

Appendix L

SYSTEMA-4.5.0

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Abstract

Model & meshing scripted access

SYSTEMA 4.5.0 allows the automation of all the model & meshing commands, such as geometry creation and modification, thermal properties, all the meshes parameters, through a Python script. This powerful feature is very useful to automatically modify the geometry (for symmetries or homotheties, for instance), to create reduced model, or to ease model creation by using variables, loops or logical instructions. It also facilitates all interfaces with external model format.

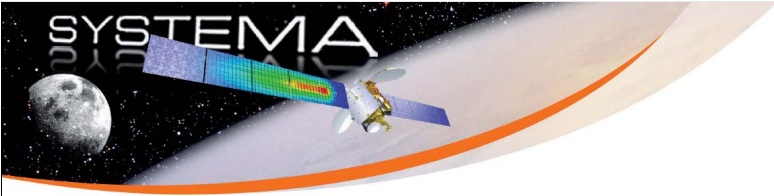
SYSTEMA is shipped with a library of scripted functions to help the user to easily reach the full potential of this new functionality. Basic modules are provided, such as model tree scan; examples are also given and will be demonstrated: surface activity automated change, creation of a parameterized honeycomb structure, meshing reduction...

3D improvements

The SYSTEMA 3D engine is both more realistic and more precise: it proposes now a real size solar system. It also provides new tools to help the understanding of the 3D scene and to visualize the different orientations of the satellite shapes. Moreover, the quality of the rendering has been upgraded, improving dramatically the videos generated by SYSTEMA.


Mission definition improvements

One of our ongoing development goals is to ease the creation of a mission. The mission module has been revamped around a new timeline widget that presents to the user all time data in a very intuitive way. With this tool, it will be very easy to synchronize trajectories, kinematics phases, mission events...

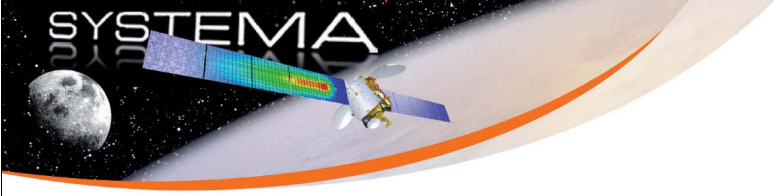


Content

- Model & meshing scripted access
- 3D improvements
- Mission definition improvements




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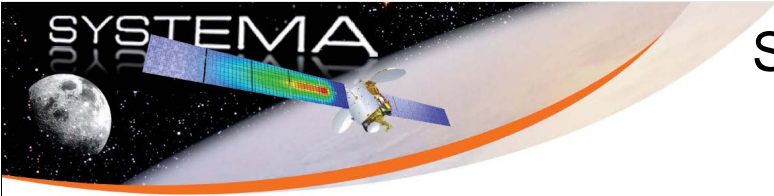
Content

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Model & meshing scripted access



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Scripting


Objectives

To allow the user to manipulate the model / meshing outside the Systema interface:

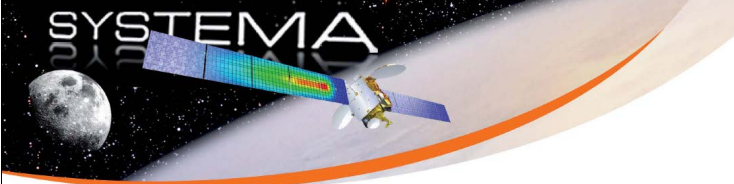
- External tools interface
- Meshing reduction...

To allow the user to define a set of reusable functions, automating complex tasks:

- Repetitive structures
- Model parametrization
- Symmetries & homotheties
- Activity change...



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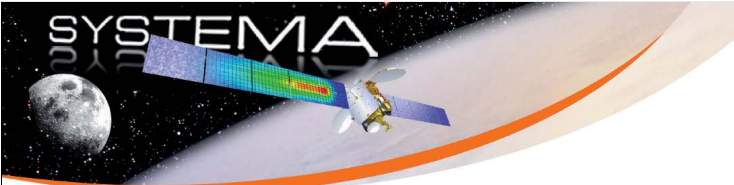
Scripting

What is the scripting?

- Possibility to execute Python scripts inside a Systema execution
- Python API to control Systema
- Programmatic access to all of Systema model & meshing data and features



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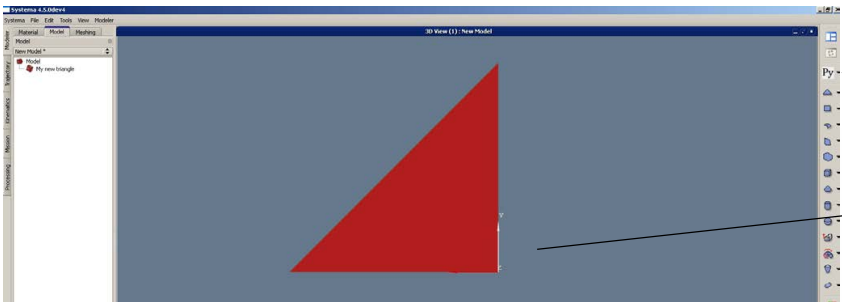


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Scripting


Your first Systema script

```
model = ModelFile()  
geometry = createGeometry("triangle",[Point(0,0,0),Point(1,0,0),Point(0,1,0)],[])  
shape = ModelShape("My new triangle", geometry)  
shape.insertInto(model.getRoot())
```




Select and execute your script using the « Py » button

The result appears immediately !



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Scripting

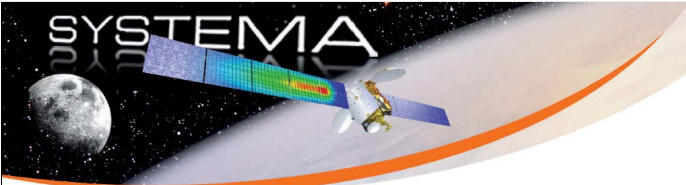
How does it work?

The Systema Python interface provides intuitive objects and methods

- Same services as the Systema graphical interface:
 - Systema's file management
 - Object and shape management
 - Access to geometrical data
 - Thermal properties
 - Meshing & numbering parameters
- And more!
 - Variables, loops, logical instructions
 - File reading/writing, network, other Python modules



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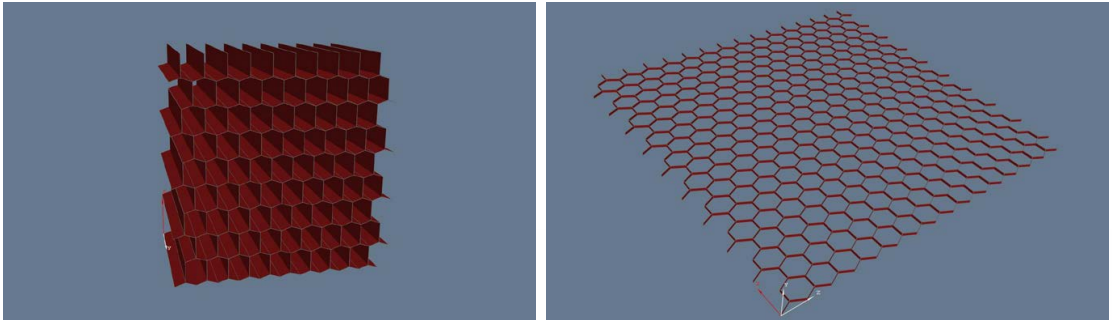


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Scripting

What can I do with it?


- Repetitive structures
- Parametrization



Two exemples of the function `honeycomb(nx,nz,height,width,depth)`



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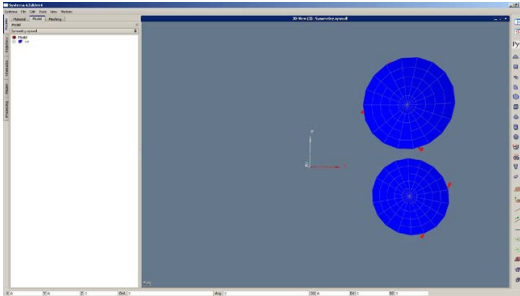
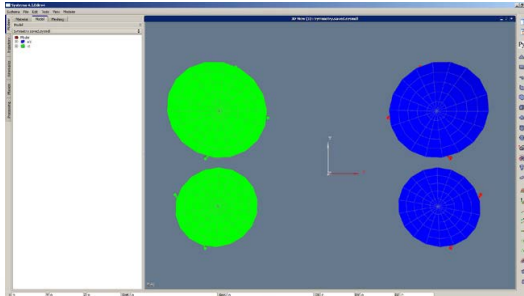


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Scripting

What can I do with it?

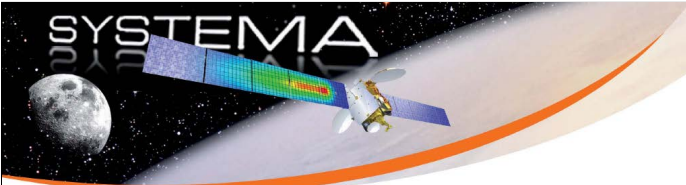
- Symmetries

Application of a symmetry function on antennas: *symmetry(origin, destination, a, b, c, d)*



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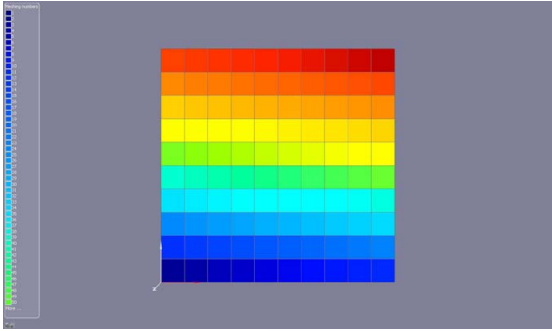
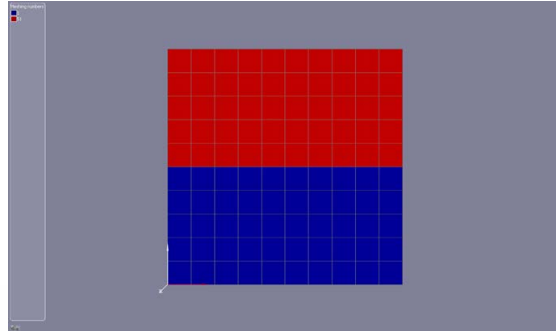


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Scripting

What can I do with it?


- Meshing reduction

Example of a rectangle, meshed 10 by 10. The script read a file that indicates the correspondence between old and new meshes number. Here, the meshing is condensated in 2 nodes.




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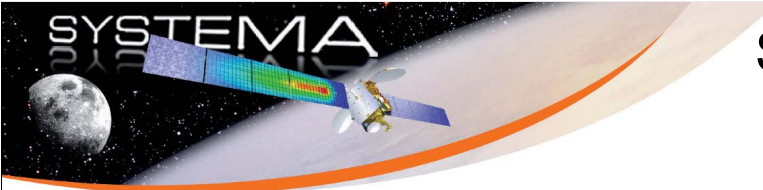
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Scripting

- Delivered with high-level libraries (tree scan, search, ...)
- An open-source platform will be set up, dedicated to the enrichment of these libraries, and to the promotion of the tool
- Complete examples and tutorials
- Complete documentation
- Will be implemented in the other Systema modules



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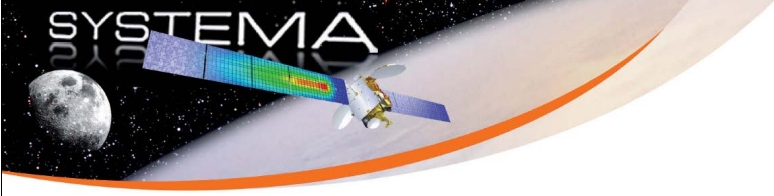
Scripting

The scripting

- Python interface to control Systema
- A set of reusable functions to automate complex tasks
- Existing libraries are provided, as well as documentation and support




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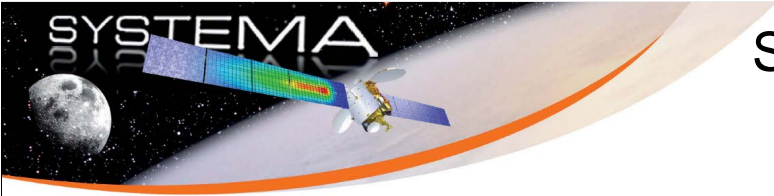
Content

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3D improvements



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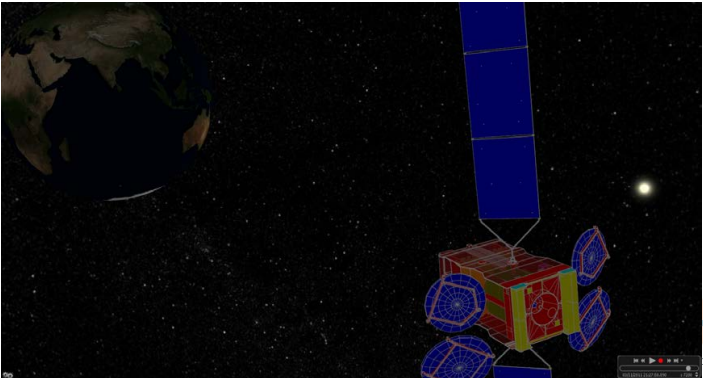


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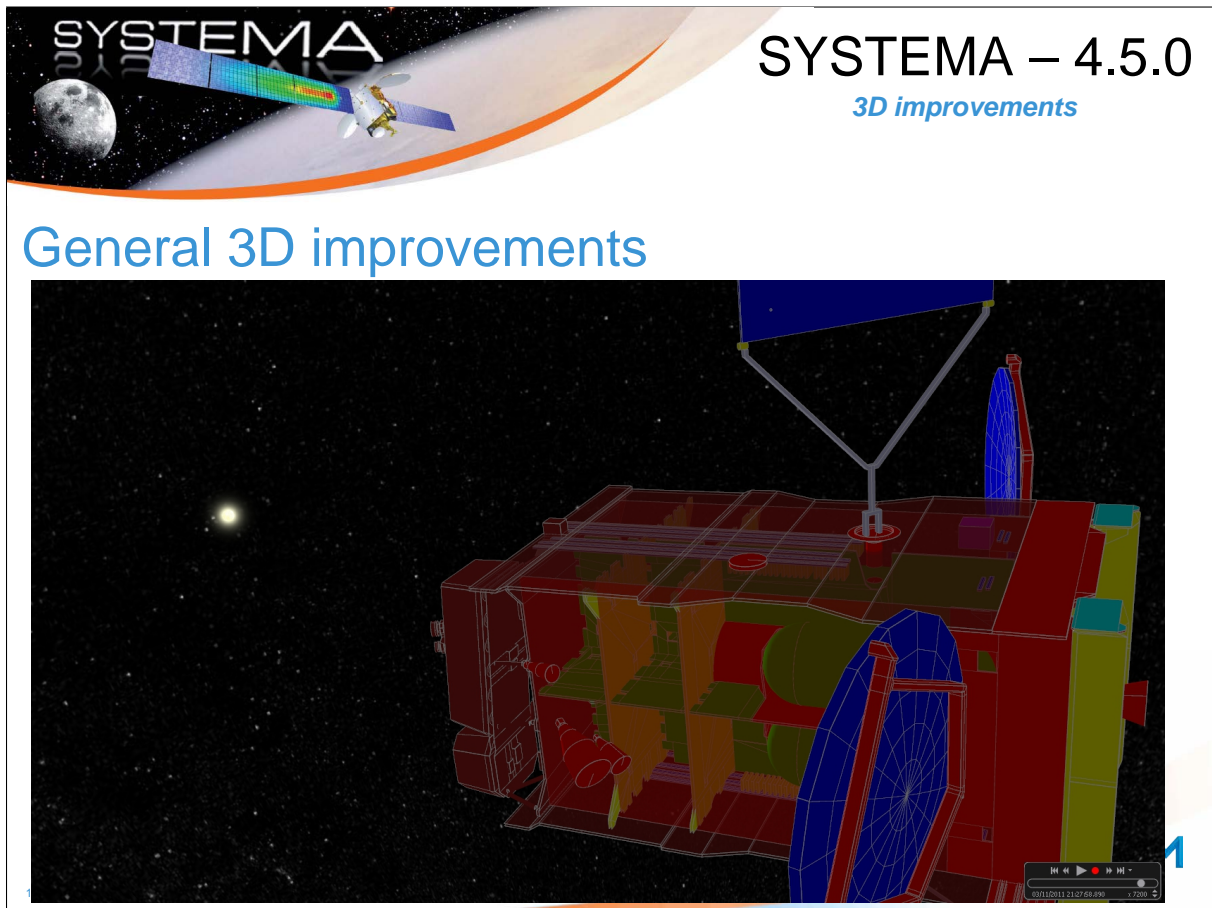
3D improvements

General 3D improvements

- Rendering of the sun
- Real size solar system
- Better precision
- High-definition textures of the earth



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3D improvements

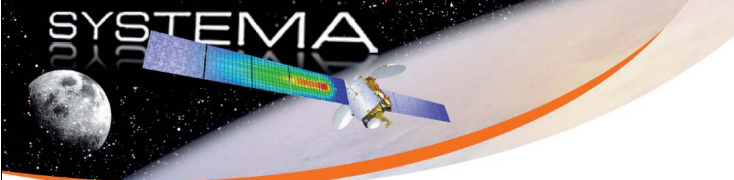
Ergonomics

Objectives:

- Help the user to understand the orientation of the shapes
- Help the user to understand the orientation of the satellite in the solar system

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3D improvements

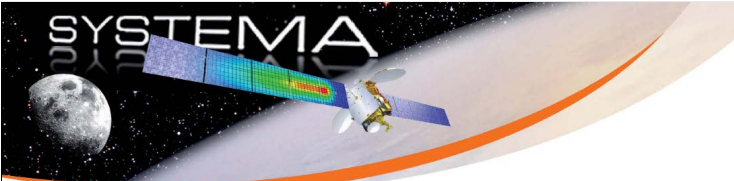
Ergonomics

A new functionality: “orientation frames”

- To easily see interesting frames and directions
- To add and compose these frames



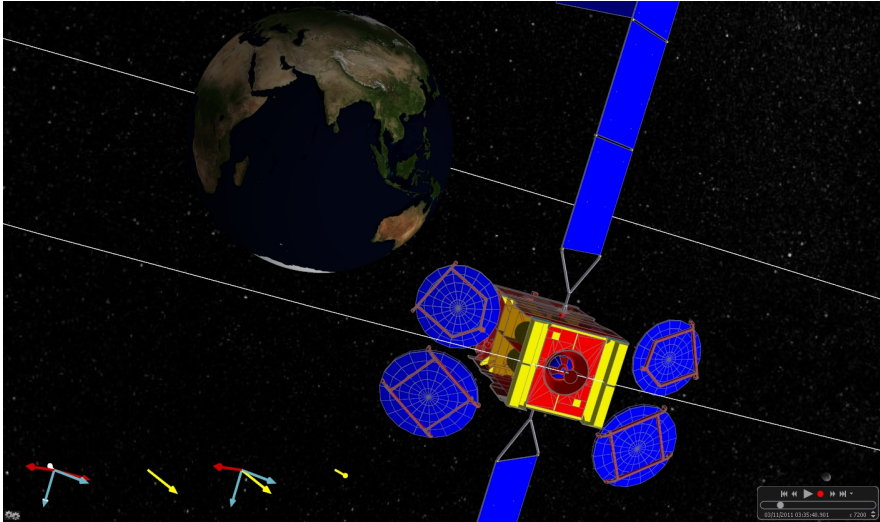
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3D improvements

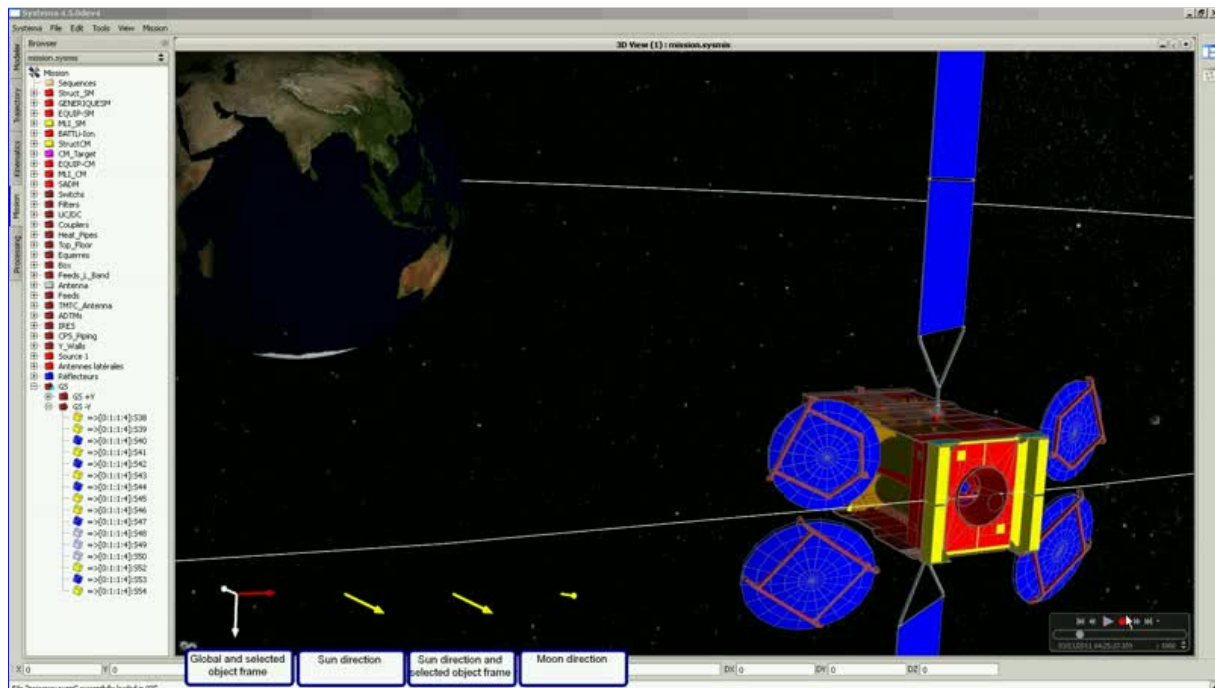
Ergonomics



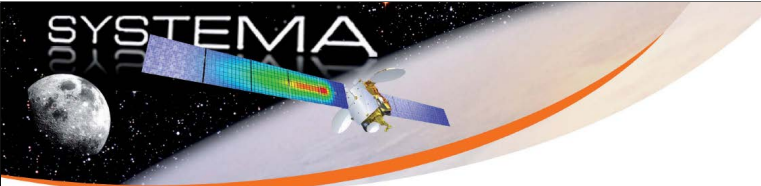
[See attached video](#)



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If clicking on the picture above does not run the movie then try opening the file
'movies/ergonomics.html' manually.

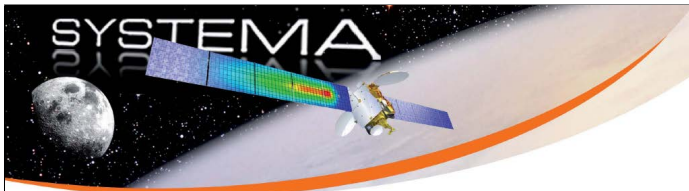

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Mission definition improvements



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Mission definition improvements

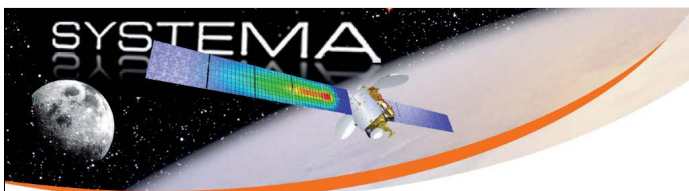
Objectives

To allow the user to interactively define a complex mission composed of successive maneuvers (imaging, sun pointing...):

- Synchronize the different events of a mission
- Visualize all relevant information



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Mission definition improvements

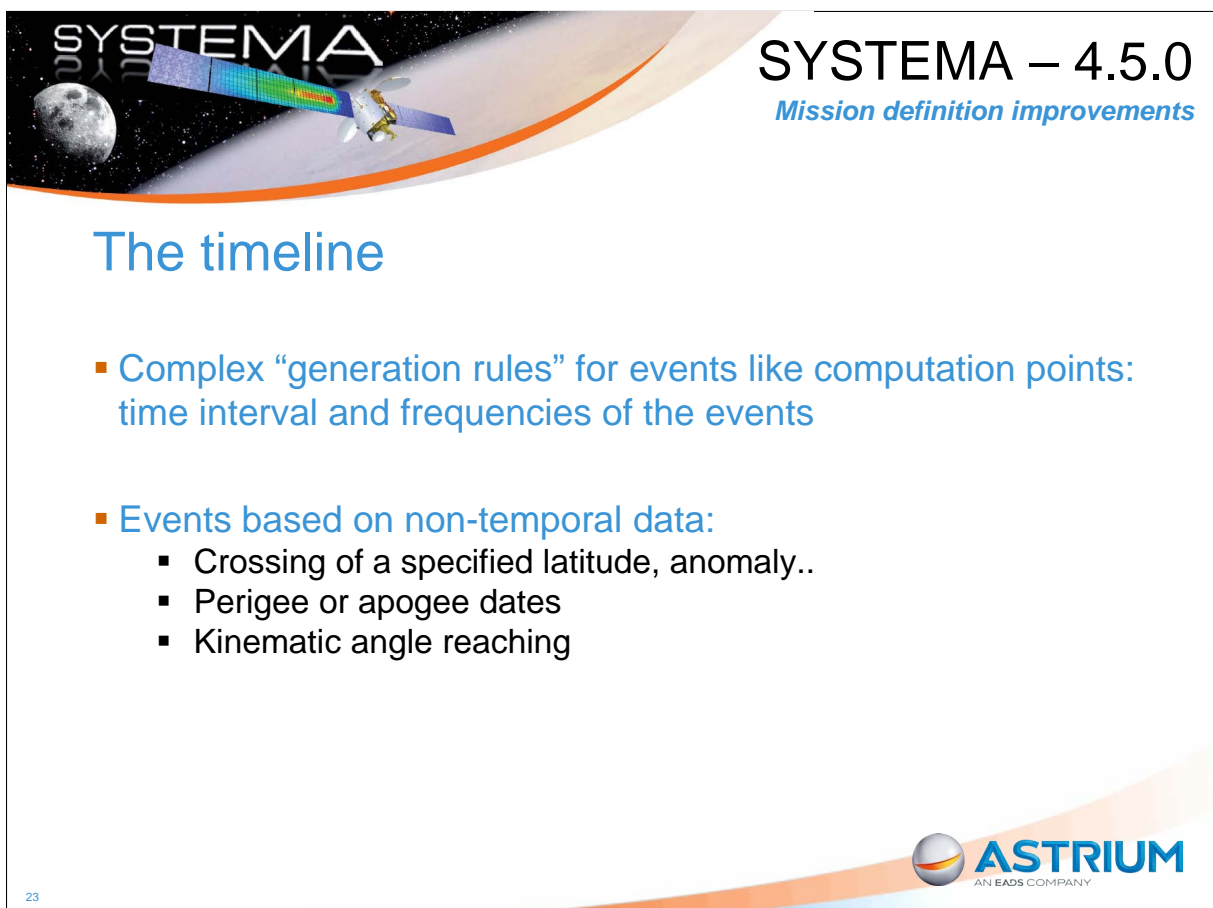
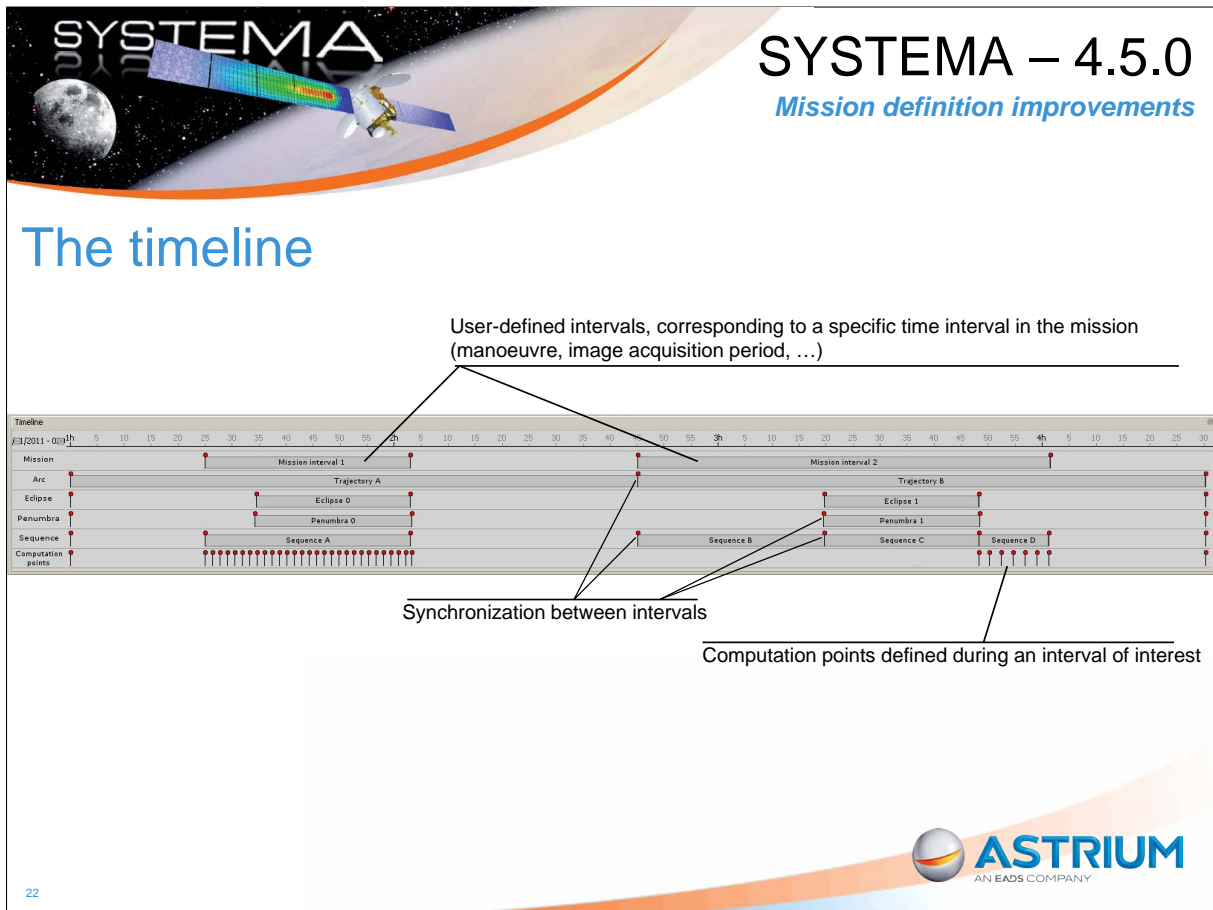
The timeline

To see and modify all time-related data of a mission

- Trajectory arcs beginning and end
- Eclipse and penumbra intervals
- Kinematics sequences
- Computation points
- User-defined events and intervals



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SYSTEMA

THERMICA

THERMISOL

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The screenshot shows the SYSTEMA THERMISOL web application interface. It features a navigation menu on the left with links to Home, Products, Systems, Thermica Suite, Thermisol, Overview, Technical details, Applications, Smart2, Quartz, and Support. The main content area displays the 'THERMISOL - Applications' section, which includes a description of the software's use in Astrium and a section titled 'Automatic time-step adjustment'. This section contains a graph showing the evolution of temperature for three nodes (1000, 2000, and 3000) over time, with a caption 'Automatic time-step adjustment'.

