

C++ and Workshop – WG4

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Outline

C++ Interface... Interface... Interface...

- C++ GarfieldMainFrame (3rd attempt!!!)
- New Garfield in C++ for MPGD (the future)
- Geant4 Parameterization Framework (example)

- Plan for an RD51 'Software School'

- Summary

C++ GarfieldMainFrame

First version 2008 by Rob Veenhof

- C++ GarfieldMainFrame
- Basic C++ wrapper of Fortran code
- Basic objects (wires and planes)
 - cell = new Cell();
 - dl = new DriftLine();
 - track = new Track();
- To allow interface with **ROOT (?)**
- Objects for **Geant4 (!)**
- **GarfieldMainFrame not maintain and obsolete**
Need to consolidate in future with C++ (next)

C++ GarfieldMainFrame

First version 2008 by Rob Veenhof

The screenshot shows the Garfield 10 software interface. The main window displays a contour plot titled "Contours of V" for "Cell: Cell 0". The plot shows the electric potential V as a function of position (x and y in cm). The x-axis ranges from -1.1 to 0.1 cm, and the y-axis ranges from -2.2 to 0.2 cm. The potential contours are concentric and centered around a point near (0, 0). The plot is overlaid on a grid.

The "Cell update" dialog box is open, showing the following settings:

- Identifier: Cell 0
- Field source: Wires, planes and periodicities
- Coordinate system: Cartesian
- Wires table:

Label	Number	d [cm]	x [cm]	y [cm]	V [cm]	w [g]	l [cm]	rho [g/cm3]
H	1	0.001	1*1	1*1	1*1000	1	1	1

Periodicities:

- Periodicity in x
- Periodicity in y

Plane descriptions:

- Lower x plane
- Lower y plane
- Upper x plane
- Upper y plane

Coordinates and labels for planes:

- Lower x plane: Coordinate: -1, Voltage: -1000, Label: A
- Lower y plane: Coordinate: -2, Voltage: -1000, Label: B

The "Field plot" panel on the right shows the function "V" and the range "21". The "Cell update" dialog has "OK" and "Apply" buttons.

New Garfield in C++ for MPGD

Heinrich Schindler and Rob Veenhof

- In development (hopefully more soon)!!!
- Totally **new** C++ code specific for MPGD
- More robust
- Need to consolidate C++ platform

Objects:

AvalancheMC or AvalancheMicroscopic

ComponentFieldMap

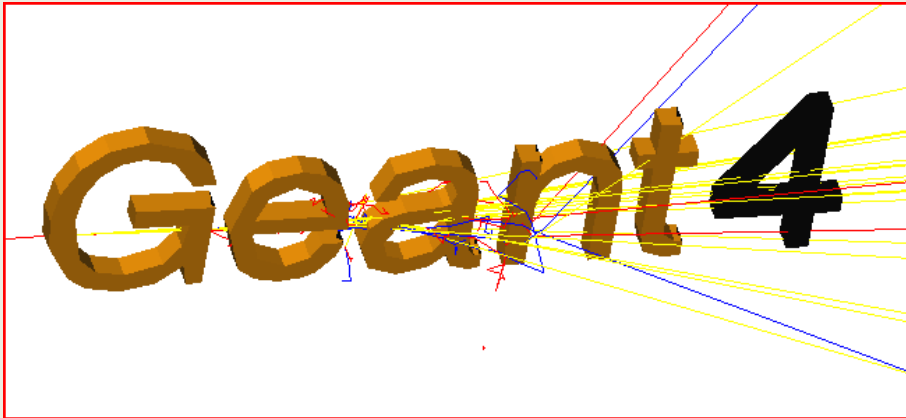
New Garfield in C++ for MPGD

Heinrich Schindler and Rob Veenhof

Allow specific study of MPGD:

- Field calculation (100 micron scale)
- Gas properties
- Calibration
- Understanding small scale physics
- Generic charge collection, transport and gain
- Avalanche, signals etc...
- Several application domains

Interface to Geant4



For the design of complex and large scale detectors

Strengths:

- Detector Construction/Geometry
- Visualization
- Accessibility
- Lots of built in features

Weaknesses:

- Transport through Gases
 - Accuracy
 - Speed
- Limited support for EM fields
 - Only uniform fields or user entered field maps

Weaknesses severely limit simulations of gas detectors!

The Team

A. Bellerive: Hardcoded (2007)

S. Guindon: Interface with C++ GarfieldMainFrame (2008)

N. Shiell & A. Bellerive: G4 FastSim GarfieldModel (2009)

R. Veenhof: Author C++ GarfieldMainFrame

Heinrich Schindler: New C++ 'Garfiled' code

P. Gumplinger: G4 Consultant (TRIUMF lab)

Plan: Was release in January 2010... Update summer 2010

Allow Garfield to propagate primary and daughter particles in gas volume for Geant4 !!!

- Primary Particle
- Detector geometry
- Visualization



- Primary Particle
- Ionized electron Paths
- Trajectory

Need to create Garfield Simulation in Geant4:

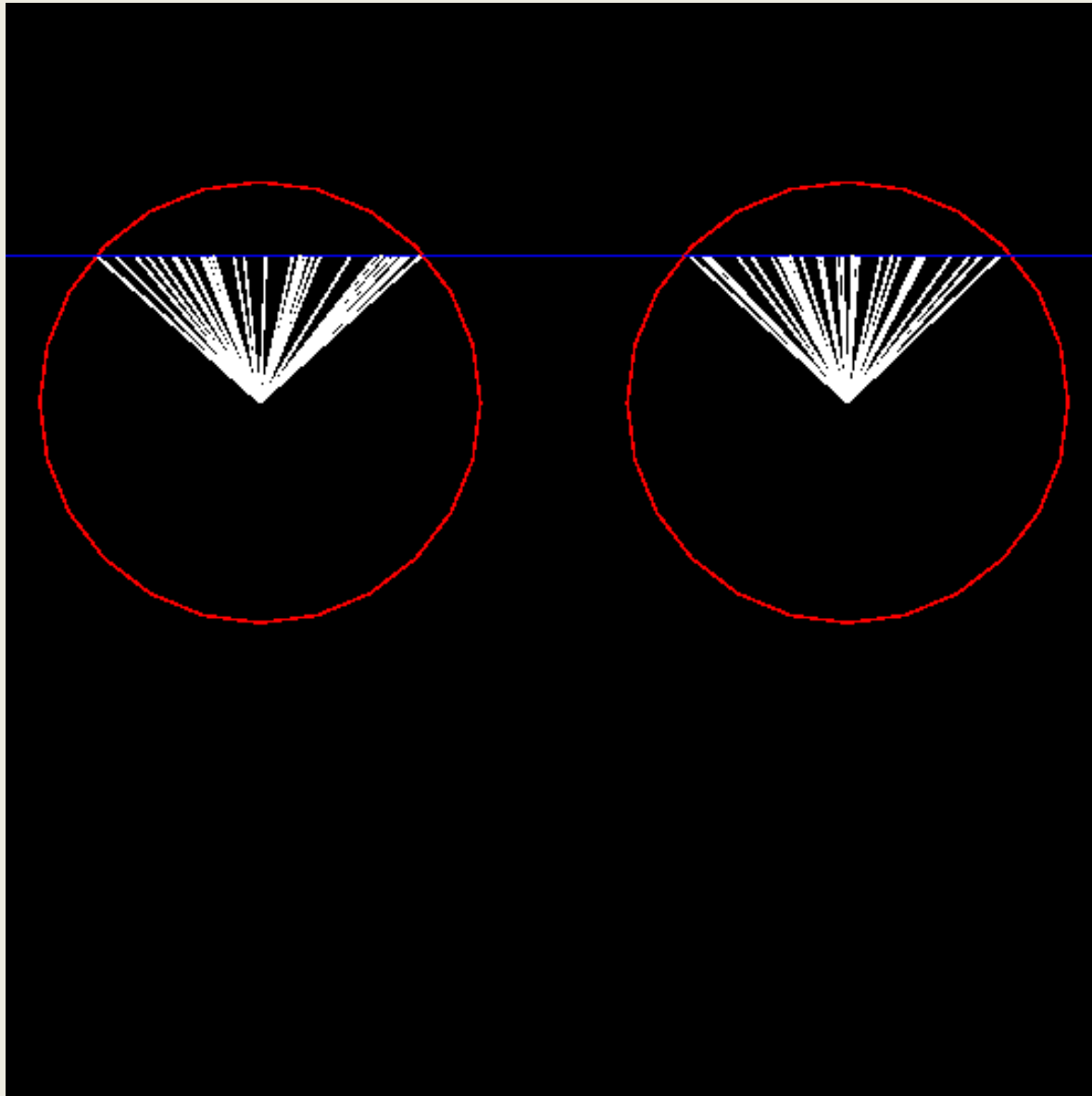
- Cell
- Gas
- DriftLine
- Track

Want to do this using **G4FastSimulationModel**:

- Define constructors
- Define pure virtual functions
 - isApplicable
 - ModelTrigger
 - Dolt

Example: Results

Visualization of Electron Paths in Geant4:



Example: Code!!!

Simple version of the code described in the RD51 talk:

<http://www.physics.carleton.ca/~alainb/G4Parameterizing.pdf>

G4VFastSimulationModel which invokes GARFIELD to propagate a particle when it enters a gas detector.

Get the file at:

<http://www.physics.carleton.ca/~alainb/G4MuonTube.tar.gz>

In your local GEANT directory, create a directory named N02 and copy G4MuonTube.tar.gz in this directory.

All instructions in [G4alainb_README](#)

Summary (C++)

Plan of Activities C++ specific

- Consolidate C++ code... Maintain, distribute, tag, etc...
- Interface with Geant4
 - In place: cell with wires and planes with G4FastSimulation
 - Missing: generic field calculator for any geometry
 - Missing: automatic gas definition properties
 - Merge GarfieldMainFrame in C++ platform
 - Be more MPGD specific (!)
- C++ data analysis platform (test beam)

Simulation and SoftwareWorkshop

Early 2011 (mini-week)

General gas detector physics

Statistical data analysis

Linux

C++

ROOT

GARFIELD (Heed/Maxwell/Margzbolz)

GEANT4

Field calculation and Boundary Element Method

Discharge / Transport

General

for junior
students

Advance

for senior
students

Simulation and SoftwareWorshop

Requirements and open questions

- Invited speakers (pedagogical)
- Prepare examples and lectures
- Linux laptop or fast connection to Ixplus (or fast connection to remote machine)
- Standard software installed (to be defined)
- Survey the 'level' of the workshop (simulation & software)
- Location: at CERN (to be confirmed)
- When : to be defined