Cryogenic Magnetic Shield Modeling & Verification

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Abstract

In ESA's Cosmic Vision program, the Japanese SPICA satellite is a mission of opportunity in the M-class, with the SAFARI instrument being one of the next generation space-borne astronomy instruments being developed to take advantage of SPICA's cryogenically cooled 3-m class primary mirror. The SAFARI instrument will use large-format arrays of Transition Edge Sensor (TES) bolometers read-out with Frequency Domain Multiplexing (FDM) and operating at 50 mK.

These TES detectors use the transition in resistivity between the superconducting and normal state to sense the deposited power. Laboratory measurements at SRON have demonstrated the performance of these detectors but also indicate that their performance is very sensitive to the magnetic field at the detector. By selecting appropriate non-magnetic materials, shielding by high-permeability-metal and super¬conducting shields we expect to be able to control the field to the appropriate level for space application. However, the required suppression of > 10-4 in the satellite has not been demonstrated for a realistic detector configuration. The purpose of this programme is to demonstrate the required magnetic shielding for a realistic detector configuration.

We describe the magnetic shielding models created in COMSOL Multiphysics® and compare the modelling results with measurements performed on test shields.

Reference

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