



HEMT and SiGe readout ASICs for amplification and multiplexing at very low temperature of high impedance sensors : new results and performances

Main author:

DE LA BROÏSE Xavier

Co-authors:

Bounab Ayoub, CEA/DSM/IRFU

de la Broïse Xavier, CEA/DSM/IRFU

Lugiez Francis, CEA/DSM/IRFU

High impedance "fast" detectors, like MIS micro-calorimeters matrices for X-ray spectro-imaging, require a readout electronics located as close as possible to the sensors, inside the cryostat. This requires very low power dissipation as well as very low noise cryo-electronics.

We have developed a two stages electronics. The first stage uses HEMT transistors to perform the impedance matching ; these HEMT are developed by CNRS/LPN to optimize noise and input impedance performances. The second stage is made of SiGe integrated circuits developed by us. They multiplex and amplify the signal, and switch the input stage, so that HEMT transistors are powered only when read, to minimize the power consumption. The electronics is optimized for the 100 Hz-10 kHz bandwidth (when 1 Mohm detector), and works at temperature between 2.5 K and 15 K.

A first version of electronics, with 9 input channels, has been developed some years ago and successfully tested at 4.2 K, with satisfying performances in terms of noise, power consumption, bandwidth and commutation/multiplexing. This validated the architecture and technologies, and allowed the development of a new version of electronics, full scale dimensioned (with 34 input channels) and containing a lot of improvements and optimizations (consumption, bandwidth, programming, integration, etc.). This new version of electronics has been manufactured and tested. Its features, test results and performances are presented here