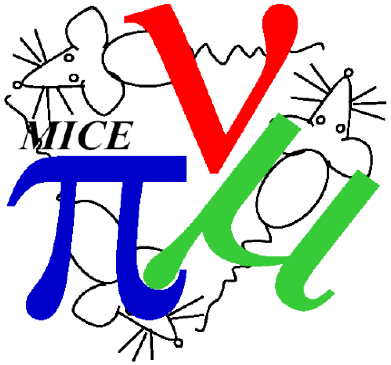
MICE Geometry



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Review of Geometry

- Review of geometry work package on 2014-10-23
  - Organised on a very short time scale
  - With apologies to folks who could not attend
- Participants
  - Ryan Bayes
  - Chris Rogers
  - Chris Hunt
  - Jaroslaw Pasternak (remote)
  - Durga Rajaram (remote)
- Meeting page
  - http://micewww.pp.rl.ac.uk/projects/maus/wiki/Geom_workshop_151014

Geometry Aim

- Aim of the geometry is to provide a robust model of MICE
  - MICE is a precision experiment
  - We care about details of windows, absorbers, field maps
- Detectors are sensitive at ~ 3 MeV, ~ 500 micron level
  - Geometry should produce accurate results at ~ 10 % of detector resolution
  - Energy loss at 1 % level → ~ 0.1 MeV
  - Position at few 10s of micron level
- Detectors+physics should drive the errors, not MC
  - (We can probably reduce systematics to around 10% of detector resolution)
- We need a fine-grained geometry

Geometry Specification

- Geometry software should provide support to
  - Track a beam through MICE from target to beam stop
    - At minimum, require one good muon per second
  - Understand effect of misalignment and misconstruction
    - “Systematics studies”
  - Validate the implementation of the geometry
    - i.e. some physicist-understandable display of the geometry
  - Provide automated tools for simulating a particular MICE run, given a run number, time stamp or equivalent
  - Provide sufficiently automated tools for simulating a hypothetical set up
    - Obviously user needs to be able to communicate to the software what they want to change
    - Would like to support batch production
  - Support online reconstruction
    - Require faster load and less detail

Geometry Specification (3)

- Anything else?

Implementation (Upload)

- To date the only existing model of MICE lies with Jason Tarrant (integration engineer)
- Seek to import the CAD geometry from the integration engineer
  - Considered doing this by hand
  - Decided to experiment with a direct import using “FastRad” tool to generate “GDML” files
  - Direct import seemed to work okay
    - Implemented toy geometry which met basic requirements
- GDML geometry is uploaded to CDB with a validity range (in time)
- Magnet currents and other transient settings are uploaded to CDB per run number
  - Proton absorber, diffuser settings, etc
  - Magnet currents, etc
  - Pure MC data gets a negative run number and time stamp in 1970s

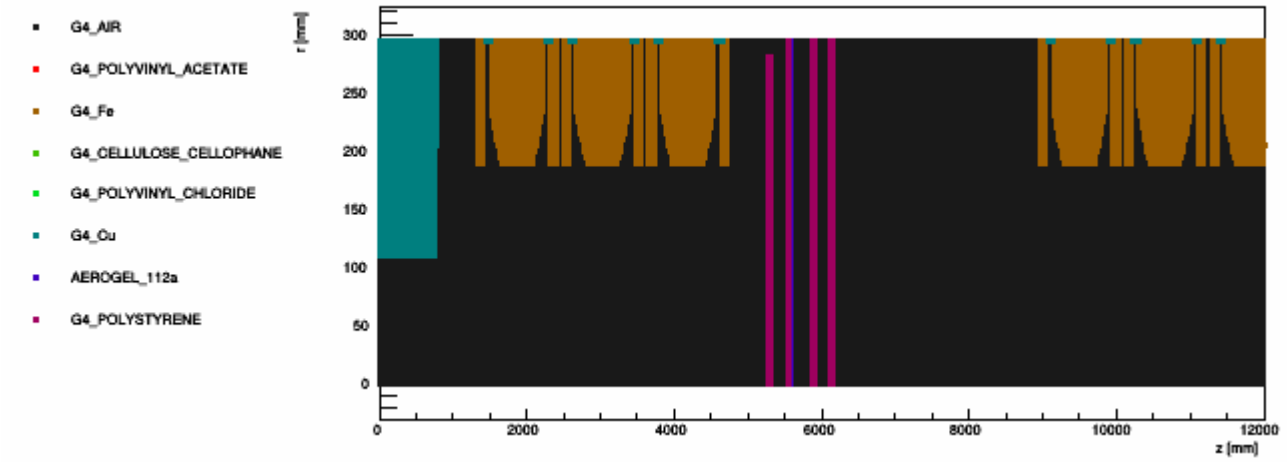
Implementation (Download)

- At download time
  - User specifies id, run number of time stamp and downloads geometry
  - GDML geometry is converted to MiceModules format, a custom MAUS format
  - CDB values for transients are read in and added to the geometry
  - This is all cached on the local disk
- At run time
  - MiceModules are read in
  - MAUS builds the geometry and tracking begins

Status

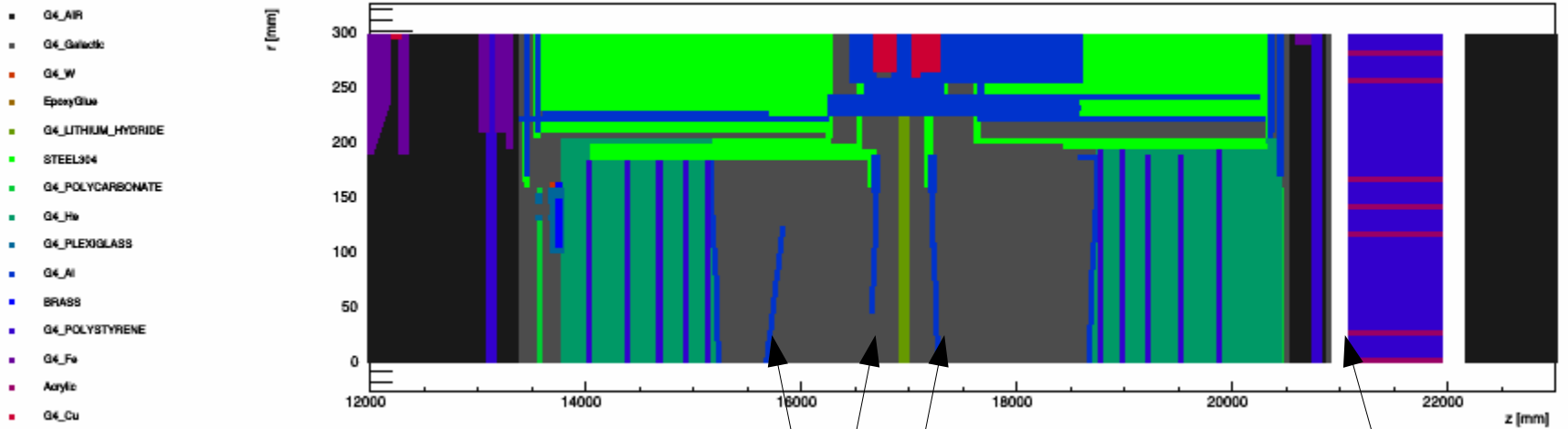
- Go through requirements one by one
- Requirement: Track a beam through MICE from target to beam stop
  - Yes, this has been done, see Ryan's talks
- Understand effect of misalignment and misconstruction
  - Partially. It is possible to substitute a user-defined geometry element instead of the default CAD one (or move the default CAD one)
  - Need to implement misalignment of entire module
  - Is this sufficient? Seek user feedback
- Validate the implementation of the geometry
  - Yes … see next slides (Rogers)
  - Nb: Geometry Version 44
  - Nb: ROOT files for all this stuff are available – enabling user to zoom in etc

Beamline Materials



- Material as a function of r and z
  - In this plot, move out in plane (x=y, z)
  - This is actual tracking data
  - i.e. what Geant4 sees as it steps through the geometry

Cooling Channel Materials

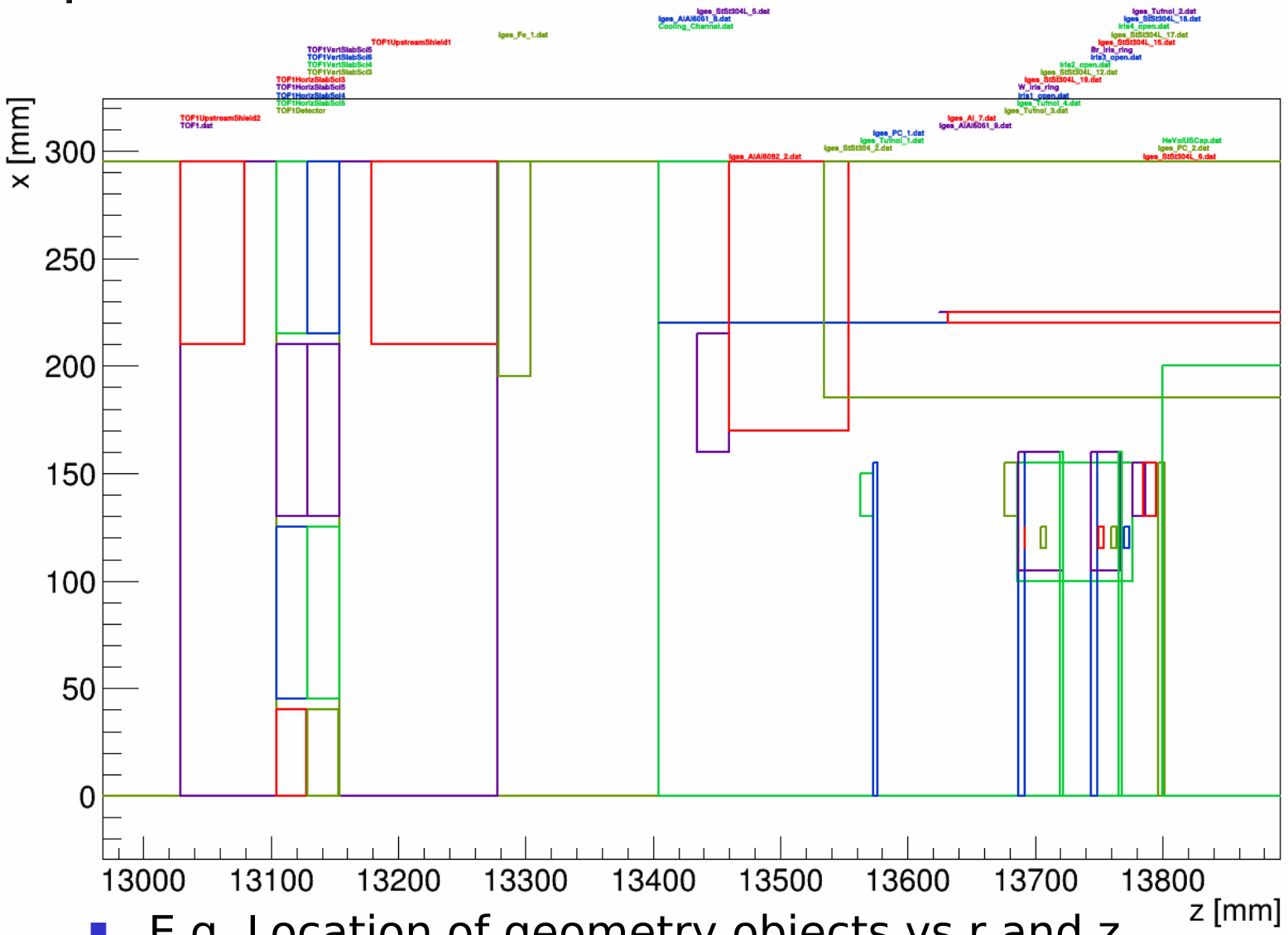


Mysterious windows

No tracking data

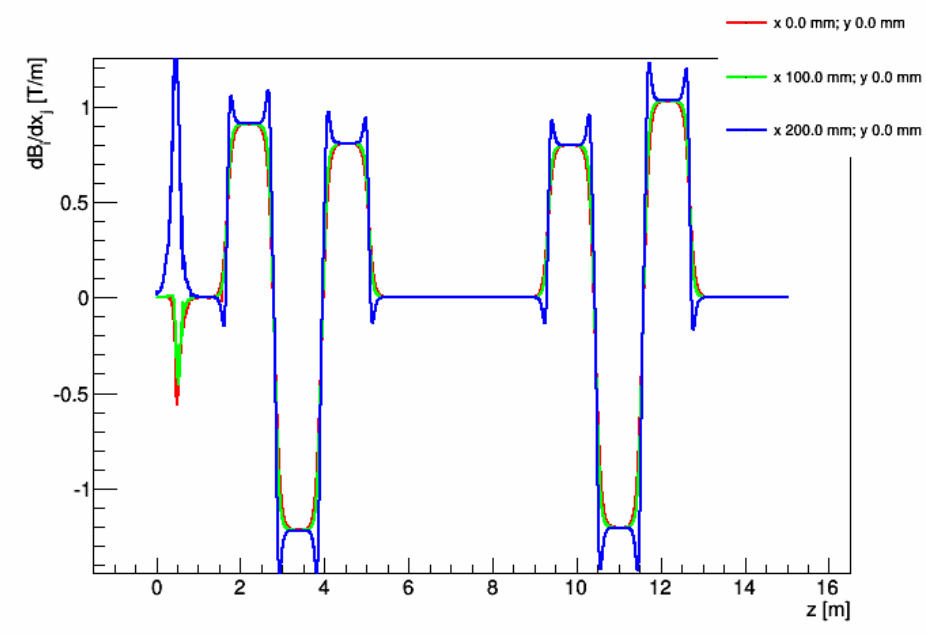
- Material as a function of r and z
  - In this plot, move out in plane (x=y, z)

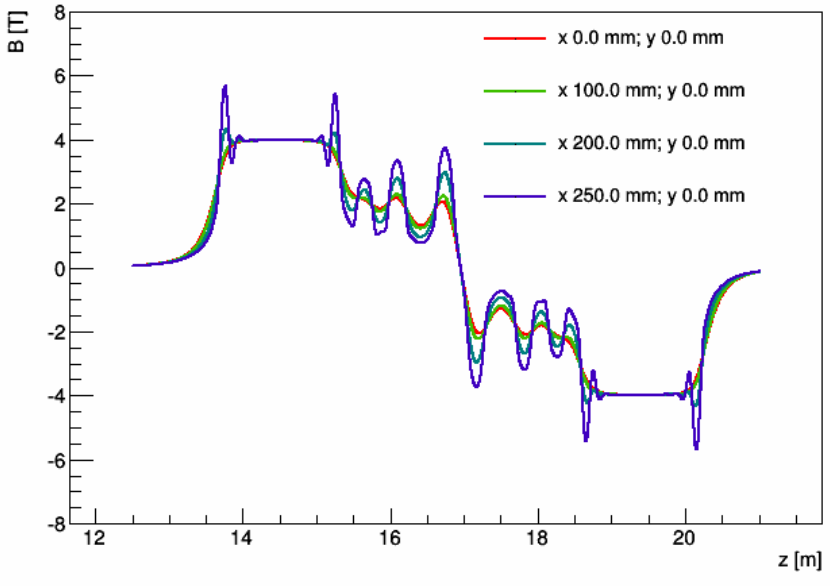
Volumes at upstream end



- E.g. Location of geometry objects vs r and z

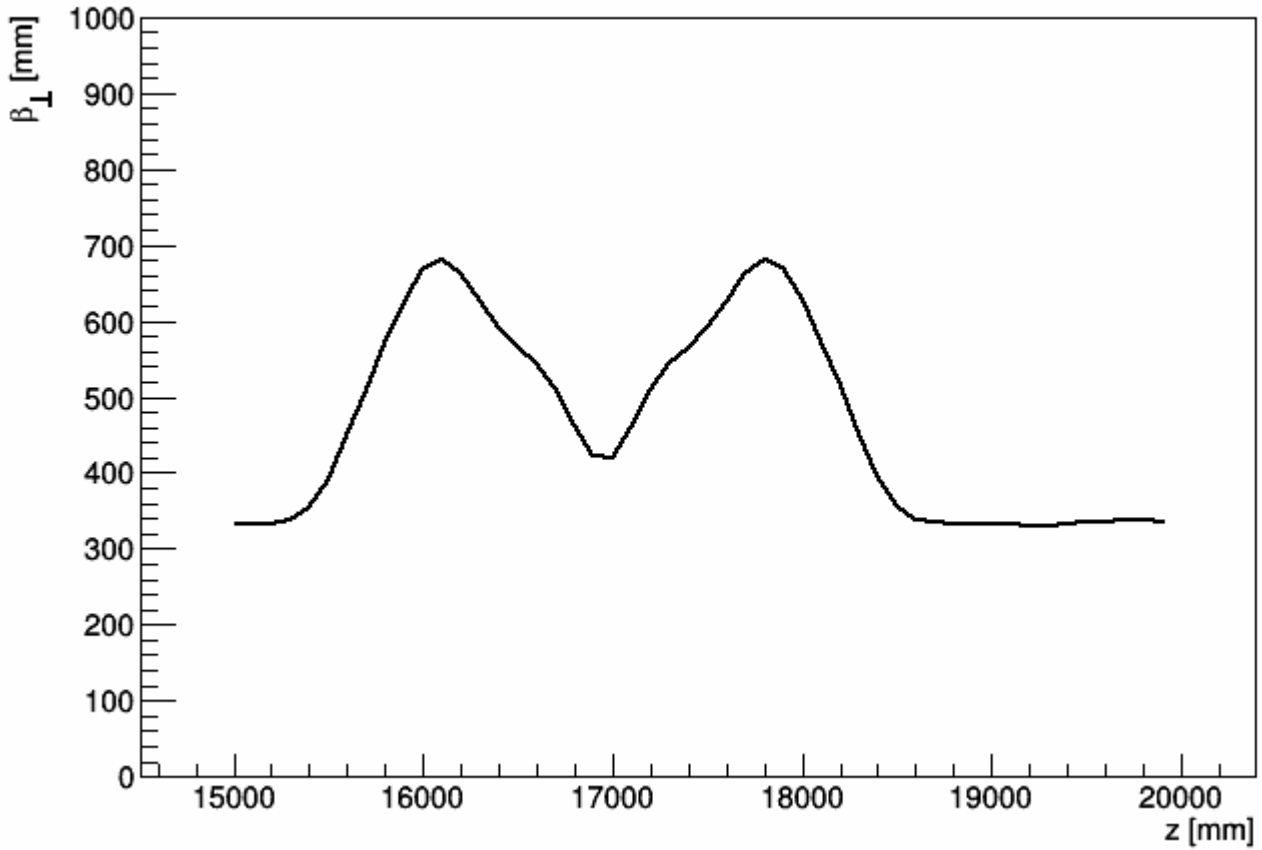
Fields





- Field maps

Linear Optics



- For nominal optic settings c/o Victoria Blackmore

Geometry Status

- Provide automated tools for simulating a particular MICE run, given a run number, time stamp or equivalent
  - Yes
- Provide sufficiently automated tools for simulating a hypothetical set up
  - Some stuff is not automatable – e.g. can't easily manipulate material thicknesses
  - Seek user feedback to tell us what they want
- Support online reconstruction
  - No! Current geometry is too heavy for online

Conclusions

- **The geometry is okay to use for MC studies**
- Some details on windows need to be cleaned up
- Some feedback from users on how they want to run systematics studies etc would be appreciated
- MAUS is YOUR tool – tell the developers what YOU want
  - Lead times can be large for feature requests so start asking now!