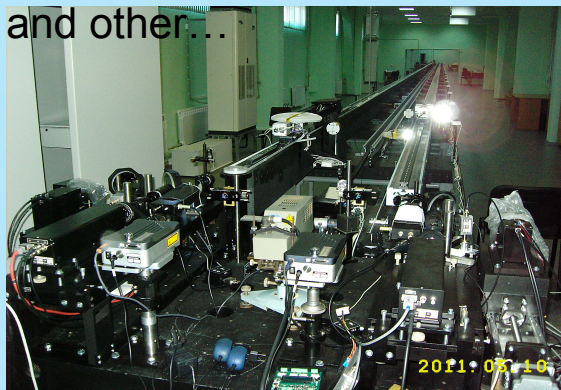
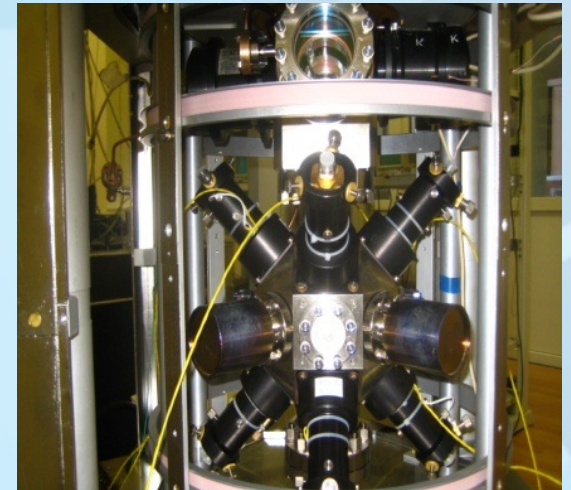


# Metrological support

National time and frequency standard in Mendeleevo UTC(SU);  
National standard of length in Mendeleevo;  
Secondary time and frequency standard in Irkutsk city;

# Auxiliary equipment

Mobile laboratory with mobile TWSTFT station and active H-maser;  
Fixed TWSTFT station in Mendeleevo;  
Leica TDA 5005;  
Precise gravimeters;  
GPS/GLONASS receivers;  
Local Geodetic Network;  
and other...



# Errors SLR-measurements associated with the par value of the reference frequency

$$\frac{\Delta R}{R} = - \frac{\Delta f}{f}$$

$R$  – distance  
 $f$  - reference frequency

Accounting for this component of the error becomes relevant in the transition to the millimeter and submillimeter accuracy of measurements

## Errors SLR-measurements associated with time scale

Now error of time scale of most laser stations is 50 ... 200 ns.  
Fixation point in time of measurement can be significantly greater amount ranging up to values of a microsecond.





# Calibration and accounting errors.

## Hardware, software and organizing:

Creation of a full time service for laser station operating in automatic or semi-automatic mode.

Calibration of laser stations' time scales comparison.

Calibration equipment and assemblies of laser station

Continuous monitoring and comparison of reference frequencies and time scales of laser station with a state and/or regional standard.

The introduction of a new generation of laser stations and/or improvement of existing.

Formation output of measurement results based on the values of reference frequency.



## Plans and perspectives

Upgrade stations Irkutsk and Mendeleevo to ensure the transfer time. This will be used for testing of comparison standards of the time methods, support time scale of the GLONASS, supporting atomic time experiment, verification of microwave systems.

Creation of a new generation laser stations.

Spreading of the proposed activities on all Russian laser network.



*Thanks!!* 😊

*Special gratitude to our colleagues, who participated in the discussion of the issues involved.*

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