

Step IV Geometry Development

Ryan Bayes

School of Physics and Astronomy
University of Glasgow

18 June, 2013

Outline

- 1 Architecture of MAUS Geometry
- 2 CAD Drawings of Step IV
- 3 Progress in Simulation
- 4 Ongoing and Future Work

Goals of Geometry Implementation

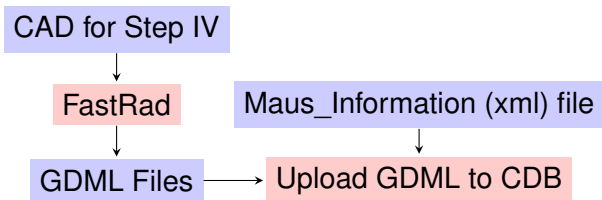
- Precision in the position of experimental elements is a fundamental requirement of simulation and reconstruction.
- Need to match MAUS geometry to surveys
- In the past all geometries have been implemented by hand.
 - Only as good as the information filtered to the programmer
 - Many hands means less certainty
- Implementing system to extract geometry from engineering drawing
 - As developed by Matthew Littlefield
 - Geometry is written to Calibration Data Base.

Reminder Geometry Task Force

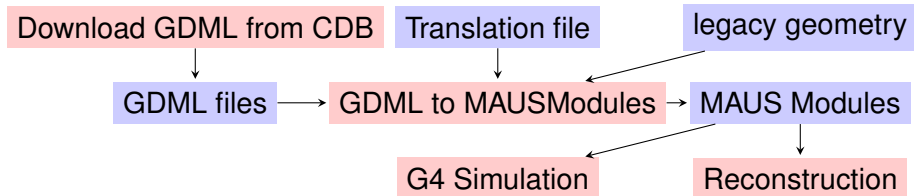
- Jason Tarrant
 - Develops CAD models of experiment.
 - Turns models into machine readable GDML.
- Stephania Ricciardi
 - Geometry validation
- Paval Snopak
 - Absorber model development
- Victoria Blackmore
 - Help in implementation and validation of magnetic fields.
- Chris Heidt (?)
 - Implemented tracker geometry in GDML.
- Ryan Bayes
 - Assuming software development and handling of new models
 - Implementation of tracker geometry in GDML.

Geometry Workflow

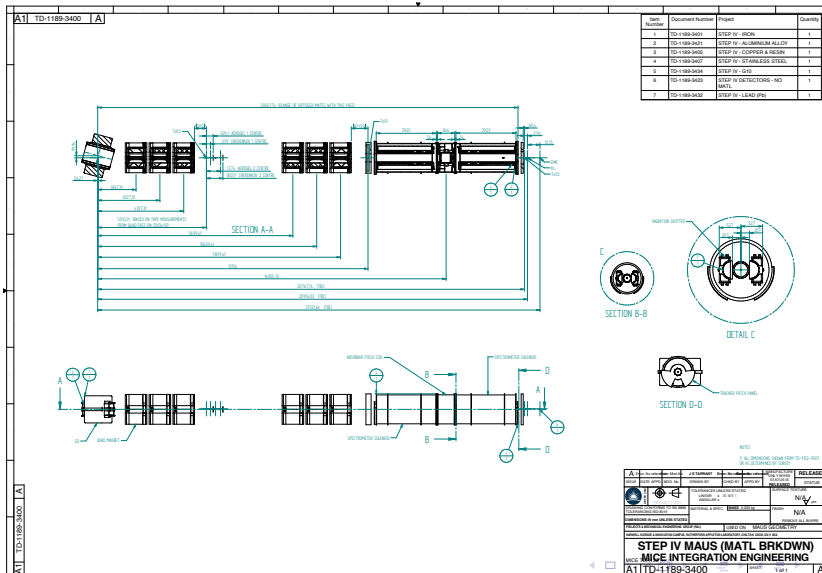
File Preparation Workflow



User Workflow



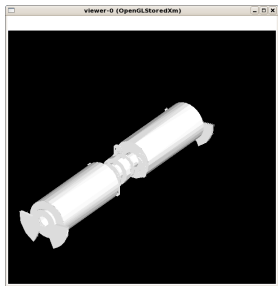
Step IV CAD Drawing



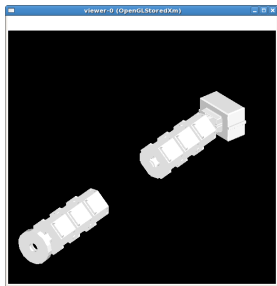
Toy Simulation to Evaluate GDML files

- Used GEANT4 example out of box.
- Files evaluated by material

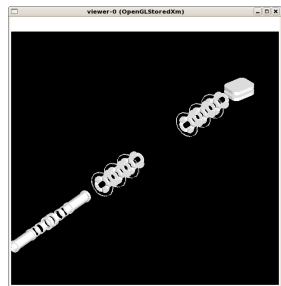
Aluminum



Iron

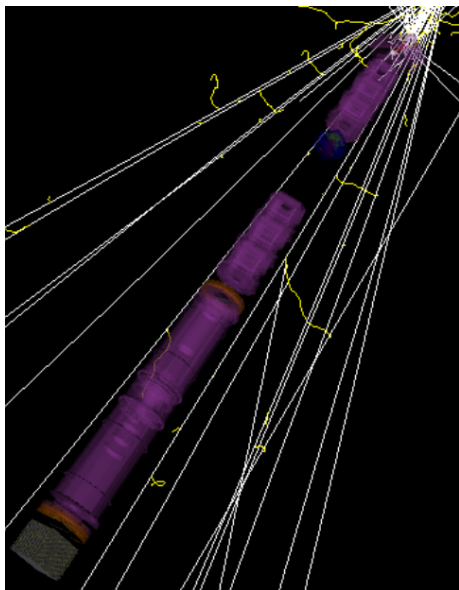


Copper



- Not shown are the stainless-steel, lead, and G10 elements.

Simulations in MAUS



- Translation of GDML works in correct coordinate system.
- Geometry includes placeholders for all detectors except Tracker
- Needs diffuser and absorber placeholders.
- Legacy geometry used for specific detectors
 - TOFs
 - Cherenkovs
 - KL
 - EMR

Updating GEANT4

- Issue: the handling of Tessellated solids in GEANT4
 - Provoked a warning statement during placement of solids.
 - Warning statements filled log files with GBytes of text.
 - Setup took hours.
- Solution: Upgrade version of GEANT4
 - G4.9.5.p01 removes warning statement
 - G4.9.6.p02 reduces loading time to minutes (\approx 20 minutes).
- Unknown if further improvements in loading or running time can be achieved
 - Direct use of GDML.
 - Simplification of geometry.

Further Improvements

Tracker Geometry

- Tracker geometry needs to be rewritten to allow CDB control.
 - Necessary for the maintenance of alignment.
 - Corrections needed beyond the placement/rotations allowed for legacy derived detectors.
- Attempt make by Chris Heidt.
 - Does not run in current system (version problem).
 - Need to remove cryostat (which is in the CAD).
 - Need to create multiple xml and stylesheets to replicate

Magnetic Fields

- Need to be vetted and placed.
- Fields need to be associated with requisite beam-line elements.

Conclusion

- Much progress has been made since last collaboration meeting
 - Viable beam-line geometry from CAD.
 - Solved a few technical issues against running the simulation.
 - Made the new geometry put the legacy detectors in correct places.
- Still some work to do.
 - Complete CDB controlled tracker geometry
 - Vet and place magnetic fields.
 - Optimization and testing of implementation.