

What is LCPhys

Overview

[LCPhys](#) is a [Geant4](#) physics list written by Dennis Wright for simulation of events in ILC detectors.

[LCPhys Source Code Documentation \(doxygen\)](#)

[LCPhys Thin Target Tests](#)

LCPhys contains the following classes.

- [LCPhysicsList](#) - physics list definition; subclass of [G4VModularPhysicsList](#)
- [LCDecayPhysics](#) - particle decays
- [LCBosonPhysics](#) - gammas and geantinos
- [LCLeptonPhysics](#) - leptons
- [LCHadronPhysics](#) - hadron physics
- [LCIonPhysics](#) - ion physics

Particle Decays

Applies [G4Decay](#) process to all applicable particles.

Bosons

[LCBosonPhysics](#)

- [G4Geantino](#)
- [G4ChargedGeantino](#)
- [G4Gamma](#)
 - [G4GammaConversion](#)
 - [G4ComptonScattering](#)
 - [G4PhotoElectricEffect](#)
 - [G4GammaNuclearReaction](#) - gamma nuclear low
 - 0 to 3.5 GeV
 - [G4TheoFSGenerator](#) - high energy gamma nuclear model
 - 3.0 GeV to 100.0 TeV
 - [G4GeneratorPrecompoundInterface](#) - high energy gamma transport
 - [G4QGSMModel](#) - string model
 - [G4QGSMFragmentation](#) - string fragmentation model (template)
 - [G4ExcitedStringDecay](#) - concrete fragmentation model

Leptons

[LCLeptonPhysics](#)

- [G4Electron](#), [G4Positron](#)
 - [G4MultipleScattering](#)
 - [G4eIonisation](#)
 - [G4eBremsstrahlung](#)
- [G4Electron](#)
 - [G4ElectronNuclearProcess](#)
 - [G4ElectroNuclearReaction](#)
- [G4Positron](#)
 - [G4eplusAnnihilation](#)
 - [G4PositronNuclearProcess](#)
 - [G4ElectroNuclearReaction](#)
- [G4MuonMinus](#), [G4MuonPlus](#)
 - [G4MultipleScattering](#)
 - [G4MuIonisation](#)
 - [G4MuBremsstrahlung](#)
 - [G4MuPairProduction](#)
- [G4TauMinus](#), [G4TauPlus](#)
 - [G4MultipleScattering](#)
 - [G4hIonisation](#)
- [G4NeutrinoE](#)
- [G4AntiNeutrinoE](#)
- [G4NeutrinoMu](#)
- [G4AntiNeutrinoMu](#)
- [G4NeutrinoTau](#)
- [G4AntiNeutrinoTau](#)



No Neutrino Physics

Geant4 does not include the simulation of neutrino physics, except their transport.

Hadron Physics

[LCHadronPhysics](#)

This class creates the mesons using `G4MesonConstructor`, baryons with `G4BaryonConstructor`, and resonances and quarks with `G4ShortLivedConstructor`.

Hadron Models

- hadronic elastic process and model - same for all hadrons
 - [G4HadronElasticProcess](#)
 - [G4LElastic](#)

```
G4HadronElasticProcess* elasticProcess = new G4HadronElasticProcess();
G4LElastic* elasticModel = new G4LElastic();
elasticProcess->RegisterMe(elasticModel);
```

- Bertini cascade model for p,n,pi+,pi- between 0 and 9.9 GeV

```
G4CascadeInterface* bertiniModel = new G4CascadeInterface();
bertiniModel->SetMaxEnergy(9.9*GeV);
```

- Bertini cascade model for K+,K-,K0L,K0S,Lambda,Sigma+,Sigma-,Xi0,Xi- between 0 and 13 GeV

```
G4CascadeInterface* bertiniModelStrange = new G4CascadeInterface();
bertiniModelStrange->SetMaxEnergy(13*GeV);
```

- Low energy parameterized models between 9.5 and 25 GeV
 - The LEP models are defined for each type of particle. (see below)
- Quark-Gluon String Model (QGSP) for p,n,pi+,pi-,K+,K-,K0L,K0S between 12 GeV and 100 TeV
 - `G4TheoFSGenerator`
 - `G4GeneratorPrecompoundInterface` - transport
 - `G4PreCompoundModel` - deexcitation
 - `G4QGSMModel` - high energy generator
 - `G4ExcitedStringDecay` - fragmentation model
 - `G4QGSMFragmentation` - Quark-Gluon String model fragmentation

Defining the QGSP process and model in [LCHadronPhysics.cc](#).

```
G4TheoFSGenerator* QGSPModel = new G4TheoFSGenerator();
G4GeneratorPrecompoundInterface* theCascade = new G4GeneratorPrecompoundInterface();
G4ExcitationHandler* exHandler = new G4ExcitationHandler();
G4PreCompoundModel* preCompound = new G4PreCompoundModel(exHandler);
theCascade->SetDeExcitation(preCompound);
QGSPModel->SetTransport(theCascade);
G4QGSMFragmentation* frag = new G4QGSMFragmentation();
G4ExcitedStringDecay* stringDecay = new G4ExcitedStringDecay(frag);
G4QGSMModel<G4QGSParticipants>* stringModel = new G4QGSMModel<G4QGSParticipants>();
stringModel->SetFragmentationModel(stringDecay);
QGSPModel->SetHighEnergyGenerator(stringModel);
QGSPModel->SetMinEnergy(12*GeV);
QGSPModel->SetMaxEnergy(100*TeV);
```

- `G4PionPlus`
- `G4PionMinus`
- `G4KaonPlus`
- `G4KaonMinus`
- `G4KaonZeroLong`
- `G4KaonZeroShort`
- `G4Proton`
- `G4AntiProton`

- G4Neutron
- G4AntiNeutron
- G4Lambda
- G4AntiLambda
- G4SigmaMinus
- G4AntiSigmaMinus
- G4SigmaPlus
- G4AntiSigmaPlus
- G4XiMinus
- G4AntiXiMinus
- G4XiZero
- G4AntiXiZero
- G4OmegaMinus
- G4AntiOmegaMinus

Ion Physics

[LCIonPhysics](#)