Systema-Thermica

European Space Thermal Engineering Workshop 2022

18th-20th of October, 2022

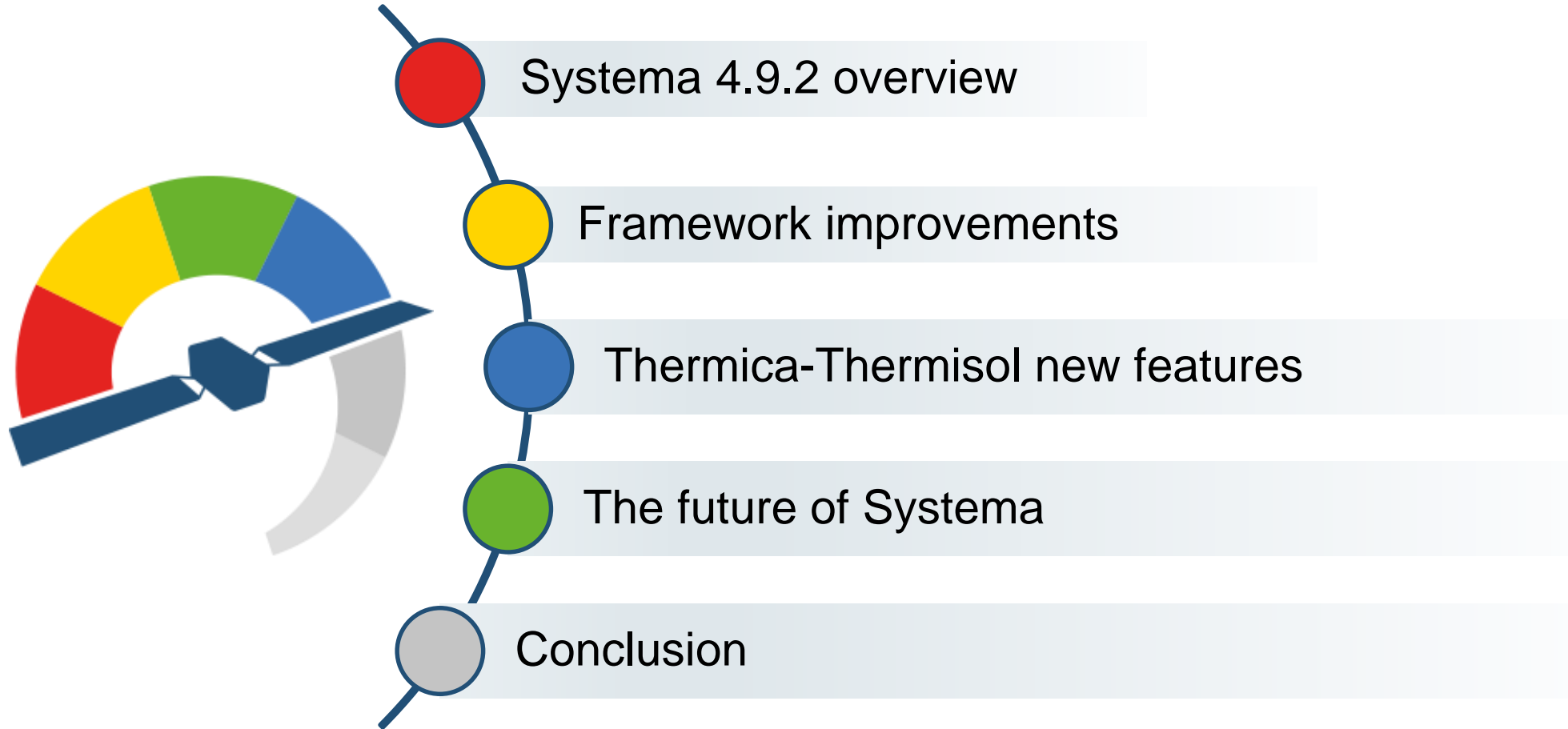DEFENCE AND SPACE

Presenters: *L. Galeron – M. Lepilliez*
Contributors: *C. Bayeux, G. Capblancq, D. Cayrol-Midan*

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Agenda

Systema 4.9.2 overview

Framework improvements

Thermica-Thermisol new features

The future of Systema

Conclusion

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| 4.5.3b | 4.8.3P3 | 4.9.2 | … |

Systema - Thermica LTS 4.9.2 Sept. 2022:

- The main effort has been put on ergonomy, optimisations and validation
- Improvements on Thermica & Thermisol

User Interface / Connecting with other software

- New Python console based on Jupyter.
- Step-TAS import/export improvements, now fully support phases of materials.
- New ergonomic features (drag&drop, player displayed in elapsed time, …)

Overview

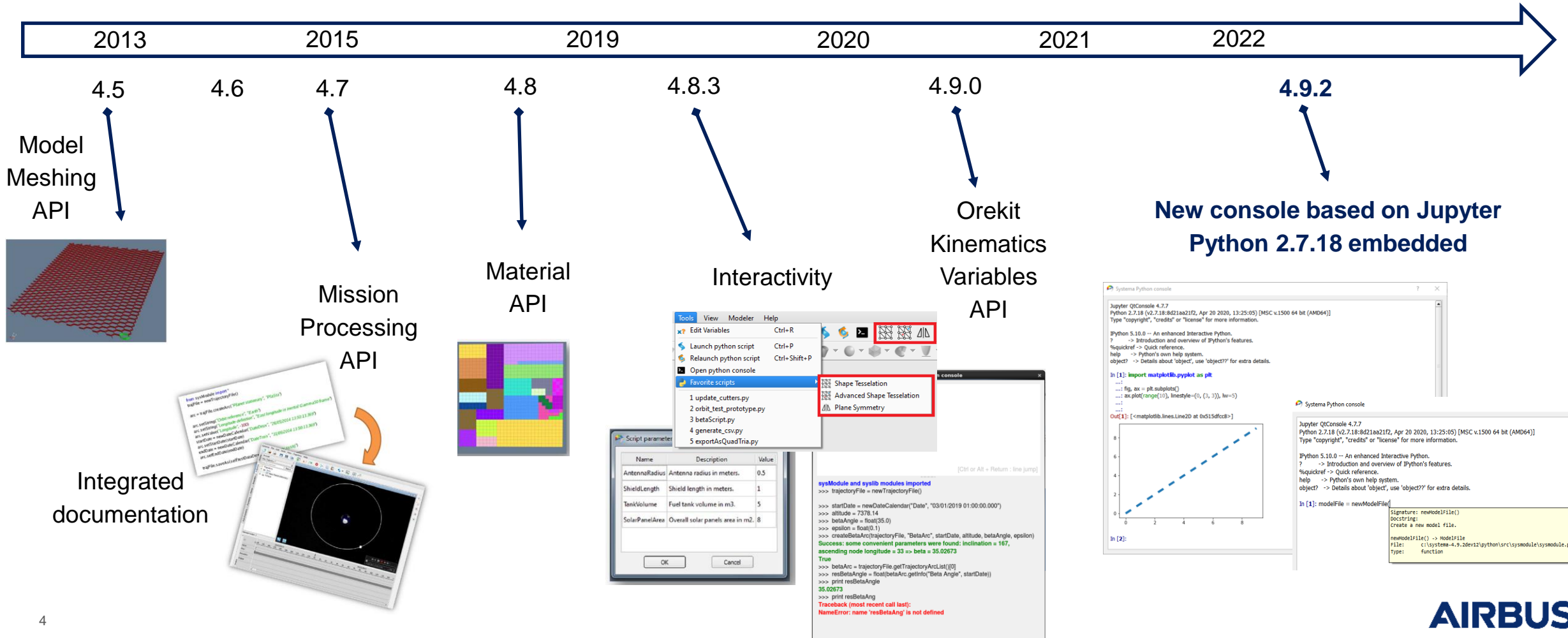| KEY MESSAGE |
|---|
| Systema-4.9.2 is the new **Long Term Support** (LTS) version
→ Exporting files for the previous **LTS** versions (4.8.3 and 4.5.1) is provided. |

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Python API improvements

Since Systema 4.5, the Systema Python API has been continously improved as demonstrated in the previous ESTEW presentations.

| 2013 | 2015 | 2019 | 2020 | 2021 | 2022 |

4.5   4.6   4.7   4.8   4.8.3   4.9.0   **4.9.2**

Model Meshing API

Mission Processing API

Material API

Interactivity

Orekit Kinematics Variables API

New console based on Jupyter Python 2.7.18 embedded

Integrated documentation

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Systema

Python API improvements

New Python console based on **Jupyter**.

➜ Autocompletion

➜ Embedded help

➜ Method descriptions etc…

Systema 4.9.2 now embeds an extensive **Python 2.7.18** distribution with several packages for scientific computation and applications (matplotlib, pandas, etc…)

Complete list of available modules listed in the release note.

➕ New methods provided in the Python API.

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Trajectory / Kinematics

- The supported reference frames in Systema are clarified to avoid confusion.

  💡 Details can be found in the release note

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

- New kinematic laws are provided:
  - X direction of ICRF
  - Y direction of ICRF
  - Z direction of ICRF
  - Ecliptic north

💡 The ICRF (International Celestial Reference Frame) is the current standard celestial reference system adopted by the International Astronomical Union (IAU).
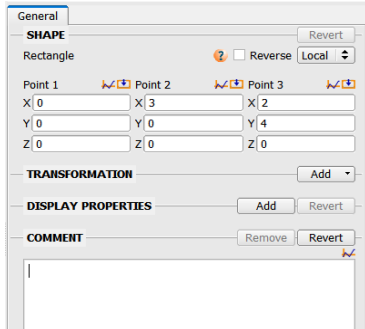
- The support of ephemeris and attitude STK file is improved.

- New textual information can be displayed in trajectory tab:
  - The occulting body during eclipses and penumbras
  - The Solar Zenith Angle

Solar Zenith Angle (Nadir)
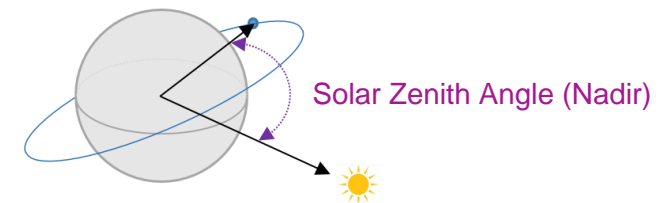
These information are also available in the mission log.

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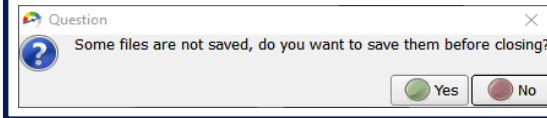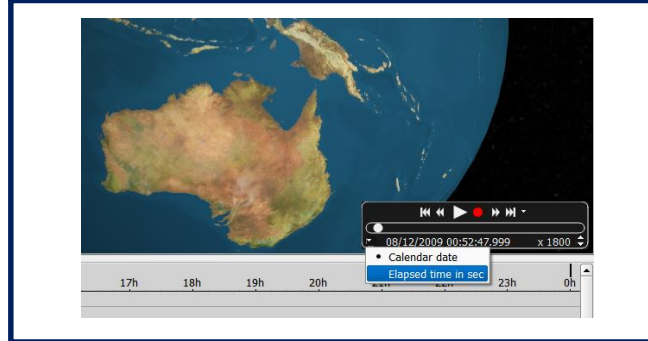
FREE COMMENT

For all Systema files

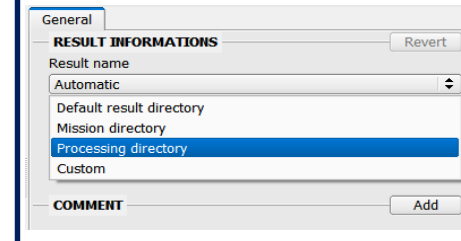## CLOSE ALL WITHOUT SAVING

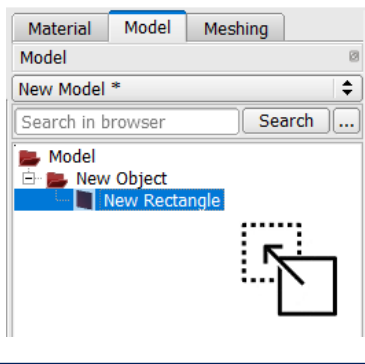With a single confirmation message

PLAYER DISPLAYED IN ELAPSED TIME

RESULT PATH

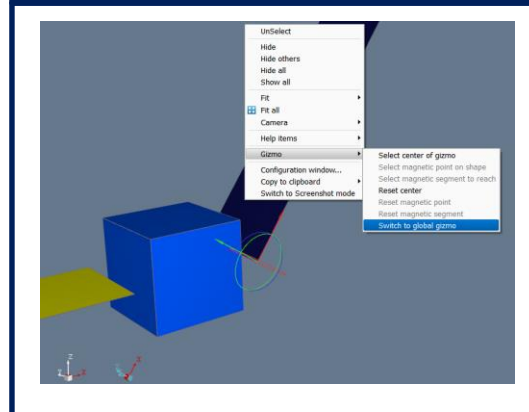Use the path of the processing files to build the results directory.

Systema

Ergonomy
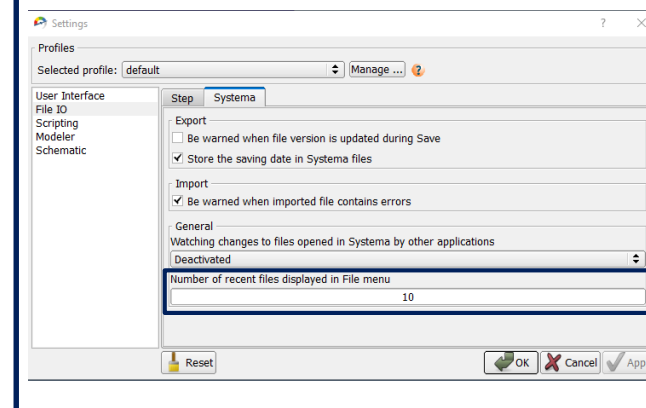
DRAG & DROP

In modeler tree
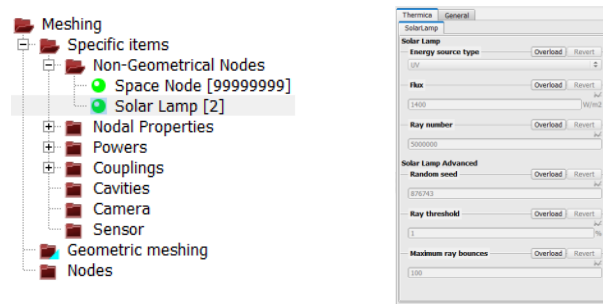

LOCAL GIZMO

MAX RECENT FILES

New setting to set the number of recent files displayed in "File" menu

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Thermica – Thermisol new features

▪ **THERMICA**

– Solar Lamp : a new specific item called Solar Lamp allows to model a source of UV or IR emission.

– Conduction with Simplified-RCN improved for condensed nodes.

– Solar flux : export of Solar constant value in the .sf.nwk file.

– Planet fluxes : export of Planet direction vector and Solar Zenith Angle now possible in the .pf.nwk file.

– Nodal description : export geometrical positions and normal vectors (FX, FY, FZ, NX, NY, NZ) in H5 file.

▪ **THERMISOL**

– GETCSG(Node) routine to get the CSG value of any node in the dck file

– The libsolver is now built in 64bits on both Linux and Windows while it was only on Linux in Systema 4.9.1 (~2 times faster!)

For a test case with :
  Number of Thermal Nodes : 25.174
  Number of GL   : 54.602
  Number of GR   : 5.904.564
  Number of GF   : 530

Computation time comparison

Minutes

■ 32 bits ■ 64 bits
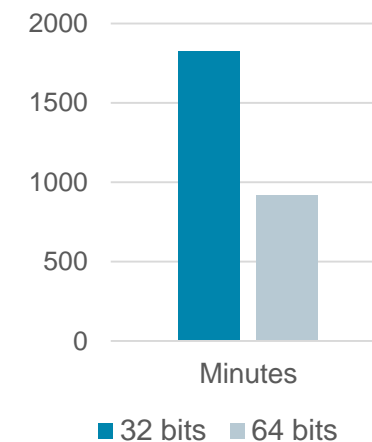
✚ Lots of corrected issues thanks to **our user feedbacks**

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Systema

Thermica – Thermisol new features

Solar lamp
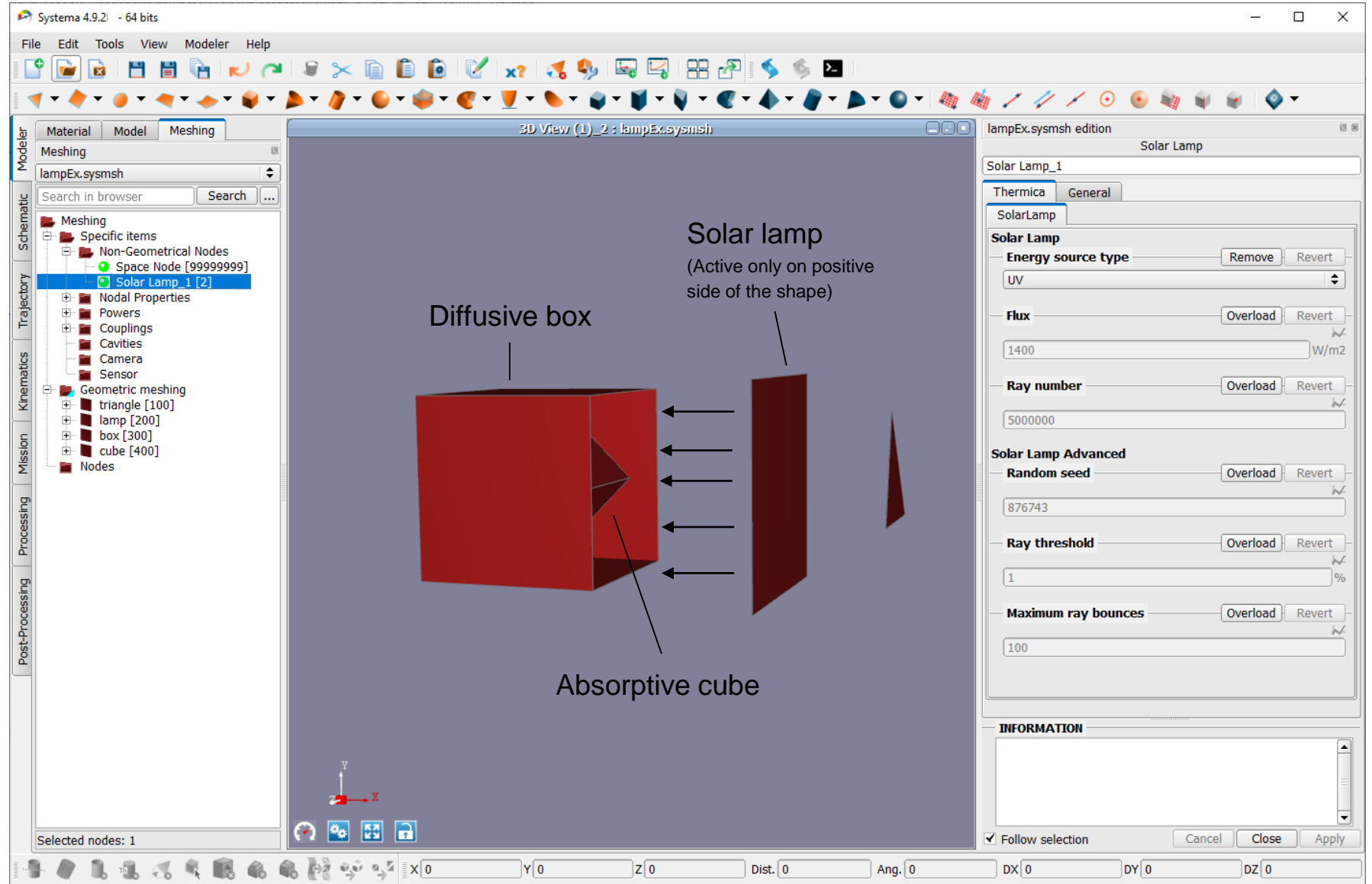
QS automatically computed in the « Nodal Description » module output in nod.nwk file

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4.9.0

4.9.1

5.0

4.9.2

4.9.3

2024 → 2026

- Release Systema V4.9.4, …
- Release Systema v5.0

2022 → 2023

Release Systema 4.9.3

- Main focus on Thermica
- Framework improvements
- Transverse physics applications around thermal modelling
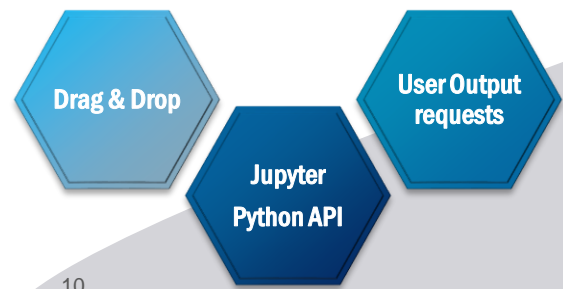- Renforce applications for transition to V5

Conduction
Convection
Spe. Items

OREKIT
Python API
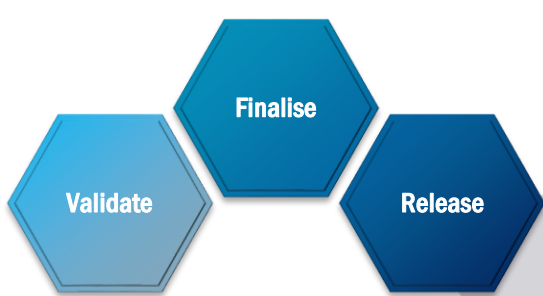
Airdrag
Power

2021 → 2022

Release Systema 4.9.2
- LTS, Consolidation
- Python API & Interface
- Ergonomic features
- Performances
- Solar Lamp

Drag & Drop

Jupyter
Python API

User Output
requests

Systema

The future of Systema

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4.9.0

4.9.1

5.0

4.9.2

4.9.3
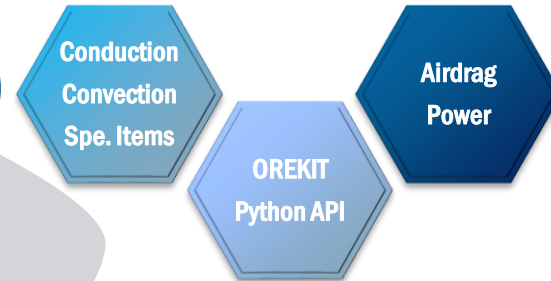
Finalise

Validate

Release

2024 → 2026

- Validated Beta Testers
- Testing
- Final iterations
- Release Systema v5.0
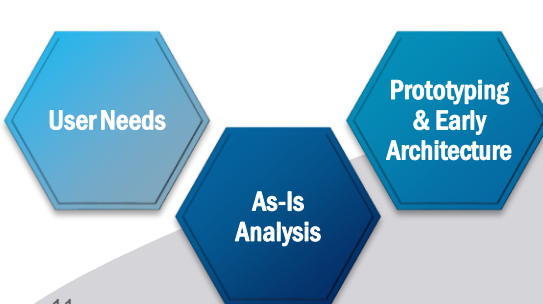- Continuous Improvement (ongoing)

2022 → 2024

- Prototyping & Early Architecture definition
- Software Requirements Documentation
- Primary Software Development Phase
- Select Key Users / Beta Testers
- Continuous Improvement (ongoing)
- Control Board Reviews

User Needs

Define

Develop
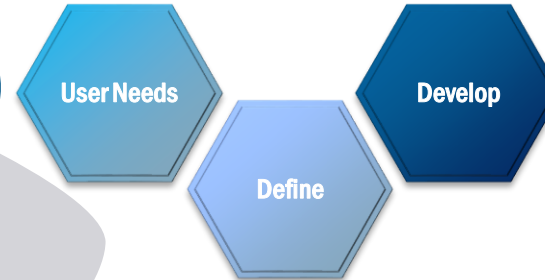
2021 → 2022

- User Survey (internal & external)
- As-Is Analysis
- User Workshops (Space Physics, Power, Thermal)
- Requirements Definition
- Continuous Improvement (ongoing)

User Needs

As-Is Analysis

Prototyping & Early Architecture

Systema

The future of Systema

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Conclusion

- **Systema-4.9.2** is the new **Long Term Support** (LTS) version
- Main improvements concern the ergonomy, the python API and the validation.

- New features on Thermica-Thermisol

- Continuous improvements for **V4**
- **V5** definitions and specifications on-going

- New **website** (available soon!)
- Need to apply for download links (Airbus geo-restrictions)
- Subscribe for V5 updates and review board participation

KEEP IN TOUCH

https://www.airbus.com/en/products-services/space/customer-services/systema
or http://www.systema.airbusdefenceandspace.com
(automatic redirection)

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Systema

Thank you

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