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ICC/P6-01: The Finite Element Analysis of an Inertial Electrostatic Confinement Unit

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A new inertial electrostatic confinement (IEC) fusion unit was designed via finite element analysis (FEA) in a 3D electrostatic frame. Finite element method (FEM) was applied to the unit in order to identify the potential and electrical fields inside the spherical reaction chamber. Different material types and cathode geometries were tested, theoretically and the electrostatic responses of the central cathode were determined in the cases of different dielectric materials. The effects of cathode geometries were explored in order to identify the minimal and maximal field values at the vicinity of the cathode and inside the vertical and horizontal rings of the cathode structure. It was found that the number of vertical rings plays an important role to produce circular potential wells near the vertical rings. The increment of vertical rings on the cathode affects the bottom corner of electrical potential, thereby ions may be scattered to the entire region of the cathode. In fact, there should be an optimal number of vertical rings so that a better ion core can be obtained at the middle of the central grid for the confinement. Parallel to our earlier study, the dielectric materials surrounding the cathode also affect the field structure near the cathode rods, too. The dielectric thickness was changed in the entire study and some materials were found to be better in order to form homogeneous field inside the cathode for the ion dynamics.

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