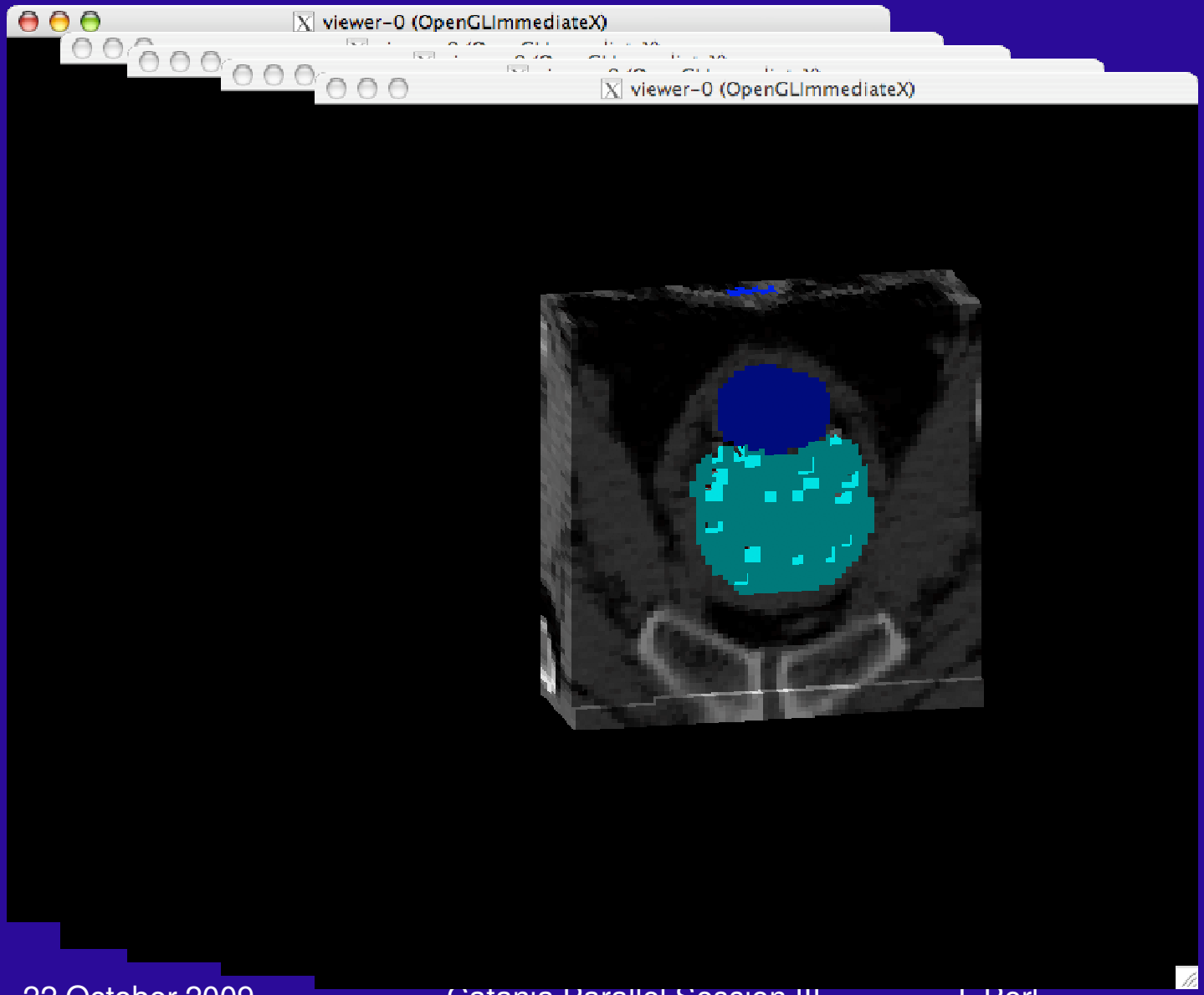
Summary of Parallel Session III

- Performance of Brachytherapy Realistic Application
- Working Session
- Application from Univ. Laval, Luc Beaulieu and Hossein Afsharpour (code originally by Jean-Fancois Carrier)
- An actual prostate patient case including
  - DICOM I/O
  - Model of seeds
- Does not use any parameterization (nested, regular, etc.)
  - Simple G4PVPlacement
- Voxels that include seeds are replaced by seed surrounded by water
- Code is not included in the Geant4 release, but can be shared with any Geant4 expert who is interested in helping to study performance issues
  - Contact Joseph Perl

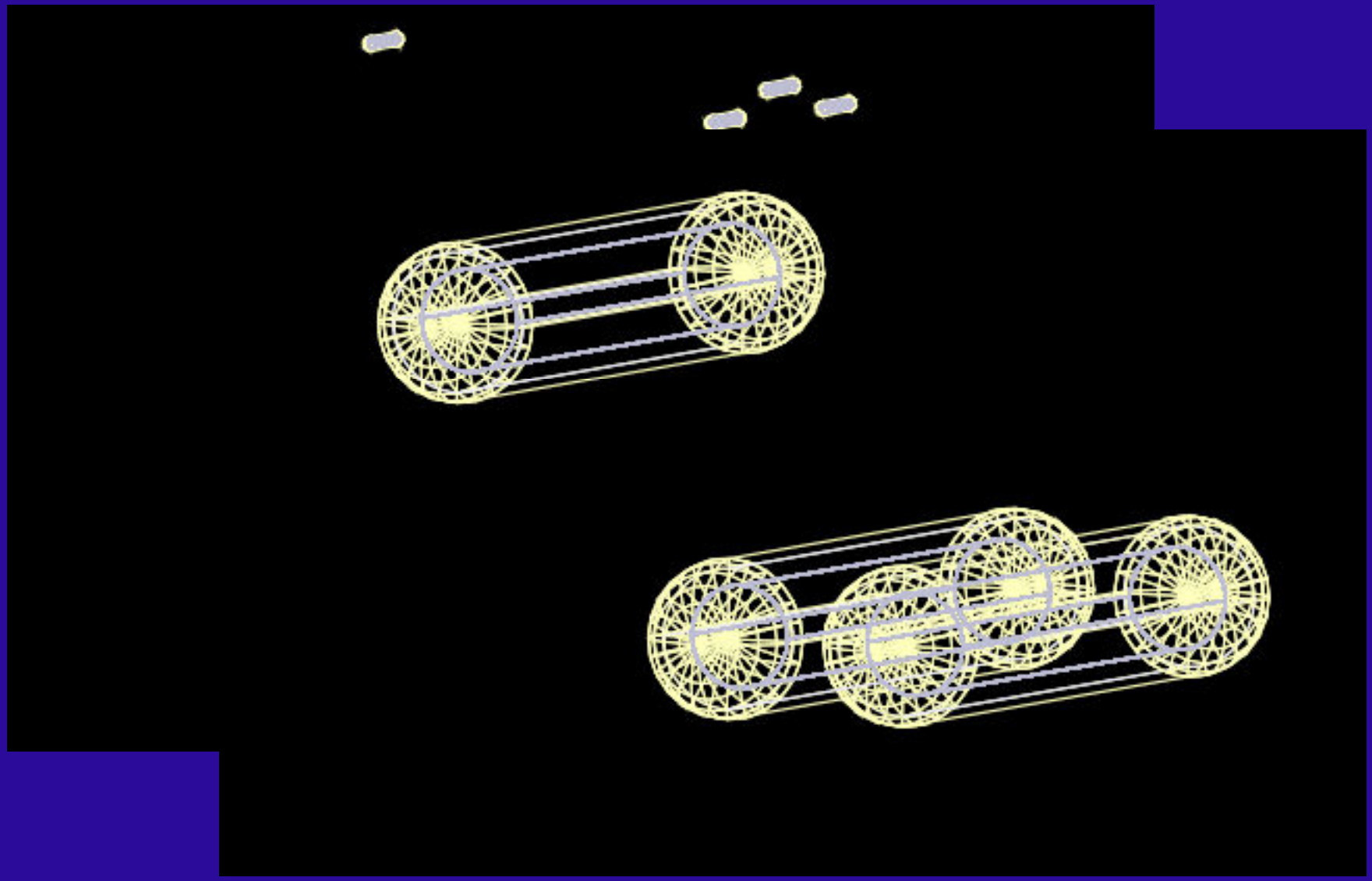
Visualization

Example includes visualization in OpenGL



Seeds

Replaced old specific VisManager with G4VisExecutive to add HepRepFile




00% G4RunManager::DoEventLoop(int, char const*, int)
368% G4EventManager::DoProcessing(G4Event*)
.092% G4TrackingManager::ProcessOneTrack(G4Track*)
6.526% G4SteppingManager::Stepping()
63.127% G4SteppingManager::InvokePostStepDoItProcs()
63.008% G4SteppingManager::InvokePSDIP(unsigned long)
60.837% G4Transportation::PostStepDoIt(G4Track const&, G4Step const&)
57.086% G4Navigator::LocateGlobalPointAndSetup(CLHEP::Hep3Vector const&, CLHEP::Hep3Vector
32.096% G4NavigationHistory::NewLevel(G4VPhysicalVolume*, EVolume, int)
21.319% G4NavigationLevel::G4NavigationLevel(G4VPhysicalVolume*, G4AffineTransform const
16.700% G4NavigationLevelRep::G4NavigationLevelRep(G4VPhysicalVolume*, G4AffineTransfo
16.700% G4NavigationLevelRep::G4NavigationLevelRep(G4VPhysicalVolume*, G4AffineTransf
4.619% G4NavigationLevel::G4NavigationLevel(G4VPhysicalVolume*, G4AffineTransform const
5.527% G4NavigationHistory::NewLevel(G4VPhysicalVolume*, EVolume, int)
3.672% G4NavigationLevel::operator=(G4NavigationLevel const&)
3.198% G4NavigationLevel::operator=(G4NavigationLevel const&)
0.474% G4NavigationLevelRep::~G4NavigationLevelRep()
0.474% G4NavigationLevelRep::~G4NavigationLevelRep()
1.342% G4NavigationLevel::~G4NavigationLevel()
1.342% G4NavigationLevel::~G4NavigationLevel()
0.237% G4NavigationLevelRep::G4NavigationLevelRep(G4VPhysicalVolume*, G4AffineTransform
0.237% G4NavigationLevelRep::G4NavigationLevelRep(G4VPhysicalVolume*, G4AffineTransform
19.858% G4Navigator::LocateGlobalPointAndSetup(CLHEP::Hep3Vector const&, CLHEP::Hep3Vecto
3.119% G4Box::Inside(CLHEP::Hep3Vector const&) const
3.119% G4Box::Inside(CLHEP::Hep3Vector const&) const
1.145% G4PVPlacement::GetCopyNo() const
1.145% G4PVPlacement::GetCopyNo() const
0.553% G4NavigationLevel::G4NavigationLevel(G4VPhysicalVolume*, G4AffineTransform const&,
0.553% G4NavigationLevel::G4NavigationLevel(G4VPhysicalVolume*, G4AffineTransform const&

Timing

Original version

- Release 4.9.2
- Uses the obsolete low energy physics
- 1M Histories takes 30min on Mac laptop

Upgraded to Recent release

- Ref09
- Same obsolete physics models
- Improved LogLogInterpolation, etc.
- 1M Histories takes 25min

Upgraded to new models

- Physics list from Microbeam example recommended by Sebastien
  - except with Range Cut set to 0.1mm as in previous physics list
- 1M Histories takes 16min

But still need to verify dose is same or better

Test for Overlaps

Based on amount of time profiling shows in Navigation, Makoto suspects there is a geometry overlap problem.

Turn on overlap checking by adding optional last argument to G4PVPlacement

- new G4PVPlacement(0,ThePosition,"VoxelPhys",LogVoxelBox,World_phys,true,0);

becomes

- new G4PVPlacement(0,ThePosition,"VoxelPhys",LogVoxelBox,World_phys,true,0,true);
- Remember to remove this later since it makes the code very slow
  - Just something to use for diagnostic purposes

Result of Overlap Test

- Of course Makoto was right

```
*** G4Exception : InvalidSetup
    issued by : G4PVPlacement::CheckOverlaps()
Overlap with volume already placed !
*** This is just a warning message.
Checking overlaps for volume VoxelPhys ...
WARNING - G4PVPlacement::CheckOverlaps()
        Overlap is detected for volume VoxelPhys
        with VoxelPhys volume's
        local point (-0.637978,-0.219319,-0.5), overlapping by at least: 26.084 um

*** G4Exception : InvalidSetup
    issued by : G4PVPlacement::CheckOverlaps()
Overlap with volume already placed !
*** This is just a warning message.
Checking overlaps for volume VoxelPhys ...
WARNING - G4PVPlacement::CheckOverlaps()
        Overlap is detected for volume VoxelPhys
        with VoxelPhys volume's
        local point (0.547984,0.564082,-0.5), overlapping by at least: 99.9797 um
```

Summary

- Good example of the kind of code that is still out there in our user community
  - and these are some of our more dedicated users
- Simply moving to newer physics lists can help users
- Profiling can be easy and informative
- We can expect great improvements in performance of this application