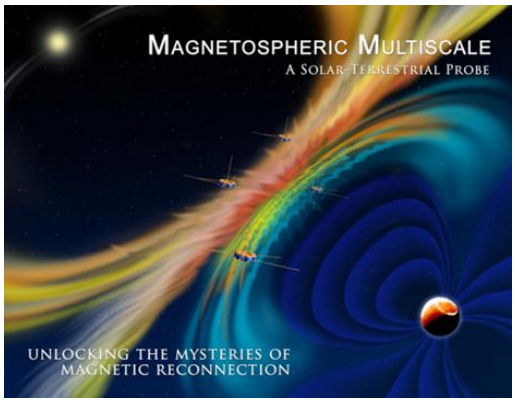
# Magnetospheric Multi-Scale Mission (MMS)

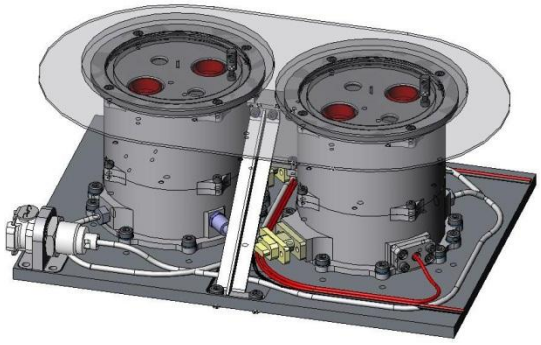
**Customer**: European Space Agency (ESA) and National Aeronautics and Space Administration (NASA)
**Project partner**: Space Research Institute (IWF, Austria)
**FHWN/FOTEC core tasks**: Development, manufacturing and test of Liquid Metal Ion Sources (LMIS) thruster.



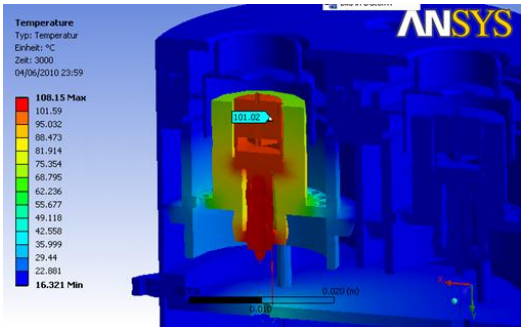

The Magnetospheric Multi-Scale Mission (MMS) is a Solar Terrestrial Probe program of the National Aeronautics and Space Administration (NASA). The scientific objectives of the MMS mission are to explore and understand the fundamental plasma physics processes of, primarily, magnetic reconnection, and secondarily, particle acceleration and turbulence, on both the micro- and mesoscales in the Earth's magnetosphere.

The primary objective of active spacecraft potential control (ASPOC) is to insure the effective and complete measurement of the ambient plasma distribution functions. The instruments ASPOC emit a beam of positive indium ions at energies of order 4 to 12 keV and currents up to 50 µA (normal operating range) or 100 µA (short-term de-contamination mode) in order to control the electrical potential of the spacecraft.

The Aerospace Engineering Department together with FOTEC was subcontracted to develop the core element of the ASPOC, namely the Liquid Metal Ion Sources (LMIS). The work encompasses a variety of tasks such as the mechanical and thermal design of the units as well as comprehensive experimental testing of the ASPOC prior to delivery.



The core element of the ASPOC is the Liquid Metal Ion Source. This ion source consists of a needle covered with Indium which is heated above the Indium melting point (156.6 ºC). Then a sufficiently high electric potential is applied between the emitter and an extractor electrode until a field strength of about $10^9$ V/m is reached at the tip. The equilibrium between the surface tension and the electric field strength forms a so-called Taylor cone on the surface with a jet protruding due to space charge. Atoms are then ionised at the tip of the jet and accelerated out by the same field that created them. The expelled ions are replenished by the hydrodynamic flow of the liquid metal.




Thermal assessment of the design

For more information about the MMS mission, see here (http://mms.gsfc.nasa.gov )