A Finite Element Model for the Thermal Transport in Solid Targets

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Since the polarization relaxation time of polarized targets quickly decreases with increasing temperature, the choice of size and shape of the target, and in particular of its thickness, must be based on the evaluation of the temperature profile inside the target for the specific experimental conditions. This evaluation is particularly important when designing a target for scattering experiments for which a high beam intensity and collimation are required, as localized beam heating causes inhomogeneous depolarization of the target.

The efficiency of the thermal transport in the target material for dissipating the heat deposited by the beam toward the cryogenic bath depends not only on the thermal conductivity of the material itself but it is also strongly limited by the Kapitza thermal impedance on the boundary. We present a new finite element model to study the thermal transport properties as a function of size and shape of the target and of the thermal conductivity parameters.