Using PYTHIA in PHY8810

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1 PYTHIA Project

We will make use of the PYTHIA Monte Carlo program in PHY8810 to explore some aspects of particle physics. Everyone will have a project that will require the use of PYTHIA to explore and produce a report due the end of the semester that will contribute xx% of your final grade.

2 Installation

Get the latest PYTHIA 8.1 release from `http://home.thep.lu.se/ torbjorn/Pythia.html`. Follow the instructions for installation on your computer.

Note, on macs try `make` if you get the message `gmake: command not found`.

Read the `README` file in the main directory. Then go to the `examples` subdirectory, look at the `README` file there, and follow the instructions to run the first three example programs. Compare your output to the reference results found in the `examples/outref` directory.

3 Student Projects

Some other possible topics:
Seeing $H \to \mu\mu$ on the $Z \to \mu\mu$ tail for a $125\,\mathrm{GeV}/c^2$ higgs Boson.
Differences between $c\bar{c}$ and $b\bar{b}$ production and fragmentation at $\Upsilon(4S)$.
Study of boosted jets from high pT top decays.
Study of $e^+e^- \to HZ^0$ for a high energy linear collider.
Analysis of multi-jet QCD events with different jet clustering algorithms.

student	Project
Christopher Clarke	W and Z production with pile-up and beam gas for 14 TeV pp collisions.
Hussein Farhat	$e^+e^- \rightarrow$ SUSY (500GeV to 1TeV)
Sudeshna Ganguly	Compare $e^+e^- \rightarrow c\bar{c}$ and $e^+e^- \rightarrow B\bar{B}$ at Belle $\Upsilon(4S)$.
Ryan Gillard	$e^+e^- \rightarrow Z^0H$ production for 125 GeV Higgs Boson.
Derek Hazard	Particle spectra from dark matter particle–anti-particle annihilation at cosmic scales.
Gagun Kaur	Jet characteristics with Fastjet and JetClu (vary cone sizes, kT, ...).
Michael Kordell	Study effects of different PDFs on high invariant mass dijet evetns.
Joydeep Roy	Study of production of supersymmetry in 14 TeV pp collisions
Kevin Siehl	Diboson production in 14 TeV pp interactions.

Effect of multiple parton interactions on event characteristics — the underlying event.
Using LHE event files created with another program, for instance, MadGraph.
Production of exotic particles at LHC: 4th generation, leptoquarks, excited fermions, excited gravitons.
Same sign versus opposite sign muon pairs in B decays.
Onium decays.
Study of pile-up and beam-gas effects on W and Z selection.
Studies with single-particle gun. Need to consider what particles to use.
Study of hypothetical $t\bar{t}$ resonance.
Study of some possible SUSY scenarios.
Extra dimensions.
Studies with different PDF sets.
Study of W + jets production.