



EDGE - A pre-processing tool helpful to design your SPIS CAD model

- SPINE meeting

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Meeting – October 2018

Artenum invests for several years on tools able to model the radiation effect of space environment

- **EDGE: Extended Gdml Editor** is an easy-to-use GDML editor to load and edit GDML CAD
- GDML format (Geometry Description Markup Language) is used
 - by the Geant4 simulation tool kit, the reference solution for particle-matter interaction;
 - to design the geometry and materials of a system to model;
 - currently in space, radiations analysis, neutronics, high-energy particles research and nuclear safety



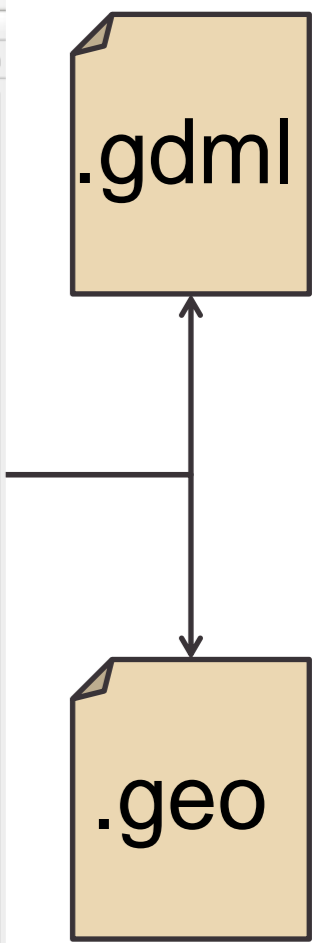
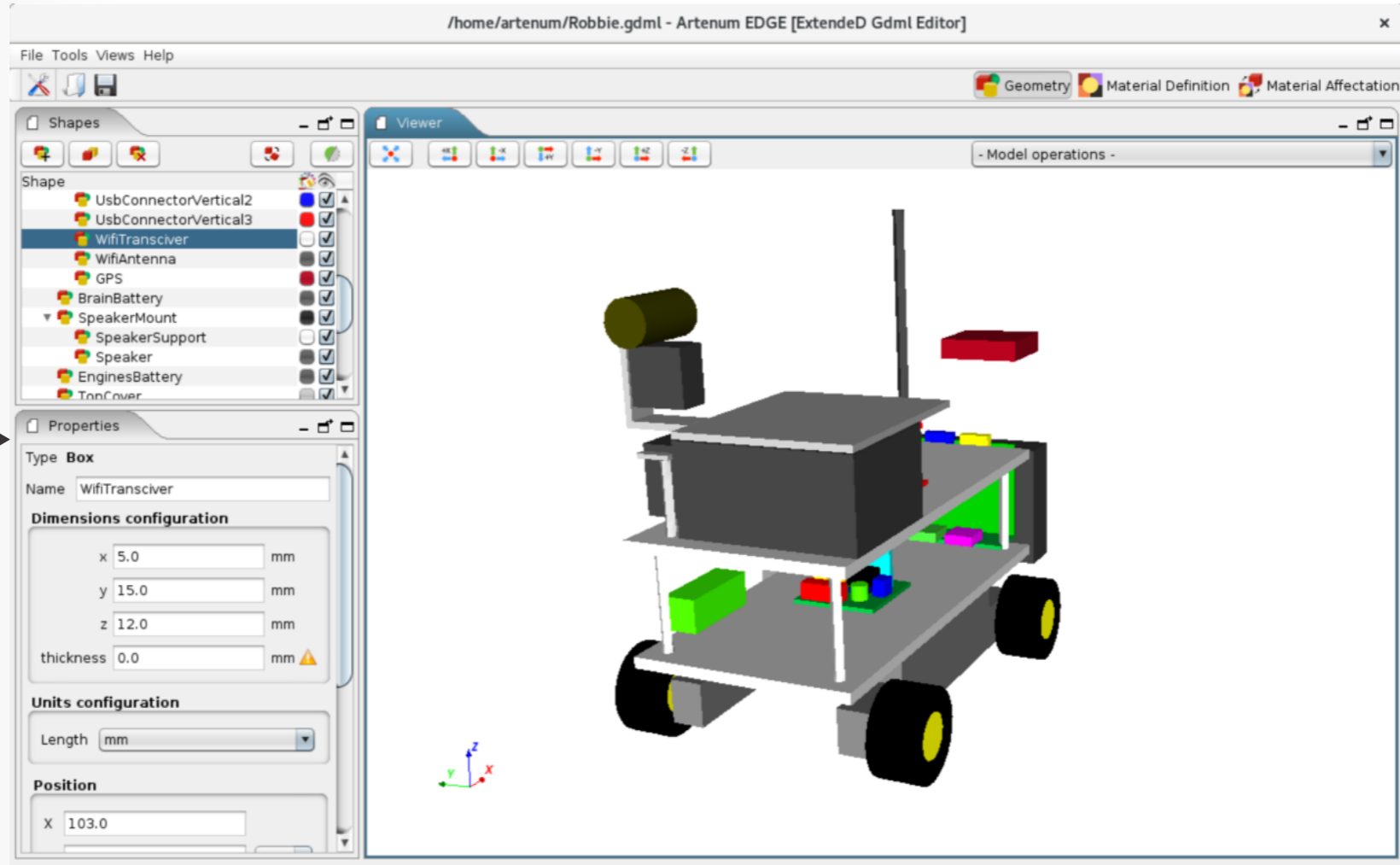
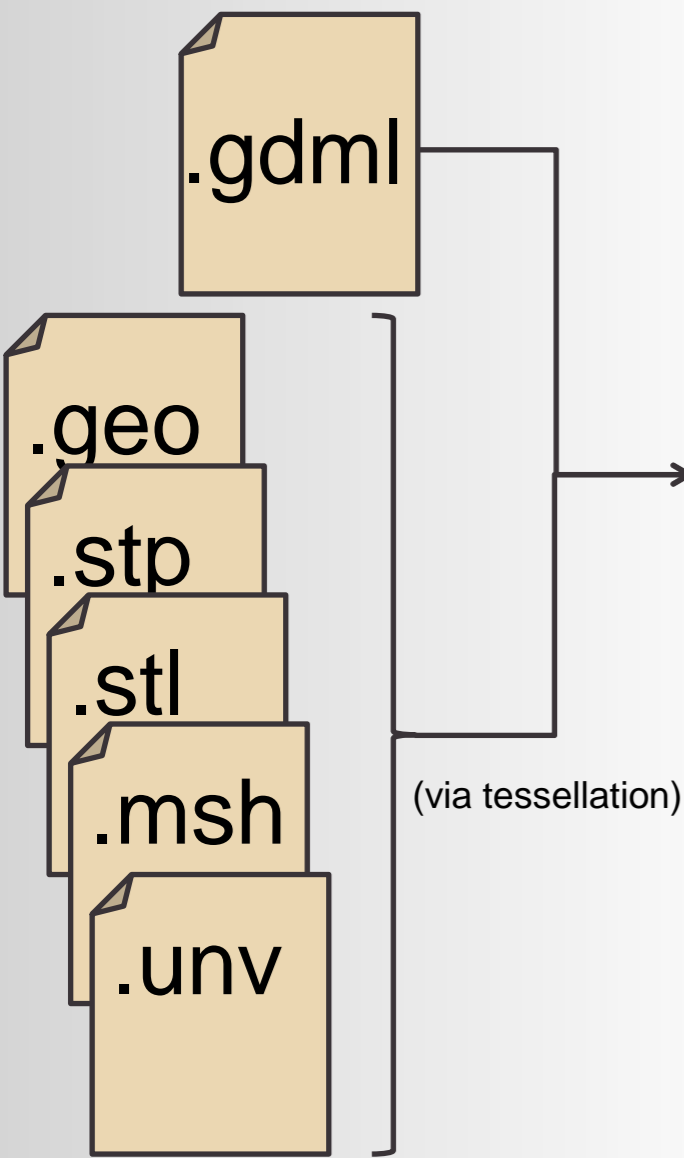
EDGE

- **Easy-to-use** tool to create **GDML geometries**
- User-friendly GUI **to create/visualise and edit GDML** based geometries with real-time **3D rendering**
- 3 perspectives/modes:
 - Geometry edition
 - Material definition
 - Material assignement
- Available on **Linux, macOS and Windows**
- Version **2.3.2** released in **October 2018**
- Used at ESA/TEC-EPS (time-unlimited, multi-users EDGE 2.1.0 license for internal use)

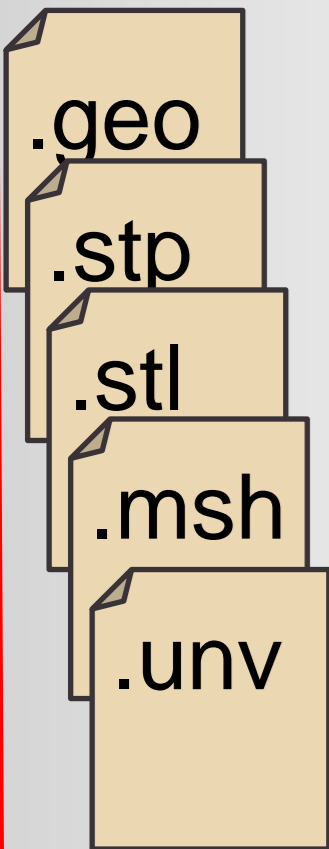
Some EDGE versions	
Version	Date
2.0.11	Feb. 2016
2.0.17	Oct. 2016
2.1.0	Feb. 2018
2.2.0	Apr. 2018
2.3.0	Jul. 2018
2.3.2	Oct. 2018

Import

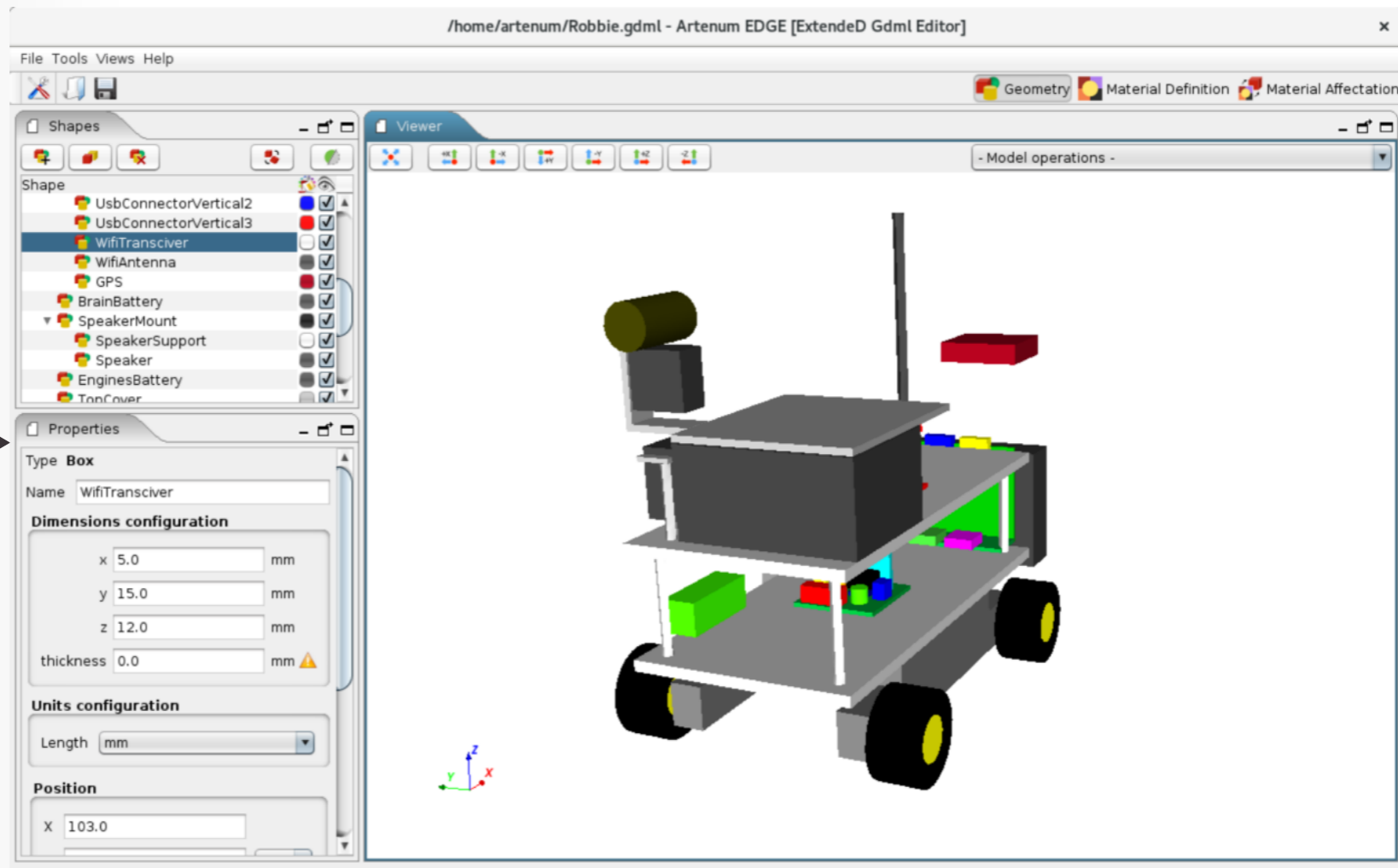
Export



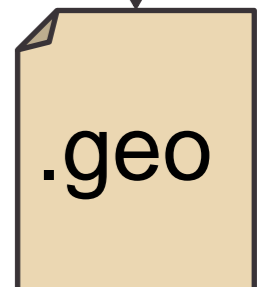
Import



(via tessellation)

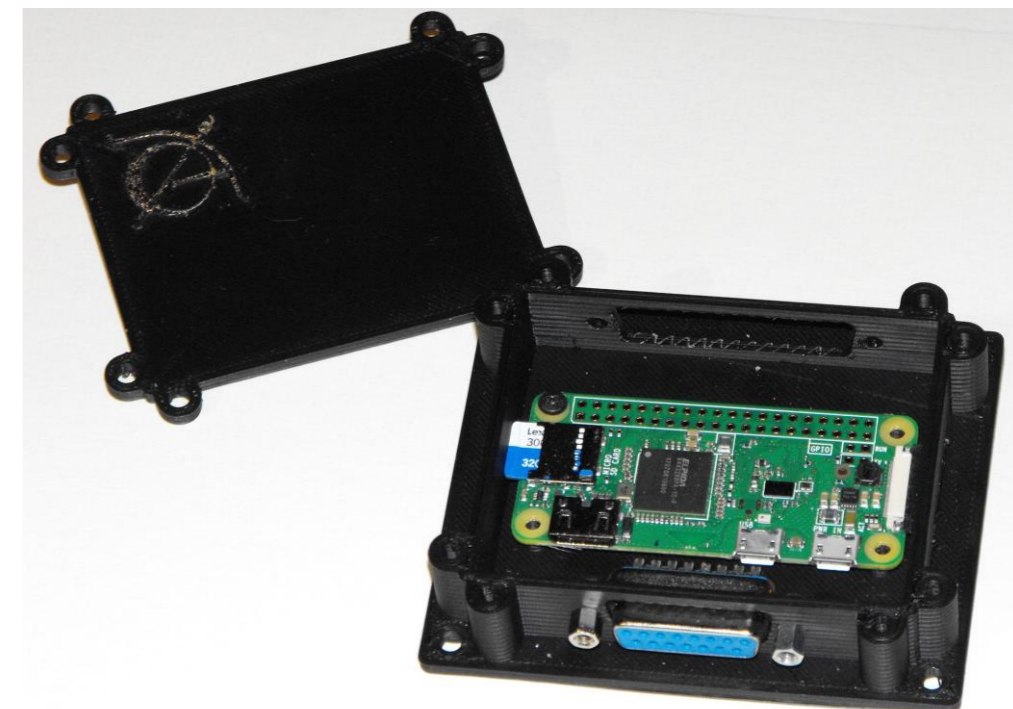
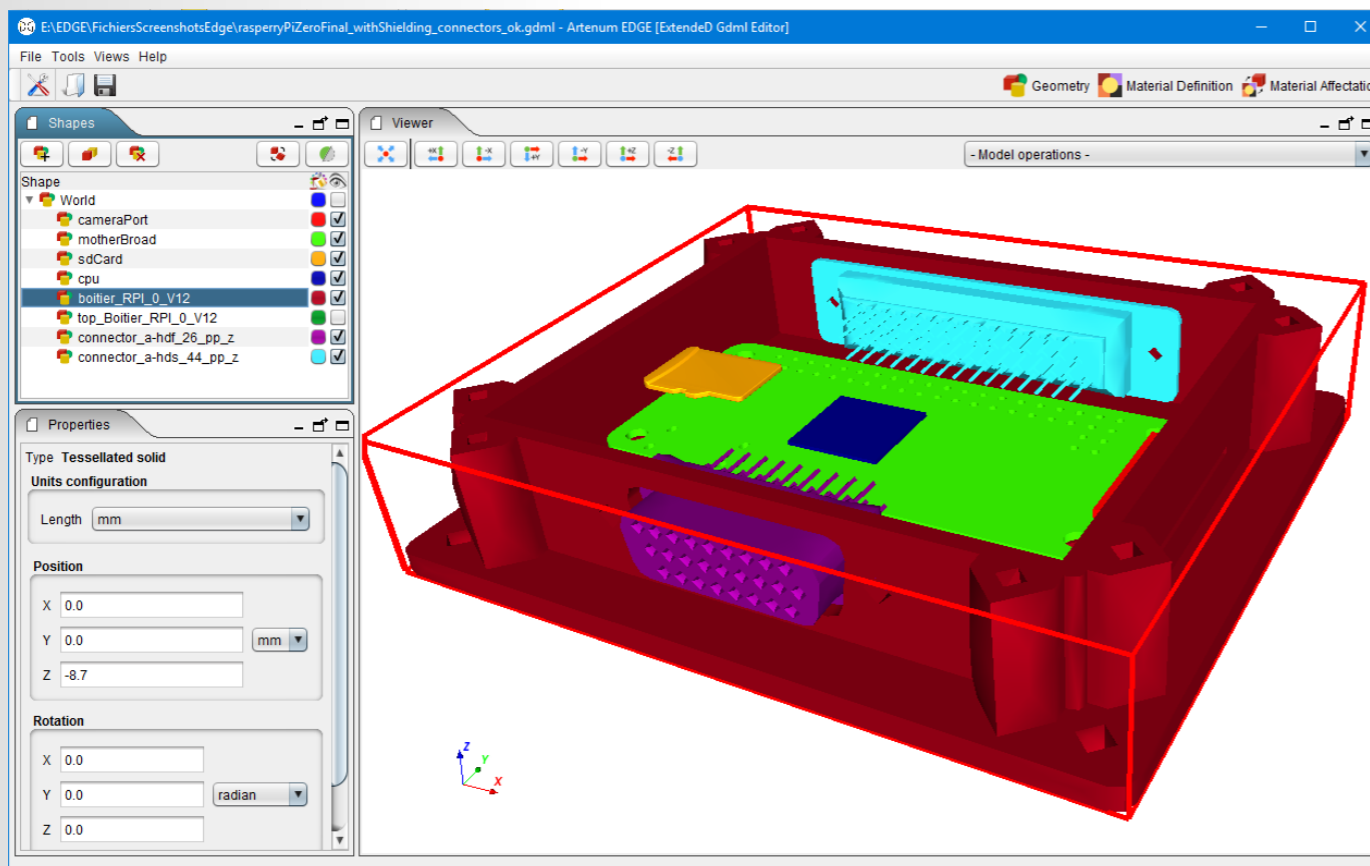
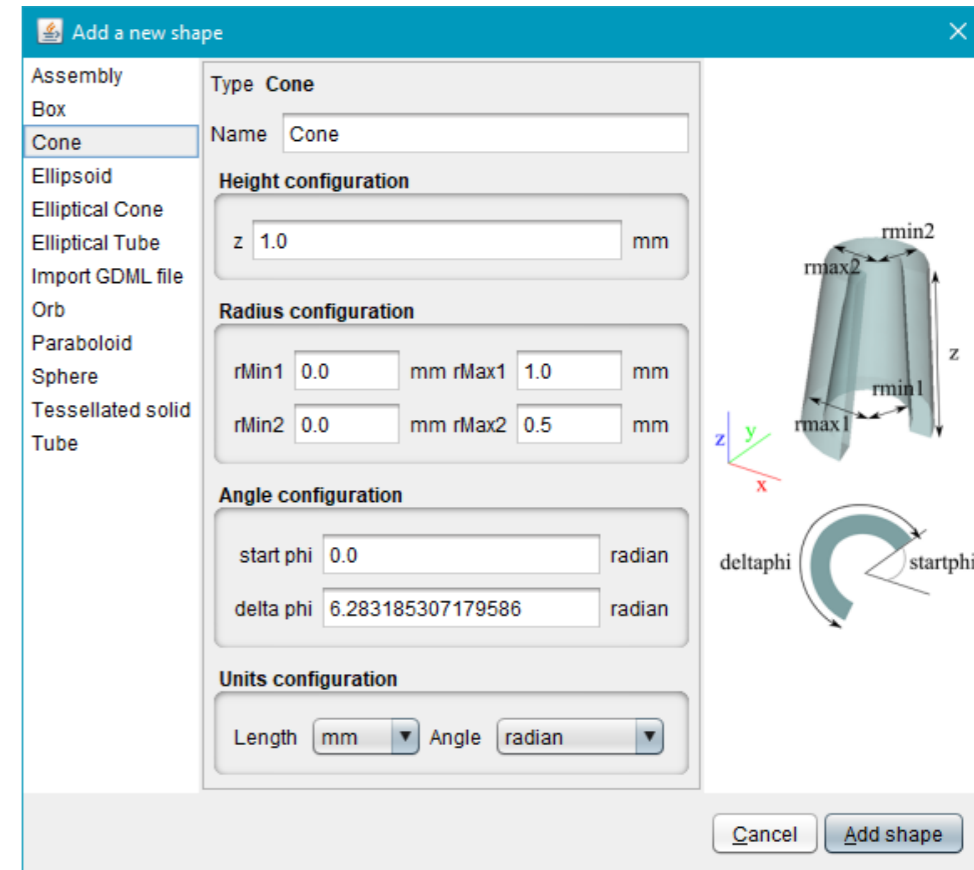


Export

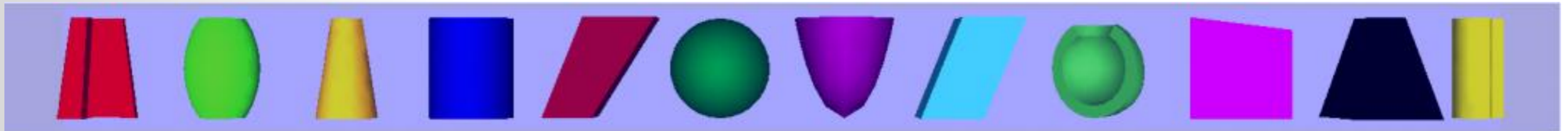


Helpful to design CAD for SPIS simulations

- Create GDML geometry from scratch
- Handle different GDML shapes
- Exact representation of GDML shapes in EDGE 3D viewer



- Handle **most** of GDML elements



- “**Thickness**” parameter on some shape to create easily “hollow” elements (cavity inside)
- Possibility to **reorganise** the **hierarchy** of elements with a drag and drop function

Type Box

Name

Dimensions configuration

x mm

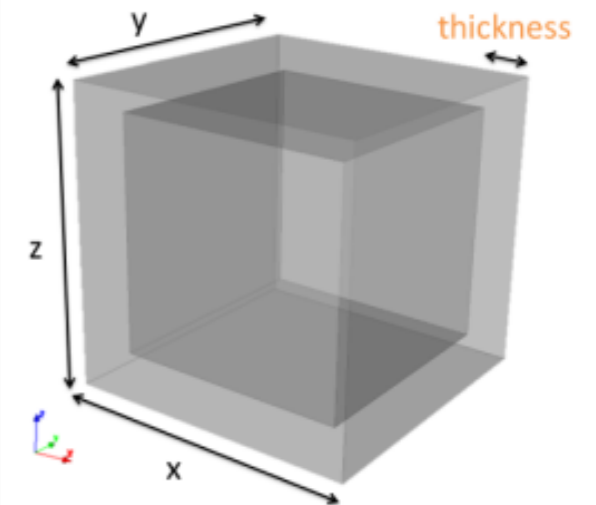
y mm

z mm

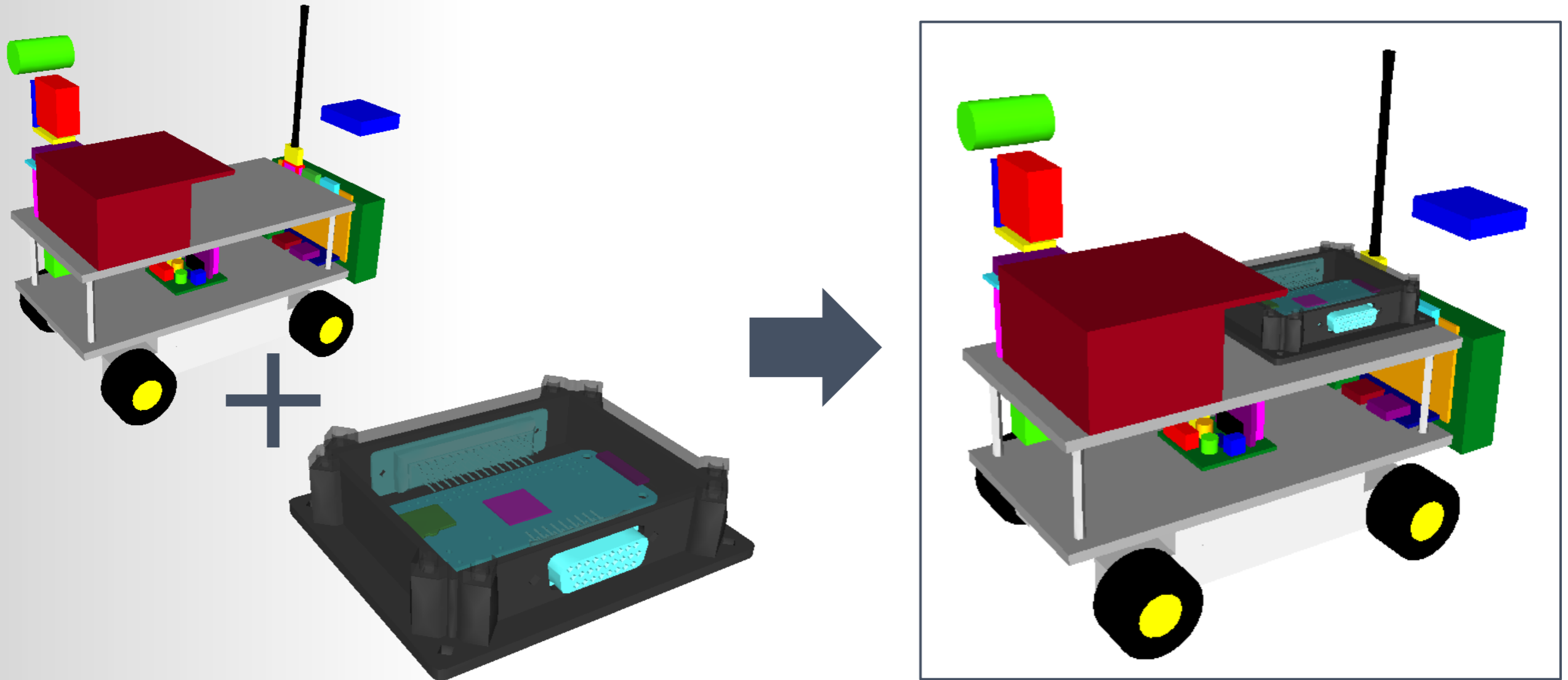
thickness mm ⚠

Units configuration

Length



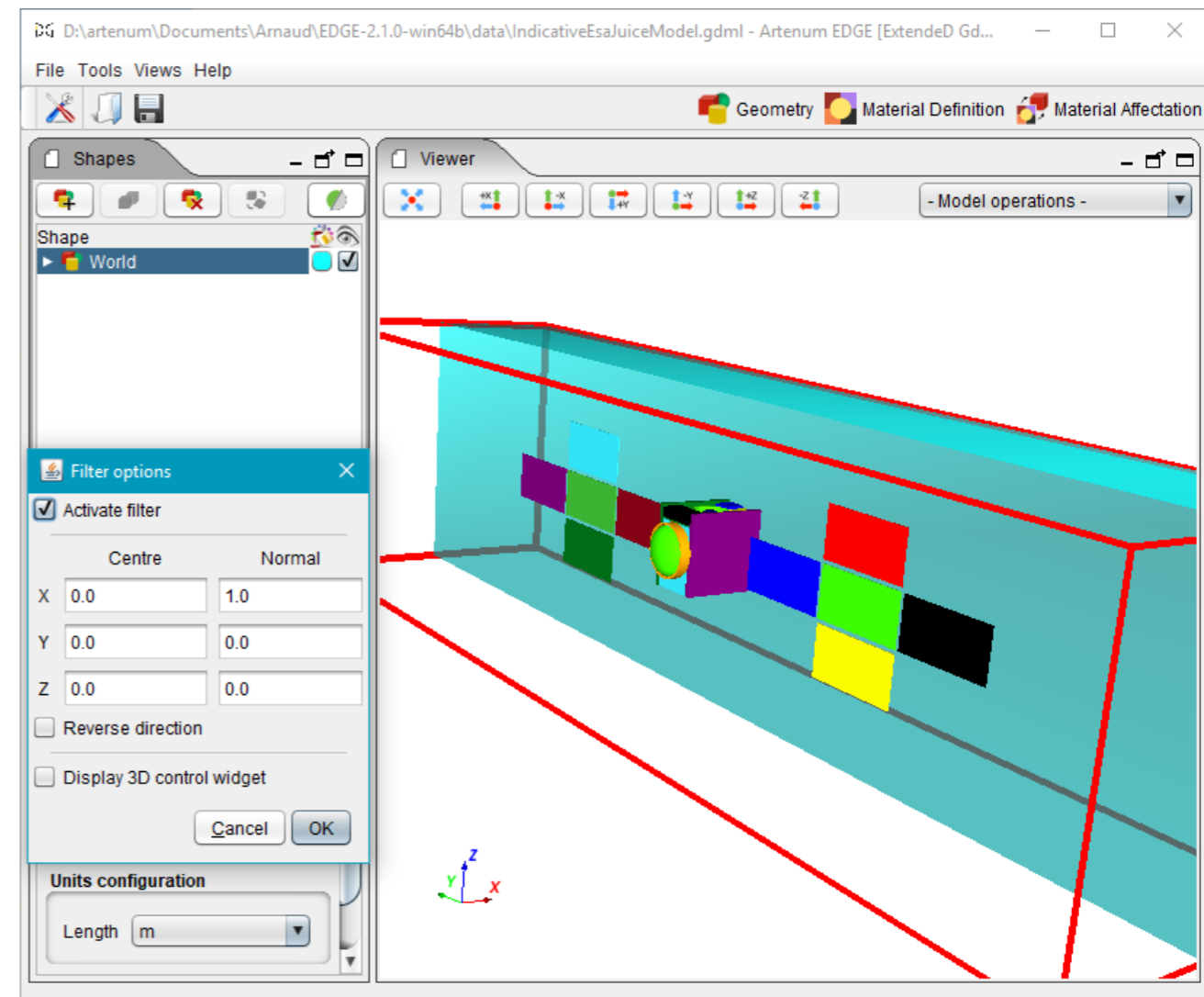
Import external files as a children



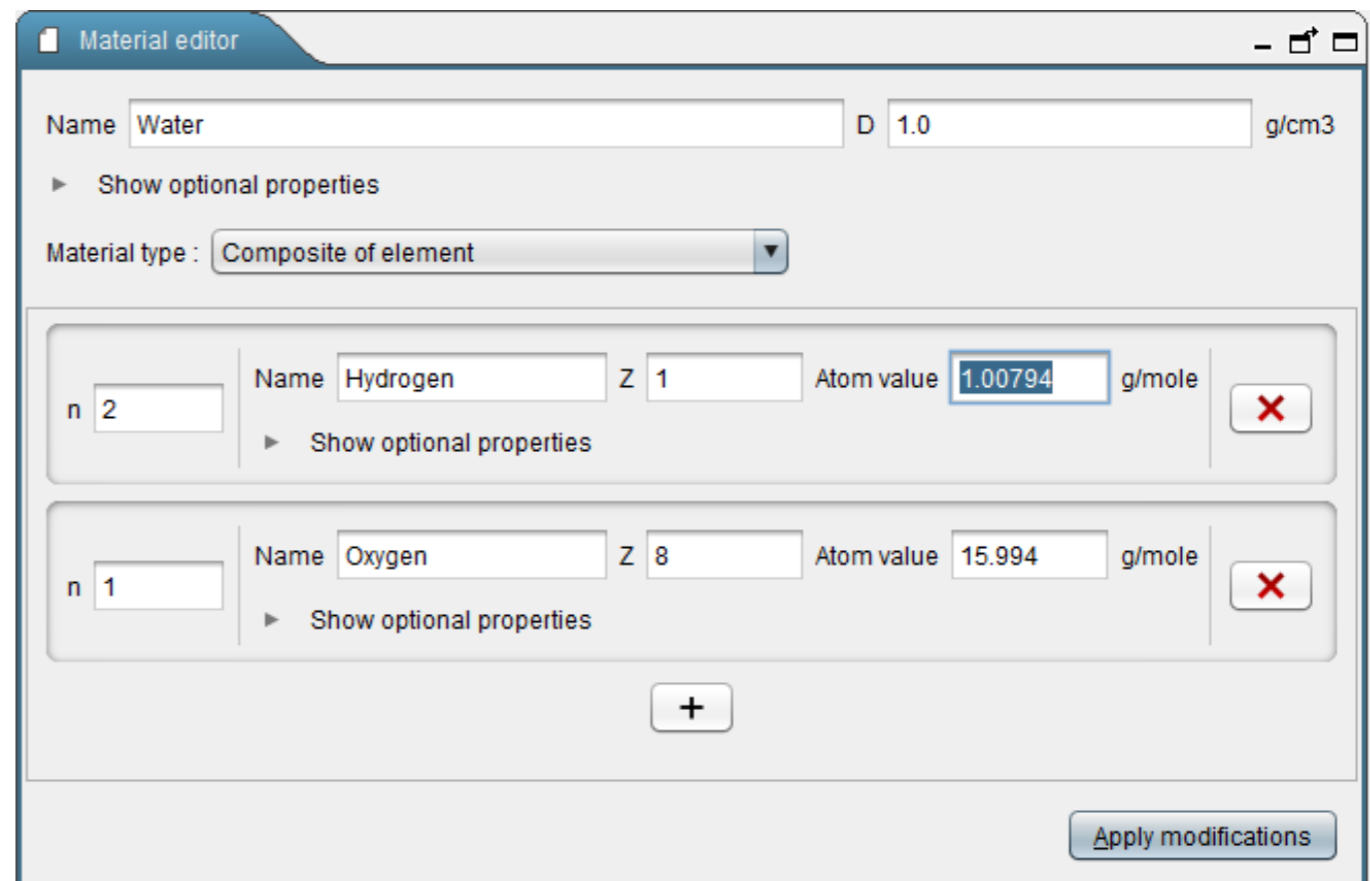
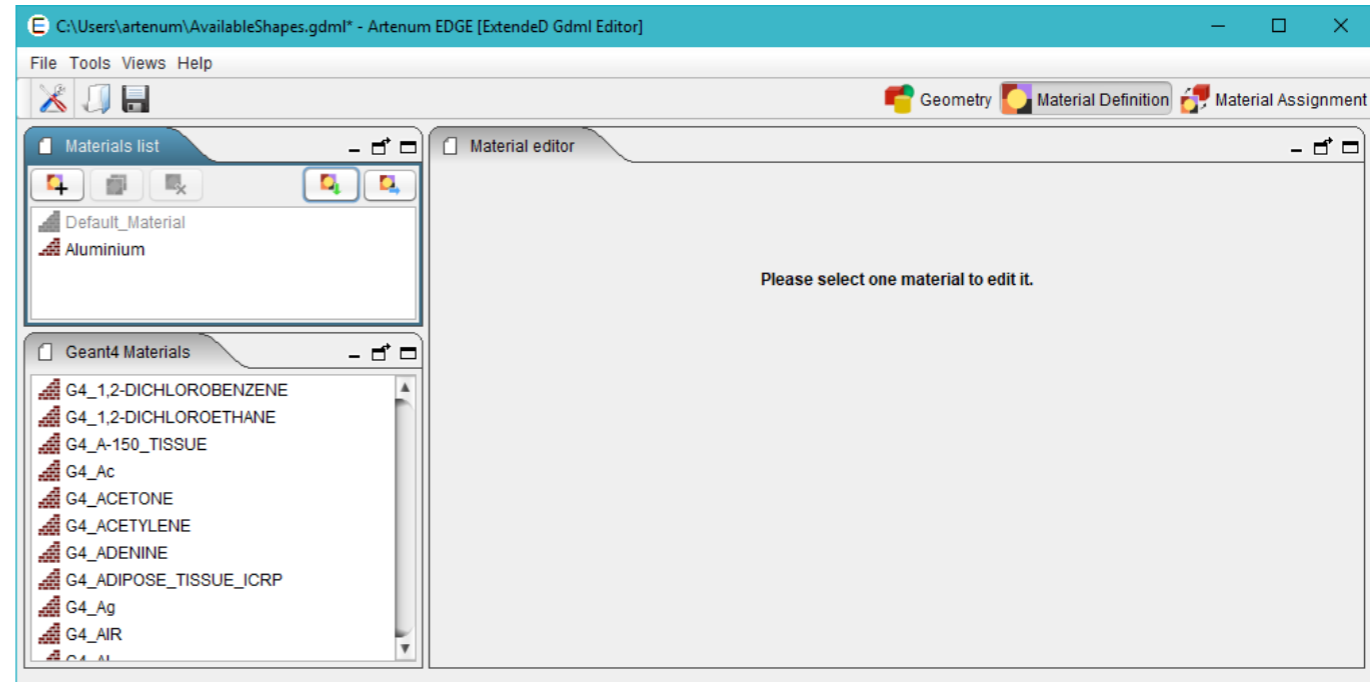
- Handles name conflicts by renaming conflicting imported elements
- Allows importing sub-systems (i.e payload) into the global modelled geometry (i.e spacecraft)

3D Visualisation functions

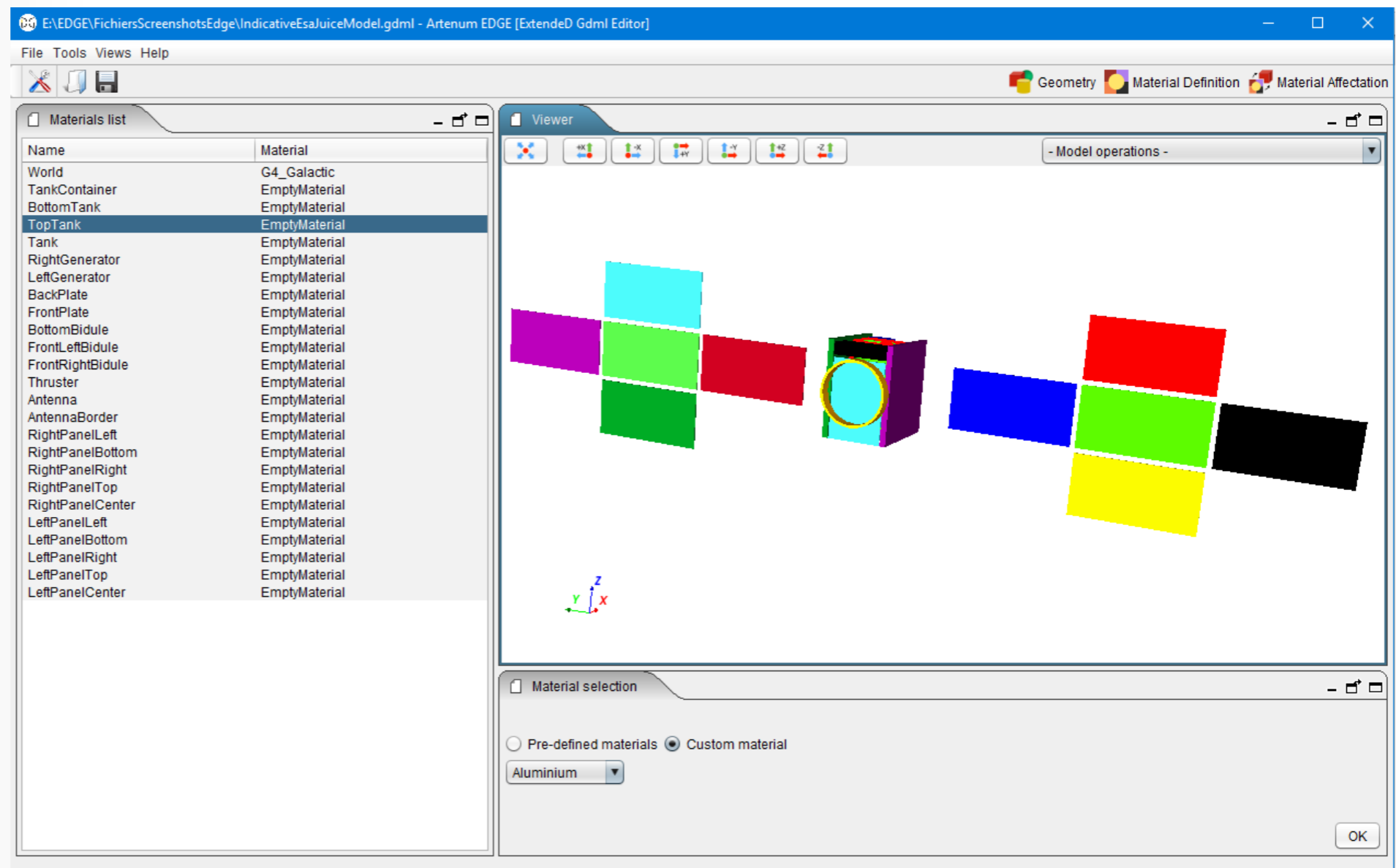
- **3D controls** (align along axis and reset camera)
- **Clipping** filter, useful to see inside an element by seeing only parts of it. Set it:
 - with centre and normal or
 - using interactive 3D component



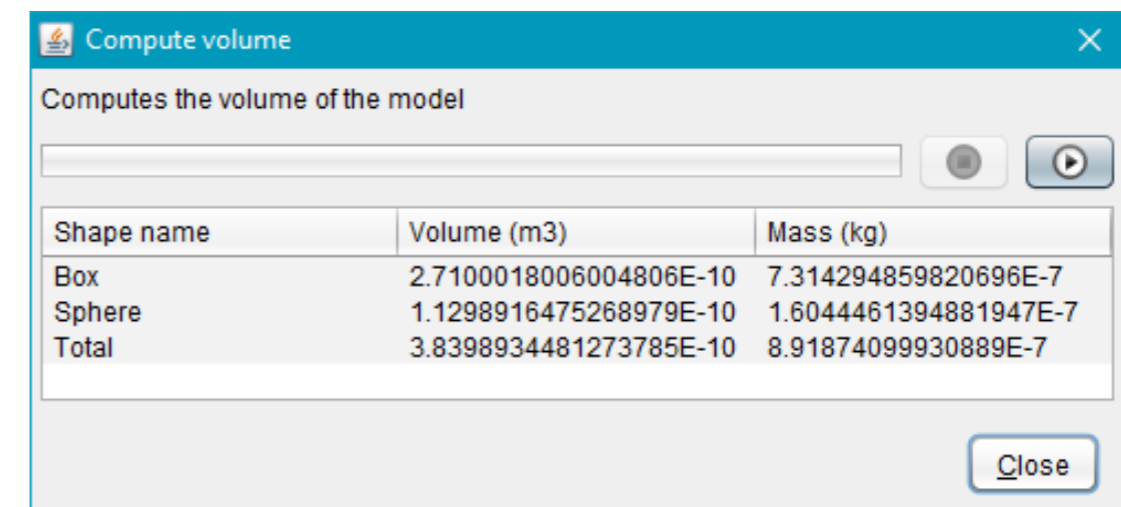
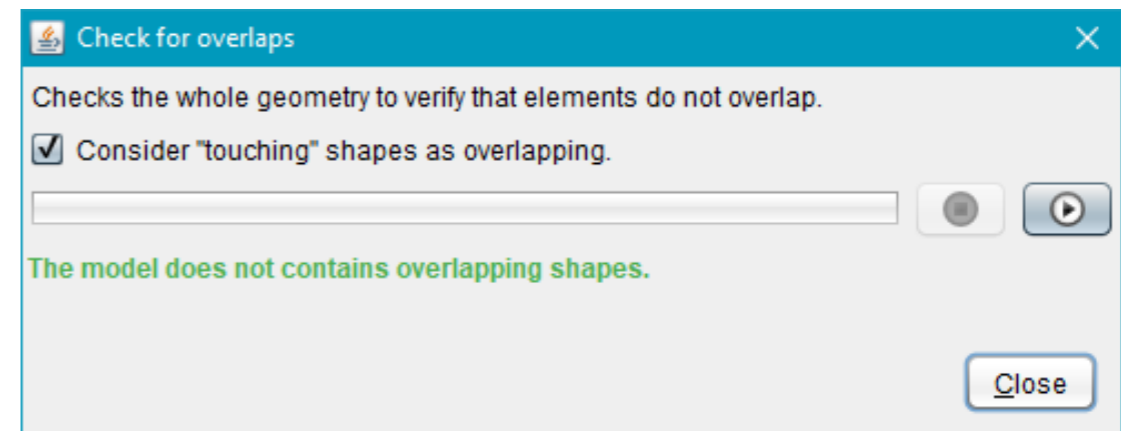
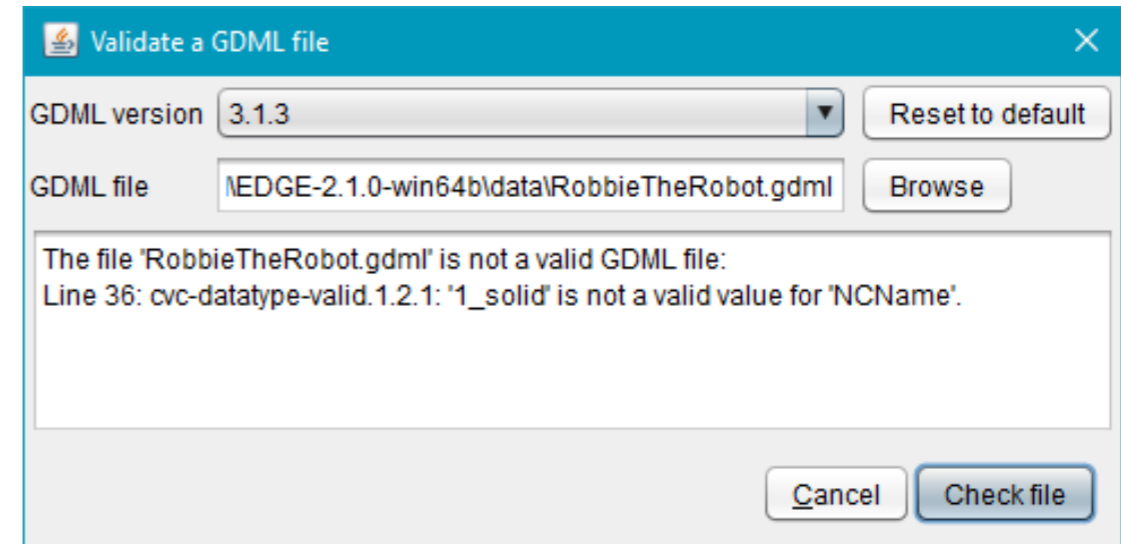
- User-friendly **material editor**
- Duplicate user-defined materials
- **Import/Export materials** from another .gdml file
- List of the available Geant4 default materials
- GDML materials different from SPIS ones => no export available for SPIS



- Possible to assign default Geant4 materials
- Material assignment of several elements at the same time
- GDML materials different from SPIS ones => no export available for SPIS



- Tool to check the **validity of a GDML file** against the GDML File Schemas (XSD)
- Tool to check that solids do not **overlap** each others
- Tool to compute the **volume** and **mass** of the geometry using the material density



EDGE

is based on

also uses



Gmsh PENELOPE

Frida DockingFrames GNU Trove



Java™



OSGi™ ...

KERIDWEN

INTEGRATED MODELLING ENVIRONMENT

Artenum **open-source modular** toolbox of interoperable software modules providing a structured set of **key functions** common to most **scientific software**.

also powers

SPIS

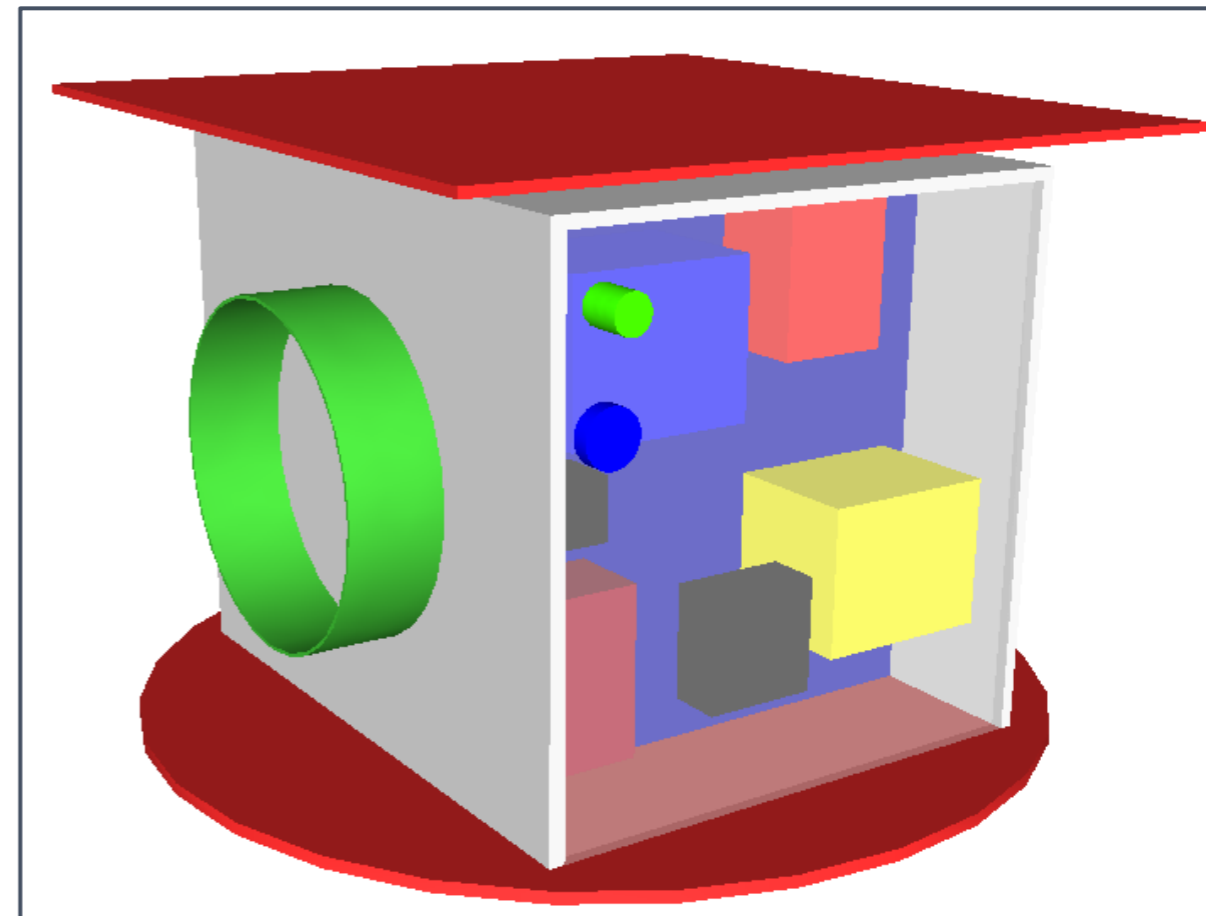
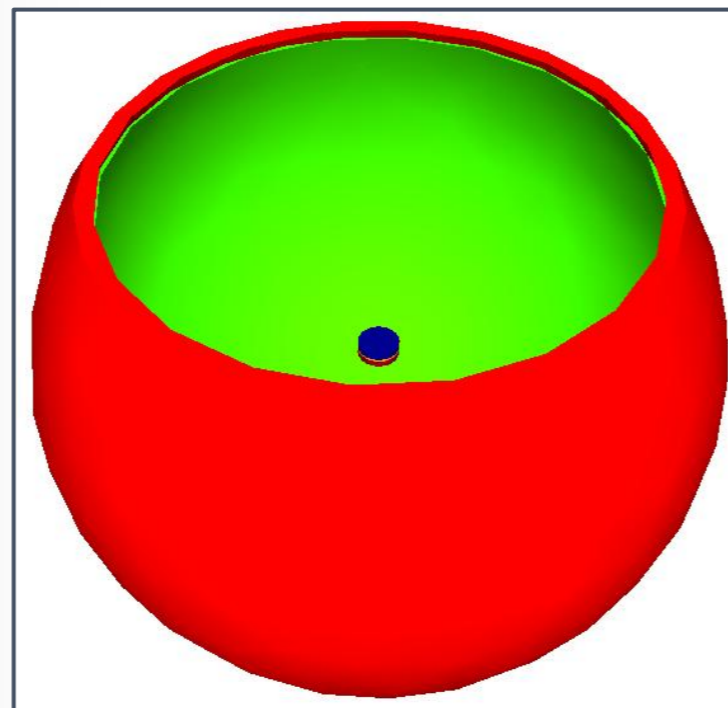
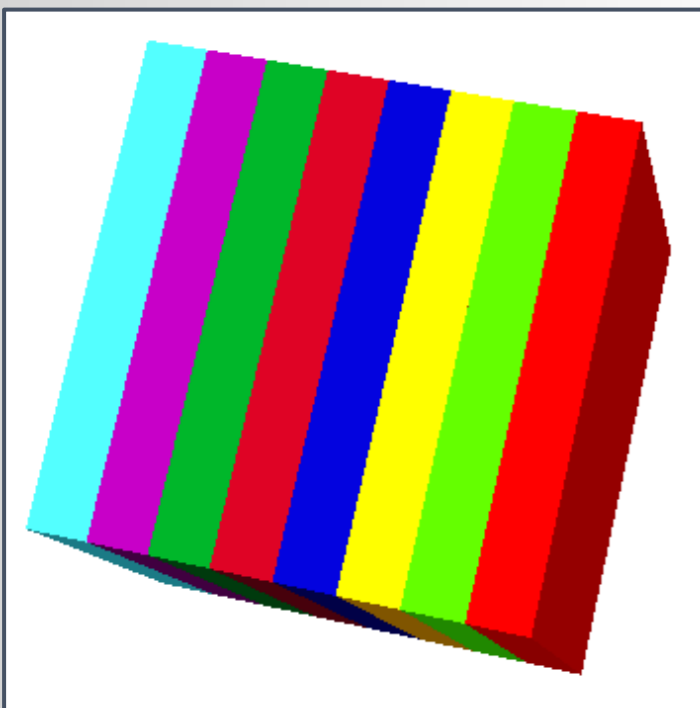
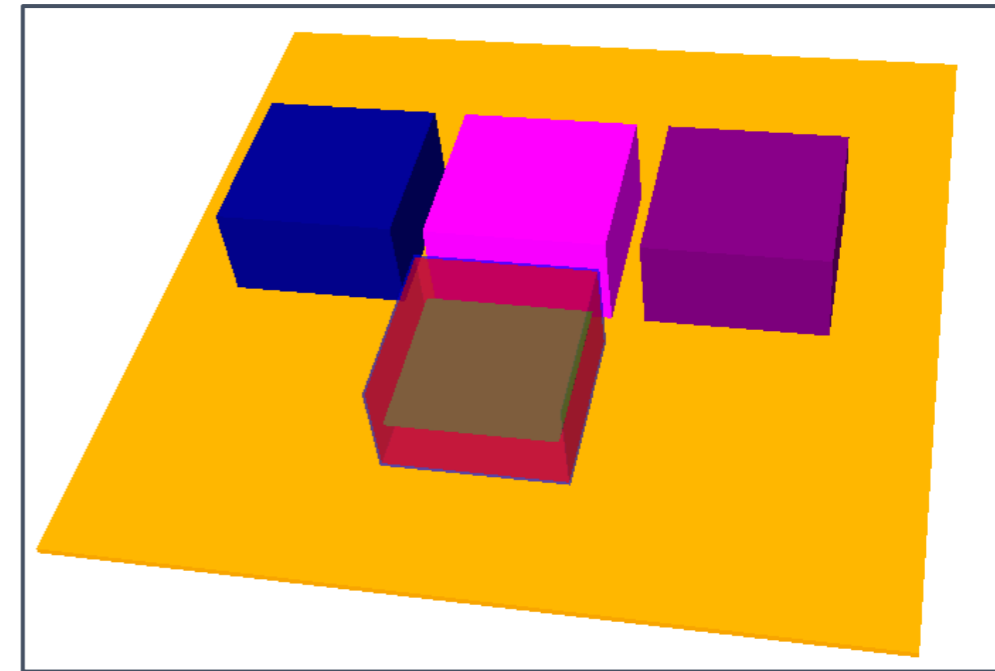


- Standard/shared components:
- > improve efficiency/speed of developments
 - > **enhance quality of software**
 - > Keridwen improvements benefits all tools

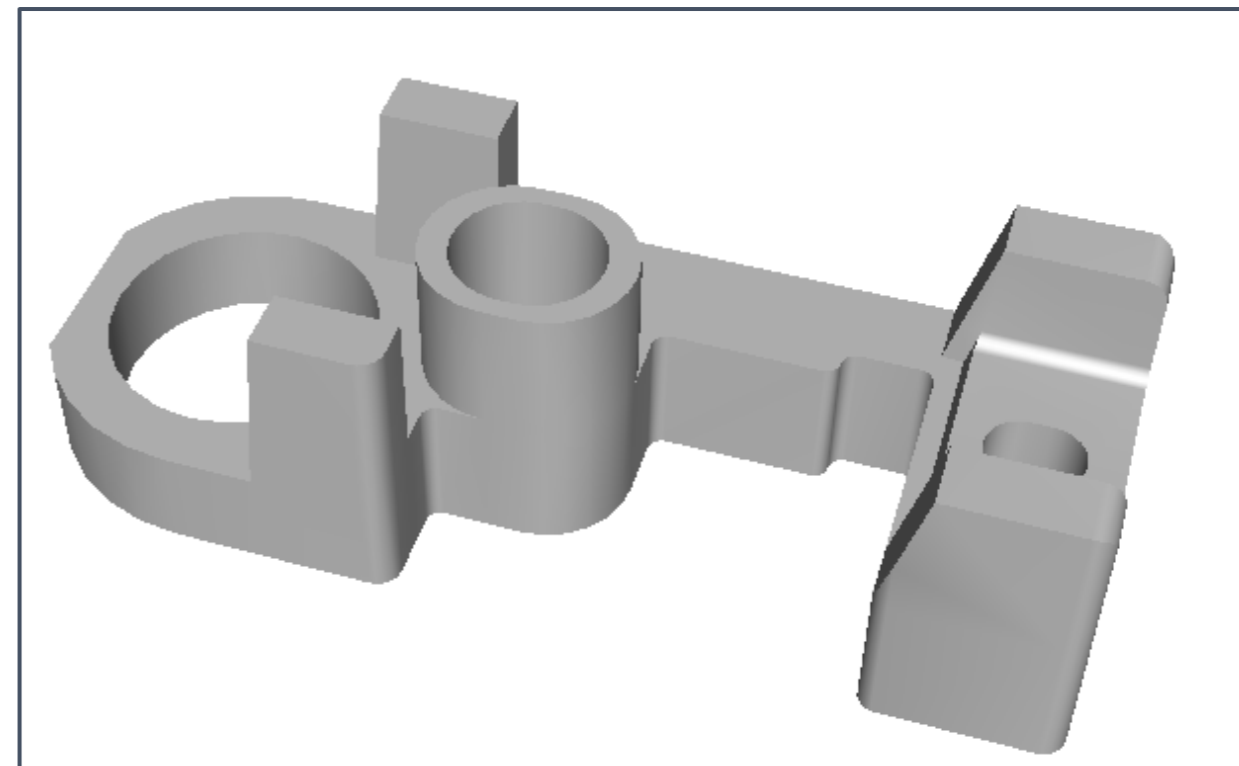
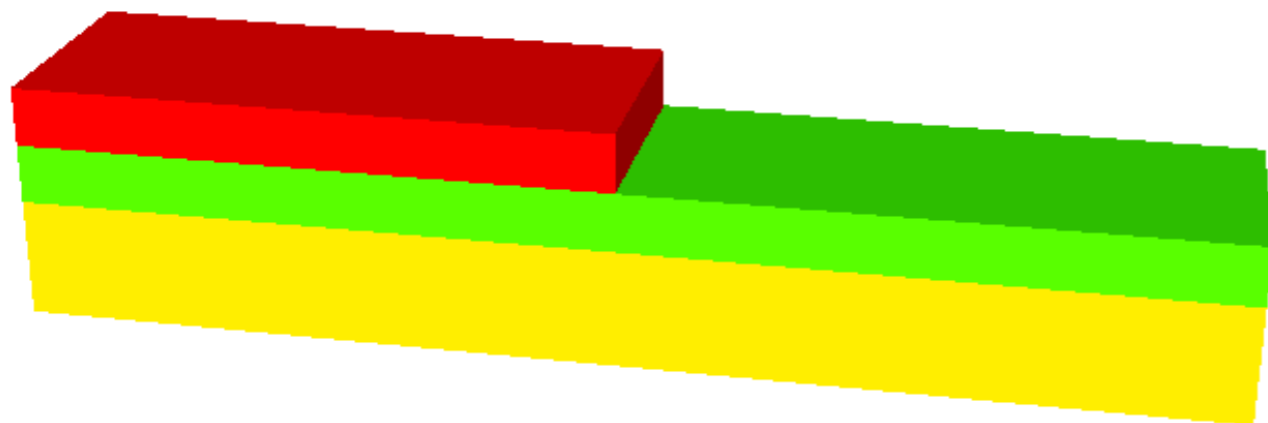
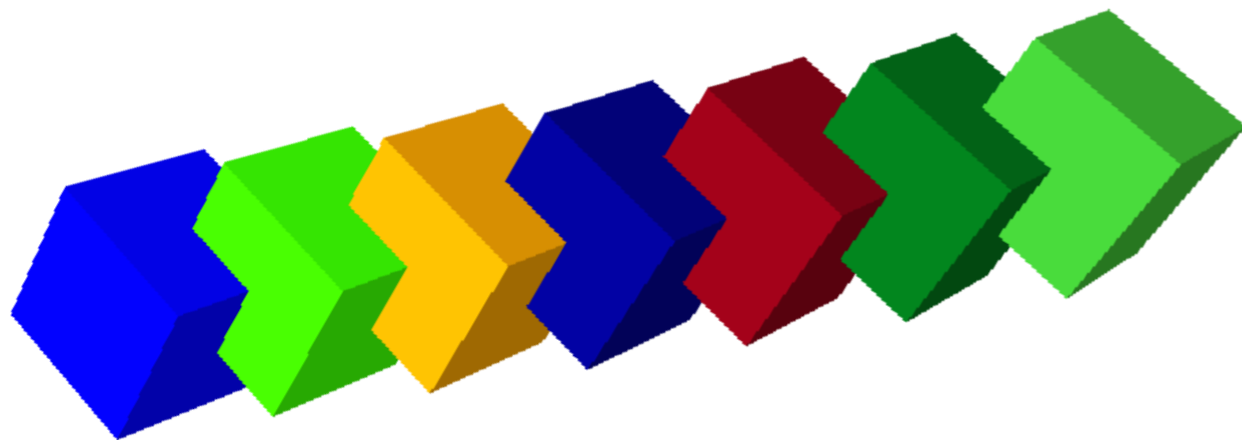
More info at

<http://www.keridwen.org>

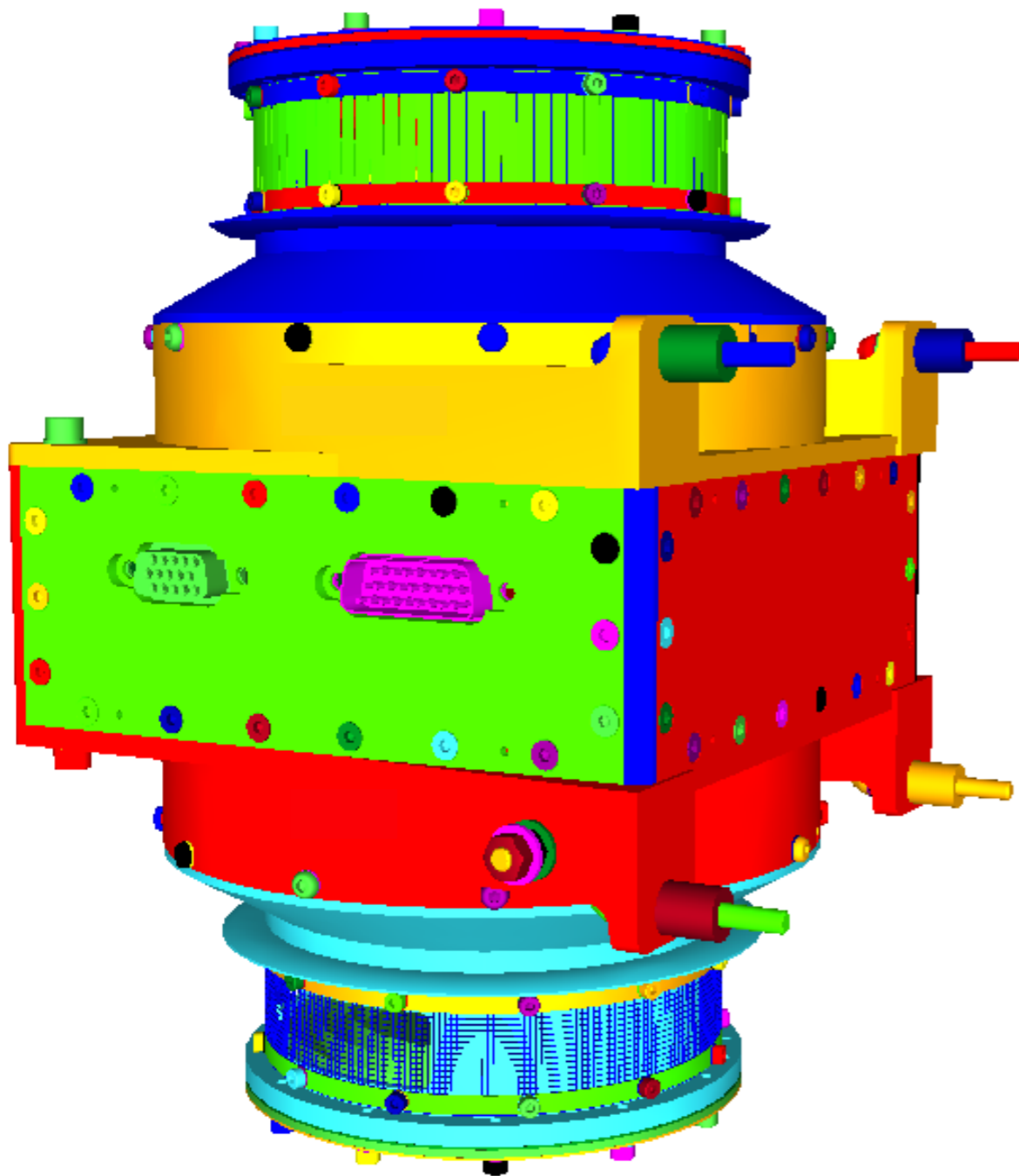
- Loaded all **GRAS 03-04 example files**:
 - **33 files OK**
 - **1 file loaded with warnings**:
 - <loop> tag not handled currently yet
 - **1 file incorrectly loaded**:
 - EDGE does not correctly interpret a variable with degree unit used in a solid with radian angle unit and the resulting interpretation is incorrect



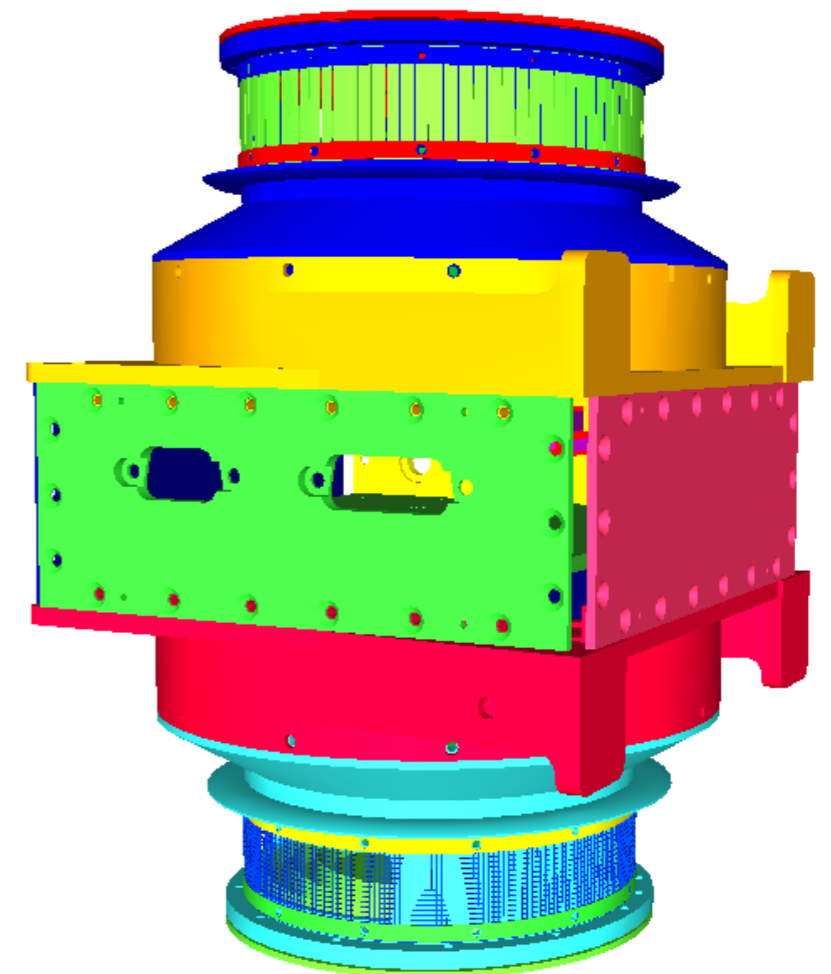
- Loaded additional **example files from others Gras versions:**
 - **35 files OK**
 - **2 files loaded with warnings:**
 - some solids are not interpreted by Edge yet



- Advanced CAD processing



- Rich STEP-AP importer
- Geometry simplification/cleaning capabilities
- Editing

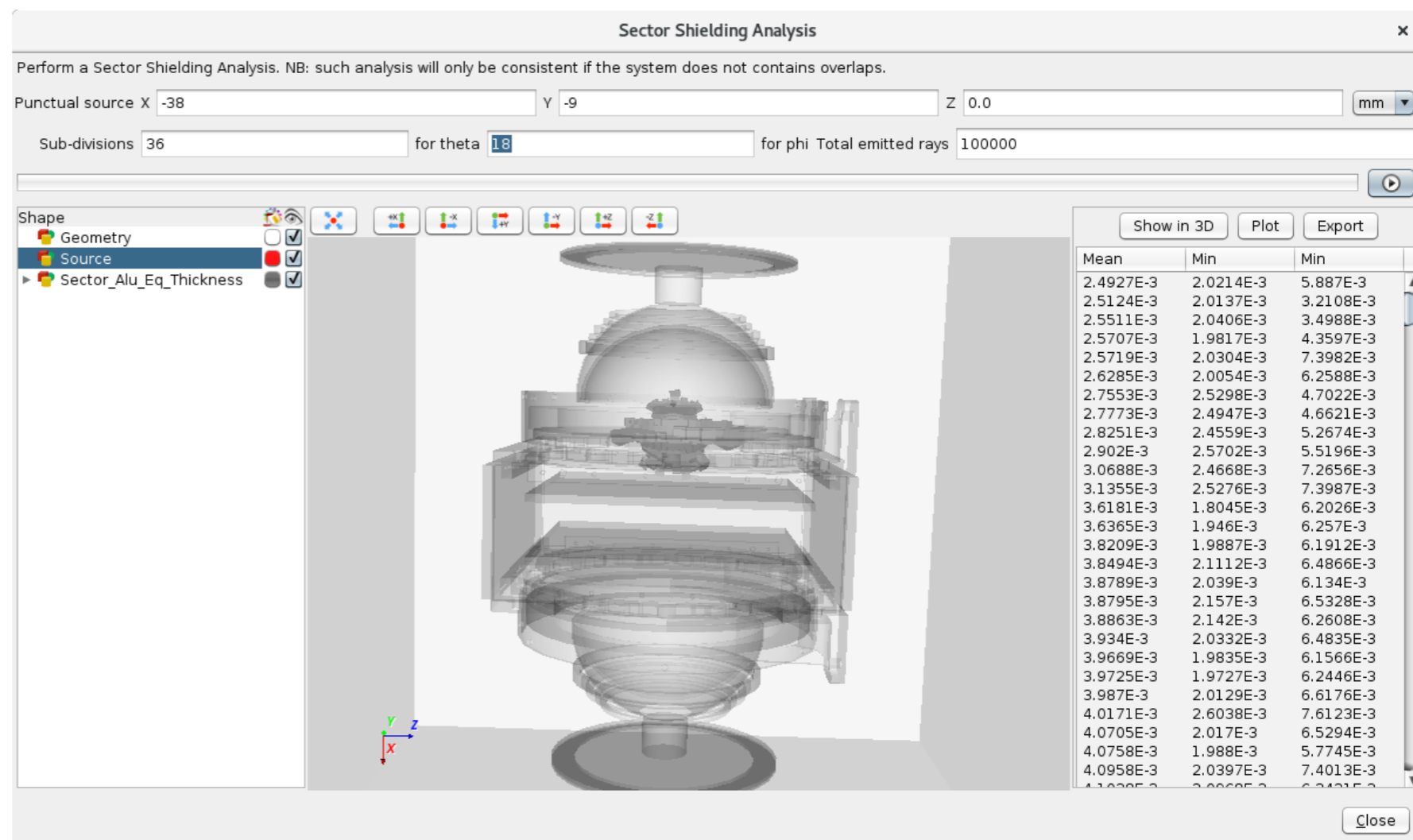


Ambre experiment, with courtesy of CNES

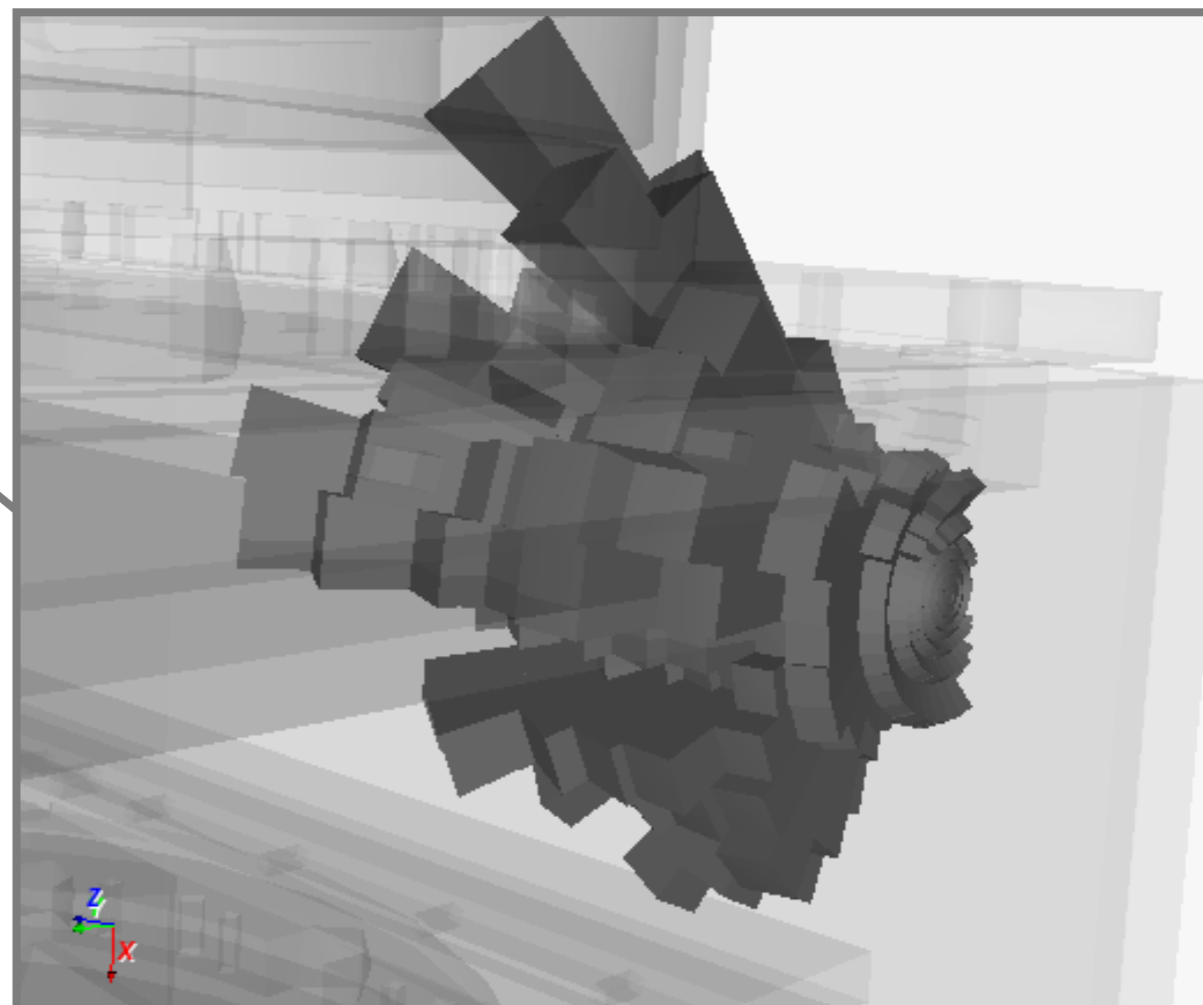
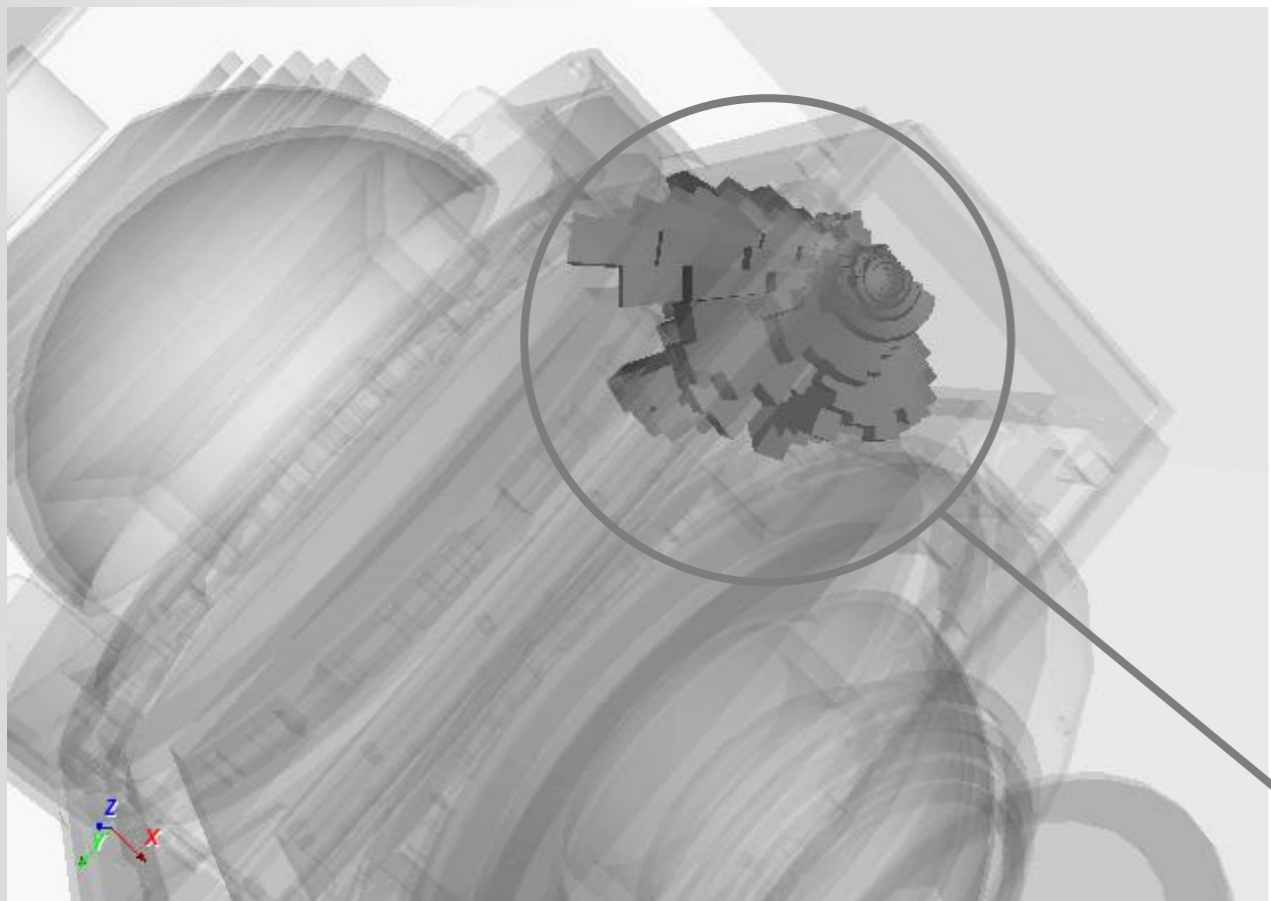
- Radiations pre-analysis EDGE plugin: SSAM
- Pre-condition tool for Geant4 analysis:
 - Quick calculation
 - Sphere equation model
 - Thickness of each materials from a point

- Aluminium equivalent thickness computation
 - Depending on material densities on all directions

- Deposited dose computation

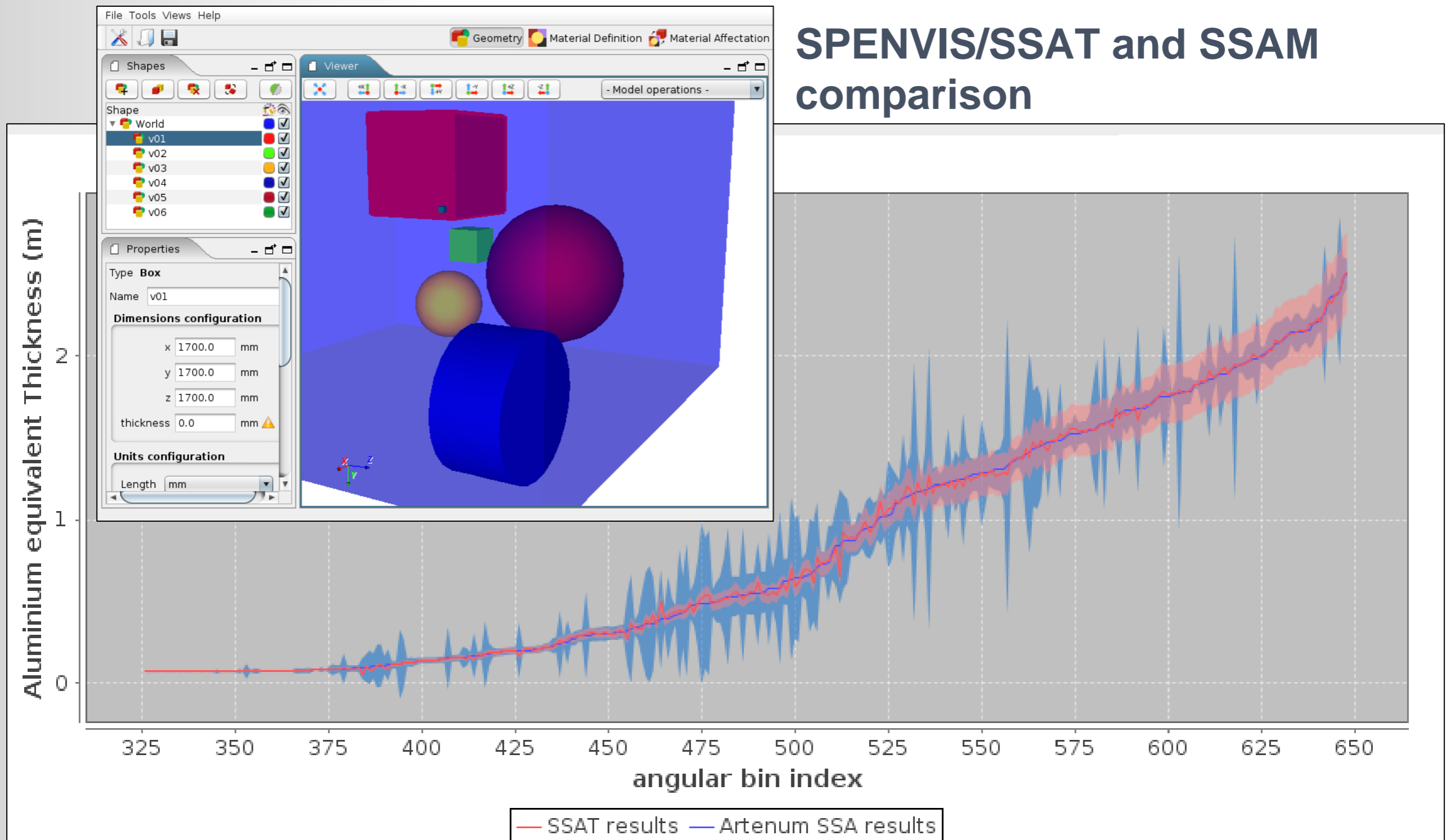


- Radiations pre-analysis EDGE plugin: SSAM



- Radiations pre-analysis EDGE plugin: SSAM

SPENVIS/SSAT and SSAM comparison



Questions?

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More information on <http://www.space-suite.com/edge/>