

Physics Lists



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Overview



- ❧ Recent updates
 - ❧ Supported physics lists are stable
- ❧ Planned changes
- ❧ Documentation
- ❧ Wishes for improvement

Recent Updates



- ❧ Goal: Eliminate use of CHIPS in main physics lists
 - ❧ CHIPS used as
 - ❧ Stopping models
 - ❧ Gamma and electro-nuclear
 - ❧ G4EmExtraPhysics.{hh,cc} do not use Bertini
 - ❧ Quasi-elastic in QGS, cross section and model
 - ❧ Kaon cross section
 - ❧ Hyperons
- ❧ Prepare physics list independent of CHIPS
 - ❧ FTFP_BERT_TRV, as experimental list, used to test development of alternative models and code.
- ❧ G4 9.6beta: FTFP_BERT does not use CHIPS
 - ❧ Uses cross sections by M.Kossov, but ported/re-implemented to use standard interface.

Other changes



- ❧ 44 tags in 2012
 - ❧ Fixing coverity issues
 - ❧ Re-use same process or models in some place to save on memory

- ❧ INCL/ABLA removed, leaving only INCLXX
- ❧ DNA model builders updated
- ❧ CHIPS_HP introduced

Updates for 9.6



- ❧ Shall we further reduce use of CHIPS?
 - ❧ E.g. all non-production lists
 - ❧ QGSP_BERT?

- ❧ Updates to EM builders
 - ❧ Discussed in ||-2a

- ❧ Other updates?

Automatic documentation



- ❧ Printout at begin of job lists for a subset of all particles
 - ❧ Processes and models with energy range for main particles
 - ❧ Cross sections
- ❧ Automated generation of web documentation in progress
 - ❧ Detailed content of hadronic processes and models
 - ❧ EM not part of this
 - ❧ For each of models used, a short description is included, or linked
 - ❧ Dig through 'composite' models still in progress
 - ❧ E.g. FTFP: string model → PrecompoundInterface → Precompound → de-excitation
 - ❧ cross section need descriptions
 - ❧ Old example:
http://gunter.web.cern.ch/gunter/PL/FTFP_BERT.html
- ❧ Help needed to provide or improve short descriptions.

Summary of Hadronic Processes, Models and Cross Sections for

- **proton**

process : hadElastic

- models :

- hElasticCHIPS from 0 GeV to 100000 GeV

- cross sections :

- CHIPSElasticXS from 0 GeV to 100000 GeV

process : ProtonInelastic

- models :

- FTFP from 4 GeV to 100000 GeV

- BertiniCascade from 0 GeV to 5 GeV

- cross sections :

- G4CrossSectionPairGG from 0 GeV to 100000 GeV

- **neutron**

process : hadElastic

- models :

- hElasticCHIPS from 0 GeV to 100000 GeV

- cross sections :

- CHIPSElasticXS from 0 GeV to 100000 GeV

process : NeutronInelastic

- models :

- FTFP from 4 GeV to 100000 GeV

Documentation (2)



⌘ Can we agree on list of “best” or recommended physics list(s) per domain?

⌘ HEP: FTFP_BERT

⌘ Medical:

⌘ Shielding: shielding

⌘ Underground/low background:

⌘ space

⌘ A long dormant attempt:

⌘ <http://geant4.web.cern.ch/geant4/support/physicsLists/>

Difficulties



- ❧ Several developers contribute, all on the same code directory builders
 - ❧ one directory with > 130 classes
 - ❧ No split of builders for em, hadronics, etc.
 - ❧ Should be split, tags on sub-categories
 - ❧ Code is or has become complex
 - ❧ Some design choices from years ago
 - ❧ Many similar builders, just to try new features

Wishes



- ❧ Better names, like Shielding
- ❧ Redesign of builders
 - ❧ A small change often needs modifications in several builder classes
 - ❧ Cross sections and models tied together
- ❧ Reduce repetition of code in builders and (Hadronic)XYZPhysics
 - ❧ Templates, factory, ??
- ❧ Current factory references a large part of all physics processes and models.

Summary



- ❧ Production physics lists are stable
 - ❧ Can/Should we remove CHIPS from QGSP_BERT
- ❧ Documentation is improving
 - ❧ Help from model developers needed to finish short descriptions for 9.6
 - ❧ Automatic documentation is hadronics only
- ❧ Significant re-organization and re-design of code needed
 - ❧ Fresh ideas from new volunteers will help

- ❧ Anomaly: code not managed by working group