

United Nations/International Astronautical Federation 31st Workshop on
Space Technology for Socio-Economic Benefits: "Space Sustainability as a Game-Changer
for Development" - Milan, Italy, 11-13 October 2024

National System of Space Situational Awareness (SSA)

Fesenkov Astrophysical Institute, Almaty, Kazakhstan

Gulnara.omarova@fai.kz

2024

Fesenkov Astrophysical Institute (FAI) history on NEO research: facts at a glance

- Near-Earth objects survey since 1957
- The comet 67P/Churyumov-Gerasimenko(the target of Rosetta mission) was discovered at FAI
- 1978 – 1990 – building of the
- Assy-Turgen Observatory near Almaty



ASSY–TURGEN OBSERVATORY (ATO)

Geographical Location:

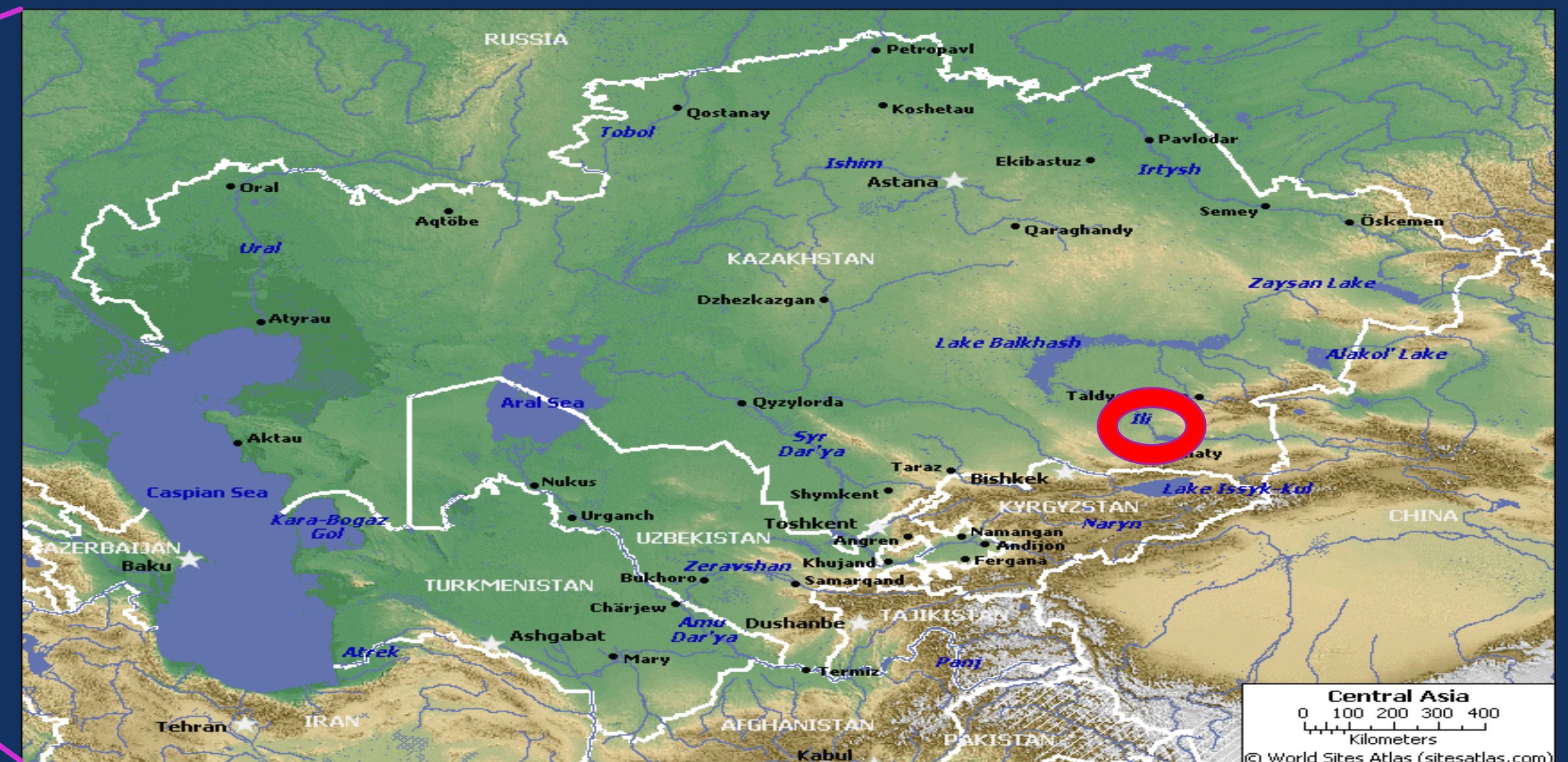
Coordinates: 43°13'31" N, 77°52'18" E

Altitude: 2750 meters

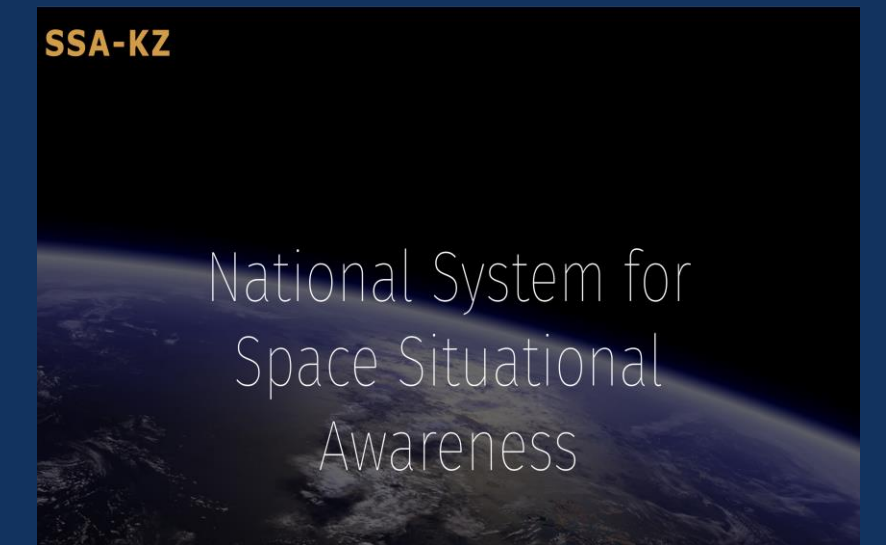
Astroclimate: 1500 h/year, wind speed ~2 m/s, median temperature in summer +9.5C, in winter -10.5

SSA-KZ

National System for
Space Situational
Awareness

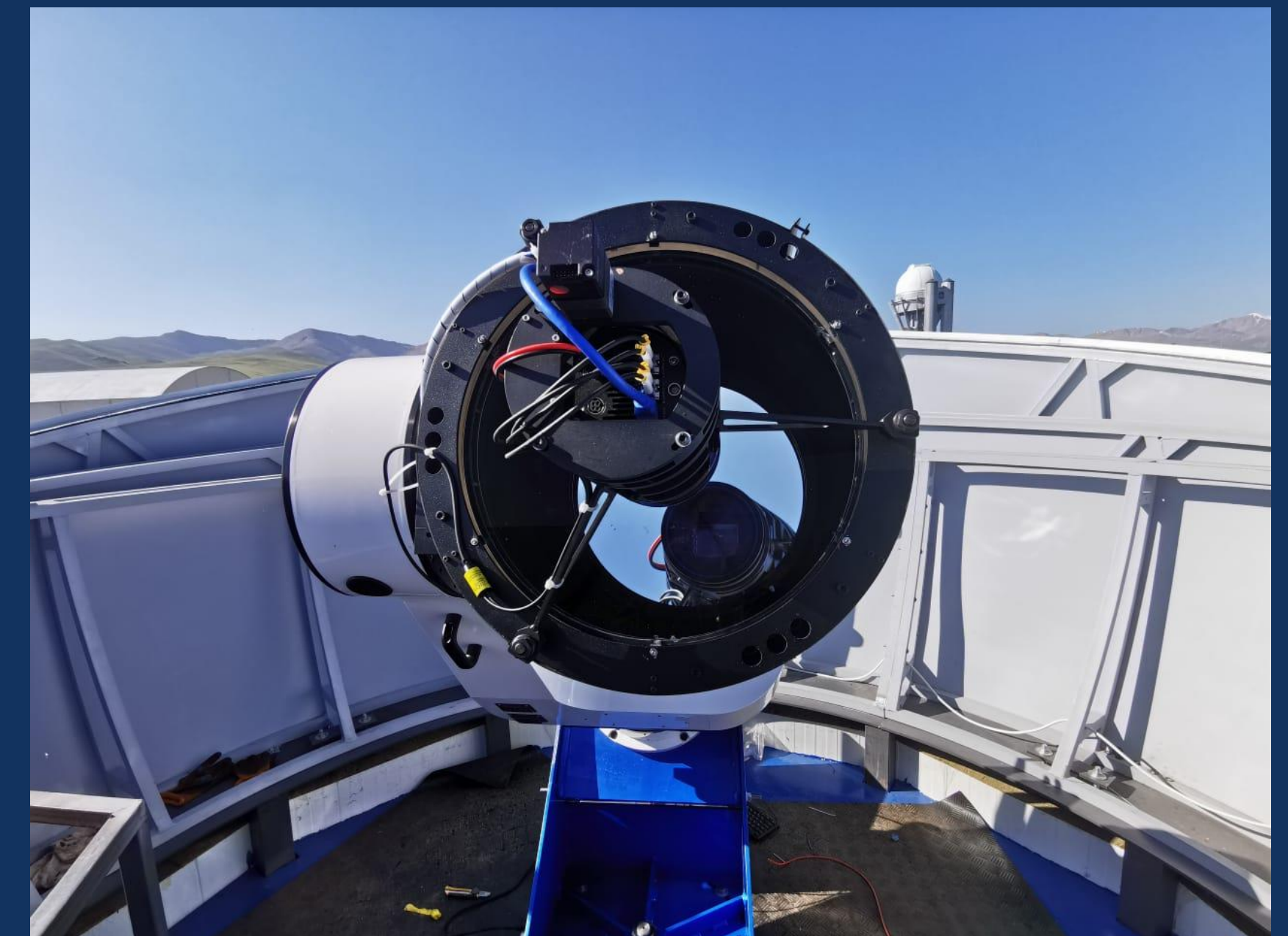


Current capabilities for the SSA development

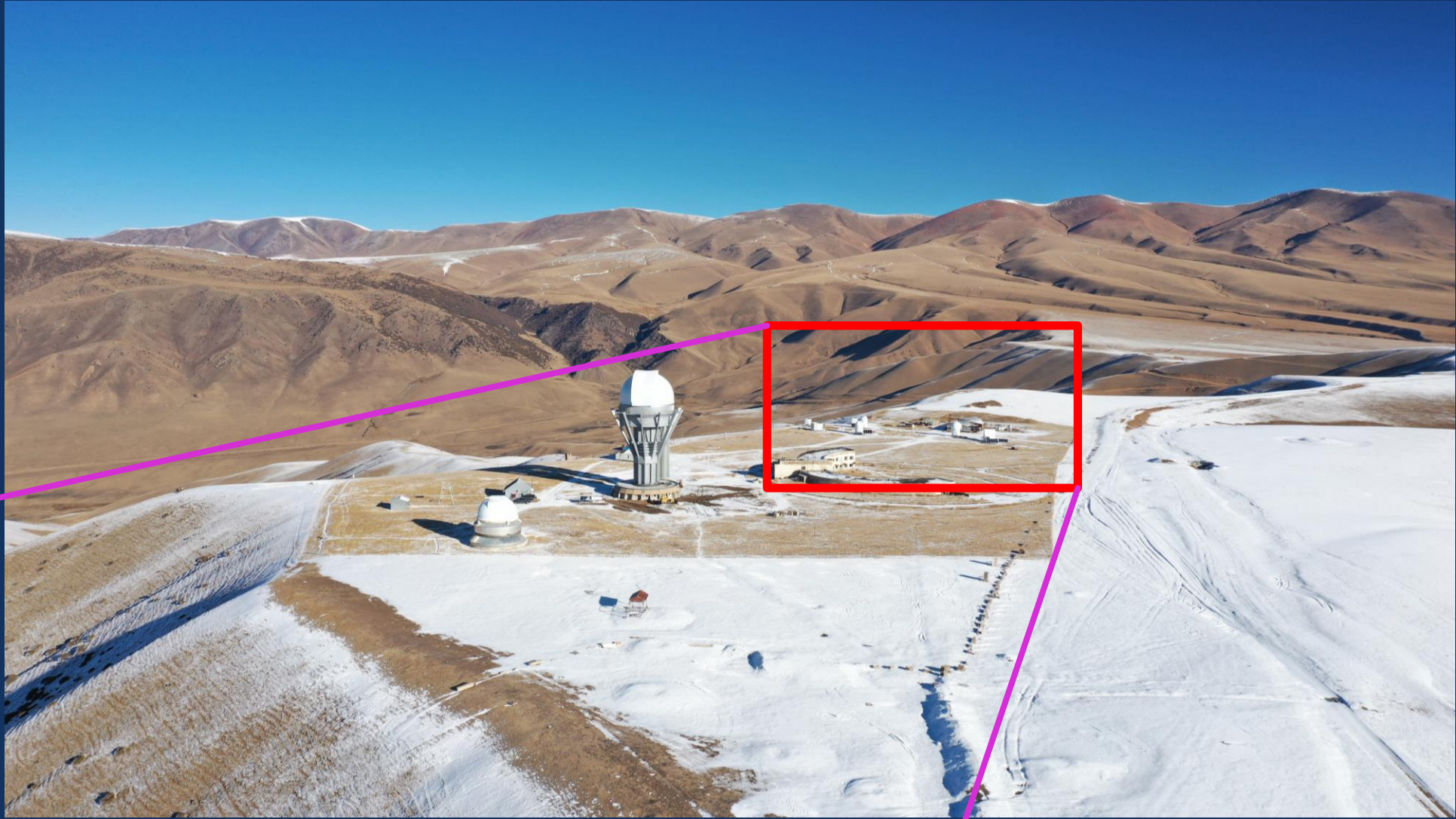


Instruments Installed: AZT-20, RC500, WFOS-40.

Under development and installation - WFOS-70, Zeiss-800, telescopes of partners (two instruments), relocation of two Zeiss-1000.



ATO General view and development since 2020



North-East view



2020



2024



Current SSA capabilities include:

RSO catalog support: Wide-Field Optical Systems (RC500, WFOS-40)

LEO survey: WFOS-40 (Gb of data per night)

Follow-up observations of asteroids: Phaethon, DART and HERA missions

New Wide-Field-of-View optical systems (WFOS-70)

Current SSA capabilities



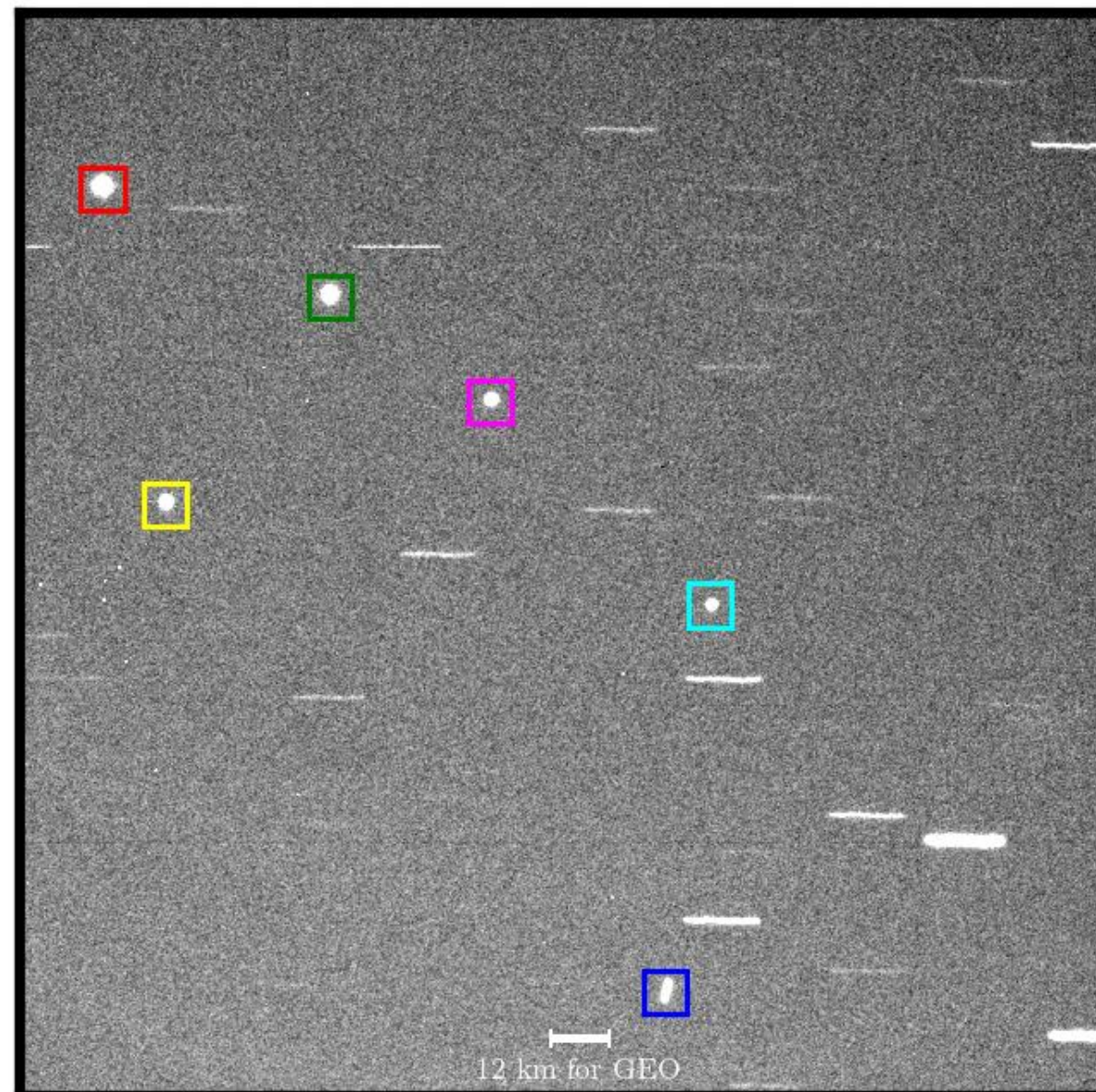
Near-Miss Events

NME forecast for all GEO in catalog starting at 10 days before an event

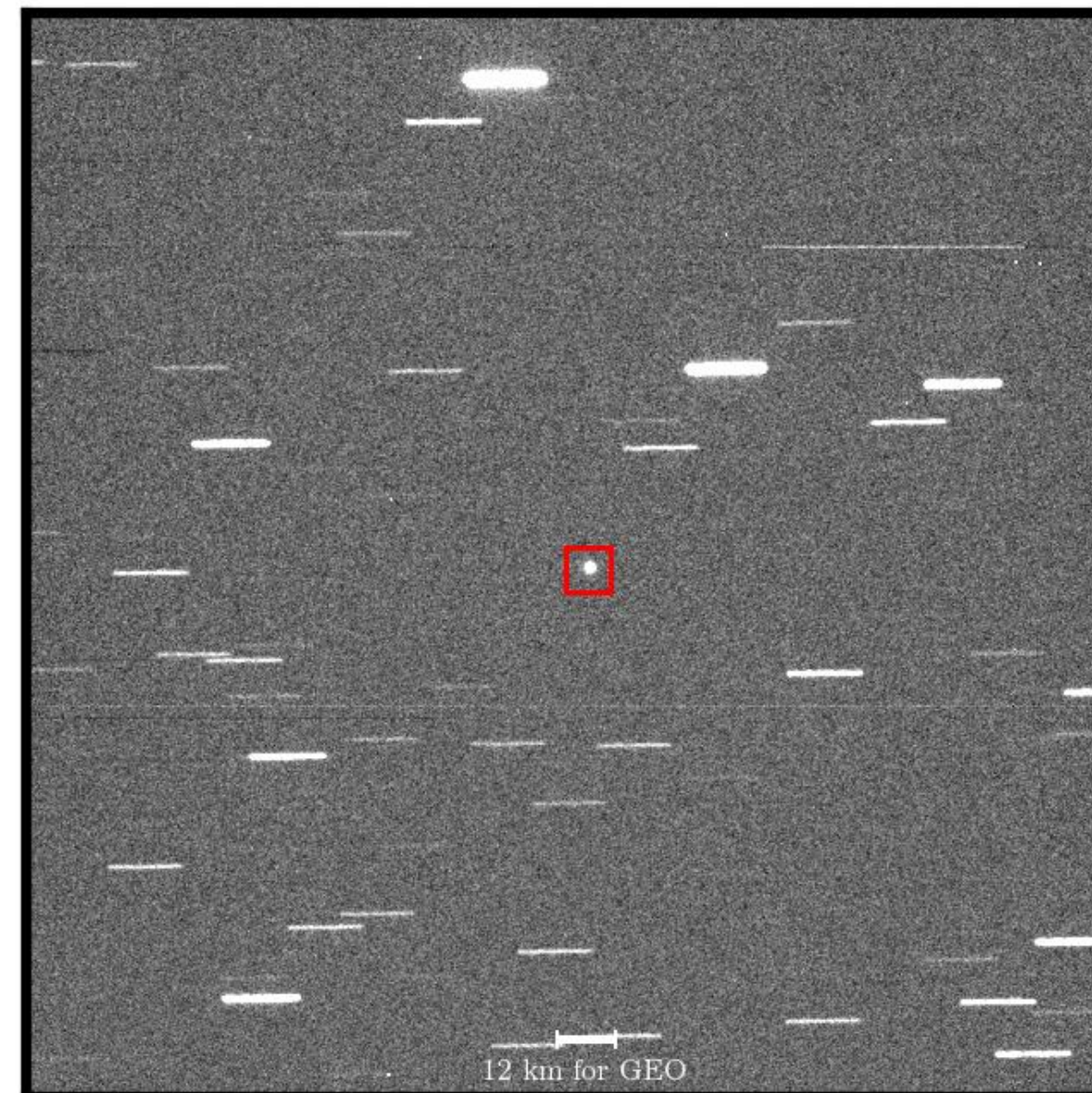
NME monitoring for GEO: determine closest angular distance and corresponding moment

SSA web-site <https://ssa.fai.kz>

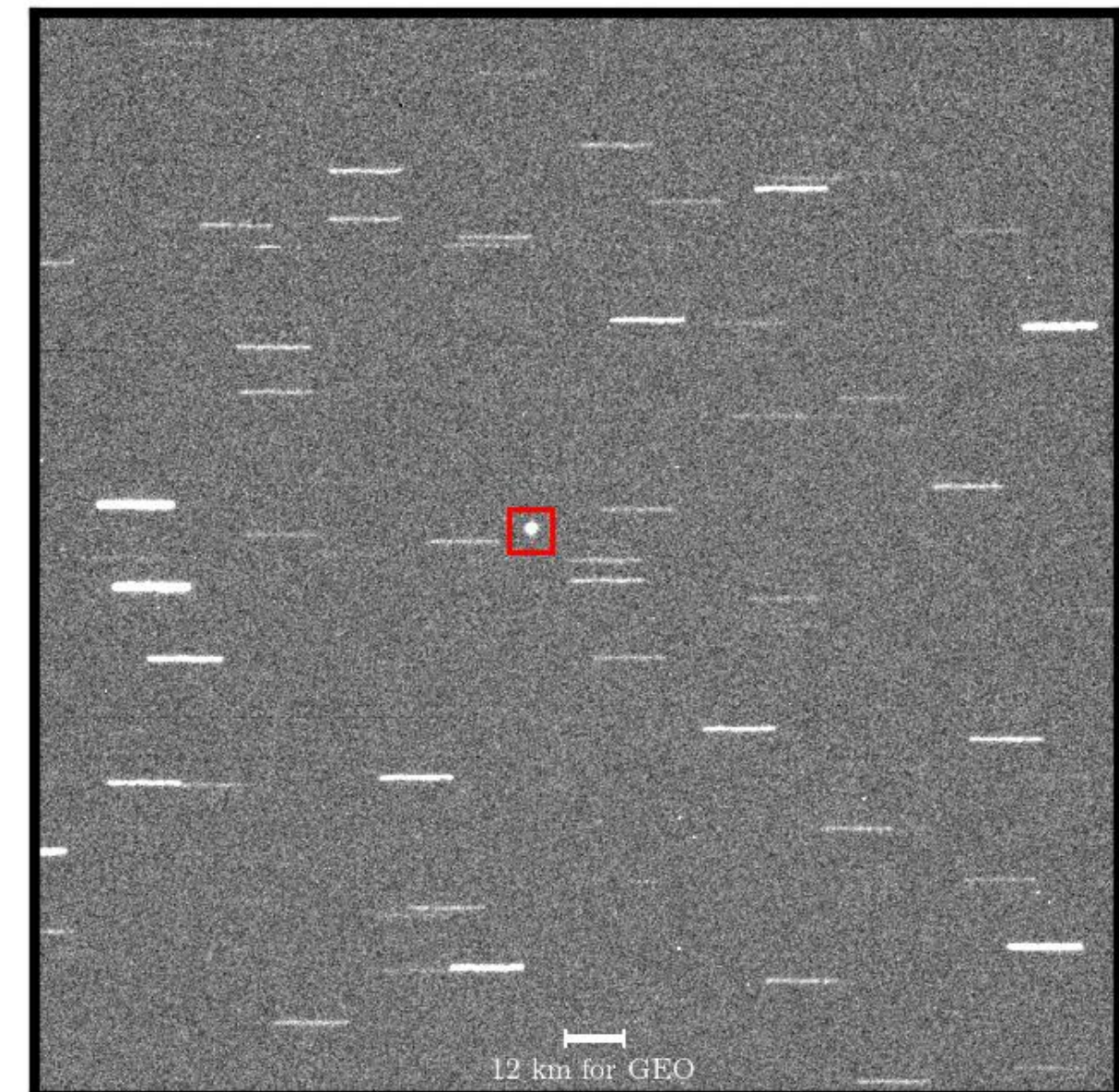
2023-02-26 20:54:15.019999
Zeiss-1000 "East", Tien-Shan Observatory, KZ



2023-11-04 19:19:49.100000
Zeiss-1000 "East", Tien-Shan Observatory, KZ



2023-10-11 20:57:01.340000
Zeiss-1000 "East", Tien-Shan Observatory, KZ



Current SSA capabilities



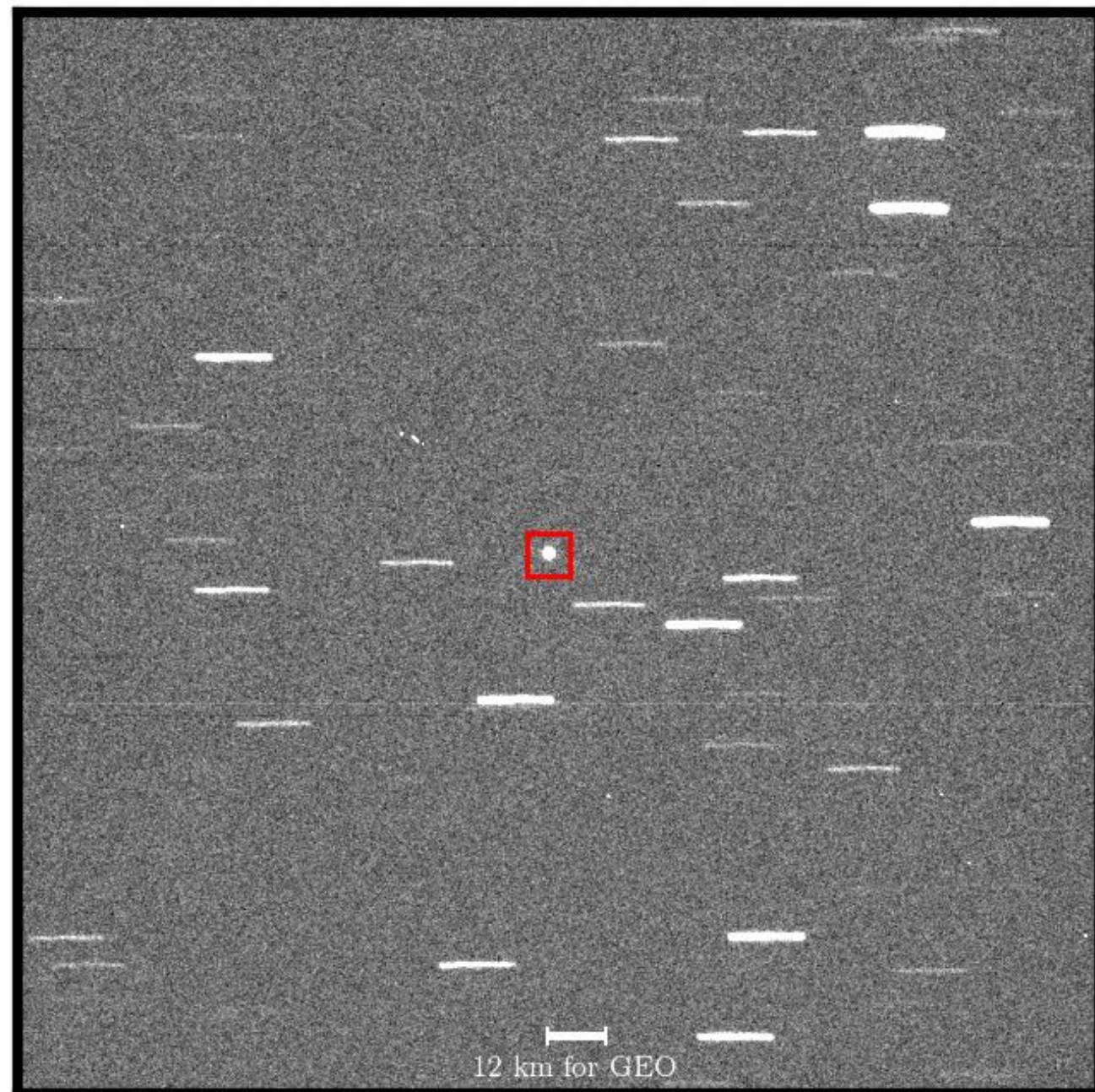
Near-Miss Events (KAZSAT case)

In collaboration with Republican Center of Space Communication (RCSC)

Use RCSC data for KAZSAT satellites and TLE+FAI catalogs for other objects

10-days forecast with orbit propagation and RCSC data

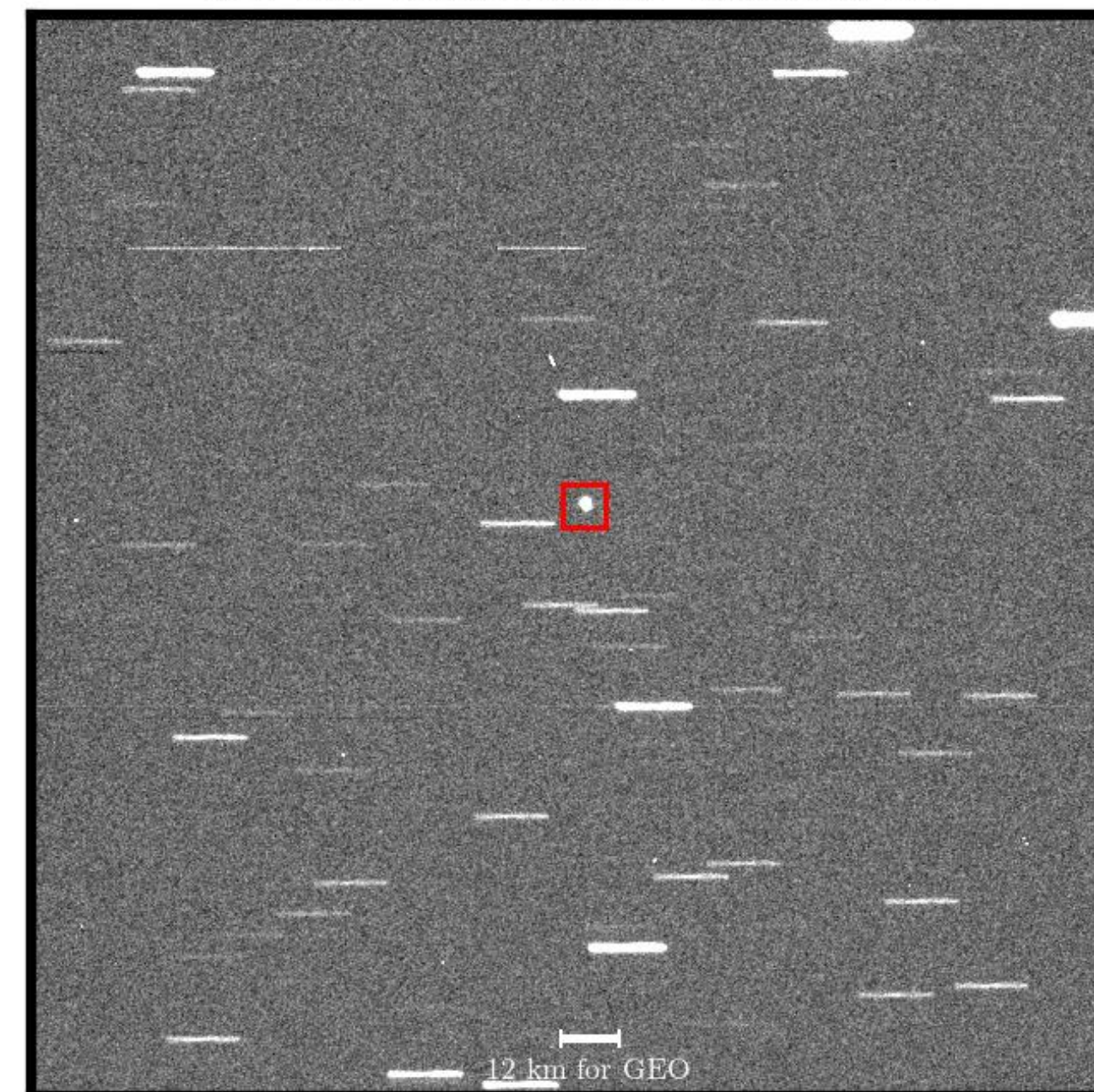
2023-11-05 19:14:25.269998
Zeiss-1000 "East", Tien-Shan Observatory, KZ



Event on November 5, 2023:
KAZSAT-2 with FENGYUN 2E

Forecast: UT 19:22:57, $\Delta u = 11.1$ km
Observed: UT 19:22:56, $\Delta u = 11.6$ km

2023-11-06 19:12:24.890000
Zeiss-1000 "East", Tien-Shan Observatory, KZ



Event on November 6, 2023:
KAZSAT-2 with FENGYUN 2E

Forecast: UT 19:18:53, $\Delta u = 9.3$ km
Observed: UT 19:18:54, $\Delta u = 9.5$ km

Current SSA capabilities

LEO survey



Direct drive high-speed slewing (up to 50 deg/sec) with high-precision positioning



CHANDRAYAAN-3 observations WFOS-40 at Assy-Turgen Observatory



Current SSA capabilities

LEO survey

NORAD 36095

COSMOS 2455

Int'l Code: 2009-063A

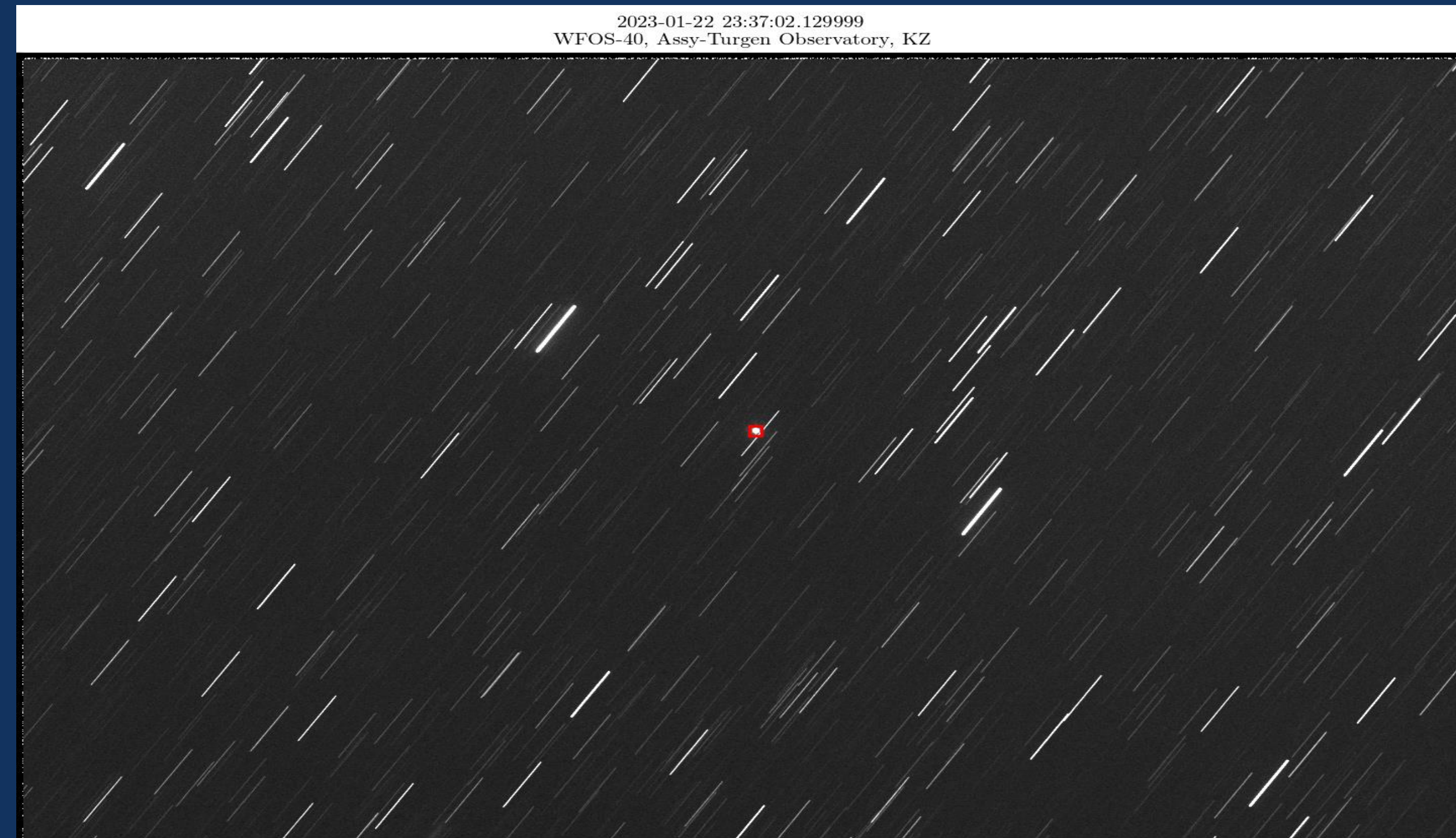
Perigee: 909.2 km

Apogee: 914.4 km

Inclination: 67.1 °

Period: 103.1 minutes

Semi major axis: 7282 km



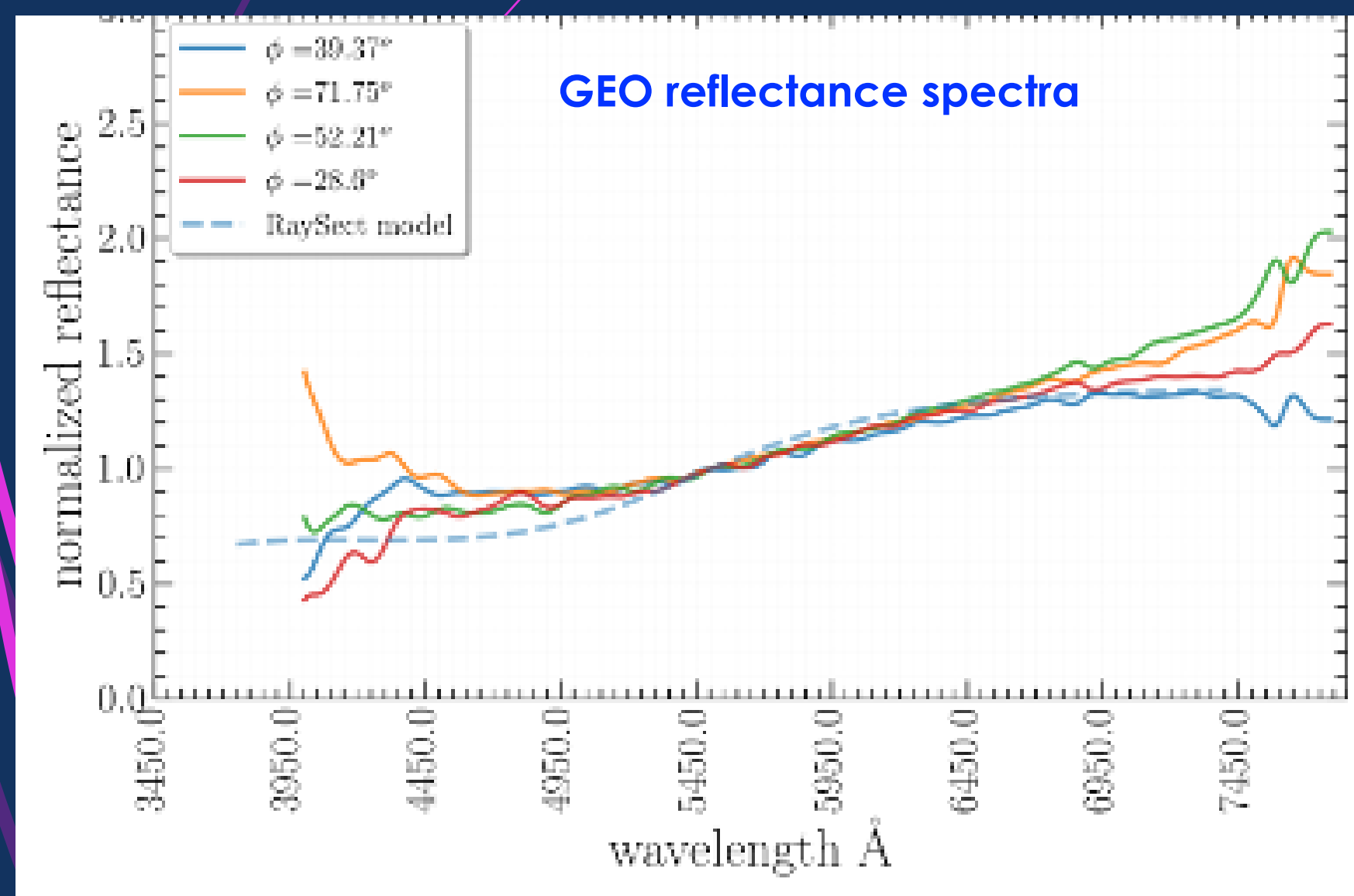
Current SSA capabilities



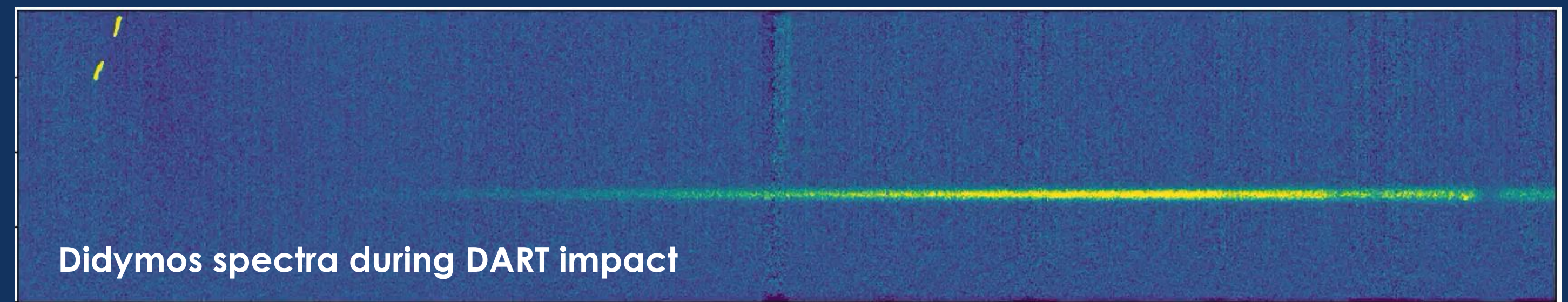
RSO and asteroid spectroscopy

Follow-up observations of asteroids: photometry (Zeiss-1000) and spectroscopy (AZT-20)

Spectroscopy of GEO: identification, material science (AZT-20 spectroscopy)



Reflection spectra - spectra normalized by solar-like star spectra and flux at 550 nm

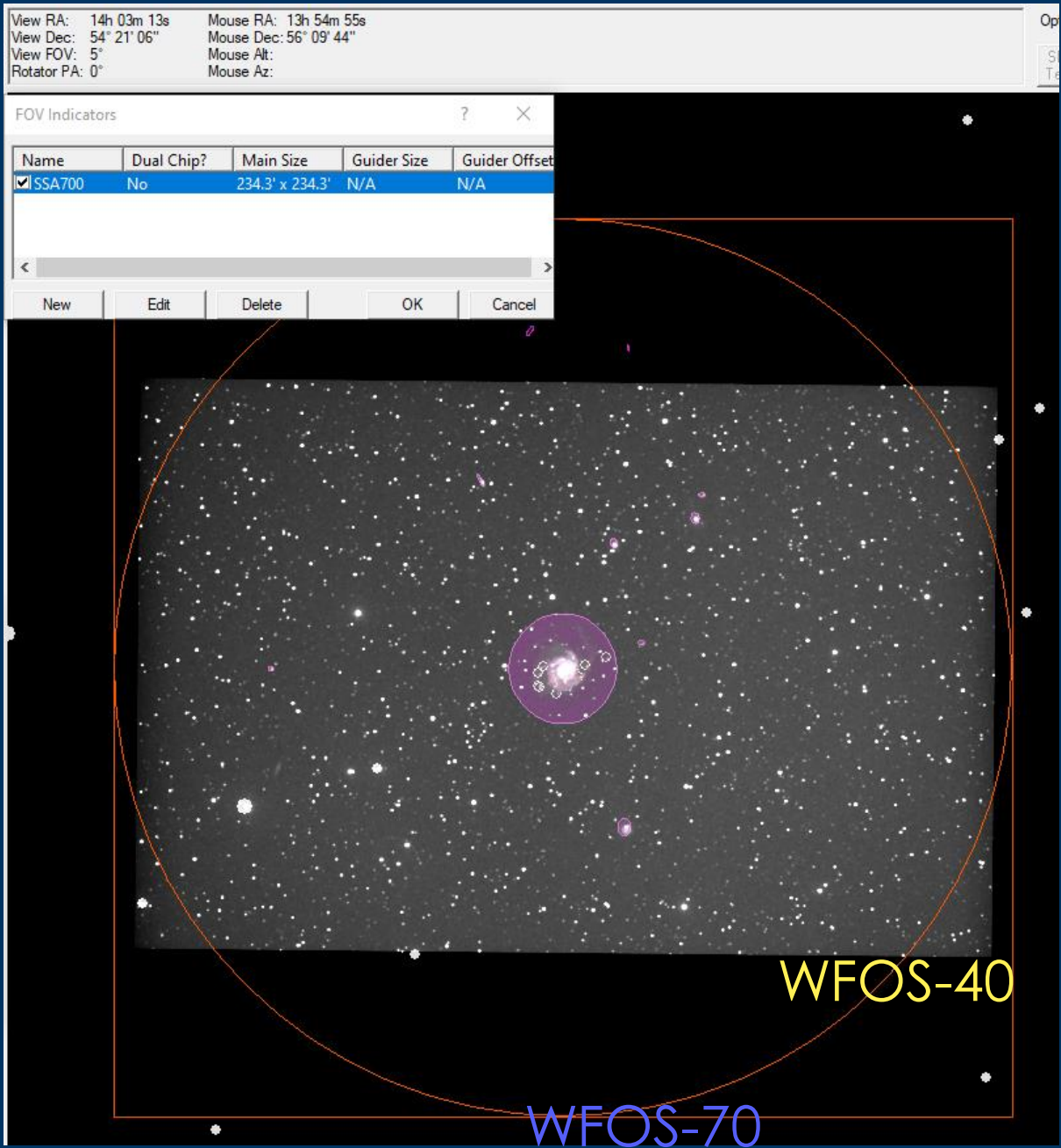
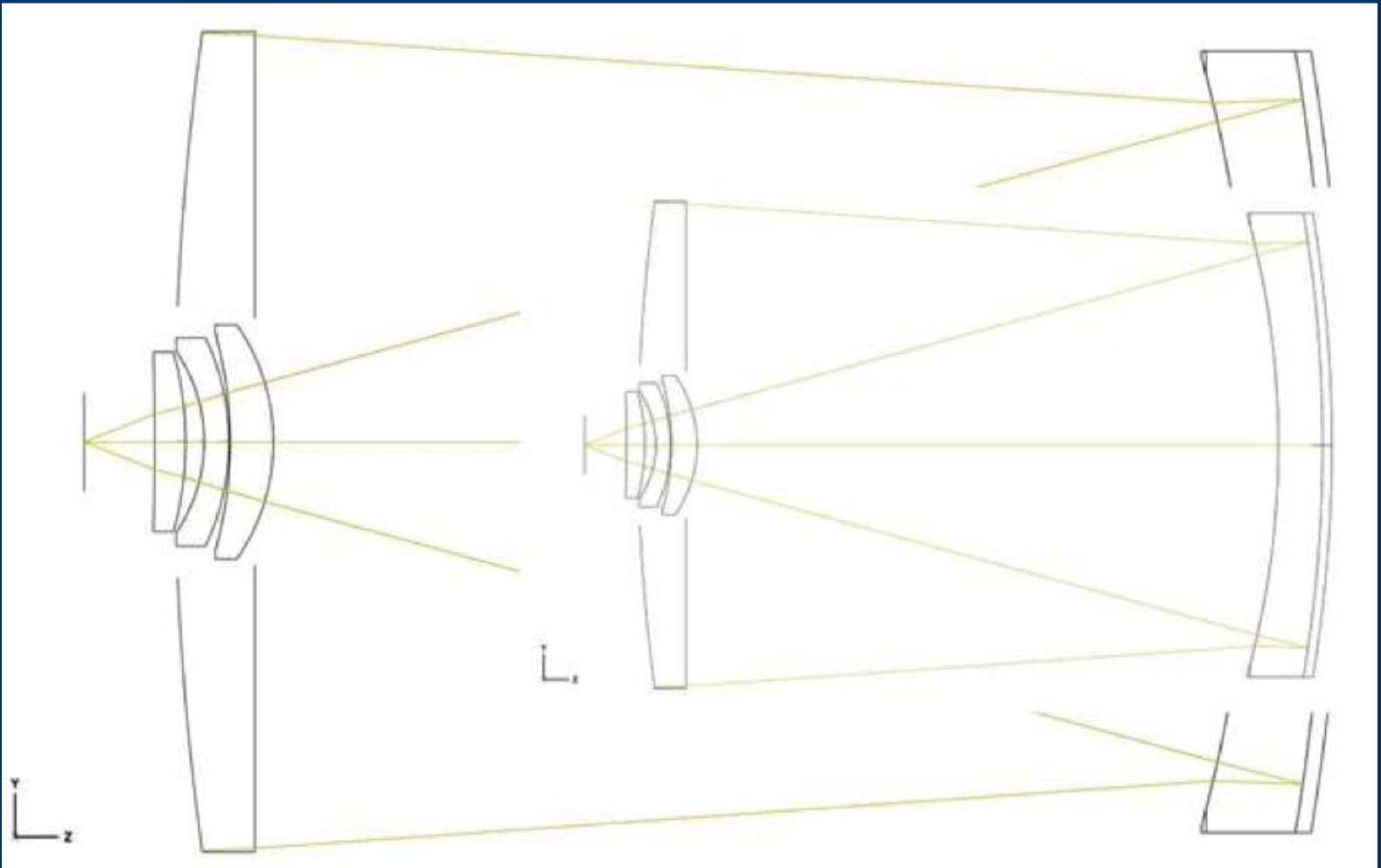


Asteroid taxonomy, NEO identification, Space weathering of the NEOs surfaces and components, asteroid spectra, RSO reflection spectroscopy

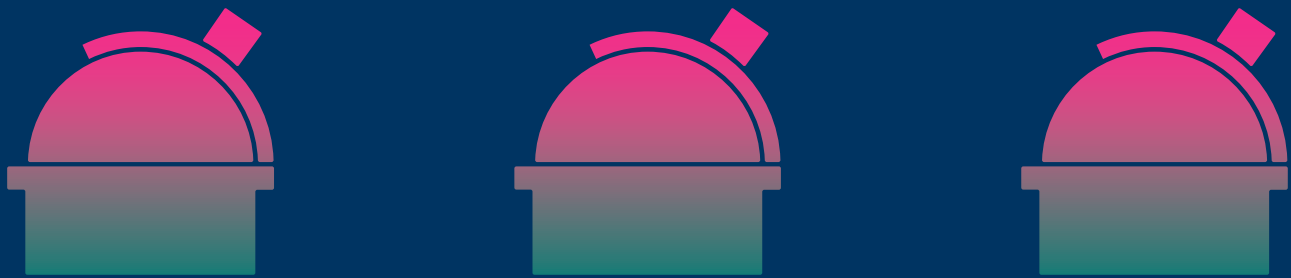
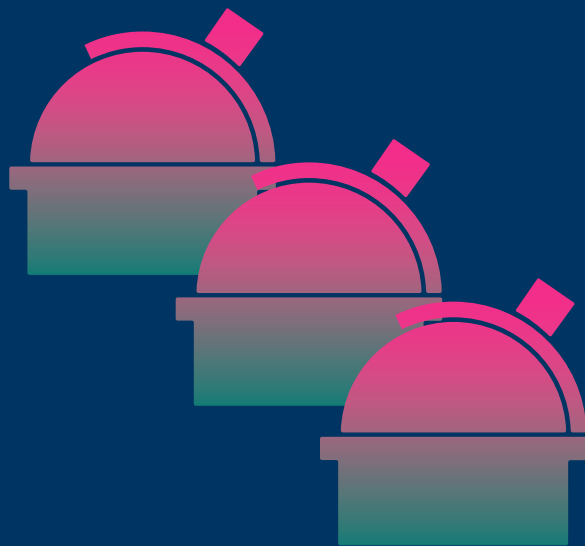
Future Enhance of the SSA capabilities



New generation of Wide-Field Optical System



Network of telescopes
for SSA and NEO



Locations to be selected

Thank you! Welcome for cooperation!

SSA web-site <https://ssa.fai.kz>

