

MG5aMC tutorial

Ex. I: Install MadGraph 5!

- launch it (`$./bin/mg5_amc`)
- **learn** it!
 - ➔ Type **tutorial** and follow instructions
- install external package
 - ➔ install MadAnalysis5

Where to find help (after the school)?

- Type tutorial
- Use the command “help” / “help XXX”
 - ➔ “help” tell you the next command that you need to do.
- Launchpad:
 - ➔ <https://answers.launchpad.net/madgraph5>
 - ➔ FAQ: <https://answers.launchpad.net/madgraph5/+faqs>

ASK US!

Exercise I: What are the “Cards”?

- Look at the Cards and identify what they do
 - ➔ `param_card`
 - ➔ `run_card:`
- To see such cards run:
 - ➔ Generate `p p > t t~`
 - ➔ Output
 - ➔ Launch
 - ◆ Type enter to the first question
 - ◆ Now you can type 1 or 2 to see the files

Exercise I: Cards Meaning

- How do you change
 - ➔ top mass
 - ➔ top width
 - ➔ W mass
 - ➔ beam energy
 - ➔ pt cut on the lepton

Ex. II : Syntax

Goal ● What's the default choice for QED/QCD order

Learn ● What's the difference between

$$\Rightarrow p p \rightarrow t t^{\sim}$$

$$\Rightarrow p p \rightarrow t t^{\sim} \text{ QED}=0$$

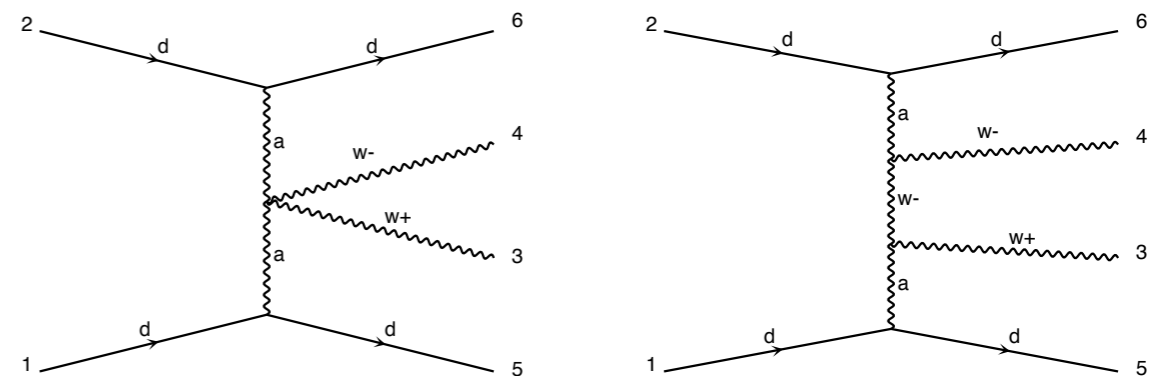
$$\Rightarrow p p \rightarrow t t^{\sim} \text{ QED} \leq 2$$

- Compute the cross-section for each of those and check the diagram

Check

- Generate VBF process (two jet + two W in final state) **only the diagram!**

- check that you have the QED diagram that you want:



Exercise III: Syntax again

- Generate the cross-section and the distribution (invariant mass) for
 - $pp > e^+ e^-$
 - $pp > z, z > e^+ e^-$
 - $pp > z > e^+ e^-$
 - $pp > e^+ e^- \$ z$ (note: it might not work in newest versions)
 - $pp > e^+ e^- / z$

Hint :To plot automatically distributions:

```
mg5> install MadAnalysis5
```

- Use the invariant mass distribution to determine the meaning of each syntax.

Exercise IV

Top Pair production

- Generate the process
- Which partonic subprocesses contribute?
- How many Feynman diagrams has each subprocess?
- Output the code
- Compute the cross-section at the LHC (13 TeV) for $m_t=170$ GeV
- Are b-quarks included in the initial state? If not, how can I include them?
- Recompute the $t\bar{t}$ cross-section for $m_t=170, 172, 174 \dots 180$ GeV