

Progress Report on the New SLR System of GGOS's Core Site Metsähovi, Finland.

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Introduction

Finnish Geodetic Institute's (FGI) Metsähovi research station is one of the GGOS's core sites and equipped with all the fundamental space geodetic techniques together with superconducting and absolute gravimeters. First SLR observations in Finland were made at the Metsähovi research station already in 1978. In 2012 the Ministry of Agriculture and Forestry granted a special fund for upgrading the instrumentation of Metsähovi and the national GNSS network FinnRef. With this funding it became possible to acquire a completely new modern kHz-capable SLR system. Here we present the current status of the upcoming new SLR system.

New Observatory

The first SLR building in Metsähovi, erected in 1975 was torn down in August 2014 and is replaced with a modern observatory building (Fig 1. & Fig 2.). The new telescope will stand on a ~3.5 meter high concrete pier on the second floor and will be sheltered by a 5.3 meter slit-type dome by Baader Planetarium GMBH (Germany). The hollow pier has two optical windows in the ground floor from which two independent lasers can be guided up through to the telescope's Coudé path. All the SLR electronics as well as the laser will be located in a room with an almost clean-room environment and temperature stability within one degree. Operator will control everything from the second room and entering the instrument room or the dome are necessary only during maintenance or when adjusting or installing something.



Figure 1. The new SLR observatory, 22.10.2014. On the foreground the first SLR of the FGI, behind: the benchmark of the Finnish height system and the GNSS-antenna of the permanent Finnref network.

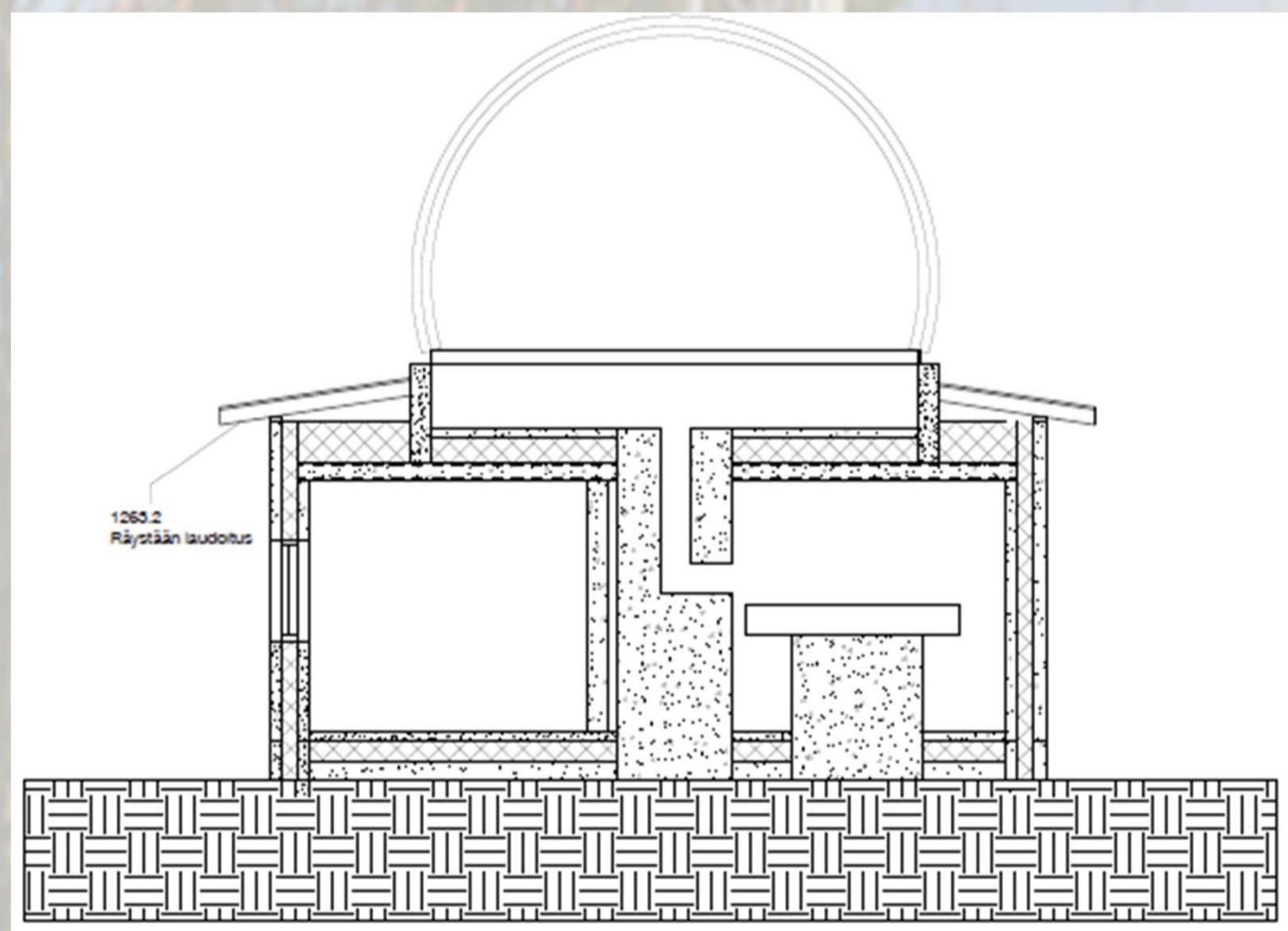


Figure 2. Blueprint of the new observatory building showing the 5.3m diameter Baader dome, and the concrete piers for the telescope and optical table where the laser is located (one storey down).

New Telescope

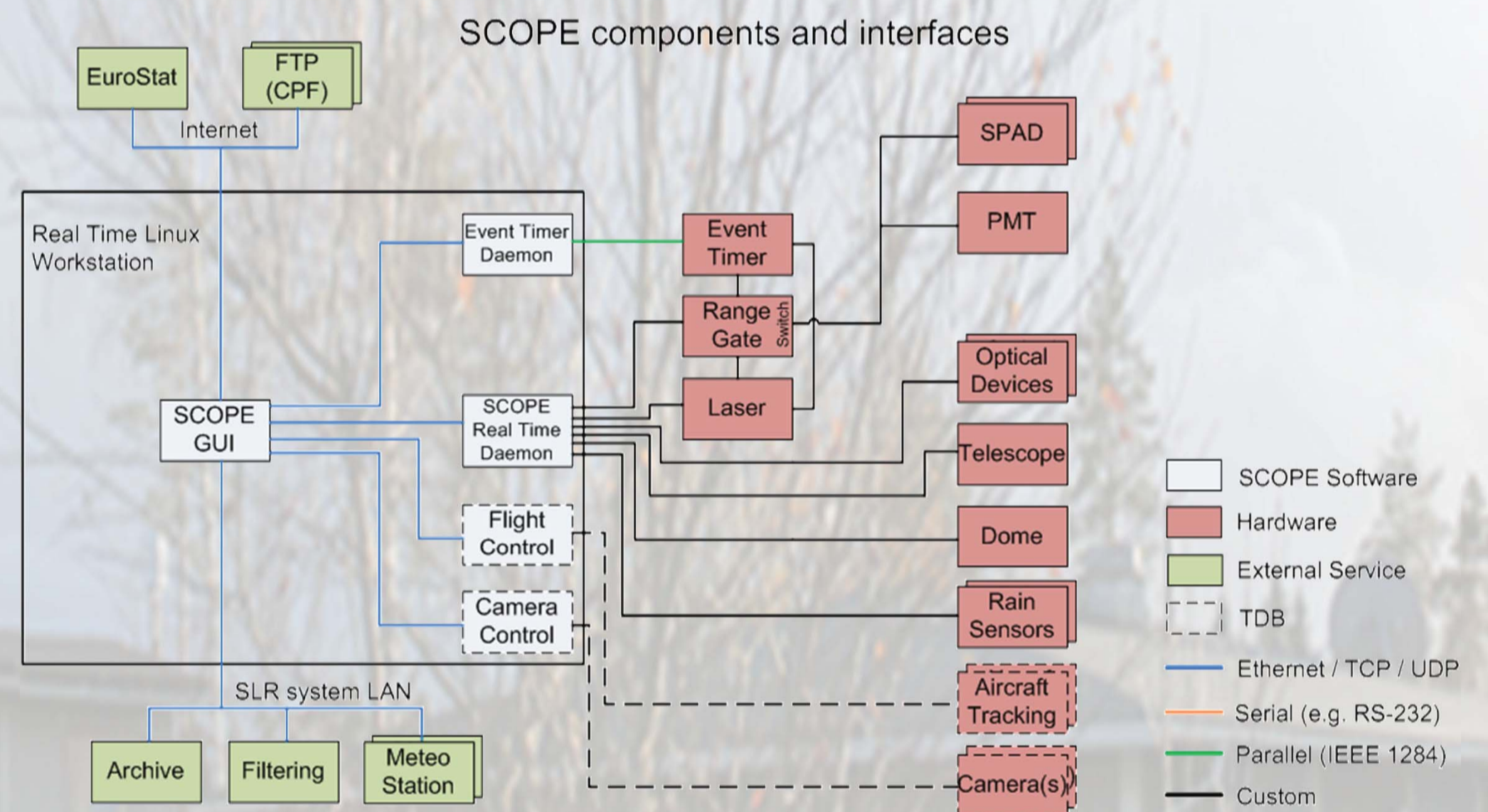
FGI published an international invitation to tender on March 2013 for procuring a new state-of-the-art SLR telescope system to Metsähovi. In September 2013 the contract was awarded to Cybioms Corp. (USA) who will supply FGI with a bistatic telescope system with a 0.5m receive telescope and a 0.1m transmit telescope. The telescope will be installed in Metsähovi during 2015. The telescope will be capable of tracking objects with orbits between 200-25000km with few arcsecond accuracy during night and day.

SCOPE – SLR Control and Operation Software

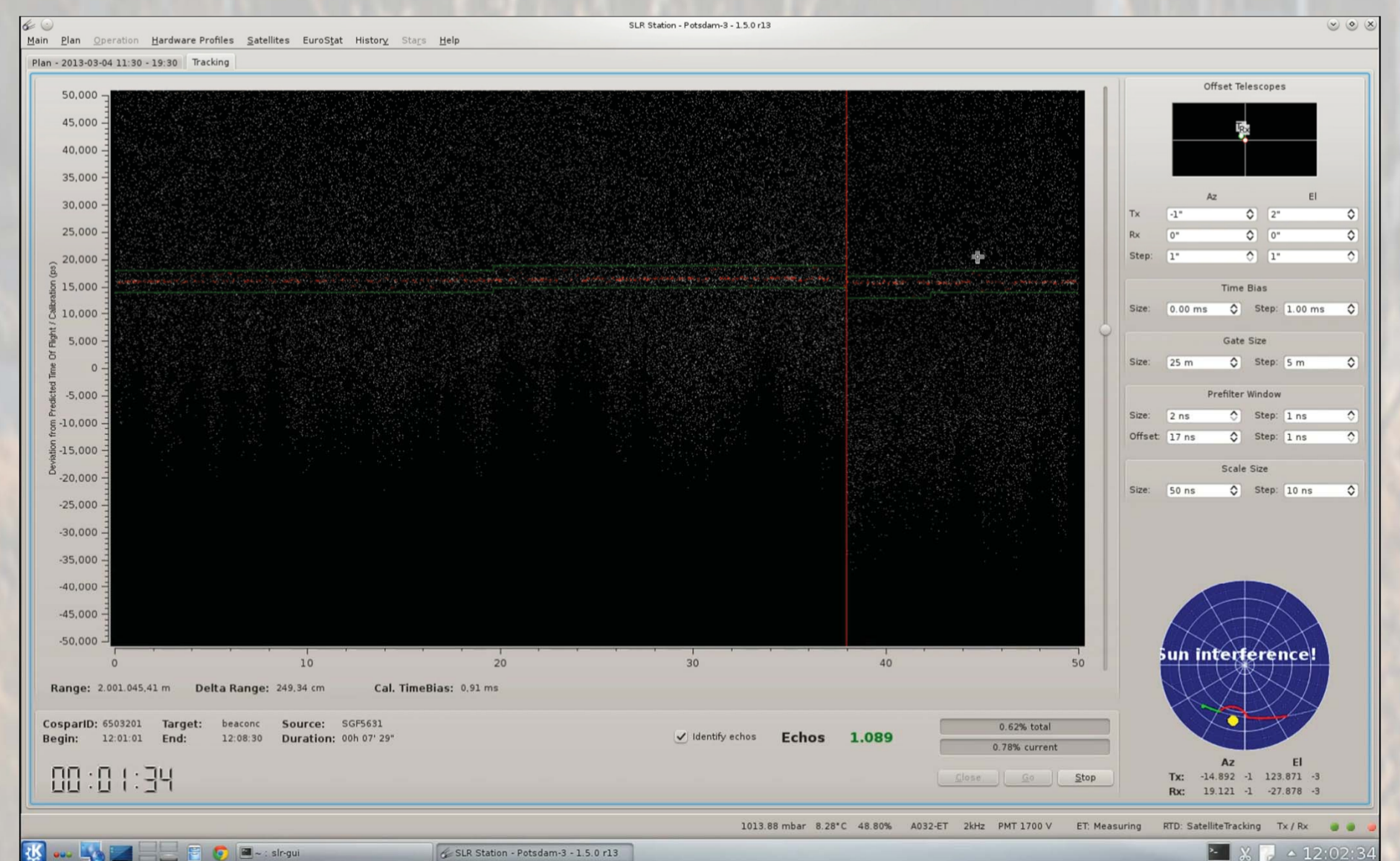
SCOPE is a software stack for SLR stations which covers all aspects of the SLR operation. It was initially designed and developed by SpaceTech GmbH (STI) for the SLR station in Potsdam and is now being adapted for the new kHz SLR system in Metsähovi. The SCOPE software stack consists of a daemon which commands and controls all station hardware components in real-time, an operator interface which allows the operator to monitor and perform all SLR operations and the SCOPE station simulation for software verification, troubleshooting and training. All these software components are running on a single Linux based workstation (with real-time kernel).

Key aspects:

- Build on top of a state-of-the-art operating system with continuous long-term support
- Modern modular software design which allows extending the software for new SLR applications
- Flexibly exchangeable drivers for all hardware components like telescope, dome, range gate, laser, optical devices, rain & meteo sensors, ... allowing an adaptation of the software to different SLR stations
- Configurable safety limits for hardware and operations like speed limits for dome and telescope, minimal sun distance, minimum tracking elevation, ...
- Easy to use central operator interface to command and control all aspects of the station and the SLR operation



Figures 3&4. Above: Box diagram of SCOPE. Below: Screenshot of SCOPE user interface while tracking Beacon-C with automatically performed sun avoidance.



The new range gate

SpaceTech GmbH and GFZ are currently developing an enhanced version of the existing Potsdam range gate for the Potsdam and Metsähovi SLR systems. Beside a major hardware upgrade, the new version will also include a newly developed firmware. The hardware upgrade is based on commercial off-the-shelf hardware components for easy reproduction and includes a faster processor and a better time resolution. The new firmware will support all the standard SLR applications but is already designed to be extended for advanced SLR applications like synchronised space debris tracking together with other stations.