



# Preparing VIRAC Radiotelescope RT-32 for receiving and processing signals related to Artificial Earth Satellites.

**Vladislavs Bezrukovs**  
**VIRAC, Latvia**

**XL YERAC**  
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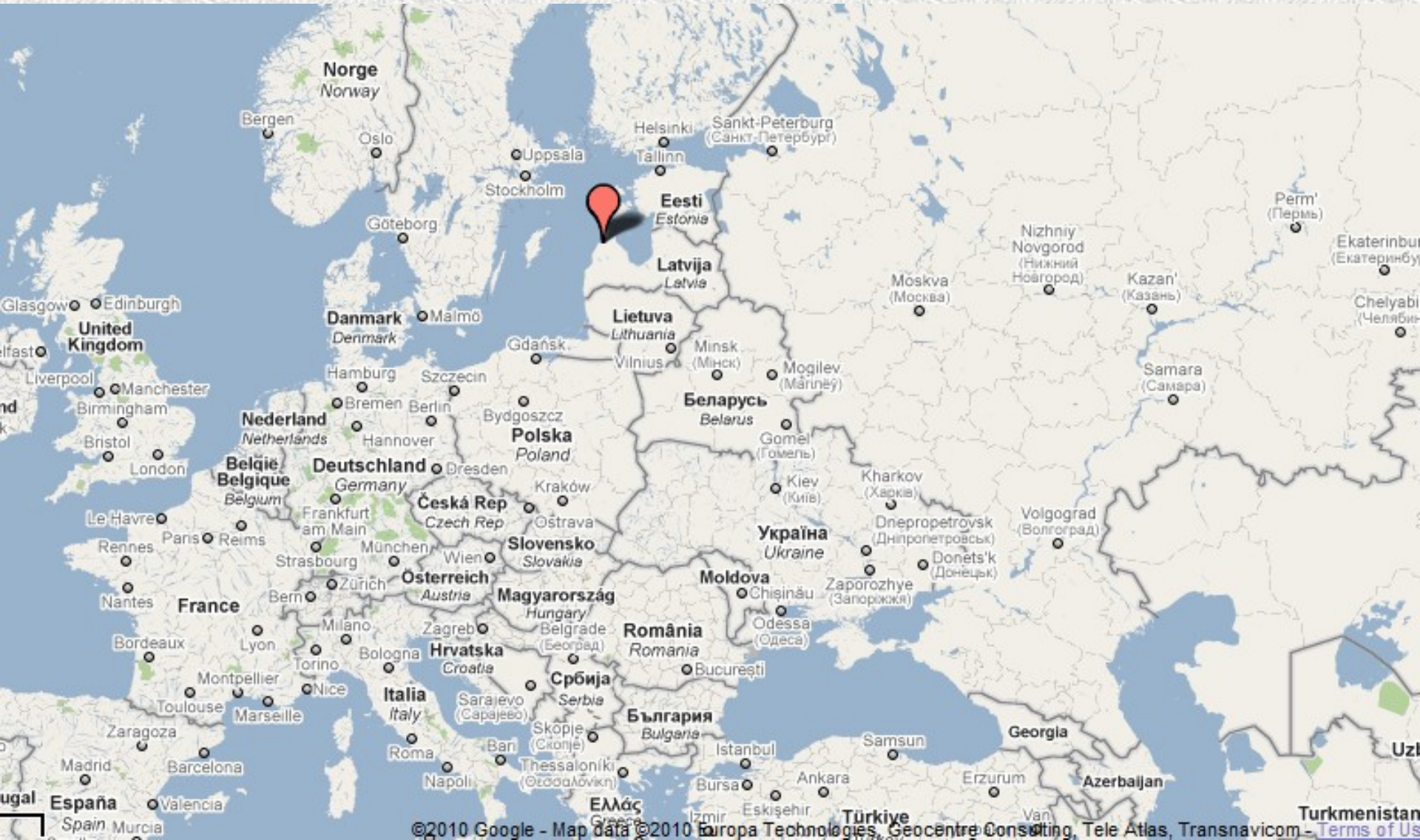


# Outline

- Ventspils International Radio Astronomy Centre (VIRAC).
- Project "Signals related to Artificial Earth Satellites: Technologies of Receiving, Transmitting and Processing".
- Irbene Radio telescope RT-32 preparation for observations.
- Space debris observation experiment VLBR10.1, 30 of June of 2010,



# Ventspils International Radio Astronomy Centre (VIRAC)





# Ventspils International Radio Astronomy Centre (VIRAC)

- EVN;
- Low frequency VLBI network;
- Cosmic debris;
- Sun observations;
- Masers;
- Satellites;
- Wind studies;



RT-2



13/10  
RT-16

RT-32



# Project: “Signals related to Artificial Earth Satellites: Technologies of Receiving, Transmitting and Processing”

- Started: December 2009;
- Involved more than 20 researchers.
- Reconstruction of the telescope RT-16, includes research in the fields of electronics, mechanics and mathematical modeling.
- Developing and applying methods for processing of recorded data.
- **Space debris radiolocation using the radio telescope RT-32 and the VLBI techniques. Software correlator for VLBI data processing and software for computing the orbital elements and future coordinates of the observed objects (debris).**
- Collaboration with Radio physical Research Institute, Nizhnij Novgorod, Russia and LFVN



# Low Frequency VLBI Network Project (LFVN)

## Radio Telescopes:

- Bear Lakes RT-64
- Pushchino RT-22
- Zimenki RT-15
- St. Pustyn RT-14 (Russia)
- Evpatoria RT-70
- Simeiz RT-22 (Ukraine)
- Noto RT-32
- Medicina RT-32 (Italy),
- Urumqi RT-25 (China),
- **Ventspils RT-32 (Latvia).**

## Frequencies:

- **92 cm**, 18 cm, **6 cm**.

## Recording systems:

- **MK-2, NRTV, MK-V.**

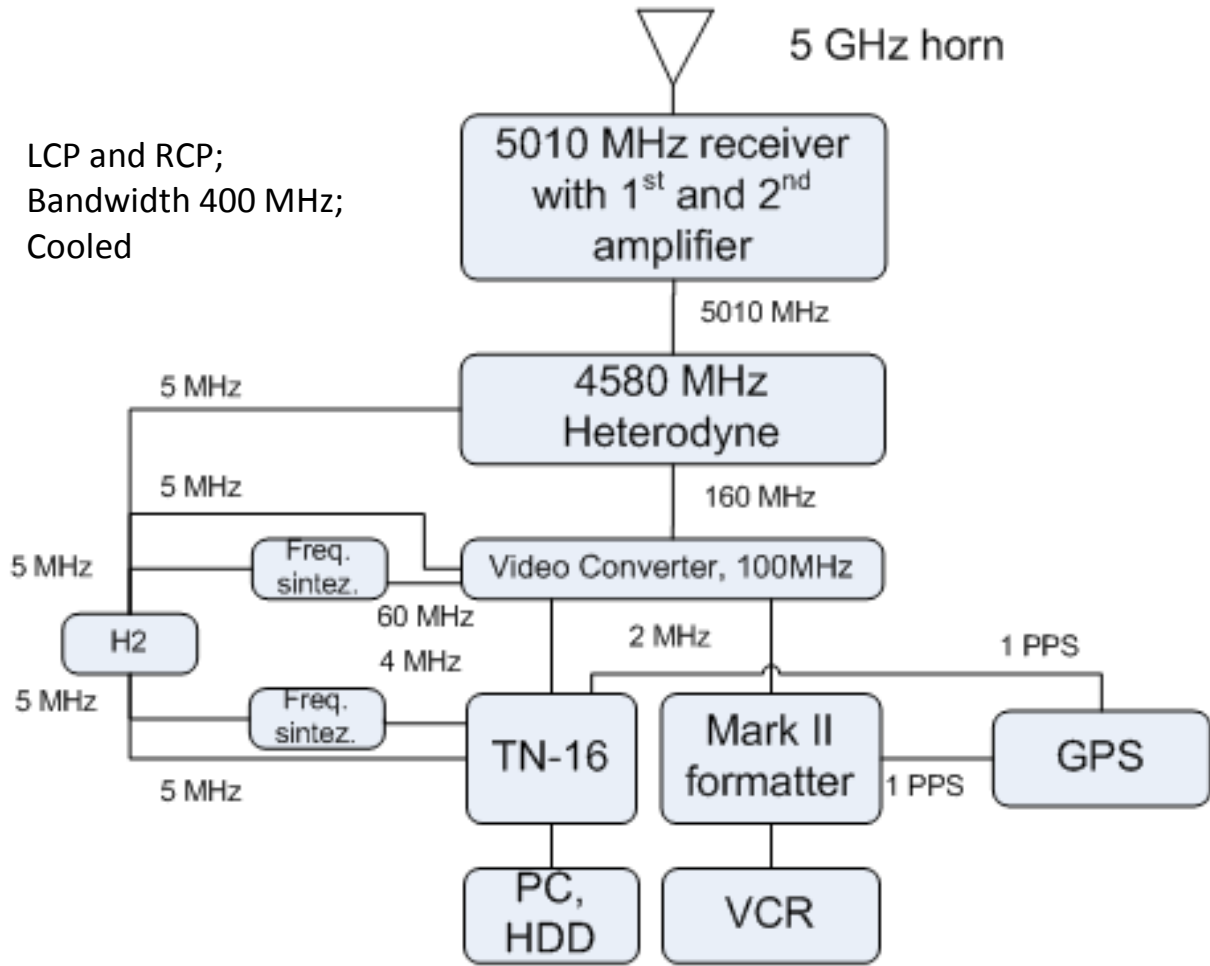
## Activities:

- Investigations of solar wind, solar spikes, AGN, OH-masers, active stars and radar research of Earth group planets, close asteroids and space debris objects.

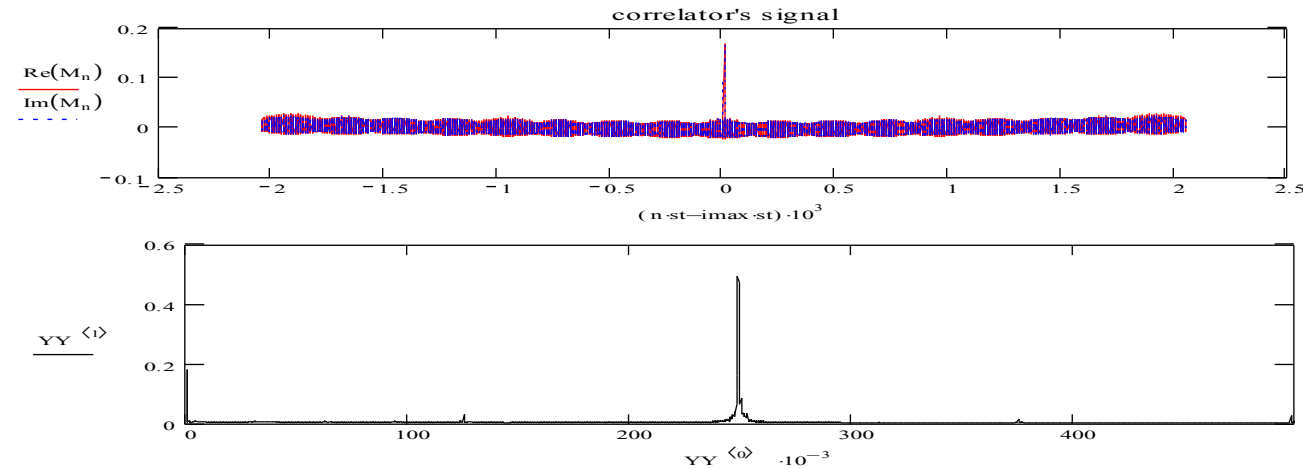


# Irbene RT-32 receiving system

LCP and RCP;  
Bandwidth 400 MHz;  
Cooled



Receiving system at 5GHz with recording terminal TN-16 (NRTV) was calibrated using external signal generator and is suitable for VLBI experiments .



vesti chastotny interval: `interv := ( 00 500000 )`

Chastota maxim (kHz): `Fm = 248.84 kHz`

Amplituda maximuma: `Am = 0.495`

chastotnoe razreshenie: `kf = 0.244 kHz`

`Fm := fm(interv0,0,interv0,1)0    Am := fm(interv0,0,interv0,1)1·s`

`filer1 = "f:\scan\out\tk"`

Example of power spectra from 5.01 GHz signal autocorrelation.  
Frequency 250 kHz, bandwidth 0.5 MHz. (29.06.2010).



# Experiment VLBR 10.1

VLBR10.1, 30 of June of 2010, 09:04 – 17:00 UT

The irradiation of space debris objects was implemented by power transmitter of **Evpatoria locator** on RT-70 (Ukraine);

Reception:

**Medicina** (RT-32, Italy),

**Ventspils** (RT-32, Latvia).

# Regime of experiment «Beam-park»:

The beams of transmitting and receiving antenna are crossed in given point.

During observation the transiting space object are detected and the number per time unit are estimated.

The estimations of **radial velocity, tangential velocity, period of rotation** may be performed in result of data processing.



# The scientific tasks of experiment:

- Investigations of space debris (Iridium-Cosmos and Fengyun 1C fragments) in LEO;
- Several LEO regions for searching not yet catalogued debris;
- High Area/Mass debris in GEO;
- Astronomical and radar calibrators.

## Transmission mode:

Monochromatic radiation;  
central frequency of **5010.024 MHz**,  
polarization **RCP**,  
power **P=40 kW**

## Observational mode:

Bandwidth: **500 KHz**  
Central frequency: **5010.0 MHz**  
Polarization:  
**RCP and LCP** (Medicina),  
**LCP** (Ventspils)

## Recording systems:

**Mark-V** (Medicina),

**TN-16, Mark-II** (Ventspils)



| #  | Catalog Number | Time UT       |                            |
|----|----------------|---------------|----------------------------|
| 1  | 34502          | 09:04 – 09:06 |                            |
| 2  | 1520           | 09:45 – 09:47 | 76 kHz $\square$ 2.3 km/s  |
| 3  | 35303          | 10:04 – 10:06 | -40 kHz $\square$ 1.1 km/s |
| 4  | 31424          | 10:23 – 10:25 |                            |
| 5  | 21131          | 10:53 – 10:55 | 16 kHz $\square$ 0.5 km/s  |
| 6  | <i>BP011</i>   | 11:05 – 11:45 |                            |
| 7  | <i>BP012</i>   | 12:05 – 12:45 |                            |
| 8  | <i>BP013</i>   | 13:05 – 13:35 |                            |
| 9  | 900            | 13:56 – 13:58 |                            |
| 10 | 35716          | 14:07 – 14:09 |                            |
| 11 | 26277          | 14:24 – 14:26 |                            |
| 12 | <i>BP021</i>   | 14:39 – 15:19 |                            |
| 13 | 35726          | 15:38 – 15:40 |                            |
| 14 | <i>BP022</i>   | 15:47 – 16:15 |                            |
| 15 | 3C273B         | 16:30 – 16:40 |                            |
| 16 | 3C286          | 16:50 – 17:00 |                            |

# In collaboration with:

Nikolaj Dugin, Radiophysical Research Institute, Nizhnij Novgorod, Russia;  
Maria Nechaeva, VIRAC;  
Ivars Šmels, VIRAC;  
Guntis Ozoliņš, VIRAC;  
Dmitrij Bezrukov, VIRAC;  
and all other VIRAC team.

**Thank you for attention.**

