

Physics Lists developments

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Geant4 workshop 2019

Jefferson Lab

Content

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

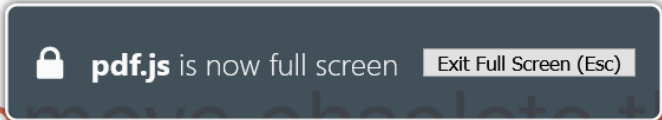
Technical changes

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
 - G4DataQuestionnaire – cmake make necessary checks
 - Printout about version of Physics List (different from Geant4 version)

Implemented, with additions

The screenshot shows a GitLab Merge Request (MR) page. The top navigation bar includes the GitLab logo, project navigation (Projects, Groups, Activity, Milestones, Snippets), a search bar, and notification icons. The left sidebar shows the project structure: Project, Repository, Issues (7), Merge Requests (6), CI / CD, Operations, Packages, and Settings. The main content area displays the MR details:

- MR Info:** Merged, Opened 1 month ago by **Gunter Folger**. An **Edit** button is visible.
- Title:** **phys-lists-V10-05-02, and phys-util-V10-05-00, phys-builders-V10-05-00, test23-V10-05-04, test38-V10-05-00, test46-V10-05-00, exhadr02-V10-05-02**
- Description:** Code clean-up in physics lists:
 - remove template mechanism
 - except for G4GenericPhysicsList, G4PhysListStamper, and INCLXXPhysicsListHelper
 - delete copy ctor and assignmnet operator
 - for empty dtor, use =default
 - move include/x.icc to src/x.cc for lists without template
 - remove SetCuts() implementation where not specialised
 - remove version number from lists
 - remove G4DataQuestionaire
- Tag specifics:**
 - phys-lists-V10-05-02 - main cleanup
 - phys-util-V10-05-00 - to remove G4DataQuestionaire.hh
- Remove use of G4DataQuestionaire:**
 - phys-builders-V10-05-00
 - test23-V10-05-04
 - test38-V10-05-00
 - test46-V10-05-00
 - exhadr02-V10-05-02

The right sidebar shows the MR's configuration: To Do (Mark as done), 0 Assignees (None - assign yourself), Milestone (None), Time tracking (No estimate or time spent), Labels (None), Lock merge request (Unlocked), 4 participants, Notifications (toggle on), and Reference: geant4/geant4-dev!4...

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 & 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*