PROJECT OF MULTI-PURPOSE OPTICAL TRACKING SYSTEM

Diana Haritonova, Inese Janpaule, Augusts Rubans, Ansis Zarins
Institute of Geodesy and Geoinformatics, University of Latvia (diana.haritonova@inbox.lv)

IEGULDĪJUMS TAVĀ NĀKOTNĒ
ESF EIROPAS SOCIĀLAIS FONDS
EIROPAS SAVIENĪBA

INTRODUCTION

Institute of Geodesy and Geoinformatics and Institute of Physics of the University of Latvia during 2014-2015 are engaged in a joint ESF –funded project, the result of which must be a functional prototype of new multi-purpose optical tracking system for both positional and laser ranging observations of near-Earth objects.

THE TARGET TECHNICAL FEATURES

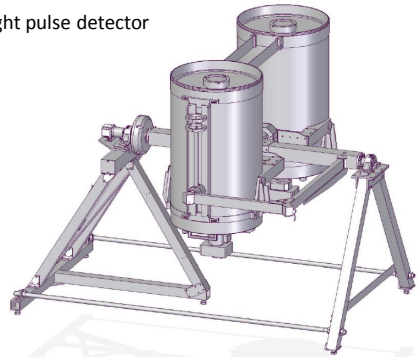
- Twin 40 cm optical systems on Alt-Alt mount, separate transmitted beam collimator.
- Tracking of any orbital object, positioning accuracy within a few arcseconds.
- Positional observation accuracy within a fraction of arcsecond for objects with optical magnitude up to 15^m.
- SLR capability (depending on laser transmitter properties) up to geostationary orbit.
- Possibility of simultaneous positional and SLR observations, usage of both optical systems in various combinations.

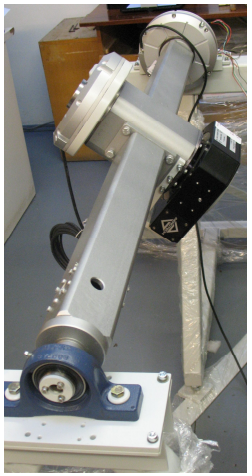
Although design of the mount is optimized to minimize deformations, software-implemented mount error model should be used to achieve expected positioning accuracy. Additionally, active beam direction control will be used in transmitting coude path.

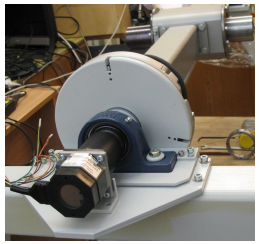
Tracking system uses stepper motor drive.

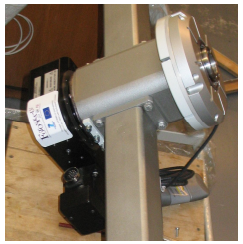
One of twin optical systems will be fitted with a CCD and used for astrometric purposes (including mount pointing direction determination, object coordinate determination, object guiding).

The other, fitted with reflected light pulse detector and filter wheel, will be used for SLR pulse processing.



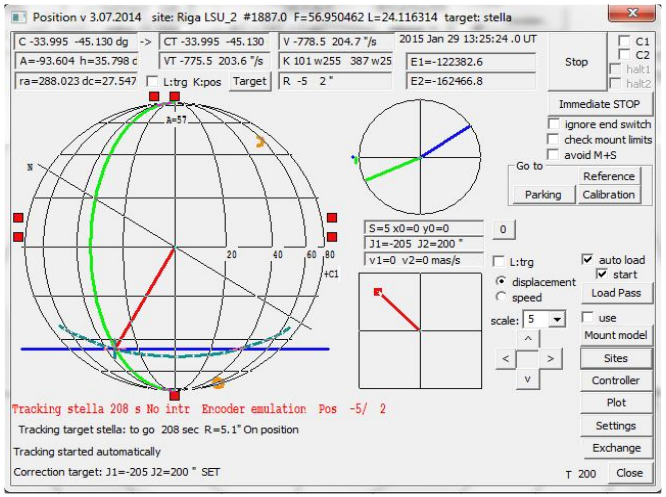


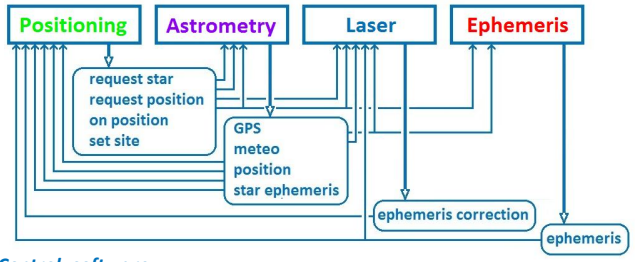




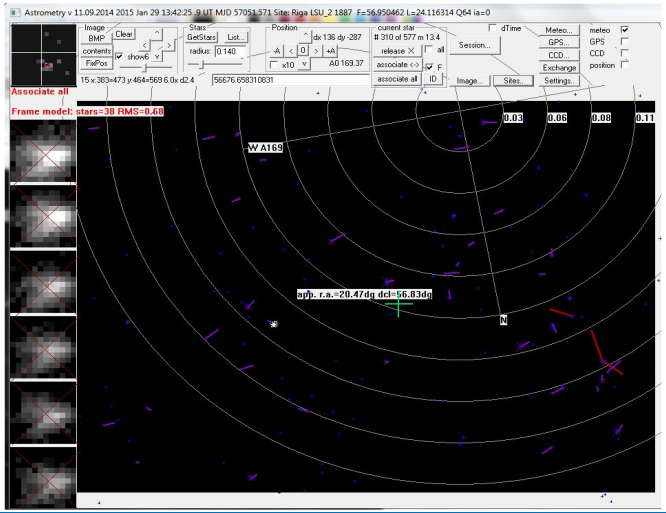
PRESENT STAGE

Instrument construction design is completed, all major components are manufactured or purchased and now are being assembled. Principal functionality of control software is already implemented, presently hardware control and inter-process communication tests and adjustments are being done. The first operational tests are expected in the second half of 2015.

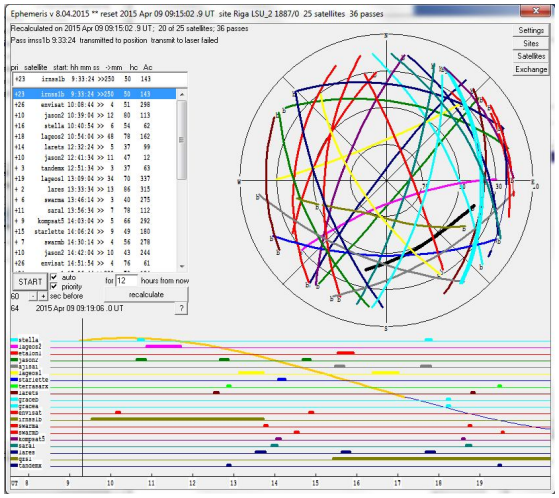




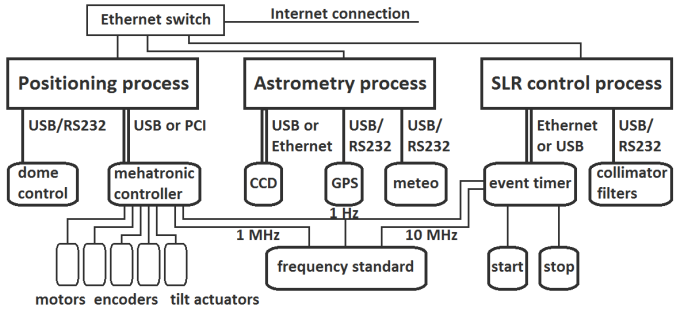
Control software *consists of 4 semi-autonomous main modules supporting positioning, ephemeris, astrometry and SLR functionality. Modules can reside on separate computers, joined in a local network; inter-process communication is asynchronous, using Windows mailslot mechanism.*



Positioning module *is responsible for processing of encoder information, control of positioning motors and beam correction actuators, collecting and processing of mount error model measurements and implementation of the model. Prediction information is received from ephemeris or astrometry modules. Positioning module also visualizes mount position; it contains manual mount control interface and instrument dome controls.*

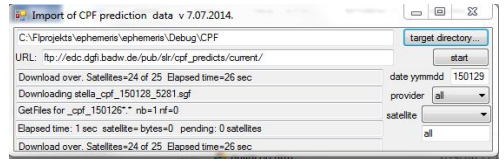


Tasks of ***Ephemeris module*** *are satellite prediction data management, situation visualization and providing of current pass prediction to positioning module. Sites, satellites and predictions databases are maintained here.*



Astrometry module *supports image acquisition and analysis, reference star selection and identification, astrometric processing of frame data (a subset of NOMAD star catalog up to star magnitude 16^m and NOVAS astrometry package are used), object recognition and test for presence in star or minor objects catalogues. Additionally, focusing support and interfaces to GPS receiver and to meteostation are located here. Although manual control is possible, astrometric processing is designed to be fully automatic.*

Hardware control *is distributed between 3 control software modules. Ethernet, USB or RS232 communications are used, depending on hardware specifics.*



Import of CPF prediction data from Internet is realized in a separate submodule. It regularly renovates local CPF database for requested satellites.

ACKNOWLEDGEMENT

This research was funded by ESF, project # 2013/0066/1DP/1.1.1.2.0/13/APIA/VIAA/059.