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Design and manufacture of the large-bore 8T superconducting solenoid for the NAFASSY test facility

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A wide bore superconducting solenoid is the core of the NAFASSY (National Facility for Superconducting Systems) test facility, which is under construction at the University of Salerno. The NAFASSY laboratory is a joint program among University of Salerno, ENEA, CRdC and INFN under the financial support of the Italian Ministry for University and Research. The facility, hosted in a new building, includes a 250 W supercritical He refrigerator, a 20kA two quadrants (-20V, +25V) power converter for feeding the solenoid or INFN fast ramped accelerator magnets, and a 50kA/+12V power supply for the testing sample. The completion and the commissioning of the facility is foreseen within 2016. The NAFASSY magnet is a large-bore Nb₃Sn solenoid, able to provide a peak field of 8 T close to the insert inner radius. Having a warm bore diameter of 1144 mm and a height of 1276 mm, the solenoid will allow to perform tests relevant for long size NbTi or medium-field Nb₃Sn Cable-In-Conduit Conductors (CICCs), as well as small magnets, at variable temperature (ranging from 4.2 K to 10 K) in the presence of a transverse magnetic field. In fact, the warm bore makes the sample under test to be independent of the background solenoid. The design of the magnet is based on a rectangular CICC, cooled by forced flow supercritical He at 4.5 K and fed at a maximum current of 20 kA through a pair of high temperature superconductors current leads. The detailed design of the 8T solenoid, including the electro-magnetic, structural and thermo-hydraulic analysis, will be reported, as well as the production status.

Primary author: CORATO, Valentina (ENEA- C.R. Frascati, Italy)

Co-authors: Dr DI ZENOBIO, Aldo (ENEA- C.R. Frascati, Italy); Dr ANEMONA, Alessandro (ICAS); Dr DELLA CORTE, Antonio (ENEA - C.R. Frascati, Italy); Dr FIAMOZZI ZIGNANI, Chiarasole (ENEA- C.R. Frascati, Italy); Dr TOMASSETTI, Giordano (ENEA- C.R. Frascati, Italy); Dr MESSINA, Giuseppe (ENEA- C.R. Frascati, Italy); Mr AFFINITO, Luigi (ENEA- C.R. Frascati, Italy); Dr MUZZI, Luigi (ENEA- C.R. Frascati, Italy); Mrs FREDA, Rosa (ENEA- C.R. Frascati, Italy); Mr CHIARELLI, Sandro (ENEA- C.R. Frascati, Italy); Dr TURTÙ, Simonetta (ENEA- C.R. Frascati, Italy); Dr BESI VETRELLA, Ugo (ENEA- C.R. Frascati, Italy); Dr GAMBARDELLA, Umberto (INFN- Sezione di Napoli, Italy)

Presenter: Dr DELLA CORTE, Antonio (ENEA - C.R. Frascati, Italy)

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