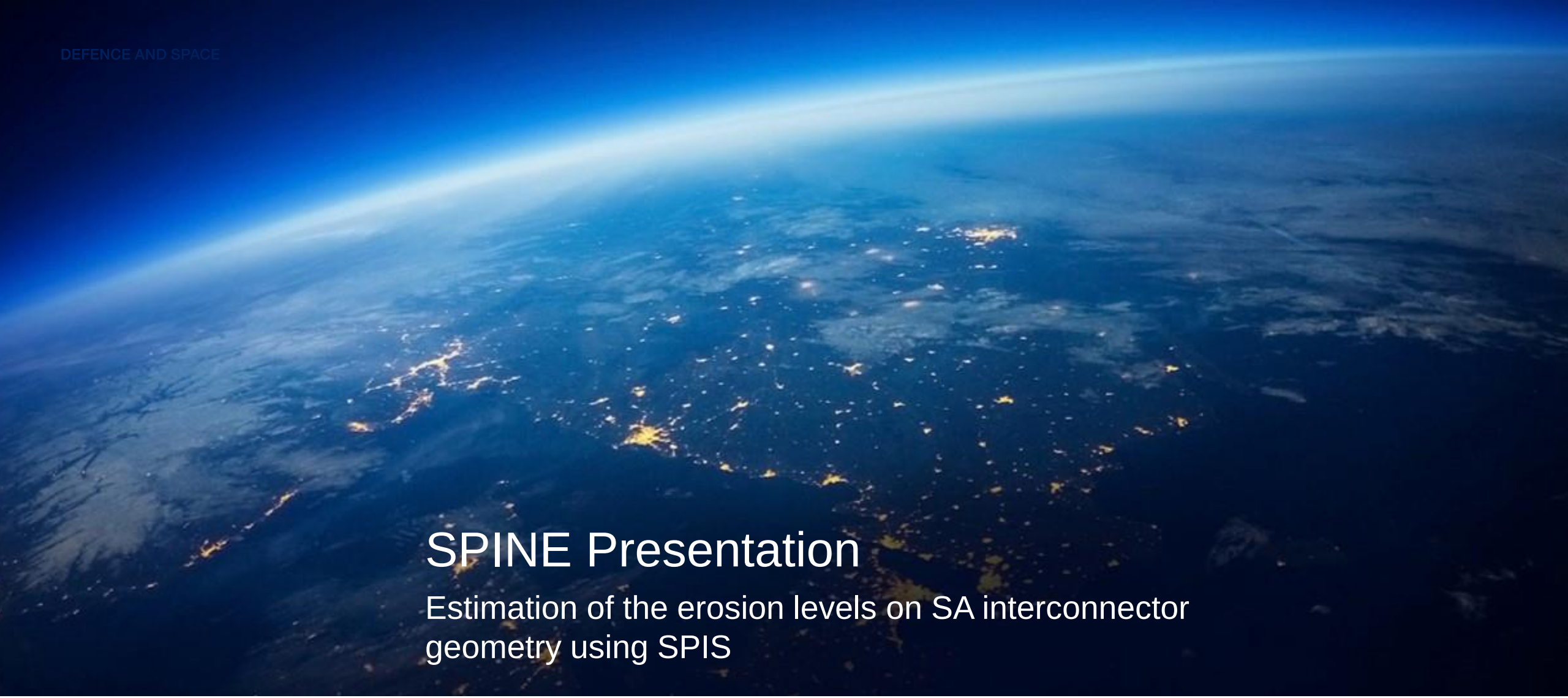

SPINE Presentation

Estimation of the erosion levels on SA interconnector geometry using SPIS

DEFENCE AND SPACE

V. MALZIEU, Space Physics Engineer

08 June 2021

AIRBUS

See Page 2 for Export Control Information concerning this document's content

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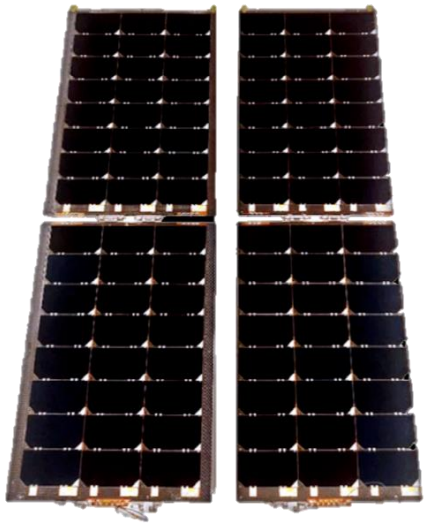
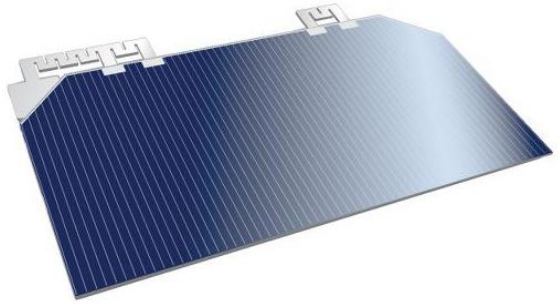
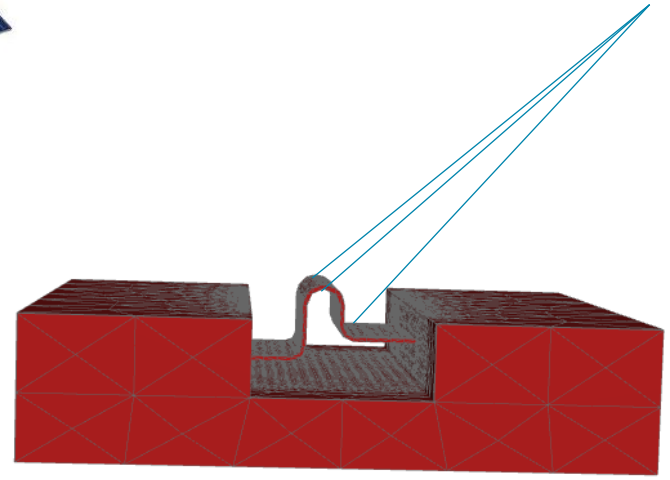
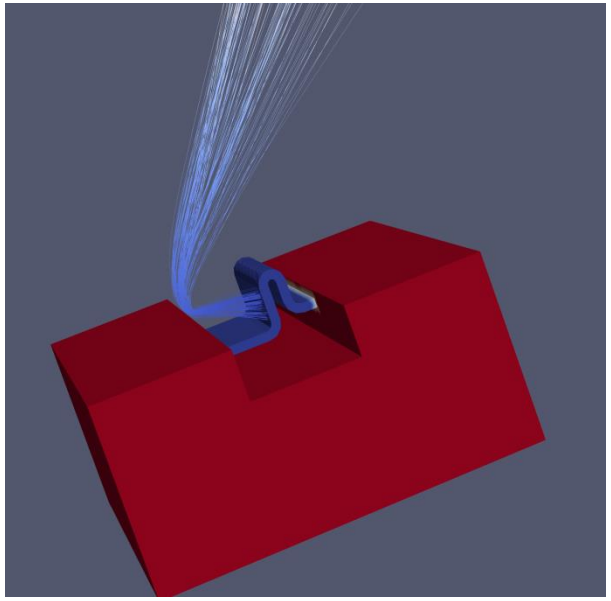
Introduction





Systema





- Scale problem, small shape in a big satellite
- Erosion of the interconnectors of the solar array are a dimensioning factor.

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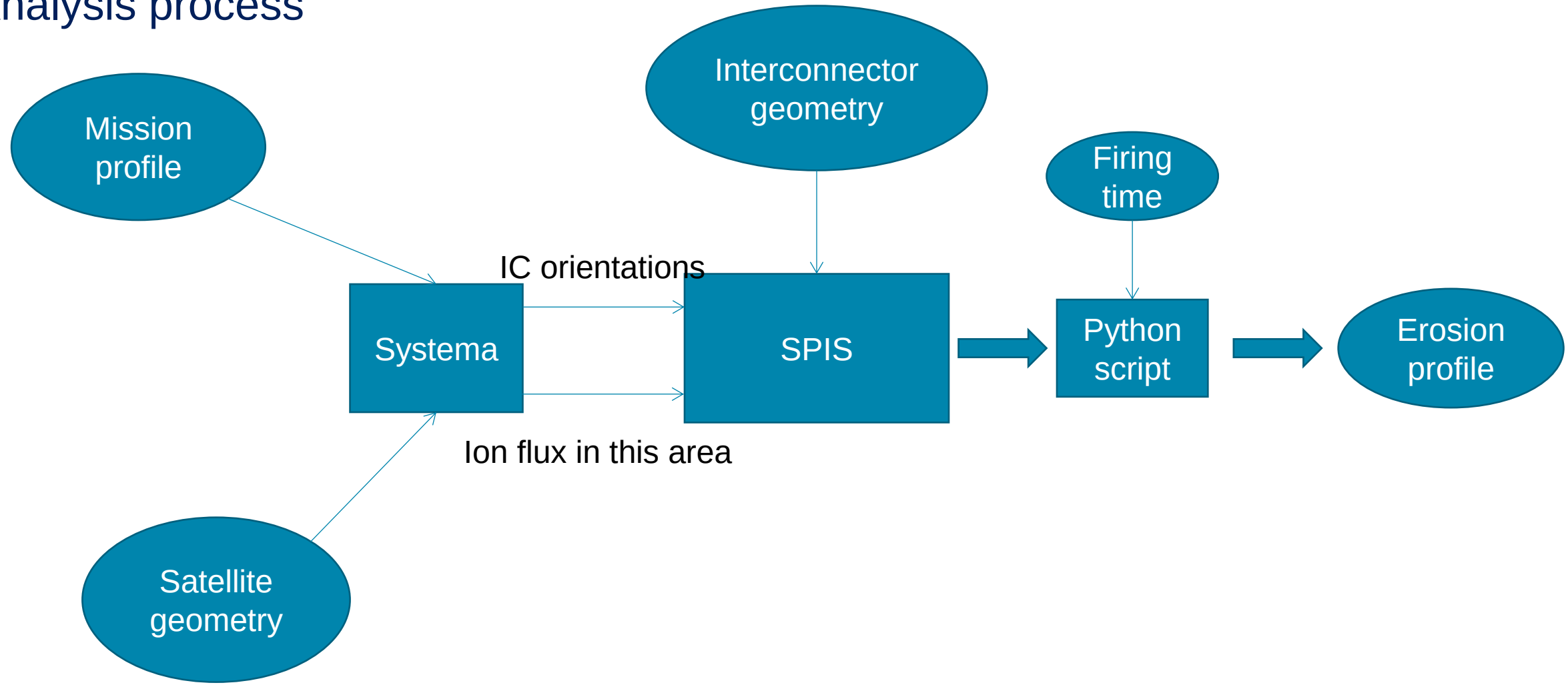
Analysis process

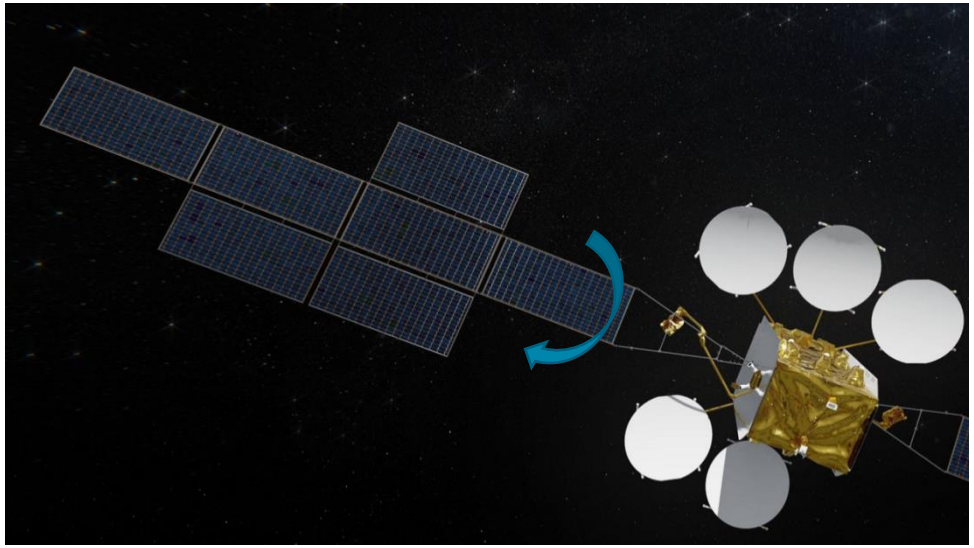


SPIS inputs generation

- A mission contains many different firing configurations
  - Solar array rotates
  - Thruster moves
  - Operating point of the thruster changes
  - Appendices/Walls cause some shadowing

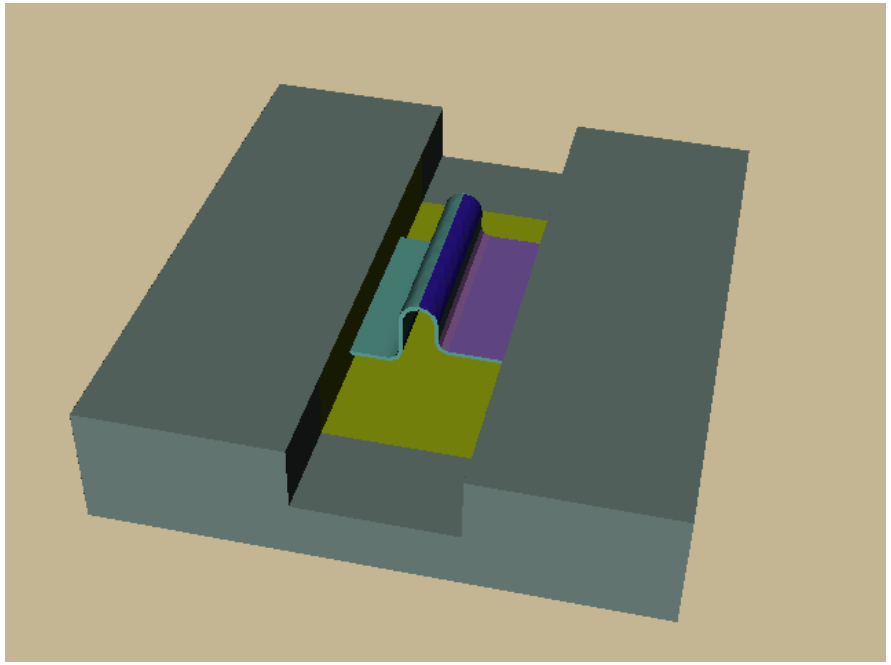
⇒ Not one computation is needed but many small computations

- Orientations and plasma parameters are generated for each IC of interest



SPIS Computation

- Simulation characteristics:
  - Injection of particles performed with Extended Populations and a distribution defined in a file
  - Erosion parameters defined in a file (interval dev to work around the import bugs)
  - Electrons defined as an unlimited Boltzmann distribution
- Circuit convergence issues were fixed by using some insulating materials as a buffer
- One computation takes ~1h on one core
- Multiples computation are run in parallel with a scheduler (python)



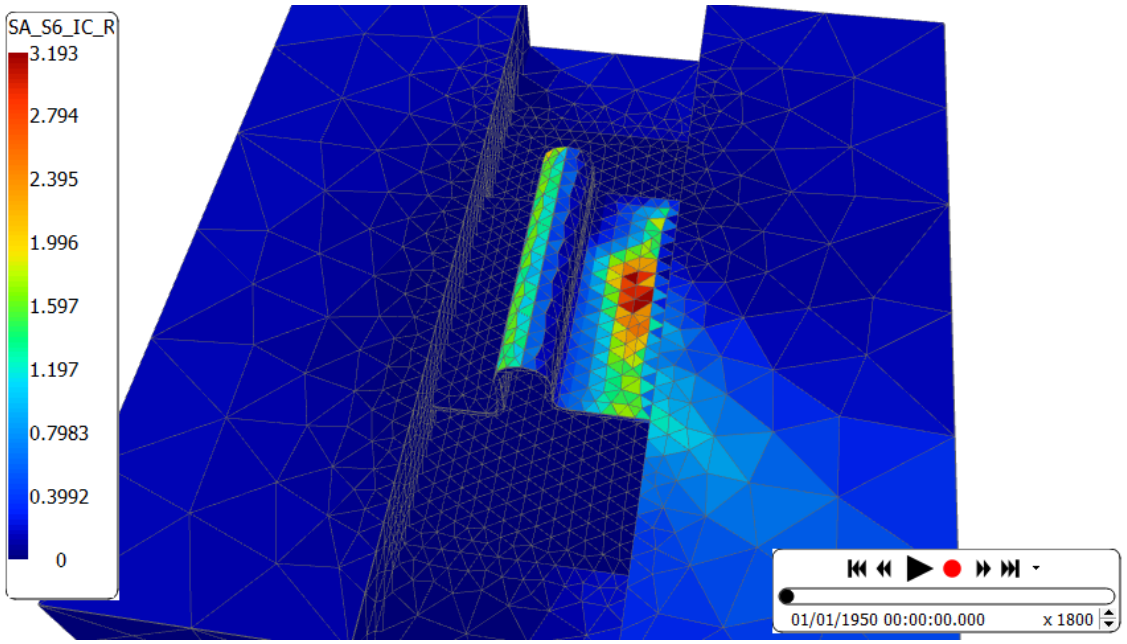
Results

- Extraction of the data from the .nc files with a java program
- Processing of the results to sum them together taking into account the correct firing time

- Results are then displayed in Systema

- Comparison with Systema simulations have shown that for high energy ions the results are similar in SPIS or Systema
- Noise of SPIS is reduced by summing all the different computations together

- Some mesh bias may influence the results



Result not related to any project

Conclusion

- SPIS was used to do a complex small-scale analysis
- Many thousand computation have been performed

- 3D erosion profile have been estimated for one case, more cases to come!

- Future possibilities
  - Import the plasma parameters from another SPIS simulation – Requires the use of many instruments or new development in SPIS
  - Characterize the electrons/ions current with this method for charging
  - Compare the results with SPIS EP 6.1.0

Main problems encountered during the analysis

- Some bugs
  - Meshes too small make SPIS crash
  - Import of a file in the groups sometimes gives weird results
  - Weirdness when looking at the code that is not commented
  - Having to deploy the groups twice sometimes
- Lack of documentation
- Java being random
- Lack of industrialization
  - Can crash and still hang up
  - Script to launch a computation is not optimized
  - Lack of proper testing (some auto-test fail once we fix some bugs?)

No easy solution

- SPIS is complex (too complex?)
- Sharing bugs is often complicated due to models being protected

SPIS is of great help on places that need plasma simulation to be performed (shadowed regions)

Thanks to Artenum for responding to posts on the forum, this was helpful.

Doing a SPIS analysis for a project is expensive due to all the issues above which prevents its day to day use.

Thank you