

G4RD2: Stateless Geant4 prototype

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Geant4 Task Force Web page

- General introduction
- Some development plan
- To be added:
 - concrete examples demonstrating the functionality
 - benchmarking results



 **GEANT4**
A SIMULATION TOOLKIT

✓ Basic page *Stateless Geant4 prototype* has been updated.

Stateless Geant4 prototype

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R&D task number: G4RD2

Development of Geant4 stateless-kernel prototype

This task consists of the development of a Geant4 prototype where the kernel and the physics processes would be 'stateless' allowing to study fine-grained parallelism. In the current Geant4 implementation when a particle is being tracked, the tracking and the stepping managers hold the pointer to it until the particle is stopped. Moreover, the stepping manager as well as some physics processes hold the 'state' of the step (pre- and post-step information, physics processes, etc). This situation prevents from having a fine-grained control over the simulation flow with the possibility of pausing and grouping particles together for a potential vectorized processing. Our goal here, therefore, is to be able to pause/resume any track at any moment (for instance after selecting the physics process, but before generating the final state) and to be able to process containers of tracks which are about to undergo the same transportation stage.

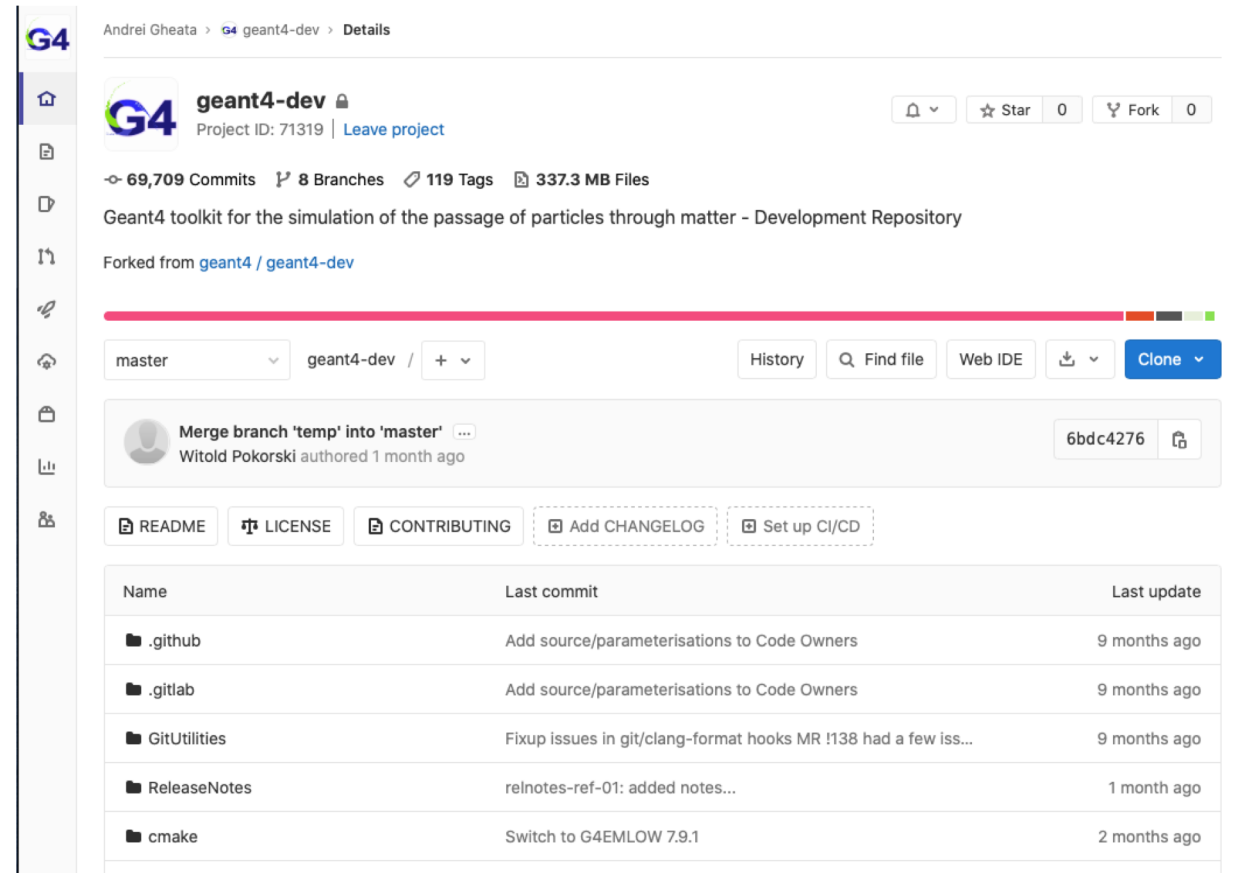
The different steps of the prototyping consist of:

- removal of track and step members from the managers and change of signature of the managers methods to include the track as argument
- move of the different 'stepping state' members from the managers to the track object
- split of the stepping into stages, each processing the contents of the container of particles in the given stage
- benchmarking of grouped (vectorized) processing of different stepping stages

Lead and main developers: Andrei Gheata, [Witek Pokorski](#)

Repository

- fork of the geant4-dev
 - <https://gitlab.cern.ch/agheata/geant4-dev>
- updated automatically every few minutes
- keeping the development on top of geant4-dev master
- will be using 'Issues' to track progress
 - to do



The screenshot shows the GitLab interface for the repository 'geant4-dev' by user 'Andrei Gheata'. The repository is a fork of 'geant4 / geant4-dev'. It has 69,709 commits, 8 branches, 119 tags, and 337.3 MB of files. The description is 'Geant4 toolkit for the simulation of the passage of particles through matter - Development Repository'. The current branch is 'master'. A recent merge commit by Witold Pokorski is shown. Below the merge commit are links for README, LICENSE, CONTRIBUTING, Add CHANGELOG, and Set up CI/CD. A table lists the repository's structure with columns for Name, Last commit, and Last update.

Name	Last commit	Last update
└─ .github	Add source/parameterisations to Code Owners	9 months ago
└─ .gitlab	Add source/parameterisations to Code Owners	9 months ago
└─ GitUtilities	Fixup issues in git/clang-format hooks MR !138 had a few iss...	9 months ago
└─ ReleaseNotes	relnotes-ref-01: added notes...	1 month ago
└─ cmake	Switch to G4EMLOW 7.9.1	2 months ago

Overall prototype status

- pointers to track and step moved away from managers
 - methods of the managers called now with argument *Track
- all step- and physics-related members moved from stepping manager to track
- stepping split in stages (along step geometry, physics, post step, etc)
 - introduced containers for each 'stage'
- need to look at navigation and physics processes to remove any 'state' from them
- TO DO:
 - start benchmarking by pausing, mixing and resuming particles
 - look at grouped/basketized/vectorized processing of specific stages