

Next-Generation Ion Thruster Design Tool to Support Future Space Missions

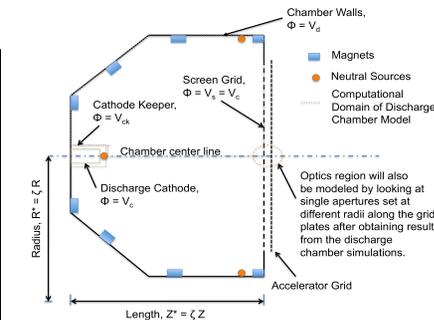
PI: Sudhakar Mahalingam / Tech-X Corporation, Boulder, CO

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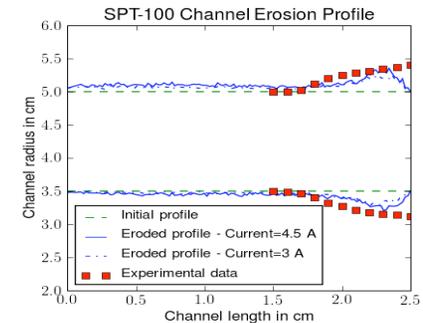
Identification and Significance of Innovation

A kinetic model that simulates the dynamic electric fields inside the ion thruster discharge chamber plasma is proposed. This will be the first time that this has been done. Self-consistent erosion models to study the ion-impingement effects on the NEXT thruster components will help NASA GRC to predict the life time operation of the high power ion propulsion options for future space missions. We envision one seamless model to study the full ion thruster plasma.

Expected TRL Range at the end of Contract (1-9): TRL 6



Kinetic OOPIC Pro model for the NEXT Ion Propulsion System (IPS).



SPT-100 channel erosion results using OOPIC Pro. Life-time of the NEXT IPS can be accurately modeled via kinetic simulations.

Technical Objectives and Work Plan

Objectives:

- Include electric field effects into ion engine modeling in a physically precise manner.
- Demonstrate the ability of this computer tool to support ion thruster development for future space missions.

Tasks:

- Integrate and enhance particle tracking capabilities in kinetic discharge chamber model with OOPIC Pro
- Demonstrate the dynamic electric field model for the NASA's Evolutionary Xenon Thruster (NEXT) discharge chamber
- Measure the ion impingement effects on the discharge chamber components and performance parameters
- Demonstrate the kinetic model for studying the NEXT high power and high-thrust-to-power operating conditions

NASA and Non-NASA Applications

NASA Application: Off-the-shelf computational tools minimize the modeling development effort required by NASA for thruster simulations. These tools support both ion and Hall thruster electric propulsion systems.

Non NASA Application: Accurate plasma modeling and sputter erosion tools have applications in other government organizations as well as the aerospace, satellite, ion source and plasma processing industries.

Firm Contacts

Tech-X Corporation
5621 Arapahoe Ave Suite A
Boulder CO 80303

www.txcorp.com
Tel:303-448-0727
Fax:303-448-7756