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[Invited Oral] Design Options of the Superconducting Detector Magnets for a very large 100 TeV Hadron Collider

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Early 2014 a new design study has started at CERN for a future 100 TeV circular proton-proton collider, a factor 7 more than in the present LHC. A new 100 km tunnel for the collider magnets is foreseen as well as two new general purpose detectors. A conceptual design report is to be issued in 2018 for consideration by CERN and collaborating institutes. The new 100 TeV collider may be operational earliest medio 2040.

The increase in collision energy from 7 to 100 TeV implies a scaling up of the detector magnets as well in size and magnetic field for maintaining particle detection resolution. Options for the new detector magnet systems are being explored. Option one is a scaling up of the ATLAS magnet system layout based on using toroids for muon tracking and a solenoid for the inner detector. Also two dipole magnets are incorporated for covering the low angle forward directions. In a similar way the second option features a scaled-up CMS solenoid but also in combination with two dipole magnets.

The outer dimensions of the magnet systems show a diameter of 20-30 m and an overall length of 40 to 50 m. The magnetic field in the bores of the large toroid and solenoid will go up to some 2.5 and 6 tesla, respectively, with peak magnetic fields in the 7-8 tesla range, still possible with NbTi technology. The magnetic stored energies are in the record range of 50-100 GJ.

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