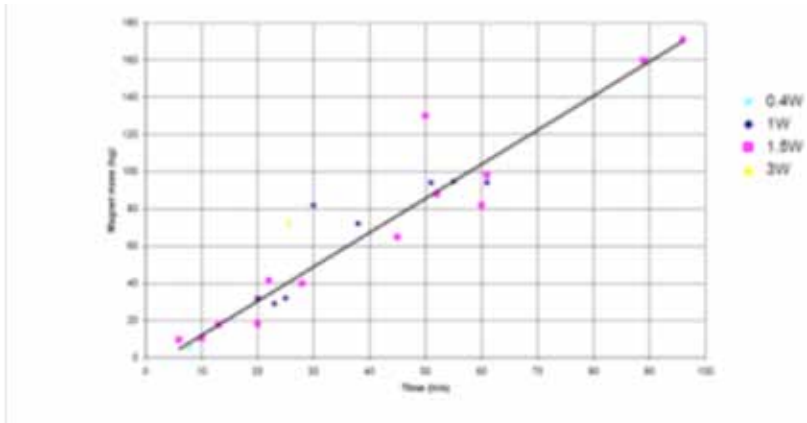


GM / Pulse Tube Cryocoolers

Measurement Data

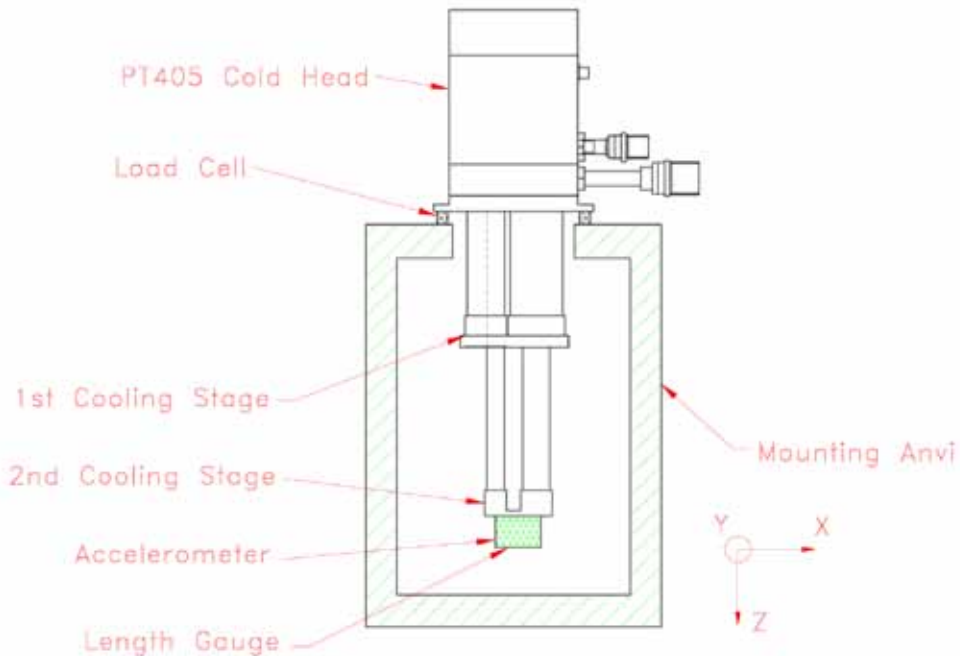
Cool down Time vs Magnet Mass for Cryogen Free Systems



PT405 Vibration Measurement

Vibration Test Rig

- a) Length gauge measures the displacements of the 2nd stage heat exchanger;
- b) Load cell measures the mounting forces of the cold head exerted on the cryostat.



Amplitude of displacement of the 2nd stage cold head on three directions

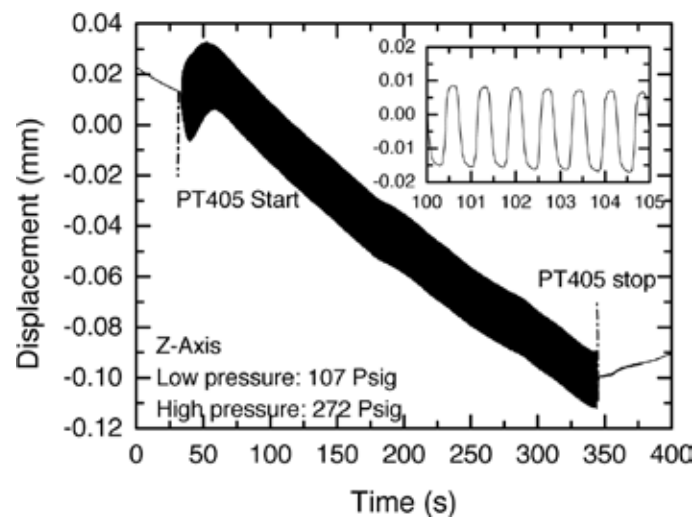
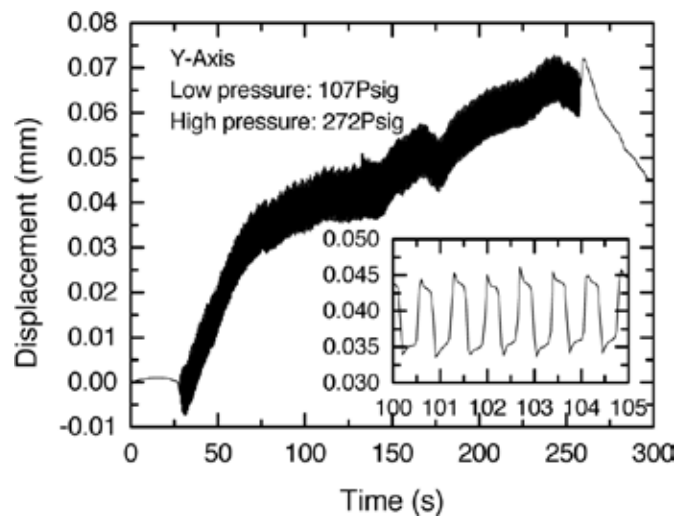
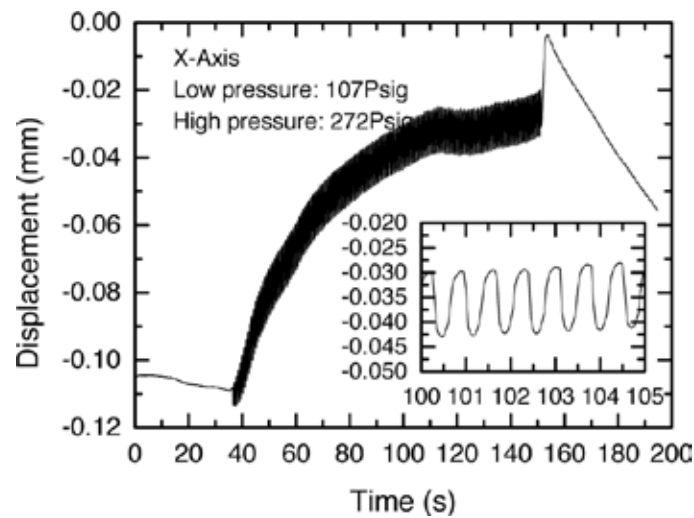
	X-axis	Y-axis	Z-axis
Length Gauge* Measurement	6 μm	6 μm	12 μm

*Suction pressure: 107Psig; Discharge pressure: 272Psig; (4 K operation pressures)

GM / Pulse Tube Cryocoolers

Measurement Data

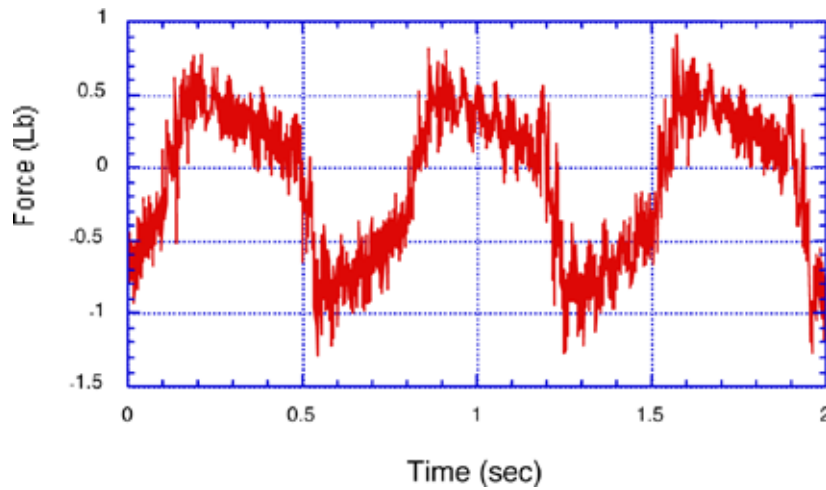
Dynamic displacements on the 2nd stage cold head. The PT405 starts from room temperature.



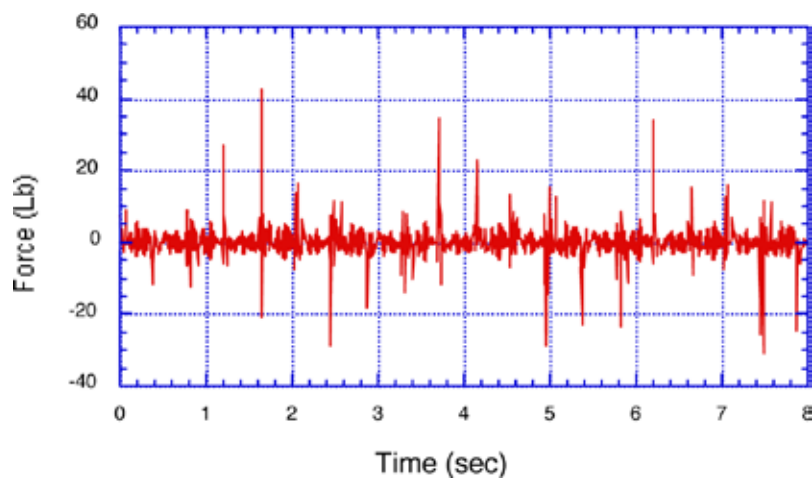
GM / Pulse Tube Cryocoolers

Measurement Data

Measured mounting forces of 4K pulse tube and GM cryocoolers



(a) Pulse Tube



(b) GM

Summary

The displacements and mounting forces are mostly generated by pressurisation and expansion of helium inside the pulse tube assembly. The measured curves are very similar to the dynamic pressure wave of the helium.