STEP-to-Root
from CAD to Monte Carlo Simulation

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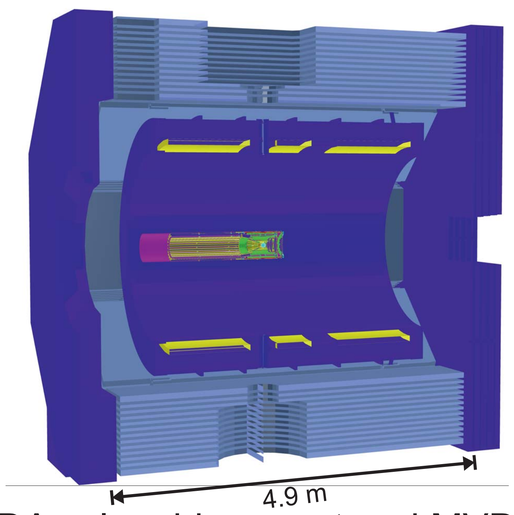
Motivation

- Easy conversion of existing CAD detector designs to geometry description files for Monte-Carlo simulations
- Better agreement between simulated and actual detector
- Simplification of detector design progress
- Improved level of detail in simulations

Design Choices

- Use STEP format as standardized CAD file format
- Use OpenCascade[1] as a basis tool collection for reading in STEP files and do data handling
- Different output formats possible
- Main support for ROOT GeoManager files
- Base geometries directly supported
- More complex geometries require user interference

Examples



PANDA solenoid magnet and MVD

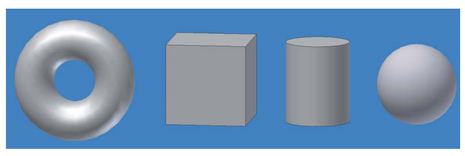
Two Worlds

CAD

- Solids are represented by their boundaries (BREPS)
- The object itself does not know what type of geometry it is.

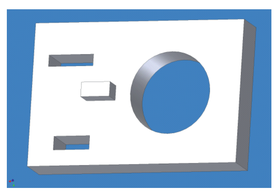
For example:
- A box is described as an object consisting of six surfaces which are planes. Each plane consists of four edges which are lines and each line has a start and stop point

ROOT



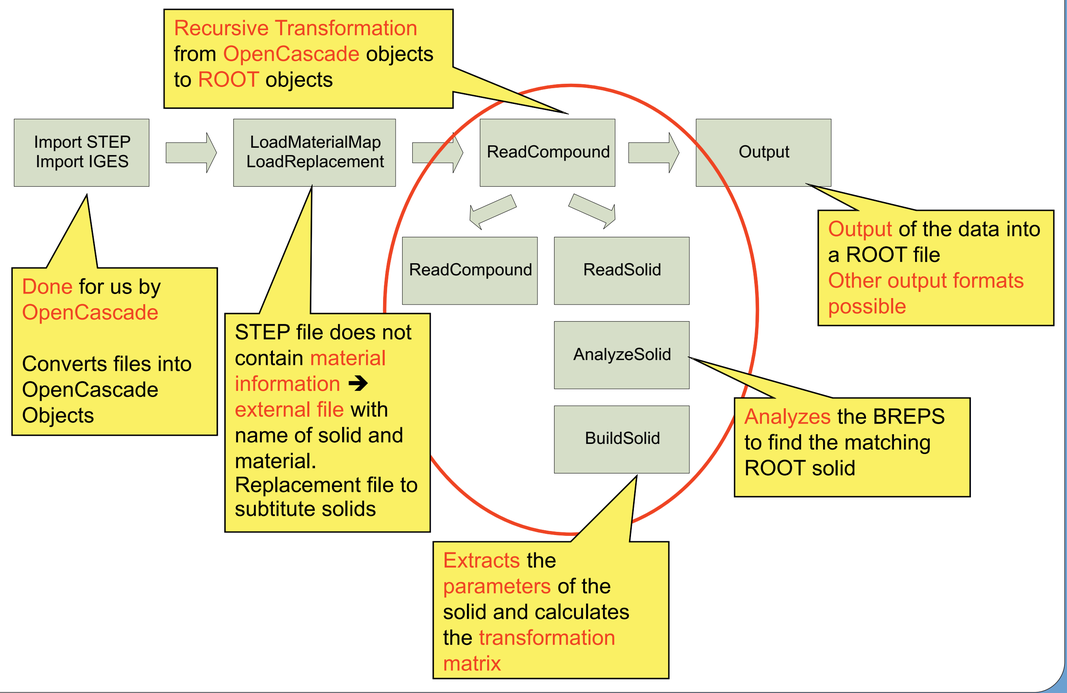
- Bodies are created by basic solids like: torus, box, cylinde, sphere ...

More complex solids can be created by boolean combinations of basic objects



Find ROOT object which fits to the bunch of surfaces of the CAD program and extract the parameters

Software Design Scheme



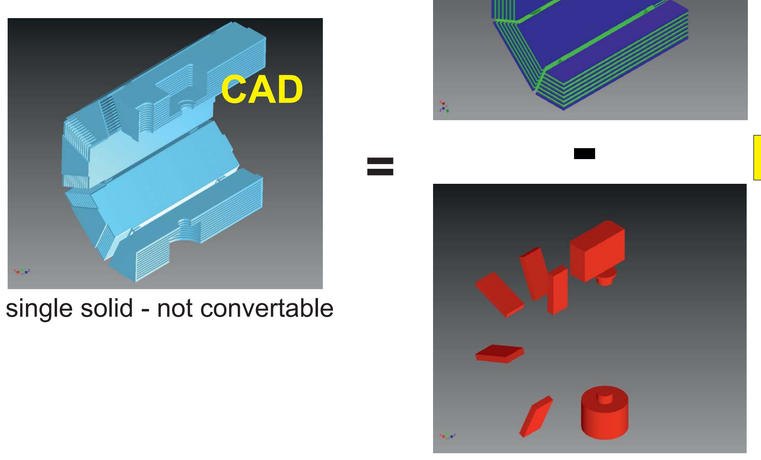
Replacement

- Some geometries are too complex for an automatic conversion
- Others are too complex for fast tracking in simulation

- Possible to replace any geometry object by a substitute:

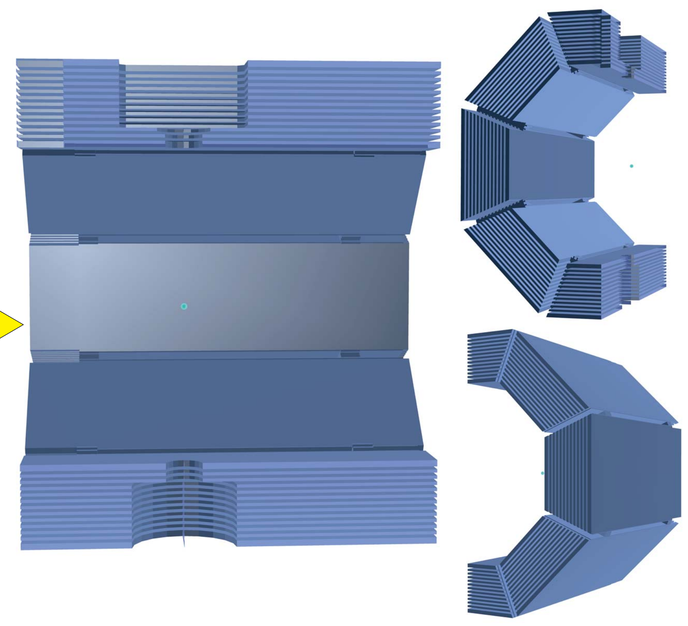
  a) a basic root geometry
  b) an alternative STEP file
  c) a boolean combination of STEP files (see example)

Example: Boolean STEP Files

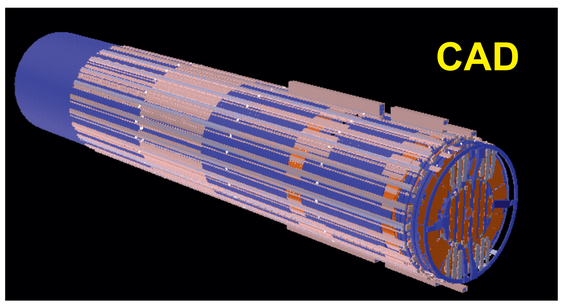


single solid - not convertable

ROOT Geometry

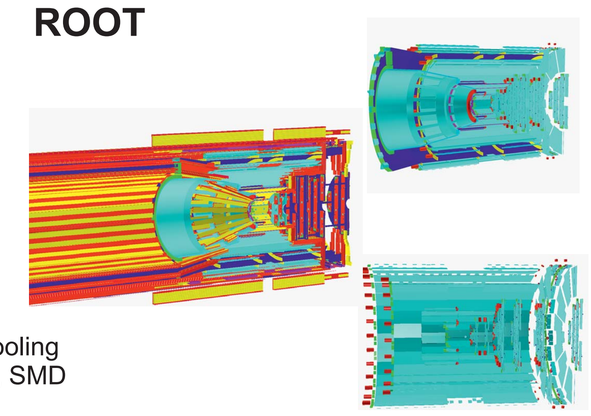


Example MVD



70,458 volumes
sensors, support, cooling
cabling, connectors, SMD

ROOT



Summary

- CAD converter is able to convert STEP files into „GEANT-like“ geometries
- Works best for ROOT geometries
- Used in the PANDA experiment for the MVD and the solenoid magnet
- Not a plug & play tool but a big help for complex designs [2]

[1] www.opencascade.org

[2] further information can be found at: http://panda-wiki.gsi.de/cgi-bin/view/Computing/CadConverter

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