

# Comsol Simulation for Axions → FEM Simulation Study for Various Experiment Configurations.

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Using commercial FEM software (COMSOL Multiphysics®), we solve the Axion- Maxwell equations in the geometrical context of experiments that search for axion and axion-like-particles (ALPs) dark matter. In this poster, we will present our approach to three different experimental setups.

Firstly, the BRASS-p is the pilot experiment that searches for axion/ALPs in the frequency range of 12-18 GHz (49.63 - 74.4  $\mu\text{eV}$ ). The combination of multiple FEM modules (AC/DC and RF modules) is used to explore the realistic magnetic field of the magnet panels and the axion-induced radiation. Accompanied with further studies concerning the efficiency and coherence effect of the overall setup.

Secondly, one can consider the possibility of detecting the skin current induced by the low mass axion dark matter (from kHz to a few of MHz, peV to neV) using a novel solenoid magnet. The theoretical foundation and simulation result will be discussed. Followed by the proposed approaches to pick up the signal using High Impedance Amplifier (HIA) and/or SQUIDS receiver.

Finally, we offer a closer look at the Weakly Interacting Slender Particle detection with LC circuit (WISPLC), an experiment that searches for axion/ALPs in the frequency range up to 2MHz using the pickup look inside the warm-bore solenoid magnet. We present our FEM solution for the implication of the presence of the superconducting coils on the pickup flux.

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