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Superconducting magnet structures and developments for 4th Generation ECR ion sources

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In an Electron Cyclotron Resonance (ECR) ion source for heavy-ion accelerators, the plasma is confined by a magnet system composed by a combination of sextupole and solenoid coils which generate a magnetic field characterized by closed iso-surfaces. Third generation sources operate at RF frequencies in the 20 to 30 GHz range and implement coils made with Nb-Ti superconductor producing magnetic fields of 6 to 7 T. Fourth generation sources aim at RF frequencies at the 50 GHz level. For these sources, the magnet system relies either on Nb-Ti superconducting coils with innovative and more efficient designs, like the MARS magnet currently under development at Lawrence Berkeley National Laboratory (LBNL), USA, or on the use of advanced superconducting materials, like Nb3Sn, which can achieve magnetic fields of up to 15 T. The latter option is being investigated both at the Institute of Modern Physics (IMP), China, and at LBNL. In this presentation, we provide an overview on the development of magnet systems for 4th generation ECR ion Sources, focusing on the description of their magnetic and mechanical designs, and on the status of their fabrication and qualification tests.

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