Physics Lists developments

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Geant4 workshop 2019

Jefferson Lab

Content

- Technical changes
- Changes to hadronics builders
- EM: Next talk

Technical changes

Technical changes

- Wish to remove templates from physics list classes since long
- Vladimir suggested more changes in March wg meeting

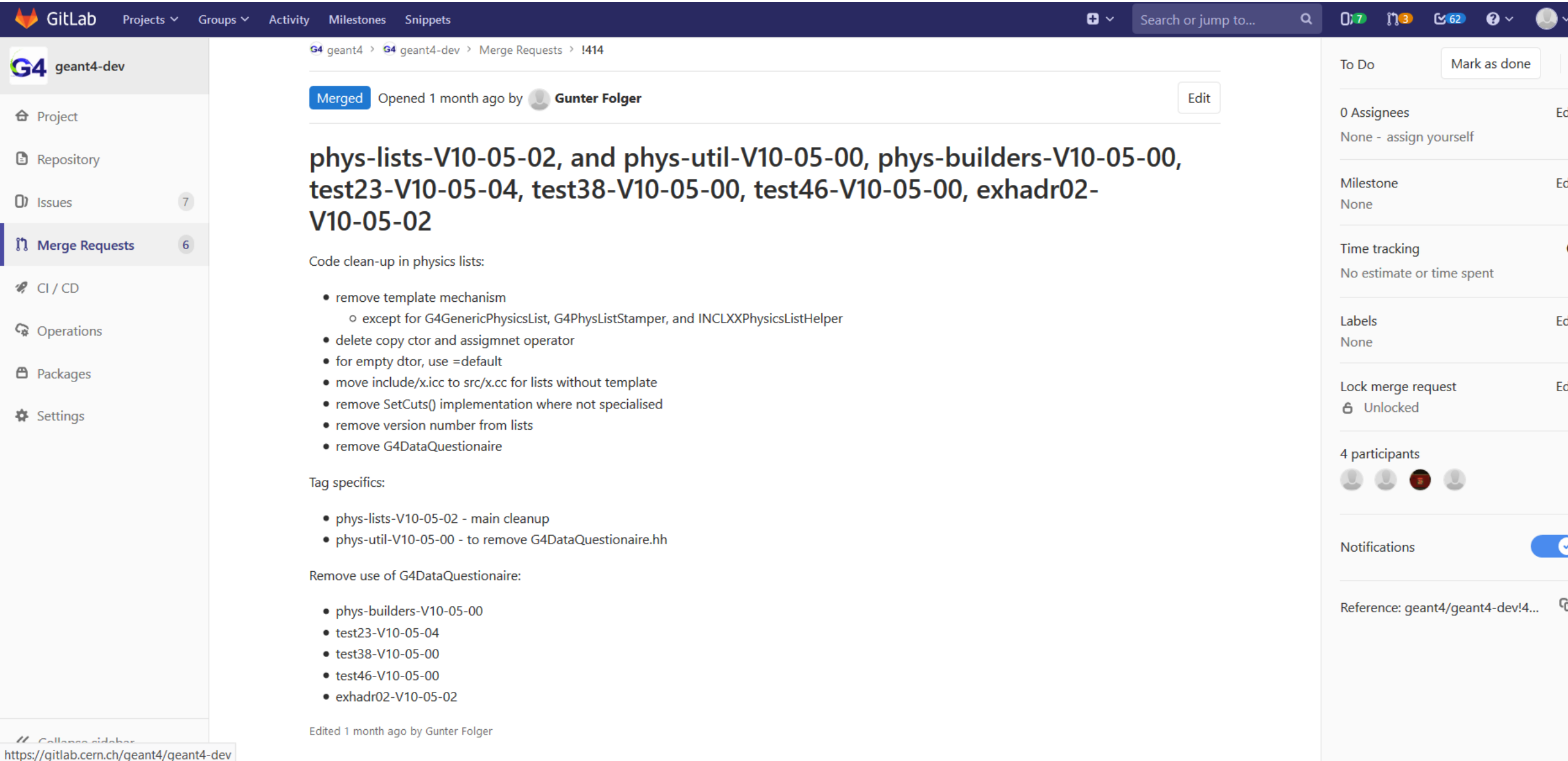
Proposal by Vladimir
March 2019

Obsolete things in physics lists

Let us remove obsolete things

- Propose move *.icc to source *.cc remove templates and SetCuts methods
  - Templates in Physics List classes looks as an anachronism
  - SetCuts() method is not needed – base class method is fine
- Propose in the new *.cc files remove things, which we cannot support properly
  - G4DataQuestionaire – cmake make necessary checks
  - Printout about version of Physics List (different from Geant4 version)

Implemented, with additions



Proposal by Vladimir March 201

Hadronic cross sections

Default hadronic cross sections

- For long time the default hadronic cross section was GHEISHA
  - This was helping to reduce Physics List code
  - This was a source of several problems which we heroically resolved before the release involving time of several developers
  - Just recently Alberto fix the remaining bug (is it the last?)
- We do not need such defaults anymore
  - Now we have better cross sections practically for all particles
    - new defaults may be defined in process sub-library
    - Alternatively in hadronic physics in Physics List library
  - We should also remove cross section definition from all builders, which should build models

Proposal by Vladimir
March 201

Hadronic Builders

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String models

Hadronic builders and string models

- Builder objects by definition should serve in a thread to build models
  - They should not be kept in run time and be destructed end of run
  - They should be destructed after work is done
- QGS and FTF model instantiation looks exceptional
  - Instantiation of G4ExcitedStringDecay and template G4QGSParticipants make a problem to understand why this is needed
    - This construction may be well implemented within QGS and FTF model base classes
    - Extra interfaces may be left allowing to substitute the default sub-model

Changes to hadronics builders

Slides provided by Alberto Ribon

Notes

- Review and update of transition energy range for most physics lists
  - Will also be discussed in hadronic plenary session 3
- Modeling updates not discussed here, plenary 3

Status up to G4 10.5.ref07

- **[3, 12] GeV** transition region between FTFP and BERT in FTFP_BERT physics list
  - Since G4 10.3 (December 2016)
  - The main motivation was to use more BERT and less FTFP to have lower energy response and wider hadronic showers
  - But thin-target data (HARP) prefer FTFP to BERT above ~ 5 GeV
  - This transition region is for the main hadrons − pions, kaons, and nucleons − but for the other hadron types, different regions were used (mainly for historical reasons):
    - [2, 6] GeV for hyperons (Λ , Σ , Ξ , Ω)
    - [2, 4] GeV/nucleon for light ions (d , t , He3, α)
  - Transition region between BIC and FTFP was also different (again, mainly for historical reasons):
    - [9.5, 9.9] GeV for nucleons
    - For pions, either BERT, or BIC < 1.3 GeV, or BIC < 1.5 GeV was used depending on the physics list

Change in G4 10.5.ref08

- **[3, 6] GeV** new transition region between FTFP and BERT in FTFP_BERT physics list
  - Requested by CMS and supported by thin-target experimental data
  - Discussed and agreed at the Hadronic Group meeting on July 24th
  - Took the occasion to set consistently the same transition region for all hadrons (i.e. also for hyperons and light ions)
  - Reviewed also the transition for **BIC** (Binary Cascade model), for the physics list where it is used
    - **[3, 6] GeV** between FTFP and BIC for proton and neutron
    - For pions, **BIC < 1.5 GeV** , 1 GeV < BERT < 6 GeV , FTFP > 3 GeV
  - Left unchanged the transition region QGSP − FTFP : **[12, 25] GeV**
  - Left unchanged the transition region in these 4 special P.L. : **FTFP_BERT_ATL** , **INCLXX-**based P.L. , **NuBeam** , **ShieldingM**
  - *See back up slides for the effects on hadronic showers*