

MetroMag: a European infrastructure for low magnetic field metrology

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The MetroMag European project involves 16 partners from 12 different countries, including National Metrology Institutes, Universities, Research centres and enterprises that are experts in magnetic field measurements, with the aim of developing improved capabilities for measurements and calibrations of low-intensity magnetic fields (10 μ T – 10 mT), with uncertainty ranges between 2 mT/T and 0.2 mT/T respectively.

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1. Introduction

Measurements in the low magnetic field range (10 μ T – 10 mT) are increasingly required in key areas such as electric mobility, medicine, industry, safety applications, geological prospecting. However, only very few European National Metrology Institutes have the required capabilities to perform traceable measurements in this low magnetic field range. Consequently, the adoption of novel technologies and materials is hindered by the lack of pan-European metrological expertise in this area. A new European project, 24RPT02 MetroMag [1], will address these issues involving 16 partners from 12 different countries.

2. Results and discussion

Primary standards of magnetic field are based on nuclear magnetic resonance in water, and are limited to a few tens of mT. The only key comparison on magnetic field intensity dates back to more than 20 years, and today a new comparison would be difficult to perform. Moreover, compensation of the environmental magnetic field (Figure 1 shows a typical 3-axes compensation setup based on Helmholtz coils) has become a challenge because of the increasing electromagnetic pollution.

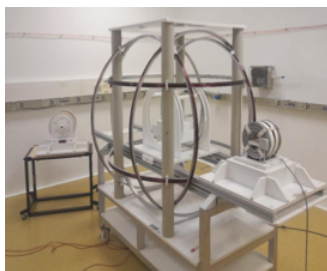


Figure 1: Typical environment magnetic field compensation setup, based on 3 orthogonal Helmholtz coils and a fluxgate sensor working as a zero detector.

The MetroMag project [1], from July 2025 to June 2028, will address these issues aiming at five main objectives:

1. Developing measurement and calibration standards for low-strength magnetic fields;

2. Developing a travelling standard, and associated procedures and best practices, to establish and validate a capability for traceable low magnetic field measurement among the participating partners;
3. Developing new methods and algorithms for environment magnetic field compensation during calibrations;
4. Developing a suitable network of National Metrology Institutes at the European level for magnetic field measurements;
5. Transferring metrological developments, technologies and infrastructures to technical committees, standardisation bodies, stakeholders, society and users.

Different approaches will be exploited for low-strength magnetic field measurement, i.e. free-precession nuclear magnetic resonance, SQUID, ³He and optical magnetometers, novel types of fluxgates. Active compensation or gradiometer configurations will also be exploited for environment field compensation. An interlaboratory comparison will be performed with a set of uncalibrated travelling coils that will pave the way to future dissemination of the Tesla unit and to worldwide key comparisons. Members of academia, industry and standardisation bodies are welcome to join MetroMag as stakeholders. Visit the website [1] for more information.

References

- [1] <https://sites.google.com/inrim.it/metromag>

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