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Thermal Losses in a Coaxial Pulse Tube Cryocooler

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Conductive and radiative losses in pulse tube cryocoolers are difficult to predict, particularly in a coaxial configuration. The static losses in a pulse tube must be accounted for and factored when determining the cooling power, and the thermal losses as a result of radiation must be quantified to establish their significance. Studies have previously shown that there is a discrepancy between computationally simulated cooling performances and experimentally measured values. This could be attributed to the under-prediction of thermal losses in numerical models. A lumped parameter model using ESATAN-TMS was created to determine the thermal losses in a coaxial pulse tube cryocooler in order to improve model validation between experimental and computed values. The thermal losses simulated were found to significantly improve the correlation between numerical and experimental data for a coaxial pulse tube using an active displacer. An analysis of the variation of the losses at different regions in the pulse tube and its impact on cooling performance is presented.