# Charging tools for science missions

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## Introduction

- Significant inputs to spacecraft plasma interaction modelling requirements are provided at SPINE meetings.
- Various effects have been identified.
- Current modelling limitations have been identified.
- There is a need for new developments which could be performed in SPIS framework.

# Types of effects to model

- wire boom interaction with plasma (including secondary emission and particle collection);
- solar arrays plasma interaction (including interconnectors current collections);
- energy spectrum of secondary particles (including photo-electron);
- input energy spectrum from the sun in UV-X range;
- detailed characteristics of particle beams emitted by active devices such as ion emitters (when relevant);
- magnetic field effect on charged particle collection and emission;
- wake effects;
- shading;
- electromotive force effect;
- detailed characteristics of ground based testing environment;
- detailed characteristics of ambient charged particle environment;
- deep dielectric charging effect on surface potential;
- Transient effects due to dust impacts



# Charging codes limitations

- Current ‘charging tools’ are not good enough.
- Statistical errors.
- Too small spatial scale range.
- Appropriate boundary conditions in presence of large scale perturbations (magnetic, wake).
- energy spectrum of secondary particles (including photo-electron);
- input energy spectrum from the sun in UV-X range;
- accuracy of surface-plasma interaction models.
- need validation with flight data.
- need possibility to perform verification at low level software complexity.

# Approach

- New appropriate modules could be written and integrated in SPIS.
- Validation should be performed on cases relevant to scientific missions.
- ESA study planned (cf emits.esa.int).
- SPINE community should be in the loop.
  - Experience with effects and validation
  - Concerned SPIS users