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***Boundary Layer Losses in a  
Miniaturized Tapered Pulse Tube***

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Miniaturized cryocoolers are a vital components for cooling of infrared sensors in small satellites. Smaller cryocoolers have lower compression and expansion swept volumes and achieve cooling by operating at high frequencies (100-300 Hz range). Previously, we studied high frequency straight pulse tube, and investigated the effects of diameter, aspect ratio of pulse tube, bounding temperatures and frequency on the boundary layer losses. In this follow-up study the role of design parameters and operating conditions on the tapered pulse tube boundary layer losses is investigated. Computational fluid dynamics (CFD) is used for this investigation. The results show the existence of a size threshold, where smaller high frequency tapered pulse tube cryocoolers can no longer be useful due to their high boundary layer losses.