

SPENVIS JAVA Geometry Definition Tool

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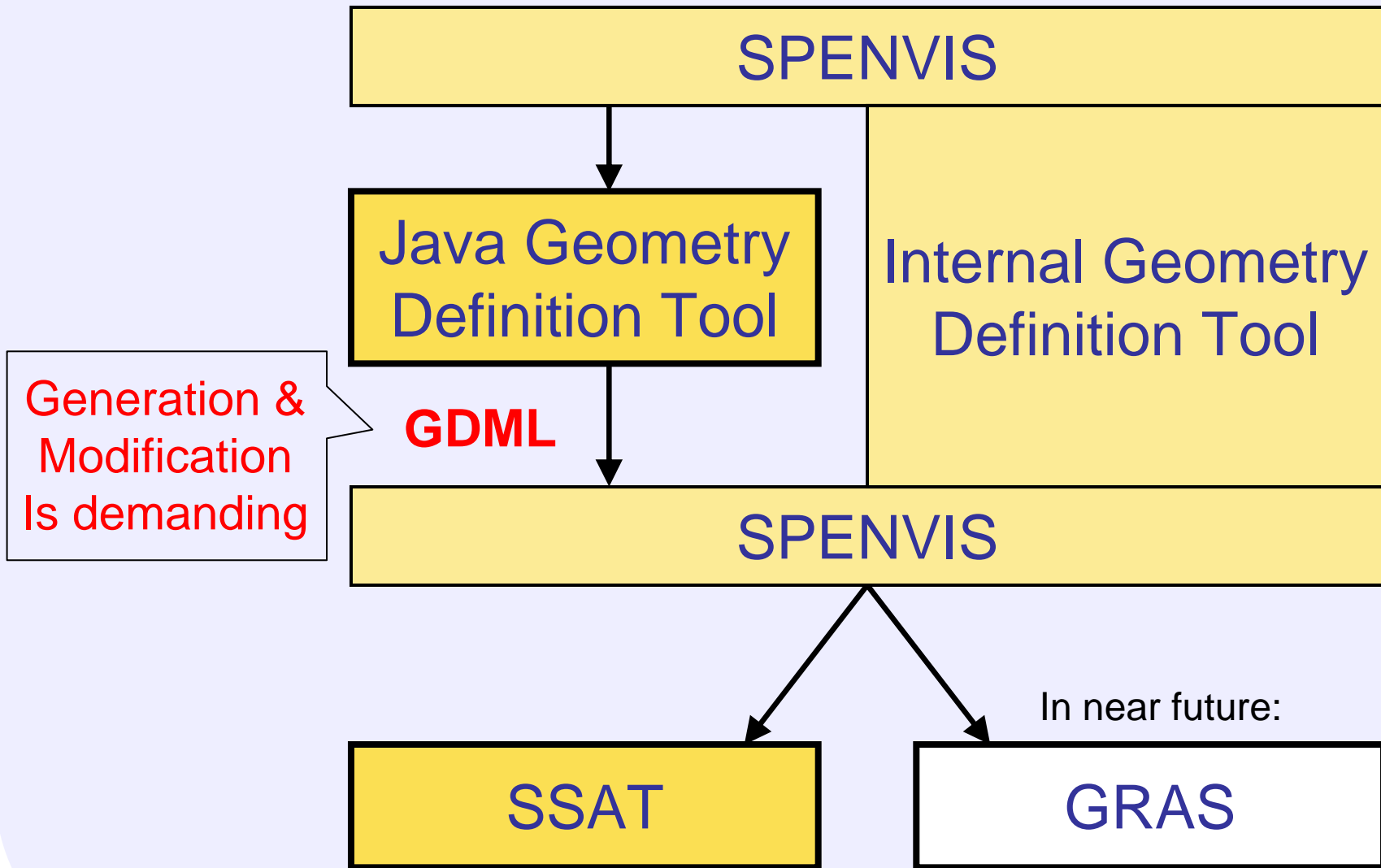


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- **Motivation**
- **Program functionality**
- **GDML export and validation**
- **SSAT analysis example**
- **GMSH format**



Motivation



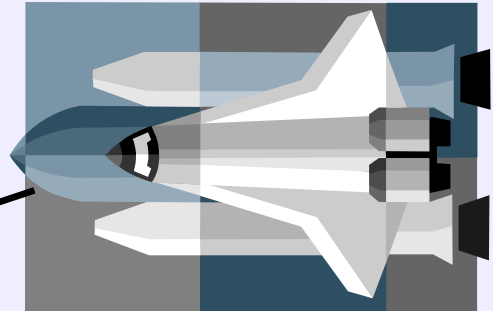
Generation & Modification Is demanding

In near future:

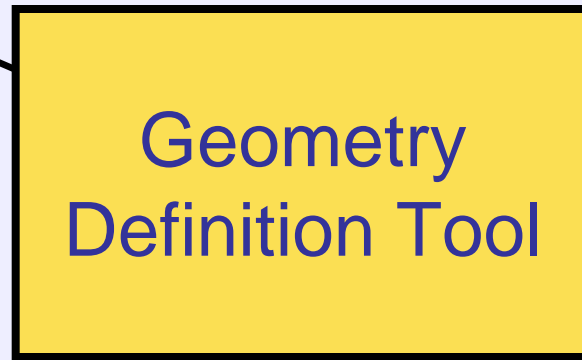
Motivation



Easy to use

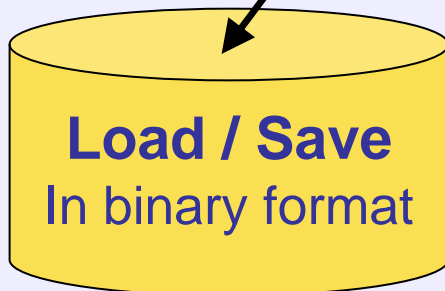


Real-time Visualisation
of the models

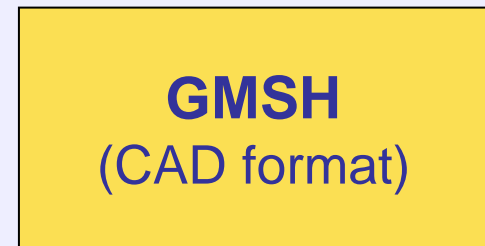


Geometry
Definition Tool

In-/Export



Export



Availability



From SPENVIS-Help

Following the link will download and start the program

Geometry Generation Tool: Description

The **Geometry Generation Tool** is a software for geometry creation and GDML export. It has been developed by the SPENVIS group of the [Belgian Institute for Space Aeronomie](#).

The program allows the user to interactively build geometries using a number of basic primitives. Simply by adding these objects to a tree, the 3D geometry is created and displayed. Created objects can be inspected immediately for corrections or modifications. The perspective can easily be rotated, panned and zoomed by the user.

Loading and saving of geometries created with the Geometry Generation Tool is provided as well as the export to GDML. The Java-based program uses the [X3D](#) library for 3D visualisation.

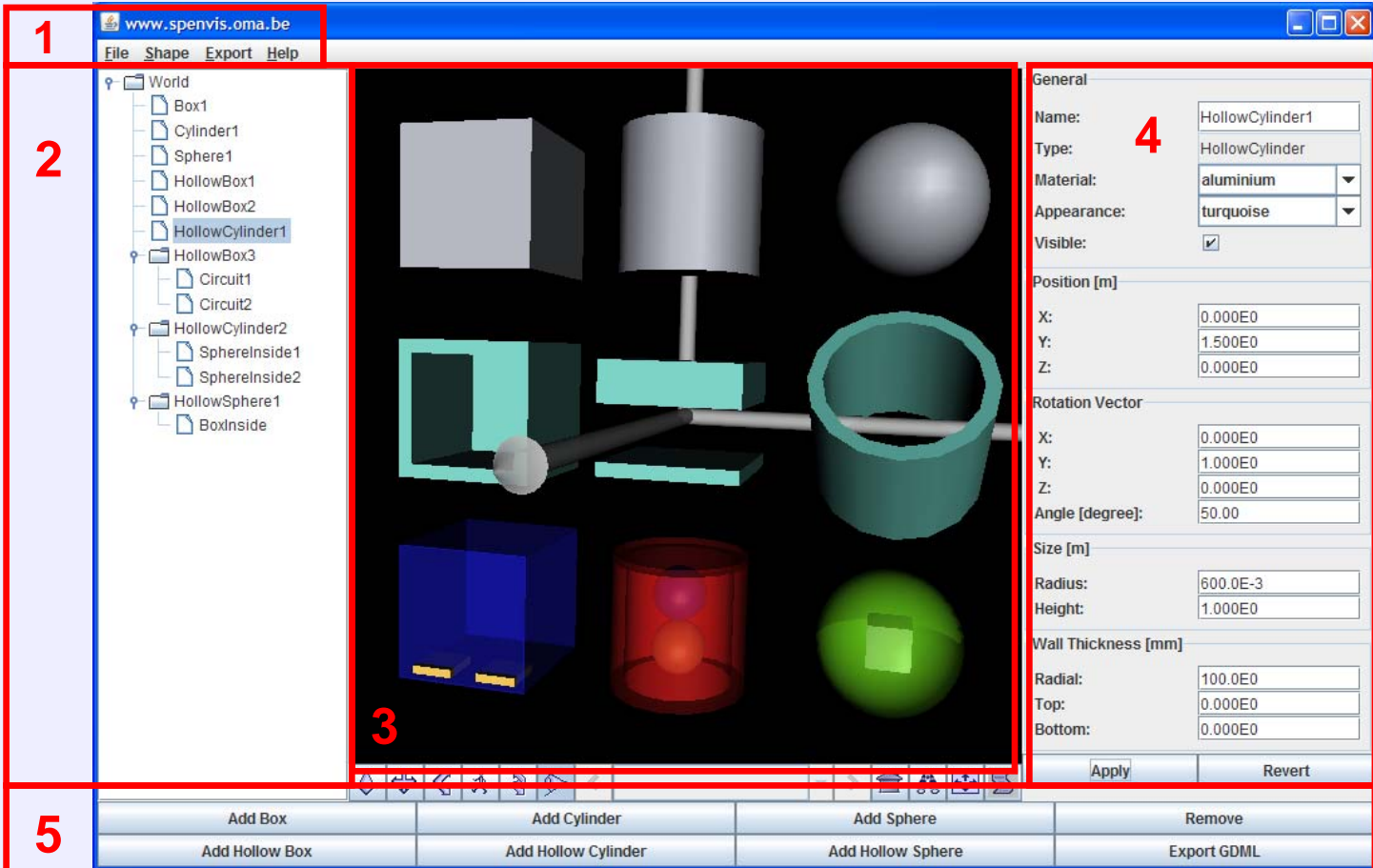
Interface description

Figure 1: Screenshot of the GUI with frames highlighting the program properties

<http://www.spennis.oma.be/download/jgdtool/beta/WP430.jnlp>

Requires: Java Web-Start 6.0+ & Internet Connection

Program Functionality



- 1: Menu bar
- 2: Tree panel
- 3: Visualisation panel
- 4: Property panel
- 5: Action buttons

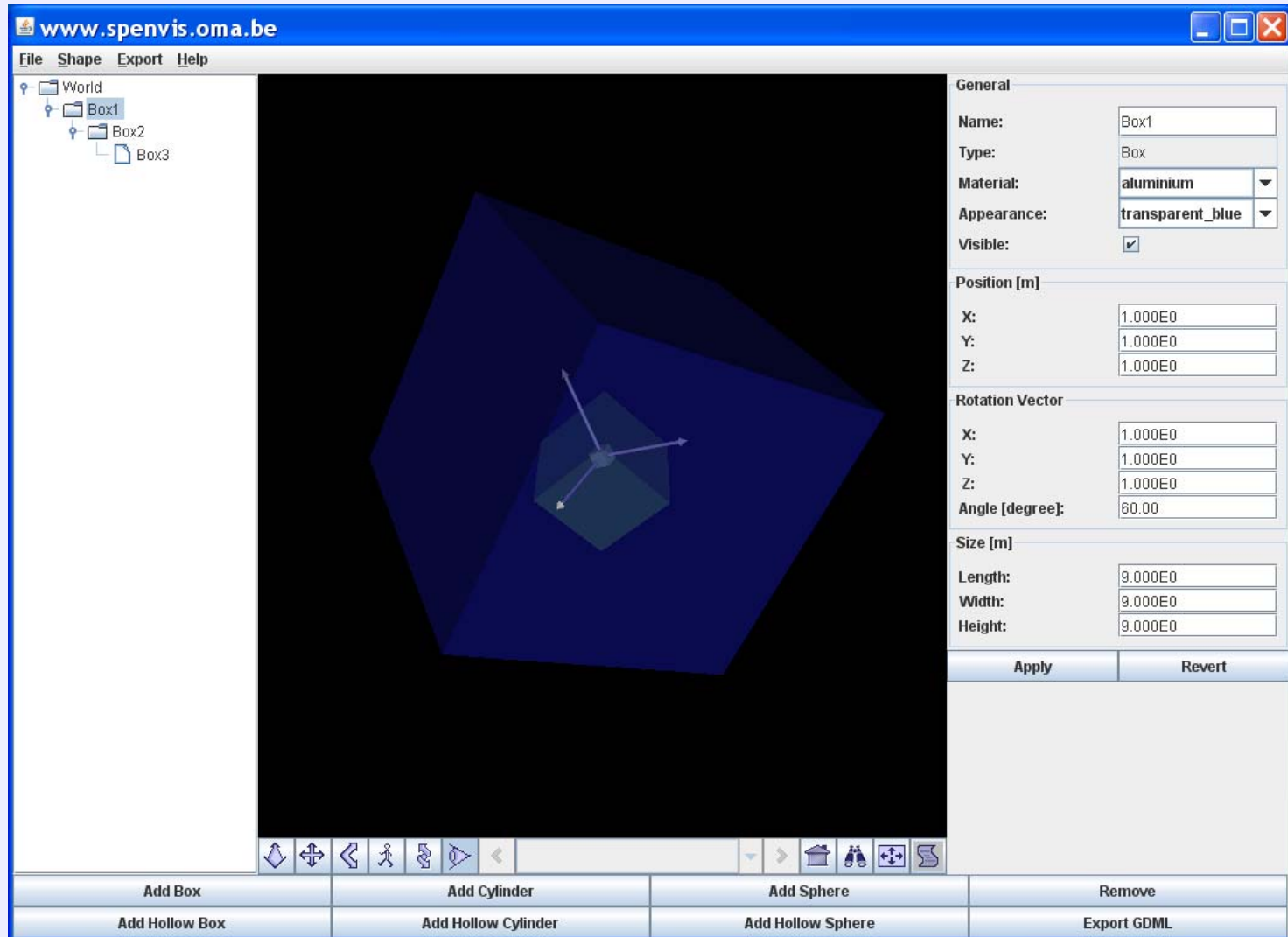
GDML Generation & Validation

- GDML (Geometry Description Markup Language) is XML based meta-language used to run GEANT4 analyses
- Shape-based geometry definition, not node-based

```
<?xml version="1.0" encoding="UTF-8"?>
<gdml xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="http://service-spi.web.cern.ch/
      service-spi/app/releases/GDML/schema/gdml.xsd">
<define>
  <constant name="PI" value="3.141592653589793" />
  <position name="_pos_Box1" x="1.0" y="1.0" z="1.0" unit="m" />
  <rotation name="_rot_Box1" x="0.1476*PI" y="0.2323*PI" z="0.1476*PI" />
</define>
...
```

- DAWN & DAVID (GEANT4 tools) check for logical errors
- Test case: three_boxes: 3 rotations & 3 translations along (1,1,1)

GDML: Three-Boxes Test Case

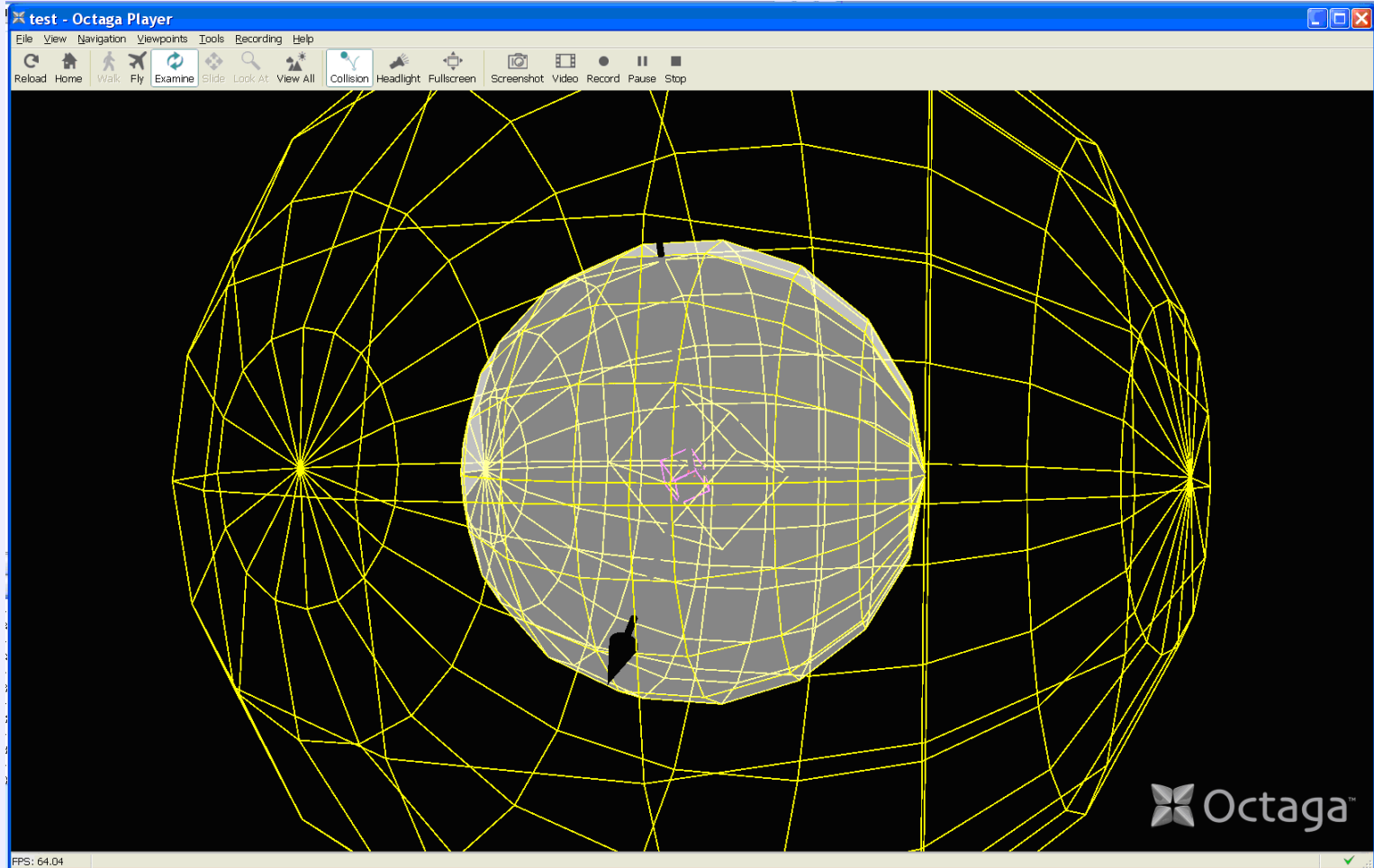


The screenshot displays the web interface for www.spenvis.oma.be. The interface includes a menu bar (File, Shape, Export, Help), a tree view on the left showing a hierarchy of 'World' containing 'Box1', 'Box2', and 'Box3'. The central 3D view shows three nested, semi-transparent blue boxes. The right-hand side features a control panel for the selected object, 'Box1'. The control panel includes the following settings:

- General:** Name: Box1, Type: Box, Material: aluminium, Appearance: transparent_blue, Visible:
- Position [m]:** X: 1.000E0, Y: 1.000E0, Z: 1.000E0
- Rotation Vector:** X: 1.000E0, Y: 1.000E0, Z: 1.000E0, Angle [degree]: 60.00
- Size [m]:** Length: 9.000E0, Width: 9.000E0, Height: 9.000E0

Buttons for 'Apply' and 'Revert' are located below the control panel. At the bottom of the interface is a toolbar with icons for various actions, and a row of buttons: 'Add Box', 'Add Cylinder', 'Add Sphere', 'Remove', 'Add Hollow Box', 'Add Hollow Cylinder', 'Add Hollow Sphere', and 'Export GDML'.

Spennis GDML Creation

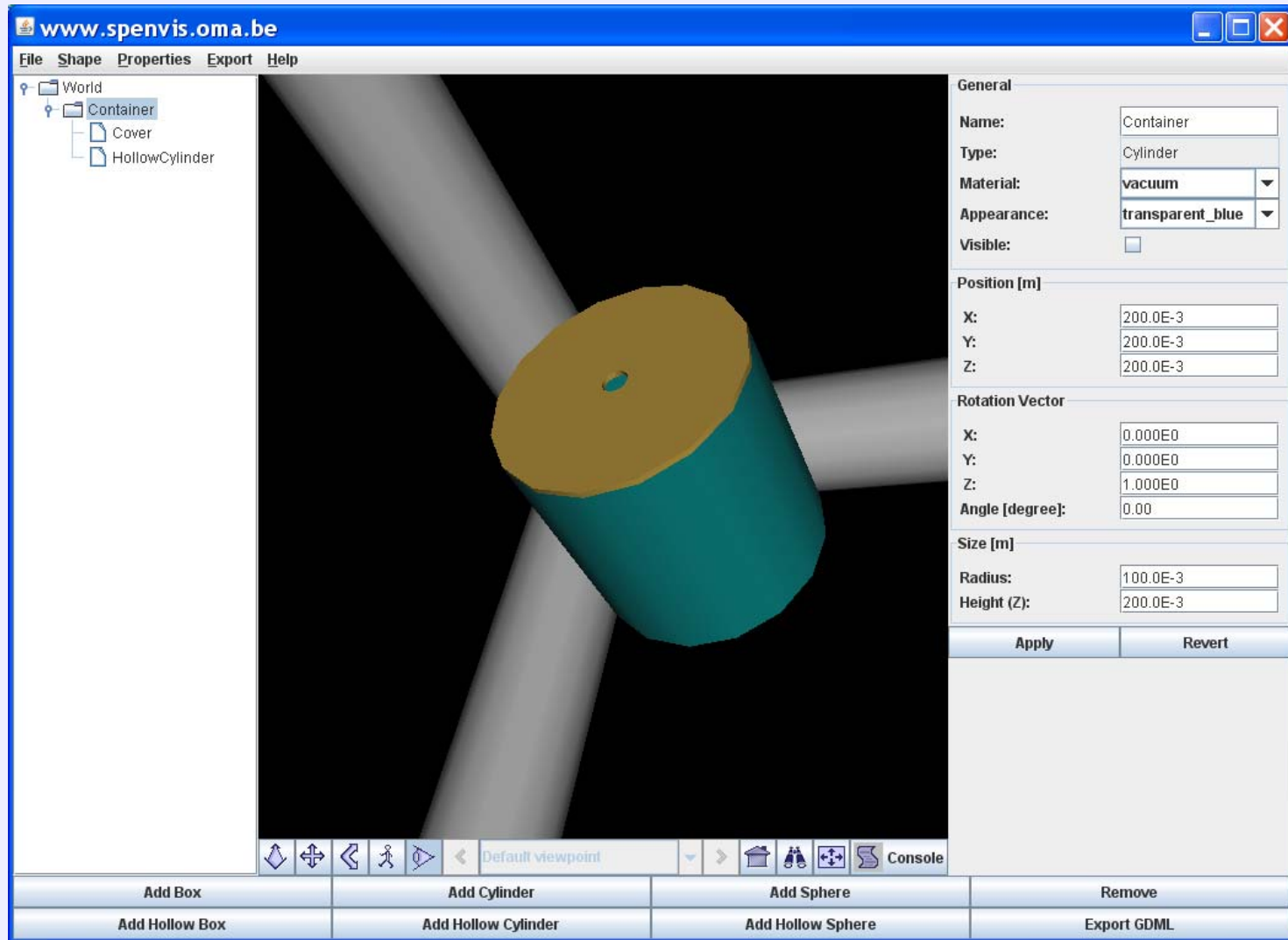


- Using "current" Spennis the three_boxes test case generates **wrong GDML**

SSAT Example

- **SSAT = Sector Shielding Analysis Tool (GEANT4)**
- **Performs ray-tracing from internal point**
- **Example geometry is a Hollow-Cylinder**
- **Aim: calculate the shielding**

SSAT Example: GDML Creation



Hole on top, cover and main body from different materials

SSAT Example: GDML Import



Geant4 tools: Sector Shielding Analysis Tool (SSAT) parameters - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.spenvis.oma.be/htbin/spenvis.exe/REGRESSION?%23resetToPrevious(ssat_par.html)

DB BAHN - Verbindungen - Fehler Geant4 tools: Sector Shieldi... Help: Project management Google SPENVIS - Space Environment, ... http://dev.spen...is.exe/DEV_TEST

SPENVIS Project: REGRESSION
Geant4 tools
Sector Shielding Analysis Tool (SSAT): Parameters

UP Output Help

The Sector Shielding Analysis Tool (SSAT) performs ray tracing from a user defined point within the geometry to determine shielding levels and shielding distributions.

Note: [geometry definition tool](#) has not run

Geometry: new GDML file upload

Geometry file: X:\MyFiles\PSS_documents\docstest_case.gdml [Browse...]

Shielding distribution scheme

Scheme: linear

Thickness: 0

Number of bins: 100

Dose calculation: none

Reset Ray tracing > Create macro >>

Tool developed by

QinetiQ DCH

© ESA

Done

SSAT Example



Geant4 tools: Sector Shielding Analysis Tool (SSAT) ray tracing - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.spenvis.oma.be/htbin/spenvis.exe/TEST2

DB BAHN - Verbindungen - Fehler Geant4 tools: Sector Shieldi... Help: Project management Google SPENVIS - Space Environment, ... http://dev.spen...is.exe/DEV_TEST

SPENVIS Project: TEST2

Geant4 tools

Sector Shielding Analysis Tool (SSAT): Ray tracing parameters

Output Help

Angular window

Units: degrees

Minimum theta: 0

Maximum theta: 180

Minimum phi: 0

Maximum phi: 360

Number of polar (theta) bins: 18

Binning interval in polar mode: linear

Number of azimuthal (phi) bins: 36

Set reference directions

Ray tracing

Angular sampling distribution: isotropic

Number of rays per angular bin: 100

Path length calculation method: slant

Geantino source position (in m)

X: 0.2

Y: 0.2

Z: 0.2

Geometry visualization

Visualization plus calculation

Include rays in visualization

Reset < Parameters Create macro >

Tool developed by

QinetiQ DCH

Done

SSAT Example



The screenshot shows a Mozilla Firefox browser window with the title "Geant4 tools: Sector Shielding Analysis Tool (SSAT) macro file - Mozilla Firefox". The address bar shows the URL "http://www.spennis.oma.be/htbin/spennis.exe/TEST2". The browser tabs include "DB BAHN - Verbindungen - Fehler", "Geant4 tools: Sector Shieldi...", "Help: Project management", "SPENVIS - Space Environment, ...", and "http://dev.spenn...js.exe/DEV_TEST".

The main content area features a dark blue header with the text "SPENVIS Project: TEST2", "Geant4 tools", and "Sector Shielding Analysis Tool (SSAT): Macro file". There are "Output" and "Help" buttons on the right and an "UP" button on the left.

Below the header, a text box contains the following information:
The following file contains the macro commands used as input for the Shielded Simulation Analysis Tool:
[Macro file for the sector shielding analysis tool](#)
This macro file can be downloaded to run on your own hardware (MS-Windows or PC Linux). A [local copy of the SSAT software](#) can be downloaded from QinetiQ.
To run SSAT on the SPENVIS server, click the **run** button below.

Navigation buttons include "<< Parameters", "< Ray tracing", and "Run >".

Below the navigation buttons, it says "Tool developed by" followed by the logos for "QinetiQ" and "DCH".

At the bottom of the page, there is a dark blue bar with "© ESA" on the left and a set of navigation icons on the right.

The status bar at the very bottom of the browser window shows "Done".

SSAT Example



The screenshot shows the web interface of the Sector Shielding Analysis Tool (SSAT) for the SPENVIS Project: TEST2. The browser window title is "Geant4 tools: Sector Shielding Analysis Tool (SSAT) results - Mozilla Firefox". The address bar shows the URL "http://www.spervis.oma.be/htbin/spervis.exe/TEST2".

The main content area has a dark blue header with the text "SPENVIS Project: TEST2", "Geant4 tools", and "Sector Shielding Analysis Tool (SSAT): Results". There are "Output" and "Help" buttons on the right and an "UP" button on the left.

Below the header, there are two columns: "Tables" and "Plots".

Tables	Plots
GDML file for the sector shielding analysis tool Macro file for the sector shielding analysis tool Log file for the sector shielding analysis tool Output file for the sector shielding analysis tool	VRML representation of the GDML geometry Shielding distribution as a function of shielding thickness (png)

Below the tables, there is a "New plots" section with a form:

Fraction of solid angle (linear scale) as a function of shielding thickness (linear scale)

Plot as: Portable Network Graphics (PNG)

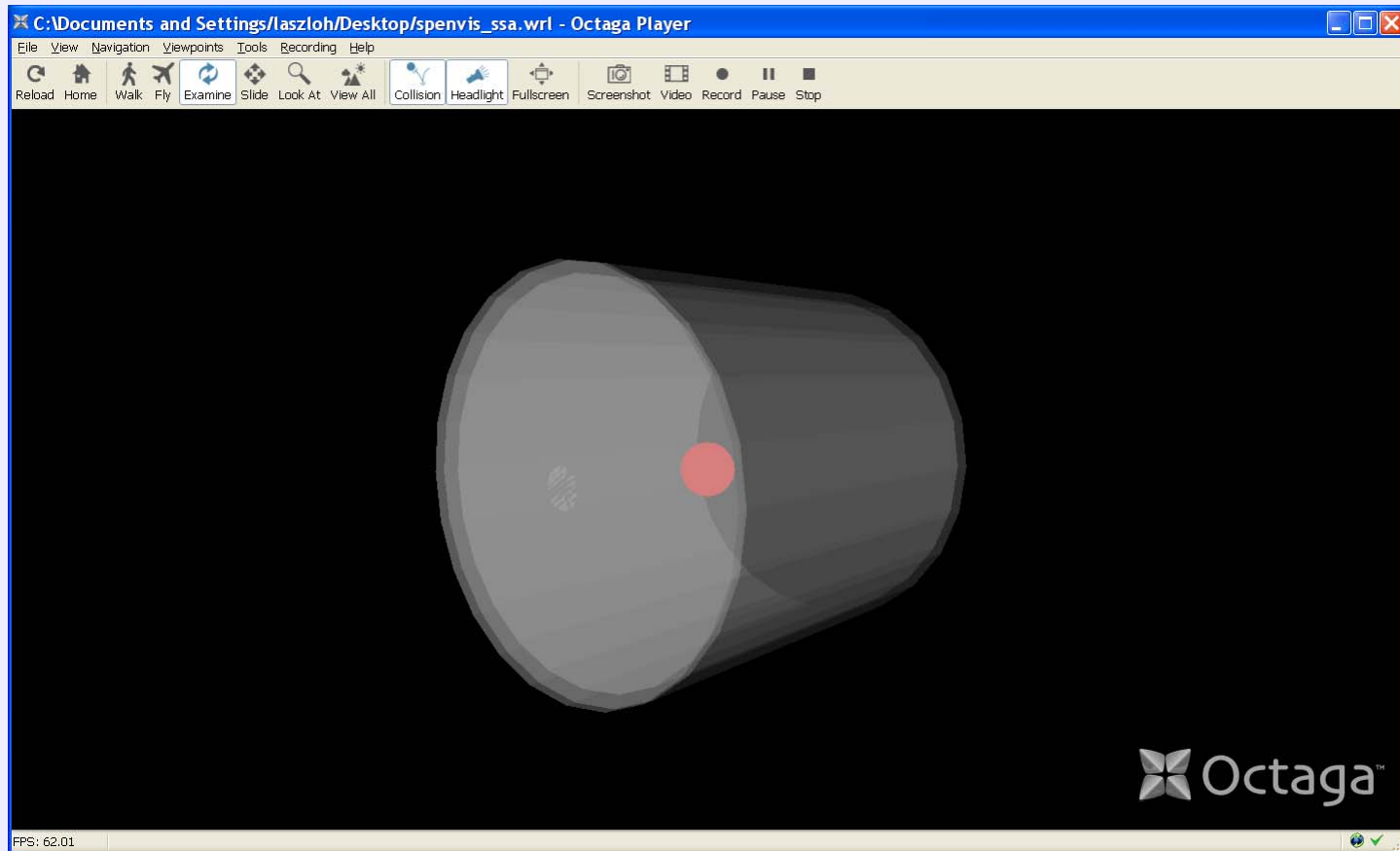
Navigation buttons: << Parameters, < Ray tracing

Tool developed by:

© ESA

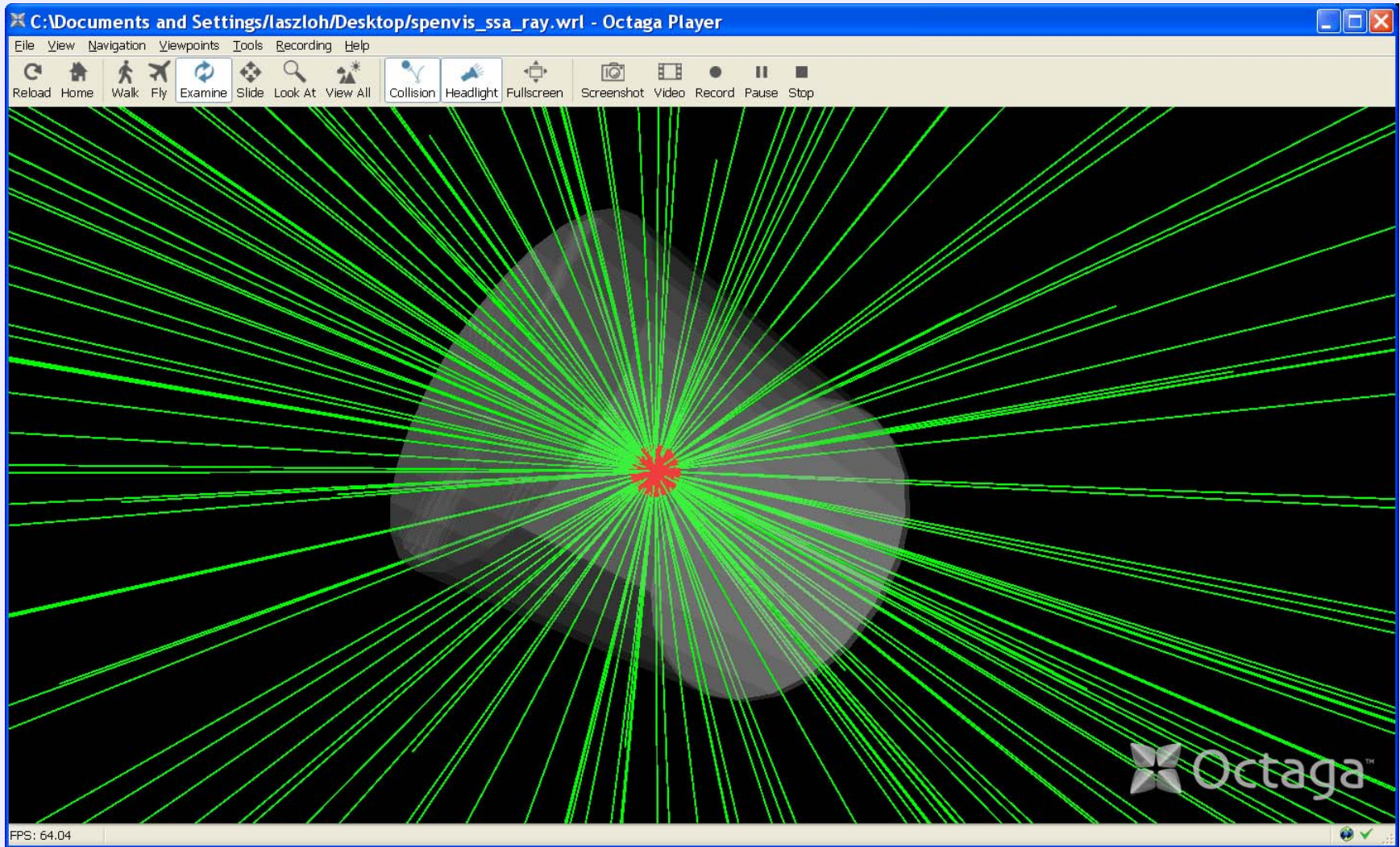
Done

SSAT Example: Analysis Geometry

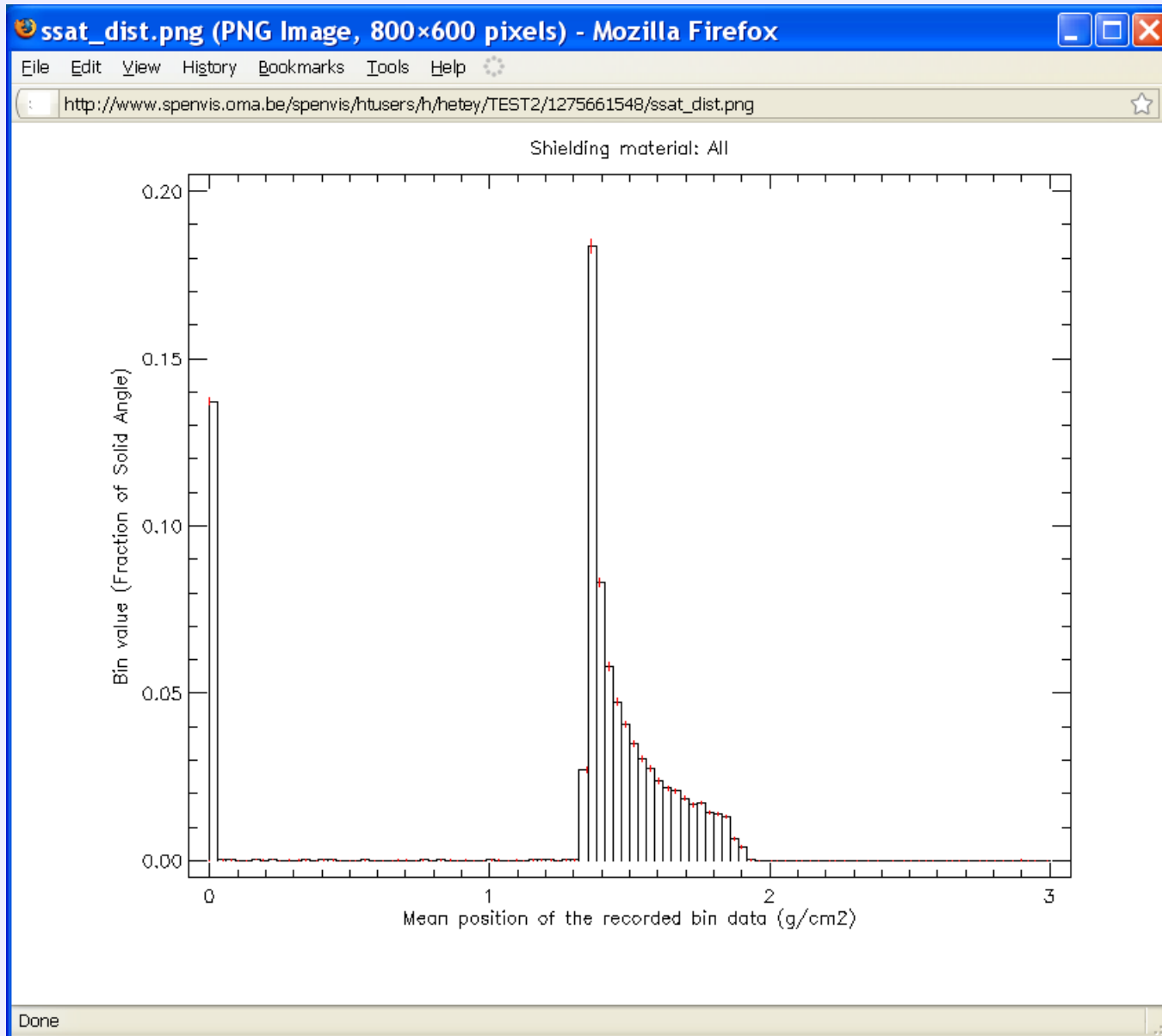


(Octaga-Player: <http://www.octaga.com/>
free for non-commercial use)

SSAT Example: Result Visualisation



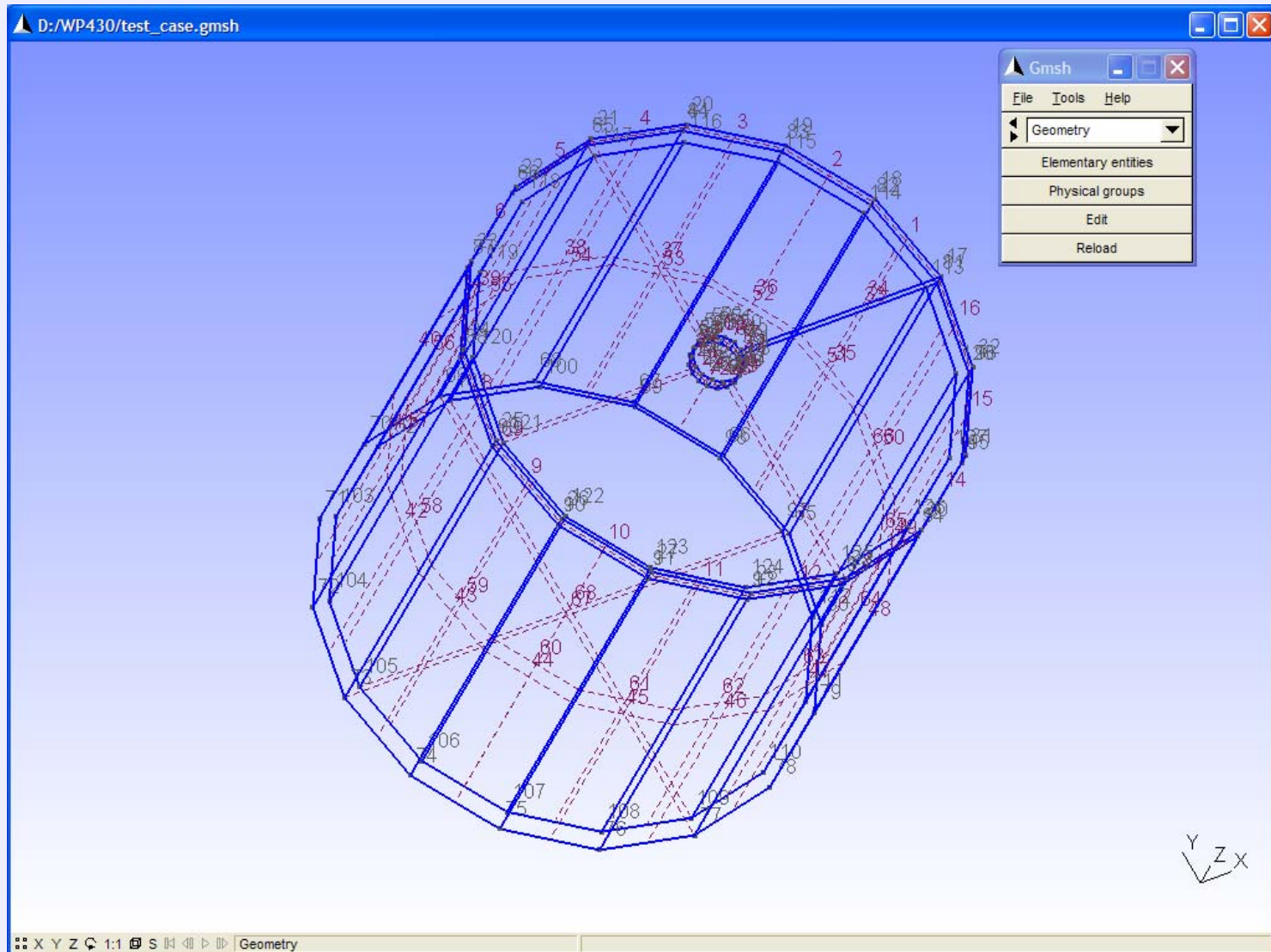
SSAT Example: Shielding Distribution



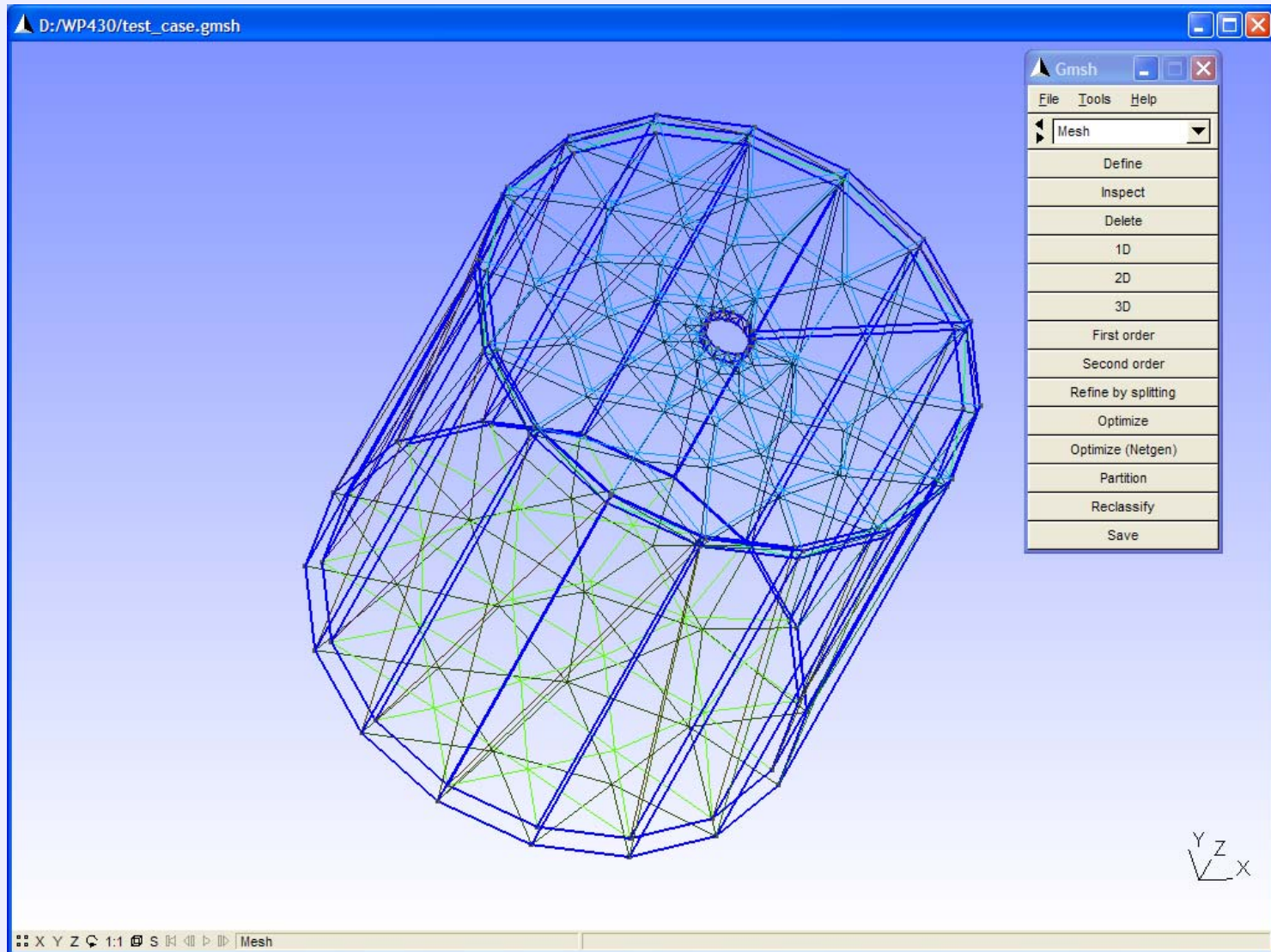
GMSH Format

- Tool exports geometry in CAD-format
- Import to FEM mesh generator GMSH
<http://www.geuz.org/gmsh/> (free software)
- GMSH used by SPIS
- Can be applied for other CAE tools

GMSH: Geometry Import



GMSH: Meshing



Thanks for your attention!

**Any problem report is welcome!!
This software is new...**

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