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Shell-based support structure for the 45 GHz ECR Ion Source MARS-D

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Superconducting electron cyclotron resonance ion sources (ECRISs) using NbTi coils and optimized for 28 GHz resonant heating have been successfully operated for almost two decades. Moving to higher heating frequencies requires increased magnetic fields, but traditional racetrack-and-solenoid ECRIS structures are at their limit using NbTi. Rather than moving to a superconductor untested in this field, the Mixed Axial and Radial field System (MARS) being developed at Lawrence Berkeley National Laboratory employs a novel closed-loop-coil design that more efficiently utilizes conductor fields and will allow the use of NbTi in a next-generation, 45 GHz ECRIS. This article presents the design of the shell-based support structure central to the MARS-D magnet design, as well as structural analysis of its components and optimization of pre-load parameters that will guarantee its successful operation.

Primary author: JUCHNO, Mariusz (LBNL)

Co-authors: HODGKINSON, Adrian (Lawrence Berkeley National Laboratory); Dr TODD, Damon (LBNL); XIE, Daniel (Lawrence Berkeley National Laboratory); BENITEZ, Janilee (LBNL); DOYLE, Jennifer (LBNL); Dr PHAIR, Larry (LBNL); WANG, Li (Lawrence Berkeley National Laboratory); COVO, Michel Kireeff (LBNL); LOEW, Tim (LBNL)

Presenter: JUCHNO, Mariusz (LBNL)

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