Fermilab U.S. DEPARTMENT OF ENERGY | Office of Science

Update on Recent Maintenance on the Extensible Physics List Factory

Robert Hatcher

Geant4 Hadronics Working Group Mtg

September 18, 2024

GEANT4 A SIMULATION TOOLKIT

About the (Alt or) Extensible Physics List Factory

The purpose of this factory is to allow for more flexibility than supplied by the default factory.

New physics lists can be added solely by adding code to their own source code to register them with the factory

- Allows users to extend the factory with their own custom list

Additional physics constructors can be added to existing lists when they themselves are registered with a constructor factory

List factory uses a convention:

- Using "_<constructor>" uses ReplacePhysics()
  - Based on the original EM extensions in the default factory
  - e.g. _EMZ calls ReplacePhysics(new G4EmStandardPhysics_option4)
- Using "+<constructor>" uses RegisterPhysics() – extension of factory behaviour
- Factory provides for using short-hands for full constructor name (e.g. EMZ)
- My understanding is that ReplacePhysics() is equivalent to RegisterPhysics() if there is nothing to replace

Recent Changes in the Default Factory

Many of the new additions are of the form XYZ_HPT where HPT represents RegisterPhysics(new G4ThermalNeutrons)

◦ So to support those we needed to register the short-hand "HPT" for "G4ThermalNeutrons" (and assume that ReplacePhysics() acts like RegisterPhysics() for physics that isn't included in the base list)

- Alternatively use "<base-list>+HPT"

◦ We also needed to make the sub-list parser a bit smarter, breaking a match on only "_", "+" or the end of the string

- This prevents lists like "FTFP_BERT_HP" from being found as a "base" list when the user specifies "FTFP_BERT_HPT"

Predefined Extension Shortcuts

- EM0 – G4EmStandardPhysics
- EMV – G4EmStandardPhysics_option1
- EMX – G4EmStandardPhysics_option2
- EMY – G4EmStandardPhysics_option3
- EMZ -- G4EmStandardPhysics_option4
- LIV – G4EmLivermorePhysics
- PEN – G4EmPenelopePhysics
- GS or _GS – G4EmStandardPhysicsGS
- SS or _SS – G4EmStandardPhysicsSS
- WVI – G4EmStandardPhysicsWVI
- LE or _LE – G4EmLowEPPhysics

- HPT – G4ThermalNeutrons; new addition

- Additionally any others registered by users
- .

Physics Lists In Default Factory, Supported By Alt

- FTFP_BERT
- FTFP_BERT_HP
- FTFP_BERT_TRV
- FTFP_BERT_ATL
- FTFQGSP_BERT
- FTFP_INCLXX
- FTFP_INCLXX_HP
- FTF_BIC
- LBE
- QBBC
- QGSP_BERT
- QGSP_BERT_HP
- QGSP_BIC
- QGSP_BIC_HP
- QGSP_BIC_AllHP
- QGSP_FTFP_BERT
- QGSP_INCLXX
- QGSP_INCLXX_HP
- QGS_BIC
- Shielding
- ShieldingLEND
- ShieldingM
- NuBeam
- FTFP_BERT_HPT
- FTFP_INCLXX_HPT
- QGSP_BERT_HPT
- QGSP_BIC_HPT
- QGSP_INCLXX_HPT
- Shielding_HPT
- ShieldingM_HPT

Not Supported

- Shielding_HP – alternative name for Shielding

- ShieldingLIQMD – uses extra args; needs a wrapper like ShieldingLEND
- ShieldingLIQMD_HP – alternative name for ShieldingLIQMD
- ShieldingLIQMD_HPT – based on ShieldingLIQMD with HPT extension

- QGSP_BIC_AllHPT – breaks naming convention
  - Achievable using QGSP_BIC_AllHP+HPT instead
- .