Russian Academy of Sciences
Keldysh Institute of Applied Mathematics

CURRENT IMPROVEMENTS OF THE ISON NETWORK

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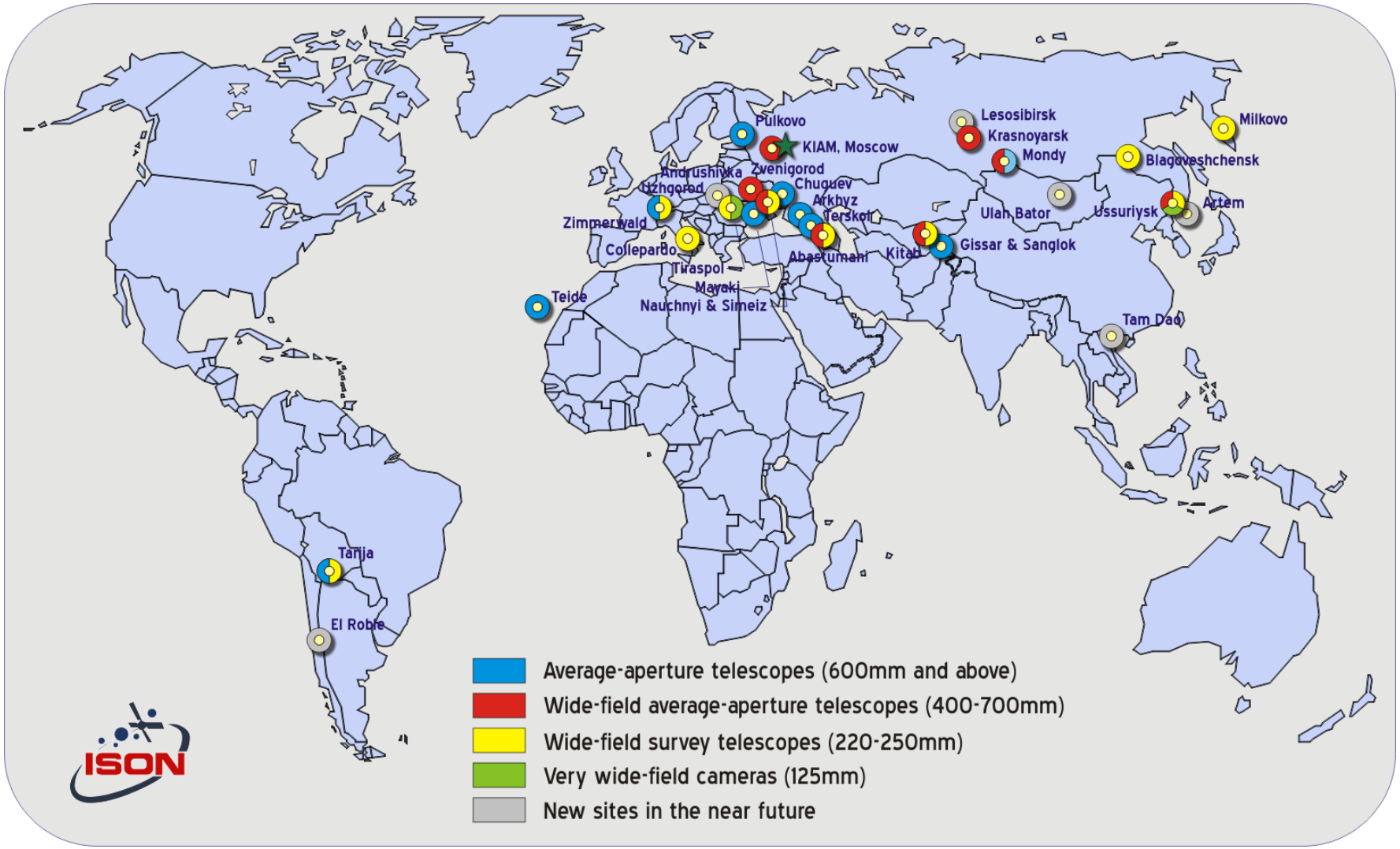
International scientific optical network



ISON is an open international project started in 2004 for regular monitoring of the near-Earth space

ISON structure

- **Optical network includes 33 telescopes of 23 observatories in 10 countries (Bolivia, Georgia, Italy, Moldova, Russia, Switzerland, Spain, Tajikistan, Ukraine, Uzbekistan)**

- **5 network operation supporting groups:**

  - electric and software engineering

  - optical and mount engineering

  - observation planning and data processing

  - network development

  - new observation technique elaboration

ISON structure and tasks

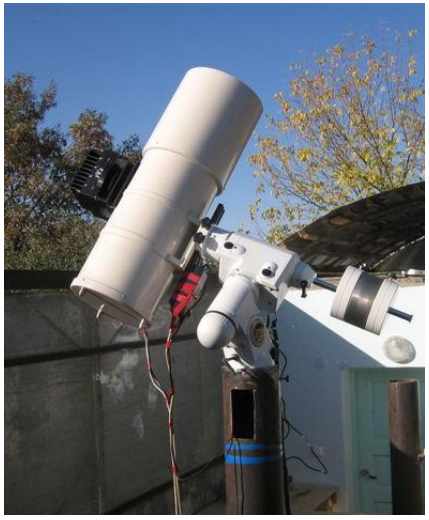
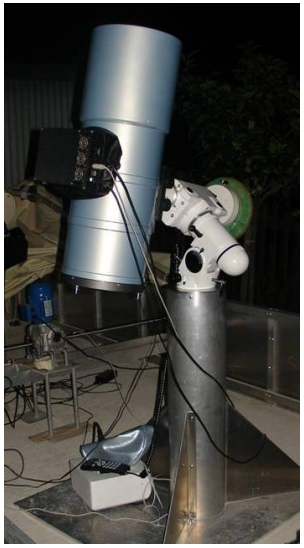
Optical facilities form three subsets:

- search and survey subsystem for surveys of the GEO region (down to 16^m)
- subsystem for tracking of the high orbit faint (fainter than 16^m) space debris at GEO and GTO
- subsystem for discovering and tracking of very faint (fainter than 18^m) at GEO

Current primary tasks: regular GEO monitoring, new GEO and GTO faint objects discovering and tracking, maintenance as complete GEO objects database as possible

KIAM coordinates activities and analyze measurements

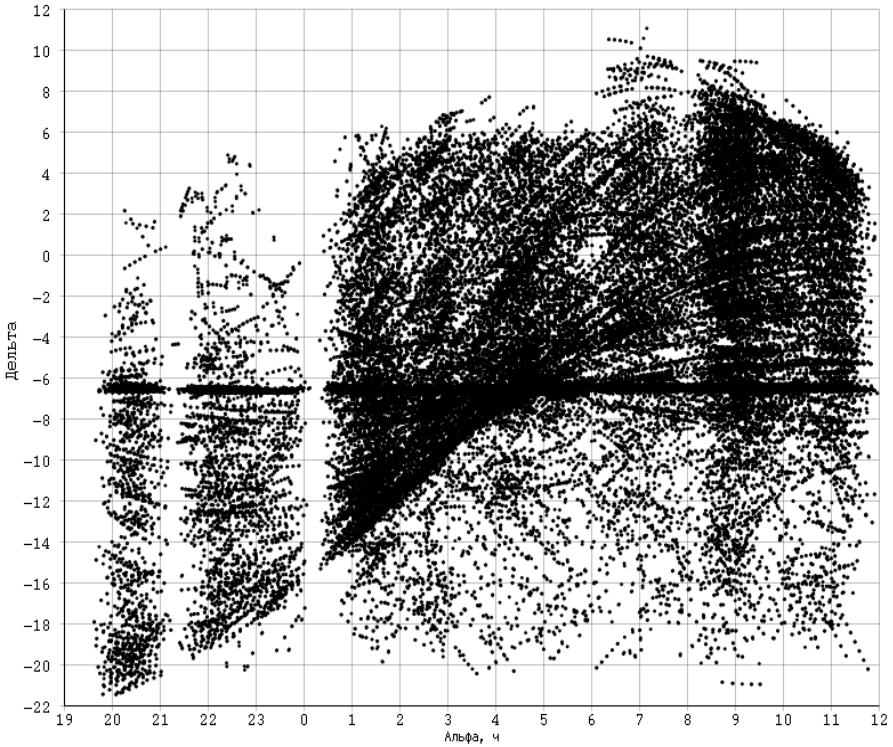
Search and survey subsystem for the GEO region: *nine 22-25 cm telescopes with FOV of 3.5- 5.5 degree*

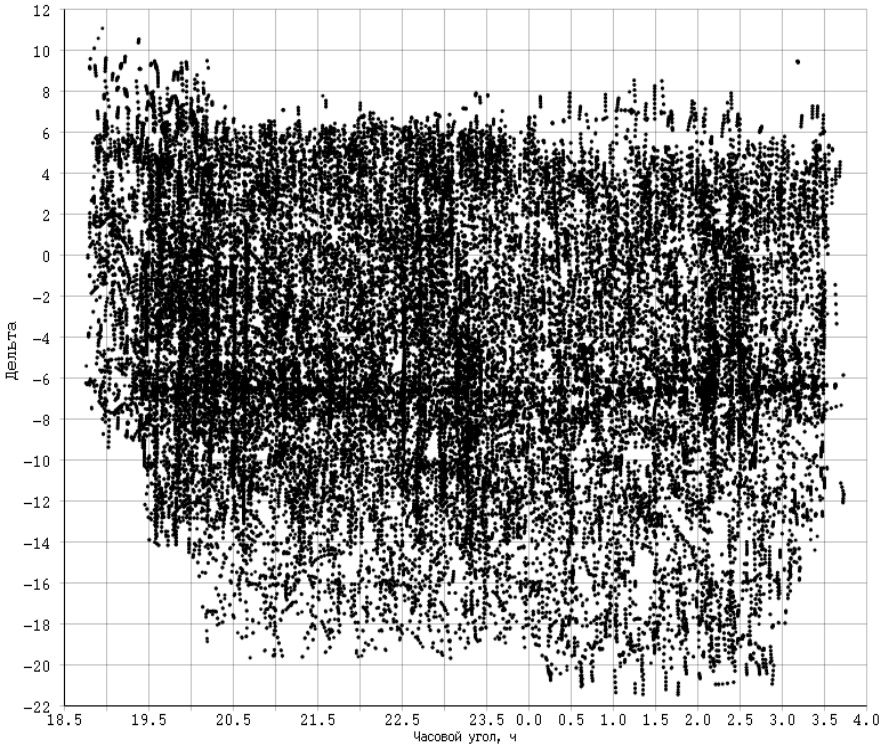








Coverage in GEO surveys.
Ussuriysk ORI-22, 2009/09/01-2010/03/01





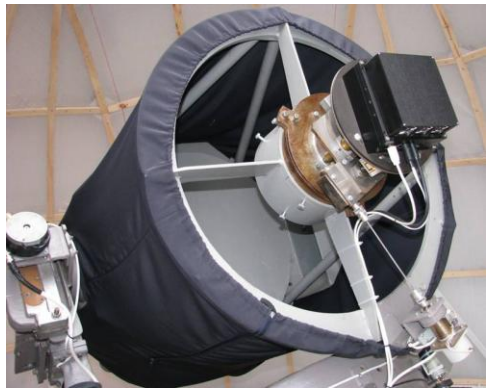
Right Ascension - Declination

Hour Angle - Declination

Subsystem for faint debris tracking:

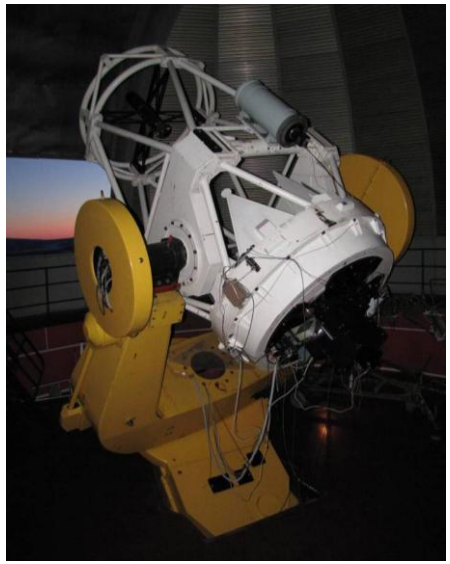
AT-64 Nauchny-1, RC-600 Mayaki, S-600 Andrushivka, ZIMLAT Zimmerwald, AZT-14 Mondy, AS-32 Abastumani, Zeiss-600 Arkhyz, AZT-8 Gissar

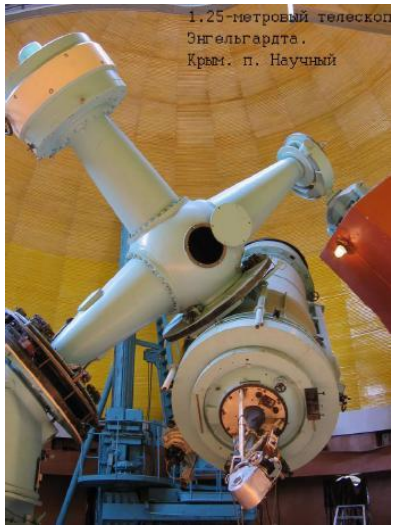







Subsystem for very faint debris tracking – down to 21^m: 2.6 m ZTSh Nauchny-1, Zeiss-1000 Teide, Zeiss-2000 Terskol, 1.7 m AZT-33IR Mondy, 1.25 m ZTE Nauchny-2





New directions of works

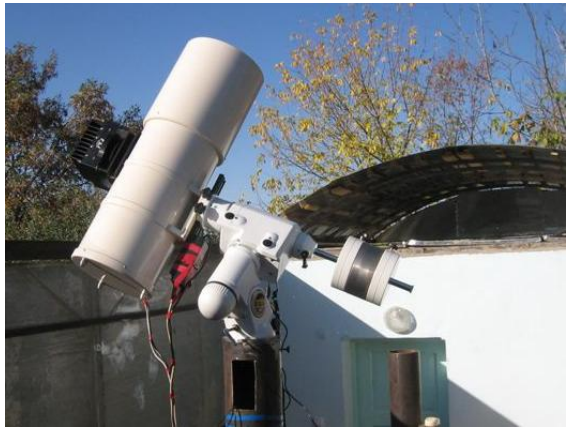
- **ISON participates in the Roscosmos project "Automated System for Prediction and Warning on the dangerous situations in the near-Earth space".** KIAM is responsible for the prediction of the dangerous situations at high orbits. This task requires orbital data quality and high observing regularity
- **ISON research on near-Earth asteroids (NEA) started in 2010** – discovering new NEAs, follow-up observations to improve orbits, photometry study of the physical properties of NEAs
- **GRB optical afterglow observations were restarted with ISON in 2010**

Directions of ISON improvements

- finishing the ISON subset of small automated GEO survey telescopes
- forming new subset for tracking the individual GEO and HEO objects on long measuring arc
- forming two new subsets for NEA observations – for discovering and photometry observations
- developing the series of telescopes with FOV of 15x7.5 degree for the HEO-object survey
- creating the dedicated twin telescope for fast photometry in two filters simultaneously
- establishing a few more observation facilities in Western Hemisphere

Finishing the survey subset

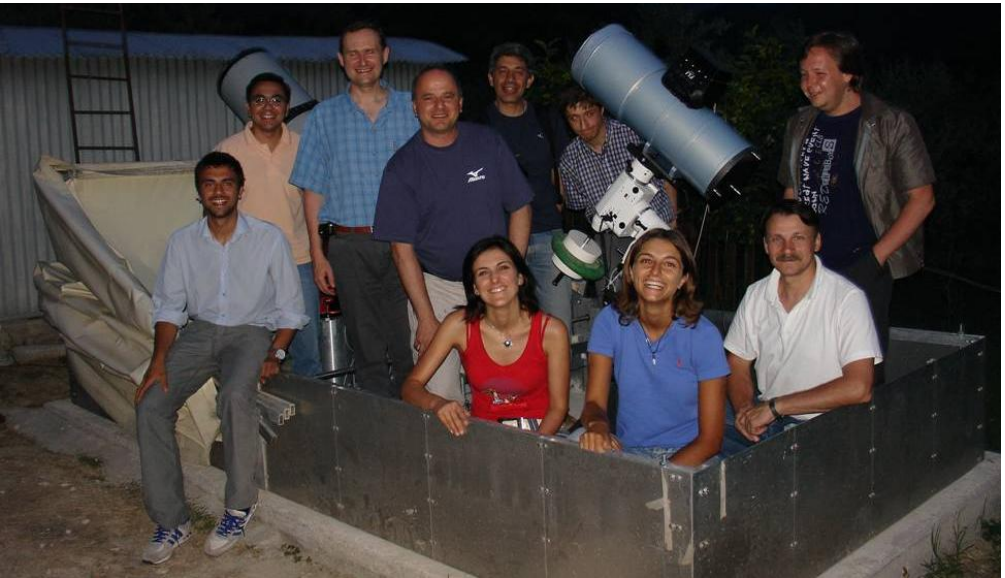
Start of regular GEO surveys in Ussuriysk (Sep 2009) and Kitab (Jun 2010)



Finishing the survey subset

Start of regular GEO surveys

Colleparo (Apr 2010) and Blagoveschensk (May 2010)



Finishing the survey subset

Start of regular GEO surveys

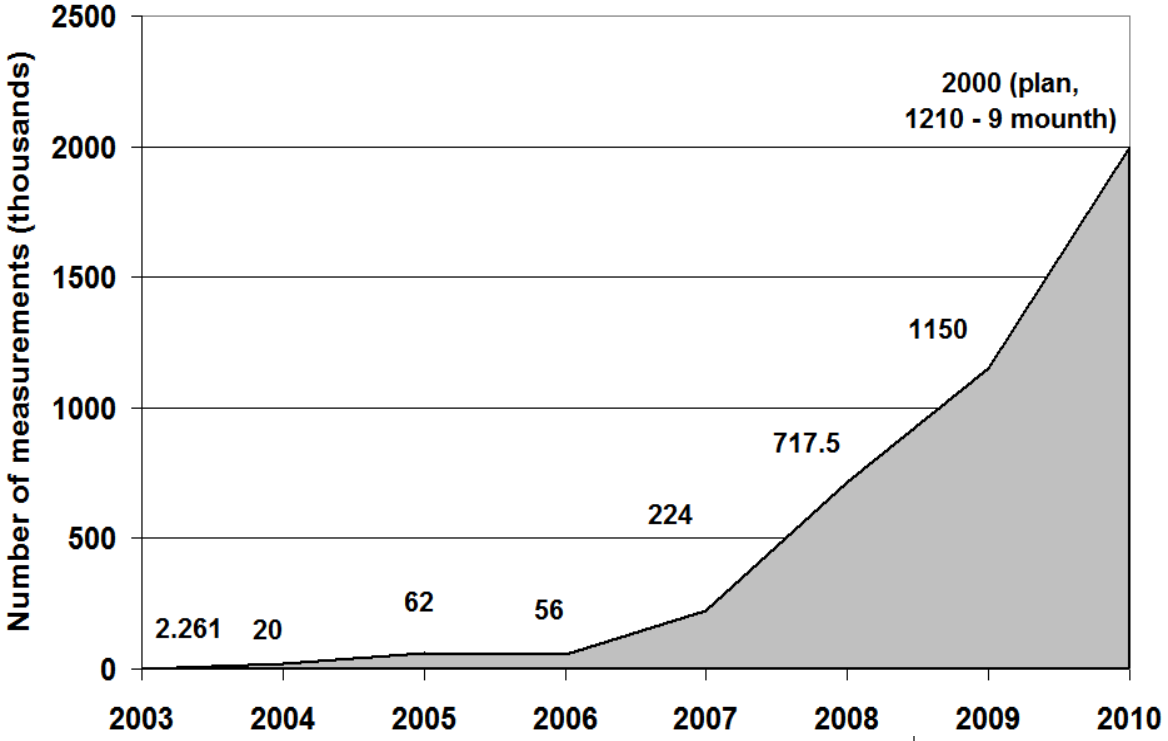
Tarija (Jul 2010) and Pulkovo (Sep 2010)

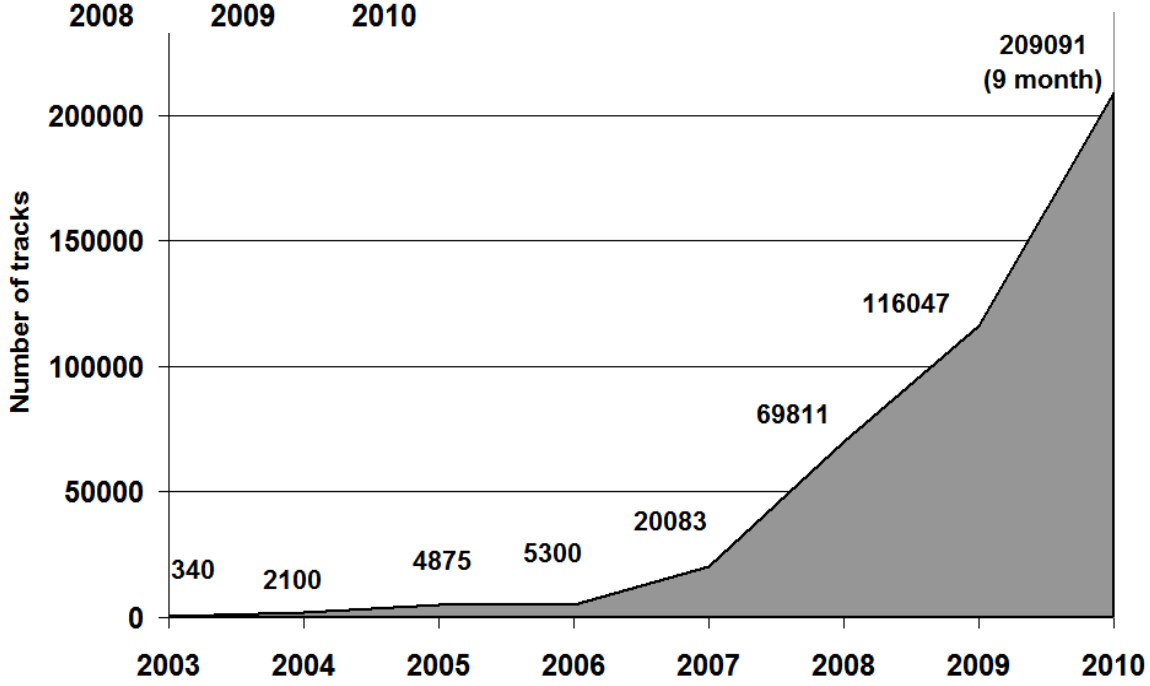
Directions of ISON improvements

- to the date 7 of 9 telescopes (Tarija, Collepardo, Nauchnyi, Pulkovo, Kitab, Blagoveschensk and Ussuriysk) of survey subset provides regular GEO surveying.
- Tiraspol and Milkovo must start surveying soon
- KIAM collected 1.15 million measurements in 120 thousands tracks in 2009 and 1.21 million measurements in 150 thousands tracks in 2010
- periodicity of GEO objects observations is significantly increased

ISON observation statistics from 2003 to 2010 years

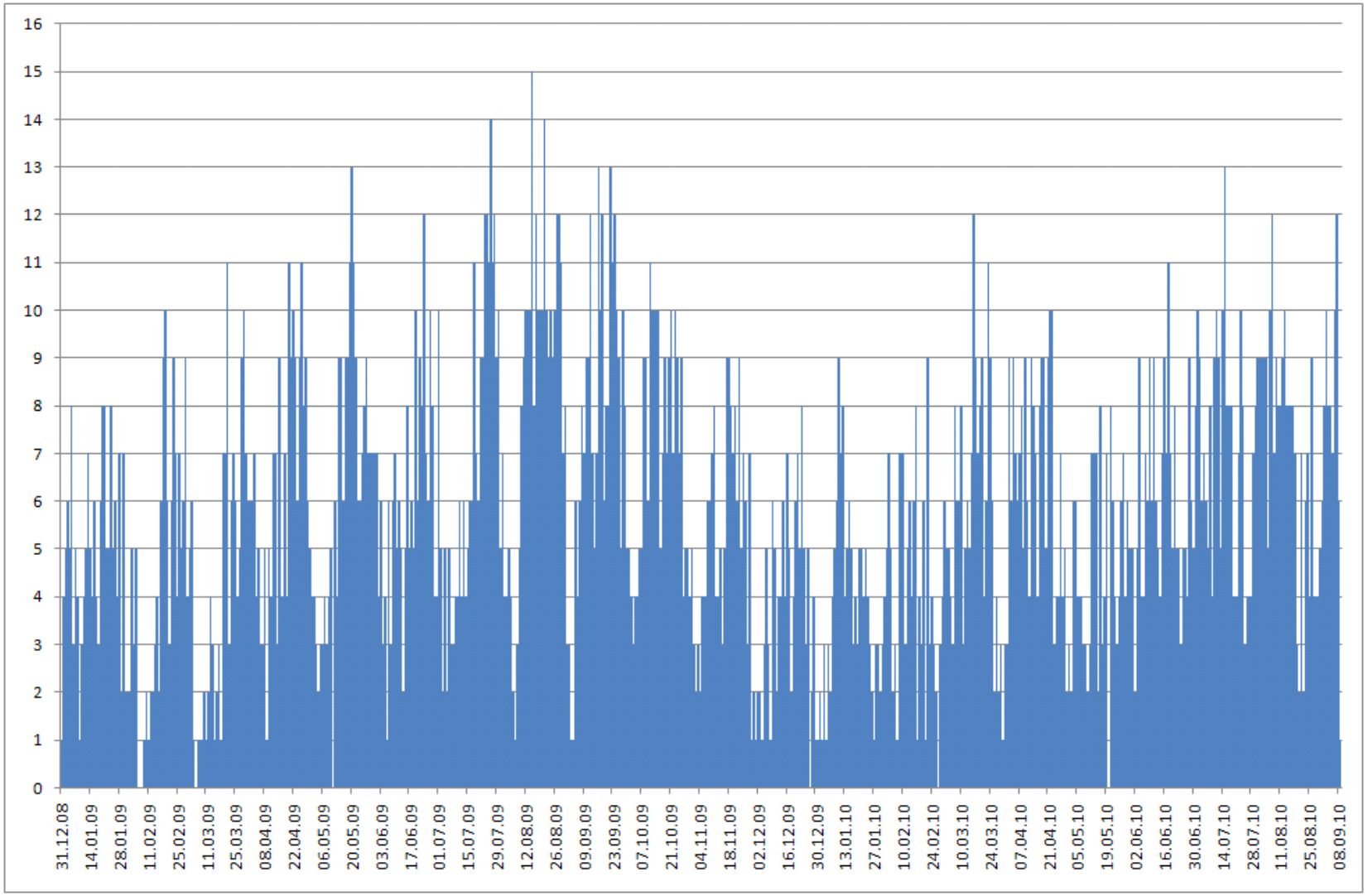
measurements and tracks



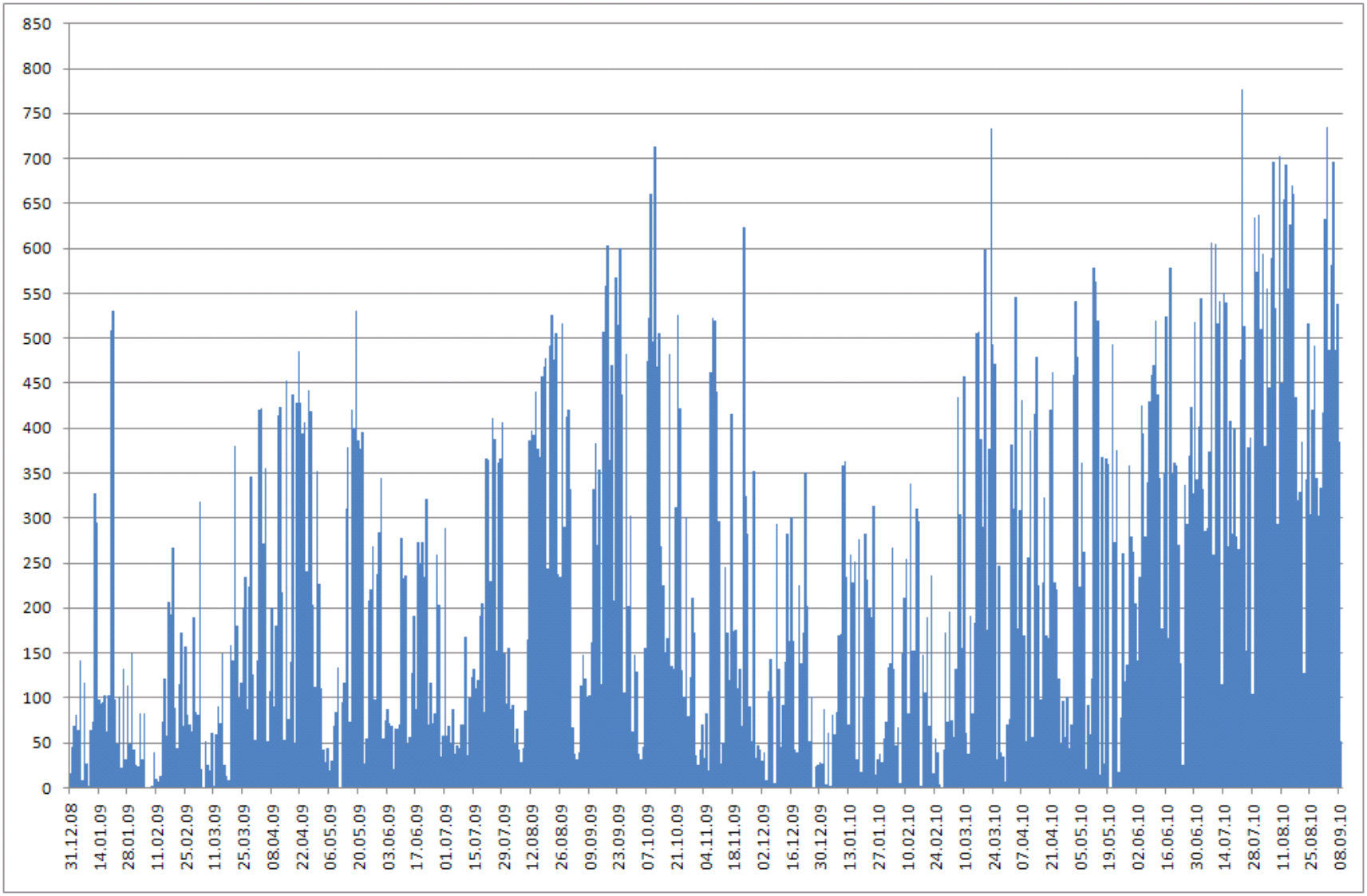


ISON

ISON telescopes operating per night



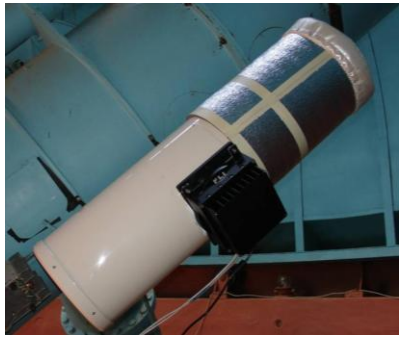
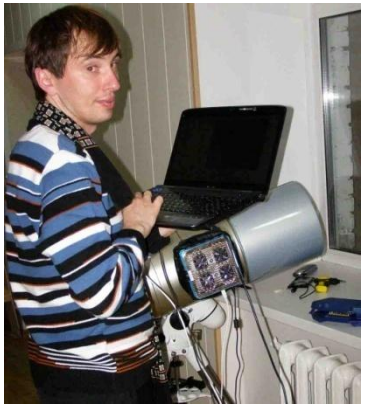
Observed Individual GEO Objects Number (by night, Jan 2009 - Aug 2010)



Forming the subset for tracking GEO and HEO objects on long measuring arc

- 25 cm telescopes are installed in Artem, Ussuriysk, Lesosibirsk, Nauchnyi, Uzhgorod, Tiraspol
- and are produced for Blagoveschensk and Kitab



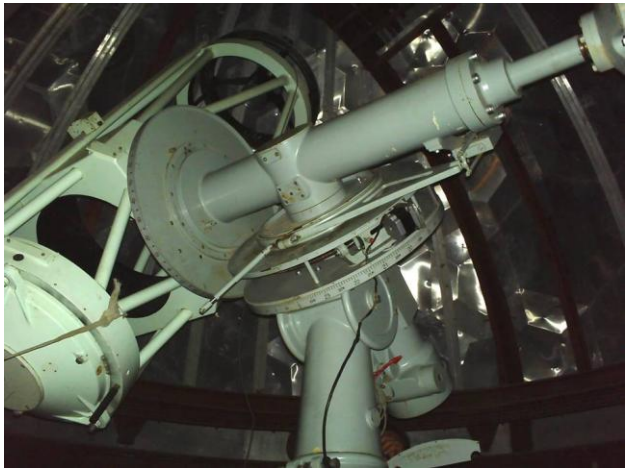




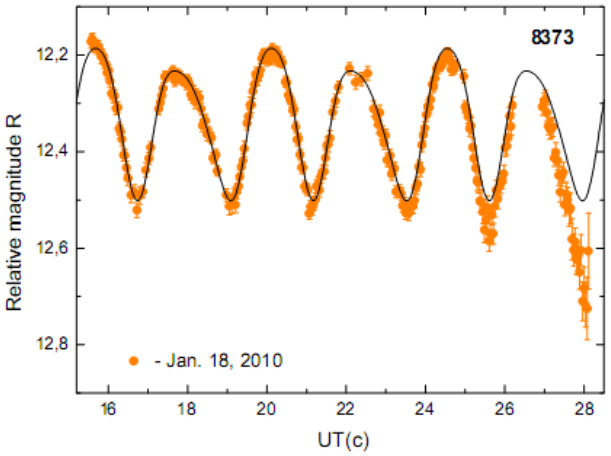
Forming subset for NEA searching

- 45.5 cm New Mexico (1.65°, Jun 2010), 60 cm Andrushivka (1°, upgrade Apr 2010), 50 cm Ussuriysk (1.8°, Aug 2010), 40 cm Kitab (2.3°, Oct 2010?)
- 3000 sq.degrees were surveyed, thousands asteroids were measured, hundreds asteroids were rediscovered, tens of the main-belt asteroids, two Mars-crossers, and one NEA (2010 RN80) were discovered

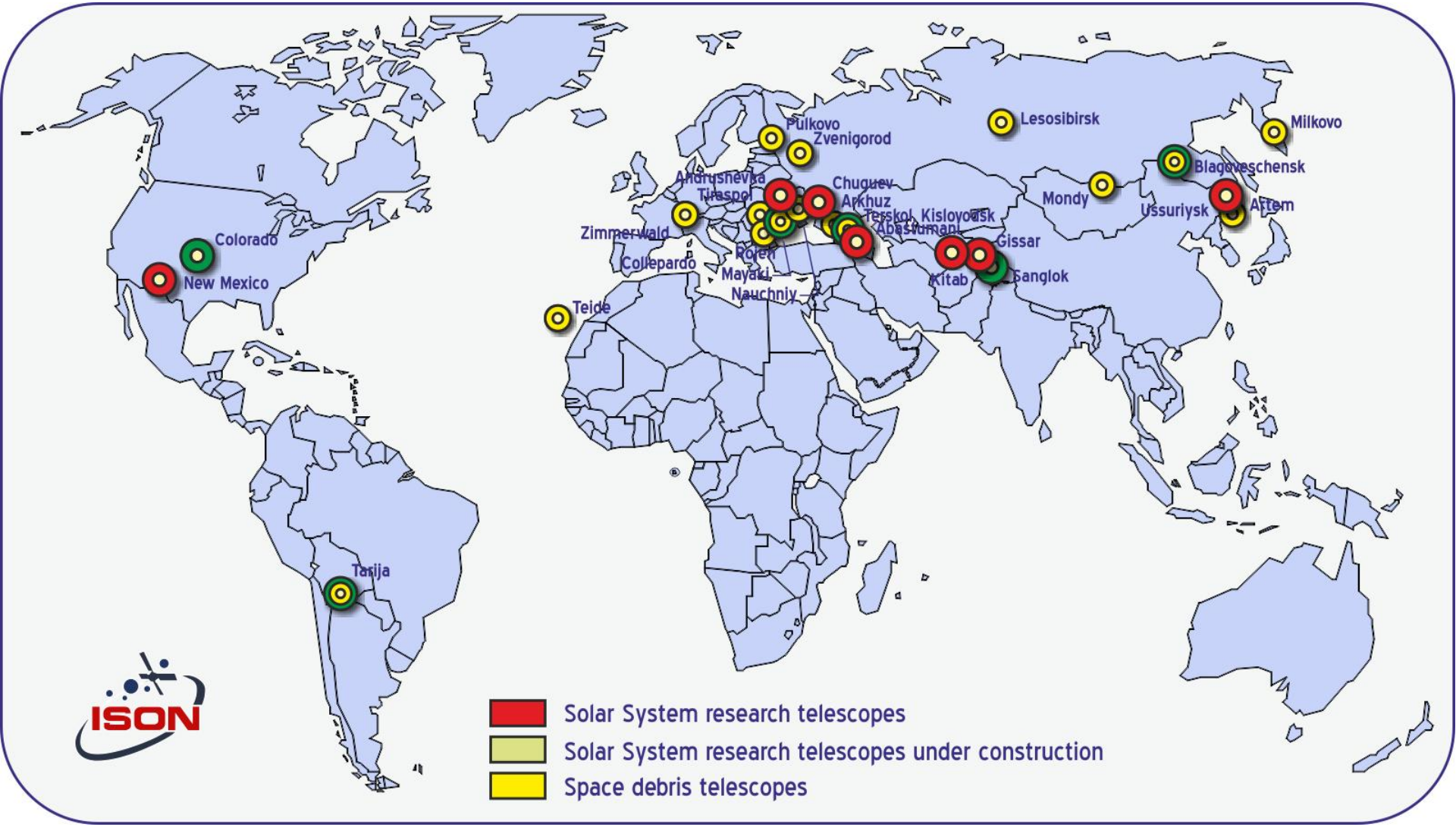



Forming subset for NEA photometry





ISON asteroid subsets – searching and photometry

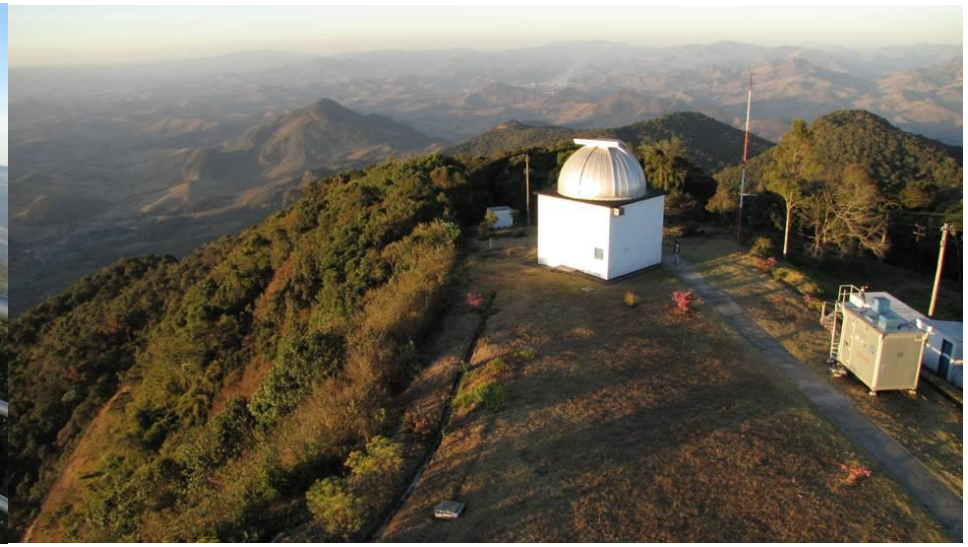


Searching of new places: Argentina – 4600 m

Searching of new places: Venezuela – 3600 m

Searching of new places: Mexico – 2800 m

Searching of new places: Brazil – 1900 m



Conclusion and outlook

- **ISON continues the development**
- **2 millions measurements in 200 000 tracks will be collected by KIAM in 2010**
- **GEO survey subset started operations**
- **subset for GEO and HEO object tracking is forming**
- **two asteroid subsets are formed – for searching and photometry, first NEA is discovered**
- **A few more observatories will be established in Western Hemisphere (ISON expedition visited Brazil, Argentina, Mexico, Venezuela, and plan to visit Chile)**
- **series of telescopes with FOV of 15x7.5 degree for the HEO-object survey is in production**