The LaTeX report

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Contents

1 Setup

1.1 Command history

```
ma5>
# set directory where running "./bin/ma5"; set lumi; define the signal significance
ma5>set main.currentdir = /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data
# need to change this directory path -> exit and type "pwd" to get the path
ma5>set main.lumi = 40
ma5>set main.fom.formula = 5
ma5>set main.fom.x = 0.0
ma5>
# import samples -> change the path to the LHE file
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/axion_signal/-
axion_signal_gurrola_cuts_1MeV.lhe.gz as signal
ma5>
# define bg and signal samples
ma5>set signal.type = signal
ma5>
# a jet can be from a light quark or b quark
ma5>define jets = j
ma5>define e = e+ e-
ma5>define mu = mu+ mu-
ma5>define ta = ta+ ta-
ma5>define lept = e mu ta
ma5>define ax = 9000005
ma5>select ((sdETA(jets[1] jets[2]) > 3.6 or sdETA(jets[1] jets[2]) < -3.6) and M(jets[1]
jets[2]) > 750) and (PT(a[1]) > 300 and M(a[1] a[2]) > 500)
ma5>
# define which plots to make
ma5>plot ETA(a[1] a[2])
ma5>
#set the plot/graph parameters
ma5>#set selection[1].xmin = -10
ma5>#set selection[1].xmax = 10
ma5>#set selection[1].nbins = 200
ma5>#set selection[1].titleX = "η[ax]"
  ma5>submit 1MeV_axion_rapidity_with_selections
```

1.2 Configuration

- MadAnalysis version 1.6.33 (2017/11/20).
- Histograms given for an integrated luminosity of 40.0fb^{-1}.

2 Datasets

2.1 signal

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-post_optimization_studies/mad_analyses .
- Sample consisting of: signal events.
- Generated events: 1000000 events.
- Normalization to the luminosity: 4094+/- 2 events.
- Ratio (event weight): 0.0041 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/-madgraph_data/axion_signal/-axion_signal_gurrola_cuts_1MeV.lh	1000000	0.102 @ 0.028%	0.0

3 Histos and cuts

3.1 Cut 1

```
* Cut:  select ( ( sdETA ( jets[1] jets[2] ) > 3.6 or sdETA ( jets[1] jets[2] ) < -3.6
) and M ( jets[1] jets[2] ) > 750.0 ) and ( PT ( a[1] ) > 300.0 and M ( a[1] a[2] )
> 500.0 )
```

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	767.0 +/- 25.0	3327.1 +/- 25.0	0.1873 +/- 0.0061	0.1873 +/- 0.0061

3.2 Histogram 1

`* Plot:  ETA ( a[1] a[2] )`

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	766	1.0	0.00391743	1.818	0.0	0.0005338

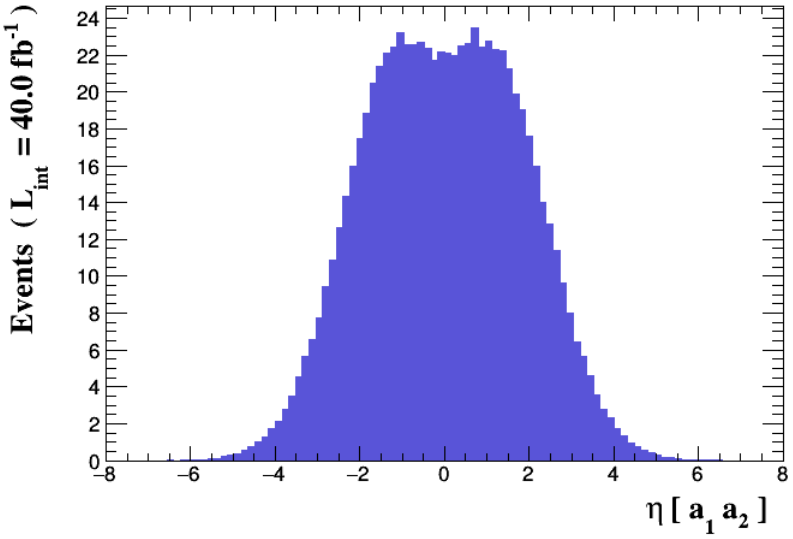

Figure 1.

4 Summary

4.1 Cut-flow charts

- How to compare signal (S) and background (B): S/sqrt(S+B+(xB)**2) .
- Object definition selections are indicated in cyan.
- Reject and select are indicated by 'REJ' and 'SEL' respectively

Cuts	Signal (S)	Background (B)	S vs B
Initial (no cut)	4094.08 +/- 1.13		
SEL: ((sdETA (jets[1] jets[2]) > 3.6 or sdETA	767.0 +/- 25.0		