High Frequency Pulse Tube Cooler for Quantum Telecommunication

T. Prouvé, T. Latella, J.M. Duval, Univ. Grenoble Alpes, CEA, IRIG, DSBT, France; S. Dang, Absolut System, France; R. Gourgues, Single Quantum, The Netherlands

Quantum telecommunication could benefit from the use of single photon detectors cooled down below 4 K. These detectors are currently cooled down using GM coolers, which leads to a bulky, noisy and high electrical power consumption set-up. Moreover, the cooling temperature of GM coolers is limited to about 2.4 K, which can be a limitation in the detection efficiency. A compact and mobile cryogenic cooling system below 2 K would be a valuable improvement. The consortium composed by CEA, Single Quantum and Absolut System, is supported by a Eurostar Eureka grant in order to build a complete demonstrator of such a novel compact telecom quantum module. The cryogenic system is made by coupling a high frequency, low temperature, pulse tube cooler and a Helium Joule-Thomson (JT) loop. In this paper, the development and performances of the high frequency pulse tube cooler will be first presented. In a second step, the coupling of this pulse tube cooler with a JT cooler prototype will be made before the final assembly into the cryostat hosting the detector. This will allow adjusting the operating settings before the final integration into the cryostat. The results obtained will be also presented.