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Systema Framework

Release Note

4.9.3

Trajectory

- New version of Orekit (10.3) embedded
- The accuracy of the true anomaly and apoapsis/periapsis computations is increased. Thus :
  - The duration of trajectories defined prior to 4.9.3 with end date based on number of revolution will be different in Systema-4.9.3
  - The computation points defined in mission based on true anomaly step will be different in Systema 4.9.3.

  Please refer to "Systema V4 releases migration manual" for more details.

- Moreover the conversion true solar time / longitude for the ascending node is also more accurate. For instance, the delta on longitude between previous 4.9 release is about :
  - 0.5 degrees for Earth
  - 174 degrees for Mars
- For Time-Position-Velocity arcs, the "Center of the reference frame" option is now available for OEM, STK, Cartesian position in Veis1950, EME2000 and ICRF frames. This option has 2 possible values :
  - Default (the reference is used as is => EME2000 and Veis1950 are Earth centered and ICRF is solar systema barycenter centered whatever the center of the arc). It is the default to keep the same behaviour than before.
  - Orbit reference : the center of the reference frame is now the orbit ref. So for instance, for an arc around Mars, any ref frame is now considered as Mars centered.

  Moreover, CentralBody field of STK files is now taken into account if the celestial body used is known by Systema and if it is declared in the list of available celestial bodies of the trajectory. This is the same behaviour than OEM files: if CENTER_NAME defined in the OEM file is not in the available bodies, it is ignored.

- More details about local solar time are provided in the technical annex of the trajectory module.
- The "help" button is now available in the arc edition panel.
- Pole definition of jovian moons updated to be compliant with "Report of the IAU Working Group on CartographicCoordinates and Rotational Elements: 2009".
- "Relative time" kind of date used in Time-Position-Velocity arcs fixed
- Celestial bodies not supported for planet stationary arcs are no longer available in the arc definition.
- Improvement of performances for trajectory with a lot of orbits

Python API

- The full Python Api of Orekit (10.3) is now embedded in Systema, including Hipparchus et Rugged modules. Please refer to https://orekit.org/site-orekit-10.3/apidocs/index.html for more details on the provided classes.
- Till the previous release of Systema, the Python API was dedicated to create and modify data. This paradigm is revised in Systema 493 and it is now possible to create and tune 3D views, set the results to display and manage the player to allow the user to automatize screenshots of 3D views.
- Selecting a point in a displayed 3D view is now possible with the Python API
- New methods provided to set and get the position and the rotation of schematic components
- Issue when converting Julian to calendar dates fixed
- Orientations of faces for 6 faces boxed exported with tesselateThermicaNode python method fixed. Moreover, the performance of this python method has been improved.
- Removed variable with python is now complete

Modeller / Meshing

- Improved STEP-TAS export for some extruded polygons. Note: Systema supports oblique prisms whereas the STEP-TAS protocol does not. When exporting this kind of prism, a warning is raised to notify the user. A tolerance has been introduced to allow solid box cutters export if the angle between the vectors is less than 0.1°
- The color of help items can be set to ease screenshots.
- Hide functionality improved for nodes with a distinct side management
- Drag&Drop in the browser tree fixed to reorganize shapes at the same level
- Issue with cutters only volumic shapes fixed

Kinematics

- AEM files with Euler angles are supported
- A warning is raised if an ambiguous law is used for two pointing laws (and thus for usually, the main attitude)
- Update of the play/pause button fixed
- Missing definitions in the user manual added for some kinematics laws and transformations

Schematics

- Issue with aligned component fixed

Mission

- All textual information dependant of the selected meshes displayed in the 3D view are now updated when the selection in the meshing browser changed.

General

- A new dialog is used to select files to avoid slowdowns on Windows

- The maximum resolution of 3D viewports is no longer limited. Thus SYSTEMA_ENABLE_HIGH_RES is no longer supported. Previous behaviour can be restored with SYSTEMA_LIMIT_RESOLUTION environment variable.

4.9.2P1

➢ LTS

Systema-4.9.2P1 is the maintenance version of the current Long Term Support (LTS) version.

➢ Bug fixes

General

- Prevent scrolling up the edition panel when editing a field

Python API

- Cannot set kinematics links to shape under object fixed
- Setting wrong container for properties lead to crash fixed
- Support for importing of h5py Python module on Linux
- Improve the display of the html Python API doc

Kinematics

- Fix the Ecliptic North pointing law

Mission

- Avoid empty 3D view in the mission when setting specific some camera options

Meshing

- Wrong selected nodes on specific items after re-opening meshing fixed
- Specific item definition lost when modifying a shape fixed

Import/Export

- Support for saving a STEP-TAS file with no "Default phase" in material database

4.9.2

➢ LTS

Systema-4.9.2 is the new Long Term Support (LTS) version.

Exporting files for the previous LTS version (4.8.3) is provided for any kind of Systema files:

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Model

- Conversion of radiative enclosures from string to integer. The value may be modified.
- Grid help item conversion (removal of grid length and number of cells)
- Suppression of transformations on cutters to avoid issue in Systema-4.8.3

Meshing

- Removal of solar lamp specific items for Thermica meshing

Trajectory

- Time position velocity arcs with ICRF data are removed. This conversion does not take into account the conversion of the external files (for instance, STK ephemerid file in ICRF ref frame)
- Time position velocity arcs with Planet inertial data and earth centered are replaced by Gamma50/Veis1950 data
- Time position velocity arcs with Planet inertial data and non-earth centered are removed

Note that how trajectories are dynamically computed and the planet ephemerids provided by Orekit till Systema-4.9.0 are now exported.

Kinematics

- Kinematics bodies using ICRF axis pointing laws are removed
- Ecliptic north kinematics laws are replaced by Gamma50 Z pointing laws
- Kinematics bodies with 2 pointing vectors laws based on at least one ICRF axis are removed

Processing

- Option "Processing Directory" used to build the result directory is replaced by "Default Result Directory"

➢ Python API

A new python console based on Jupyter is now provided by Systema. Among a large numbers of features, it allows to use auto-completion, to get the description of the methods:

Systema 4.9.2 now embeds Python 2.7.18 distribution with the following modules:

PACKAGE	VERSION	DESCRIPTION
alabaster	0.7.12	A configurable sidebar-enabled Sphinx theme
Babel	2.9.1	Internationalization utilities

backports-abc	0.5	A backport of recent additions to the 'collections.abc' module.
backports.functools-lru-cache	1.6.4	Backport of functools.lru_cache
backports.shutil-get-terminal-size	1.0.0	A backport of the get_terminal_size function from Python 3.3's shutil.
certifi	2021.10.8	Python package for providing Mozilla's CA Bundle.
chardet	4.0.0	Character encoding auto-detection in Python 3
colorama	0.4.4	Cross-platform colored terminal text.
cycler	0.10.0	Composable style cycles
decorator	4.4.2	Decorators for Humans
docutils	0.17.1	Docutils -- Python Documentation Utilities
enum34	1.1.10	Python 3.4 Enum backported to 3.3; 3.2; 3.1; 2.7; 2.6; 2.5; and 2.4
et-xmlfile	1.0.1	An implementation of lxml.xmlfile for the standard library
futures	3.3.0	The latest version for concurrent.futures package from Python
h5py	2.10.0	Read and write HDF5 files from Python
idna	2.1	Internationalized Domain Names in Applications (IDNA)
imagesize	1.3.0	Getting image size from png/jpeg/jpeg2000/gif file
ipykernel	4.10.1	IPython Kernel for Jupyter
ipython	5.10.0	IPython: Productive Interactive Computing
ipython-genutils	0.2.0	Vestigial utilities from Ipython
jdcal	1.4.1	Julian dates from proleptic Gregorian and Julian calendars.
Jinja2	2.11.3	A very fast and expressive template engine.
jupyter-client	5.3.5	Jupyter protocol implementation and client libraries
jupyter-core	4.6.3	Jupyter core package. A base package on which Jupyter projects rely.
kiwisolver	1.1.0	A fast implementation of the Cassowary constraint solver
MarkupSafe	1.1.1	Safely add untrusted strings to HTML/XML markup.
matplotlib	2.2.5	Python plotting package
numpy	1.16.6	NumPy is the fundamental package for array computing with Python.
openpyxl	2.6.4	A Python library to read/write Excel 2010 xlsx/xlsm files
packaging	20.9	Core utilities for Python packages
pandas	0.24.2	Powerful data structures for data analysis; time series; and statistics
pathlib2	2.3.6	Object-oriented filesystem paths
pexpect	4.8.0	Pexpect allows easy control of interactive console applications.
pickleshare	0.7.5	Tiny 'shelve'-like database with concurrency support
Pillow	6.2.2	Python Imaging Library
prompt-toolkit	1.0.18	Library for building powerful interactive command lines in Python
ptyprocess	0.7.0	Run a subprocess in a pseudo terminal
py	1.11.0	library with cross-python path, ini-parsing, io, code, log facilities
Pygments	2.5.2	Pygments is a syntax highlighting package written in Python.
pyparsing	2.4.7	Python parsing module
pytest	2.3.5	pytest: simple powerful testing with Python

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python-dateutil	2.8.2	Various utilities for working with date and datetime objects
pytz	2021.3	World timezone definitions; modern and historical
pywin32	228	Python for Window Extensions
pyzmq	19.0.2	Python bindings for 0MQ
qtconsole	4.7.7	Jupyter Qt console
QtPy	1.11.2	Provides an abstraction layer on top of the various Qt bindings.
requests	2.26.0	Python HTTP for Humans.
scandir	1.10.0	scandir; a better directory iterator and faster os.walk()
scipy	1.2.3	SciPy: Scientific Library for Python
simplegeneric	0.8.1	Simple generic functions (similar to Python's own len(); pickle.dump(); etc.)
singledispatch	3.7.0	Backport functools.singledispatch from Python 3.4 to Python 2.6-3.3.
sip	4.19.19	A Python bindings generator for C/C++ libraries
six	1.16.0	Python 2 and 3 compatibility utilities
snowballstemmer	2.2.0	This package provides 29 stemmers for 28 languages generated from Snowball algorithms.
Sphinx	1.8.6	Python documentation generator
sphinx-rtd-theme	1.0.0	Read the Docs theme for Sphinx
sphinxcontrib-websupport	1.1.2	Sphinx API for Web Apps
subprocess32	3.5.4	A backport of the subprocess module from Python 3 for use on 2.x.
tornado	5.1.1	Tornado is a Python web framework and asynchronous networking library; originally developed at FriendFeed.
traitlets	4.3.3	Traitlets Python configuration system
typing	3.10.0.0	Type Hints for Python
urllib3	1.26.7	HTTP library with thread-safe connection pooling; file post; and more.
wcwidth	0.2.5	Measures the displayed width of unicode strings in a terminal
win-unicode-console	0.5	Enable Unicode input and display when running Python from Windows console.
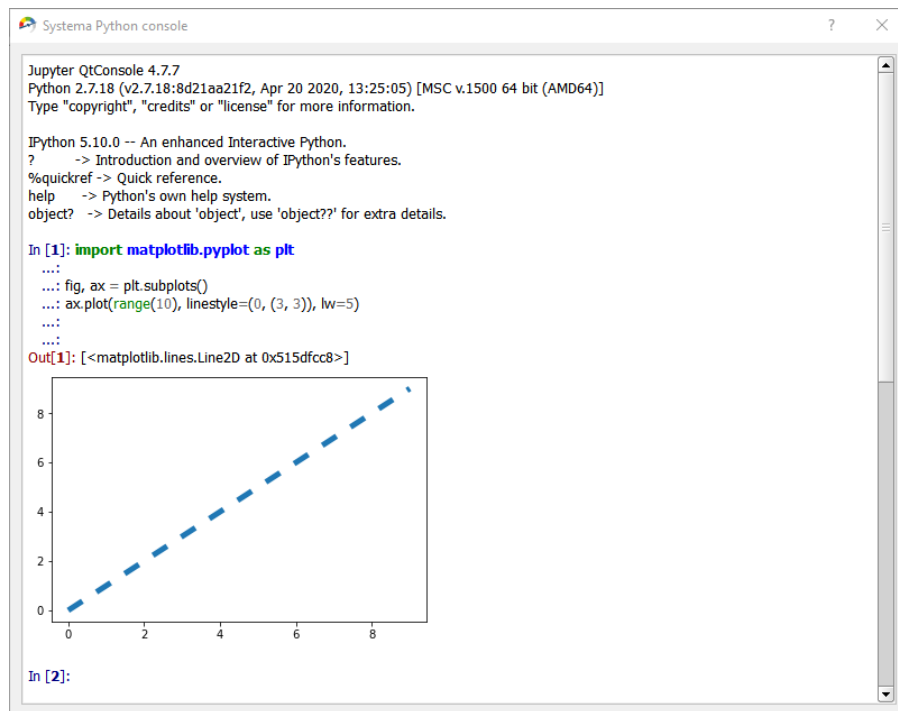
Moreover, Systema Python API provides new methods to:
- Create help items in a model file
- Get information about the ephemeris and the attitude at any time for a given mission
- Get the list of material names stored in a material file
- Convert a quaternion to a transformation matrix
- Get and set the general properties of Sensors
- Manage the node number of non-geometrical nodes
- Duplicate easily specific items
- Remove some properties (condensation, label, submodel, shift) from meshing files
- Load HDF5 results file
- Get the list of schematic components and powcmp files.
- Ensure uniqueness of electrical and thermal node numbers
- Import prptbl files

➢ Ergonomy

Modifying the tree of a geometrical model can be done easily with Drag & Drop. Using Ctrl modified during the drag operations allows to duplicate the selected items.
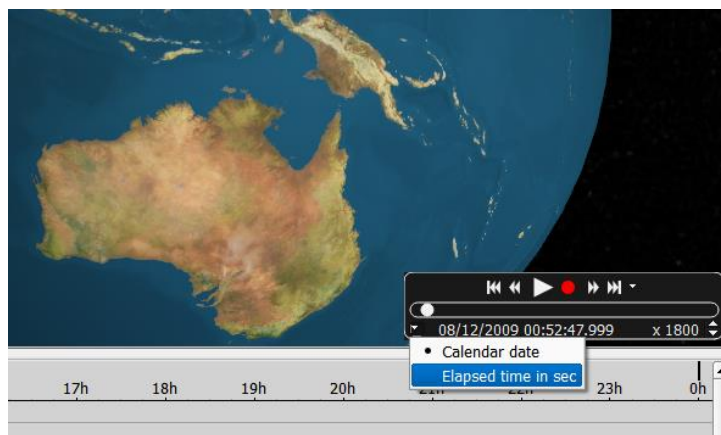
For all Systema files, it is possible to add a free comment:
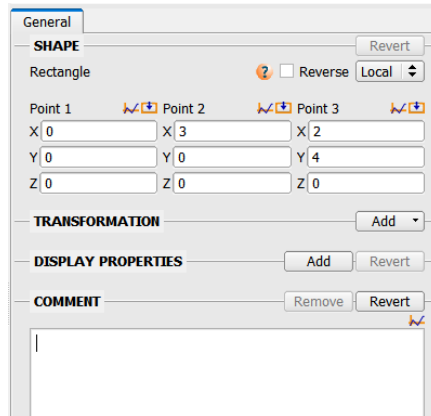
In the 3D views where models are displayed, it is now possible to choose if the gizmo is based on the local or global axis system
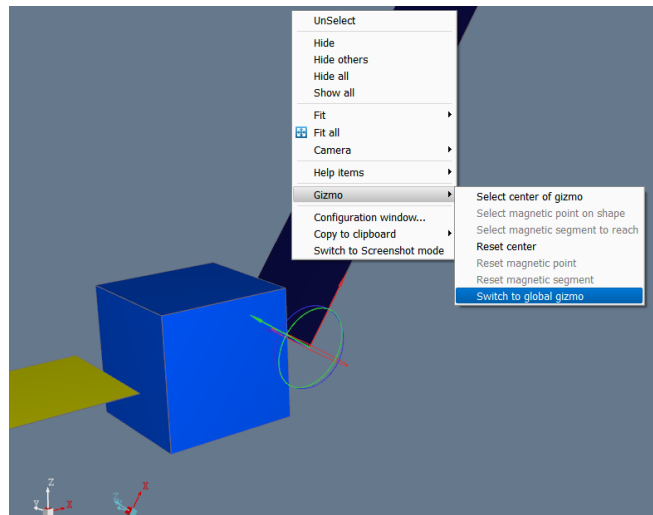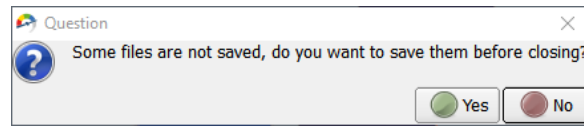

The player displayed in 3D views (trajectory, mission and meshing if results are loaded) can be switched in elapsed time.
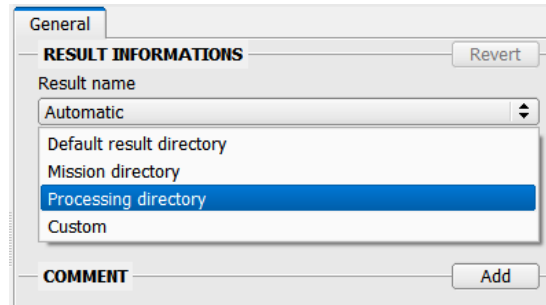

Closing all the files without saving is now possible with just a single confirmation message:

For processing diagram, It is possible to use the path of the processing files to build the results directory:

New settings are available to tune Systema:

- Change the default max number of recent files
- Watch external modifications of Systema file
- Set the default mode for players (calendar date or elapsed time)
- Store or not the saving date in Systema files

When defining the referenced objects for a specific item in a meshing file, « Add selection » can be used either on a selected mesh or shape

➢ Trajectory/Kinematics

• Reference frames

Systema allows to import arc or kinematics definitions defined in ICRF.

Moreover, the supported reference frames in Systema are clarified to avoid confusion.

In Systema-4.9.2, J2000 and Gamma50/Veis1950 are now always Earth centered. Previously, the center was not clear for celestial bodies different from Earth. ⚠ Thus, when importing trajectory files with Time-Position-Velocity arcs from previous versions in Systema 4.9.2, the data format must be checked. There is not automatic modification.

The supported formats in Time-Position-Velocity format are now for cartesian position and velocity:

- "Cartesian position and velocity in Veis1950":
  inertial reference frame. Earth centered. In previous version, it was "Cartesian position and velocity in planet inertial reference Gamma50". With the Python API, use "Cartesian G50" for this kind of data.
- "Cartesian position and velocity in planet inertial frame":
  inertial reference frame. Orbit reference centered. In previous version, it was "Cartesian position and velocity in planet inertial reference J2000". With the Python API, use "Cartesian Planet Inertial" for this kind of data.
- "Cartesian position and velocity in J2000":
  inertial and earth centered reference frame. With the Python API, use "Cartesian J2000" for this kind of data.

- "Cartesian position and velocity in ICRF":
  inertial reference frame, solar system barycenter centered. With the Python API, use "Cartesian ICRF" for this kind of data.

When using a STK ephemeris file, CoordinateSystem is now taken into account as follow:

- B1950 : Veis1950
- J2000 : EME2000 (so earth centered in Systema). For STK it can be centered on another body defined by CentralBody field. This is ignored
- ICRF : ICRF (so solar systema barycenter centered in Systema). For STK it can be centered on another body defined by CentralBody field. This is ignored
- Other values or no header == Planet inertial (for compatibility purpose)

When using IDM-CIC OEM files, REF_FRAME keyword is taken into account as follow:

- EME2000 : EME2000
- ICRF : ICRF
- Other : Planet Inertial

In the mission log, M50 is replaced by (Planet Inertial). Note that the velocity in J2000 is now earth centered.

- **STK files**

The support of ephemeris and attitude STK file is improved:

- Tabulations and extra spaces are allowed in headers
- The ScenarioEpoch line must be formatted as ScenarioEpoch dd MMM yyyy hh:mm:ss.zzz where d, y, h, m, s, z are digits and MMM must
  be Jan/Feb/Mar/Apr/May/Jun/Jul/Aug/Sep/Oct/Nov/Dec. The separators can be one or several space or tabulation. The number of day must be in [0; 31]. If ScenarioEpoch is not correctly defined, a warning is raised and 01/01/1970 00:00:00 is taken as reference.
- The comparisons of strings used for keywords and dates are case insensitive
- CoordinateSystem keyword is taken into account (see § Reference frames for more details).

- **Informations**

In the 3d views where trajectories are displayed, new textual information can be displayed:

- The occulting body during eclipses and penumbra
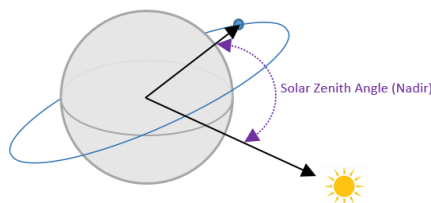
- The Solar Zenith Angle

These information are also available in the mission log.

- **Kinematic Laws**

New kinematic laws are provided:

- X direction of ICRF
- Y direction of ICRF
- Z direction of ICRF
- Ecliptic north:

  Until Systema-4.9.0, the Z directions of J2000 and Gamma50 were in fact oriented to the normal to the ecliptic plane. Thus, when importing kinematic files defined in the J2000 reference frame for example, the use of the "Orbit planet reference north direction" law was necessary. This confusion has been corrected in Systema-4.9.0 and as a result, it was no longer possible to point the ecliptic to the north. The Ecliptic north law is now restored in Systema-4.9.2.

➢ **STEP-TAS**

The import/export of STEP-TAS files is improved to fully support:
- Phases of materials
- Sentinel values in thermo-optical properties (IR & UV)
- Infinite "inside" prism cutters
- Import of meshed boxes

➢ **Miscelleanous**

A new version of the Elysium tools used to import CAD files is provided on Windows to solve internal license issue encountered on Windows 10.

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4.9.1

➢ **STEP-TAS**

The implementation of the STEP-TAS standard is improved in Systema-4.9.1:

- o Import/export of the bulk properties including activity

- o Import/export of the transverse properties of materials

- o Import/export of the radiative enclosures

- o Export of 4,5 and 6 faces boxes as boxes

- o Issue when exporting 4 points truncated sphere

- o Avoid creating multiple materials with the same properties on export

- o Improvement of infinte solid by plane cutters management

➢ **Schematic**

All actions available in schematic diagrams are now handled by the undo/redo mechanism.

➢ **Performances**

Performances of the modeler and the meshing are highly improved. Moreover file saving on the network is now very fast.

➢ **Python**

New methods are available in the Python API to:

- o Determine if an application property is overloaded or not

- o Create a single computation point in a mission file

- o Create a set of sequence intervals in a mission file

Warning : To get the value of the enclosure property of Thermica through the Python API, getString or getInheritedString method must be used instead of getValue or getInheritedValue methods. See the release note of Thermica for more details.

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➤ **Ergonomy**

The user can choose the color palette to use in the 3D view in the following list:

- o Back body (used by default)

- o Wave length

- o Black and white

- o Viridis (colorblindness compatible)

The user can define the colors for undefined or out of bound values to use in 3D views.

HDF5 files can be opened quickly by drag and drop in the processing tab.

Points of normal vectors displayed in the 3D view of the modeler are now selectable.

4.9.0

Major improvements:

➢ **Trajectory module**

- **Orekit integration**

The trajectory module now embeds the Orekit java library. Orekit is a reference flight dynamics library extensively and successfully used by many major actors in the space industry. Orekit provides efficient components for the development of space dynamics applications (gravity models, celestial bodies, orbits, etc).

For more details about Orekit, please refer to www.orekit.org.

Systema-4.9.0 is the first space physics analysis software to directly embed Orekit. The Orekit integration is transparent to users:
  - No extra license
  - No additional installation step
  - File forward compatibility (Gamma50 - VEIS1950 reference frame)

The Systema mission module also becomes more open:
  - Orekit is open-source
  - All Systema calculation methods accessible through the Python API

The position of Earth and Mars are now precisely computed thanks to the ephemeris files by Orekit. Consequently, the celestial bodies Earth_2020, Earth_2030, Earth_2040 and Mars_2030 provided in Systema 4.8.3 have been removed from Systema 4.9.0.
To ensure backward compatibility, trajectory files containing reference to Earth_2020, Earth_2030, Earth_2040 or Mars_2030 are automatically replaced by Earth or Mars in Systema 4.9.0

- **Maps file**

When computing planet fluxes, the Albedo coefficients and the incoming IR flux can be defined using an input maps file. It's now possible to display maps files directly on celestial bodies in the trajectory and mission 3D view.
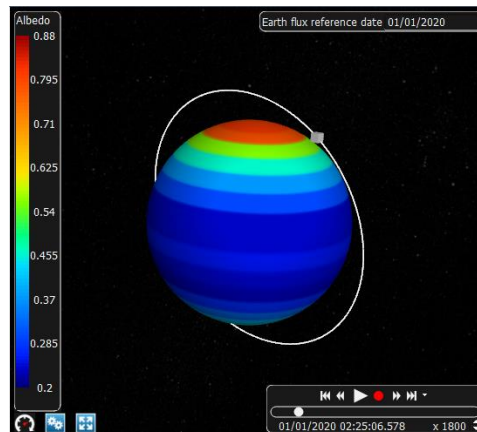
- **Ground track view**

The ground track view available in the Trajectory module is improved to allow the user to display several arcs at the same time and to manage multi-celestial bodies' trajectories and to play the trajectory:
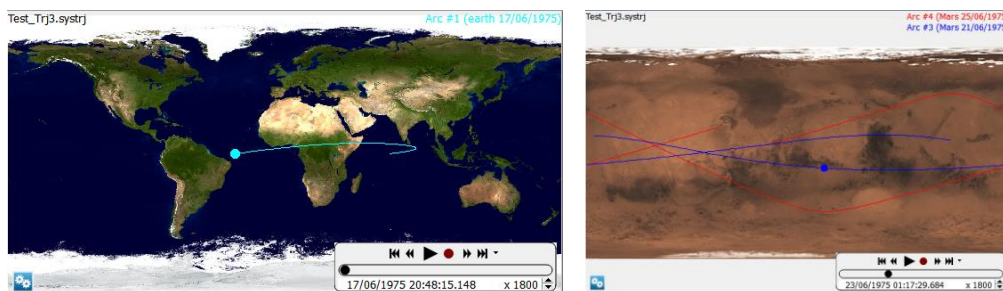
➢ **STEP-TAS**

The implementation of the STEP-TAS standard is highly improved in Systema-4.9.0:

- Integration of the validation of the imported and exported thermal models from STEP-TAS Software Development Kit (SDK).
- Irregular meshing are now managed in import/export
- Antenna with focal can be exported
- Infinite solid by plane cutter are now supported
- Management of cutter highly improved. Cutters are no longer replicated when exporting a model.
- Issue about orientations of faces box fixed
- Coplanarity issues regarding the STEP-TAS rules for quadrangles can be automatically fixed when exporting a model
- Issue about numbering parameters set on objects fixed
- Warnings if some materials cannot be correctly exported are now raised

New settings are available to tune the STEP-TAS import/export process:

- Disable STEP-TAS validation

- Enable automatic quadrangle coplanarity correction on export
- Be warned when imported file contains errors

➢ Ergonomy

The 3D view of the modeler provides now a very powerful tool to enable quick and easy 3D manipulation: the gizmo.

The gizmo provides a new way to move and rotate objects and shapes of a model directly in the 3D view. The gizmo is an alternative to the transformations available in the modeler. Depending on the actions you are looking for, you can choose between the definition of transformations and the Gizmo to manipulate models.
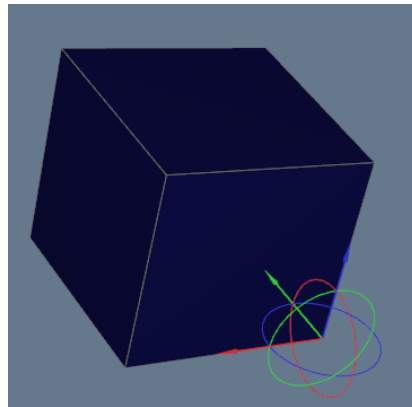
The gizmo:
- Can quickly be repositioned and reoriented for better control of the transformation.
- Let's you transform your current selection (shapes and objects)
- Provides a quick way to define the exact value of the angle of a rotation or the distance of translation
- Can take into account magnetism to easily align or snap model elements.

➢ Python

A lot of new methods are available in the Python API to:

- Manage variables and get the list of variables used in any Systema file
- Full support of all options available to create kinematics files
- Define the type of a processing mission
- Enable propagation with or without J2 effect in trajectories
- Manage the available celestial bodies of a trajectory
- Get the celestial velocity and transformation matrix
- Define dates with events
- Get the start and dates of eclipse and penumbra for a trajectory file
- Enable Specific item by node edition in meshing file

- Manage the kinematics link in mission files

Moreover, helper's methods are also available to:

- Get the list of opened files
- Get the result directory parameters of a processing file
- Get the selected elements of a meshing file
- Get the last n selected point in a model file
- Get information about the current selected point in a model (X,Y,Z, Distance, Angle, DX, DY, DZ)
- Improvement of the symmetry method of the syslib module

The Python console provides a more efficient copy/paste function and an easier history navigation mechanism.

➢ **Framework customization**

Systema 4.9.0 offers more customization possibilities thanks to the following new settings:

- The dynamic scale option of the 3D view can be activated/deactivated (activated by default); it can then be modified and overridden in the scale configuration window
- The anti-aliasing option for the 3D views (activated by default).
- The font size (10 by default).
- The interactive mode to create shape can be set/unset as a continuous mode
- The default values of the visibility and selection options of the modeler 3D view can be set
- The location of the Power components (only available if Power is installed)

➢ **Performance**

Performances of the timeline of the mission and of the modeler selection mechanism are highly improved.

Other improvements/corrections:

➢ **Kinematics**

Issues about Gamma50 and EME2000 pointing laws are fixed and are coherent with the trajectory module.

Issue about attitude already shift at orbit start is fixed

➢ **Trajectory**

The management of the "Kind of date" option for Time-Position-Velocity was improved to be taken into account only when relevant (for STK and CIC OEM file for instance) and to avoid issues that lead to 50 years shift.

➢ **Post-processing**

It's now possible to extract data from HDF5 file to XLSX files thanks to the Extraction XLSX box.

➢ **Modeller**

Creating shapes in interactive mode is now done in continuous mode.

A quick way to switch from display mode to screenshot mode is provided in the contextual menu of the 3D view so that taking screenshots can be performed quickly.

For general truncated cylinders cutters, the behavior of the cutting algorithm is now the same if finite or not (limitation of Systema 4.8.3).

Issue about transformations defined with a cosine matrix for cutter is fixed

➢ **Schematic**

The schematic file selector indicates if a modified file needs to be saved and provides the full path of file in a tooltip

The location on points are now correctly saved

➢ **Miscellaneous**

A new contextual menu allows to taken into account time and parameters controllers when copying a 3D view to the clipboard.

When recording videos, new formats are supported:

- m1v
- mp4
- avi

A tooltip is now displayed on recent files and python scripts to give more details about the file path.

4.8.3P3

No modifications.

4.8.3P2

➢ **Bug fixes**

When cutting a shape, the orientation is no longer modified.

4.8.3P1

➢ **Bug fixes**

Profiles are now stored in the local application data storage. This location can be defined thanks to the SYSTEMA_PROFILE_DIR environment variable

A new setting is available to manage the default value of the dynamic scale option of the 3D views. It is highly recommended to turn this option off when displaying the color scale on huge models.

Icons and menus related to volumic shapes are now hidden by default. It is possible to change this configuration thanks to the settings.

On Windows, importing hdf5 files with a large number of entities do no longer lead to instabilities.

In the 3D view of the trajectory, if the celestial names and several celestial are displayed, fitting on a celestial body now succeeds

Custom Mars celestial is available with more accurate trajectory modelling around 2030 decade.

When displaying building points in the 3d view of the modeler, it is possible to select several shapes directly in the 3D view.

Crashes when using with finite cutters with the difference operation that generates very small triangles are now fixed.

All the required components to display the online user manual on Windows are now provided.

4.8.3

Major improvements:

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➢ **Framework customization**

The Systema framework becomes highly customizable through a settings system. Settings are user options that are persisted between Systema start-ups. They can be used, among other things, to:

- Customize the GUI (choice of tabs to display, geometrical shapes icons visibilities, etc)
- Define user functions (Python scripts accessible from the GUI)
- Tune the file import/export options (ex : Step files tesselation)

Settings can be edited through a dedicated window (in File/Settings) shown below. Sets of settings can be saved into files called "profiles" which can be easily shared between users.
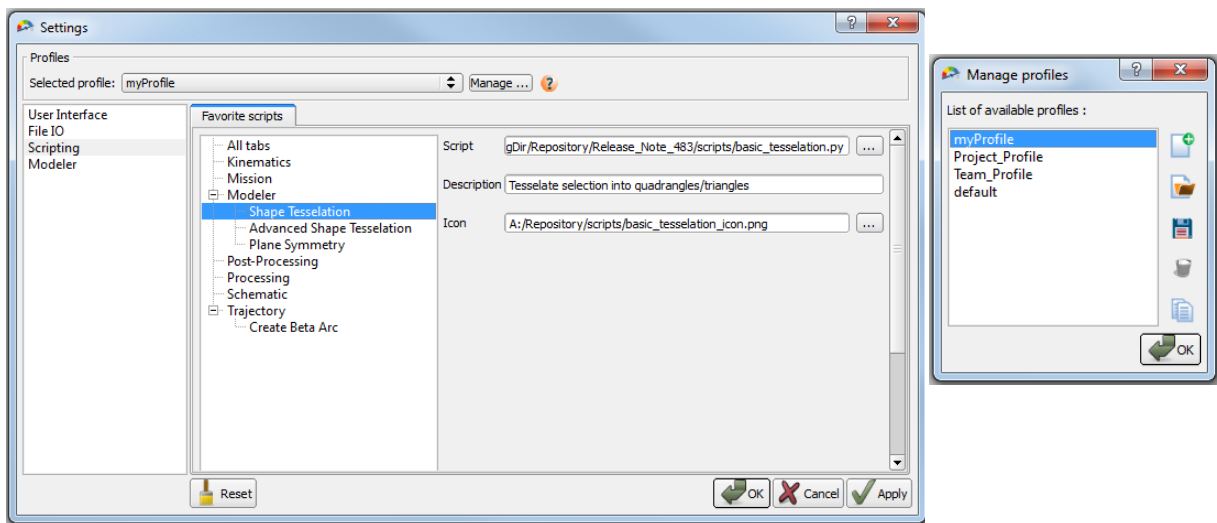
The Python user functions defined in the settings window are displayed for each tab in a dedicated toolbar as well as in a menu called "Favorite scripts".

These scripts can use the current selection (shapes, objects, meshes, specific items, etc) made by the user.

A similar persistence mechanism enables Systema to remember
the scripts that were previously executed and the files that were
previously loaded. These recent scripts/files are accessible directly through the menus.

**AIRBUS**
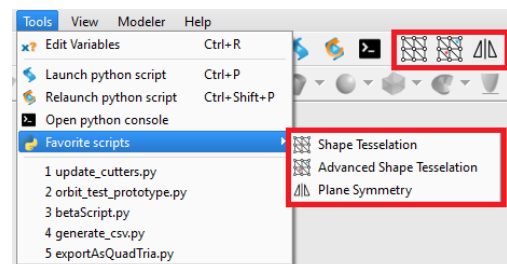
➢ Finite cutters

The exchange of geometry/meshing is facilitated by the addition of finite cutters that replace the legacy infinite cutters.
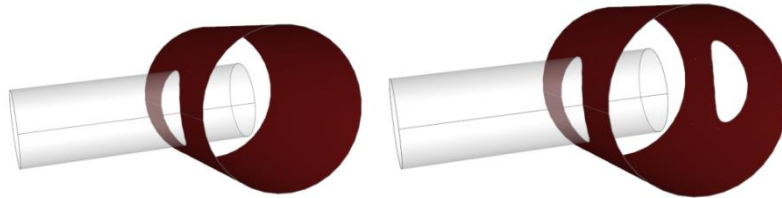
Finite cylinder cutter vs Infinite cylinder cutter (legacy)

Even though infinite cutters are still available for retro-compatibility purposes, the use of finite cutters is highly recommended to:

- Enable the reverse cutters (intersection operation)
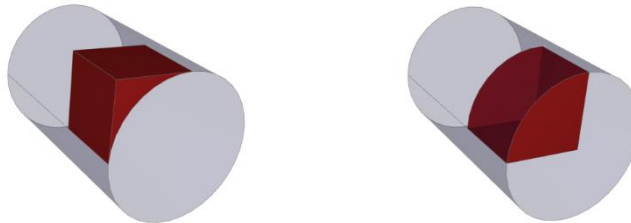

Difference (inside cut) vs Intersection (outside cut)

- Better support the Step-TAS import/export (cylinder, box and triangle prism cutters)
- Improve the stability and efficiency of the shape tessellation
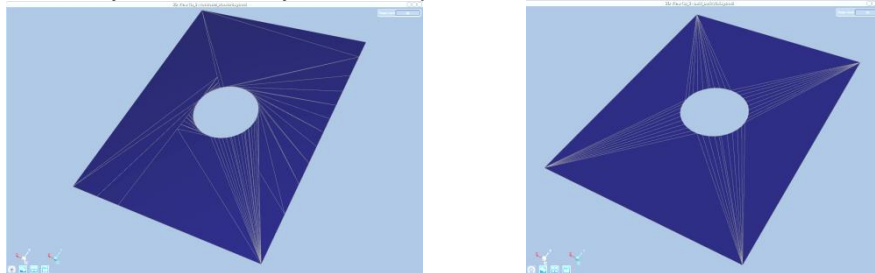
Tesselation of cut rectangle with legacy cutter vs finite cutter (x2 less triangles generated)

➤ Specific items on nodes

Specific items (i.e. non-geometrical items) created from the GUI can reference individual meshes/nodes in the shell geometries (instead of only shapes).
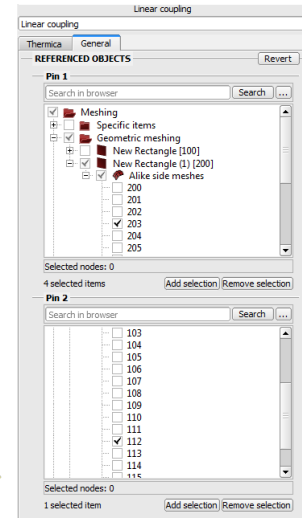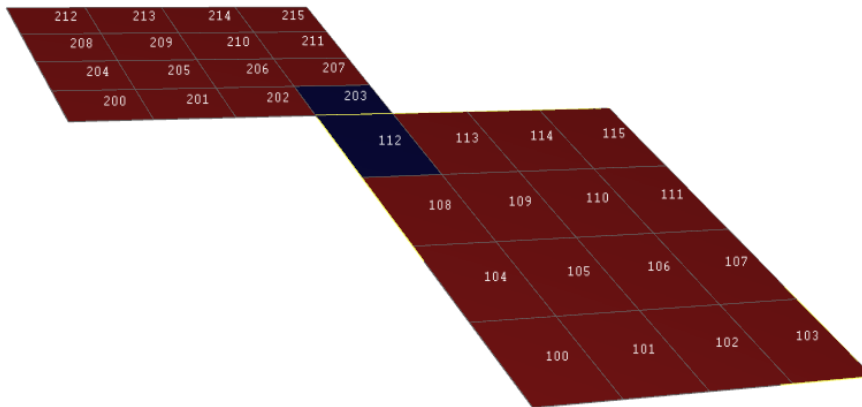
Creation of a linear coupling from the GUI between node 203 and 112

➤ Post-processing by folder

Post-processing diagrams can work on folders also called file list (instead of single files). Regular expressions can be used to filter the files to be post-processed inside the input folder.

Using a Processing output folder as the input of a Post-processing makes the results management way easier.
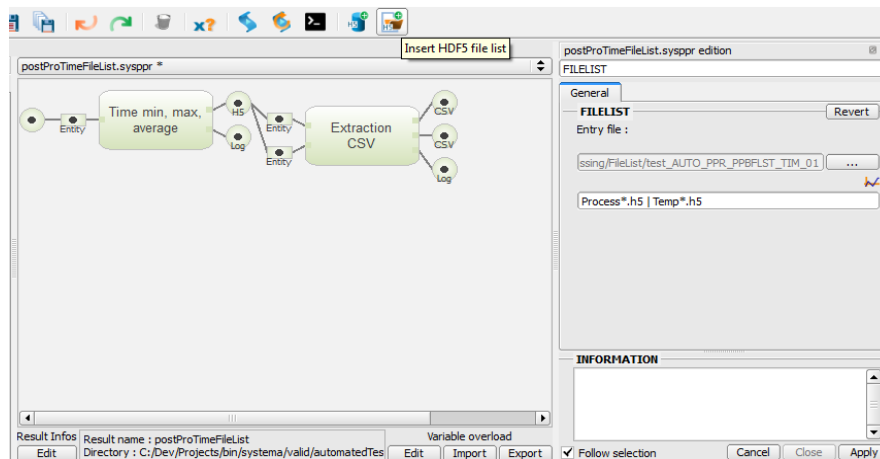
Post-processing diagram fetching all Process*.h5 and Temp*.h5 files in a folder to perform average calculation and CSV extraction

Minor improvements/corrections:

➢ General

- The Python scripting API execution time was reduced up to 10 times in non-interactive mode (-script option in console mode). The Systema memory footprint in this case was also decreased by around 100Mo.
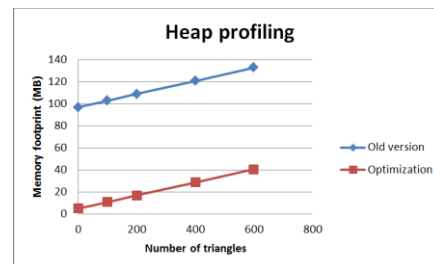
Legacy API vs 4.8.3 API execution time and memory usage comparison in –script mode

- An interactive Python console including syntax colouring and output management is available from every tab to access more quickly to the Python API

- The non-interactive scripting mode (-script in console mode) can run even without X server on the host machine (useful to address clusters hardware)

- The right side toolbar was relocated at the top of the main window for more convenience

- A "Close All" function in the "File" menu enables the quick closing of all opened files in every tabs

- Tabs can be hidden/shown using the "Tabs display" setting

- The 3D optimization algorithm can be disabled without restarting Systema by using the "Enable optimization" setting (requires 3D view re-creation)

- Search by variable name is available in the search tool using the "~" keyword (ex: ~myVariableName) to find where the variable is used in the data tree

- The Enter keyboard shortcut can be used to start the search tool

- The Enter keyboard shortcut can be used to Apply properties even if several edition tabs are opened

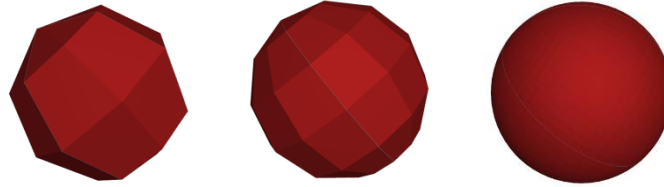- A quick access to the user manual keyboard shortcuts library is available in the "Help" menu

➢ Modeler

- Copy/pasting model elements creates the elements copies in the same order as they appeared initially

- The chord (c) and angle (a) tolerance of the Step import function can be modified in the "File IO" settings to adapt the precision of the generated geometry

STEP AP-214 sphere model generated by Patran imported with different (c, a) parameters

- The "Segment" help item enables the creation of a line segment using an origin, a direction and a distance

- Shapes/cutters type icons can be hidden/shown in the Modeler interface thanks to the "Visibility" setting

- The "File" menu was reorganized so that the "New" and "Open" functions are more practical to use

- Shapes with zero thickness cannot be exported to Step-TAS (an error is raised and blocks the export)

- Coating specularity is correctly imported from Step-TAS models

- Shapes using a material and overloaded but unchanged fields are exported to Step-TAS with the initial material name

- The transformation of a selected cutter is represented by a reference cube in the 3D view

- Several cutters can be inserted in the same shape using the Python API

- When a shape is at the same level as a cutter in the tree, it can be moved without cut refresh 3D glitch

- Polygon shapes can be created through the Python API

- Keyboard shortcuts for Copy/Pasting (Ctrl+C, Ctrl+V) fields in the coordinates bar are fixed

- Search on ranges of properties values (<,>, <=, >=) are available in the Model search tool

➤ **Meshing**

- The "tesselateThermicaNode" and "tesselateThermicaMeshing" Python methods in syslib enable the tessellation in quadrangles/triangles of meshed geometries while conserving the meshing numbering (for Thermica meshing only)

- Meshing can be created from the Python API for applications different from Thermica

➤ **Trajectory**

- Custom Earth celestials are available with more accurate Earth trajectory modelling around 2020, 2030 and 2040 decades. It is highly encouraged to use these celestials to import CIC OEM trajectories with a higher precision (x10 in the accuracy of the resulting beta angle). To do that, change the name of the center planet in the OEM file (ex: CENTER NAME = EARTH_2020)

- Circular arcs can be defined with an altitude and a beta angle using the "createBetaArc" method in the syslib

- The derived orbit parameters values (Geolocalization, Beta Angle, etc) can be accessed from the Python API using the "TrajectoryArc::getInfo" method in the sysModule

- File path of the "Time-Position-Velocity" arcs can be directly assigned from the Python API

- The user manual details the references and limitations of the orbit modelling around the Moon celestial

➢ **Kinematics**

- The user manual tells the proper way to import CIC AEM/MEM files with the correct reference axis

➢ **Post-Processing**

- Enabled/disabled status of box inputs/outputs appear more clearly in the GUI

- The "Dynamic scale" option is checked by default in the result scale configuration

- The user manual details the limitations of the standard post-processing boxes.

Limitations

➢ **Finite cutters**

For general truncated cylinders cutters, the behavior of the cutting algorithm is different in this case between infinite and finite difference as shown below:
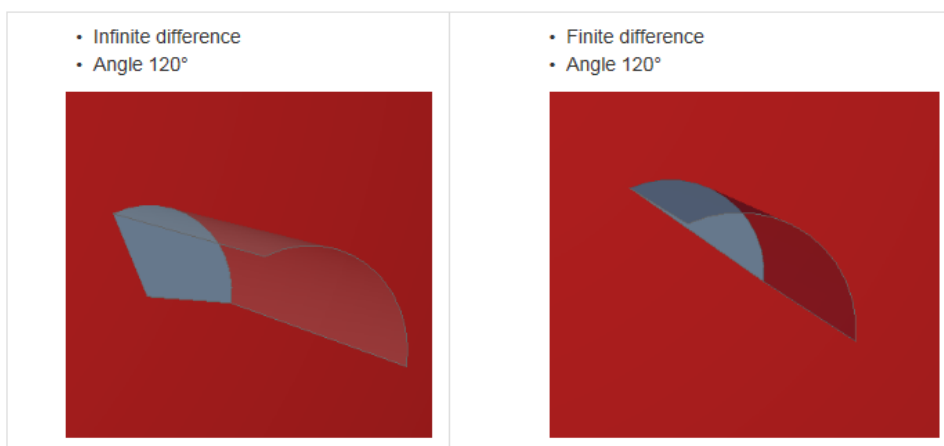

Figure 1 - General truncated cylinder Infinite vs Finite cuts

In both cases, computations algorithms will use the "Infinite difference" cut (the only difference is on the 3D display).

➢ **Processing**

On Windows, importing hdf5 files with a large number of entities may lead to instabilities.

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4.8.2

Major improvements:

➢ **Advanced variables**

Systema variables are totally revamped to enable definitions with inter-dependencies using a mathematical syntax as follows:

$$myScalar = norm(myVector) + sqrt(2) + log(exp(10)) - cos(x)$$

Both scalar and vector types are available along with basic operations and mathematical functions. Syntax rules are defined within the User Manual. Circular dependencies, naming and syntax errors are automatically detected by the software to enable a quick recovery.

The variable edition panel was replaced by a dedicated table window enabling simultaneous display of multiple variables lists from several files and the possibility of multi-windowing work.
Variables are displayed within a table that can be sorted by columns or with a custom order. The variables states (ok or in error), types, formulas and current values are constantly displayed.
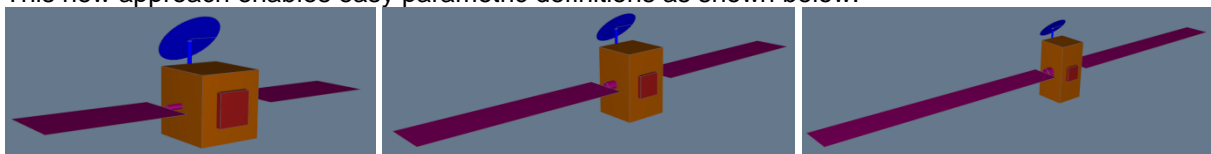

This new approach enables easy parametric definitions as shown below:

Basic satellite geometric definition with advanced variables

Minor improvements / corrections:

➢ **General**

- The optimized 3D rendering mode is now used by default by the Systema viewers. In case of hardware incompatibility, it is possible to disable optimizations by setting the environment variable SYSTEMA_DISABLE_3D_OPTIMIZATION to 1

- To shorten the learning phase of the Systema Python API, examples and illustrations were added to the Python API documentation

- The ergonomics of Systema was improved through several modifications:

- In order to follow the classical UI conventions, the ""Systema" menu was removed. The "About Systema" section is now located in the "Help" menu.

- The Yes/No pop-ups always appear in the middle of the main window.

- To avoid unwanted data edition, the mouse scroll do not impact the values of the combo boxes in the edition windows anymore

- Some buttons in the edition window were redesigned to be more visible and intuitive
    Current design: Old design:

- The keypad Enter key can now be used in place of the normal Enter key in the edition windows

- The "Apply and close" button was removed from the edition window

- A page in the User Manual now describes all compatible file formats managed by Systema V4

- The discrete result scale is now sorted by values

- The User Manual contains a page about the file formats supported by Systema

➢ **Modeler**

- SYSBAS files containing polygons can be imported without errors.

- The shape aggregation function was disabled.

- All broken shapes/transformations quick help access are fixed

- Performance improvement of properties display in the browser tree (blue and grey triangles)

➢ **Meshing**

- The bug of selection inversion on positive/negative sides of the meshes is now corrected.

- Specific items can now be customized to enable node selection (instead of shapes) and specific items can be hidden in the referenced objects tree. The usage of this customization is up to the application developer.

- A warning is raised when specific items do not reference any items.

- The import of Nastran/Patran bdf files now manages the MAT4 field containing thermal conductivity, specific heat and density. Moreover, it can handle mixed simple/double precision GRID fields.

➢ Schematics

- The Schematics components can now be copied, cut and pasted. This operation holds the intrinsic and relative positioning of the components, the connexions between connectors and all applicative properties. Points are not copied.

➢ Trajectory

- An error is raised when arcs end dates are anterior to begin dates.

- Second trajectory arc display is now correctly displayed in 3D viewer

➢ Kinematics

- The integrated documentation for Transformation matrices files explains more precisely the expected file format.

- The phase edition window do not appear unexpectedly anymore when switching to the Kinematics tab

➢ Mission

- Changing the model used by a mission in both GUI and Python API do not lead to Systema crashes anymore.

- Mission sequence intervals do not appear as "INVALID" anymore when the original "Default" phase was deleted

- Intervals names and content are automatically updated to default kinematics phase when their related phase is deleted

➢ Processing

- Systema applications that do no ensure down compatibility (capacity do open files from previous versions) on Processing files can notify users by a warning that they should rebuild their old Processing files.

Note: This warning can be ignored for processing files built with Systema 4.8.2 and opened with Systema 4.8.3.

- To avoid mistakes in processing management, all processes checkboxes are now checked by default before the run (it is still possible to uncheck some processes if needed).

➢ Post-Processing

- Entities can be defined manually using a text field.

- Minor bug correction on box multiple input connections

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4.8.1

Major improvements:

➢ Boosted Performances

Systema 3D rendering performances are sharply increased, reaching frame rates up to ten times higher, even on big models. With this rendering boost, it is possible to manipulate geometries containing more than 80 000 meshes with a smooth display.
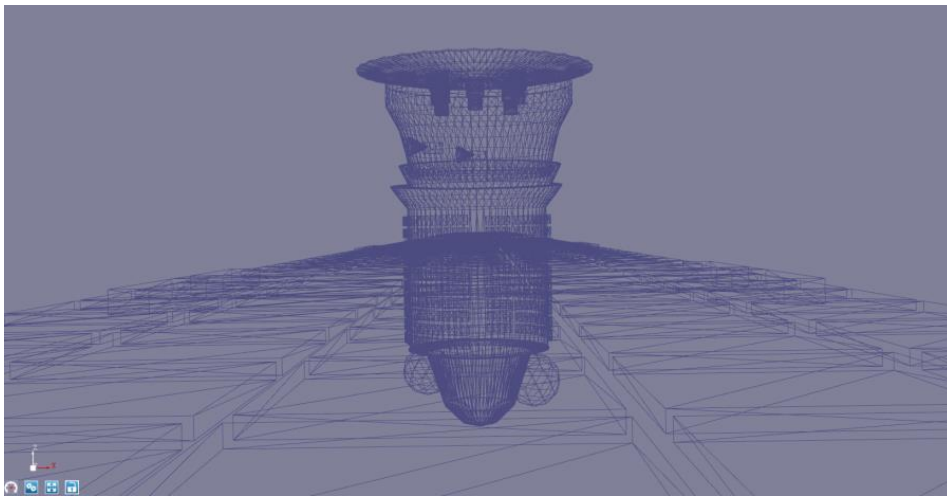
This boost is enabled by a resort to the GPU resources available on the host machine. In case your computer does not have compatible graphics card (or chipset), Systema still runs with the performances of the previous version.

In order to activate the boosted rendering mode, you just need to add the following variable to your environment: "SYSTEMA_3D_OPTIM = 1". You can easily verify that the rendering boost is activated by checking the state of the rendering icon at the bottom left corner of the 3D View:

Enabled:

Disabled:

➤ **Cutters**

Cutters transformations become fully editable, just like shapes transformations. They can be selected directly in the 3D view and their building points can be shown. Finally, cutters transformations are automatically converted while importing/exporting from/to Step-TAS format.
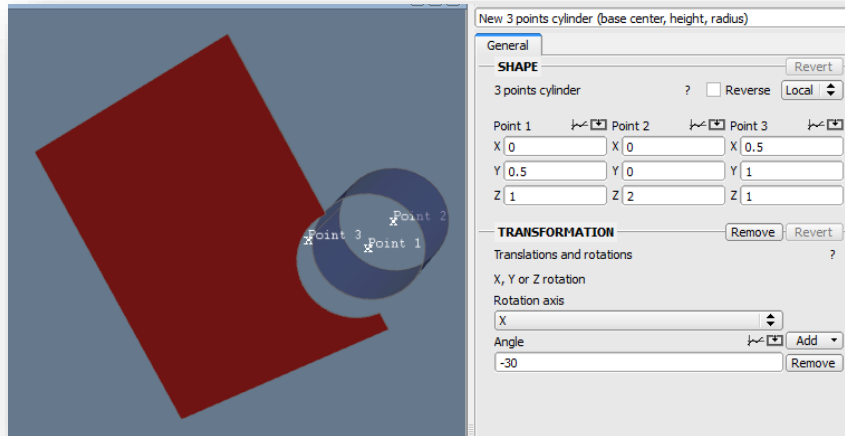
➤ **Aggregated Shapes**

Complex geometries can now be simplified into aggregated shapes that gather several shapes into one Systema shape. Aggregated shapes can then be split back into the group of shapes they represent. Aggregated shapes can be easily visualized in the 3D view by means of a new display option (see screenshot below).

The application properties held by the shapes to aggregate are erased. Only the properties of the parent object are inherited. Nevertheless, it is possible to edit the properties of the generated aggregated shape.

Warning: this kind of shapes is only supported by the sysmdl format.

Réf   : RN.000041865.AIRB
Edition : 10
Date   : 29/09/2023
Page   : 32
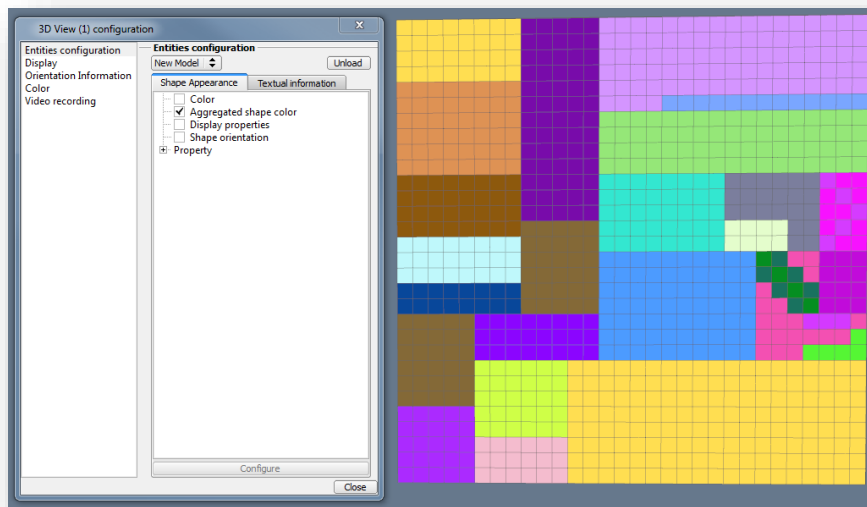
Minor improvements / corrections:

➤ Python script parameters value assignment

The Systema Python scripting interface comprises functions enabling the assignment of values to the input parameters of the script itself, either through command line arguments or with a graphical user interface. Thus, you can use one script with different input parameters without re-editing it.
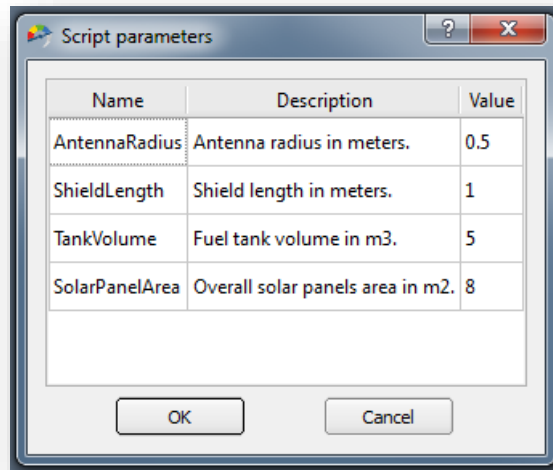
➤ Advanced camera manipulations

Systema provides alternatives to classical UI interactions. Keyboards inputs are available to manipulate the camera in the 3D view. Moreover, it is possible to restrict camera movements to the active 2D plane in order to work precisely on a 2D geometry. The current 2D-locking state of the camera is displayed at the bottom left corner of the 3D view:

2D plan locked:

2D plan unlocked:

The applicable User Manual for Systema-4.8.1 is the 4.8.1.

4.8.0P1

Schematic:

➤ Bug corrections

Schema layouts are accurately reproduced at schematic files opening.

Pressing the "SHIFT" key while drawing a link does not lead to unexpected behaviour anymore.

The schematic manipulations are more stable:
- The links deletion mechanism is more stable when several points lie on the line
- Opening the variables window does not prevent from deleting items anymore
- The "Fit all" function adjusts the view correctly
- The "Test action" popup menu does not exists anymore (useless menu)
- Connectors numbering display is more consistent

➤ Downgrades

The following functions were disabled to avoid instability:

- Line re-link function (Alt+click)
- Points creation on oriented networks lines
- Link creation from input connector

➤ New features

The input/output nature of oriented connectors is now explicitly shown in the GUI with arrows.

The log view is now displayed by default when creating or opening schematic files to facilitate unauthorized manipulations detection.

4.8.0

Major improvements:

➢ Schematic

Systema provides a **schematic module** to create electrical, thermal and logical synoptic.

A library of components such as Battery, Solar Panel, Diode or Comparator delivered with the Power application is loaded at runtime. Each component has specific properties and specific connectors that are fully editable.

Schematics can be manipulated in a user-friendly way. Components are dragged and dropped into the schematic diagram area. Components can be linked to other ones through connectors to build the complete schematic.

These schematics can be stored in files and exchanged such as any other Systema entity. Users can finally select a schematic entity in the Processing module to support computations.

➢ Material lifecycle management

Material properties can be managed all along their lifecycle. Users can create material phases (beginning of life, end of life, etc) and assign them different sets of properties.
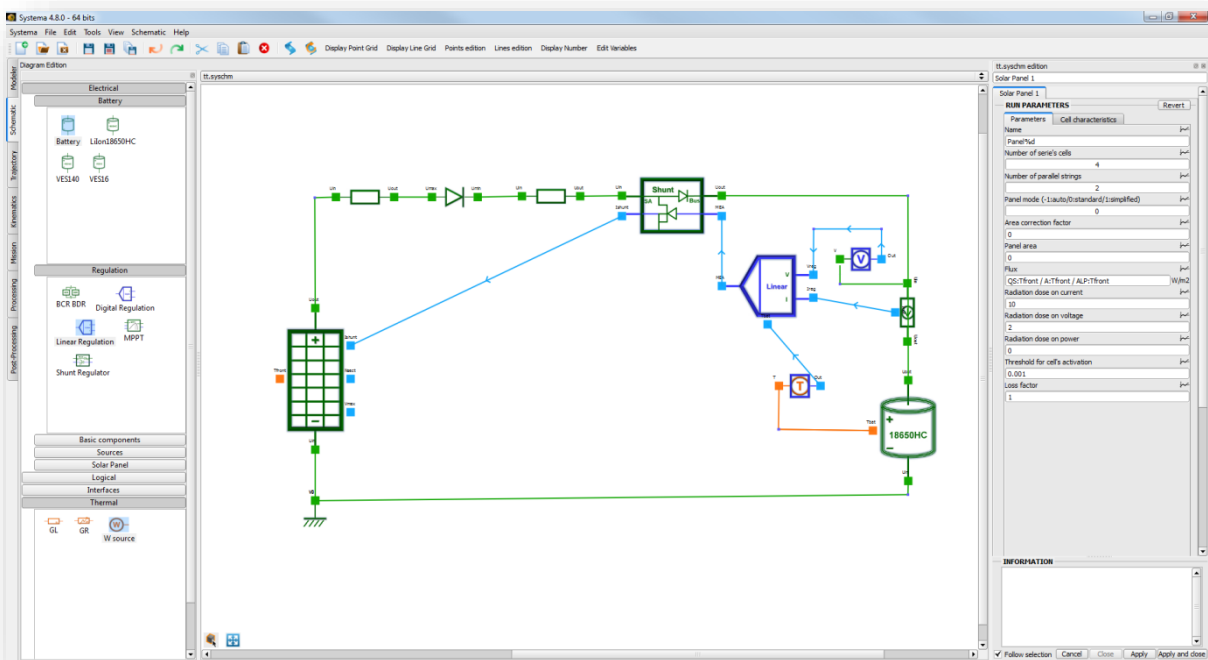
The material phase can then be selected in the Processing module and exported in the sysset file in order to be used during computations.
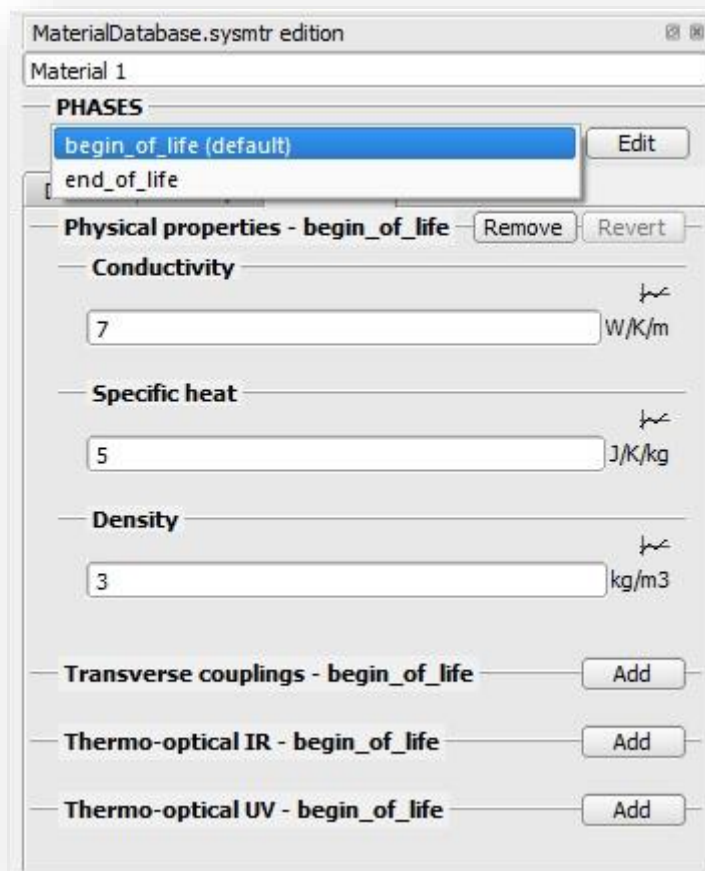
➢ **Jupiter's moon (Callisto, Europa, Ganymede)**

Systema manages **realistic simulations around Jupiter's moons**.

Relative positions of planet / moon / sun are implemented.

Sun eclipses from both moons and Jupiter are available. Jupiter eclipse from moons is also available.

➢ **STEP-TAS import/export**

Some improvements/corrections on the STEP-TAS import and export have been implemented:

- Correction of "4 points truncated closed disc" export (outer radius is not valued - or to zero, and angle 2 is also zero instead of 360)

- Correction of "4 points truncated closed cone" export: EndAngle corrected

- Cutters registered are INSIDE cutting instead of OUTSIDE

- Improve the export of material by referencing them only once

- Correction of sysmtr file update after a save in **STEP-TAS** format

- Transverse properties are not exported to the **STEP-TAS** files (no crash anymore)

- Bulk activity is equal to none when **STEP-TAS** is opened in Systema

- Update the way to import and export the specularity

➤ **Python API**

- The **performance** of python script execution has been improved generally

- A method "exportAsQuadTria" for ModelShape has been added to split the shape into sub-shapes (following the export bulk method)

- A methods isExpanded/isCollapsed can be used on the Modeler browser objects

- It is possible to create a polygon with more than 3 building points in the modeler

- **Mission sequences** are managed in Python (only calendar date can be used)

Minor improvements / corrections:

➢ **General**

- The size of the **log view** is no more reinitialized after each Python script run

- The navigation into the **browsers** can be done through the **keyboard arrows** (up/down/left/right)

- **3D Viewer** can be manipulated through **tactile screens**

- Upgrade of RedHat supported platform from 4.2 to 6.6

- Upgrade of libraries:

   - OpenSceneGraph: 3.4.0

   - Python: 2.7.11

➢ **Modeler**

- An advanced functionality in the right-click menu is available to divide the extruded polygons of more than 3 points base, into 3 points base extruded polygons.

- An advanced functionality in the right-click menu is available to divide the **polygons** of 3 points base or more, into **triangles**

- A python script is available in the installation directory to correct accuracy of quadrangles with a small area (<15mm²)

- **Parametric variables** can be imported directly from **CSV files** to define applicative properties

- **Line and point help items** can be selected in the 3D viewer

- An **advanced search** is available to find shapes with defined **applicative properties**

- CAD files can be opened and simplified when Systema installation directory is in read-only. Log files generated by the Elysium CAD Library at the download and during simplification are written in the default temporary file of the operating system.

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➢ **Meshing**

- The path of the current model associated to the meshing is displayed in a popup

- It is possible to **select only the visible face** of a mesh

- Browser tree search can be done on a **range of meshes**

- A crash raised by the meshing of Antenna has been corrected

➢ **Processing**

- Input files can be **edited** directly with the text editor integrated into Systema (only CSV or txt files)

- Relaunch of a processing has been corrected

➢ **Post-Processing**

- **Parameters** of HDF5 files are managed by the post-processing boxes to extract data

To use **SYSBAS** import and export on **Linux RedHat 6**, please install the following libraries before:

- expat.i686
- fontconfig.i686
- freetype.i686
- glibc.i686
- libICE.i686
- libSM.i686
- libX11.i686
- libXau.i686
- libXcursor.i686
- libXdamage.i686
- libXext.i686
- libXfixes.i686
- libXi.i686
- libXinerama.i686
- libXmu.i686
- libXrandr.i686

- libXrender.i686
- libXt.i686
- libXxf86vm.i686
- libdrm.i686
- libgcc.i686
- libselinux.i686
- libstdc++.i686
- libuuid.i686
- libxcb.i686
- mesa-dri-drivers.i686
- mesa-libGL.i686
- elfutils-libelf.i686
- mesa-dri-filesystem.i686
- mesa-private-llvm.i686
- mesa-libGLU.i686

4.7.1

Minor improvements / corrections:

➢ **Modeler**

-               **Labels** have been added in meshing to overload the path to the mesh. For example, the path to the mesh 100 is /root/object1/object2/shape1/100, it can be overloaded to become /myOverloadedPath/shape1/100

-               **Multi-edition** is available in the meshing browser. You can select several shapes or several objects to edit them at the same time.

-               The definition of the material file is possible via the **Systema Python API**. You can update the material database or use the default one through python script.

-               The performances of the display of **applicative properties** in the 3D view have been improved.

-               The **colors of result** in Dosrad meshing 3d view are no longer faded. They are correctly displayed.

➤ **Trajectory**

- **OEM files** are managed by Systema in the Trajectory tab, through a Time-Position-Velocity import process. OEM trajectory (Orbit Ephemeris Message) is defined by ASCII files and describes the orbit via the position and the velocity of the satellite. It is based on the reference format CCSDS. The CIC exchange protocol limits the use of some parameters (see the description below).

```
CNES CIC based OEM ephemeride (*.txt) file

The file contains a header, a metadata block and a data block.

See following example :
CIC_OEM_VERS = 2.0
CREATION_DATE = 2015-03-30T17:01:25
ORIGINATOR = CNES

META_START

COMMENT Ephemeride file example
OBJECT_NAME = CubeSat
OBJECT_ID = CubeSat
CENTER_NAME = EARTH
REF_FRAME   = EME2000
TIME_SYSTEM = UTC

META_END
COMMENT Date in modified julian days followed by seconds, positions (x y z) in km [and optional velocity values]

55276 0.0 4264.085921 -832.254441 5618.208465
55276 30.24 4421.338968 -916.904119 5481.941484
55276 59.616 4574.176227 -1000.637990 5340.185449
```

OEM file description

➢ Kinematics

- **AEM** and **MEM files** are managed by Systema in the Kinematics tab, with the kinematic law "Transformations defined in a file". AEM kinematic (Attitude Ephemeris Message) describes the satellite attitude. MEM file (Mission Ephemeris Message) describes the rotation of satellite moving bodies. They are defined by ASCII files and based on the reference format CCSDS. The CIC exchange protocol limits the use of some parameters (see the descriptions below).

```
CNES CIC based AEM attitude (*.txt) file.
See following example :
CIC_AEM_VERS = 1.0
CREATION_DATE = 2015-03-30T17:12:25
ORIGINATOR    = CNES

META_START
COMMENT Attitude AEM file example

OBJECT_NAME = CubeSat
OBJECT_ID = CubeSat
REF_FRAME_A = EME2000
REF_FRAME_B = SC_BODY_1
ATTITUDE_DIR = A2B
TIME_SYSTEM = UTC
ATTITUDE_TYPE = QUATERNION

META_STOP
COMMENT Date in modified julian days followed seconds and quaternion (QW Q1 Q2 Q3).

55276 0.0 0.002077 -0.001994 0.989996 0.141064
55276 2.592 0.002005 -0.001982 0.991072 0.133296
55276 6.048 0.001933 -0.001970 0.992087 0.125519
```

AEM file description

```
CNES CIC based MEM attitude (*.txt) file.
See following example :
CIC_MEM_VERS = 1.0
CREATION_DATE = 2015-03-30T17:17:25
ORIGINATOR    = CNES

META_START
COMMENT Rotation MEM file example

OBJECT_NAME = CubeSat
OBJECT_ID = CubeSat
USER_DEFINED_PROTOCOL = CIC
USER_DEFINED_CONTENT = ROTATION_ANGLE_SA_1
TIME_SYSTEM = UTC
ATTITUDE_TYPE = QUATERNION

META_STOP
COMMENT Date in modified julian days followed by seconds and angle in degrees.

55275 85516.3872  -180
55276  607.9104  -90
55276 2099.4336    0
```

MEM file description

➢ **Mission**

- The **timeline** is stabilized. Modifications which impact the trajectory, the kinematics and the mission are better managed.

➢ **Post-Processing**

- Groups can be defined from **node label** besides node id.

For more details on how to use these features, please refer to the Systema documentation.

AIRBUS

4.7.0

Major improvements:

➢ **CAD**

A new library to better manage CAD files has been added.

Simplification functionalities on CAD models are available like the removal of small shapes, the removal of holes, chamfers, or fillets, and the tessellation.
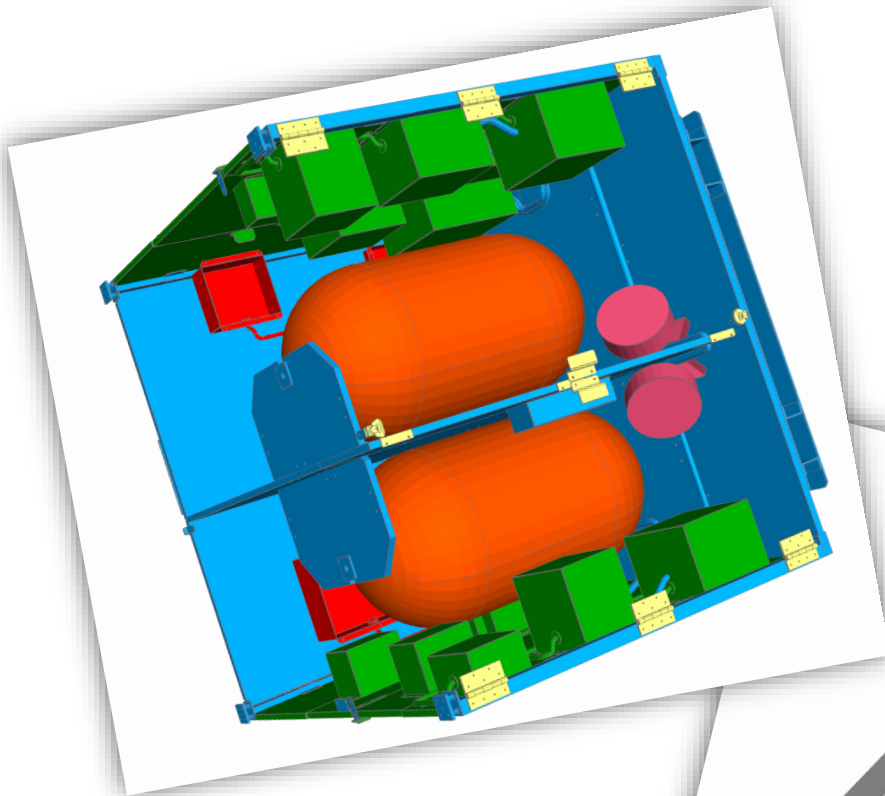
➢ **Post-Processing**

The new Post-Processing tab is available to manage your results. A diagram is built from a sequence of toolbox.

Systema provides a set of toolboxes, like the extraction, the comparison, the generation of graphs or the calculation of radiative budgets. These boxes are represented by Python script. They are fully customizable. It is possible to create your own toolbox.
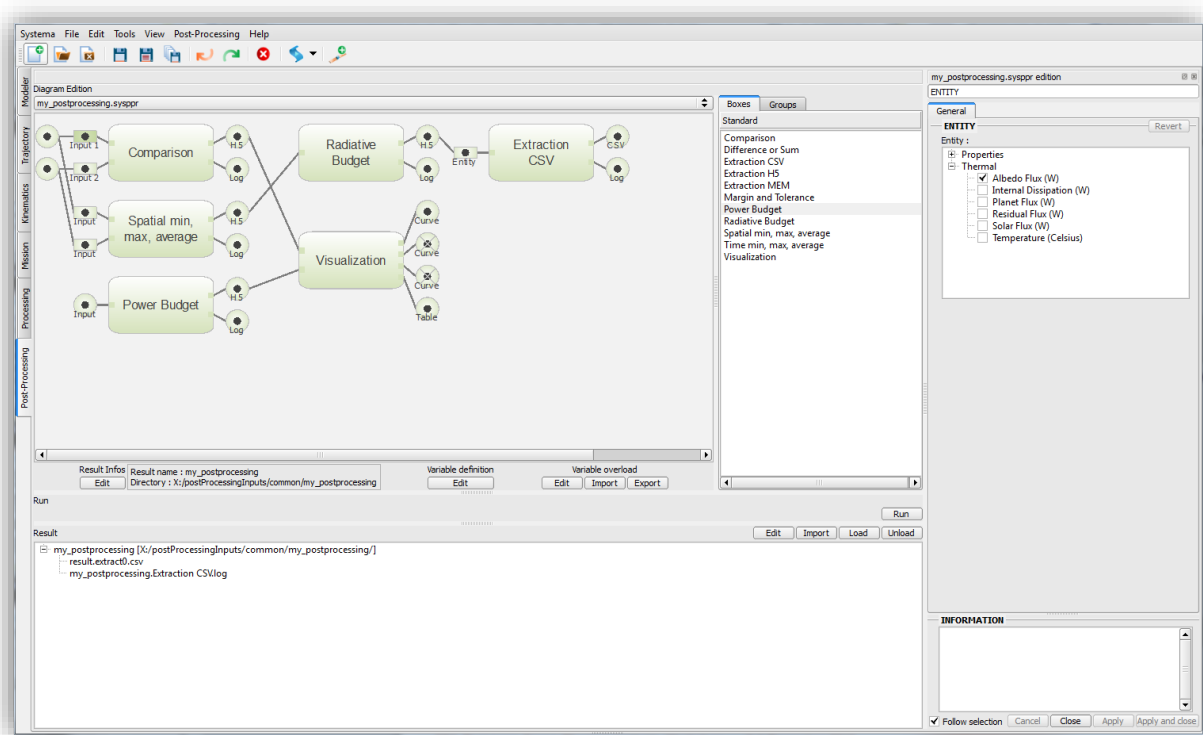
➢ **Upgrade of 3D performances**

The 3D manipulation on Modeler has been improved to be more fluid and easy to use. Systema is able to manage files of 250 Mo.

➢ **Python API**

Extended to all SYSTEMA Tabs, the Python interface allows managing Systema by script. Basic functionalities of Trajectory, Kinematic, Mission, Processing and Post-Processing are available besides the one of model and meshing.

The Python button is displayed in each tab of Systema.
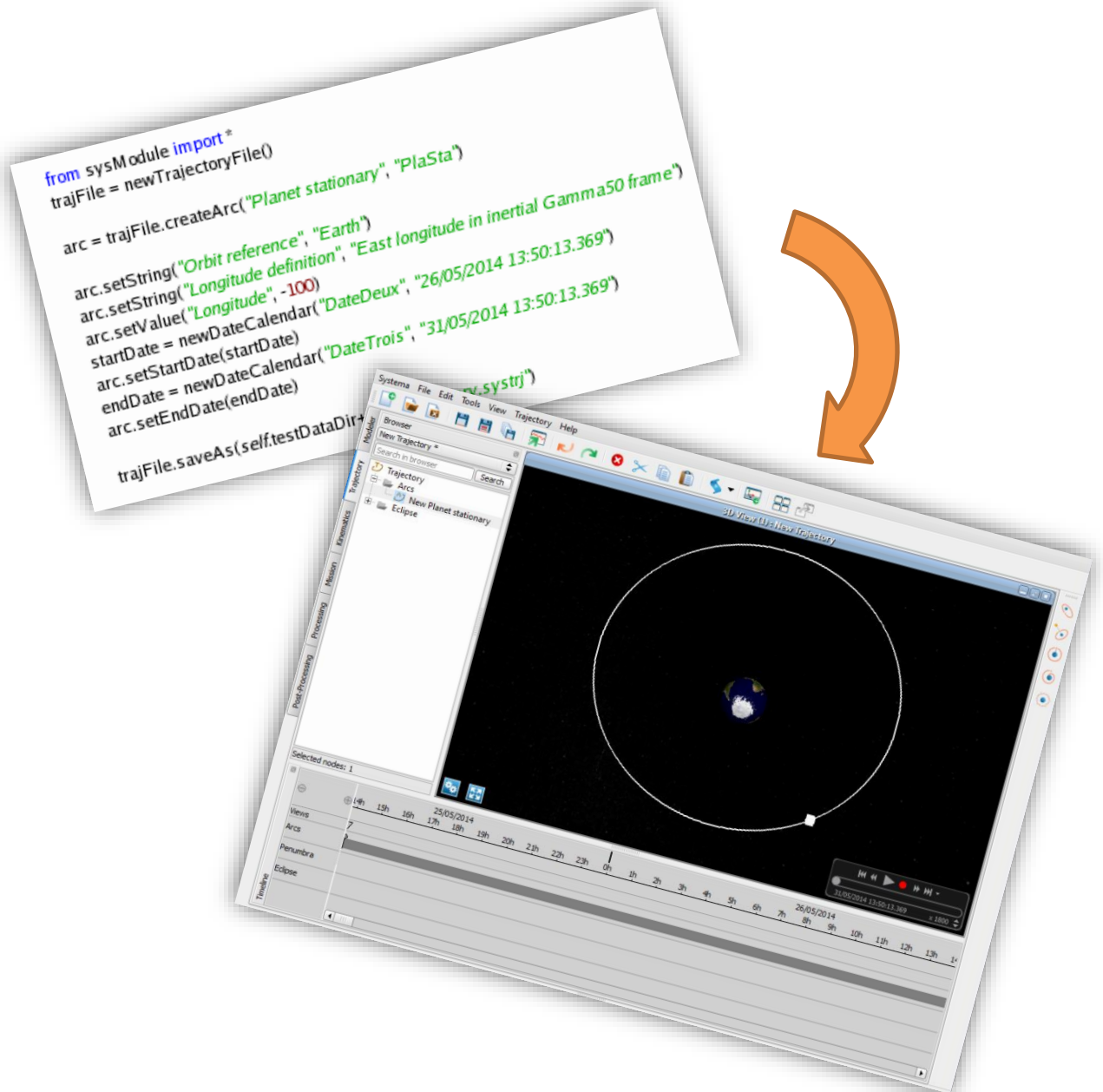
➢ **Windows 64 bits version**

Systema 4.7 comes with a 64 bits version on Linux and Windows. Such a version allows working on bigger models, and offers better performances on 64 bits architectures.

Minor improvements / corrections:

➤ **General**

- Search tool is available on each browser and selects each node with the name defined in the search field.

- Systema allows archiving all the current associated files into the same directory.

- The User Manual and the Python help are fully integrated in Systema. The new Help buttons are added in the menu bar.

- Two new transformations are available: the rotation around an axis defined by two points or by a point and a direction.

- Systema Files can be opened by a drag-and-drop directly from the directory to Systema GUI.

- Python API documentation has been revamped. Tutorials on model and meshing parts are available.

- STEP-TAS library is the version STEP-TAS-1.0RC5.

➤ **Model**

- In 4.6, the volumes have been added. In 4.7, two new volumic shapes are available: the volumic sphere and the volumic revolution quadrangle

- The 2D Curve window has been redesigned. It is possible to define the different kinds of axis (time, result or nodes), to manage the time axis (change its scale), to display few results with different unit, etc.

- An interface with shapes defined in GDML format has been added. Only volumic box and cylinder are imported and exported in GDML.

- Textual information and shape appearance covers all application properties on 3DView.

➤ **Trajectory**

- Earth eclipse is managed on moon trajectory.

➤ **Kinematic**

\-   New algorithm of kinematic calculation improves the pointing direction on slot ball joint and ball joint kinematics.

➢ **Processing**

\-   The diagram manipulation is improved: it is easier to link two boxes, a zoom functionality is added.

\-   The "-overload" batch option is usable in the GUI of Systema. The overload of variable can be imported and exported in a file.

\-   The variables are exported in the SYSSET file.

4.6.1

Minor improvements / corrections:

- Fix an erroneous export of meshed 4-boxes and spheres in SYSEXP

- Fix of a crash during creation of time-position-speed arcs

The applicable User Manual for Systema-4.6.1 is the 4.6.0.

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Réf   : RN.000041865.AIRB
Edition : 10
Date   : 29/09/2023
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4.6.0

Major improvements:

➢ **Volumic shapes**

Systema 4.6 features new volumic shapes that can be used by Thermica to perform complex conduction analysis in special cases where the classic 2D approximation is not enough.

Volumic boxes, extruded triangles and quadrangles, tetrahedron, cylinders and cones have been added, and can be meshed in a*b*c.
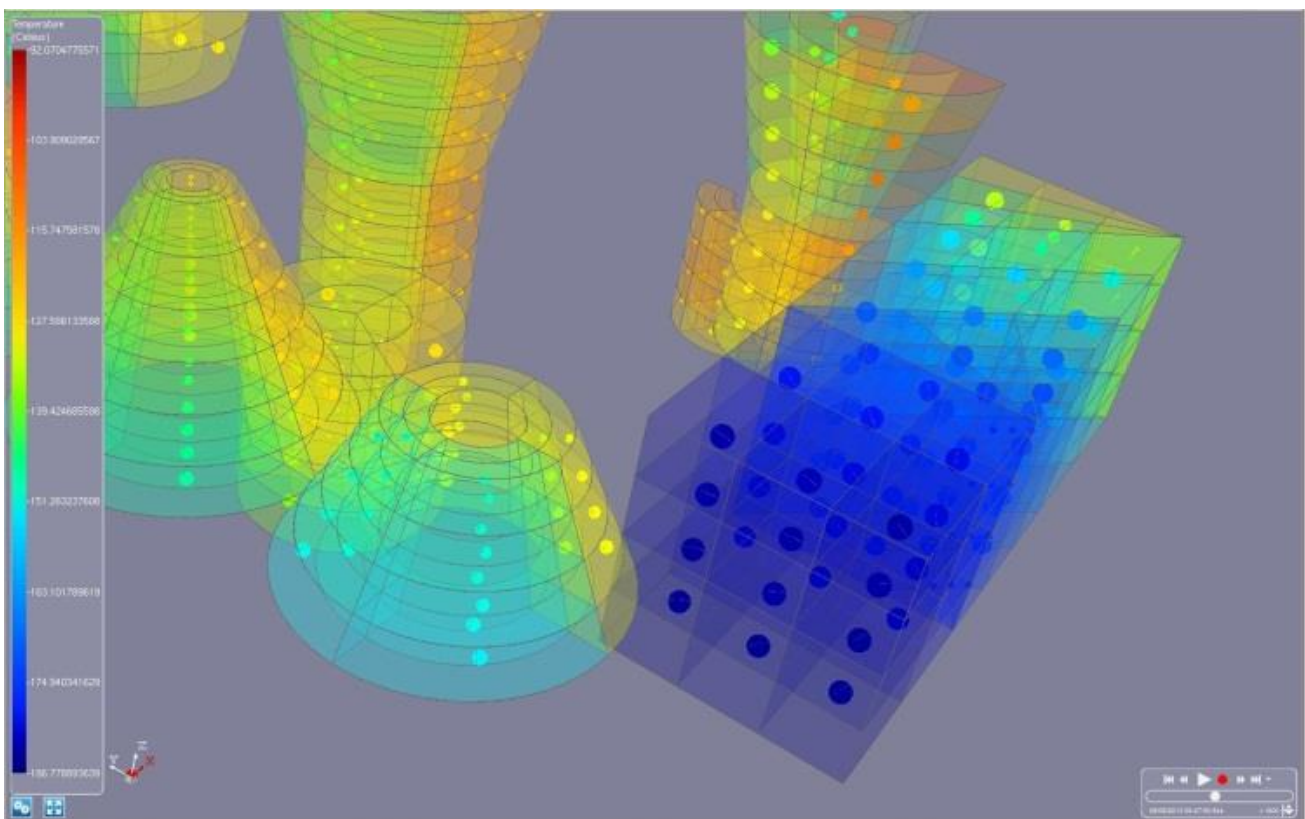
➢ **New Systema release cycle and Long Term Support**

New versions of Systema are delivered every year, with their lot of new features and corrections. These versions are supported for one year, meaning that users can benefit for corrections and bug fixes for one year. Once a new version is delivered, no maintenance is provided on older versions.

Some users do not want to switch version every year. That is why we will issue, every three years, a version labelled as "Long Term Support". This version will keep being supported for these three years, until a new Long Term Support is delivered.

The Long Term Support version is provided without additional fee. No features are added, and only critical bugs are fixed, to maximize the stability and the reliability of these versions.

Short Term Support versions will still be issued every year. Users will be able to switch their work from STS to LTS, and the other way around, if need be ; so that they can use the LTS for everyday work, and switch to STS when they need its new features.

AIRBUS
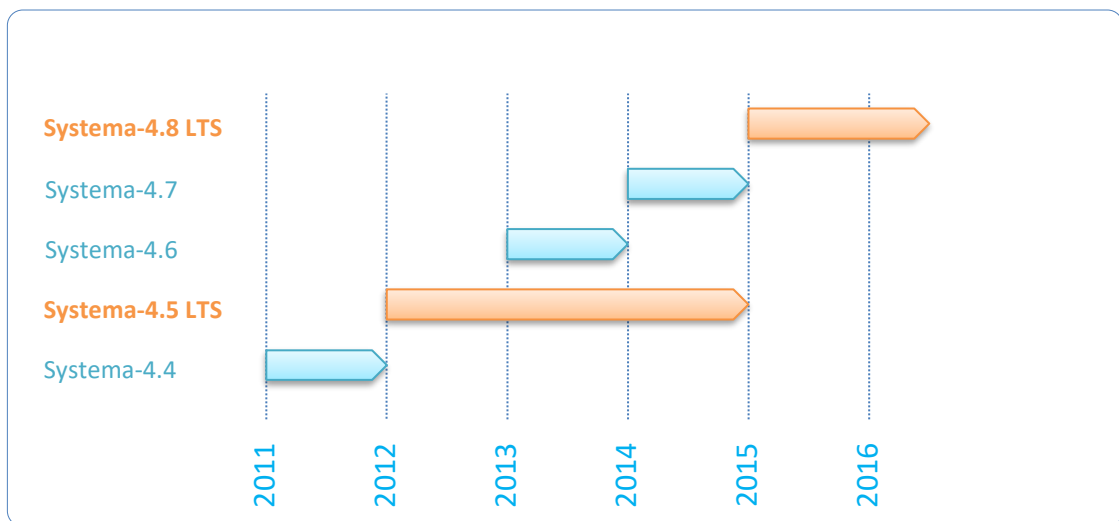
➢ **Mission data**

To allow the user to perform light mission and system analysis, Systema exports new mission-related data.

This data includes:

- Transformations from Sun to Planets and from Planets to spacecraft, velocity vectors

- Orbit angular momentum

- Lighting status (light, eclipse, penumbra)

- Orientation of the different mobile parts of the spacecraft …

This data comes in addition of the data already available in the Mission Log.

The Mission Log is a HTML file that gives this data in an Excel-compatible table, at all the computation dates.

Mission

Mission computation points																
Computation point	Date	Date (Gamma 50)	Date (J2000)	Current Phase	Current Sequence	Current arc	Sun constant (W/m2)	Inertial transformation Sun to S/C (Gamma50) - Tx (m)	Inertial transformation Sun to S/C (Gamma50) - Ty (m)	Inertial transformation Sun to S/C (Gamma50) - Tz (m)	Inertial transformation Sun to S/C (Gamma50) - Rx (°)	Inertial transformation Sun to S/C (Gamma50) - Ry (°)	Inertial transformation Sun to S/C (Gamma50) - Rz (°)	Distance from Sun to S/C (km)	Rotational transformation Sun to S/C - Tx (m)
Computation generated event (1)	21/12/2013 17:21:43.155	23365.72341615	5103.22341615	Default phase		New Sun synchronous	1416.966	-2.879045e+07	1.471675e+11	-1718181	66.55603	-41.55716	81.30372	1.471675e+08	-2.879045e+07
Computation generated event (2)	21/12/2013 17:23:07.653	23365.72439414	5103.22439414	Default phase		New Sun synchronous	1416.963	-3.129517e+07	1.471677e+11	-1116258	73.22227	-42.1202	85.75314	1.471677e+08	-3.129517e+07
Computation generated event (3)	21/12/2013 17:24:32.152	23365.72537213	5103.22537213	Default phase		New Sun synchronous	1416.961	-3.38366e+07	1.471678e+11	-502617.1	79.96611	-42.29217	90.28641	1.471678e+08	-3.38366e+07
Computation generated event (4)	21/12/2013 17:25:56.650	23365.72635012	5103.22635012	Default phase		New Sun synchronous	1416.959	-3.641486e+07	1.471679e+11	118078.8	86.70445	-42.0686	94.81365	1.471679e+08	-3.641486e+07
Computation generated event (5)	21/12/2013 17:27:21.148	23365.72732811	5103.22732811	Default phase		New Sun synchronous	1416.958	-3.902978e+07	1.471679e+11	741110.9	93.35473	-41.45531	99.24553	1.471679e+08	-3.902978e+07
Computation generated event (6)	21/12/2013 17:28:45.646	23365.7283061	5103.2283061	Default phase		New Sun synchronous	1416.958	-4.168094e+07	1.471679e+11	1361744	99.84323	-40.46773	103.5015	1.471679e+08	-4.168094e+07
Computation generated event (7)	21/12/2013 17:30:10.144	23365.72928409	5103.22928409	Default phase		New Sun synchronous	1416.959	-4.436761e+07	1.471679e+11	1975259	106.1113	-39.12918	107.5158	1.471679e+08	-4.436761e+07
Computation generated event (8)	21/12/2013 17:31:34.643	23365.73026207	5103.23026207	Default phase		New Sun synchronous	1416.96	-4.708881e+07	1.471678e+11	2576994	112.1184	-37.46858	111.2408	1.471678e+08	-4.708881e+07

➢ **EME2000 import**

Systema is able to import trajectory files in EME2000, i.e. dates and positions in EME2000.

➢ **Linux 64 bits version**

Systema-4.6 comes with a 64 bits version on Linux. Such a version allows to work on bigger models, and offers better performances on 64 bits architectures.

Minor improvements / corrections:

➢ **General**

- Toolbars are available in all tabs, for an easier access to Systema's functions. They feature new icons, for a better look & feel.

- When opening files, the different working directories are stored for future access.

- It is possible to save all files in Long Term Support format, for opening in versions 4.5.x. Some new features in 4.6 (e.g., volumes) are not exported.

- It is possible to install several versions of Systema without launch scripts: the SYSTEMA_HOME and SYSTEMA_WORKING_DIR variables are optionnals, and are not defined by default anymore.

- An option to choose the automatic opening of 3D windows has been added in the "View" menu.

- The license agreement has been updated.

➢ **Modeler**

- SYSEXP/SYSBAS export has improved, to reduce its memory footprint.

- Rotations with fixed axis are correctly imported in STEP-TAS files.

- Unsupported versions of STEP-TAS files are detected at load and a message is issued to the user.

- 4 points truncated closed cone and 4 points truncated cone were bugged when their second base was bigger than the first. The problem is fixed, and cones from older models are corrected at import in the 4.6.

- During STEP-TAS import, shapes with accuracy problems were not loaded. Now they are, and the user can manually correct the accuracy errors.

- Fix a wrong modification of materials at STEP-TAS export

- Specularity and transmitivity coefficients are applied for created materials in STEP-TAS export.

- The default selection mode has been changed : "children items" option (i.e., when selecting an object, highlighting in light blue in the 3D of all its children shapes) is activated by default.

- When exporting an Outgassing meshing in SYSEXP/SYSBAS, the mesh numbers are not exported anymore.

- SYSEXP export precision has been enhanced : small values of applicative properties (eg, 1e-12) are correctly exported.

- Several SYSBAS/SYSEXP import/export bugs have been corrected.

- The dynamic scale is properly updated after a property modification.

- The memory footprint during the undo/redo has been improved

- When exporting meshed boxes in SYSEXP/SYSBAS, the numbering is correct.

- SYSMAT thermal properties are properly converted in V4 definition.

➢ Meshing

- A meshing node view has been created. It lists all the nodes of the meshing, grouped by sub-model. It is accessible through an option in the "Modeler" menu.

- Copy-paste of objects in the meshing keeps the locally-defined meshing numbers.

- Copy-paste of a meshed bounding box in Dosrad previously led to a crash, it is handled.

➢ Trajectory

- In Time-Position-Speed orbits, the possibility to choose a date relative to a fixed date has been added.

- In Time-Position-Speed orbits, the possibility to work on a rotational frame freezed in an inertial frame at a specific date has been added.

- In Time-Position-Speed orbits, the possibility to interpolate the trajectory in an inertial frame has been added.

- There is a display of the duration of intervals (arcs, eclipses) in the Timeline.

- The computation of eclipses and penumbras has been improved to be the same than the one used in Thermica.

- A bug where a spacecraft could be always in eclipse has been fixed.

- A wrong computation of eclipses for Time-Position-Speed trajectories has been fixed.

- A wrong computation of velocity due to a bad interpolation of a Time-Position-Speed trajectory has been fixed.

- Eclipses of Mercury are computed correctly.

- The orbit of Mercury is now correct.

➢ Kinematics

- A new law has been added: "Frozen rotational orientation"; i.e. planet rotational reference frame frozen at a defined date.

➢ Mission

- A 3D display bug on the origin of the kinematic bodies has been added.

➢ Processing

- The memory footprint during SYSSET generation has been improved.

- The mission Log is generated with the SYSSET file, and can be parametrized.

➢ Scripting

- A model comparison function, with HTML report, has been added in the Systema library.

- A function to access all the properties of objects and shapes has been added in the Python API.

- A function that returns a list of all shapes and objects of a model has been added in the Systema library.

- The Systema library has been revamped, for a better readability and understanding for the user.

- A function to easily access to applicative properties by just giving its name and the application as parameters has been added in the Python API.

- Specific items are now available in the Python API.

4.5.2

Major improvements:

➢ **Post-processing**

New table view that completes the curve view:

- Display of all results in a table

- Complete synchronization with the curve for a dual display

- Selection of points

- Possibility to add columns with min/max/mean values

- CSV export of selected or all results
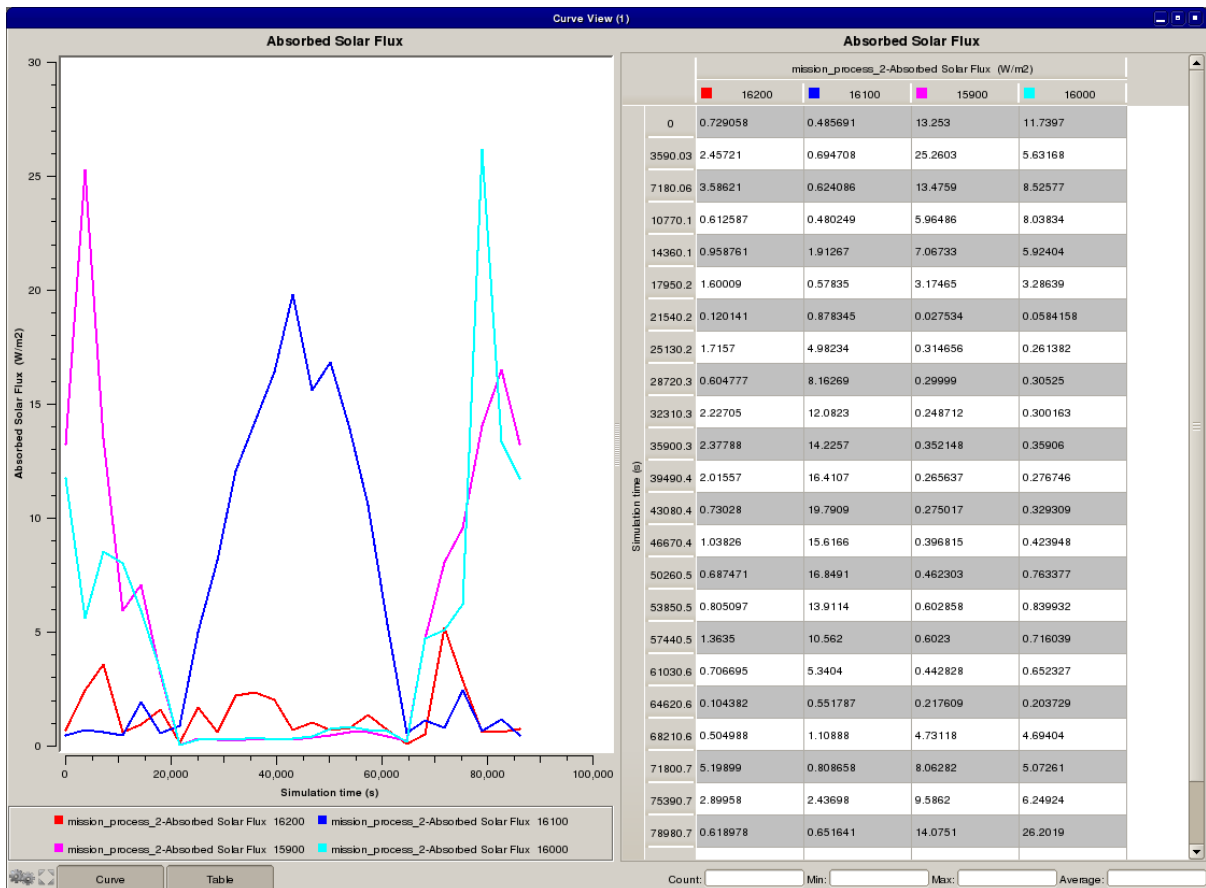
Minor improvements / corrections:

➢ **Modeler**

- Fixed various bugs on SYSEXP import/export

  o Plume activity was not imported

  o Default activity could be wrong after a SYSEXP import

  o Bad Outgassing-Plume properties export when a shape was reversed

  o Bad creation of intermediary objects for applicative properties export

  o Bad box numbering at SYSEXP/SYSBAS import fixed

  o When exporting a box in SYSEXP/SYSBAS, it is not always possible to have the same numbering. Error message added in that case.

  o Antenna meshing is not compatible between the V3 and the V4. When importing/exporting, an error message is added to warn the user that the numbering may be different.

- Import of BDF physical properties: thickness, density and temperature in Thermica, Dosrad and Outgassing

- Performance improvement on the BDF import

- Fixed various bugs on STEP-TAS import/export

➢ **Scripting**

- Various features added in the API

➢ **Mission**

- Fix a bug when using the multi-mission display

- Fix multiple bugs on the hide/show in the 3D

- Fix a bug when computation points where created outside the interval

- Fix sun constant display bug

- Fix the crash happening when creating too much computation points in batch mode

4.5.1

Major improvements:

➢ **Post-processing**

Complete reforging of the curve view:

- New look and feel (background, grid, zoom, fit, draggable scales)

- Possibility to display several results in the same curve (even if the units are different)

- Possibility to lock the selected meshes for a curve view, in order to select other meshes without modifying the display of the 2D view

- CSV export of results

- Parametric results are managed by the curve view

- Scales are available in both decimal and logarithmic

- Titles are configurable
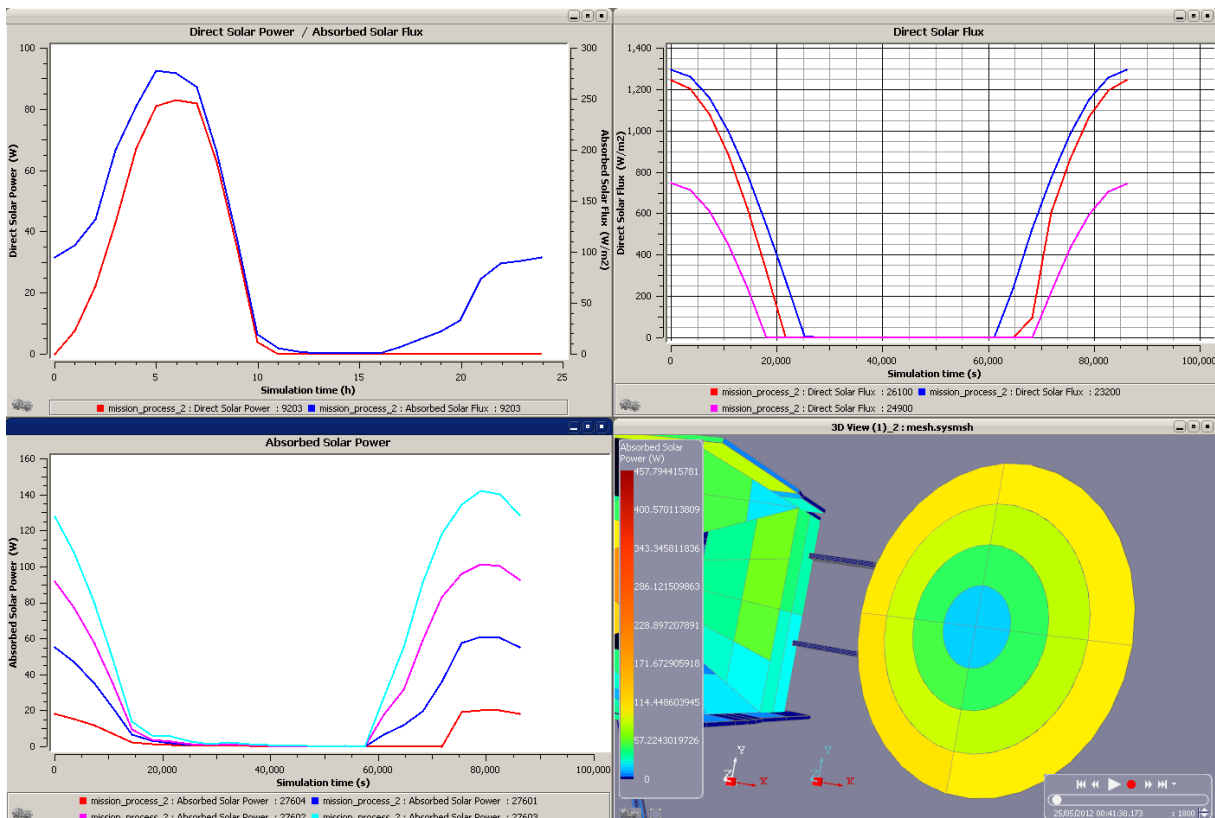
Minor improvements / corrections:

➢ **General**

- An icon is shown for Systema's executable on Windows

- Path of loaded files are shown in the browser file chooser

- Fix a bug regarding relative HTML links in Systema's text editor

➢ **Modeler**

- Fix the import/export of Thermica's transmission coefficients in SYSEXP

- A VRML export is available

- A shortcut to re-create the last help item is available (CTRL + i)

- Change the default activity when using Outgassing to "Positive side" instead of "Both sides".

- Change the default activity when using Plumimp to "Active" instead of "Inactive".

- Step-TAS import/export handles dual bulk

- Fix the reverse side feature for faceted shapes

- Possibility to create invalid interactive shapes (eg, non-coplanar), to fix them afterwards

- Improvement of the help items section in the contextual menu

- Fix a case of incorrect special paste

- Fix a crash when building an invalid interactive truncated disc

- Fix a crash when applying a transformation on an invalid shape

- Fix the automatic collapsing of the tree when creating objects or specific items

- Fix a crash when loading a SYSEXP containing properties from an uninstalled application

- Import of Plume V3 material files

- Fix an error when importing SYSEXP with optional properties in Plume and Outgassing

➢ **Meshing**

- Possibility to copy/paste special items

- When numbering errors are detected, the other meshes with the same numbers are now displayed in the error message

- Automatically edit bounding boxes and computations points after their creation

- Fix a crash when creating a virtual item when multiple elements are selected

- Fix an incorrect error when opening two meshing files using the same variable identifier

- It's now possible to create Thermica meshings if Plumimp is installed

- Fix synchronization problem between models and meshings

- Fix a copy/paste error when cutters are involved

- Fix a crash when undoing/redoing a copy/paste involving cutters

- Fix the "reverse shape" value when importing/exporting SYSEXP Outgassing files

- Fix wrong display of dependant items

- Add the copy-paste action in the contextual menu

➢ **Scripting**

- Material management in Python: possibility to read and write material names on objects and shapes

➢ **Trajectory**

- Removing generic roles for referencing arc begins or ends

- Fix the unit of the dates by latitude and longitude

- Fix an error of computation points creation on a specific interval or on eclipses or penumbras

- Fix a crash when moving an arc after another

- Fix a timeline update error when creating a Time-Position-Velocity arc

➢ **Mission**

- The 2D curve view is available in the mission module

- When many computation points need to be created, a menu appears to ask for confirmation

- It's now impossible to modify an interval generated by a "Custom interval rule"

- Fix a crash when adding a 3D view in the mission module

- Fix an error when deleting a kinematics phase used in the mission

➢ **Processing**

- Only one menu is displayed when right clicking in the process window, instead of two

- Fix process modules drag&drop difficulties

- Fix a crash when closing the process diagram

4.5.0

Major improvements:

➤ **Timeline**

Complete reforging of the time management

- Displaying of all time information in a Timeline view

- Possibility to synchronize and chain different time events and intervals

- More powerful computation points generation system

- Better visibility of sequences ordering and attached phases

- Generation of a set of sequences

- Synchronisation of multiple 3D views
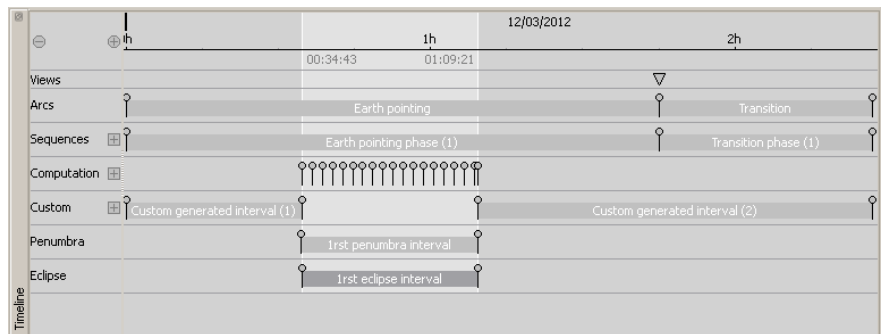
➤ **Python interface**

The Python scripting allows the user to create and modify model and meshing files through a Python interface

- The user can act on objects, shapes, geometries, transformations, application properties, meshing and numbering parameters in the same way he does in the graphical interface

- The scripting is particularly useful when interfacing Systema with external tools and formats

- Automation of complex or repetitive tasks : symmetries, activities inversion, meshing reduction

- Examples, documentation and support are provided

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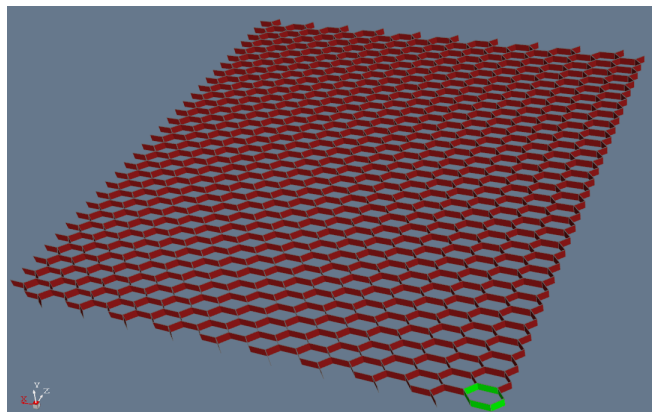
➢ 3D improvements

- The solar system 3D representation is in real scale. To better locate celestial bodies, planet indicators are available in the 3D view

- Frames in the Modeler and Mission 3D views: the orientation frames are now always visible, and are customizable.

- New video recording mode: record only the computation points of the mission
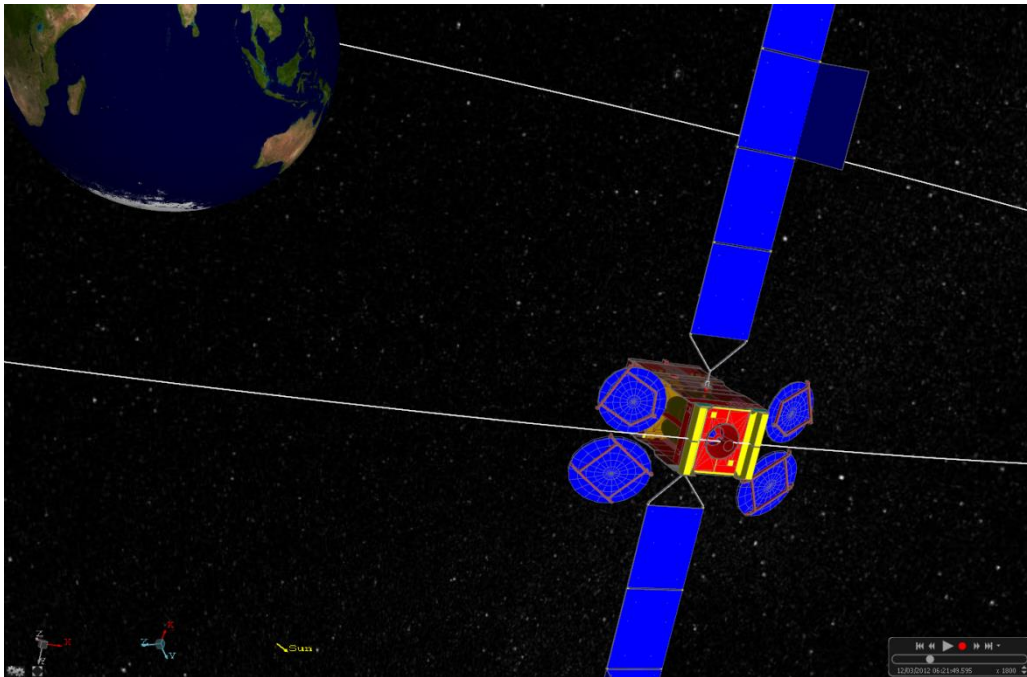
➢ Trajectory

- The revolution trajectory parameter is now computed as a time and not as an angle

- Correction of the mean solar time resolution in sun-synchronous orbits

➢ Process execution

- Smart process execution: Systema automatically proposes a list of processes to execute depending on the modifications made by the user

➢ **Rays**

- Management of ray properties: color display of the rays representing the value of their properties

- Display filter of the rays based on their properties
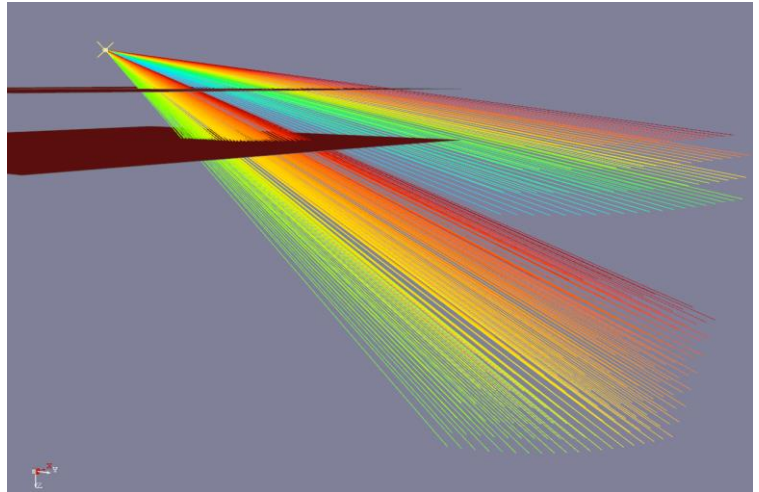
Minor improvements / corrections :

➢ **General**

- Possibility to create new meshing, mission and processing files from unsaved Systema files

- Create of an intelligent Fit button in the 3D views

- Fix 3D rendering bug on certain Intel graphic cards

- The edition window is dockable

- Display of variable resolved values in edition windows

- New variable types have been created: dates, durations and hours can be defined

- Change of the incrementation of variable names

- Commas character are now forbidden in decimal inputs

- Fix on a bug that happened when too many files were opened

➢ **Modeler**

- The log window is hidden by default in the Modeler

- Displaying of the building points of the selected shape in the Modeler 3D view

- Fix crashes and geometrical errors in STEP-AP203 import

- Fix a crash when displaying normals on faceted shapes

- Fix the import of meshed box and revolved polygons in SYSEXP

- Fix the import of BDF files using scientific notations

- Fix a crash when exporting certain files in BLK

➢ **Meshing**

- Possibility to add the currently selected shapes as references in specific items

- Fix meshing renaming

➢ **Trajectory**

- Fix the incorrect import of TRJINP reference dates

- Fix incorrect eclipse computations of ground orbits

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➢ **Kinematics**

- New kinematic law that points to a position defined in a Systema trajectory

- Fix a crash when closing a kinematics when displaying on a test trajectory

➢ **Mission**

- New batch mode to assemble missions

- The mission browser now displays the meshes

- Automatic fit and camera locking on the model when loading a mission

- Several improvements in the Mission Log

- Fix of the incorrect selection of shapes in the mission 3D view

- Fix of the incorrect displaying of shapes that are close to the camera

- Fix a crash when referencing a trajectory without arc

- Fix a crash when loading several missions in the same 3D view

➢ **Processing**

- Fix a bug when the mission or the meshing has a dot in its name

➢ **Post-processing**

- Discrete color scales are now ordered by values

- The units of the results are displayed in the color scale and in the textual information

- Fix color differences between the 3D and the color scale

- Fix of the displaying of the time selector when viewing time-dependant textual information in the meshing

4.4.2

Minor improvements / corrections :

➤ **Modeler**

- Add optional SYSEXP & SYSBAS export of material names (only names are exported, not material database)

- Add new geometrical transformation: "three rotations sequence". This transformation can either be a rotation in fixed or transformed axis. Old "Euler angles" transformations correspond to a rotation in fixed axis

- Fix property name in SYSEXP & SYSBAS export error message

➤ **Kinematics**

- In the "transformation defined in a file" kinematic law:

- replace roll-pitch-yaw data format by rotation in fixed axis

- add rotation in transformed axis data format

- Add a new pointing law to planet longitude / latitude: allow a pointing in a planet rotational frame

- Fix a 3D rendering failure with some regular spin laws.

- Fix a crash when creating some laws defined in a file.

➤ **Mission**

- Fix a 3D geometry misplacement when an origin is modified in kinematics

- Fix a freeze on kinematics file attachment when kinematics contains some linear attitude laws

- Fix an error in generation of computation dates by angular step method

- Fix an update error in 3D view when a trajectory arc is modified

- Fix the missing meshing file path in file list of mission log

➤ **Processing**

- Fix computation execution failure on some Windows platforms

4.4.1

Minor improvements / corrections :

➢ **General**

- Check SYSTEMA_HOME environment variable on loading

- Visualisation of ray paths:

- Properties displayed on ray paths as a color

- Filtering of ray paths by property value

➢ **Modeler**

- Improve the performance of file saving when geometries has been imported from VRML or Step-AP203 format.

- Fix the rendering of discs with a diameter less than 3 mm

- Fix a side color swapping for result display on a geometry defined as reversed

- Fix disabled contextual menus for non-geometrical items creation in meshing

- Add cut-copy-paste features for meshings across files (copy also model geometry)

- Fix a precision error in v3 material import

- Fix a crash when loading 4.3.3c meshing file with empty custom number parameter

➢ **Kinematics**

- Remove the "Ecliptic north direction" pointing law, replaced by "Z direction of Gamma50"

➢ **Mission**

- Add a new type of computation date generation: built from the angle of a linear attitude law of a kinematics body

- A model is now required to create a mission

- When a mission log is generated, the file is opened in text editor

- Application choice is no more needed for mission log generation

- Fix the modification of the root mission node on file loading when the mission root refers to another kinematics item than root

- Fix 3D rendering problem for mission without trajectory

- Fix the computation date generation for mission without trajectory

- Fix randomly computation date duplication

- Fix mission log generation for missions without trajectory

- Fix "Current misalignment" textual information for missions without trajectory

➢ Processing

- In "Current mission", a meshing can be referenced as well as a mission

- Results file are opened with the default program (as defined by the operating system)

- Fix a result path mistake on run, when results information has never been edited in process diagram

- Fix random run hanging on Windows 7

- Fix slowness in hdf5 result file

4.4.0

Major improvements:

➢ **General**

- Visualisation of ray paths:

- filtering by impacted shapes

- displayed in meshing and mission 3D view

- Module tabs are moved from the bottom to the left

➢ **Modeler**

- Bdf (MSC Nastran mechanical meshing file) import

- mechanical numbers are imported as applicative numbers

- Step-Tas (ESA standard exchange format) import / export

- Menu on icon to create shapes: access to all creation types (default and interactive)

- Reforging of help items:

- now help items are stored in the current model

- coordinates can be edited

- they can be renamed

- a transformation can be applied to a help item

- creation by icon

- new types of help item creation

- Reforging of material edition:

- integrated edition, dynamic update of properties using materials

- support of variables for material properties

- multi-application material file

- Numbering rules in meshing:

- distinct side numbering in meshing

- numbering rules, submodel name and condensation authorization can be set independently

- new numbering methods and advanced parameters

- New option to not mesh a part hierarchy

- All imported shapes (from Bdf / VRML / Step-AP203 / Step-Tas) can be used as it for computation (without simplication)

- New textual information types on 3D view: shape count, areas, applicative properties, results

- Possibility of suppressing the model transformations in a sub-tree

- The browser icon indicates if the item holds a property (blue triangle) or if a child holds a property (grey triangle)

➢ Trajectory

- STK ephemerides import in Time-Position-Speed orbits

- New date types: by longitude, latitude or solar declination on planet

- Timeline display (read only)

➢ Kinematics

- STK attitude import in Time-Position-Speed orbits

- New pointing references: orientation of Gamma 50 frame

➢ Mission

- The mission is associated to one application

- Performance enhancement of the mission 3D view

- Enhancement of mission 3D view:

- visualisation of kinematics frames in the realistic view

- navigation across computation dates

- New textual information types on 3D view: associated kinematics body, current phase, misalignment, kinematics attitude

- The browser icon indicates if the item is linked to a kinematics body (blue triangle) or if a child is linked to a kinematics body (grey triangle)

- Timeline display (read only)

- Mission log: synthesis of all information for each computation date

Minor improvements / corrections :

➢ **General**

- Possibility to save a default colour map configuration (shape appearance)

- In edition windows, apply can be done even if the data is not valid

- A "*" flag indicates that a file is saved or not.

➢ **Modeler**

- Fix the point / vector injection in transformation

- Fix a crash on interaction between copy, paste, undo and redo

➢ **Kinematics**

- Fix pointing law behaviour when pointing vector is (0; 1; 0)

- Fix pointing law behaviour when using velocity pointing on a planet stationary orbit

- Fix pointing law behaviour when using angular momentum reference

- In parameters of some pointing law, inconsistent "rotation axis" label replaced by "pointing vector"

➢ **Mission**

- Fix the update of mission 3D view when trajectory and kinematics are updated

- Fix crashes on missions without kinematics

- Fix crashes on missions without trajectory

➢ **Processing**

- Default result directory is now the current mission directory

- Fix crashes and freezes and process execution

4.3.3

Major improvements:

➤ **General**

- Parametric computation :

- variable instantiation added for all entities (model, meshing, trajectory, kinematics, mission and processing) : these variables can be used to replace manual values (integer, float, boolean, string, point, vector)

- variable overloading now possible in processing (for a run)

- batch execution for process run with following optional features :

- execution of a single computation binary

- variable overloading by values defined in a text file

- result directory path overloading

- Integrated license configuration (demonstration mode available)

- Windows Vista and Seven compatibility

- Technical annex added in user manual :

- model shapes and transformations

- trajectory orbits

- kinematics connections and laws

➤ **Modeler**

- Integrated material file editor (adapted to application properties)

- Bdf (MSC Nastran mechanical meshing file) export

- Step-Tas meshing import-export (based on ESA 1.0RC4 SDK) :

deactivated by default ; for activation, please contact our reseller

- Specific meshing items for Thermica usage

➢ **Trajectory**

- New parameters on orbit definitions :

- keplerian orbit : ellipse parameters can be defined by periapsis and apoapsis

- keplerian / sun synchronous / planet stationary orbit : ascending node can be defined by longitude or solar time

- time-position-velocity orbit :

- new position definition : by east longitude, latitude and altitude (spherical coordinate) in planet rotational reference

- new interpolation method : quadratic interpolation (keplerian propagator already available)

➢ **Kinematics**

- New law defined by a file : Euler angles

➢ **Mission**

- Camera lock from/to a celestial body direction

➢ **Processing**

- Processing now references the mission

- Improvements on application launcher :

- more reliability

- executed processes are killed when run window is closed

- process re-run disabled

Minor improvements / corrections :

➢ **General**

    - Movie format compatible with Microsoft software

    - 3D view fixes :

        - control / alt key handling for point selection or camera manipulation

        - text rendering bug (as a white rectangle)

➢ **Modeler**

    - New transformation defined by Euler angles

    - SYSEXP and SYSBAS import/export fixes

    - Step-AP203 import fixes

    - Deactivation of import/export formats : unv, blk, igs

    - Dynamic color scale : computed only with current date and visible items

    - New color mapping on meshing : meshes number

    - Fixes on application's properties color mapping

    - Shape and transformation help images updated

➢ **Trajectory**

    - Bug fixed about the start date of a time-position-velocity orbit

    - Crash fixed when the semi major axis of a keplerian orbit is less than the planet radius

    - Crash fixed about earth season date usage

➢ **Kinematics**

    - Mandatory law on root kinematics body : two vector pointing law

    - New origin and adaptation transformation defined by Euler angles

    - Connection and law help images added

➢ **Mission**

    - Fix a 3D view freeze when mission does not more reference a trajectory

    - Fix the disappearing of celestial name

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Patches:

➢ **4.3.3a**

- Fix SSL library dependency problems

- Fix an error when path begins by "\\" characters

- Improvements of VRML import

- references and scales are imported

- import time and 3D rendering speed are improved

- imported shapes can be faceted

- Add parallel edition on several selected shapes of model :

- orientation reversing

- colour properties or applicative properties removing

- Fix the update of modeler colors when displaying shape orientation and properties

- Fix a crash on texture usage

- Fix errors on grid help item creation (by face selection)

- Fix the availability of help item creation undo when creation by face

- Fix an error in material files import (created on Windows platform)

- Fix an error on the label of properties in material editor (and add a scroll on properties list)

- Fix a crash on Dostar file load

- Fix the availability of processing file deactivation when its input process has been deleted

➢ **4.3.3b**

- Fix SYSEXP export features :

- bad export of mesh numbers when custom numbering is used

- warning messages on properties side management

➢ **4.3.3c**

- Fix fail message on launch of application computation (on some platform)

4.3.2

Major improvements:

➢ **General**

- Performance improvements of 3D visualizations and meshing

➢ **Modeler**

- New file import format: VRML 2.0

- SYSEXP import: management of material import

- Improvement on the accuracy level

- Shapes transformation to the general type (available for antenna, cone, cylinder, disc, parabola and sphere)

- New feature: correction of accuracy errors:

- on quadrangle and polygon shapes

- on cosines transformation

➢ **Trajectory**

- On Sun synchronous orbits: implementation of the mean solar time instead of the true solar time

➢ **Trajectory & Mission**

- Real-time ancillary data display in the 3D View: position, velocity, anomaly, beta angle and distance to the Sun

Minor improvements:

➢ **General**

- Synthesis of the children error state in the browser

- Error message if the working directory is not writable

- Information message to prevent license expiration (last month before expiration)

- Log area resizable

- Information area resizable in the item editor

- A backup copy of files is done before saving (to prevent file deletion if the software crashes during the save)

- Screenshot available on all 3D view

- Scale bar and textual information inlaid in the screenshot

➢ **Modeler**

- New help item: sphere center

- Point picking precision improvement

- More explicit messages for SYSEXP and SYSBAS import / export

- Update of the truncated parabola definition (automatic conversion from old definitions)

- More flexible parameters of the general truncated sphere

- Icons for Interactive creation of 4 point truncated cylinder and disc

- Shortcuts for shape and object creation

- Facet shape feature in the contextual menu of the 3D view

➢ **Meshing**

- Shortcuts for virtual nodes creation

- Mesh number displayed on the center of the shape in the 3D view

➢ **Trajectory**

- The altitude of Sun synchronous arc is limited to 5500 km

- CSV import more flexible for the time-position-velocity arc

➢ **Kinematics**

- CSV import more flexible for the law defined by file

Corrections:

➢ **General**

- Fix the inlaying of contextual menu in screenshot

- Space character now allowed in the SYSTEMA_HOME Environment variable

- Fix crash in the 3D view configuration

- Correct the save format of text editor (now only text)

- Fix the update of information text in item editor

- Correct the message in case file saving does not succeed

- Add a confirmation message for file overwritting

➢ **Modeler**

- Fix the point injection in a transformation

- Fix the validity check of properties after loading a material file

- Do not create unusable points during the shape interactive creation

- Paste a cutter on a shape as child of the shape (no more as brother)

- Fix the clipping problems in the 3D view when 2 parallel line help items are created

- Fix the colour configuration behaviour for parameter / results visualization in the 3D view

- Fix a crash on the loading of 2 meshing entities in a curve view

- Fix an inversion of positive / negative side on boxes

- Fix lacks in the validity check of 3 points sphere, general truncated sphere, revolved polygon with hole and general truncated cone

- Fix a crash on a general truncated cylinder with null diameter

- Fix a crash of antennas

- Correct the 3D display of polygon with hole, 4 points truncated cylinder, antennas and parabolas

- Fix the 3D display of application parameters about the reverse option management

- SYSEXP import: correct the inheritance management in the properties import

- SYSEXP export: correct the reverse option management in the properties import

➢ **Meshing**

- Fix the computation point disappearing from the 3D view on changing the bounding box bounds

- Fix mesh deletion on shape modification

- Fix crash on antenna mesh

- Cut disabled on the meshing

➢ **Trajectory**

- Update on the 3D arc even if it is hidden

- Fix a import error on the celestial bodies management for v3 trjimp format

➢ **Mission**

- Fix update problems on trajectory or kinematics changes

- Fix the usage of anomaly step for computation dates

- Fix a crash on the edition of kinematics link in the root item

- Restore the model size feature in the 3D view

- Fix a crash when the mission references a trajectory with no arc

- Fix the VIRTUALPATH_0 file name in model reference

Patches:

➢ **4.3.2a**

- Fix the usage of sequences

➢ **4.3.2b**

- Lowering of geometrical precision constraints

- Fix a transformation conversion error during SYSEXP import

- Fix a values listing error of the discrete color scale

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➢ **4.3.2c**

- Fix the cut of near 3D objects in mission 3D view

- Fix the display of text in the 3D view (transformed in a white rectangle)

- Correct the usage of Alt and Ctrl keys on the 3D view

- Fix the display of some shapes imported from Step-AP203 file

- Remove an incongruous message "License error" on the file save

- Fix the mission 3D view break when a trajectory is detached of the mission

- Correct the configuration of background color in the trajectory and mission 3D views

- Fix a crash during some creation of a help item line

- Add the creation of help items by selection of shape faces

- Improve keplerian orbit parameters (adding for ascending node definition : rotational longitude, true solar time and mean solar time)

- Improve planet stationary orbit parameters (adding to the inertial longitude : rotational longitude, true solar time and mean solar time)

- Improve the linear attitude law with definition by rotation from the position on the begin of the phase

➢ **4.3.2d**

- Fix the precision problems of near 3D objects in mission 3D view

- Adaptation to applications without physical properties

4.3.1

Major improvements:

➤ **SYSEXP / SYSBAS**

- Meshing and numbering properties

- New shape types

➤ **Mission**

- Multi-kinematics sequences

Minor improvements:

➤ **Meshing**

- Manual numbering of meshes

- Condensation available

➤ **Trajectory**

- Sun synchronous arc: default parameters changed to altitude

- General keplerian arc: introduced "orbit reference date" in the start & end date choice

- Time-position-velocity arc: introduced "file date" in the start & end date choice

- Time-position-velocity arc: file format changed, based on CSV standard
  (separators: comma, tabulation and space characters)

➤ **Kinematics**

- File-defined law: file format changed, based on CSV standard
  (separators: comma, tabulation and space characters)

➤ **General**

- Text editor: font changed with constant width

- Imported file: introduced display of the original file path in the browser

- Save & load messages: introduced gathered log saveable to a file

- Dependant item: introduced management of the "save as" of a dependant item
  exple : when a "save as" is done on a model, the meshing is updated

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Corrections:

➢ **Modeler**

- Fix crash on the creation of a cutter on the root node

- Fix crash on the modification of a 4 point cylinder & cone

➢ - **Meshing**

- Fix crash about antenna meshing

➢ - **Kinematics**

- Fix error about Moon pointing laws

- Introduced error message to forbid any child when fast-spin law is used

➢ - **Mission**

- Fix crash on the creation of an empty computation points property

- Improve the update on model/trajectory/kinematics changes

➢ - **Result**

- Fix bad display of the mesh numbers

➢ **General**

- Improve the management of the texture relative path