

Technology Demonstration of a Neon JT Cooler System for Ariel

***M. Crook, M. Hills, G. Gilley, C. Padley, S. Brown,
A. Eagles, B. Green, E. Corlett, STFC Rutherford Appleton
Laboratory, Harwell, Oxford, UK***

Ariel is the fourth medium (M4) mission in the ESA Cosmic Vision 2015-2025 programme. The mission was adopted in November 2020 and the payload development is ongoing towards the payload Preliminary Design Review in 2022, with a launch planned in 2029. The spacecraft will carry two instruments: a Fine Guidance System (FGS) and the Ariel InfraRed Spectrometer (AIRS). AIRS requires active cooling of both its channels to below 42 K and this will be provided by a neon Joule-Thomson (JT) cooler developed by the Rutherford Appleton Laboratory. Here we describe the Technology Demonstration Activities for achievement of Technology Readiness Level (TRL) 6 for the Ariel Active Cooler System (ACS). This paper follows on from the one presented at ICC 21 [Hills, M. et al, "A Neon JT Cooler for Ariel" Cryocoolers 21, pp 423–431] by describing the assembly of the ACS and the subsequent test campaign: we detail compressor assembly, acceptance testing and performance, demonstrating pressure and mass flow requirements; we then describe results from mechanical and thermal environment tests and also cryogenic performance tests of the complete cooler. The ACS has achieved cooling powers that exceed the Ariel requirements, at input powers that are within budget. We summarize the correlation of these test results with the cooler performance modelling. We conclude by reporting on progress towards the achievement of TRL 6 for the cooler and outline the next steps in the development of a qualification model cooler.