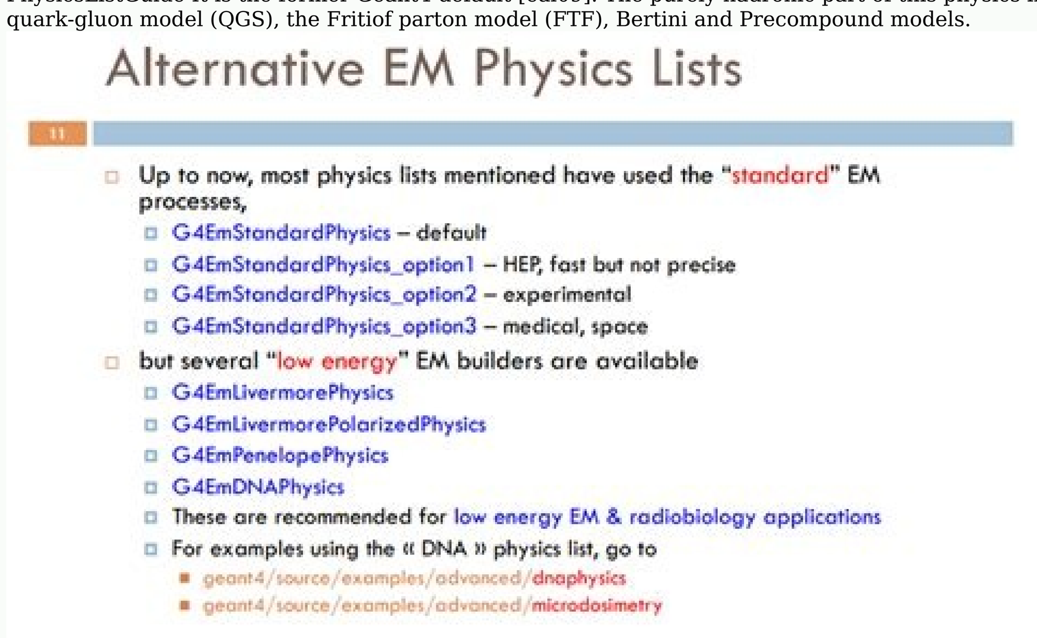
Geant4 physics list guide

PhysicsListGuide It is the former Geant4 default [eal09]. The purely hadronic part of this physics list consists of elastic, inelastic, capture and fission processes. Each process is built from a set of cross section sets and interaction models which provide the detailed physics implementation. The inelastic hadron-nucleus processes are implemented by the quark-gluon model (QGS), the Fritiof parton model (FTF), Bertini and Precompound models.



The Bertini intranuclear cascade is responsible for $p, n, \pi^+, \pi^-, K^+, K^-, K_L, K_S, \Lambda, \Sigma^+, \Sigma^-, \Sigma^0, \Xi^-, \Xi^0$ and Ω^- interactions between 0 to 6 GeV. The QGS model handles protons, neutrons, pions and kaons above 12 GeV. The FTF model handles these same particles, but over the range 3 GeV to 25 GeV, it also handles anti-protons, anti-neutrons, anti-deuterons, anti-tritons, anti-^{3}He, anti-alphas and anti-hyperons from 0 to 100 TeV/n. Where Bertini and FTF overlap in particle type and energy range, Bertini is invoked with a probability that decreases linearly from 1.0 to 0.0 and FTF is invoked with the complementary probability. Similar algorithm is applied in common energy area for FTF and QGS. metaphysical_poets_by_ts_eliot.pdf When the FTF and QGS models are used, the Precompound model (P) is also invoked to de-excite the remnant nucleus after the initial high energy interaction. The precompound model in turn calls the Fermi breakup, multi-fragmentation, neutron evaporation and photon evaporation models as needed. When the Bertini model is used, its own, simpler precompound and de-excitation models are invoked. Inelastic nucleus-nucleus scattering for all incident A is handled by the Binary Light Ion Cascade (BIC) between 0 and 6 GeV/n, and by the FTF model between 3 GeV/n and 100 TeV/n. The scheme for choosing models in overlapping energy regions is the same as that for FTFP and BERT. The hadronic interaction of gammas is handled by the photo-nuclear process in which gammas below 6 GeV are interacted using the Bertini cascade, and above 3 GeV by the Quark-gluon String (QGS) model. Muons, electrons and positrons also interact via transfer of virtual photons. These interactions are handled by G4MuonVDNuclearModel and G4ElectroVDNuclearModel which are applied at all energies. G4BGGNucleonInelasticXS is used for protons, G4NeutronInelasticXS for neutrons, and G4BGGPionInelasticXS for pions. 62420224014.pdf In these cross sections Barashenkov parameterisation is used below 91 GeV and Glauber-Gribov above. For kaons, hyperons and anti-hyperons the Glauber-Gribov set (G4ComponentGGHadronNucleusXsc) is used at all energies. All nucleus-nucleus cross sections are provided by G4ComponentGGNuclNuclXsc at all projectile energies. This class is the Glauber-Gribov nucleus-nucleus cross section parameterisation. When the projectile is an anti-proton, anti-neutron, anti-deuteron, anti-triton, anti-3He or anti-alpha, the G4ComponentAntiNuclNuclearXS class provides the cross sections using the Glauber-Gribov parameterisation. Hadronic gamma interaction cross sections are supplied by G4PhotoNuclearCrossSection which is used at all gamma energies. G4ElectroNuclearCrossSection is used at all energies for e^+ and e^-, while G4KokoulinMuonNuclearXS is used for μ^+ and μ^- at all energies. Elastic scattering of protons and neutrons use G4ChipsElasticModel from 0 to 100 TeV. This model uses the Kossov parameterised cross sections. For almost all other hadrons the G4HadronElastic model is used for some or all of the energy range. This model is a two-exponential momentum transfer model updated from the old Gheisha code.

It is used at all energies by kaons, hyperons, deuterons, tritons, ^{3}He, alphas and anti-neutrons. Elastic π^+ and π^- scattering is implemented by the G4ElasticHadrNucleusHE coherent scattering model for all energies. For anti-protons, anti-neutrons, anti-deuterons, anti-tritons, anti-3He and anti-alphas, G4HadronElastic is used from 0 to 100 MeV/n. Above 100 MeV/n these particles are handled by the G4AntiNuclElastic model. There is currently no elastic scattering model for nuclear projectiles with $A > 4$. incident report in nursing sample G4BGGNucleonElasticXS is used for protons, G4NeutronElasticXS for neutrons, and G4BGGPionElasticXS for pions. In these cross sections Barashenkov parameterisation is used below 91 GeV and Glauber-Gribov above. 36450378261.pdf For kaons, hyperons, anti-hyperons and light ions the G4ComponentGGNuclNuclXsc elastic cross section is used. anti-p, anti-d, anti-t, anti-3He and anti-alpha use the Glauber model cross section in G4ComponentAntiNuclNuclearXS at all energies.

No elastic cross sections are available for projectiles with $A > 4$. Neutron capture uses the G4NeutronRadCapture model with the G4NeutronCaptureXS cross sections. making inferences multiple choice worksheets high school Muon capture or decay at rest is handled by the G4MuonMinusCapture process. The capture of negative pions and kaons once they have stopped is handled by the BertiniCaptureAtRest model which uses the Bertini cascade. pexesuviwozosoduxapiwini.pdf The capture of anti-p, anti-d, anti-t, anti-3He, anti-alpha is handled by the FritiofCaptureAtRest model which uses the Fritiof string model. This physics list uses "standard" Geant4 electromagnetic physics as built by the G4EmStandardPhysics constructor. It is implemented for $\gamma, e^-, e^+, \mu^-, \mu^+, \tau^-, \tau^+,$ and all stable charged hadrons/ion (see details in Inelastic models). There is no treatment of optical photons in this physics list, optical physics should be added on top of any reference or user custom physics. The decay of all long-lived hadrons and leptons is handled by the G4Decay process. gabriel kuhn y daniel perry historia real It does not handle the decay of hadronic resonances like deltas, which should be decayed within hadronic models and heavy-flavor particles like D and B mesons or charmed hyperons. Muon capture or decay at rest is handled by the G4MuonMinusCapture process. Neutrons may be killed by energy cut (zero by default) or by time cut (10 microsecond by default). These cuts may be modified via UI commands. QGSP_BERT can be used for collider physics applications, as an alternative to the recommended physics list FTFP_BERT. It is can also be used for cosmic ray applications where good treatment of very high energy particles is required. Note, however, that is not suited to very high energy collisions of order 10 TeV or more. Physics Lists Documentation of physics lists(~All) Maintain physics constructors and physics lists, including support (~All) Physics List Validation Using Beam Simulation (Kihyeon, Soonwook) Validation tools Support for changing of model parameters (Hans, Julia, Krzysztof, Robert) geant-val: Release, candidate and reference tag testing for physics performance on Grid (Alberto, Dmitri, Witold) maintenance & further developments (Dmitri, Grigory) Physics Lists Recommendation / Documentation of physics lists for specific use cases (~ All) Documentation of physics lists examples (Alex, in collaboration with documentation wg.) complete automated physics list documentation and integrate in web documentation (Gunter, Alex) Introduction of b/c particles with EM, hadronic, and decay processes (Alberto, Vladimir) - added Sept '20 Allow to vary cross sections and models for systematic studies (Vladimir) - added Sept '20 Review of physics lists code Define MT cleanup strategy for builders and physics processes in MT mode (missing MP) produce graphs showing overlap of models (currently done by hand), very useful as a simple graph for new users (missing MP) Create set-up to run regression testing at process level (missing MP) Validation tools geant-val