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Enabling Ambitious Space Science Missions Thanks to 10K-20K Cryocooling

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In the past years, Air Liquide Advanced Technologies has developed a HiPTC, standing for Heat intercepted Pulse Tube Cooler, for space science missions. This cooler includes a compressor designed and built by Thales Cryogenics b.v., a dual stage cold finger developed with CEA and an electronics developed by SITAEL. This work has funded by the European Space Agency (ESA). Tests performed on one engineering model showed that the cooler reached 6.9K zero load temperature. This makes it suitable for a large number of science missions requiring cooling in the 10K-20K temperature range. This is the case for ATHENA mission, for which the cryocooler is developed and purposed to supply thermal shielding around 80K-100K, and pre-cooling at 15K for lower temperature coolers aimed at detector cooling. Recent activities on this cooler include: • Development of a TRL 6 engineering model • Study and testing of several cooler architectures, passive phase shifting or active phase shifting at the low temperature stage • Improvement of overall efficiency • Development of a new driving electronics with damping of μvibration • Preliminary studies for integration of the cooler on several space science missions projects The results show the availability of a compact, efficient and low vibration cryocooler for space science applications. The power consumption of the cooler is less than 500W including electronics. Total cooler mass is around 36 kg including drive electronics and the cooler fits in a reduced volume. Recently, ALAT has been awarded of a new ESA contract centered on the overall cooler system also including the development of Cryocooler Control Electronic realized by SITAEL. This project aims to increase the maturity of the cooler to reach Technological Readiness Level 6 at Cooler Mechanical Assembly level and be able to go to lifetime test in support to a future qualification program.