Tutorial on MC Usage & Development

CTEQ/MCnet School 2016

Organization

Two types of tutorials:

- Exploration of existing generators
  - Herwig
  - Pythia
  - Sherpa
  - Comparison & uncertainty analysis
- Build your own generator in Python
  - $e^+e^- \rightarrow$ hadrons
  - Parton shower
  - ME Corrections & POWHEG
  - MC@NLO

MC Exploration - Day 1

CTEQ/MCnet school 2016
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Tutorial session 1
Herwig examples

Herwig Tutorial

Part I

Introduction to Herwig 7

In this first part of the tutorials you will get to know Herwig. The
online Herwig documentation. The Herwig homepage is at http:/
On the Herwig homepage you find a section *Tutorials*. In this tut
section *Getting Started* which contains the subsections

- The first run.
- A look at input files.
- More runs, switching things on and off.
- Using different matrix elements and showers.
- More on matrix elements.

The documentation refers to a HERWIGPATH. On the virtual machi
to use the replacement

<HER

Sherpa Tutorial

CTEQ/MCnet School 2016

1 Introduction

Sherpa is a complete Monte-Carlo event generator for particle production at lepton-lepton, lepton-hadron,
er perturbative QCD effects, including NLO
the parton shower, is emphasized in Sherpa.
decays can also be simulated. Alternatively,
tions with massless or massive partons.
QCD corrections. The correct simulation of
led either in the parton-shower approach, or
nethods using a technique known as Matrix
escribed in Ref. [2] and have been discussed
nethod in Sherpa.
and its documentation is found online [3].
/Examples.

sections. A comprehensive list of all input
r the purpose of this tutorial, we will focus

d open the file Run.dat in an editor. Have
and }(run) (We will call this section the
tion of the collider, i.e. its beam type and
rs, which will be explained later.
ing to be simulated. Particles are identified
ds for an anti-down, 2 for an up-quark, etc.
e gluon.

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For tutorials
at Summer Schools
or self-study
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PYTHIA 8.2 Worksheet

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(specifically, it focuses on centre-of-mass energies greater than about 10 GeV), comprising

Follow worksheet instructions found in folders
~/tutorial/mc/intro/

MC Exploration - Day 2

You will work in groups using the generator you have learned how to use on day 1

You can and should exchange results with your peers using another generator

You should ask questions!

Tutorial on Monte-Carlo Uncertainties

MCnet Collaboration

1 Introduction

In this tutorial we will discuss some of the uncertainties related to the simulation of multi-jet final states. We will use Higgs-boson plus jets production as an example. You should work in groups of three (or multiples thereof), where each member generates predictions from a different event generator. Ideally, you will have a selection of people who already know "their" generator from using it in yesterday's tutorial.

At the end of the analysis part of the tutorial, you should exchange the yoda files, such that all members of your group can generate the plots on their own machine.

The easiest way to accomplish this may be DropBox (`http://www.dropbox.com/`). The DropBox Linux application is installed on the VM. You can launch it by typing `dropbox start` in a terminal window. Please note that you will have to sign in using your own account.

Alternatively, you can use a USB flash drive. You need to make it available to the VM using the "Devices" tab, see `http://tinyurl.com/69ybgp4`, steps 4 and 5. Note that it is essential to add your

...e task

Different event generators are sometimes based on very different assumptions about the underlying physics in certain collider processes. In order to compare their results it is therefore important to know

Follow worksheet instructions in found in folder ~/tutorial/mc/higgs/

Build your own generator

On day 1 you should try to work through sections 1-6

On day 2 you should attempt sections 6 & 7 or section 8, possibly both.

Follow S.Plätzer's lecture carefully to know what to do

You MUST ask questions!

Tutorial on Parton Showers and Matching

CTEQ/MCnet School 2016

1 Introduction

In this tutorial we will discuss the construction of a parton shower, matrix-element corrections, and matching at next-to-leading order. At the end, you will be able to run your own parton shower for e^+e^- →hadrons at LEP energies and compare its predictions to results from the event generator Sherpa (using a simplified setup). You will also have constructed your first MC@NLO and POWHEG generator.

2 Getting started

Change to the tutorial directory

```
cd ~/tutorial/ps/
```

For simplicity, this tutorial uses Python. If you are unfamiliar with Python, think of it as yet another scripting language, such as bash, but way more powerful. A peculiar feature of Python, and indeed its biggest weakness, is that code is structured by indentation. That means you need to pay careful

our code
answer.
udes four
rovide an
ions with

Get started by creating a file called `shower.py`. First we need to import the predefined methods

Follow worksheet instructions in found in folder ~/tutorial/ps/

Have Fun!

Enjoy the opportunity for a live discussion