
SESSION 2: Stirling & Pulse Tube Cryocoolers - Analytical

Paper No. 2-1 Tuesday Morning 11:00 AM

Impact on the Performance and Heat Flows of a PT Cooler Miniaturization

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A pulse tube cooler cooling below 10 K would allow the use of sensitive Terahertz detectors for astrophysics or earth observation. It could also simplify the cryogenic subkelvin chains if a 4 K cooling is performed. Such coolers have been previously prototyped and tested, but needed too much pre-cooling power to be compatible with spatial requirements. In order to achieve low temperatures when decreasing the heat flow, two PT prototypes have been designed and tested at CEA-DSBT, in collaboration with the French Spatial Agency (CNES). Both are coaxial, twice intercepted at two pre-cooling temperatures, and have the same length. The impact of a miniaturization of the PT sections are measured and analyzed. Interesting results have been observed, showing a decrease of both the lower temperature and the heat flow at intercepts when reducing the PT sections. An analysis of such behavior is proposed. Considering typical values of pre-cooling of 1 W @ 35 K and 3 W @ 100 K from a two-stage pulse tube, these coolers could be combined to achieve 9 K. Now this first proof of concept is validated, next steps are planned to optimize the whole geometry -and not only the sections- and study the regenerator composition in order to gain performance when keeping reasonable heat flow at intercepts.