Introduction to MadGraph

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January 23, 2018

Initializing

1) 'HEP_TOOLS -> MG5_aMC ->bin'

2) Launch MadGraph

`./mg5_aMC`

Figure 1: This is a caption

Calculating ee->\mu\mu scattering cross section

(note) When you type

`help`

you can easily find the commands you need.

4) Begin 'tutorial'

`tutorial`

```
MG5_aMC>tutorial
tutorial:
        You have entered tutorial mode. This will introduce you to the main
        syntax options of MadGraph5_aMC@NLO.

        To learn more about the different options for a command, you can use
        MG5_aMC>help A_CMD
        To see a list of all commands, use
        MG5_aMC>help

        The goal of this tutorial is to learn how to generate a process and to
        produce the output for MadEvent. In this part we will learn
        a) How to generate a process
        b) How to create output for MadEvent
        c) How to run the MadEvent output

        Let's start with the first point, how to generate a process:
        MG5_aMC>generate p p > t t~
        Note that a space is mandatory between the particle names.

MG5_aMC>
```

Figure 2: This is a caption

5) Generate a process.

Here we will generate the process given in the tutorial first. ('~' symbol after the particle stands for 'anti'particle)

`generate p p > t t~`

```
INFO: Process has 1 diagrams
INFO: Trying process: d d~ > t t~ WEIGHTED<=2 @1
INFO: Process has 1 diagrams
INFO: Trying process: d s~ > t t~ WEIGHTED<=2 @1
INFO: Trying process: s d~ > t t~ WEIGHTED<=2 @1
INFO: Trying process: s s~ > t t~ WEIGHTED<=2 @1
INFO: Process has 1 diagrams
INFO: Process u~ u > t t~ added to mirror process u u~ > t t~
INFO: Process c~ c > t t~ added to mirror process c c~ > t t~
INFO: Process d~ d > t t~ added to mirror process d d~ > t t~
INFO: Process s~ s > t t~ added to mirror process s s~ > t t~
5 processes with 7 diagrams generated in 0.068 s
Total: 5 processes with 7 diagrams
tutorial:
        You have just generated a new process.
        Note that the coupling order "QED=0" was automatically added by MG5
        to avoid non-QCD diagrams which have negligible contribution.
        You can find more information on supported syntax by using:
        MG5_aMC>help generate
        To list all defined processes, type
        MG5_aMC>display processes

        If you want to know more about particles and multiparticles present,
        write
        MG5_aMC>display particles
        MG5_aMC>display multiparticles

        If you want to add a second process, use the add process command:
        MG5_aMC>add process p p > W+ j, W+ > l+ vl @2
        This adds a decay chain process, with the W+ decaying
        leptonically.

        At this stage you can export your processes to different formats. In
        this tutorial, we will explain how to create output for MadEvent.
        This is done simply by typing:
        MG5_aMC>output MY_FIRST_MG5_RUN

MG5_aMC>
```

Figure 3: This is a caption

6) Export the process.

The format is output for MadEvent. We will give the name 'test'

```
output test
```

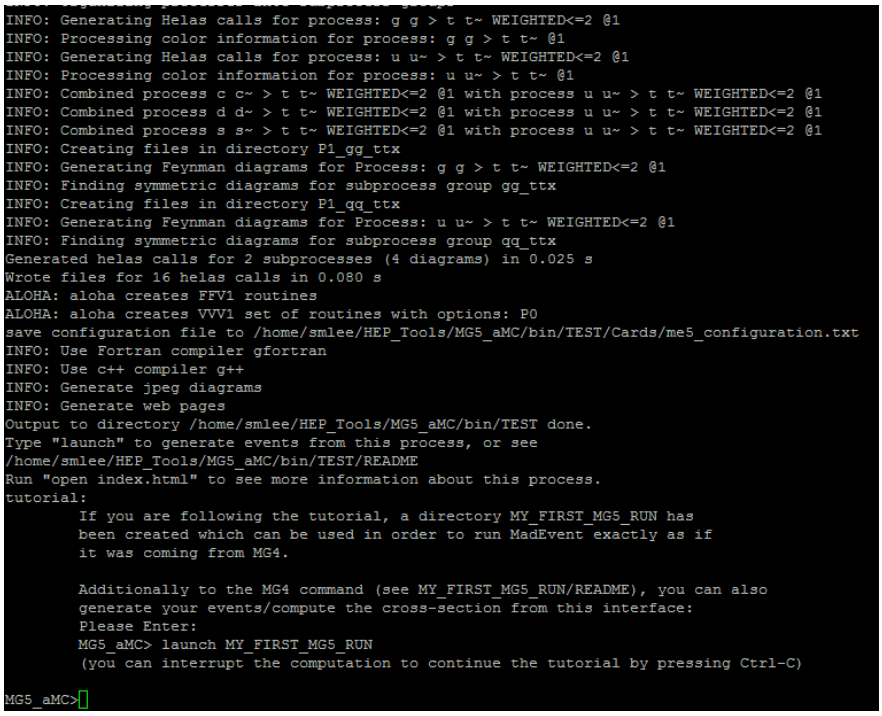

Figure 4: This is a caption

7) Launch the process.

```
launch test
```

Then, you will be asked whether you want to change options for parameters and running.

Now, we do not want to change the options.

When you want to change, see Appendix.

Therefore, type 'Enter'.

You will be asked something again. Also type 'Enter' without changing.

8) See the result

Then the firefox browser pops up and gives the result of the simulation.

9) Escape from MadGraph

```
quit
```

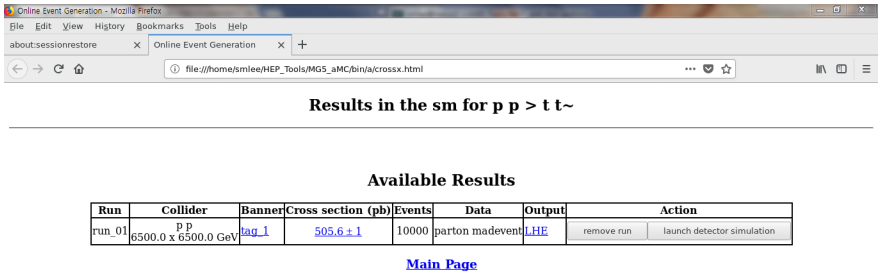

Figure 5: This is a caption

Loading the previous results

You might need the result of the previous simulation.

10) Go to /HEP_Tools/MG5_aMC/bin

There are several directories including your output ones. Go to the directory which you want to load.

```
firefox index.html
```

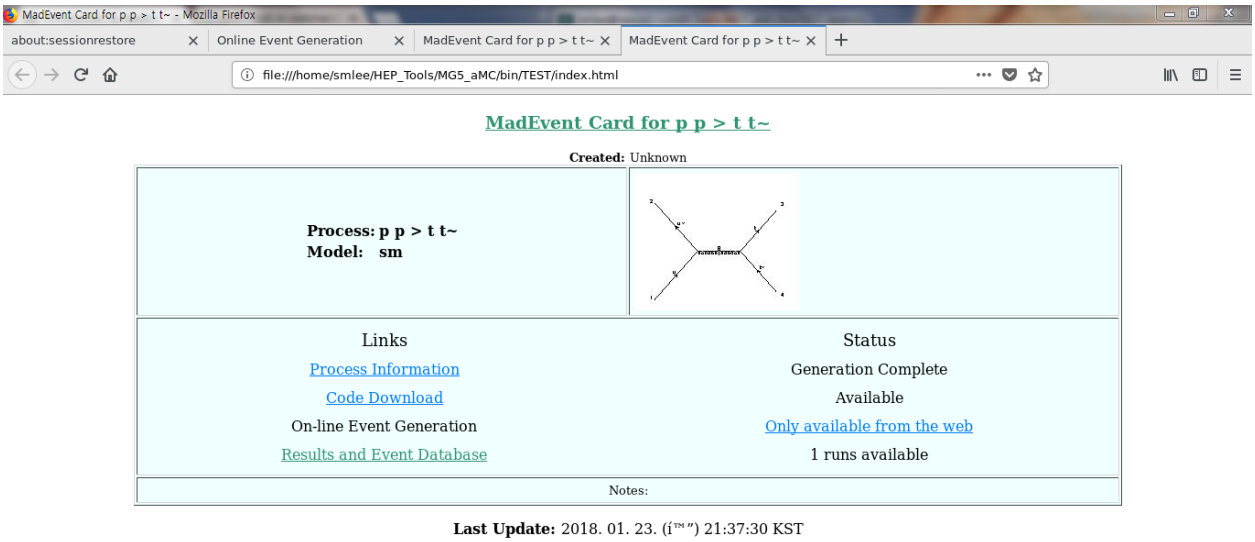

Figure 6: This is a caption

When you click ‘Results and Event Database’, you can see the previous results.

Appendix) How to change the options

Simulation contains a lot of options to change. Here, you can see how to change the momenta of colliding particles, as an simple example.

The previous processes are identical. We are right after the 'launch'

1) Launch the process.

After this you will be asked like this:

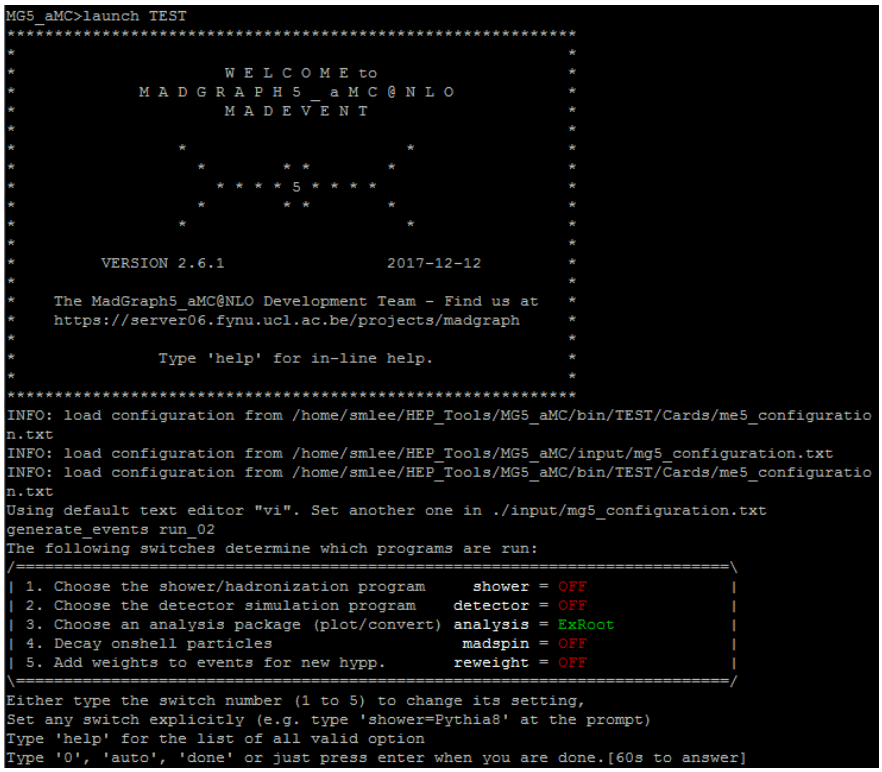

Figure 7: This is a caption

2) Determine whether programs are run or not.

For example, When you want to make the shower 'on', type '1'. You may check the shower options changes as 'shower = Pythia8'

You might want to off the shower again. Then type '1', once again.

When you are done, press 'Enter'.

Here, we will not change this options.

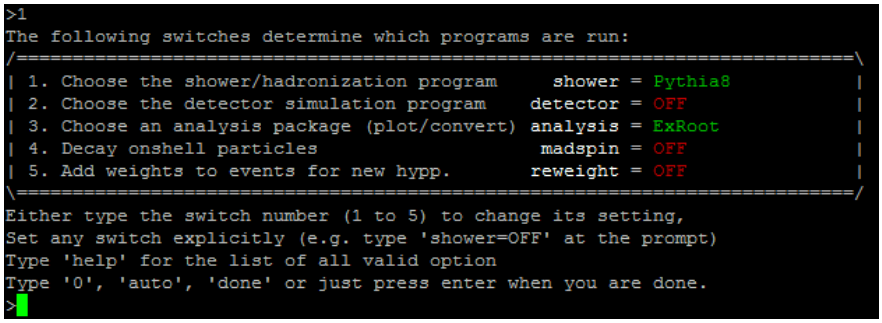

Figure 8: This is a caption

3) Edit a card

You will be asked once again as follows.

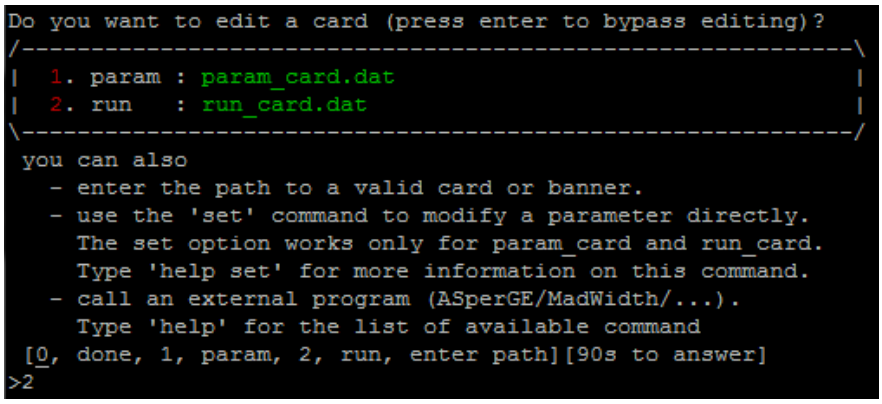

Figure 9: This is a caption

To change energies of colliding particles, type ‘2’

To go to insert mode, type ‘i’. Then you can change the script. Let us change 6500.0->1000.0.

When you are done, type ‘esc->:wq’

Now you have changed the script, press ‘Enter’ to run.

4) Result

You can get another line for new results. Note that the cross section increased, as expected.

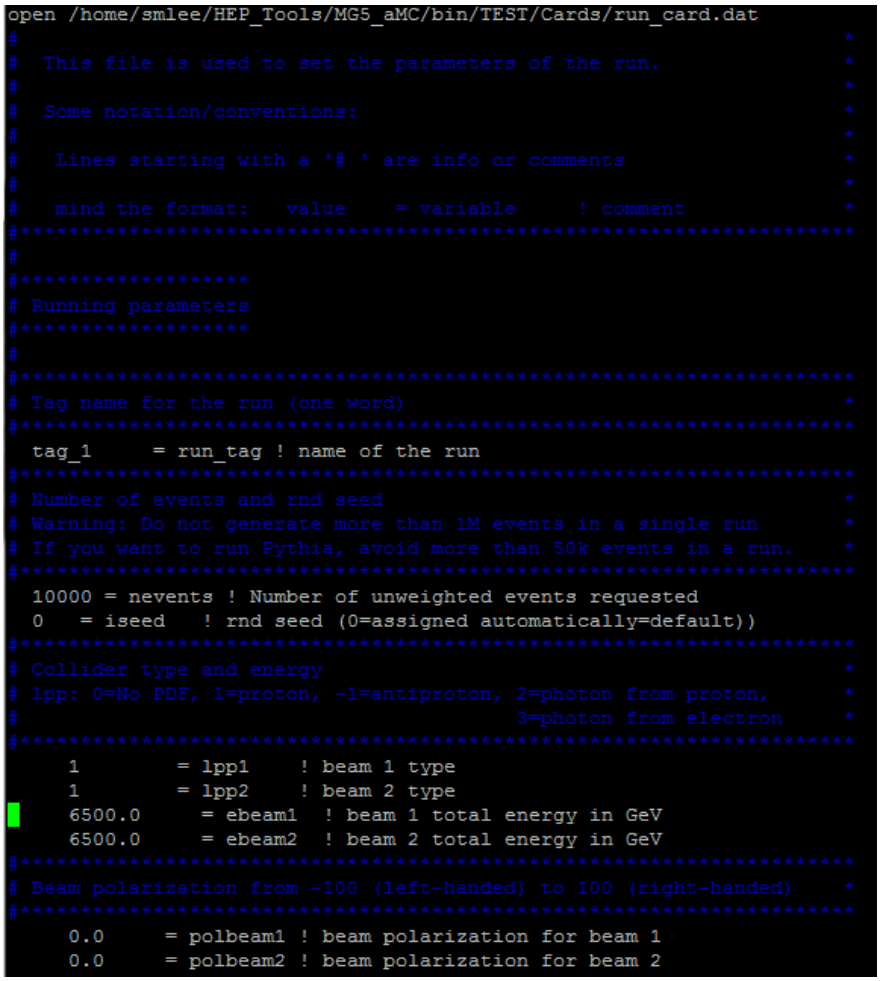

Figure 10: This is a caption

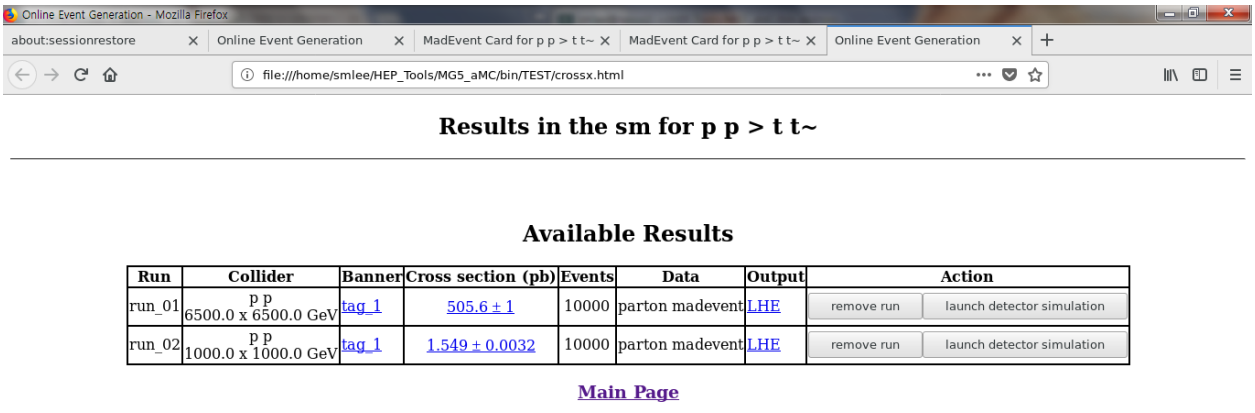

Figure 11: This is a caption