



**National Space Facilities  
Control and Test Center of  
State Space Agency of Ukraine**

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**Near-Earth Space Observation  
Activities at Ukraine in 2019**

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## Main Activities in 2019



**Observations of spacecraft and space debris for Ukrainian Space Monitoring and Analysis System (SMAS)**

**Sensors modernization and new sensors development**

**International Cooperation**

**NEOs observations**

**Radar 5N86 "Dnepr", Mukachevo**



**Perspective L-band Radar**



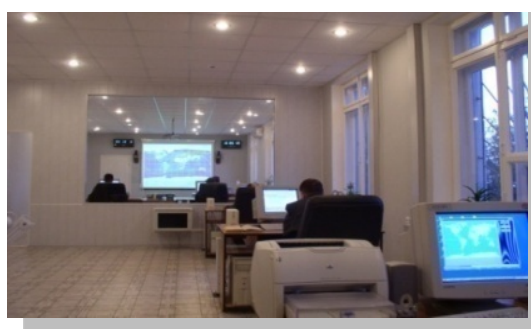
**Perspective cm-band radar**



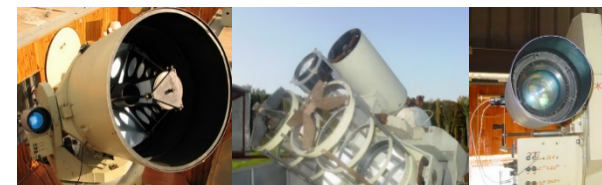
**QOS "Sazhen-S" and  
OEOS type 1 at CSIRP  
and NFC, Dunaivtsi**



**Outer Space Monitoring  
Center**



**Optical sensors at Lviv  
National University**



**Optical sensors at Odesa  
Astronomical Observatory**



**OEOS type 2 at RD SCP,  
Novosilky, Kyiv region**



**Optical sensors at Uzhhorod  
National University**



## Modernized UHF Radar (5N86)



- Detection of SO in the sector 120 degrees at a range: from 250 to 5600 km

Replacement of the control and data processing system

## L-band radar with digital antenna array



- Detection of SO in all directions (support and rotary device) at a range: up to 3000 km
- Modular principle of the construction of receiving and transmitting equipment

Undergoing tests

## Perspective centimeter-band radar based on the 25-m Cassegrain antenna



- Ultraprecise measurement of orbit parameters of SO
- Identification of the spacecraft designation

Under development



## QOS "Sazhen-S", Khmelnytsky region



New control system

## OEOS, type 1, Khmelnytsky region



New 0.5 m f/3.8 telescope.  
Operational

## OEOS, type 2, Kyiv region



New 0.3 m f/1.0 telescope.  
Operational



## Inter-Agency Space Debris Coordination Committee



## Achievements

- **>100 participants, 13 space agencies (SSAU is back!)**
- **IADC guidelines updated after 12 years**
- **Many joint WG sessions**
- **Speed-up the WG-SG approval cycle**
- **3-month frequency SG meetings (added by teleconf)**
- **New IADC website soon available**

*“if you are doing nothing, you do not break any law”*



# International Cooperation



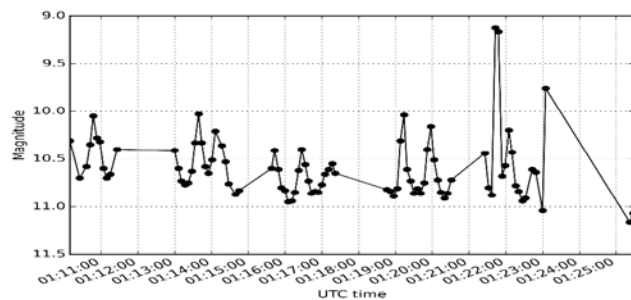
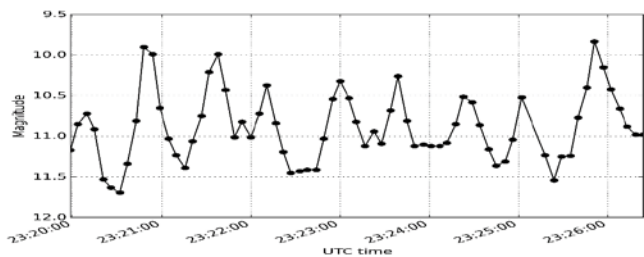
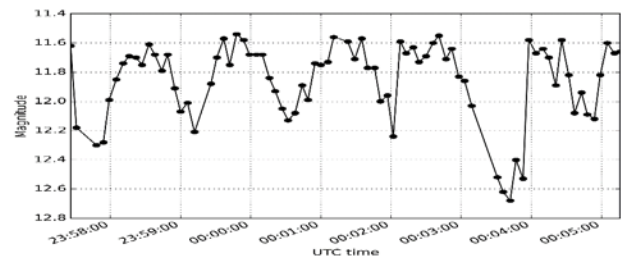
Chandryan-2 launch positional and photometrical observations (25/07 12/08/2019)

3 telescopes:

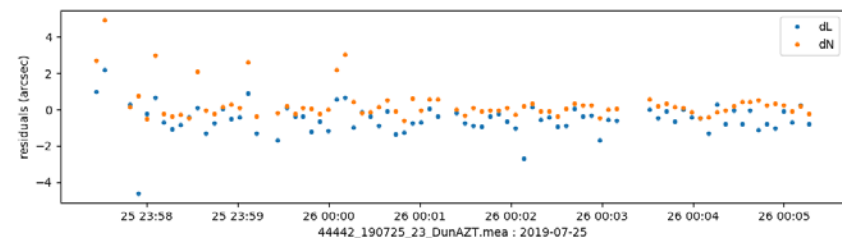
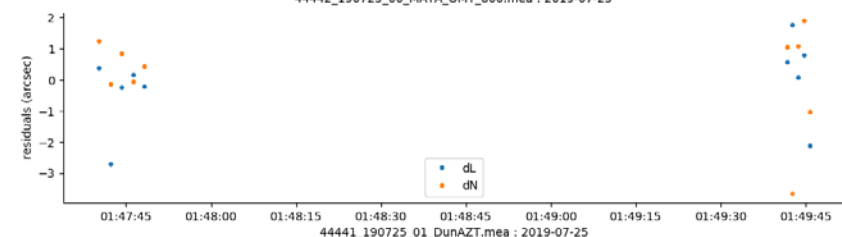
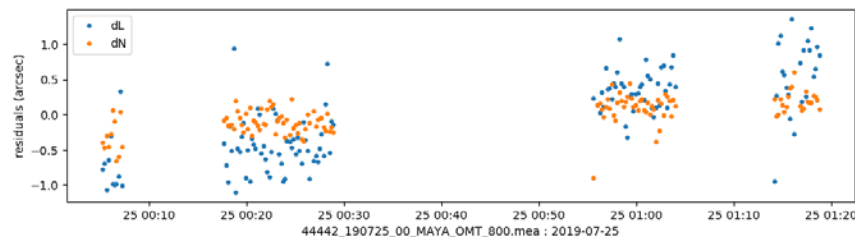
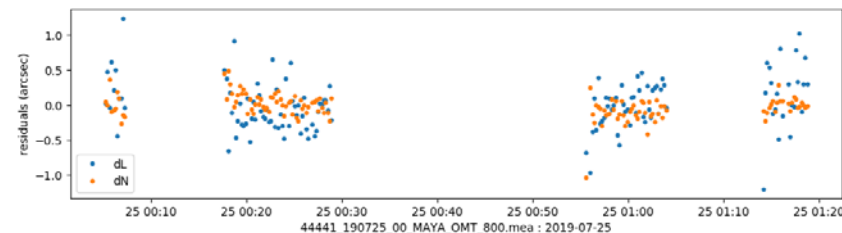
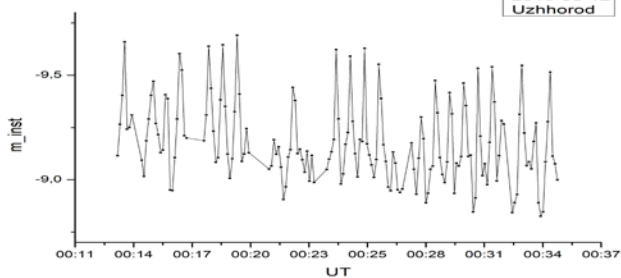
0.8 m – Mayaki, RI OAO;

0.3 m – Dunaivtsi, CSIRP and NFC

0.4 m – Derenivka, UzhNU.



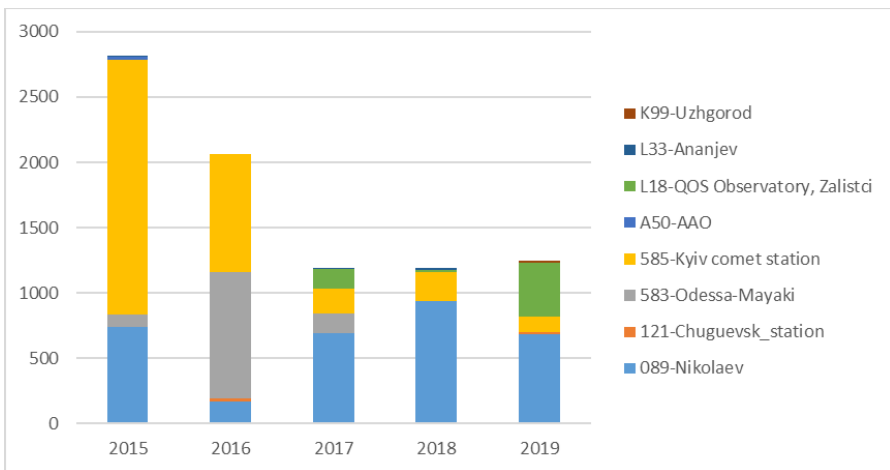
2019-08-12  
Uzhhorod





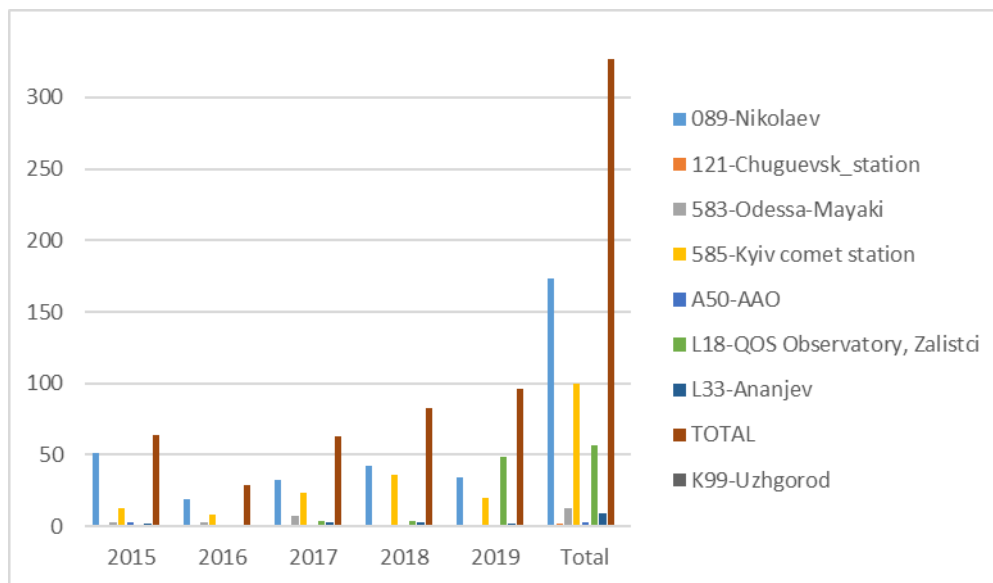
## Observation of NEOs by Ukrainian observatories in 2015-2019

### Observations



Total: 8499 observations,  
327 NEOs  
(<https://newton.spacedys.com/neodys/>)

### Objects



## Ukrainian Software for Surveillance of NEOs - CoLiTec

### Main features of CoLiTec

1. Automatic detection of weakly moving objects (WMO>2.5)
2. Work with super-wide fields of view (more than 10 sq. degrees)
3. Automatic calibration and image correction
4. Automatic robust algorithm for astrodetection
5. Automatic filtering of poor measurements
6. Viewer of results (LookSky) with GUI
7. Multithreading support in multi-core systems and in a local network
8. Processing in near-real time managed by OLDAS (OnLine Data Analysis System)

### Results (2010 – 2018)

**Observations: 600 000+.**

**Discovered: 1566** asteroids and 4 comets.

#### Comets

C/2011 X1 (Elenin) – December 10, 2010 (ISON-NM).

The first comet discovered by the Russian astronomer for the last 20 years.

P/2011 NO1 – July 7, 2011 (ISON-NM)

C/2012 S1 – September 21, 2012 (ISON-Kislovodsk)

P/2013 V3 (Nevski) – November 6, 2013 (ISON)

#### Tropical of Jupiter

2010 XR32, 2010 XG21, 2010 VO138, 2010 VT36, 2011 QJ9, 2011 QQ47, 2011 QZ75, 2011 YD47, 2011 YA3, 2011 QB76, 2012 SC50, 2012 AF1, 2012 CF52, 2012 BB27, 2012 RZ4, 2012 RM6, 2012 SD3, 2012 SN9, 2013 BP2, 2013 UF9, 2013 VD

#### NEOs

**2011 QY37**

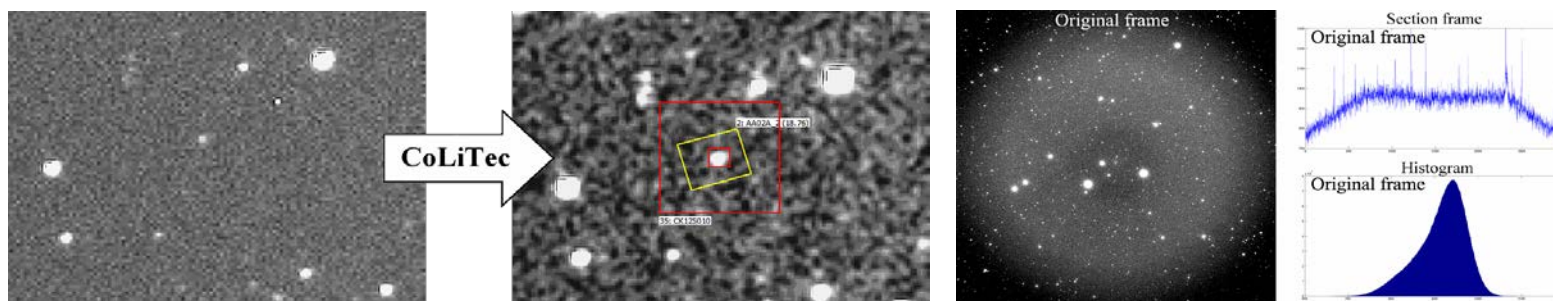
**2012 RQ16**

**2013 TB80**

**2014 KH2**

#### Unusual

2013 UL10, 2018 SQ13 (confirmation only)





# Conclusion



- 1. Ukraine's software and hardware facilities allow us to carry out a full range of tasks for monitoring near-Earth space throughout the whole range of altitudes, including space debris and NEO.**
- 2. During 2019, two new optical sensors entered operations. A few more sensors were modernized.**
- 3. The National Space Facilities Control and Test Center is ready for mutually beneficial cooperation on topics related to the monitoring of near-Earth space.**



# THANK YOU FOR YOUR ATTENTION!

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