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Experiences from the CBM collaboration: CAD to ROOT conversion for detector geometries

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Fully automated conversion from CAD geometries directly into their ROOT geometry equivalents has been a hot topic of conversation at CHEP conferences. Today multiple approaches for CAD to ROOT conversion exist. Many appear not to work well. In this paper, we report on three separate and distinct successful efforts from within the CBM collaboration, namely from our Silicon Tracking System team, from our Transition Radiation Detector team, from our Ring-imaging Cherenkov Detector team and from our Beam-Monitor Assembly team on their experiences. These studies benefit from being semi-independent and were reported upon during our biannual CBM collaboration meetings during 2023 and 2024.

In these eventually successful investigative studies, we discuss conversion from CAD in portable STEP format to meshed solids in STL format. Methods which form these into tessellated shapes are discussed. We reported on tessellation based upon TGeoArbN classes with due regard to computational costs occurred in conversion and in simulation. We conduct computation efficiency tests for transport and reconstruction simulations using different subsystems after converting them to VG shapes through a VecGeom converter command in ROOT. We bench tested different navigators and discuss geometry complexity with computational cost.

The main purpose of this contribution is to assess these investigative studies, in order to fix a plan on whether and how CAD to ROOT methods could and should be used by the CBM experiment. As the experiment is in its final design stage, we need to discuss this topics frankly.

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