



Contribution ID: 971 Contribution code: TUE-OR1-304-05

Type: Oral

## Optimizing single-turn coils for scientific applications beyond 100T

*Tuesday 16 November 2021 11:00 (15 minutes)*

We report on recent progress regarding the practical use and characterisation of fields in the 100-200T range with microsecond-duration at the LNCMI high-field magnet facility. Our Megagauss platform makes use of single-turn coils with 8-15mm diameter that are destroyed in the process, albeit with a close-to-100% chance of survival for scientific equipment in the bore. The setup permits several shots per day and is mainly used for experiments in condensed matter physics by LNCMI scientists and external users. In this context, our technical objectives are: firstly, a better characterisation of the generated field with respect to homogeneity requirements taking into account the coil deformation and asymmetry; and secondly, a better control of destructive effects associated with the explosive sublimation of conductor material at the highest fields. For this purpose both experimental and theoretical studies have been performed. A computer code has been developed that uses a multi-filamentary approach to first simulate the coil expansion, local heating and dynamic current distribution during a shot. The result is used to map out the field profile and to identify conductor regions with substantial sublimation. These hot-spots can then be treated by considering appropriate changes of the conductor's cross-sectional geometry. Originally based on circular current loops, we have also extended our approach to 3 dimensions using polygonal filaments to simulate the current feed-gap, i.e. the point where the current enters and leaves the coil, and its effect on field homogeneity. Experimentally, our principal tool are precise field and field-distribution measurements using pick-up and gradient coils as well as Faraday rotation imaging. Destructive effects at the highest fields are evaluated based on the post-mortem analysis of coil fragments, damage suffered by plastic tubes placed inside the bore and impact traces on protective elements.

**Primary authors:** Dr PORTUGALL, Oliver (CNRS-LNCMI); Dr DRACHENKO, Oleksiy (CNRS-LNCMI); Dr RIKKEN, Geert (CNRS-LNCMI)

**Presenter:** Dr PORTUGALL, Oliver (CNRS-LNCMI)

**Session Classification:** TUE-OR1-304 Resistive and Pulsed High-Field Magnets