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Design and tests of the 100 T triple coil at LNCMI

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The Laboratoire National des Champs Magnétiques Intenses (LNCMI) is a French host facility for experiments in high magnetic fields. Based on two sites, the LNCMI offers routinely static magnetic fields up to 36 T at its Grenoble site and pulsed magnetic fields up to 90 T using non-destructive magnets and up to 180 T using single-turn magnets at its Toulouse site. Internal research is carried out in the lab and experiment time is allocated to external researchers. LNCMI is a member of the European Magnetic Field Laboratory (EMFL) with the Hochfeld-Magnetlabor in Dresden (HLD) and the High Field Magnet Laboratory in Nijmegen (HFML). The LNCMI develops all the instrumentation required by experiments in high magnetic field, in particular, the electromagnets that generates these high fields.

The main difficulty to generate a very high magnetic field in a non destructive way is to contain the stresses on the magnet conductors due to the Lorentz forces. We will present the design and the first operation of a new type of pulsed magnet consisting of three nested coils energized with three independent capacitor banks. This triple coil, unique in the world, associated with the most powerful generators of the LNCMI, reached a peak field value of 98.8 T in February 2017 and permits to LNCMI to break the European record of non-destructive pulsed magnetic field established at 95.6 T in October 2016 by HLD.

The objective is to go beyond the symbolic limit of 100 T and the world record of 100.75 T kept by the Los Alamos National Laboratory since June 2012. We will describe the next steps toward this goal and some ways to go beyond, keeping in mind that this magnet is before everything else a tool for scientific research, in particular to explore the fundamental properties of the matter.

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