device for passive phase shifting in a pulse tube

Contact: Jean-Marc DUVAL DSM/INAC/SBT/GCCS jean-marc.duval@cea.fr 0438784629

PhD may follow: Yes

Summary :

Context:

Pulse tube cryocoolers produces temperature between 5 K(-268Â°C) and 100 K(-173Â°C) with few moving parts. They are particularly interesting for space applications (onboard satellites) where detectors require a low operating temperature to achieve high sensitivity. For instance IXO - for X-ray observation- or Meteosat Third Generation - for earth observation - are two planned satellites which require cryogenic temperatures. Since many years CEA/SBT is involved in the development of cryogenic devices in partnership with the European space industries (Air Liquide, ThalÃ¨s Cryogenics, ESA). CNES is partly funding the development described here.

Project:

The efficiency of these cryocoolers depends largely on a phase shift between pressure wave and mass flow of the working gas. Thanks to this phase shift a thermodynamic cycle combining compression/expansion of gas and displacement leads to efficient cooling. A novel type of phase shifting mechanism has been invented and tested at CEA/SBT leading to promising results. The lifetime of this mechanism and reproducibility of its operation should now be improved. This study will consist in defining and executing a test campaign aiming at demonstrating the lifetime of the device. It will include a large experimental part. The understanding and preliminary calculation will be also important to define the measurements.

Fluid mechanism in oscillatory flow and mechanics are an important theme for the phase shifting device itself. This study is an opportunity to deal also with the cryogenic world.

Requested skills :

Mechanics / fluid dynamics

Interest for experimenting