

## AUTODIF at CONRAD: towards an Automatic Magnetic Observatory

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**An automatic instrument allowing accurate measurement of the geomagnetic field direction was installed in CONRAD, a world première. Operation of the AUTODIF is fully automatic and performs a full vector attitude measurement every half hour with accuracy better than 6 arcseconds. AUTODIF will deliver absolute measurements able to calibrate the many CONRAD magnetometers.**

Automatic magnetic observatories do not yet exist because the geomagnetic field vector orientation measurement needs a human operator. AUTODIF (Fig. 1) aims at changing this by performing the task automatically.

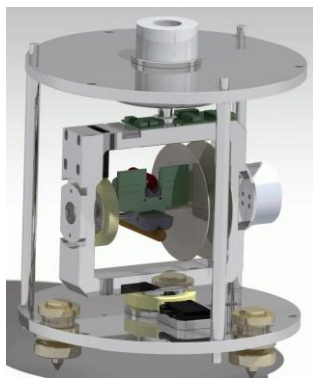


Figure 1: AUTODIF MKII v2.0. Note the special non-magnetic motors (in black) carrying out the rotations about horizontal and vertical axes normally performed by a human operator.

ZAMG and RMI of Belgium have been collaborating during many years in the construction of the Austrian geomagnetic observatory (our first contacts date back to 1982!). AUTODIF was acquired in 2008. A first test installation of the AUTODIF MKI was performed in 2009 in the seismic tunnel. In 2013, when the geomagnetic tunnel was ready, the current installation was planned.

AUTODIF is essentially a robotized theodolite with the extraordinary property that it is entirely non-magnetic. Therefore, the angles measured by this device are truly the ones that the natural geomagnetic field vector makes with our terrestrial reference frame (magnetic declination and inclination). Together with measurements from a proton magnetometer, the full geomagnetic vector is determined absolutely and opens the way to an automatic observatory.

This installation aims at a permanent presence on a pillar in the absolute section of the geomagnetic tunnel of the Conrad observatory (Fig. 2); therefore special precautions have been taken to ensure continuous and reliable operation over the lifetime of the instrument (Fig. 3). The accuracy in measuring the angles is better than 0.1 arcminute, the sampling rate of the measurement being adjustable, ranging from 4/hour to 1/week.



Figure 2: Installation location details. The insert shows a 50m distant corner cube, reflecting AUTODIF's laser beam. It is used as a directional reference.

Controls and data of AUTODIF are available over ZAMG's LAN and beyond in raw format and as final angular values. AUTODIF is designed, constructed and tested by RMI in its "Magnetic Valley" instrumentation facilities of Dourbes, Belgium ([info@magneticvalley.be](mailto:info@magneticvalley.be)).



Figure 3: ZAMG scientists with Eng. Bracke, making a point during the installation of AUTODIF. Note the blue housing protecting the instrument from dust and humidity.

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