

Geometry

Summary of Parallel Session 6-B



Gabriele Cosmo – CERN PH/SFT

Parallel Session 6-B



- ❧ “A Geant4 Magnetic Field Manager”
 - ❧ by Laurent Desorgher (University of Bern)
- ❧ “Cylindrical parameterisation for regular navigation”
 - ❧ by Pedro Arce Dubois (CIEMAT, Madrid)
- ❧ “Layered mass geometries”
 - ❧ by Shrin Enger (University Laval, Quebec)
- ❧ “A new shape: G4TorusStack”
 - ❧ by Peter Gumplinger (TRIUMF, Vancouver)
- ❧ Open discussion on selected items

Geant4 Magnetic Field Model Manager

by Laurent Desorgher

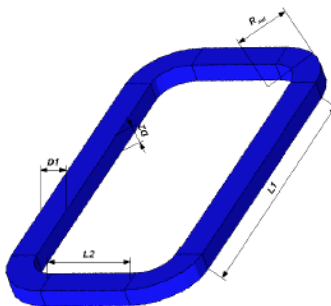
G4 Magnetic Field Model Manager User Requirements/Capability

- Possibility to define simple and complex magnetic fields by using GUI macro commands
- Possibility to model coils, and toroidal magnets
- Possibility to combine different magnetic field models
- Possibility to translate and rotate magnetic field models
- Possibility to pre-compute magnetic field from complex models and use this grid much quicker during the full simulation
- Possibility to replicate fields
- Possibility to control the method used to equation in G4 (G4Stepper, precision,...)
- Possibility to extend the Magnetic Field other G4 Fields in the as-most possible

- *Agreed for evaluation and possible inclusion as an extended example*
- *Possible inclusion of some functionalities in kernel*

Replication of Field around Z axis to Produce a Toroid

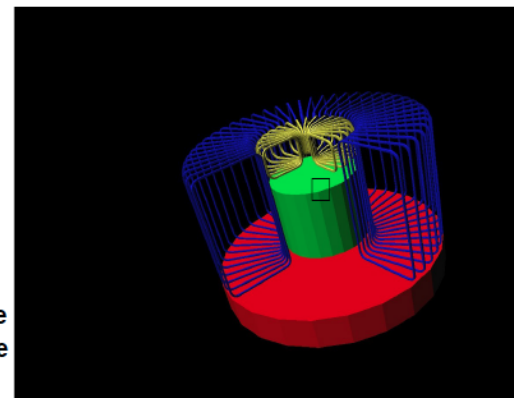
Creation of Rectangular Coil



```
/MagneticFieldModels/Coil/SetRout 1.25 m  
/MagneticFieldModels/Coil/SetD1 5 cm  
/MagneticFieldModels/Coil/SetD2 5. cm  
/MagneticFieldModels/Coil/SetL1 3. m  
/MagneticFieldModels/Coil/SetL2 0.01 m  
/MagneticFieldModels/Coil/SetI 1700000. ampere  
/MagneticFieldModels/CreateAParametrizedField Coil Field1
```

Replication of the Coil to produce a Toroid

```
#Replication of Field1  
/MagneticFieldModels/ReplicateField/SelectField Field1  
/MagneticFieldModels/ReplicateField/SetR 3. m  
/MagneticFieldModels/ReplicateField/SetPhi0 90. degree  
/MagneticFieldModels/ReplicateField/SetdPhi 7.2 degree  
/MagneticFieldModels/ReplicateField/SetNCopies 50
```



Cylindrical parameterisation for regular navigation

by Pedro Arce Dubois

Solution

1. Extend G4PhantomParameterisation for cases where voxels do not form a box and do not fill completely the mother volume
 - Option 1: do not allow discontinuous geometries (no empty voxel between two filled voxels)
 - Option 2: allow discontinuous geometries

Option 1 faster and less memory than option 2

- *Extension will be included in release 9.4*
- *Will have performance penalty implications vs. box-based geometry*

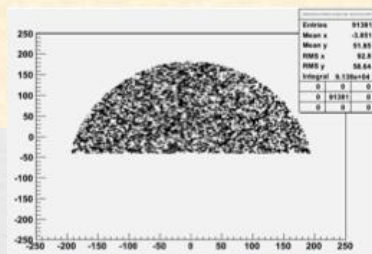
Tests

2. Implement a tool that calculates automatically the intersection between a DICOM geometry and any volume created 'ad hoc' by Geant4 geometry or created 'ad hoc' by

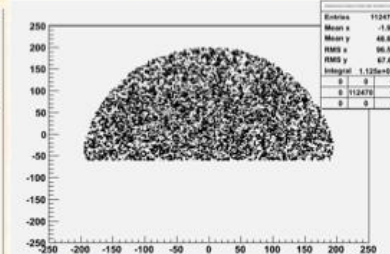
Intersect with a rotated cylinder

```
/gamos/readDICOM/intersectWithUserVolume 0. 0. 0. 45.*deg 0. 0. TUBE 0. 200. 100.
```

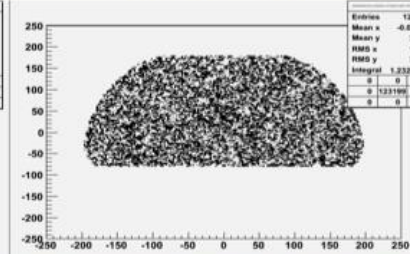
-100 < Z < -80



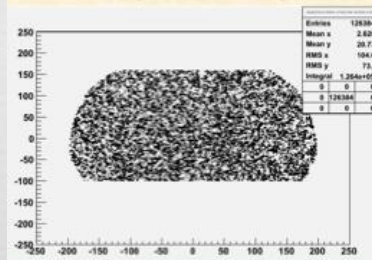
-80 < Z < -60



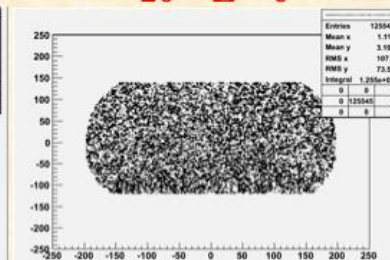
-60 < Z < -40



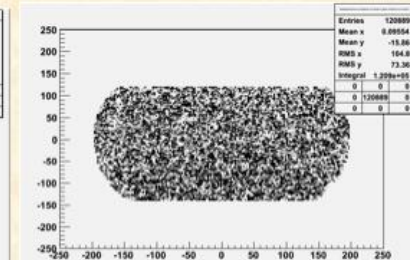
-40 < Z < -20



-20 < Z < 0



-0 < Z < 20



Layered mass geometries

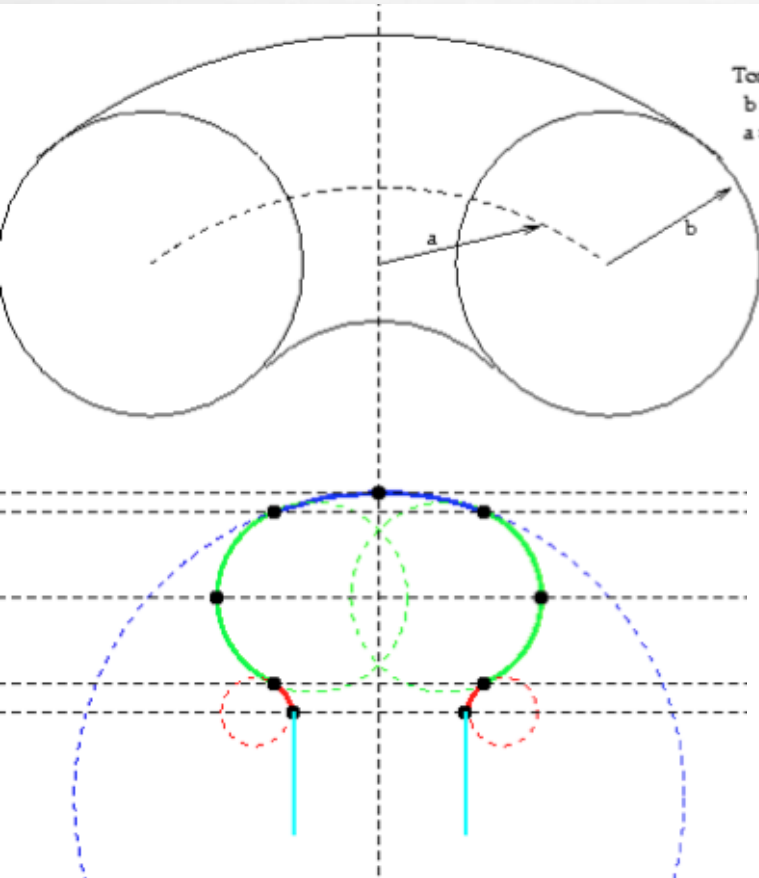
by Shrin Enger



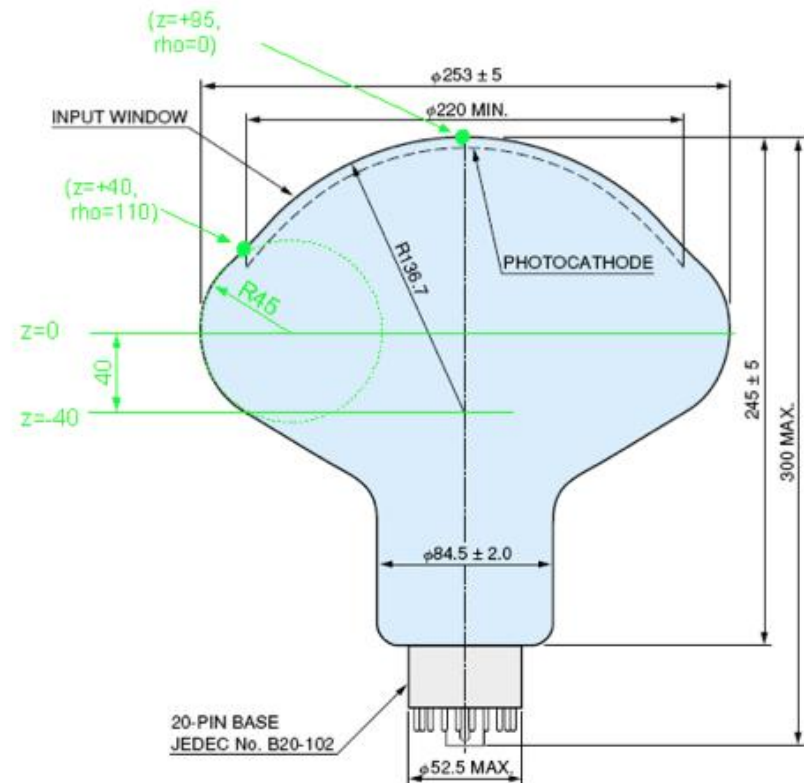
- ❧ Extension of parallel geometry
 - ❧ Priority to have the choice to travel in the main or parallel geometry
 - ❧ For example when applicator/seed/ion chamber are described with a parallel geometry and the particle is inside the applicator/seed/ion chamber it should be given the highest priority and therefore use the cross section from the material it is traveling through
- *Use-case also in HEP (support structures, simplified tracking geometries)*
- *Evaluate suitability/adaptation of current technique used for fast parameterisation*

A new shape: G4TorusStack

by Peter Gumplinger



- *Original work contributed from KamLAND simulation*
- *Issues for maintenance and complexity*



- *Agreed to perform basic testing to verify precision & correctness*

Open Discussion



1. Identification of the first/last step in a volume for curved tracks
 - Agreed to resolve outstanding issues in dedicated work meetings among geometry/tracking experts

2. Electromagnetic Field & Eloss/MSD processes
 - A first implementation (non optimised) of a precise ComputeSafety() will be available in release 9.4

3. Accuracy in updating of the safety in G4SteppingManager
 - Pre/PostStepPoint safety ambiguity
 - Addressed in architecture review. Agreed to raise priority for consideration by the architecture team