# DRF: Thesis SL-DRF-19-0486

## RESEARCH FIELD

Mechanics, energetics, process engineering / Engineering science

## TITLE

Study of the Thermomechanical Behavior of the Superconductor Nb3Sn in Coils for Future Accelerator Magnets

## ABSTRACT

In order to develop future particle accelerators such as the Future Circular Collider (FCC), high field superconducting electromagnets (higher than 15 T) are necessary. The superconductor Nb3Sn is aimed, however it causes some technical issues yet not solved during its production. The Nb3Sn is produced in the form of cables of the Rutherford type. These cables are then wound to form the coils of the electromagnet. Following winding, the conductor requires a heat treatment at 650°C in order to form the Nb3Sn superconducting phase. It is now established that significant dimensional changes of the strands occur during this phase change, translating in dimensional changes of the cables. If these changes in dimensions are not permitted by the tooling, mechanical stress add up in the coil and the superconducting performances degrade. Currently this issue is dealt with empirically by allowing clearances in central posts, around which are wound the superconducting cables, and by varying iteratively the clearances. However, the thermomechanical behavior of the Nb3Sn cables in a coil during the heat treatment needs to be quantified. The goal of this thesis is to observe and understand the changes of dimensions of this type of Nb3Sn conductors in order to help dimensioning the coil fabrication tooling for future accelerator magnets, and potentially improve their performances.

## LOCATION

Institut de recherche sur les lois fondamentales de l'univers
Département des Accélérateurs, de Cryogénie et de Magnétisme
Laboratoire d'Etudes des Aimants Supraconducteurs
Place: Saclay
Start date of the thesis: 01/10/2019

## CONTACT PERSON

Etienne Rochepault
CEA
DRF/IRFU/DACM
Bat. 123 Pce 310
F-91191 Gif-Sur-Yvette Cedex
Phone number: +33 1 69 08 37 75
Email: etienne.rochepault@cea.fr

## UNIVERSITY / GRADUATE SCHOOL

Paris-Saclay
Sciences Mécaniques et Energétiques, Matériaux et Géosciences (SMEMaG)

## FIND OUT MORE

https://www.researchgate.net/profile/Etienne_Rochepault
http://irfu-i.cea.fr/dacm/index.php

## THESIS SUPERVISOR

Olivier Hubert
ENS Pari-Saclay
LMT
61 avenue du président Wilson, 94235 Cachan