

# New developments on the full tensor magnetic gradiometer system

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## ABSTRACT

INFLUINS is a German research program which investigates the movement of fluids (and associated gases) in the Thuringian sedimentary basin. The phrase "integrated fluid dynamics" in the project name highlights the interest in the relationship between near surface and deeper fluid and material flows.

One major part of the program is to examine shallow and medium depth structures, for instance to understand fluid-fault interactions, using magnetic field measurements. The main tool is an instrument measuring the full tensor of the Earth's magnetic field (FTMG) in airborne or ground based operation. The sensors are planar gradiometer of first order with a base line of 3.5 cm and a sensitivity of below 100 fT/(m\*sqrt(Hz)) based on low temperature Superconducting Quantum Interference Devices so called SQUIDS. The gradiometers effectively suppress the Earth's magnetic field by about four orders of magnitude and are well suited to map the gradient of the Earth's magnetic field. A low sensitive reference magnetometer triplet is used in order to enhance the suppression by another three orders of magnitude.

The system can be operated in a nonmagnetic bird towed by a helicopter at low altitude or on a nonmagnetic cart towed by a 4x4 car. Both operations allow the investigation of huge areas in short time and record the full tensor gradient of the magnetic field.

Here, we introduce the new features of an airborne FTMG system which provides superior performance in fixed wing and helicopter based applications compared to conventional Caesium type magnetometers. First of all we could half the length of the liquid helium cryostat. This enabled to build a new tow fish with a much more aerodynamic shape. Additionally, we improved the performance of the inertial measurement unit which leads to a better transformation from the body to a georeferenced coordinate system.

First results of the new system in a newly developed bird flown in three survey areas in the Thuringian basin are shown. Standard deviation of noise level is lower than 60pT/m throughout a whole survey area. Examples of 2D maps of tensor components with high spatial resolution are presented.

**Key words:** SQUID, magnetic field sensor, gradiometer, full tensor, airborne, exploration