

SPENVIS

Java Geometry Definition Tool

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Tutorial



Java Geometry Definition Tool

SPENVIS User Workshop
Brussels 2013

Outline

- Introduction
- News since last Workshop in 2010
- Program use
- Application Example (JUDE UV imager)
- Format Exchange (CAD -> GDML -> CAD)

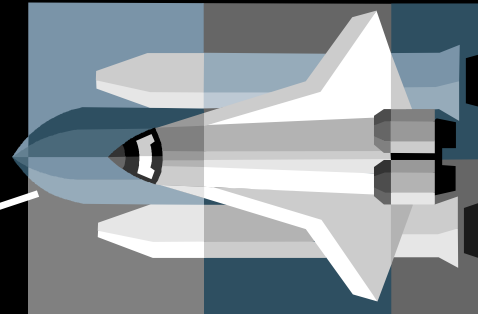
Tutorial

Introduction



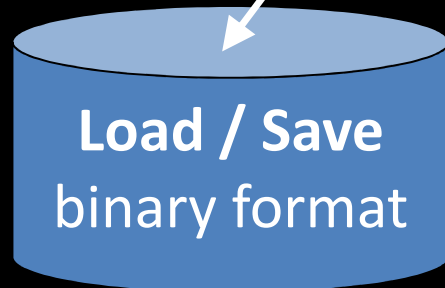
Easy to use
& free

Java Geometry
Definition Tool



Immediate visualisation
of the geometry

In-/Export



Export

GDML
(GEANT4 format)

Tutorial

News since 2010

- SPENVIS Workshop-2010 presentation:
www.spervis.oma.be/download/suw2010/presentations/8419_HETEY.pdf
- Since, no fundamental change
- Several bug corrections, two important:
- 1) Physical volume tags now include a name attribute, prefixed with “pv_”, SPENVIS-bug-207, e.g. <PHYSVOL NAME=“pv_Box1”>
- 2) Rotation direction now in line with SSAT/GRAS, see SPENVIS-bug-196

Program Use: Access

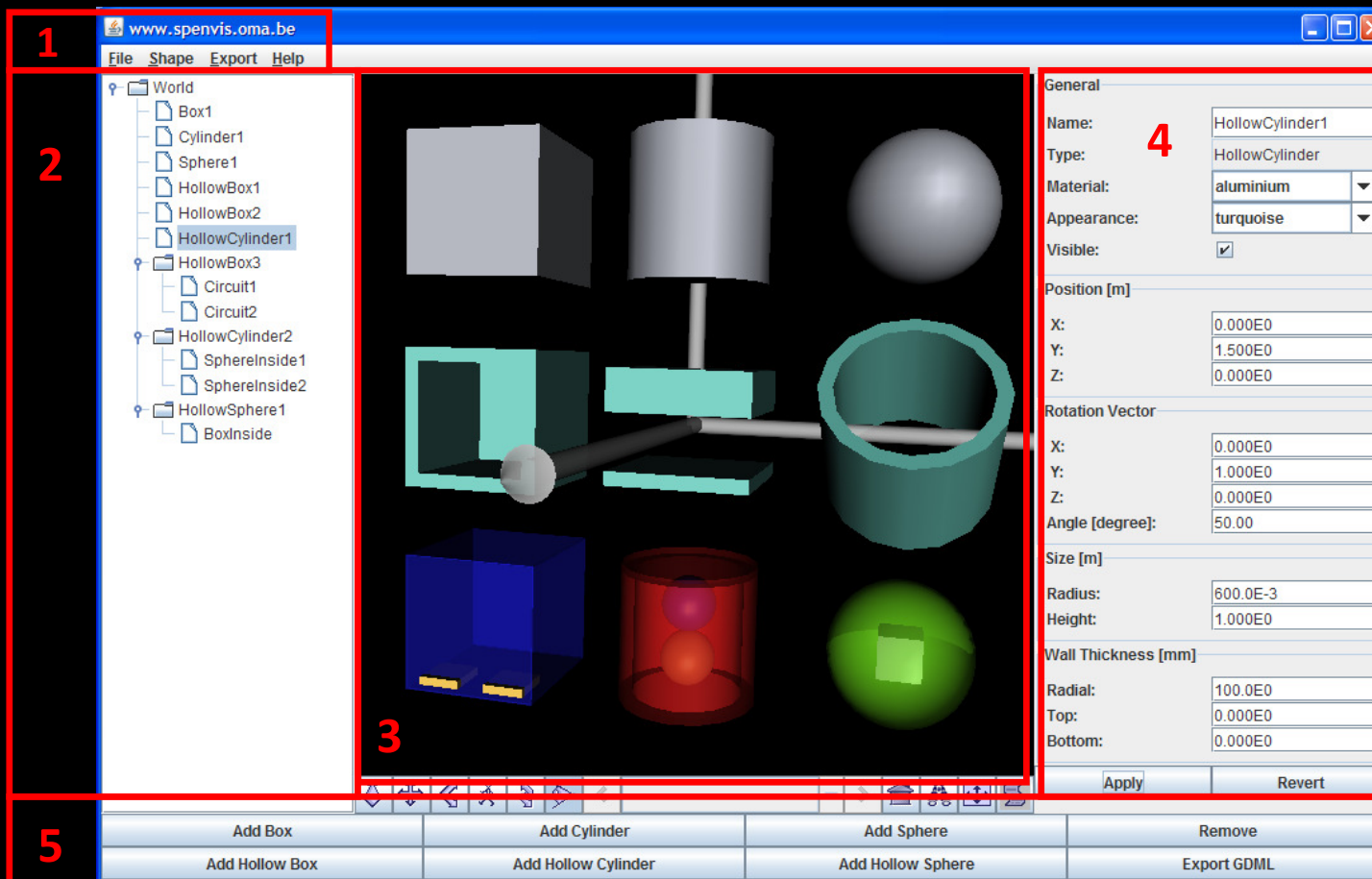
Start section: GEANT4 Tools

The image displays three browser windows illustrating the access to the GEANT4 Tools section of the SPENVIS system.

- The left window shows the "SPENVIS Project: COMBINED RUNS" interface. The "Geant4 Tools" link in the left sidebar is circled in red.
- The middle window shows the "Geant4 tools: Geometry definition: Configuration parameters" page. The text "A JAVA version of this tool is also available." is circled in red.
- The right window shows the "Geometry Generation Tool: Description" page. The text "The Geometry Generation Tool" is circled in red.

Arrows from the circled text in the middle and right windows point to a 3D visualization window in the bottom right, which displays a 3D model of a complex geometry with various components like boxes, cylinders, and spheres.

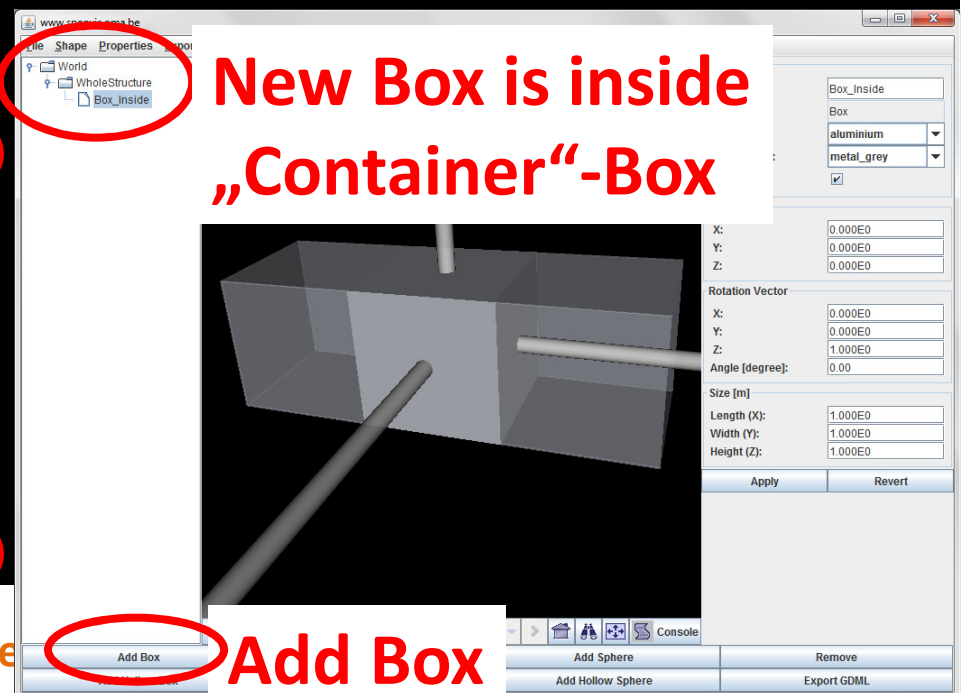
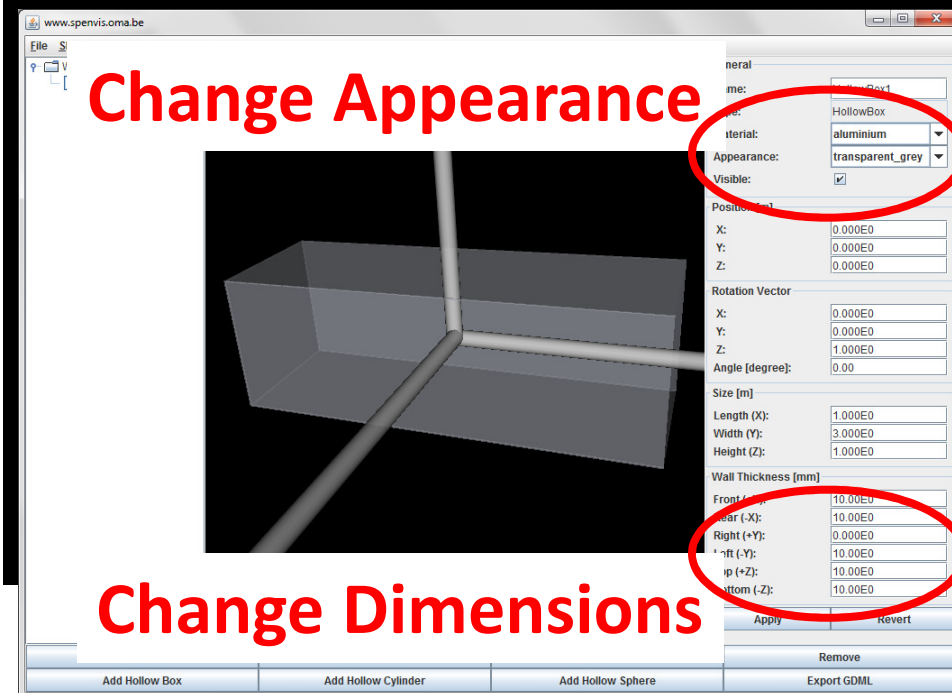
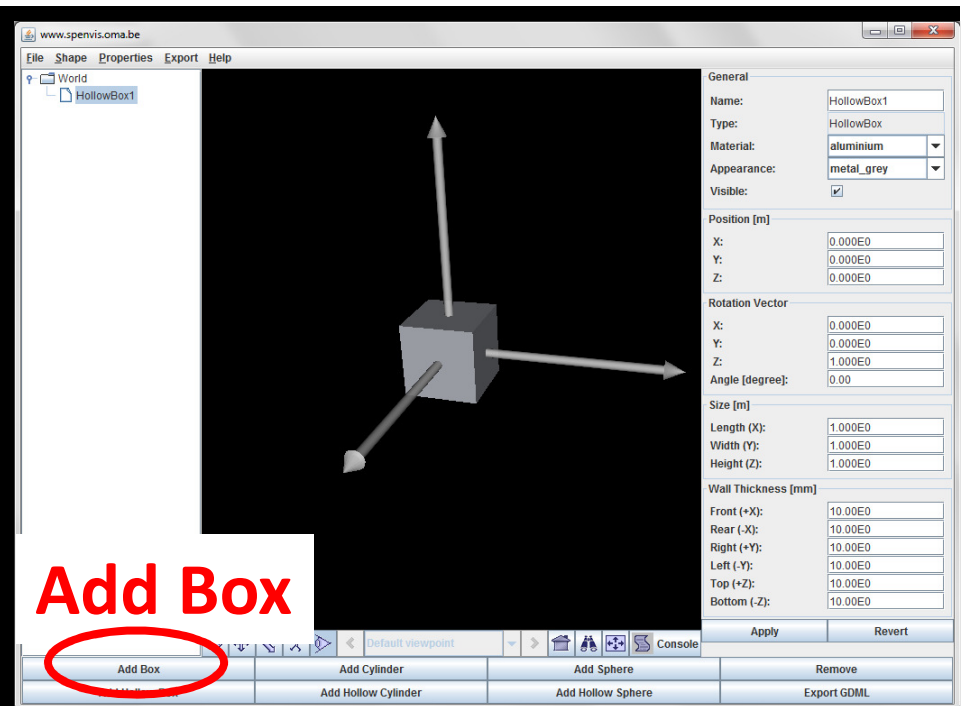
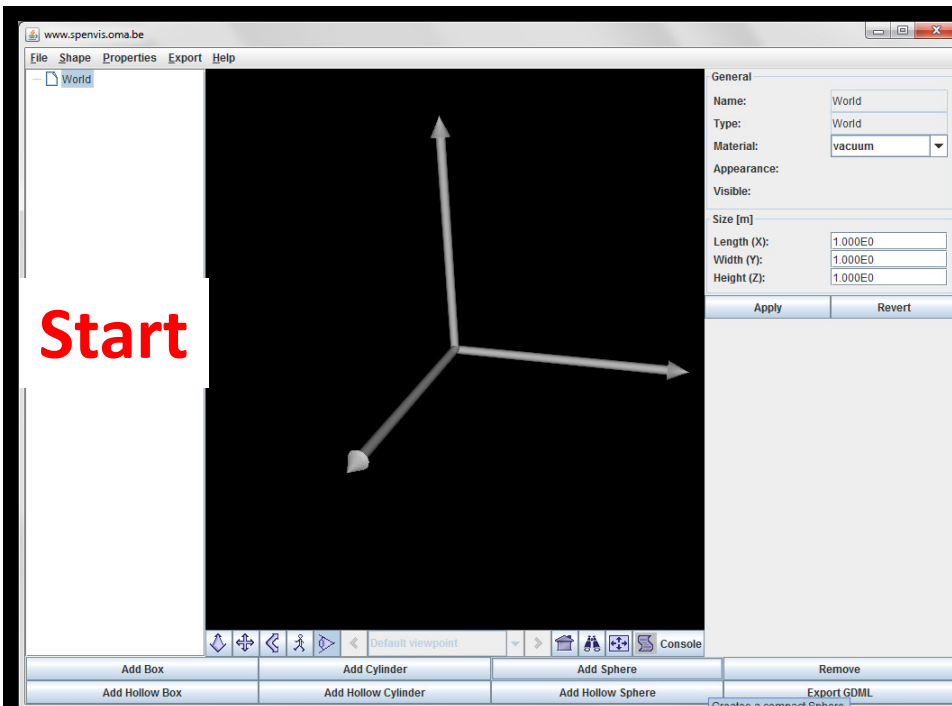
Required: Java Web-Start 6.0+ & Internet Connection



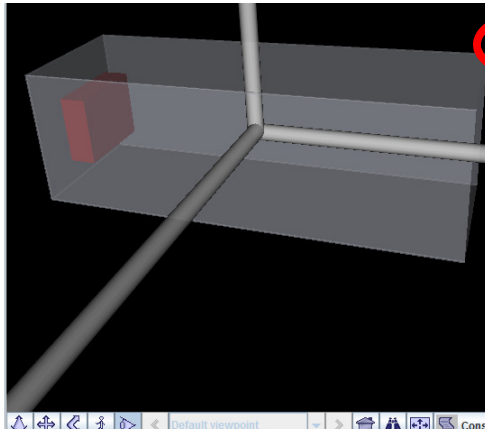
1: Menu bar
2: Tree panel

3: Visualisation panel
4: Property panel

5: Action buttons



Change Appearance, Material, Name



General

Name:

Type:

Material:

Appearance:

Visible:

Position [m]

X:

Y:

Z:

Rotation Vector

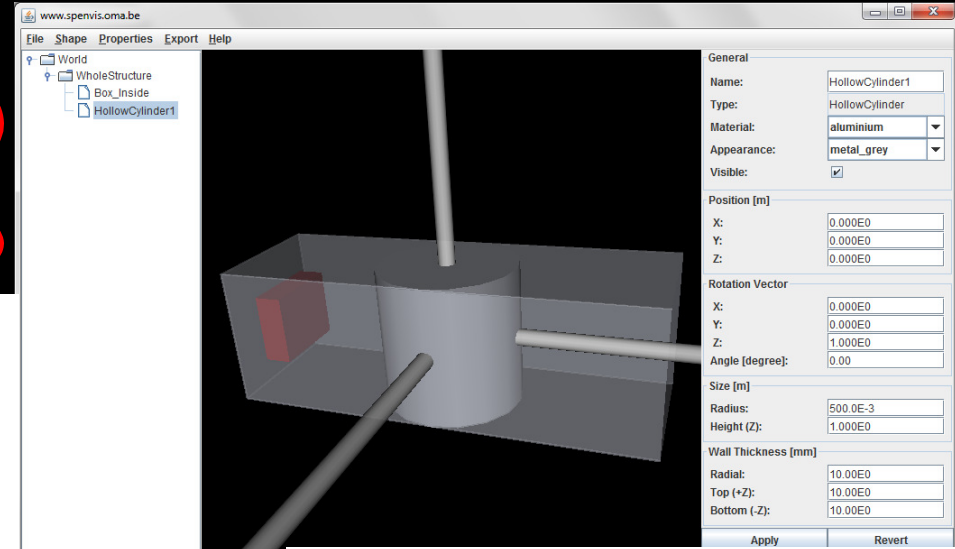
X:

Y:

Z:

Angle [degree]:

Position rel. to Parent



World

- WholeStructure
 - Box_Inside
 - HollowCylinder1

General

Name:

Type:

Material:

Appearance:

Visible:

Position [m]

X:

Y:

Z:

Rotation Vector

X:

Y:

Z:

Angle [degree]:

Size [m]

Radius:

Height (Z):

Wall Thickness [mm]

Radial:

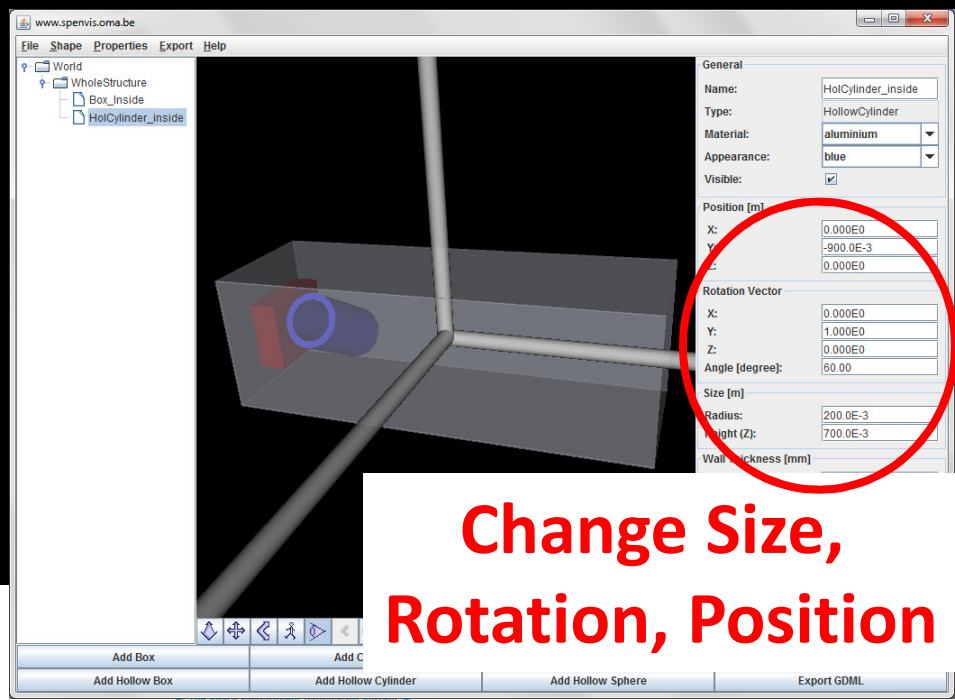
Top (+Z):

Bottom (-Z):

Apply Revert

Add Hollow Cylinder

Add Box Add Hollow Box Add Hollow Cylinder Add Hollow Sphere Export GDMML



General

Name:

Type:

Material:

Appearance:

Visible:

Position [m]

X:

Y:

Z:

Rotation Vector

X:

Y:

Z:

Angle [degree]:

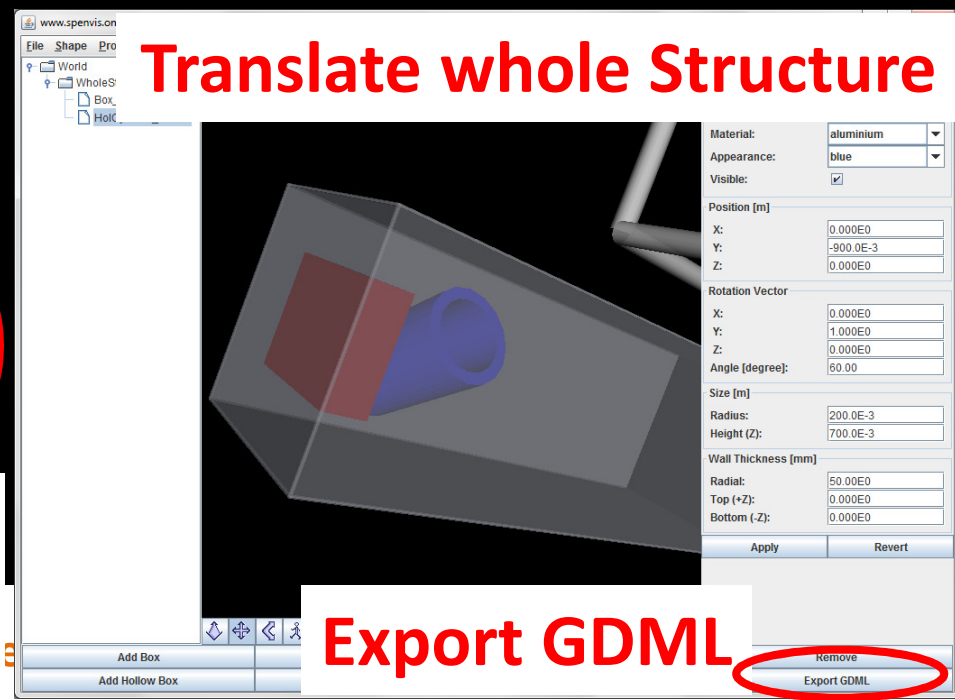
Size [m]

Radius:

Height (Z):

Wall Thickness [mm]

Change Size, Rotation, Position



World

- WholeStructure
 - Box
 - HoiCylinder_inside

General

Name:

Type:

Material:

Appearance:

Visible:

Position [m]

X:

Y:

Z:

Rotation Vector

X:

Y:

Z:

Angle [degree]:

Size [m]

Radius:

Height (Z):

Wall Thickness [mm]

Radial:

Top (+Z):

Bottom (-Z):

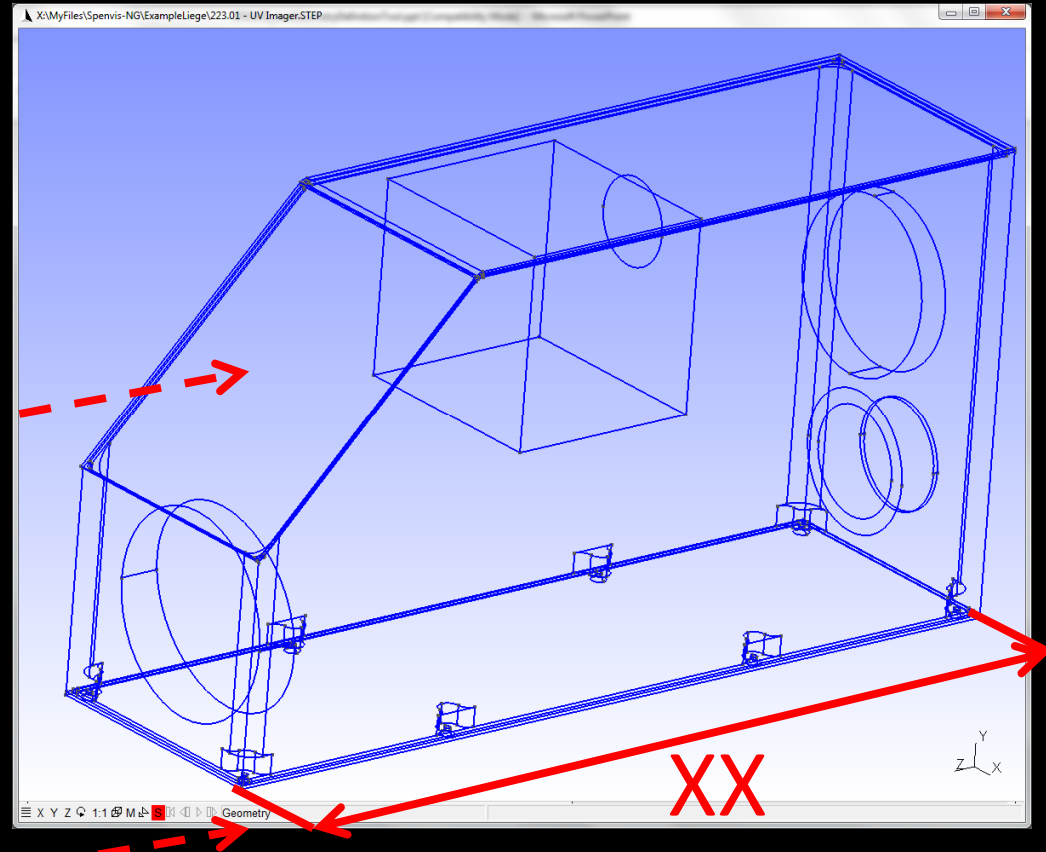
Apply Revert

Export GDMML

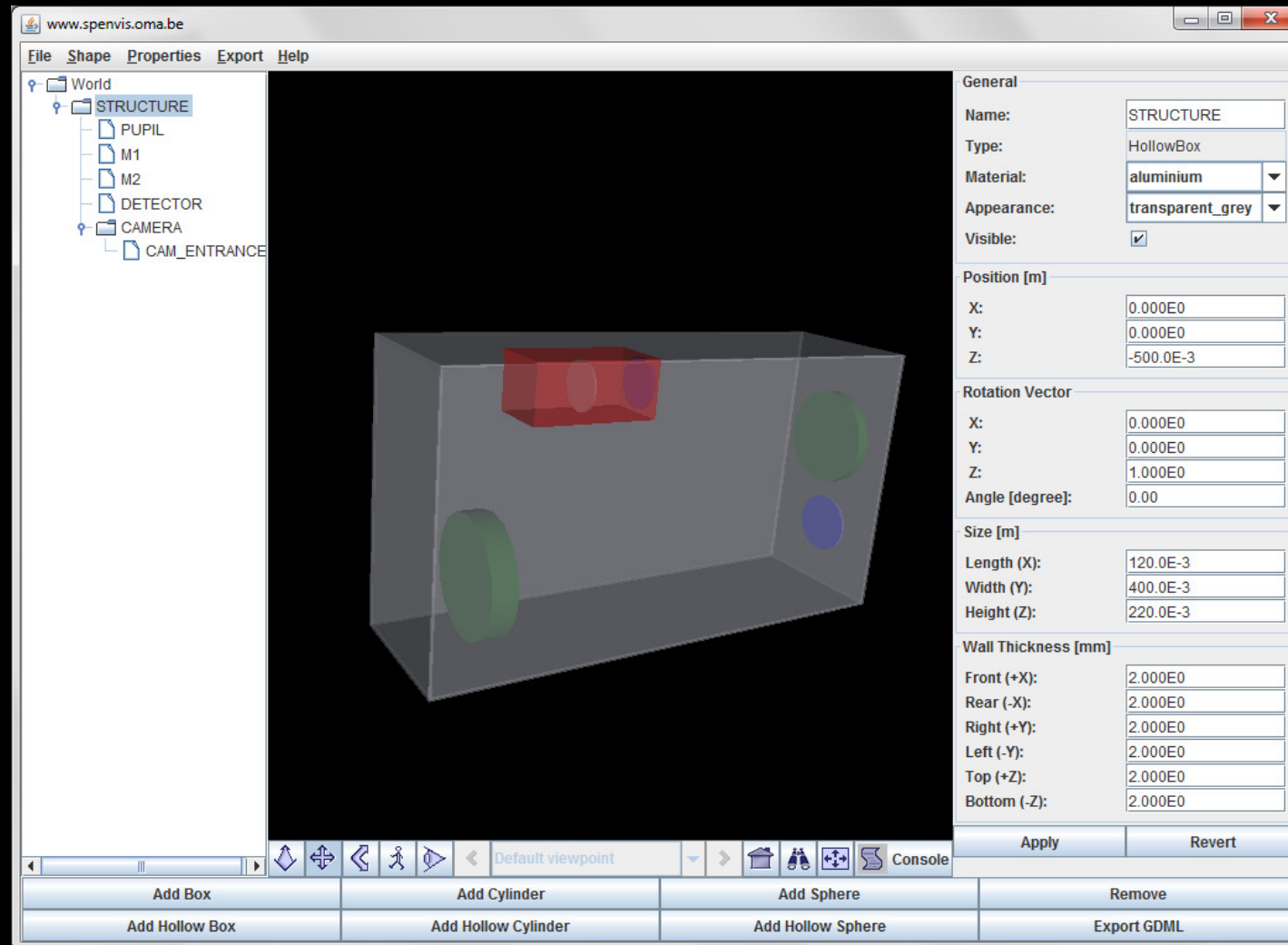
Add Box Add Hollow Box Add Hollow Cylinder Add Hollow Sphere Export GDMML Remove Export GDMML

Application Example (JUDE Imager)

- See presentation by L. Rossi (Uni Liège)
- Start: CAD geometry in STEP format
- Geometry simplification req. (box, sphere, cyl.)
- Dimensioning “by hand”



Application Example (JUDE Imager)



Tutorial

Format Exchange (CAD <-> GDML)

- Basic question:
How to transform CAD to GDML?
=> NO easy solution!!
- CAD programs (CATIA, Pro/Engineer) do not (yet) export to GDML
- But CAD programs use tree-structure for geometries, which could be adapted to the XML structure of GDML

CAD Exchange Formats: IGES, STEP

- IGES (latest version: 1996)
- STEP (still under development), not unified

```
HEADER;
```

```
FILE_DESCRIPTION (( 'STEP AP203' ), '1' );
```

```
...
```

```
DATA;
```

```
#1 = LINE ( 'NONE', #1, #2 );
```

```
#2 = CIRCLE ( 'NONE', #61, 4.9999999999999997300 );
```

```
#3 = CARTESIAN_POINT ( 'NONE', ( 40.00262149313690700,  
84.16671534130532000, 3.089810160390673600 ) );
```

```
#4 = CARTESIAN_POINT ( 'NONE', ( 39.99733838508482400,  
78.89163304442807600, 3.503427439112565700 ) );
```

```
...
```

} Lines,
Surfaces

} Points

Format Exchange: GDML Format

- GDML is XML based meta-language to run GEANT4
- Shape-based geometry definition, not node-based
- Geometry in tree structure

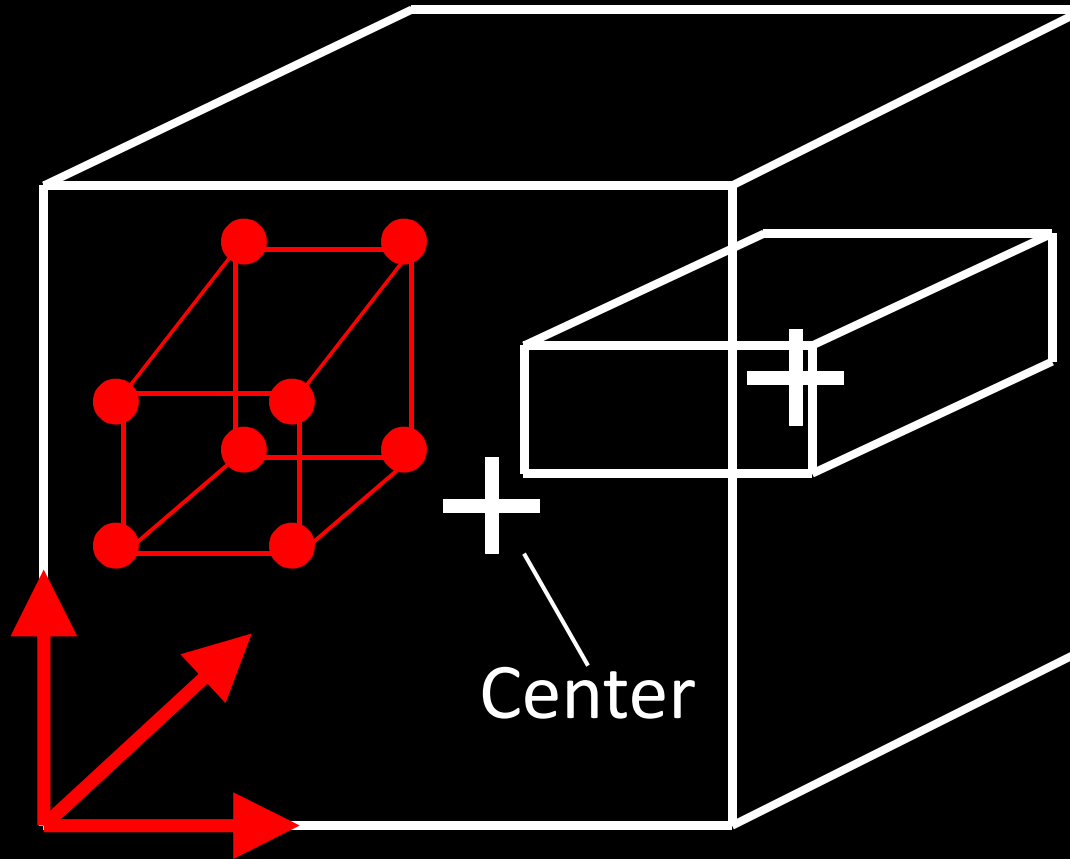
```
<define> ... </define>
<materials> ... </materials>
<solids> ... </solids>
<structure>
  <volume name="Box1"> ... </volume>
  <volume name="World"> ...
    <physvol>
      <volumeref ref="Box1" /> ...
    </physvol>
  </volume>
</structure>
```

General Definitions

Structural Tree:
„Box1“ inside „World“

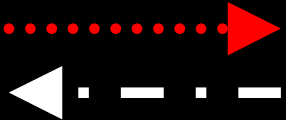
CAD vs. GDML

Point
↓
Line
↓
Surface



Parent
↓
Child

World

Arbitrary geometries  Only GDML geometries

Format Exchange

- Special tools from GEANT4 community
- FASTRAD: GDML creation (free version is limited)
- Esabase2 (not tried)
- FreeCAD: GDML=>CAD for simple geometries, e.g. box & cylinder (reported)
- <http://www.solveering.com> STL=>GDML basic translation functionality (reported)
- For new developments: OpenCascade (C++ library for CAD, STEP/IGES interfaces exist)

End

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