Sudbury Neutrino Observatory, Extending the Detector Geometry in SNOMAN for Background Investigations

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Our background study for the PMT support structure and PMT panel area using special water shells was improved by including the PSUP steel frame geometry into the SNOMAN code.

The geometry is an embedding geometry. There are regions with different priorities. The regions with higher priority are embedded in regions with lower. The handling between the various regions is done by a boundary manager.

The geometry software package, GEO, has four tiers: interface, detector element routines geometry primitives and boundary manager. The main task in extending the geometry is the development of the detector element routines. Progressing through the different generations shown in fig.1 requires using different coordinate systems.

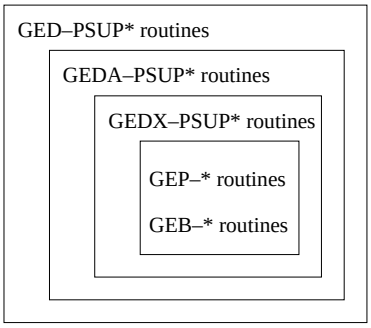

Figure 1: General scheme of extending the geometry in SNOMAN

The $GED*$ routines call their own element and internal element routines, and these routines know about their relationships to their neighbouring regions. These routines work with the overall detector frame. Next generation, the $GEDA*$ routines, handle all requests estimating the nearest or the next element and picking particular parts of the detector. They are linked to the primitives in this detector element. Therefore, a special detector element coordinate system is used. In case of the PSUP, it is the same as the overall detector coordinate system. The $GEDA*$ routines are only necessary for complex detector elements such as the PSUP steel frame. Modelling the PSUP steel frame in a geometry useable by SNOMAN requires that all components have to be described with the available primitive types. By using the high degree of symmetry in the steel frame a special field including a fifth of all struts, hubs, ropes and acrylic vessel guide cans is generated. This section of the PSUP is then simply rotated five times about ϕ to produce the complete frame. Additionally, the PSUP frame model includes a south pole hub, the acrylic vessel guide ring and the chimney ring. The struts, hubs, ropes and acrylic vessel guide ring cans are described as cylinders with radius, thickness and length. Some of them are hollow, which requires creating an internal PSUP region filled with water. The AV guide ring and the chimney ring are described as two half tori. They have an internal water volume, too. The $GEDX*$ routines are called by the $GEDA*$ routines. They handle the external and internal boundaries ($GEB*$ routines) depending on the tracking request and call the special primitive routines ($GEP*$ routines). The $GEP*$ and $GEB*$ routines are standard routines of the SNOMAN code. The shapes and the locations of all elements of the steel frame are stored in the GEDS and GEDP banks.

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