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Development and application of CATIA-GDML geometry builder

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Detector geometry exchange between CAD systems and physical Monte Carlo (MC), packages ROOT and Geant4 is a labor-consuming process necessary for fine design optimization. CAD and MC geometries have completely different structure and hierarchy. For this reason automatic conversion is possible only for very simple shapes.

CATIA-GDML Geometry Builder is a tool which allows to facilitate significantly creation of MC compatible geometry in GDML format from the CAD system CATIA v.5 which is the main design system in CERN, GSI, LNGS, and other scientific and industrial entities. The tool was introduced at CHEP2010 [1].We employ powerful measurement, design and VBA customization features of various CATIA workbenches for creation of GDML compatible representation of an existing engineering assembly. For many Root/Geant primitives we have developed parameterized CATIA User Defined Features. We have implemented in CATIA concepts of logical, physical and mother volumes. The Constructive Solid Geometry (CSG) Boolean tree can be optimized from point of view of simulation performance. At the end the CSG tree is exported into GDML.

For the last three years a number of detector models were transferred from CAD to MC and vice versa. Functionality of the tool was extended and usability was improved according to the practical experience.
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The following novelties were the most important for improvement of usability: extension of the set of implemented primitives; introduction of polycone and polyhedra; introduction of a part template for MC compatible geometry; development of a correctness checker of a resulting model before export; automated positioning by clicking; generation of symmetry from an assembly; improved handling of materials.

The up-to-date functionality, analysis of nontrivial use cases, an approach to integration with automated recognition of simple shapes, examples and hints on the best practices will be reported at the conference.

[1] S. Belogurov, Yu. Berchun, et al. 'CATIA-GDML GEOMETRY BUILDER'.
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