New telescope and observatory building to Metsähovi, Finland

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Introduction

Metsähovi Fundamental Geodetic Station of the Finnish Geodetic Institute is one of the GGOS's (Global Geodetic Observing System) Core Stations and the northernmost SLR station of the ILRS. Besides SLR, other geodetic instruments located in Metsähovi are e.g., absolute and superconducting gravimeters, GEO-VLBI (in a co-operation with the Aalto University), DORIS-beacon (CNES/IGN), GNSS receivers and as the latest one, a TerraSar-X reflector (DLR/UMunich). There are also several instruments for monitoring the environment, like the groundwater, soil moisture and weather.

The SLR operations have been offline since 2005 when the old system was shut down for renovation. The plans for renovation and upgrading were totally changed in 2012 when the Finnish government granted Finnish Geodetic Institute (FGI) a total of 8 M€ for upgrading the instrumentation of Metsähovi and the national GNSS network FinnRef.

Starting in 2012, FGI has already upgraded the permanent GNSS network of Finland during 2012-2013. A new superconducting gravimeter will be installed to Metsähovi during winter 2013-2014, also the absolute gravimeter FG-5 has been upgraded to FG-5X. At the moment, a tender for a new VLBI2010 compatible radio telescope is under preparation, aiming for a new VLBI system in 2016.

In this poster, we describe plans for the new Metsähovi SLR-station.

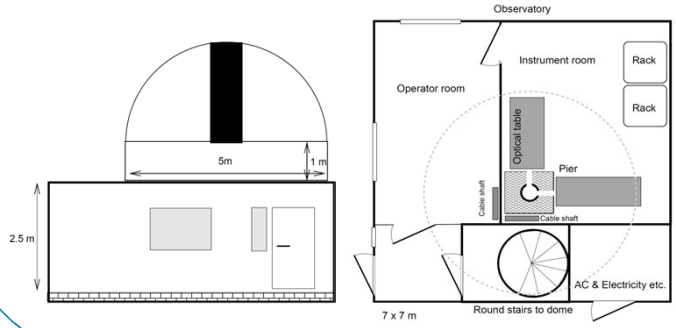
Figure 1. Panorama of Metsähovi Fundamental station. (60°13'4"N 24°23'35"E)

New telescope

After receiving the Metsähovi renovation funding, the then on-going refurbishment of the former Rigan SLR telescope was put on hiatus as priority was set to procure a new telescope that will match the speed and reliability demands of a modern kHz system, and also will be able to track even the lowest orbits precisely, accurately, and routinely in daylight.

FGI published an international invitation to tender on March 2013 for procuring a new state-of-the-art SLR telescope system to Metsähovi. Overall six tenders were received with main mirror sizes of 0.5-1.0 m. Both monostatic and bistatic designs were proposed.

In September 2013 the contract was awarded to Cybioms Corp. who will supply FGI with a bistatic 0.5 m telescope system. First light from the new Metsähovi SLR station is expected during winter 2015-2016. The telescope will constitute together with the existing hardware, HighQ 2kHz laser, Riga ET-33 and C-SPAD, a cutting-edge SLR system.



New observatory building

To provide a proper shelter for the new telescope and other SLR equipment FGI will build a new observatory building in Metsähovi (Fig. 2. & 3.). The first SLR building in Metsähovi, erected 1975 (Fig. 1.), has major moisture damage and will be torn down and replaced with a modern observatory building. The new building will have two levels: all the electronics as well as the operator room are in the ground floor; the telescope will stand on a ~3.5 meter high concrete pier on the second floor and the laser will be guided through the hollow pier up through the telescope's Coudé path. The pier will be attached straight to the bedrock that is readily available in Metsähovi. The telescope's azimuth axis will lie at approximately at a height of 4.5 meters above the ground level enabling a better field-of-view to the horizon as well as enhancing the seeing conditions. The instrument room's two optical tables and the pier's two optical exits make it possible to utilize another laser in the future for, e.g., space debris observations.

Instrument room will be air conditioned in order to keep the temperature stable, dehumidified, and pollen/dust free. Positive air pressure will be maintained for the same reason. Also the dome will have dehumified air blown in for minimizing condensation and dust building up on the telescope when not in use. The new building will be built during summer 2014 and a slit-type dome will be installed during summer/fall 2014.

In addition, a new high-end meteorological station fulfilling the standards of the World Meteorological Organization will be installed in Metsähovi during the winter 2013-2014.

Figure 2. & 3. Far left: A draft for the new observatory, showing the 5 meter dome from the East.

Left: A draft blueprint showing the ground floor of the observatory

Airplane safety

Due to the astronomical radio telescope at Metsähovi, all RF emitters are forbidden in the area. As radar is not an option as the air safety solution for Metsähovi SLR, we are investigating a solution that would utilize multiple methods for detecting airplanes in Metsähovi airspace.

During spring 2013 we installed an Alcor OMEA all-sky CCD color camera with an auto-iris feature that allows both day and night image acquisition. We also installed a passive ADS-B receiver, AirNav RadarBox. We have done preliminary work to combine these two devices with Python scripts. Together they show for the operator the positions of nearby planes and the cloudiness with a quick glance.

The screenshot below (Fig. 4.) illustrates how the positions of nearby airplanes are constantly drawn to the latest all-sky image. Here satellite information is overlaid on top of the all-sky image. Orbits of the satellites and the pointing of the telescope can be easily added to the same image within the Python code. A solution for detecting small airplanes and helicopters is still needed as those are not required to sent ADS-B info, hence are not seen by the AirNav RadarBox.

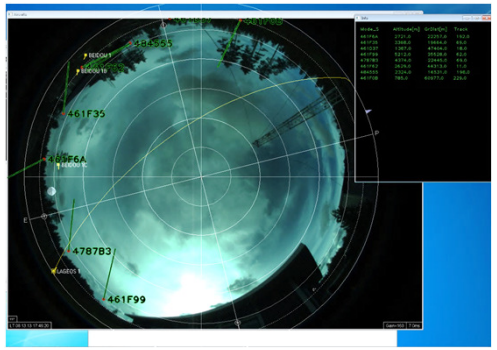


Figure 4. A screenshot showing the latest all-sky image with the airplane information (red dots and green lines) and overlaid on top of that is the satellite visibility.

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