Reconfigurable space object optical tracking system of GGI – implementation stage

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Introduction

The project objective is to install and configure the optical tracking system of GGI and start its operation initially using for positional astrometric observations.

The research is being held at the Institute of Geodesy and Geoinformatics (GGI) of the University of Latvia (UL) during 30-month period (January 2021 – June 2023).

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The project will facilitate the development of the original optical tracking system, bring new knowledge and skills to the post-doctoral researcher.

Installation of the system

The tracking system has **Alt-Alt mount** and optical scheme with **three optical channels**: transmitter equipped with laser collimator and two 16" F/10 receiving optical tube assemblies (OTAs).

One of the twin optical systems is fitted with a CCD camera. It will be used for astrometric and positioning purposes.

The other may be fitted with a reflected light pulse detector and used for satellite laser ranging (SLR) pulse processing or configured for other purposes.

8 Mpix CCD:
- 5.4 µ pixel size, 18x12 mm matrix
- 0.3 x 0.2 dg field, image scale 0.3"/pixel
- mechanical shutter (minimum exposure 0.12 sec)
- computer interface: USB, download speed ~10 MB/s
- 2x2, 3x3, 9x9 pixel binning modes.

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3M

The stars of magnitude up to 17-18 can be recognized by the software.

Frame stacking is proposed to increase this limit by several magnitudes.

Using frame stacking, it should be possible to reach maximum magnitude of about 22.
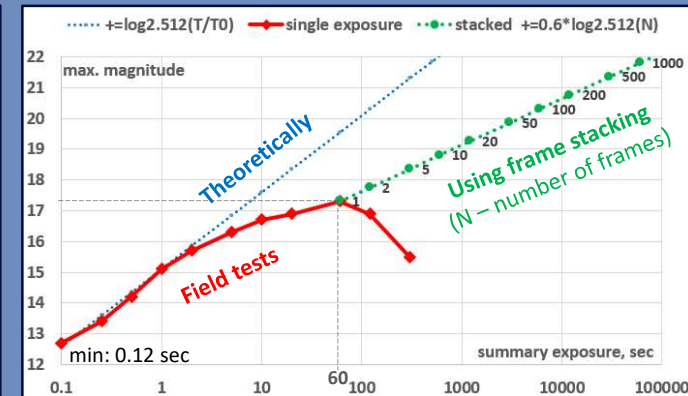
## Further steps (activities within PostDoc research):

- Adjustment, supplementation and reconfiguration of mount control software package, including computer-controlled dome manipulation.
- Reconfiguration and supplementation of image acquisition and processing software packages according to present set of hardware components.
- Functionality tests and adjustment of astrometric subsystem including mount positioning, image acquisition and analysis, selection of reference stars for image area, automatic reference star identification.
- Determination of mount error model using reference star observations.
- Positional observations of different natural and artificial space objects.
- Development of algorithm and software package for frame stacking.
- Development of optimal methodology for positional observations of different space objects.

The astrometry module supports
- image acquisition and analysis
- star image recognition
- reference star selection and identification
- astrometric processing of frame data
- object coordinate determination
- frame stacking
- star ephemeris calculation.

A subset of GAIA star catalogue (data release 3E, ~1.5 G stars up to magnitude 22), galaxies catalog GLADE (~3 M objects up to magnitude 22) are used.
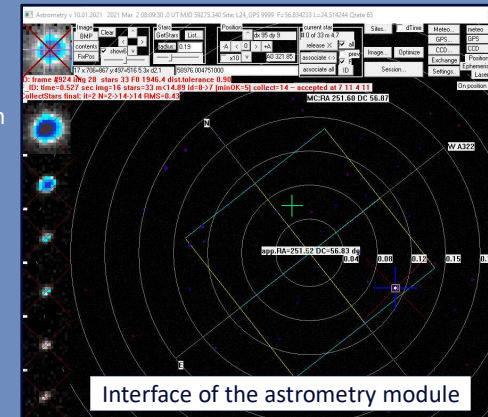
Interface of the astrometry module