Parallel session VIII

Kernel

Three talks

- Reverse Monte Carlo in Geant4
  - Laurent Desorgher
- Parallel Navigation
  - John Apostolakis
- BREPS solids construction by surfaces of extrusion & revolution
  - Gabriele Camellini

Reverse MC in Geant4 : Status

L. Desorgher , M. Verderi , M. Asai
1. SpaceIT GmbH, Bern
2.Ecole Polytechnique, Paris
3. SLAC

Implementation of Reverse Monte Carlo in Geant4 and GRAS

Reverse Tracking from the Boundary of the sensitive region to the External source.

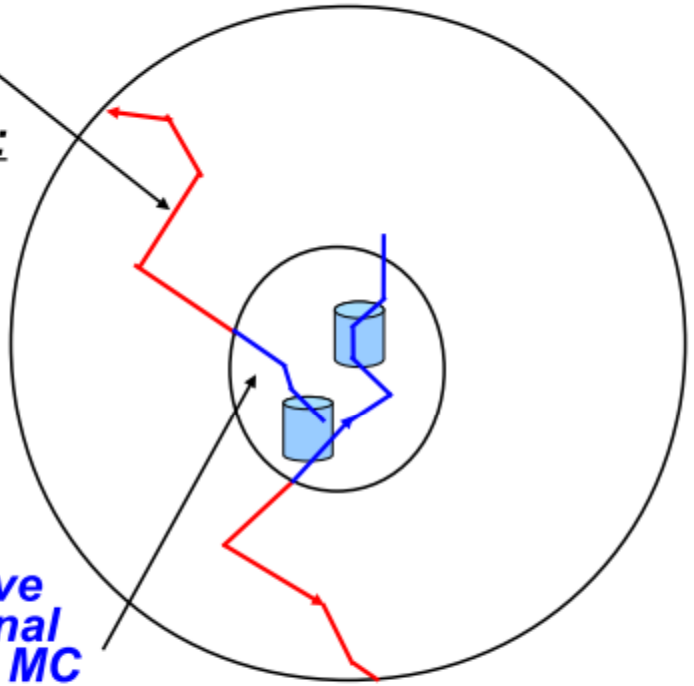
Implemented Reverse Processes:

e-, proton, and ion ionisation

e- bremsstrahlung

Compton scattering

Photo-electric effect



Forward Tracking trough the sensitive region to compute the detector signal with the same code than in a forward MC simulation.

Computing time focused on tracks that contribute to the detector signal

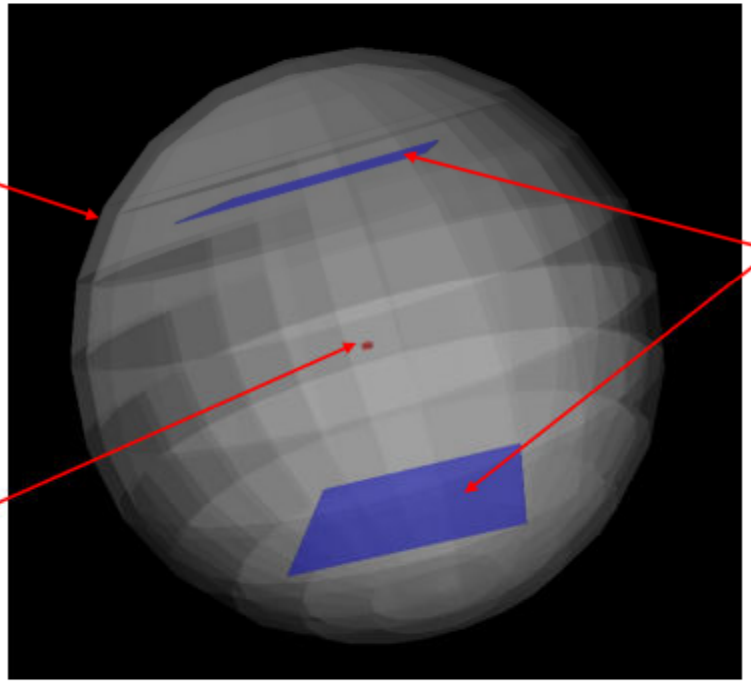
Fast dose computation in Space

Development of this year

- **Correct for a bug in photo-electric-> put a limit in CS**
- **Add weight correction after energy gain**
- **Develop alternative weight correction schema**
- **Implementation in GRAS** p
- **Implementaion of reverse proton and ion ionisation**

Simple Example : Energy deposited by e- and protons in a small sensitive Cylinder surrounded by a large aluminum shielding

Spherical Al shielding
Radius 10 cm
Thickness 5 mm

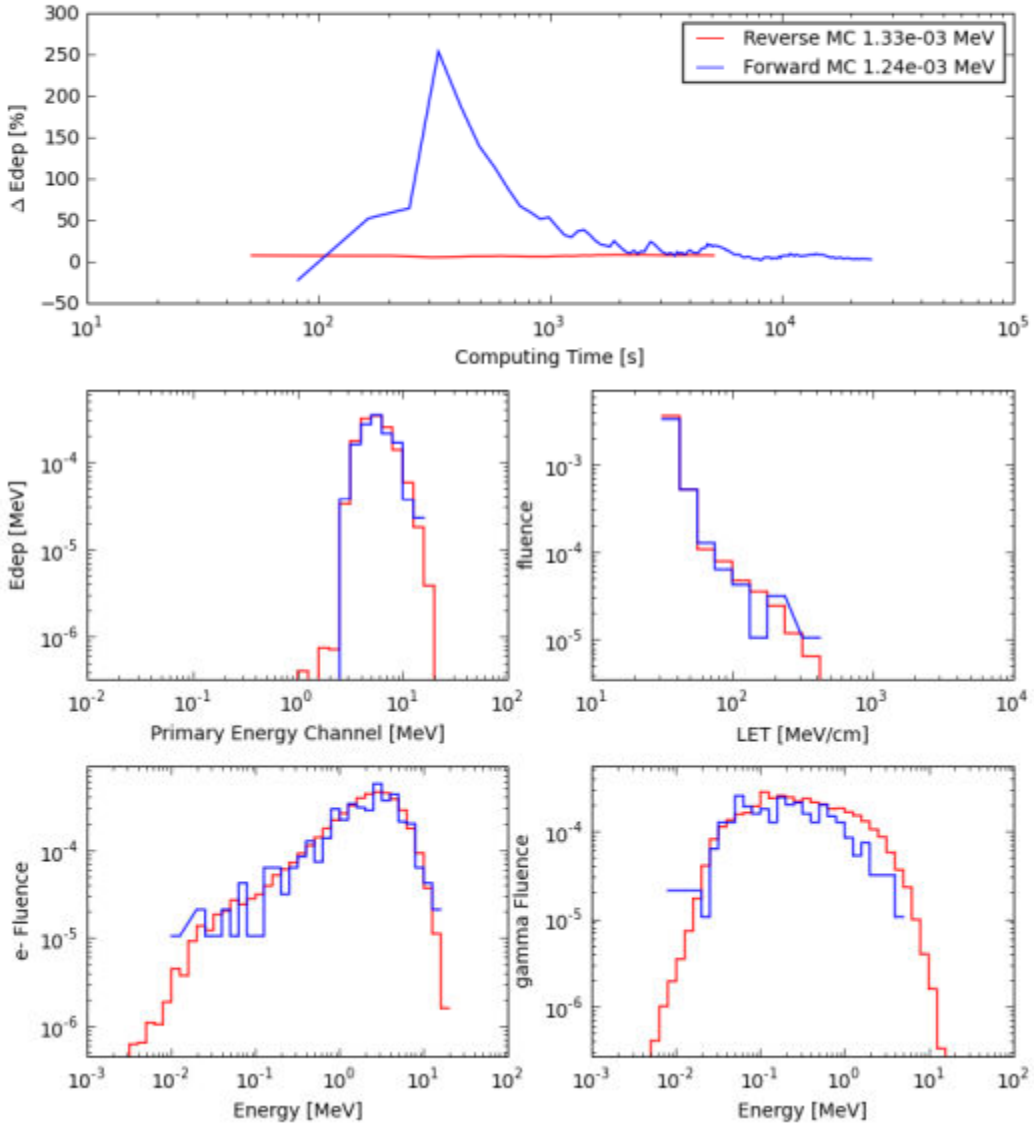


Tantalum plates
0.5mm Thick

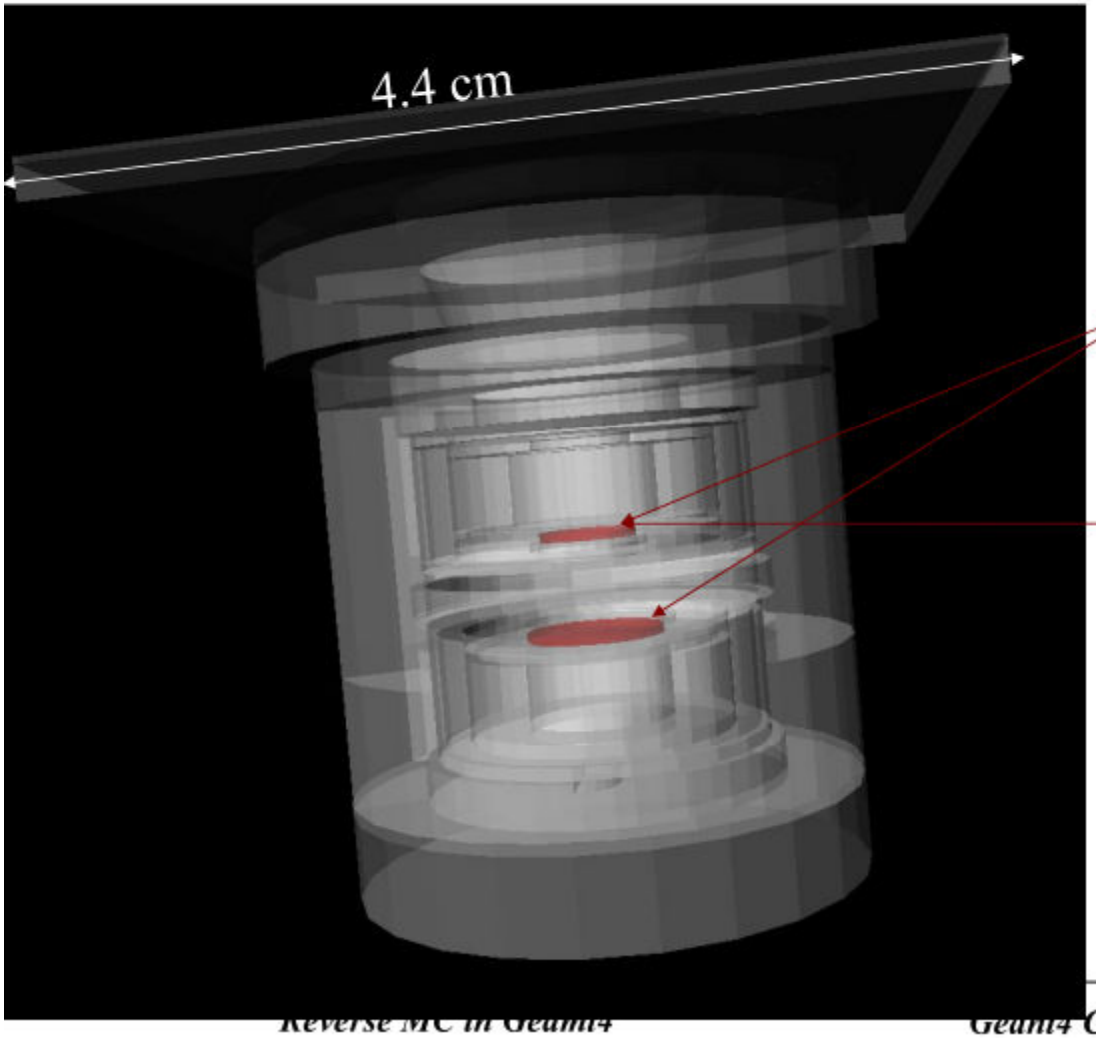
Small Si Sensitive Cylinder
Radius 1mm
Height 1 mm

External Spherical source
Radius 10 cm
Primary Particles e- and protons [1 keV, 100 MeV]
Isotropic

Comparison Reverse and forward MC simulation e- case (exp(-E/2MeV) spectrum)



Test with part of the ESA SREM Detector

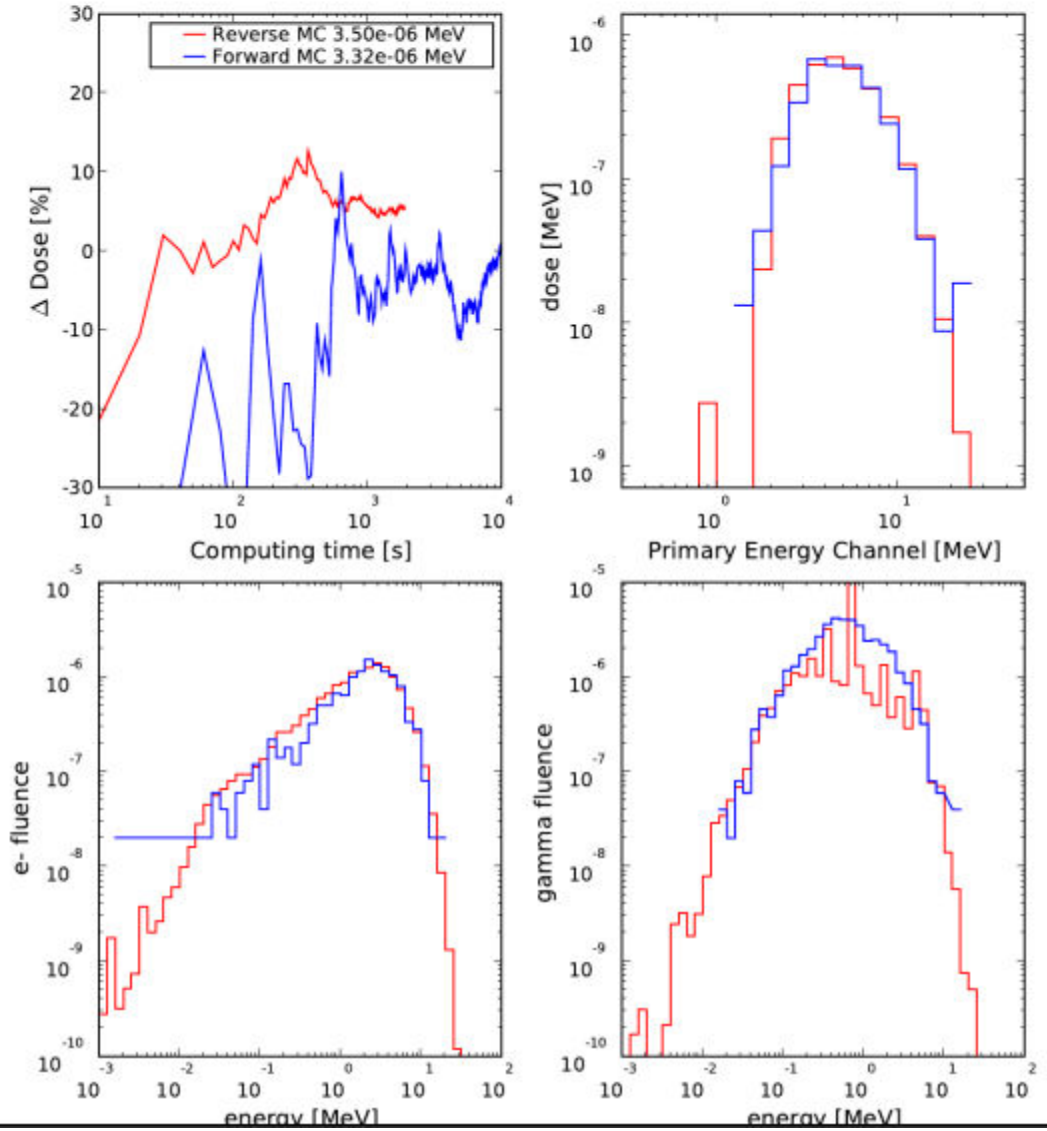


Silicium diodes surrounded by Al and Ta shielding

In this example we compute :

- the dose in the top diode
- the flux of secondaries on the top diode

Comparison Reverse and forward MC simulation e- case (exp(-E/2MeV) spectrum)



Future work

- **Release in Geant4.9.3**
  - **Update simple example + documentation (pdf ?)**
- **Further development in physics model**
  - **Improve the Multiple scattering**
  - **Bremstrahlung → Implement Secondary Spectra from Seltzer and Berger**
  - **Basically all process coming up with a differential cross section or a secondary analytical spectrum could be implemented**

Parallel Navigation

J. Apostolakis

Background

- Parallel Navigation allows the tracking of tracks in multiple geometries simultaneously. Applies
  - 'Straight' tracks (neutral or not in field)
  - Curved tracks (charged in field)
- Several classes involved at each step
  - G4CoupledTransportation
  - G4PathFinder (multiplexes for straight tracks)
  - G4PropagatorInField (charged only, +classes below it)
  - G4MultipleNavigator (charged only)

Plans

- Identify the source(s) of current problems
  - Typically it takes 2-4 days of sustained effort to identify the source of a bug.
- Timescale
  - As soon as possible

BREPS solids construction by surfaces of extrusion & revolution

Gabriele Camellini

CERN – PH-SFT – Geant4 team

20 October 2009

14th Geant4 Users and Collaboration Workshop,

Catania, Italy, 15-22 October, 2009

Swept Surfaces

(Generalized Cylinder)

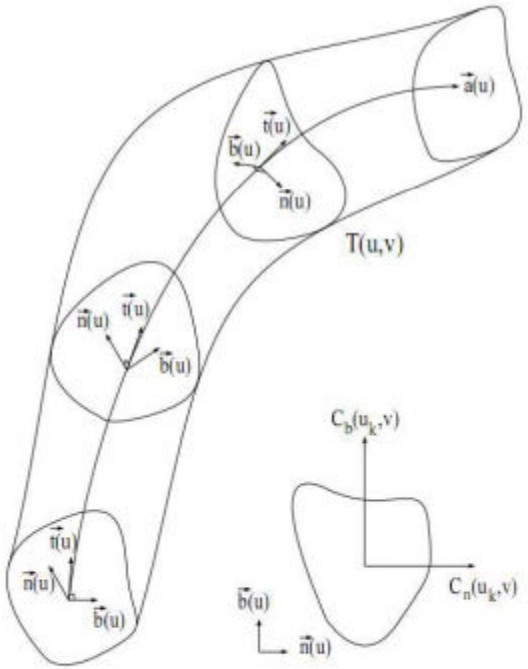
✓ **Swept surfaces** are generated by moving a 2D curve along a trajectory in 3D space.

✓ **Curve** can also change its shape and orientation during sweeping.

✓**Generalized cylinder** is the shape generated when a 2D contour is swept along a 3D trajectory.

✓ **Contour** define the cross-section of the object.

✓**Trajectory** is the axis of the object.

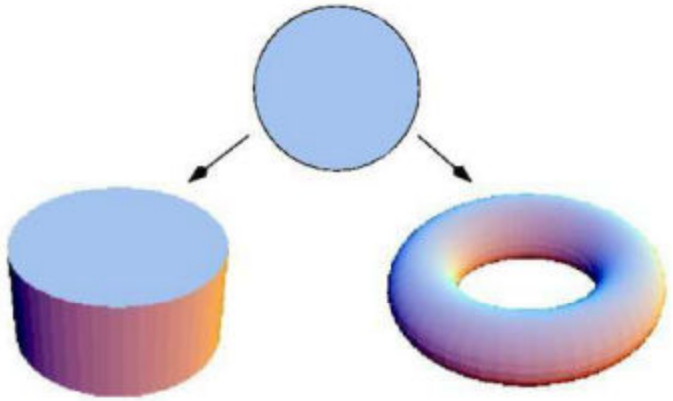


Surfaces of revolution & linear extrusion

✓ In the geometrical modelling, like Computer-Aided Desing, are commonly used only two kinds of generalised cylinders

✓ These solids are obtained by extrusion or revolution of 2D contour.

✓ For define these solids it's necessary use the corresponding surfaces.



✓ Definition of swpet surface by generic curves can generate a surfaces with inifinite extension.

✓ In this case, for generate a solids, is necessary trimming the surface along the swept direction and also should be limited the 2D curve by definition of the bounds.

Surface of linear extrusion

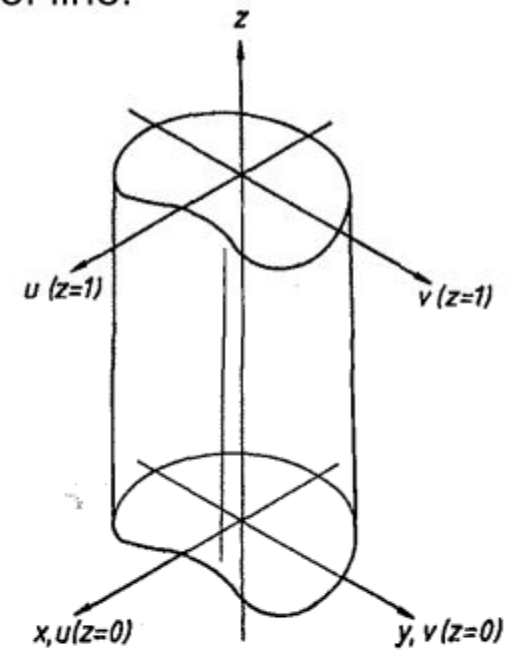
It's generated by a 2D contour swept along a segment of line.

$$\sigma(u,v) = \lambda(u) + vV$$

- ✓ $\lambda(u)$ parametrization of the swept curve
- ✓ V extrusion direction
- ✓ $-\infty < v < +\infty$ parametrization range

In current implementation

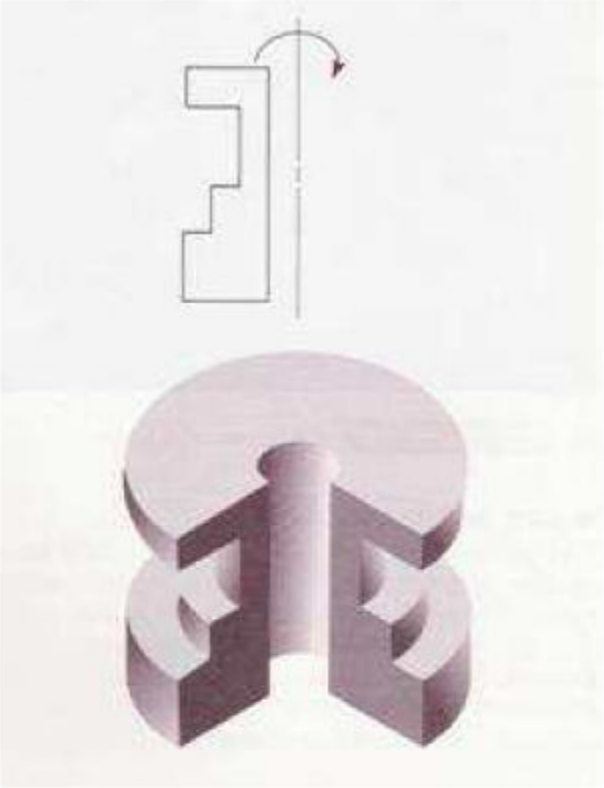
- ✓ 2D swept curve is defined on a ortogonal plane to extrusion axis and need be closed
- ✓ z axis rapresents extrusion direction



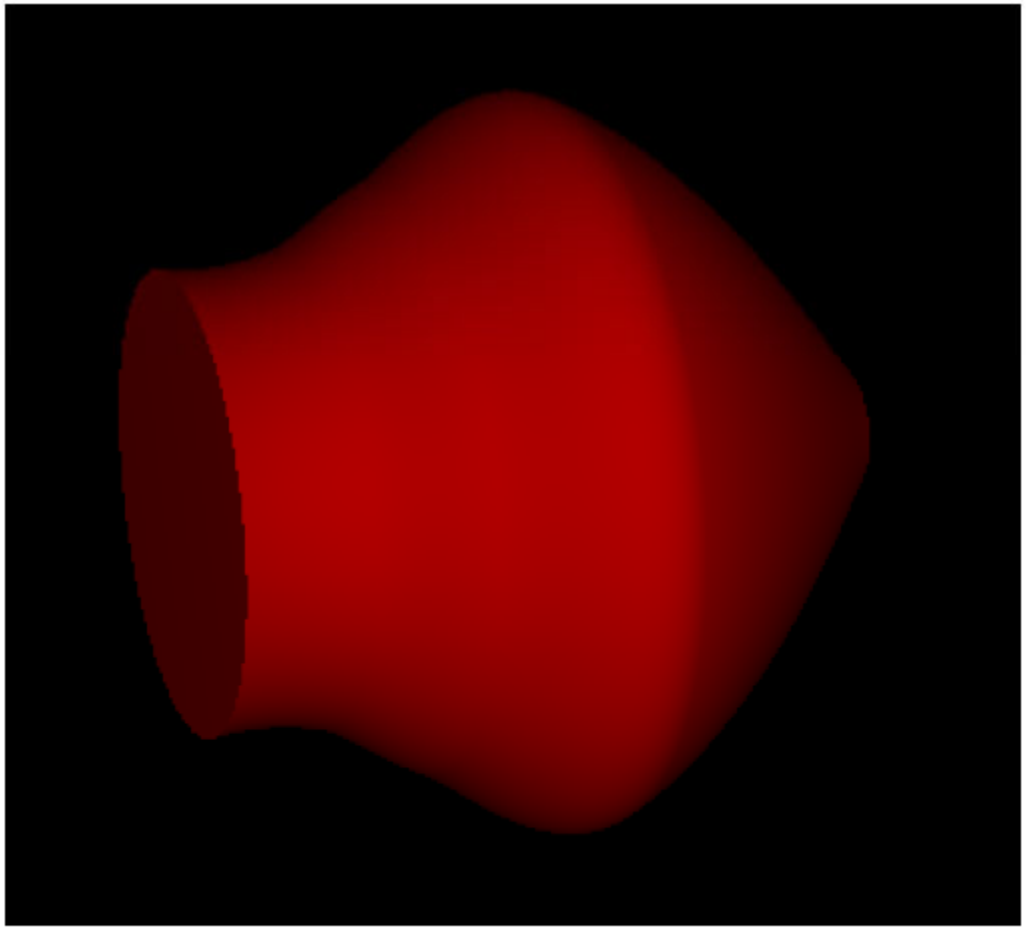
G4SurfaceOfLinearExtrusion (const &G4Curve curve, G4double length)

Surface of revolution

- ✓ It's generated by a 2D contour swept along a circular trajectory
- ✓Equivalently the solid can be generated by rotation of the 2D contour around an axis.
- ✓ If the base curve isn't closed (usual case), it's alway possibile generate a solid by adding two circular planar surface for the bottom and the top of the solid.



Example



Conclusions

Actual implementation

✓ **Linear extrusion for base curves**

✓ **Surfaces of revolution (not complete for bspline curves)**

Incoming

✓ Tangent computation for BSpline

✓ Alternative technique for compute ray - revolution surfaces intersection by binary subdivision of bo

Future work

✓ **Diagonal extrusion**

✓ **Conical extrusion**

✓ **Extrusion along an arbitrary curve**

✓ **Revolution suface limitated by phy section**