Geometry Status

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MICE CM 41

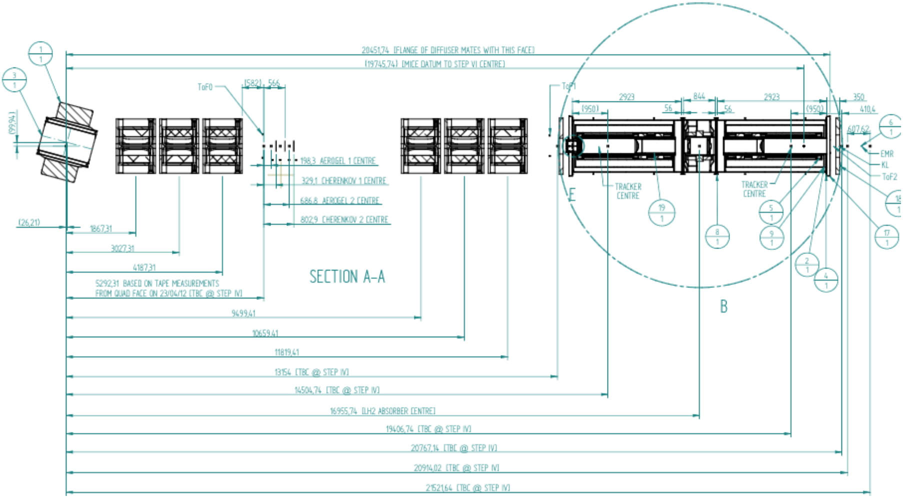
Purpose of the Geometry Project

- Need an accurate and reproducible record of the beam line geometry.
- Need to reproduce the geometry in software for the purpose of prediction and data reconstruction..
  - Limited by the knowledge available to the programmer.
  - Loss of corporate knowledge makes later analysis difficult.
- Implementing system to extract geometry from engineering drawing
  - As developed by Matthew Littlefield
  - Geometry is written to Calibration Data Base.
  - Geometry indexed by id number, by time, or by run.

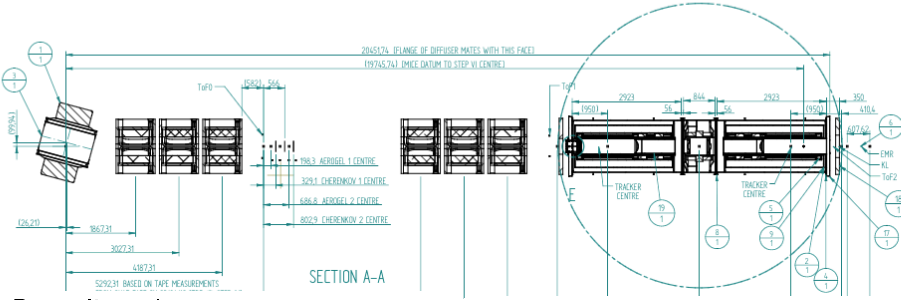
Currently involves

Stephania Ricciardi	Validation
Ryan Bayes	Software
Jason Tarrant	CAD Generation

Step IV Geometry



Step IV Geometry



Beamline elements

- Positions provided from surveys
- Magnet currents taken from CDB (by run download)
- Default fields provided for a 6π 200 MeV/c beam.

Detectors

- Positions of detectors indicated by "dummy" volumes in CAD.
- Volumes replaced by detector description in processing.

In Addition to the CAD

Definition of Detectors

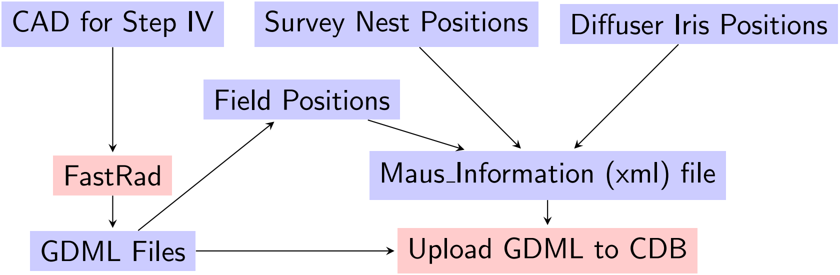
- All detectors (Trackers, TOFs, KL, Ckov, and EMR), diffuser irises, and absorbers (LH2 and LiH) are defined using GDML.
- Results of conversion of GDML to MICE modules is identical to legacy files.
- Extensions exist to define "G4Detectors" within the GDML files.

Super Conducting Fields

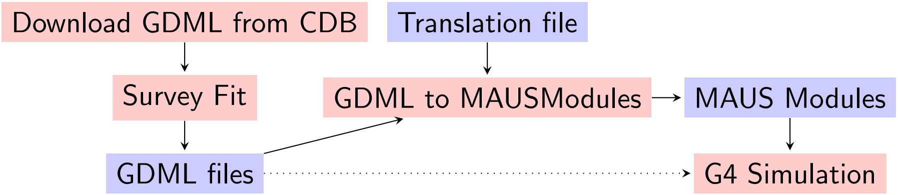
- Field currents to be stored in CDB
- Ideally treated parallel to conventional currents.
- Necessary changes are extant (but commented out) in current MAUS release.

Software Workflow

File Preparation Workflow



User Workflow



Procedures and Responsibilities

- Geometry release procedure has been revised

http://micewww.pp.rl.ac.uk/projects/maus/wiki/Geometry_release_procedure

	Process	Responsible
1	New geometry is released as a set of gdml files	JT
2	New geometry is uploaded to preprod configuration database	RB (or SR)
2.1	Run a test job on the test server	RB (or SR)
2.2	Upload geometry validation plots to wiki page	RB (or SR)
3	Assuming tests pass, upload geometry to the production CDB	RB (or SR)

When Is a New Geometry Required?

A significant change takes place in the hall

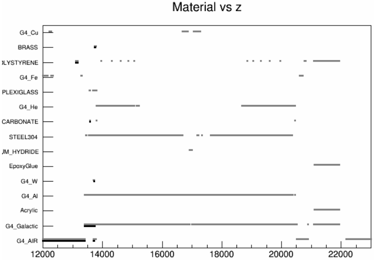
- A beam line element (or detector) changes position.
- The absorber is changed.
- Requires a survey to be done of the hall.
- Will be stored on CDB with a date corresponding to the change.

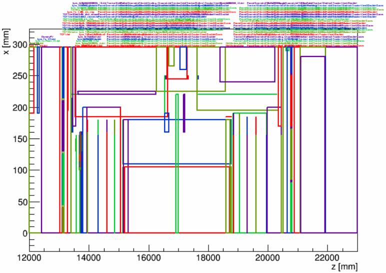
A systematic study is required for simulation

- A beam line element (or detector) changes position.
- The absorber is changed.
- Requires a known change to be implemented in the geometry files.
- Should be stored on CDB (preprod?) for archiving purposes.

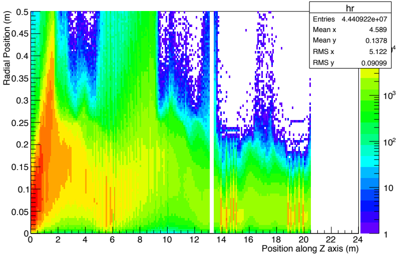
Validations of Geometry

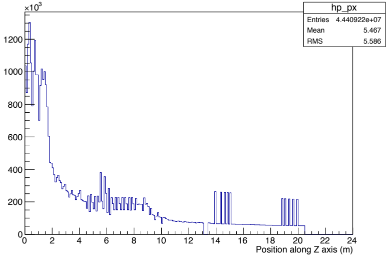
Material Validation





Virtual Plane Tracking

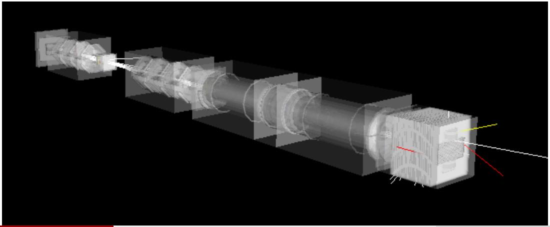




Recent Changes

Updates to CDB geometry

- Changed dating scheme.
  - "Ideal" geometries dated for some time in the future (2034 of StepIV)
  - Necessitated by algorithm of CDB get geometry by run algorithm.
- "New" geometries for Step I (geoID 46 and 47) have been committed.
- Added new Step IV geometry (geo ID 48) with corrected Tracker positions
- Sub-assemblies defined for Quads, Dipole, and Super-Conducting sections.



Upcoming Changes: Automating the GDML Preparation

- Preparation of GDML files has been done by hand.
- Requires experience and is prone to mistakes.

New GDML extraction program has been defined

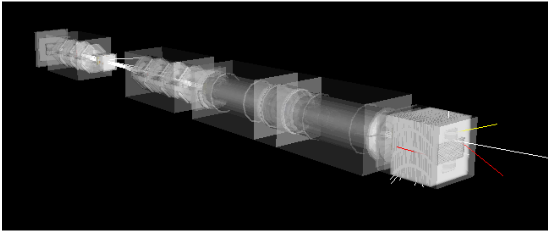
- Motivated by the incompatibility of FastRAD output after version change
  - All tessellated solids written to one file rather than one file per solid.
  - Module file translation requires the latter.
- New translation program defined to deal with new format.
  - Solids sorted into sub-assemblies by z-position.
  - Ranges need to be defined in information file.
  - Will also be useful for the old file format.
- Also reads the position of the fields from the GDML files.
  - Done by hand in the past.
  - May need adjustment to deal with arbitrary object alignments.

Upcoming Changes: Adopting the GDMLParser for Use

- Loading time of tessellated solids with MICE modules is prohibitive.
- Loading time of tessellated solids with GDML is comparable to primitive solids.

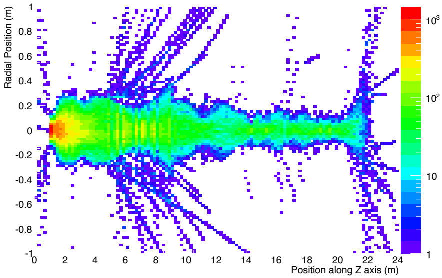
Parallel GDML/MICE module system has been developed

- GDML used for the definition of the objects in the simulation
- MICE modules used for the definition of the fields and detectors (for reconstruction)
- Backward compatibility of the geometry is supported.



- Version is dictated by objects in the MAUS_Information file.
- Requires no change in the user mode.

Status of GDML Parser Implementation



- Compare the loading times based on single spill simulations

- Used the same material and tracking validation
  - Virtual plane data shows reasonable energy loss.
  - Material validations show correct materials.
- Still have not seen production of detector digits.
  - Sensitive detectors appear to be in place.
  - Still a work in progress.

Loading Times

	Real Time	User Time	Sys Time
Legacy Geometry	2m40.386	2m34.145s	0m1.016s
CDB Geometry	26m51.606s	26m43.547s	0m1.380s
GDML Parser	1m27.834s	0m55.646s	0m1.330s

Summary of Current Status

A working geometry versioning system is in place.

- Based on the CAD models of the MICE hall.
- Imposes a single coordinate system consistent with surveys.
- Allows for a temporal coordination of geometry with the experiment.
- Validations are in place for the generation of new geometries.

Some small adjustments in system upcoming

- Automation of geometry production completing development
- Adoption of the GDML parser for use is nearing completion.

Future Projects

New modules need to be introduced to MAUS

- Tests need to be written for new modules.
- Still some problems verifying definition of sensitive detectors with the GDML parser.
- Use of the GDML Parser requires introduction of new third-party libraries.

Can we make a CAD to GDML converter native to MAUS?

- FastRAD changed beyond our control (not good).
- Method of conversion has been documented using a combination of

    FreeCAD
    CadMesh

- So far a low priority.