Budapest University of Technology and Economics
Department of Geodesy and Surveying

ETH zürich

AGU FALL MEETING

G51B-0360

Precise Astronomical Azimuth Determination by QDAEDALUS System to the Sun, Moon, and Planets in Daytime Conditions

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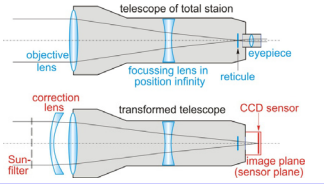
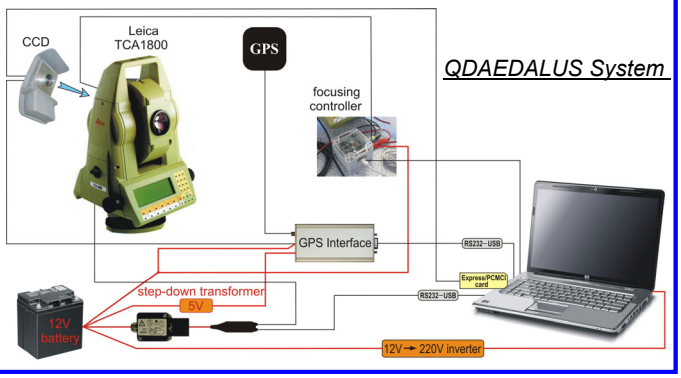
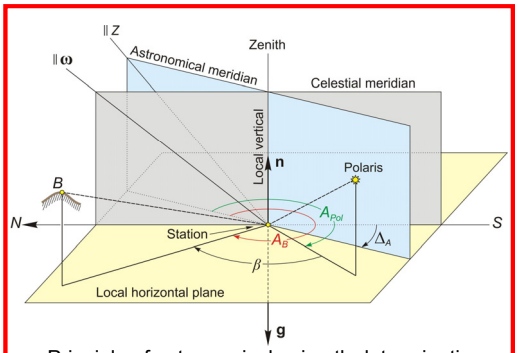
Traditional method of astronomical azimuth determination involves measurements at night to stars (Polaris). QDAEDALUS, developed by the team of the Geodesy and Geodynamics Lab (GGL, led by Prof. M. Rothacher) of ETH Zürich is a unique system combining Total Stations and modern CCD technique. It provides precise astronomical azimuths within 15 minutes of observation time at night. Furthermore, observations in daytime conditions are a challenging requirement in practice of Astro-geodetic azimuth determination. In order to perform daylight measurements, the QDAEDALUS system has been improved by allowing precise azimuth measurements to Sun, Moon, and Planets in daylight conditions by expanding the processing software with precise solar, lunar, and planetary ephemerides. With such functionality the system has a unique capability to measure astronomical azimuths with an accuracy of 0.3-0.5 arcsecs in normal daylight conditions within 15 to 20 minutes of measurement time.





QDAEDALUS System

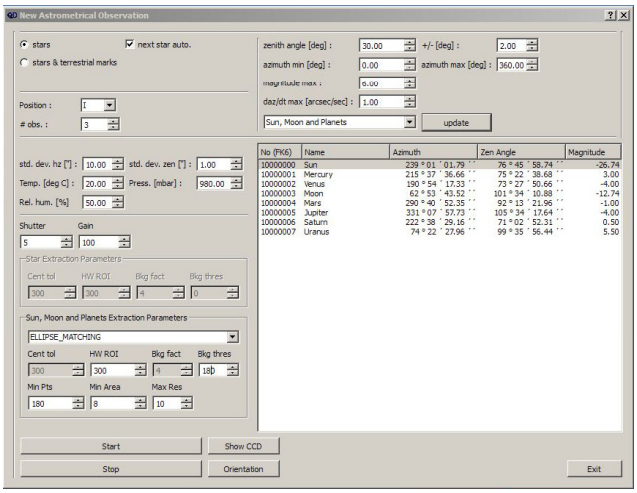


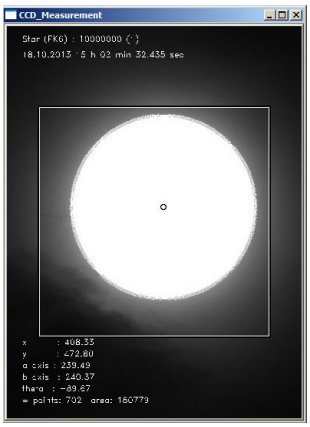
Principle of astronomical azimuth determination

GYROMAT 5000
gyrotheodolite (DMT GmbH)
measurement time: 6-9 min
accuracy: ±2.5" (1σ)
www.dmt.de

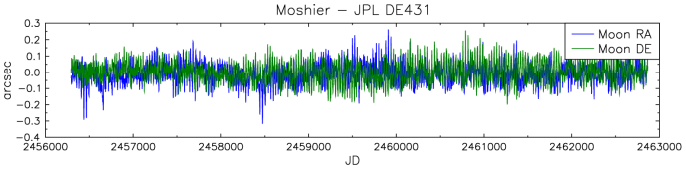
QDAEDALUS
measurement time: 10 min
accuracy: ± 0.3"- ±0.5" (1σ)

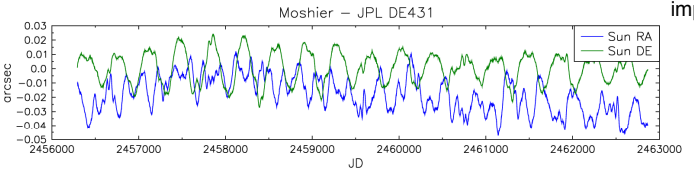
Solar azimuth measurement with QDAEDALUS





CCD image of the Sun with solar filter (matching ellipse shown)





Steve Moshier's C algorithm (www.moshier.net) has been implemented for QDAEDALUS and compared to NASA JPL DE431 solar, lunar and planetary ephemerides, RA (right ascension), DE (declination)

Summary Determination of the astronomical azimuths is not very popular, due to the difficulty of the calculations and the need for night observations. In order to perform daylight measurements, the QDAEDALUS system has been improved by allowing precise azimuth measurements to Sun, Moon, and Planets in daylight conditions.

Accuracy of azimuth determination with QDAEDALUS (to Polaris): ± 0.3"
Time of azimuth measurement: approx. 10-15 minutes
Expected accuracy of solar azimuth determination: ± 0.3" - ± 0.5"
Expected measurement time: 15-20 minutes