Federal Office
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Surveying

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Geodetic Observations and Geopotential Determination for the Optical Clock at BEV

Compliance with requirements of modern time and frequency metrology

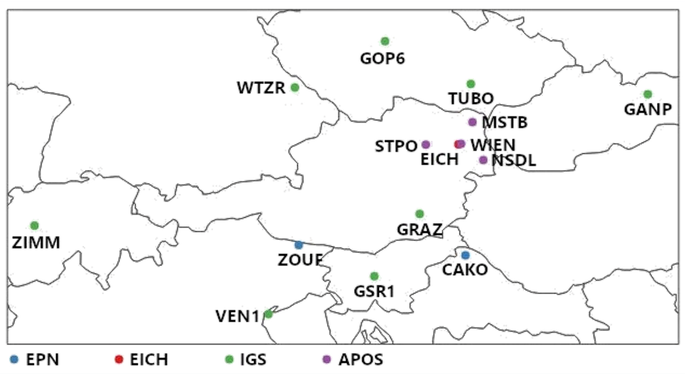
- Determination of the gravity potential at the location of BEV's new optical clock
- Required for relativistic frequency corrections and international clock comparisons
- Target uncertainty: < 1 m^2/s^2
  - Equivalent to a height accuracy of approx. 10 cm
  - Supports frequency uncertainties at the 10^{-17} level

GNSS Observations

- Permanent GNSS antenna operated continuously over several weeks
- Coordinates determined in the International Terrestrial Reference System (ITRS)
- Sub-centimetre positioning accuracy achieved
- Enables long-term monitoring of site stability



GNSS antenna on roof of BEV. ©



GNSS network used for position and height estimation in ITRF2020.

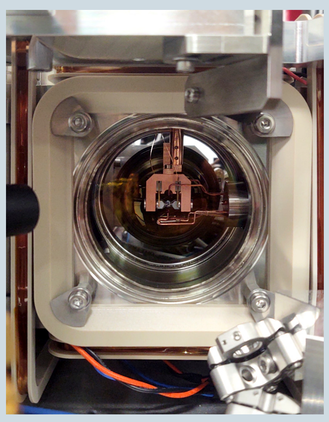
Survey & Levelling

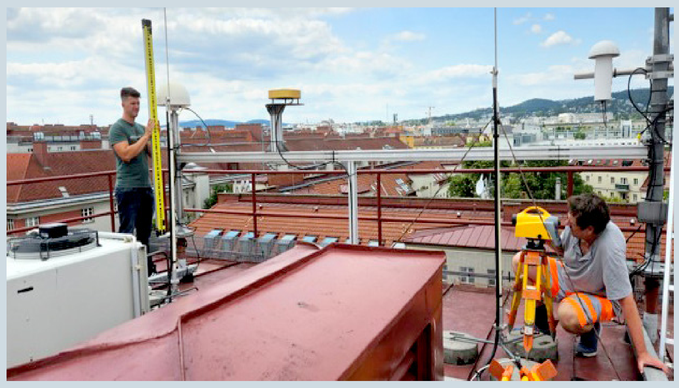
- Transfer of coordinates from rooftop antenna to clock reference point
- Combination of trigonometric surveying and precision levelling
- Connection to Austria's national height reference network
- Additional gravity observations for consistency checks

Rack of atomic clock.



Atomic clock opened for inspection.

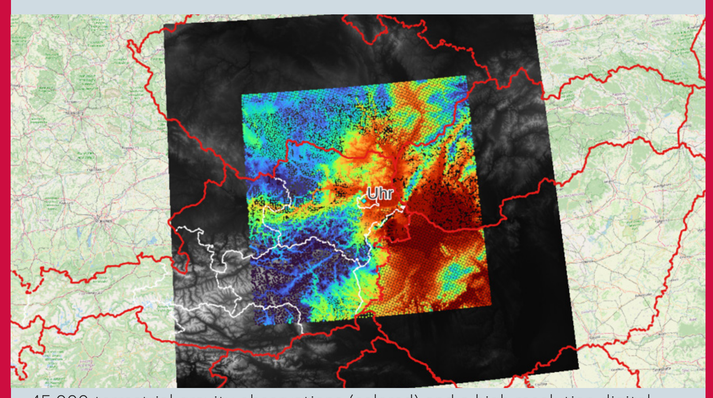




Local levelling survey. ©

Gravity Field Modelling

- Computation performed using the GROOPS software developed at TU Graz
- Local gravity field model covering a radius of 250 km around Vienna
- Based on:
  - Global gravity model (EGM2008)
  - ~45,000 terrestrial gravity observations
  - High-resolution digital terrain model
- Gravity data from BEV measurement campaigns and the European Alps Geoid Project (EAlpG)



45,000 terrestrial gravity observations (colored) and a high resolution digital terrain model (greyscale) used to calculate the gravitational potential.

EUREF Symposium 2026
Blauensteiner, F., Butta, H., Eigner, A., Fredriksson, J., Haslinger, M., Hellerschmied, A., Junker, M., Lercher, T., Lielacher, T. Mayer, D., Pavlov, S., Walenta, A., Zahn, E.
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