MadGraph 5: Tutorial

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Learn the Basics

- Launch madgraph and start the tutorial
  - ./bin/mg5
  - mg5> tutorial

and follow instructions

Do you understand MG5?

- Draw the diagram and after compare with MG5
  - u u~ > t t~
  - adding the semi-leptonic decay
  - g g > t t~ h (both SM/HEFT model)
  - g g > u u~ b b~

Answer

- generate u u~ > t t~

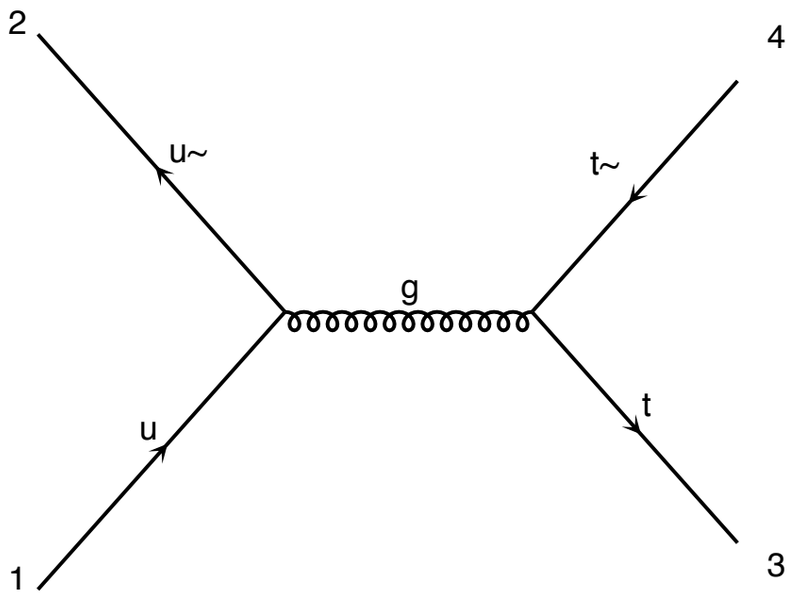


diagram 1 QCD=2, QED=0

- generate u u~ > t t~ QED=2

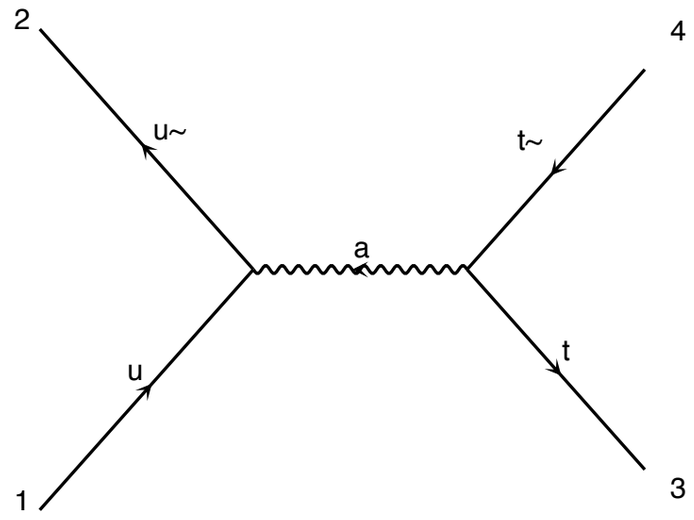
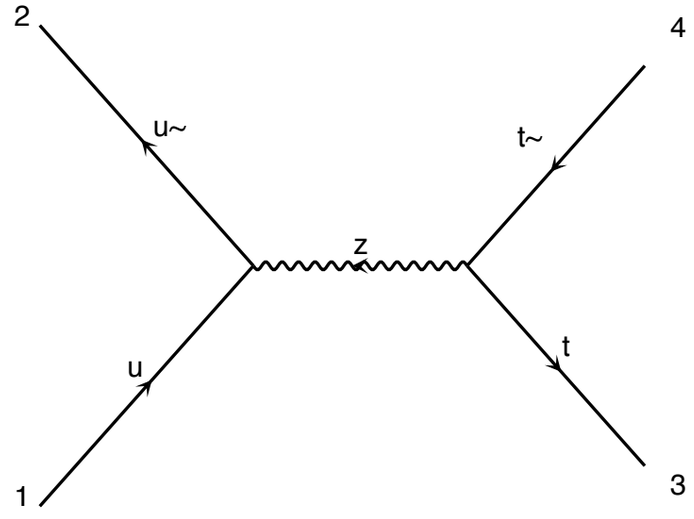


diagram 1 QCD=0, QED=2



No Higgs: yukawa set to zero in the model

Answer #2

- p p > t t~, (t > w+ b, w+ > l+ vl), \
  (t~ > w- b~, w- > j j)

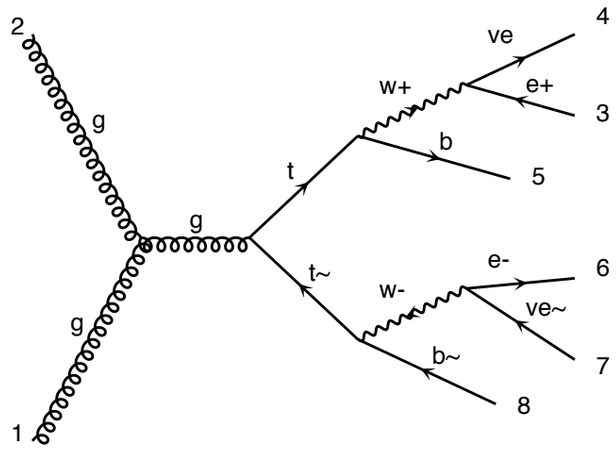


diagram 1 QCD=2, QED=4

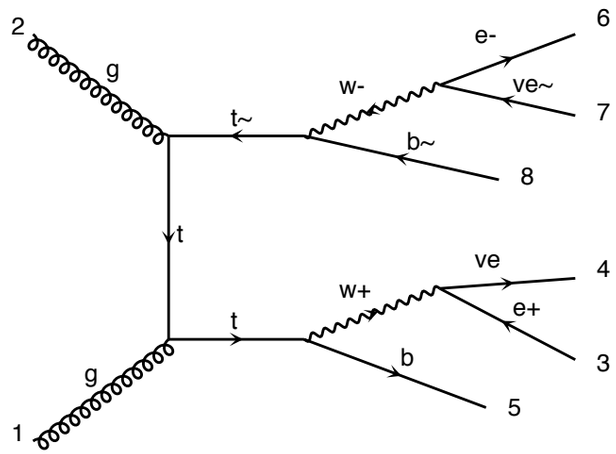
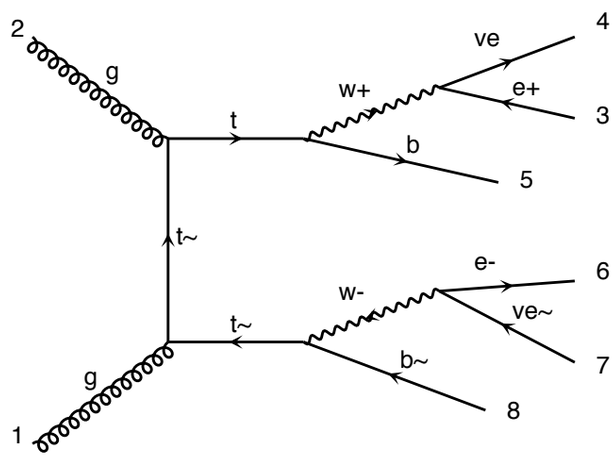
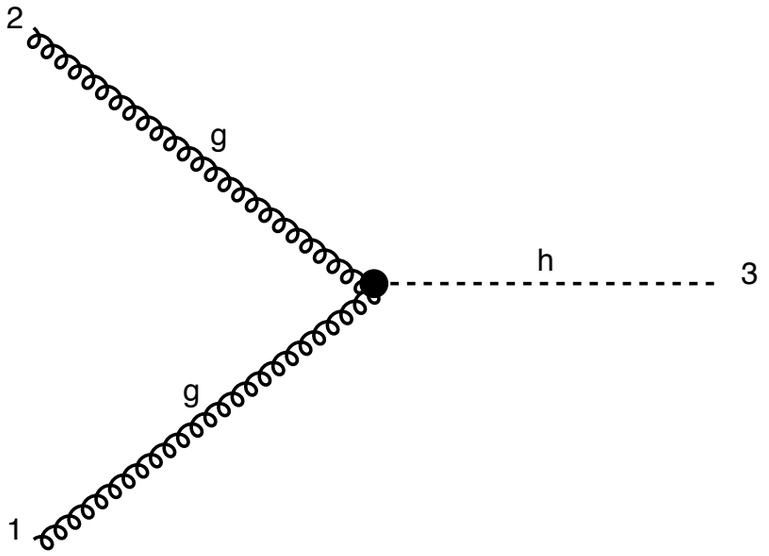


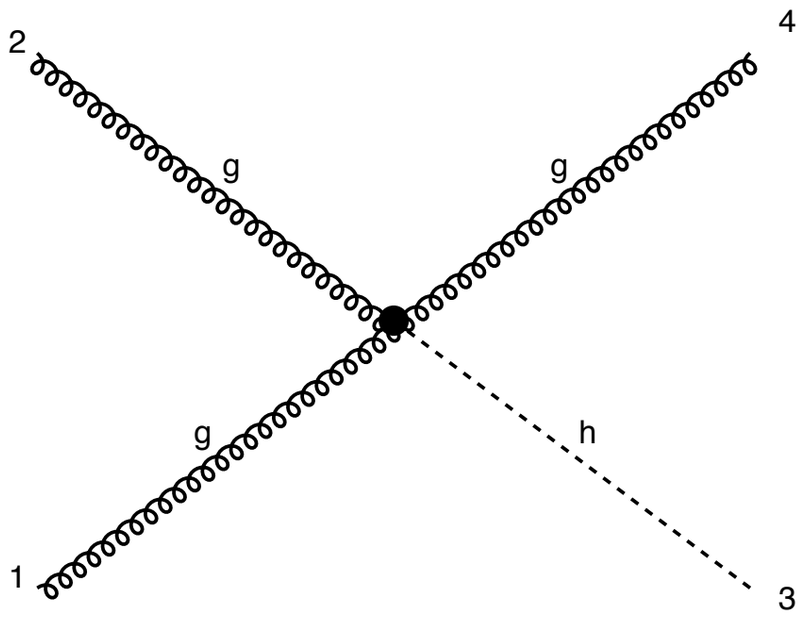
diagram 2 QCD=2, QED=4

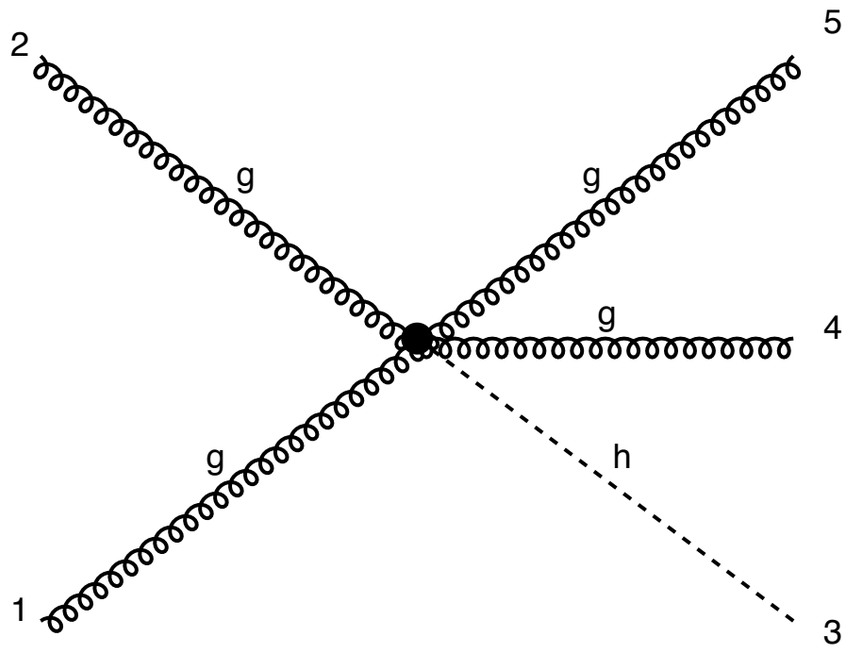


Answer #3

- HEFT







Answer #4

- 36 diagrams (84 with QED contributions)
- Don’t forget to do import model sm
- Could you do it by hand and found the 36?

Game

Game

- Who will be the first to create the diagram for:

Game

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  - Higgs produced by gluon fusion decaying in two weak bosons.

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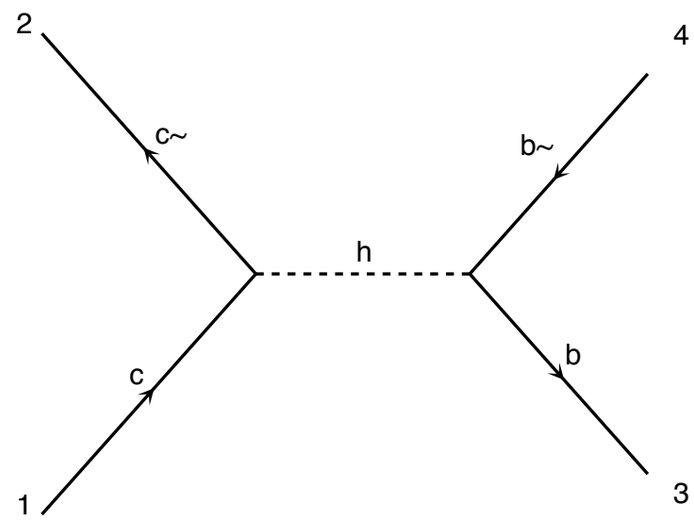
  - Higgs produced by gluon fusion decaying in two weak bosons.
  - squark pair production (squark up and down)
  - decays those in quark neutralino
  - create the following diagram:



How to compute cross-section?

- mg5 > launch [DIRECTORY] [options]
  - See help launch for options
- cd DIRECTORY
  - ./bin/generate_events

- How does it knows the parameter, the cut, ... ?
  - It uses files [cards]

What is in the cards

- Read
  - Cards/param_card.dat
  - Cards/run_card.dat
  - Cards/pythia_card_default.dat
  - Cards/pgs_card_default.dat
- To run pythia change the name of the card

Tevatron vs LHC

- Compare the Tevatron and LHC cross-section
- Check the various distributions
  - Why looking at those distributions?
  - Is the behavior expected?
  - ...

Signal + Background analysis

- Study the distributions at parton level.
- Strategy to distinguish the signal
- Look at the reconstructed level
- Is it still working?
- What is the effect of the shower?
- What is the effect of the detector?

Blind Game

- Those are signal events only (p p > ?? > Anything)
- Found which particle creates those distributions
- Try first only at detector level