# Numerical Investigation of MHD Impact on Argon Plasma Flow by Variable Magnetic Field for Space applications

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**Abstract:**

The reduction of thermal load on a space vehicle during the re-entry is of primary importance. Various investigations have been carried out previously.MagnetoHydroDynamic (MHD) control is one of these methods. By using this method, the flow around a re-entry vehicle can be changed by applying a magnetic field. To accomplish this, it is important to clarify the basic structure of the plasma flow around the body with and without a magnetic field .It is also possible to install a permanent magnet inside this probe and to simulate a space vehicle body. However, such a blunt body in supersonic flow disturbs the jet structure remarkably. It is important that the flow variables, for example Mach number, Pressure are measured over a wide range.

Magneto-hydrodynamic (MHD) effects are present in many plasma processes used at the Institüt für Raumfahrtsysteme (IRS). Therefore need to analyse MHD effect at fundamental level becomes also necessary. Further investigation of electron and heavy particle for weakly ionized plasma with magnetic field is also possible for better understanding the flow physics.

Experimental investigation had been carried out previously with one such plasma facility PWK2 together with the magneto-plasma dynamic (MPD) plasma source RB3. The interaction between a probe body and argon plasma flow is investigated to examine to what extent the probe head temperature and the bow shock distance can be influenced by applying a strong magnetic field. The experiments are performed using a strong permanent magnet installed inside a probe body using a spherical, coated probe head. The in-house code SAMSA (Self and applied field MPD thruster simulation algorithm) that has been developed, based on the navier stokes solver together with conservation of magnetic field, which gives the freedom to SAMSA not only simulate the flow and magnetic field but also the plasma generation process. Numerical simulation has been carried out over Probe body with and without magnetic field using SAMSA for Argon plasma.

The prime focus of the paper is towards numerical simulation and investigation of MHD effects with validation with ongoing experimental results.
Key words – Argon plasma, Magneto-hydrodynamic, probe Body with magnetic field, SAMSA