Contribution ID: **889** Type: **Contributed Oral Presentation**

C2Or1A-02: Survey of Magnet Designs Developed for the Future Circular Collider Detectors

Tuesday, 23 July 2019 11:15 (15 minutes)

Since 2014 a conceptual design study is ongoing at CERN for defining Detector Magnets for the Future Circular Collider. A new 100 km circular collider is foreseen whereby collision products are probed by new particle detectors. Magnet variants were optimized for the case of electron-positron (ee), electron-hadron (eh) and hadron-hadron collisions (hh) detectors. This year 2019 the conceptual design reports covering these designs are published and includes the baseline designs for the various Detectors.
For FCC-ee detectors two variants were defined: a 7.6 m bore and 7.9 m long classical 2 T / 600 MJ superconducting solenoid surrounding the calorimeter; and a very challenging 4 m bore, 6 m long, ultra-thin and radiation transparent 2 T / 170 MJ superconducting solenoid surrounding the tracker only.
For FCC-eh, the detector solenoid is combined with a dipole magnet required for guiding the electron beam in and out the collision point. The detector magnet in this case features a 3.5 T / 230 MJ, 2.6 m free bore and 9.2 m long superconducting solenoid.
Most demanding is the FCC-hh detector requiring a 14 GJ magnet system of three series connected solenoids. A 4 T superconducting main solenoid with 10 m free bore, 20 m long, is in line with two 3.2 T superconducting forward solenoids with 5.1 m free bore, 4 m long.
The detector magnets proposed need further engineering in the years to come. The conductor technology though, is common to all solenoids and shows NbTi/Cu strands based Rutherford cables, stabilized with Ni doped pure Al and eventually structurally reinforced by Al allow. The cold masses are conduction cooled. The various magnets are presented and the engineering challenges highlighted.

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Session Classification: C2Or1A - Large Scale Systems III