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Numerical design of an innovative superconducting magnetic trap for probing β-decay in ECR plasmas

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The main aim of Plasmas for Astrophysics Nuclear Decays Observation and Radiation for Archaeometry (PANDORA) project is to build a flexible magnetic plasma trap where plasma reaches a density $n_e \sim 10^{11} - 10^{13}$ cm^{-3}, and a temperature, in units of kT, $kT_e \sim 0.1 - 30$ keV in order to measure, for the first time, nuclear β-decay rates in stellar-like conditions.
Here we present the numerical design of the PANDORA magnetic system, carried out by using the commercial simulators OPERA and CST Studio Suite. In particular, we discuss the design choices taken to: 1) obtain the required magnetic field levels at relevant axial and radial positions; 2) avoid the magnetic branches along the plasma chamber wall; 3) find the optimal position for the set of plasma diagnostics that will be employed.
The magnetic trap has been conceived to be as large as possible, both in radial and axial directions, in order to exploit the plasma confinement mechanism on a bigger plasmoid volume. The plasma chamber will have a length of 700 mm and a diameter of 280 mm.
The magnetic trap tender procedure has been completed in June 2024 and the structure realization is expected to start in late 2024.

Footnotes

Funding Agency

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