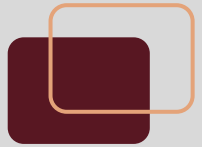


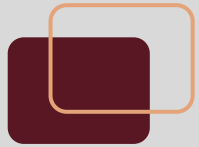
HDGeant4 development update

Richard Jones – University of Connecticut

- integration with JANA
- validation of tracking in magnetic field
- new event sources (besides particle gun)
- event-level parallelism with geant4.10
- *remaining milestones*

slide from collaboration meeting, Oct 2013

HDGeant4 project: work plan

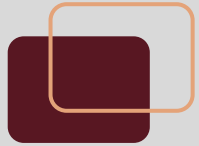


1. Download and install a recent stable release of G4
2. Create a template from one of the standard examples
3. Design classes for geometry import from hdds
4. Implement geometry import from hdds
5. Make a set of scripts to generate some standard views of GlueX
6. Debug the hdds geometry and validate using standard views
7. Implement classes for reading and stepping through magnetic fields

progress so far (10/2013)

8. Configure a robust physics list for GlueX simulations
9. Implement the particle gun event generator
10. Implement Monte Carlo event input from hddm stream
11. Implement and test the internal cobrems generator
12. Create and document standard control macros for a few common scenarios
13. Set up mechanisms for verbose tracking output
14. Implement classes for hits, truth collection and output

HDGeant4 project: work plan



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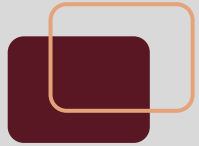
progress as of 5/2015

HDGeant4 project: work plan



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regress as of 5/2015

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9. Implement the particle gun event generator

significant updates required

10. Implement Monte Carlo event input from hddm stream
11. Implement and test the internal cobrems generator
12. ~~Create and document standard control macros for a few common scenarios~~

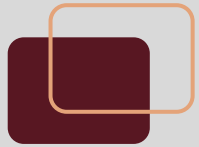
revised

13. Set up mechanisms for verbose tracking output

and validate against hdgeant3

14. Implement classes for hits, truth collection and output

HDGeant4 project: work plan



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regress as of 5/2015

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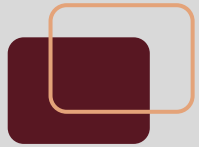
significant updates required

10. Implement Monte Carlo event input from hddm stream
11. Implement and test the internal cobrems generator
12. **Integrate G3-style user simulation options (control.in)**
13. **Implement and test event-level parallelism with G4 version 10**
14. **Use verbose tracking output to validate against hdgeant (G3)**
15. Implement classes for hits, truth collection and output

HDGeant4 project: work plan



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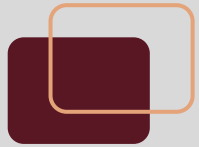
12. Integrate G3-style user simulation options (control.in)
13. Implement and test event-level parallelism with G4 version 10
14. Use verbose tracking output to validate against hdgeant (G3)
15. ~~**Implement classes for hits, truth collection and output**~~

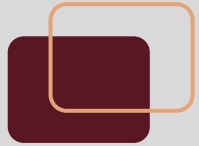
as of 10/2015

HDGeant4 project: work done



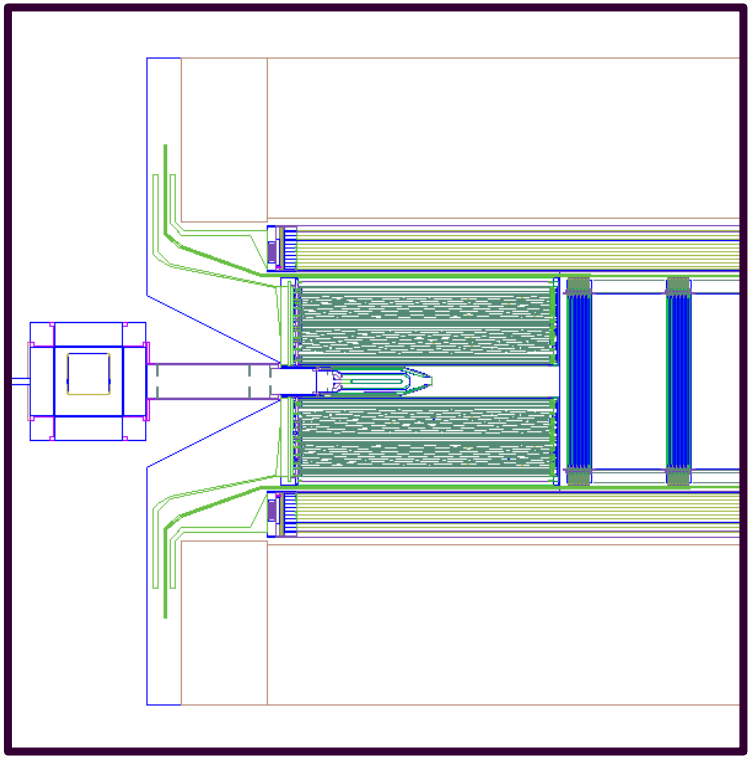
- hdds geometry fixes
- integration with JANA
- validation of tracking in magnetic field
- new event sources (besides particle gun)
- event-level parallelism with geant4.10
- *creation of hits, truth collection and output*

HDGeant4: quick start guide



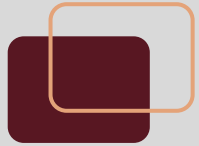
```
$ mkdir myHDGeant4 && cd myHDGeant4
$ git clone git@github.com:rjones30/HDGeant4.git
$ source mysetup.sh  [initialize JANA,G4 environment vars]
$ make
$ cd test
$ hdgeant4 -h
hdgeant4: invalid option -- 'h'

Usage: hdgeant4 [options] [<batch.mac>]
 where options include:
    -v : open a graphics window for visualization
    -tN : start N worker threads, default 1
    -rN : set run to N, default taken from control.in
```

HDGeant4: quick start guide



```
$ hdgeant4 -v
        ###########################################
        !!! WARNING - FPE detection is activated !!!
        ###########################################

************************************************************
 Geant4 version Name: geant4-10-01-patch-02 [MT]   (19-June-2015)
  << in Multi-threaded mode >>
                      Copyright : Geant4 Collaboration
                      Reference : NIM A 506 (2003), 250-303
                            WWW : http://cern.ch/geant4
************************************************************

JANA >>Created JCalibration object of type: JCalibrationCCDB
JANA >>Generated via: JCalibration using CCDB for MySQL and SQLite databases
JANA >>Run:9001
JANA >>URL: sqlite:////home/halld/ccdb/sql/ccdb-07-08-2015.sqlite
JANA >>context: default
JANA >>Reading Magnetic field map from Magnets/Solenoid/solenoid_1200A_poisson_20140520
 Nx=251 Ny=1 Nz=701 )  at 0x396b050
Reading fine-mesh B-field data from
/home/halld/jana/resources/Magnets/Solenoid/finemeshes/solenoid_1200A_poisson_20140520.e
. . .
Idle> /control/execute ../vis/stdviews/z65.mac
```

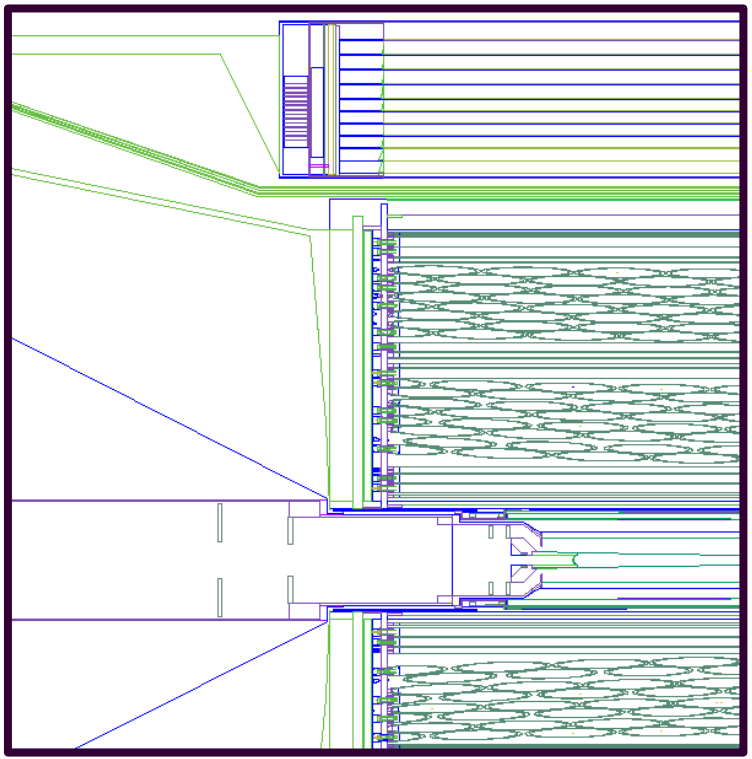
HDGeant4: quick start guide



```
Idle> /tracking/verbose 2
Idle> /run/beamOn 1
### Run 0 start.
G4WT0 > ### Run 0 start.
G4WT0 > ******************************************************************************************************
G4WT0 > * G4Track Information:   Particle = chargedgeantino,   Track ID = 1,   Parent ID = 0
G4WT0 > ******************************************************************************************************
G4WT0 > Step#        X           Y           Z          KineE      dEStep      StepLeng    TrakLeng     Volume      Process
G4WT0 >     0   4.3197 mm  -1.7414 mm   65.048 cm   191.31 MeV       0 eV        0 fm        0 fm       LIH2:1   initStep
G4WT0 >     1   9.6337 mm   2.5575 mm   64.675 cm   191.31 MeV       0 eV   7.7851 mm   7.7851 mm       TGTV:1   Parallel World 1
G4WT0 >     2    9.743 mm   2.6448 mm   64.667 cm   191.31 MeV       0 eV   159.38 um   7.9445 mm       TARG:1   Parallel World 1
G4WT0 >     3   3.1563 cm   1.9288 cm   63.171 cm   191.31 MeV       0 eV   3.1259 cm   3.9204 cm       CYLW:1   Parallel World 1
G4WT0 >     4   3.9714 cm   2.5116 cm   62.625 cm   191.31 MeV       0 eV   1.1413 cm   5.0617 cm    HALL::1:1   Parallel World 1
G4WT0 >     5   3.9722 cm   2.5122 cm   62.624 cm   191.31 MeV       0 eV   11.403 um   5.0628 cm    LASS::1:1   CoupledTransportation
G4WT0 >     6   5.7435 cm   3.7109 cm   61.458 cm   191.31 MeV       0 eV    2.436 cm   7.4988 cm       STRT:1   Parallel World 1
G4WT0 >     7   5.7622 cm   3.7231 cm   61.446 cm   191.31 MeV       0 eV   255.35 um   7.5243 cm       STIC:1   Parallel World 1
G4WT0 >     8   5.8324 cm   3.7687 cm     61.4 cm   191.31 MeV       0 eV   953.29 um   7.6196 cm       STIE:1   Parallel World 1
G4WT0 >     9   5.8686 cm   3.7922 cm   61.377 cm   191.31 MeV       0 eV   491.08 um   7.6688 cm       STIS:1   Parallel World 1
G4WT0 >    10   6.6548 cm   4.2932 cm   60.869 cm   191.31 MeV       0 eV   1.0619 cm   8.7306 cm       STRT:1   Parallel World 1
G4WT0 >    11   6.6583 cm   4.2954 cm   60.866 cm   191.31 MeV       0 eV   46.755 um   8.7353 cm       STAI:1   Parallel World 1
G4WT0 >    12   6.6597 cm   4.2963 cm   60.866 cm   191.31 MeV       0 eV   18.769 um   8.7372 cm       STRC:4   Parallel World 1
G4WT0 >    13    6.914 cm   4.4548 cm   60.702 cm   191.31 MeV       0 eV   3.4123 mm   9.0784 cm       STAO:1   Parallel World 1
G4WT0 >    14   6.9154 cm   4.4556 cm   60.701 cm   191.31 MeV       0 eV   18.767 um   9.0803 cm       STWR:1   Parallel World 1
G4WT0 >    15   6.9578 cm   4.4819 cm   60.674 cm   191.31 MeV       0 eV   568.68 um   9.1371 cm       STRT:1   Parallel World 1
G4WT0 >    16   6.9973 cm   4.5063 cm   60.649 cm   191.31 MeV       0 eV   528.68 um     9.19 cm       STTD:1   Parallel World 1
G4WT0 >    17   7.0016 cm   4.5089 cm   60.646 cm   191.31 MeV       0 eV   56.861 um   9.1957 cm       STRT:1   Parallel World 1
```

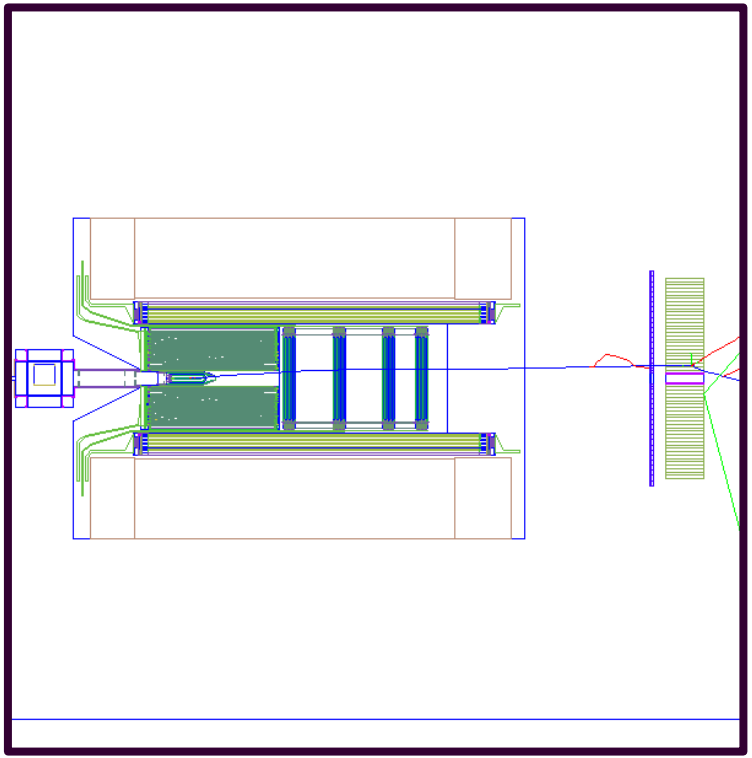
:Richard Jones, GlueX Collaboration Meeting, Newport News, Oct. 8-10, 2015

HDGeant4: quick start guide



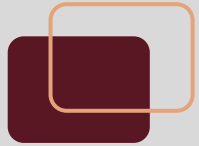
```
Idle> /vis/viewer/update
/vis/viewer/update
Window activated for picking (left-mouse), exit (middle-mouse).
(0.000282113,0.350656,52.8405) found in LIH2 copy 1 of LIH2 with
   complete path: /Parallel World 1:0/HALL:1/TARG:1/TGTV:1/LIH2:1
   layer 1 material: LiqHydrogen
   magnetic field (Tesla): -6.19202e-07,-0.000769645,1.40196

(0.000282113,17.9358,35.9994) found in STLA copy 1 of STLA with
   complete path: /Parallel World 1:0/HALL:1/LASS:1/CDC:1/DCLS:1/STLM:18/STLA:1
   layer 1 material: CDchamberGas
   magnetic field (Tesla): -1.00951e-06,-0.0641812,1.31078

(0.000282113,42.8821,10.01) found in CDRO copy 1 of CDRO with
   complete path: /Parallel World 1:0/HALL:1/LASS:1/CDC:1/CDRO:1
   layer 1 material: SignalCables
   magnetic field (Tesla): -1.72224e-06,-0.261786,1.12881

(0.000282113,77.8479,33.2965) found in BMF7 copy 1 of BMF7 with
   complete path: /Parallel World 1:0/HALL:1/LASS:1/BCAL:1/sd08:12/BCAM:1/BCK7:1/sd0f:1/
   layer 1 material: leadScint
   magnetic field (Tesla): 0,0,1e-96
```

HDGeant4: quick start guide



```
Idle> /control/execute ../vis/stdviews/z65.mac
Idle> /vis/viewer/zoom 0.5
Idle> /vis/viewer/set/targetPoint 0 0 280 cm
Idle> /vis/scene/add/trajectories smooth
Idle> /run/beamOn 1
G4WT0 > >>> Event 1
G4WT0 >     1059 trajectories stored in this event.
G4WT0 > Thread-local run terminated.
G4WT0 > Run Summary
G4WT0 >   Number of events processed : 1
G4WT0 >   User=0.23s Real=0.26s Sys=0.01s
 Run terminated.
Run Summary
  Number of events processed : 1
  User=0.25s Real=0.26s Sys=0.01s
WARNING: 1 event has been kept for refreshing and/or reviewing.
  "/vis/reviewKeptEvents" to review them.
Window activated for picking (left-mouse), exit (middle-mouse).
```

HDGeant4: *status and outlook*



- geometry, fields and event sources fully implemented
- event-level parallelism now works with Geant 4.10
- project freely available for checkout on github
  - build works on centos 6, *standard distro*
  - user beware -- pre-alpha release
  - check it out and try it!
- hits prototype under construction
  - not yet checked in
  - cdc will be released first
  - work continues in parallel with other efforts