

Before we Start ...

Some you might be interested in **MCnet Students and Postdocs**

- ▶ Students and Postdocs present their work, 1-2 times a month on Zoom
- ▶ Designed for asking questions and practising giving talks

All students and postdocs welcome! To join the mailing list:

1. Go to <https://e-groups.cern.ch/>
2. Search MCnet
3. Join mcnet-studentsandpostdocs list

If you have any issues, email me at: siddharth.sule@manchester.ac.uk



Herwig Tutorial

Siddharth Sule (Sid)

Terascale Monte Carlo School, November 2025

Welcome to Herwig!

Hadron Emission Reactions With Interfering Gluons

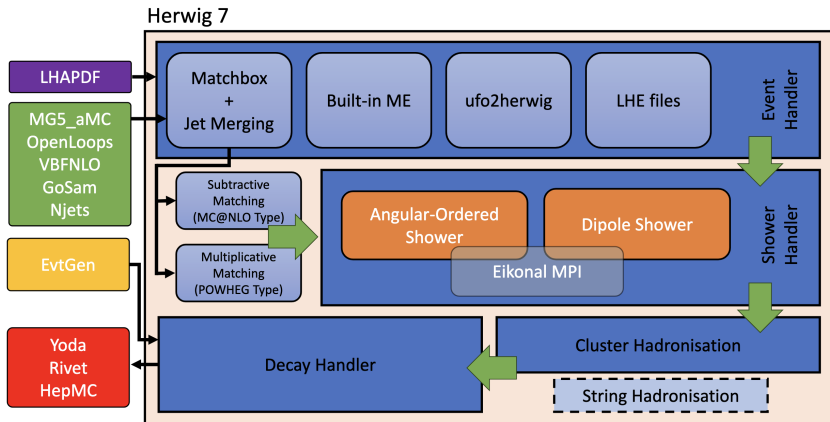
Herwig is a general-purpose event generator that has been around since the 80's

1. Originally Herwig Fortran (1984)
2. Herwig++ (2003)
3. Now just one Herwig 7 (2015)



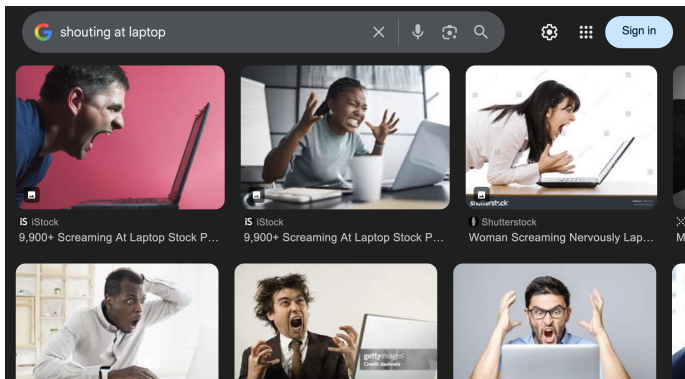
Welcome to Herwig!

(Mostly) C++ code, and connected to all your favourite MC tools.



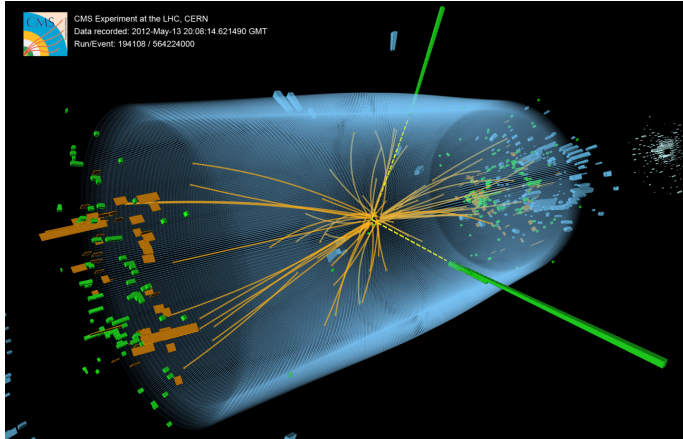
Welcome to Herwig!

Typical Herwig Installation:



(We're working on improving things, promise!)

Recap: Anatomy of a LHC Collision



Recap: Anatomy of a LHC Collision

We will consider the process

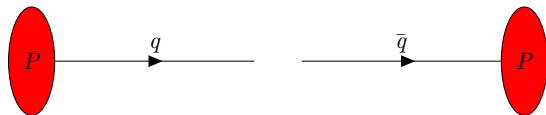
$$pp \rightarrow Z/\gamma \rightarrow e^+ e^-$$

Recap: Anatomy of a LHC Collision

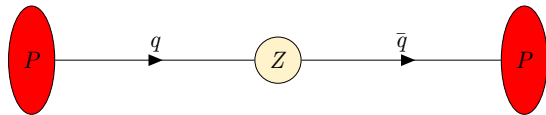
cf. Torbjörn's Slides on Monday. *We love making these diagrams ...*



Recap: Anatomy of a LHC Collision



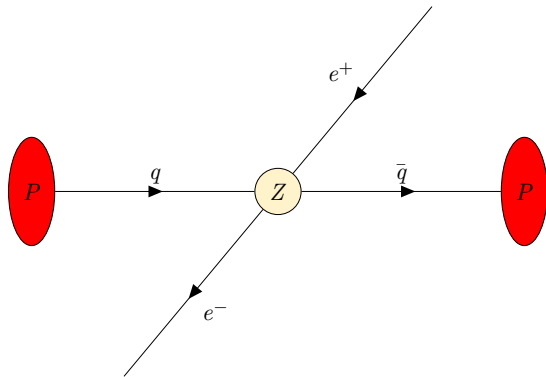
Recap: Anatomy of a LHC Collision



Recap: Anatomy of a LHC Collision

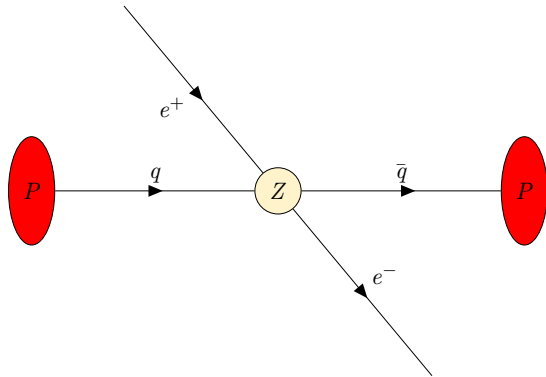
Final Particle Count: 2

Key Plot: Z Mass



Recap: Anatomy of a LHC Collision

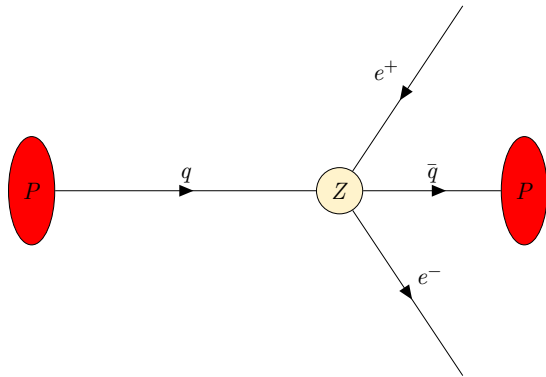
Final Particle Count: 2



Recap: Anatomy of a LHC Collision

Final Particle Count: 2

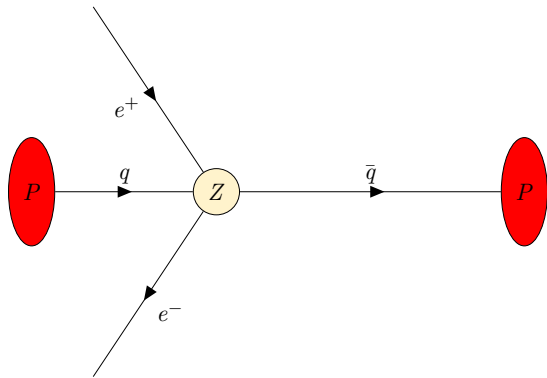
Key Plot: Z Rapidity



Recap: Anatomy of a LHC Collision

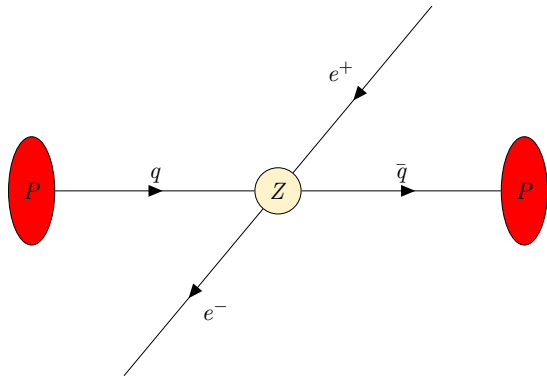
Final Particle Count: 2

Key Plot: Z Rapidity



Recap: Anatomy of a LHC Collision

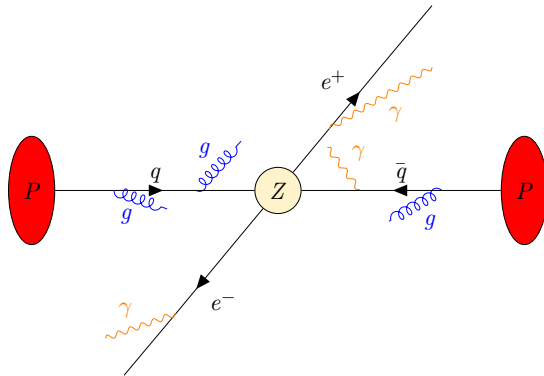
Final Particle Count: 2



Recap: Anatomy of a LHC Collision

Final State Particle Count: 8

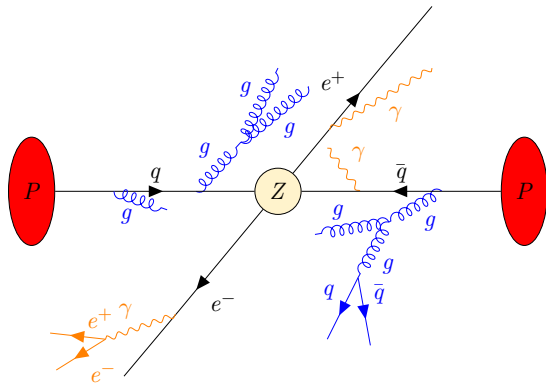
Key Plots: Z Transverse Momentum and Azimuth



Recap: Anatomy of a LHC Collision

Final State Particle Count: 15

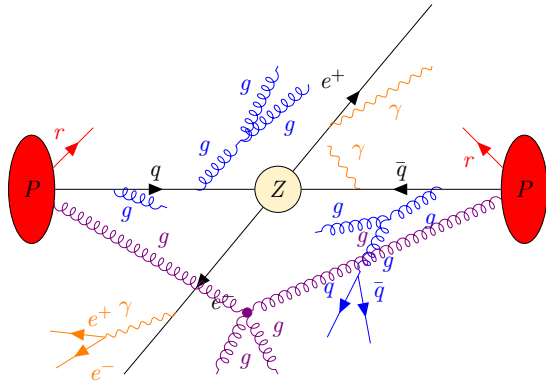
Key Plots: Jet masses, Transverse Momentum, Rapidities



Recap: Anatomy of a LHC Collision

Final State Particle Count: 19

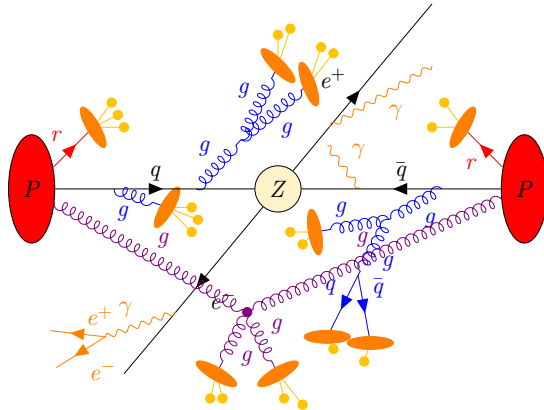
Key Plots: Jet Multiplicities



Recap: Anatomy of a LHC Collision

Final State Particle Count: 39

Shifts to all Plots



Docker

It is also possible to run docker for just one command. Set up an alias to define a shortcut for the `docker run...`

```
alias DRH='docker run -i --rm -u `id -u $USER`:`id -g` -v $PWD:$PWD -w $PWD herwigcollaboration/herwig-7.3:7.3.0'
```

Now you can run your programs like:

- ▶ `DRH Herwig read mySim.in`
- ▶ `DRH Herwig run mySim.run`
- ▶ `DRH rivet-mkhtml mySim.yoda`

Tutorial 1: LO Process

Start with Hard Process Generation:

- ▶ Check the out, tex and log from the run
- ▶ Do you observe convergence?

Then turn on the Shower and Hadronisation:

- ▶ Angular vs Dipole Shower, spot the deviations
- ▶ Notice any Hadronisation Effects? Turn on MPI as well?

BONUS: Produce ttbar/W and compare with Sherpa!

- ▶ `insert SubProcess:MatrixElements[0] MEHeavyQuark or MEqq2W2ff`
- ▶ `insert /Herwig/Analysis/Rivet:Analyses 0 MC_TTBAR or MC_WINC`

Tutorial 2: a few options...

Option A: NLO Z Production at the LHC

- ▶ Tutorial 1: NLO Matching, can compare results
- ▶ Takes a while to integrate the process
- ▶ *Maybe set it up and go for a coffee break!*
- ▶ Precomputed Version: [2024 TeraScale MC Tutorial](#)

Option B: Soft Physics, Minimum Bias [Faster ...](#)

- ▶ MPI, Diffraction, Colour Reconnection Models
- ▶ Faster simulations

...And That's All!

Thanks for Listening!

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