



Contribution ID: 970 Contribution code: WED-PO2-306-04

Type: Poster

## Energy efficiency of resistive high field magnets –the role of magnet technology and power supply operation

*Wednesday, 17 November 2021 10:30 (20 minutes)*

The design and operation of resistive high field magnets require research and development in materials science, power supply engineering and instrumentation. Additionally, their energy efficient operation has become a growing constraint. The French National High Magnetic Field laboratory at Grenoble (LNCMI) is continuously improving its high magnetic field platform in order to satisfy the demands of the user community and to use the high electric power resource in the most efficient way.

We report on recent advances on an energy efficient use of the LNCMI resistive magnets that can reduce energy consumption by up to 20%, for a given user experiment. This saving is possible due to a special architecture of the LNCMI high field magnets: they consist of two independent concentric sub magnets exhibiting different field characteristics, i.e. absolute field value for a given current and spatial field distribution. Both sub-magnets can be powered in an independent way. Thus, the current in each sub-magnet can be tuned to minimize the total electrical power for a target magnetic field requested by the user. This enables energy efficient operation. However, the consequences of strain enhancement on magnet safety and life time due to higher current densities in the inner sub magnet have to be considered.

LNCMI magnet design, power supply and instrumentation teams have recently implemented this innovative operation mode in a collaborative project. We will present its technical realization including electrical power modelling, magnet parameter simulations as well as first benchmark experiments including NMR. Finally, we will discuss the benefits, risks and perspectives in terms of energy efficiency, versatility, field quality and sustainable magnet operation.

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**Session Classification:** WED-PO2-306 Resistive and Pulsed High-Field Magnets