



Contribution ID: 1360

Type: Contributed Oral Presentation

Mon-Mo-Or1-05: Updates on the conceptual design of the European DEMO superconducting magnet system

Monday 23 September 2019 12:30 (15 minutes)

In DEMO fusion reactor the confinement of the plasma is achieved through the magnetic field generated by superconducting coils. The DEMO magnet system includes 16 Toroidal Field (TF) coils, 6 Poloidal Field (PF) coils and 5 modules for the Central Solenoid (CS) magnet. For the TF coils, four winding pack options are presented: one solution reproduces the ITER concept with radial plates, whereas the other three designs explore different winding approaches (pancakes vs. layers) without radial plates, and manufacturing techniques (react & wind vs. wind & react Nb₃Sn), with the aim of improving the effectiveness of the conductors and propose cost effective solutions for the magnet system.

For the CS modules two designs have been proposed: the first is based on a pancake wound W&R Nb₃Sn conductor, like in ITER. The second concept is based on a hybrid design with layer-wound sub-coils using HTS conductors in the high field section. Compared to the first option, the hybrid configuration allows keeping the same flux with reduced size or increasing the flux keeping the same size. Two different designs are also presented for the PF coils, following the concept that one solution is similar to the ITER one, whereas the second explore alternative concepts, such as the design of PF 1 and PF6 wound with Nb₃Sn Cable-in-Conduit Conductors.

In order to validate the designs, thermal-hydraulic and mechanical analyses are carried out for all WPs, as well as experimental tests on full size and sub-size prototypes. Results are encouraging, with some critical aspects that shall be solved in future designs.

Finally, preliminary studies of the auxiliary systems (fast discharge units, feeders and cryogenic system), aiming to optimize the power consumption and the space allocation, are presented.

Authors: CORATO, Valentina (ENEA); Dr ANEMONA, Alessandro (ICAS); BAGRETS, Nadezda (Karlsruhe Institute of Technology -KIT); Mr BRIGHENTI, Alberto (Politecnico di Torino); BONIFETTO, Roberto (Politecnico di Torino); Dr BONNE, François (CEA/SBT); Prof. BOSO, Daniela (University of Padova); BRUZZONE, Pierluigi (EPFL-SPC); D'AURIA, Vincenzo (EPFL - EPF Lausanne); DAN, Mattia (Consorzio RFX); Mr DELLA CORTE, Antonio (ENEA); DEMBKOWSKA, Aleksandra (West Pomeranian University of Technology); DICUONZO, Orestia (EPFL-SPC); DI ZENOBIO, Aldo (ENEA); FIETZ, Walter (KIT); GAIO, Elena (Consorzio RFX); GIANNINI, Lorenzo (ENEA); HELLER, Reinhard (Karlsruhe Institute of Technology); HOA, Christine (CEA SBT); IVASHOV, Ilia (Forschungszentrum Jülich GmbH); KUMAR, Mithlesh (PSI - Paul Scherrer Institut); Mr LACROIX, Benoît (CEA IRFM); LEWANDOWSKA, Monika (West Pomeranian University of Technology, Szczecin); MAISTRELLO, Alberto (Consorzio RFX); MANTEL, Nicolas (CEA); MORICI, Luigi (ENEA); MUZZI, Luigi (ENEA); Mrs NICOLLET, Sylvie (CEA IRFM); NIJHUIS, Arend (University of Twente); NUNIO, Francois (CEA); Dr ROMANELLI, Gherardo (Tratos); SARASOLA, Xabier (EPFL); SAVOLDI, Laura (Politecnico di Torino); SEDLAK, Kamil (EPFL Lausanne); STEPANOV, Boris (EPFL-SPC); TISEANU, Ion (INFLPR); TOMASSETTI, Giordano (ENEA); TORRE, Alexandre (CEA); TURTU', Simonetta (ENEA/ICAS); UGLIETTI, Davide; VORPAHL, Christian (EUROfusion); Dr WEISS, Klaus-Peter (KIT, Institute for Technical Physics); WESCHE, Rainer (EPFL); WOLF, Michael (Karlsruhe Institute of Technology (KIT)); ZANI, Louis (CEA); ZANINO, Roberto (politecnico di torino)

Presenter: SEDLAK, Kamil (EPFL Lausanne)

Session Classification: Mon-Mo-Or1 - Fusion II: Projects Around the World