The LaTeX report

Generated by elijahsheridan on 17 July 2020, 11:41:11

This report has been generated automatically by MadAnalysis 5.

Please cite:

> **E. Conte, B. Fuks and G. Serret**,
> *MadAnalysis 5, A User-Friendly Framework for Collider Phenomenology*,
> Comput. Phys. Commun. **184** (2013) 222-256,
> arXiv:1206.1599 [hep-ph].

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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_to_photon_signal/Events/run_01/-
unweighted_events.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 (PT(a[1]) > 300 and M(a[1] a[2]) > 500)
ma5>#  define which plots to make
ma5>plot E(a[1] a[2])
ma5>plot P(a[1] a[2])
ma5>#set the plot/graph parameters
ma5>set selection[1].xmin = 0
ma5>set selection[1].xmax = 3000
ma5>set selection[1].nbins = 200
ma5>set selection[1].titleX = "E[ax] (GeV)"
ma5>set selection[2].xmin = 0
ma5>set selection[2].xmax = 3000
ma5>set selection[2].nbins = 200
ma5>set selection[2].titleX = "P[ax] (GeV)"
ma5>submit axion_energy_momentum_theory_test
```

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: 1000 events.
- Normalization to the luminosity: 3837+/- 25 events.
- Ratio (event weight): 3.8 - warning: please generate more events (weight larger than 1)!

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_to_photon_signal/Events/-run_01/unweighted_events.lhe.gz	1000	0.0959 @ 0.64%	0.0

3 Histos and cuts

3.1 Cut 1

*** Cut: select 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	2292.2 +/- 33.7	1544.9 +/- 31.9	0.59737 +/- 0.00792	0.59737 +/- 0.00792

3.2 Histogram 1

*** Plot: E (a[1] a[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	2313	1.0	1676.19	722.6	0.0	5.97

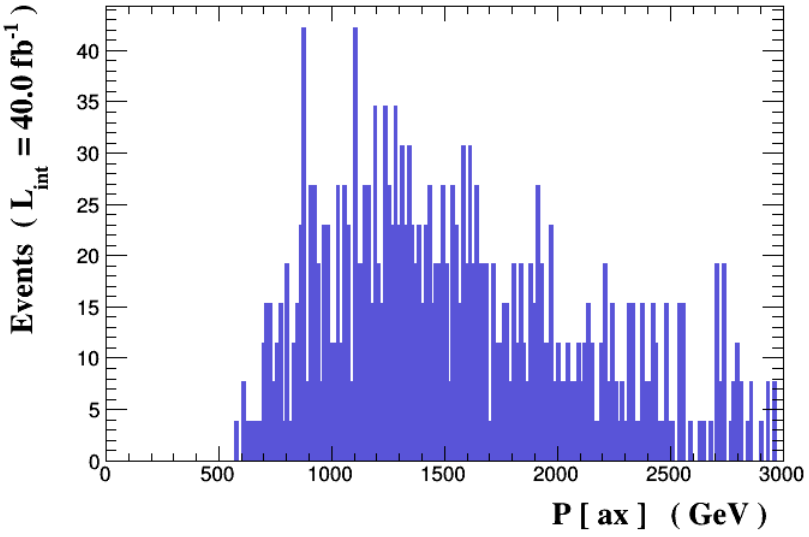

Figure 1.

3.3 Histogram 2

*** Plot: P (a[1] a[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	2313	1.0	983.497	587.1	0.0	39.97

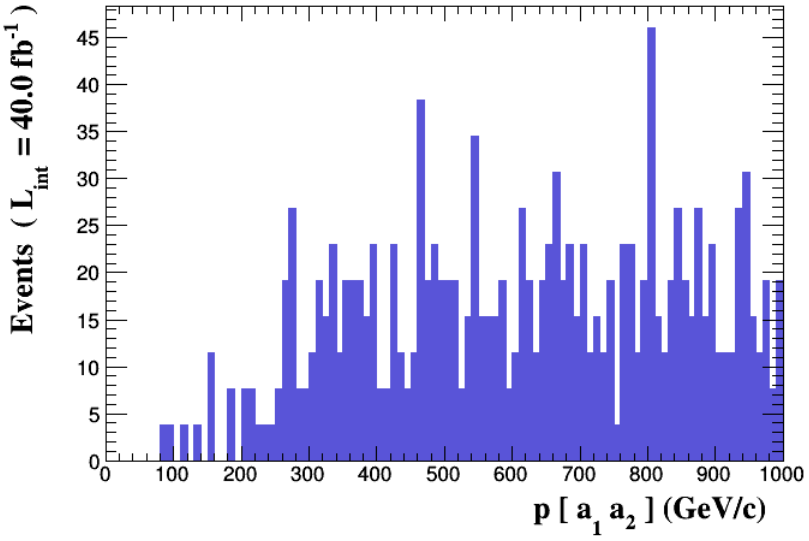

Figure 2.

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)	3837.1 +/- 24.4		
SEL: PT (a[1]) > 300.0 and M (a[1] a[2]) > 500	2292.2 +/- 33.7		