HGCALTB AdePT Integration

Main changes

- CMakeLists.txt

```
27      find_package(Geant4 REQUIRED)
28    endif()
29
30  + if(USE_ADEPT)
31  +   # Find AdePT
32  +   find_package(AdePT)
33  +   add_compile_definitions(USE_ADEPT)
34  + endif()
35  +
36    #----------------------------------------------------------------------
37    # Output pedantic warnings
38    #

50    #
51    include_directories(${CMAKE_CURRENT_SOURCE_DIR}/include
52                        ${Geant4_INCLUDE_DIR}
53  +                     ${FLUKAInterface_INCLUDE_DIR})
54  + if(USE_ADEPT)
55  +   include_directories(${CMAKE_CURRENT_SOURCE_DIR}/adept_integration/include ${AdePT_INCLUDE_DIRS})
56  + endif()
57  +
58    file(GLOB sources ${PROJECT_SOURCE_DIR}/src/*.cc)
59    file(GLOB headers ${PROJECT_SOURCE_DIR}/include/*.hh)
60  + if(USE_ADEPT)
61  +   list(APPEND sources ${PROJECT_SOURCE_DIR}/adept_integration/src/FTFP_BERT_AdePT.cc)
62  +   list(APPEND headers ${PROJECT_SOURCE_DIR}/adept_integration/include/FTFP_BERT_AdePT.hh)
63  + endif()
64
65    #----------------------------------------------------------------------
66    # Add the executable, and link it to the Geant4 libraries
67    #
68    add_executable(HGCALTB HGCALTB.cc ${sources} ${headers})
69    target_link_libraries(HGCALTB ${Geant4_LIBRARIES} ${FLUKAInterface_LIBRARIES})
70  + if(USE_ADEPT)
71  +   target_link_libraries(HGCALTB ${AdePT_LIBRARIES})
72  + endif()
73    set_target_properties(HGCALTB PROPERTIES CXX_STANDARD 17)
74
75    #----------------------------------------------------------------------

85        HGCALTBrun.mac
86        HGCALTBfullrun.mac
87      )
88  + if(USE_ADEPT)
89  + list(APPEND HGCALTB_SCRIPTS HGCALTBrun_adept.mac)
90  + endif()
91
92    foreach(_script ${HGCALTB_SCRIPTS})
93      configure_file(
```

Main changes

- Added a G4VModularPhysicsList that registers the AdePT Physics constructor

- Application main()

```
G4VUserPhysicsList *physicsList;
#ifndef USE_ADEPT
  physicsList = physListFactory->GetReferencePhysList(custom_pl);
#else
  if(adept)
    physicsList = new FTFP_BERT_AdePT();
  else
    physicsList = physListFactory->GetReferencePhysList(custom_pl);
#endif
runManager->SetUserInitialization(physicsList);
```

Main changes

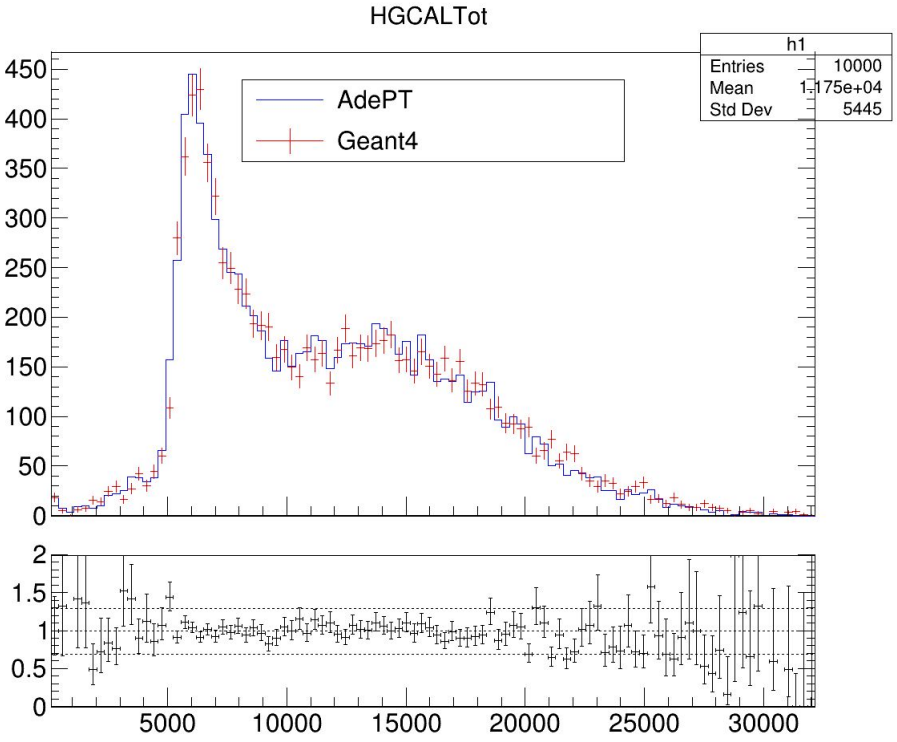
- We found out that we need to do some manual initialization of regions and material-cut couples in the Detector Construction.

- This shouldn’t be necessary in principle, it is probably related to where AdePT is initialized and it will be fixed.

```
// - REGIONS
if (worldPV->GetLogicalVolume()->GetRegion() == nullptr) {
  // Add default region if none available
  // constexpr double DefaultCut = 0.7 * mm;
  auto defaultRegion = G4RegionStore::GetInstance()->GetRegion("DefaultRegionForTheWorld");

  defaultRegion->AddRootLogicalVolume(worldPV->GetLogicalVolume());
}
for (auto region : *G4RegionStore::GetInstance()) {
  region->UsedInMassGeometry(true); // make sure all regions are marked as used
  region->UpdateMaterialList();
}
// - UPDATE COUPLES
G4cout << "Updating material-cut couples based on " << G4RegionStore::GetInstance()->size() << " regions .
G4ProductionCutsTable *theCoupleTable = G4ProductionCutsTable::GetProductionCutsTable();
```

Some validation data



Performance results

- We only did a few quick tests

- The performance doesn’t seem great with this application, going from 0.5 speedup when shooting 20GeV pi+ to around 1.08 with 300GeV pi+