

Reference Manual

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1. Overview

1.1. Structure

Based on the source files registered to GitLab, GitLab-CI builds and generates Geant4 program (Fig. 1.1). Users can view and access the program through the web browser.

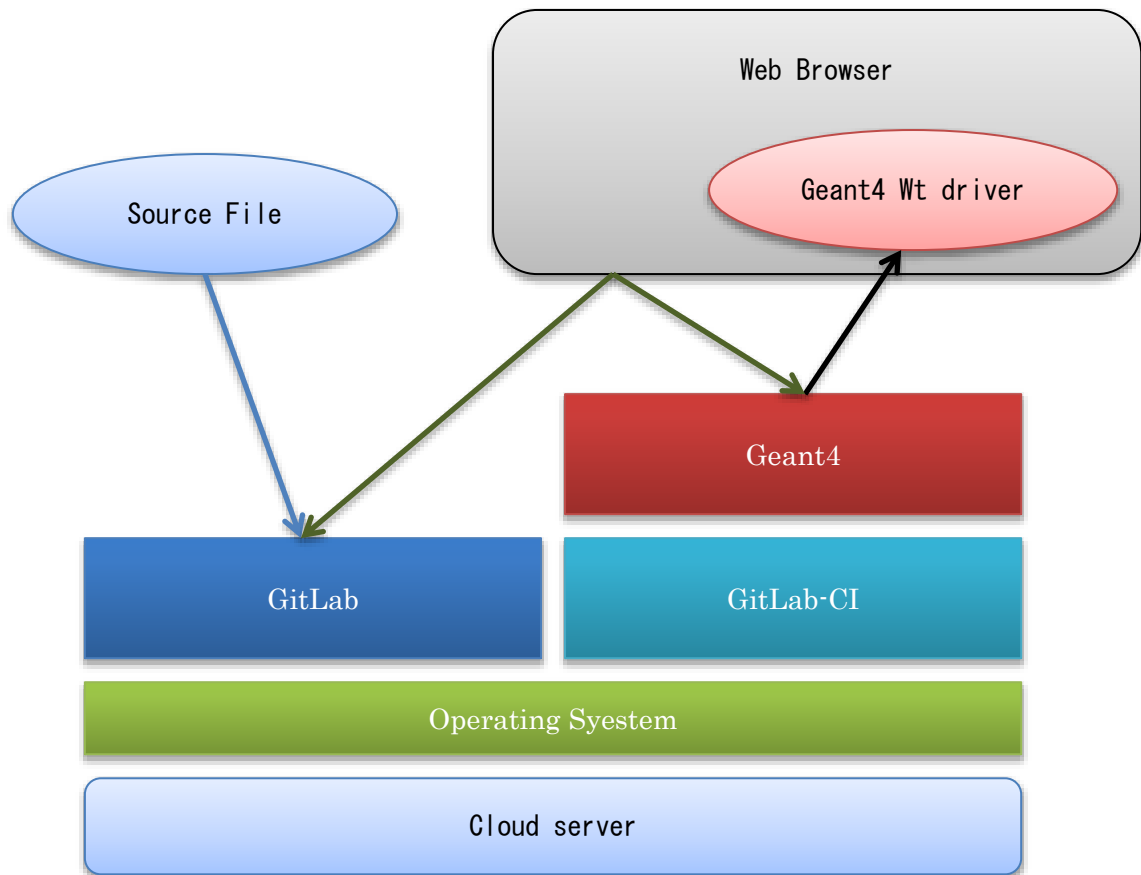


Fig. 1-1

2. How to use

2.1. Access and Sign in/out

Access the URL <https://is4.muographers.org/gitlab>

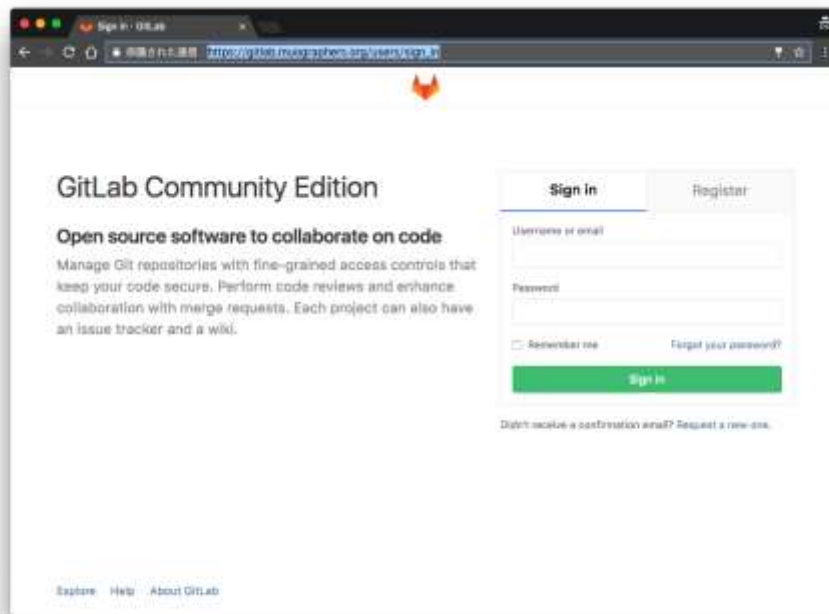


Fig. 2-1. Sign In

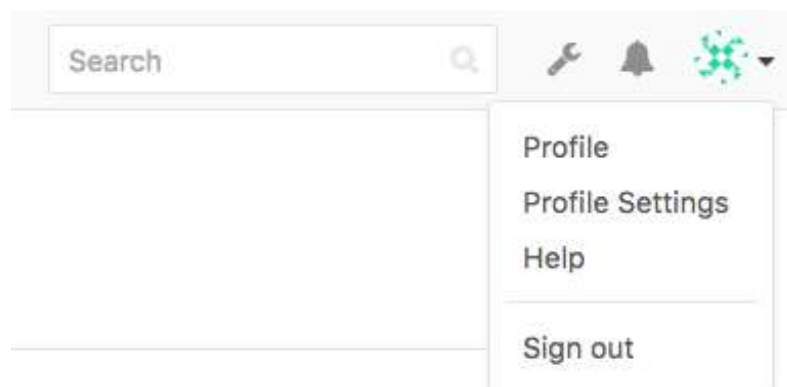


Fig 2-2. Sign Out

2.2. Building Projects

There are two ways to build a project:

- (A) Building a project based on the existing project (Fork) , and
- (B) Building a new project.

2.2.1. Fork of projects

In order to search existing projects, on the top screen, select Explore Project→ All.

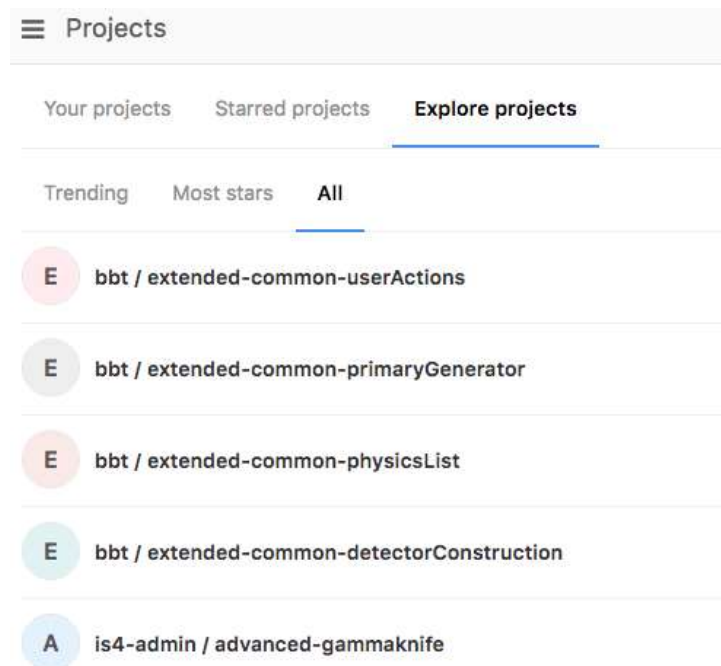


Fig 2-3. Existing projects

On the top screen of the chosen project, select the attribution of the project (user or group) by pressing the Fork button.



Fig. 2-4. Fork button

Fork project

A fork is a copy of a project.

Forking a repository allows you to make changes without affecting the original project.

Click to fork the project to a user or group



Fig. 2-5. Selection of the project attribution

The project was successfully forked.

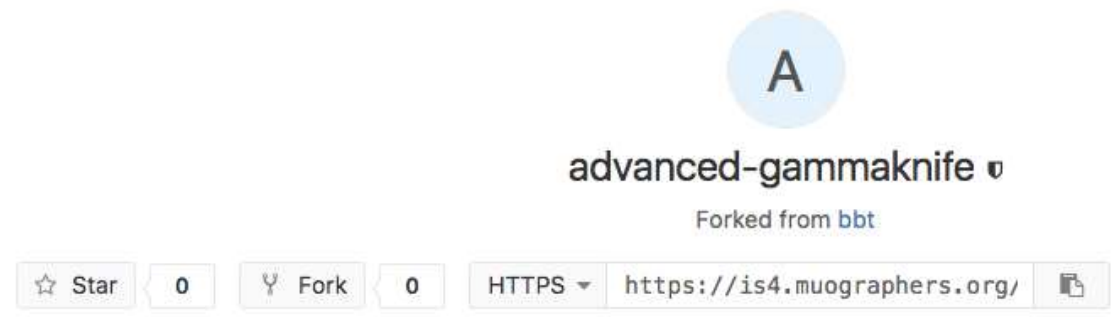


Fig. 2-6. Forked project

2.2.2. New Project

In order to create a new project, press 'New Project' button after signing in.

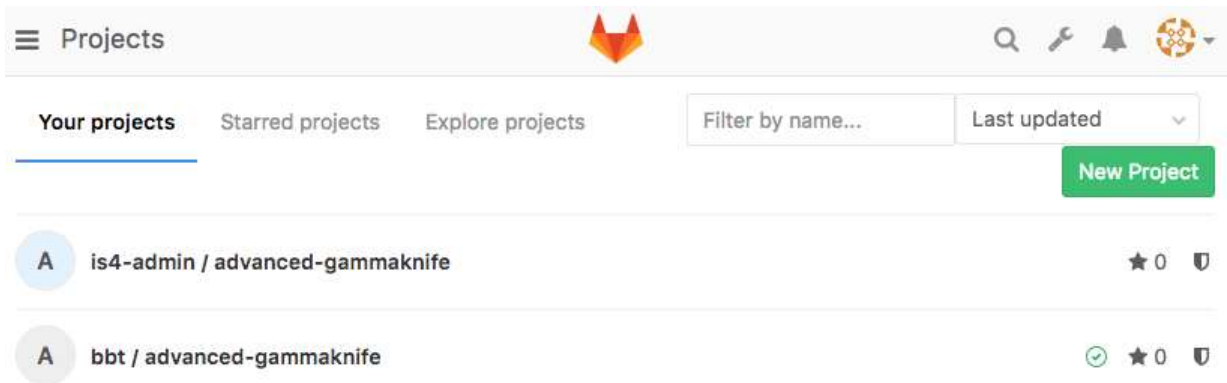


Fig. 2-7. Screen after signing in

On the page of 'New Project', set the attribution, name, and exposure level of the project, and press 'Create project' button.

New project

Create or Import your project from popular Git services

| Project path | Project name |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <input type="text" value="https://is4.muographers.org/gitlab/"/> <input type="text" value="is4-admin"/> | <input type="text" value="my-awesome-project"/> |

Fig. 2-8. Attribution and the name of the project

There are 3 different levels for exposure.




-  **Private**
Project access must be granted explicitly to each user.
-  **Internal**
The project can be cloned by any logged in user.
-  **Public**
The project can be cloned without any authentication.

Fig. 2-9. Exposure level of the project

2.3. Edit the source file

There are two ways to edit the source file: (a) edit on the web browser, and (b) edit on the local PC by making a clone with a git and push commands.

The explanation of the git command is described at the following URL.

<https://git-scm.com/book/ja/v1/>

To edit on the browser, select the project and select the file from Repository→Files, and press Edit button.

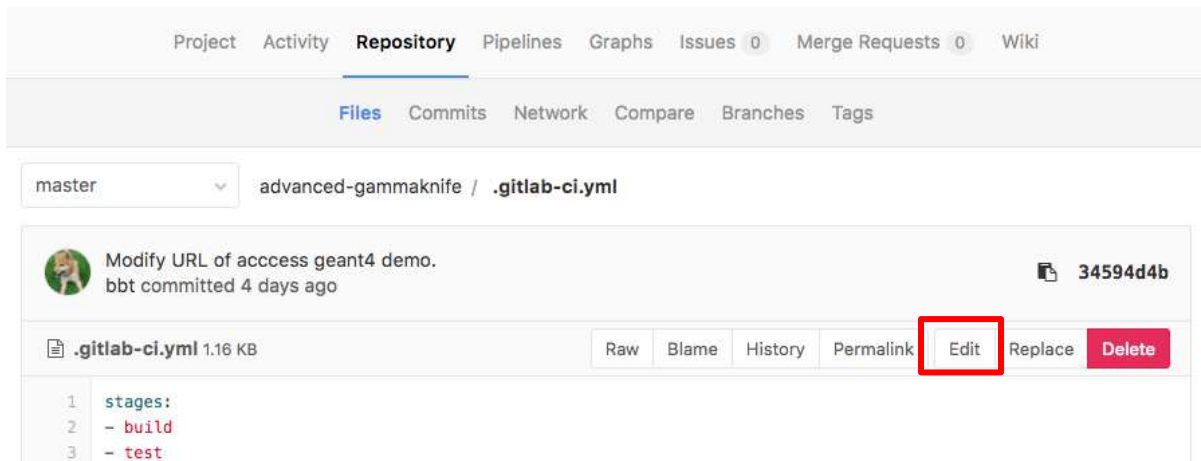


Fig. 2-9. Edit Button



Fig. 2-10. Edit mode

To create a new file, select Files menu and press ” +” button, and select a New File/Upload File.

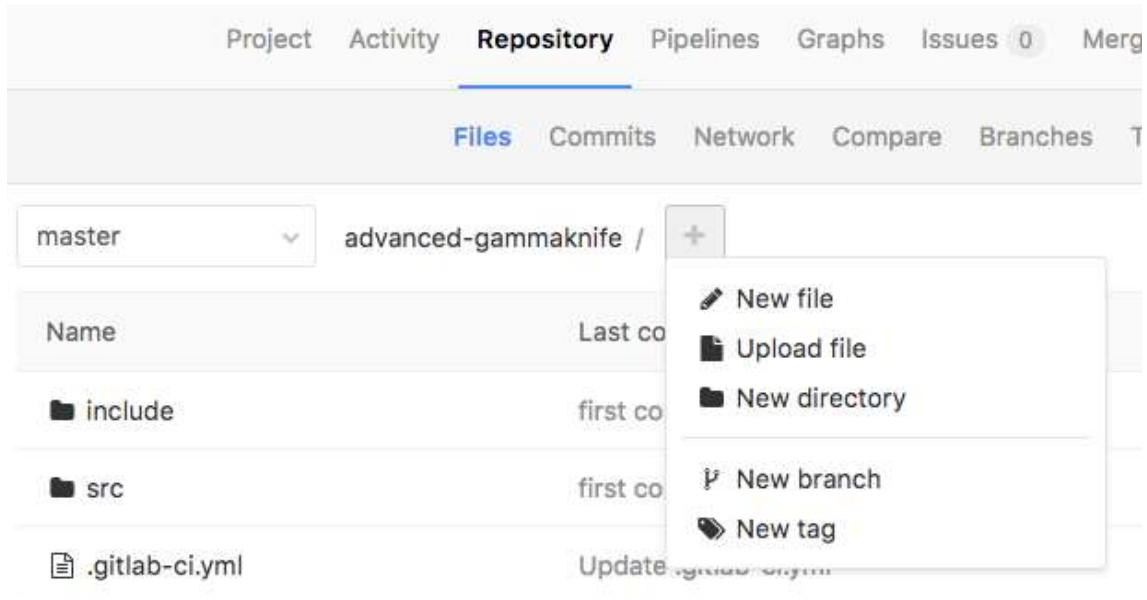


Fig. 2-11. Create a new file.

2. 4. Building and execution

2. 4. 1. Building and execution script

In order to build and execute Geant4 projects with GitLab-ci, create a file .gitlab-ci.yml at the top level and describe the required commands.

(Example)

```
stages:  
- build  
- test
```

```
make_build:
```

```
  stage: build  
  script:
```

```
    - mkdir build bin  
    - cd build  
    - cmake -DCMAKE_C_COMPILER=/usr/bin/gcc-4.8 -DCMAKE_CXX_COMPILER=/usr/bin/g++-4.8  
-DCMAKE_MODULE_PATH=/usr/local/geant4 -DCMAKE_PREFIX_PATH=/usr/local/geant4 ..  
    - make  
    - cp Ultra *.mac ../bin
```

```
  artifacts:
```

```
    paths:  
    - bin
```

```
start_test:
```

```
  stage: test  
  script:
```

```
    - export TAG=`git log -1|head -n 1|cut -d ' ' -f 2`  
    - source /usr/local/geant4/bin/geant4.sh  
    - cd bin - rm -rf /tmp/`echo $TAG`  
    - mkdir -p /tmp/`echo $TAG`  
    - export G4DAWNFILE_DEST_DIR=/tmp/`echo $TAG`/  
    - ln -s /usr/local/share/Wt/resources .  
    - nohup ./Ultra --docroot . --http-address 127.0.0.1 --http-port 0 1> 1.log 2> 2.log  
&  
    - sleep 5 - "grep server 2.log | cut -d : -f 7 | cut -d '¥'" -f 1 > /tmp/$TAG-port.txt"  
    - "#####"  
    - "echo ¥"Access http://is4.muographers.org/g4/\$TAG¥"  
    - "#####"  
    - "echo ¥"To get *.prim file, access http://is4.muographers.org/g4/\$TAG/files¥"  
    - "#####"
```

```
  dependencies:
```

```
    - make_build
```

```
stop_app:
```

```
  stage: test  
  script:
```

```
    - export TAG=`git log -1|head -n 1|cut -d ' ' -f 2`  
    - cp /tmp/$TAG/*.prim .  
    - "cat /tmp/$TAG-port.txt | xargs fuser -n tcp -k -KILL "  
    - rm /tmp/$TAG-port.txt
```

```
  when: manual
```

```
environment:
  name: review
  action: stop
.gitlab-ci.yml
```

The upper job is for (make_build), the middle job is for (start_test), and 3rd job is for (stop_app).

Detailed description about .gitlab-ci.yml can be found at the following URL.

<https://docs.gitlab.com/ce/ci/yaml/>

2.4.2. Building and execution

When .gitlab-ci.yml is registered to GitLab, building starts automatically.

When accessing the top screen of the project, 'running' is shown.



Fig. 2-12. Project screen

When clicking 'running', building at each stage will be shown.



Fig. 2-13. Detail of building

By clicking each job, the history is shown and condition is confirmable.

```

passed Build #1034 in pipeline #227 for commit a2338fb5 from master by bbt
less than a minute ago Retry build

Running with gitlab-ci-multi-runner 1.10.3 (ba2bc36)
Using SSH executor...
Running on eri01 via eri01...
Fetching changes...
Removing bin/
Removing build/
Removing builds/
HEAD is now at 23148ad update build script
From http://gitlab.muographers.org:8000/bbt/advanced-gamnaknife
23148ad..a2338fb master -> origin/master
Checking out a2338fb5 as master...
Skipping Git submodules setup
$ mkdir build bin
$ cd build
$ cmake -DCMAKE_C_COMPILER=/usr/bin/gcc-4.8 -DCMAKE_CXX_COMPILER=/usr/bin/g++-4.8 -DCMAKE_MODULE_PATH=/usr/local/geant4 -DCMAKE_PREFIX_PATH=/usr/local/geant4 ..
-- The C compiler identification is GNU 4.8.5
-- The CXX compiler identification is GNU 4.8.5
-- Check for working C compiler: /usr/bin/gcc-4.8
-- Check for working C compiler: /usr/bin/gcc-4.8 -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/g++-4.8
-- Check for working CXX compiler: /usr/bin/g++-4.8 -- works

```

Fig. 2-14. Command execution

When 'start_test' is completed without errors, a URL that accesses from Web to Geant4 (red underline) is shown on the screen. If a file is generated, it is downloadable by accessing the URL (blue underline).

```

$ #####
$ echo "Access http://is4.muographers.org/g4/$TAG"
Access http://is4.muographers.org/q4/faf1fa972322e5086d23367a3a7a77dec3fa74b4
$ #####
$ echo "To get *.prim file, access http://is4.muographers.org/g4/$TAG/files"
To get *.prim file, access http://is4.muographers.org/q4/faf1fa972322e5086d23367a3a7a77dec3fa74b4/files
$ #####
Build succeeded

```

Fig. 2-15. Geant4 access URL

2.4.3. Finalization

Executing Geant4 application continues to be executed until the finalization process. The finalization process is possible by clicking an arrow button. The arrow button is shown by selecting Pipelines→Builds.

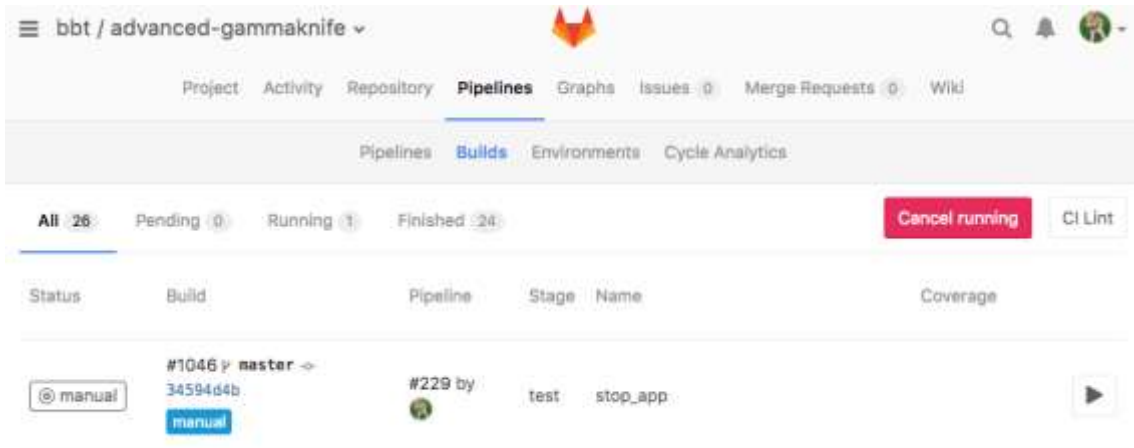


Fig. 2-16. Finalization of the application

2.5. Editing examples of the Fork project

As an example, fork 'Basic-B1', and add an object.

The file to be edited is 'src/B1Detectoronstruction.cc'. After defining Shape 2, add a cadmium plate as Shape 3 to the origin of coordinates.

```
master src/B1DetectorConsti
179 // Set Shape2 as scoring volume
180 //
181 fScoringVolume = logicShape2;
182
183 //
184 // Shape 3
185 //
186 G4Material* shape3_mat = nist->FindOrBuildMaterial("G4_Cd");
187 G4ThreeVector pos3 = G4ThreeVector(0, 0, 0); // origin
188
189 // Conical section shape
190 G4double shape3x = 9.*cm;
191 G4double shape3y = 9.*cm;
192 G4double shape3z = 1.*cm;
193 G4VSolid* solidShape3 =
194     new G4Box("Shape3",
195             shape3x, shape3y, shape3z);
196
197 G4LogicalVolume* logicShape3 =
198     new G4LogicalVolume(solidShape3, //its solid
199                       shape3_mat, //its material
200                       "Shape3"); //its name
201
202     new G4PVPlacement(0, //no rotation
203                       pos3, //at position
204                       logicShape3, //its logical volume
205                       "Shape3", //its name
206                       logicEnv, //its mother volume
207                       false, //no boolean operation
208                       0, //copy number
209                       checkOverlaps); //overlaps checking
```

Fig. 2-17. Editing a source code

When you save it, build -> application is restarted and access the shown URL. Input “/control/execute init_vis.mac” to ‘Session’ and initialize it, objects are shown.

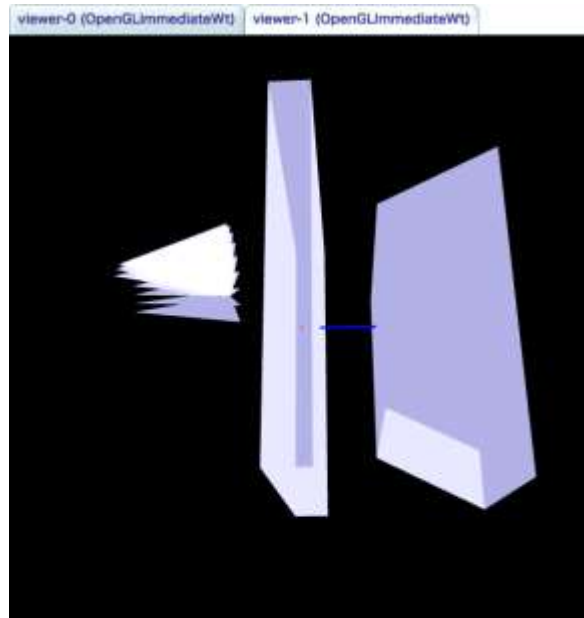


Fig 2-18. Initialized Screen

Inputting ‘Session’ “/run/beamOn 3” , and inject beam 3 times.

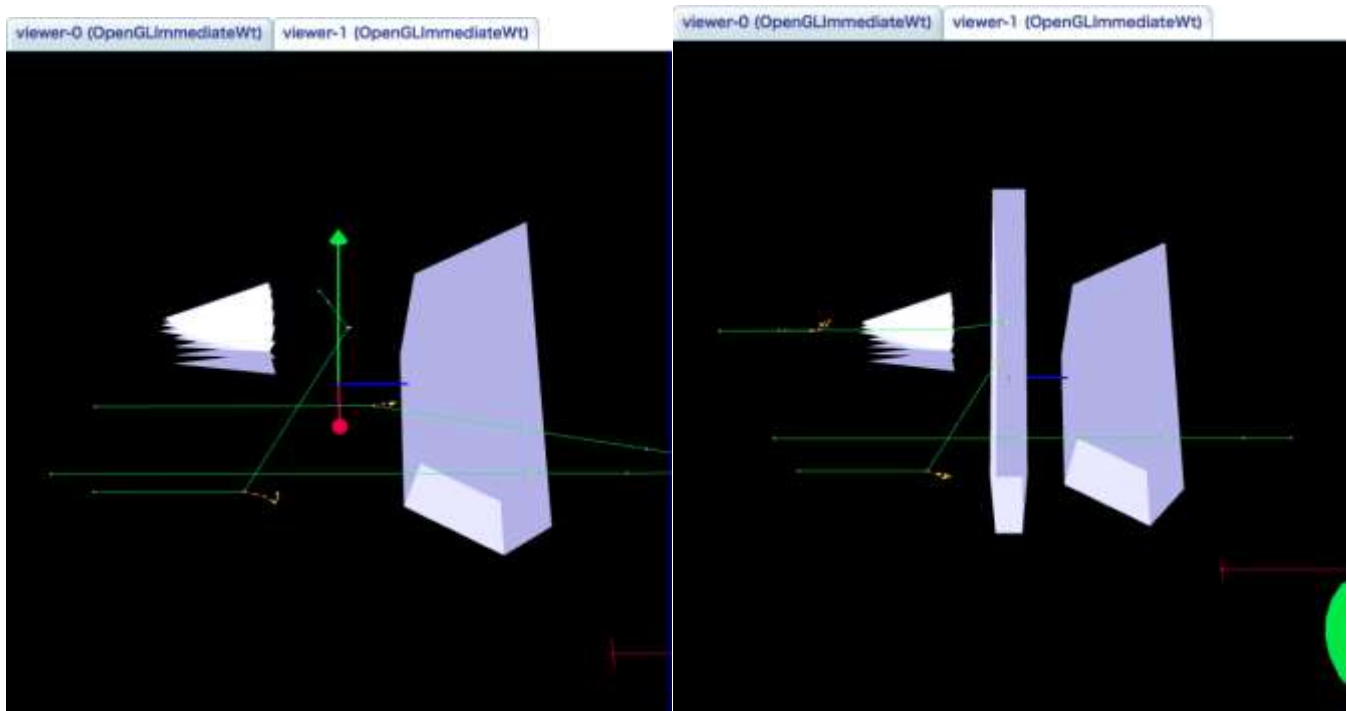


Fig.2-19. Beam injection

For more detail visit

<http://geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForApplicationDeveloper/html/>

3. Appendix

3.1. Sample projects

- (1) advanced/airshower
- (2) advanced/amsEcal
- (3) advanced/brachytherapy
- (4) advanced/dnaphysics
- (5) advanced/gammaknife
- (6) advanced/gammaray_telescope
- (7) advanced/hadrontherapy
- (8) advanced/human_phantom
- (9) advanced/iort_therapy
- (10) advanced/microdosimetry
- (11) advanced/microelectronics
- (12) advanced/radioprotection
- (13) advanced/xray_fluorescence
- (14) advanced/xray_telescope
- (15) basic/B1
- (16) basic/B2/B2a
- (17) basic/B2/B2b
- (18) basic/B3
- (19) basic/B4/B4a
- (20) basic/B4/B4b
- (21) basic/B4/B4c
- (22) basic/B4/B4d
- (23) basic/B5
- (24) extended/B1Con
- (25) extended/biasing/ReverseMC01
- (26) extended/field/field01
- (27) extended/field/field02
- (28) extended/field/field03
- (29) extended/field/field05
- (30) extended/field/field06
- (31) extended/medical/electronScattering2

- (32) extended/optical/Lxe
- (33) extended/optical/OpNovice
- (34) extended/parameterisations/gflash
- (35) extended/parameterisations/Par01
- (36) extended/persistency/gdml/G02
- (37) extended/runAndEvent/RE02
- (38) extended/runAndEvent/RE03
- (39) extended/runAndEvent/RE04
- (40) extended/runAndEvent/RE06
- (41) extended/visualization/standalone
- (42) extended/visualization/userVisAction

3.2. Software and license

Table 3-1. Software and License

| No | Software | Version | Outline | License |
|----|-----------|-----------|--------------------------------------------------------------------------------|-----------------------------|
| 1 | Geant4 | 4.10.0.p4 | a toolkit for the simulation of the passage of particles through matter | Geant4 Software License 1.0 |
| 2 | CLHEP | 2.1.4.2 | A Class Library for High Energy Physics | BSD 3Clause |
| 3 | hepmc | 2.6.9 | C++ event record for High Energy Physics Monte Carlo generators and simulation | GPL v2 |
| 4 | Wt | 3.3.0 | C++ Web Toolkit | GPL v2 |
| 5 | GitLab-ce | 8.15.5 | Git repository manager with wiki and issue tracking features | MIT |

3.2.1. Geant4 Software License

Version 1.0, 28 June 2006

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