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 # need to
change this directory path -> exit and type "pwd" to get the path
ma5>set main.lumi = 40.0
ma5>set main.SBratio = 'S/sqrt(S+B)'
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>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_0_100_merged.lhe.gz as bg_vbf_0_100
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_100_200_merged.lhe.gz as bg_vbf_100_200
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_200_400_merged.lhe.gz as bg_vbf_200_400
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_400_600_merged.lhe.gz as bg_vbf_400_600
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_600_800_merged.lhe.gz as bg_vbf_600_800
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_800_1200_merged.lhe.gz as bg_vbf_800_1200
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_1200_1600_merged.lhe.gz as bg_vbf_1200_1600
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/vbf_diphoton_background_
merged_lhe/vbf_diphoton_background_ht_1600_inf_merged.lhe.gz as bg_vbf_1600_inf
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_0_100_merged.lhe.gz as bg_dip_0_100
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_100_200_merged.lhe.gz as bg_dip_100_200
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_200_400_merged.lhe.gz as bg_dip_200_400
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_400_600_merged.lhe.gz as bg_dip_400_600
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_600_800_merged.lhe.gz as bg_dip_600_800
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_800_1200_merged.lhe.gz as bg_dip_800_1200
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_1200_1600_merged.lhe.gz as bg_dip_1200_1600
ma5>import /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/madgraph_data/diphoton_double_isr_back
merged_lhe/diphoton_double_isr_background_ht_1600_inf_merged.lhe.gz as bg_dip_1600_inf
ma5>
# define bg and signal samples
ma5>set signal.type = signal
ma5>set bg_vbf_0_100.type = background
ma5>set bg_vbf_100_200.type = background
ma5>set bg_vbf_200_400.type = background
ma5>set bg_vbf_400_600.type = background
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ma5>set bg_vbf_600_800.type = background
ma5>set bg_vbf_800_1200.type = background
ma5>set bg_vbf_1200_1600.type = background
ma5>set bg_vbf_1600_inf.type = background
ma5>set bg_dip_0_100.type = background
ma5>set bg_dip_100_200.type = background
ma5>set bg_dip_200_400.type = background
ma5>set bg_dip_400_600.type = background
ma5>set bg_dip_600_800.type = background
ma5>set bg_dip_800_1200.type = background
ma5>set bg_dip_1200_1600.type = background
ma5>set bg_dip_1600_inf.type = background
ma5># define weights for the samples
ma5>#set sample_1.weight = 1
ma5>#set sample_2.weight = 1
ma5># line styles and colors
ma5>set signal.linecolor = red
ma5>set signal.linestyle = dashed
ma5>set signal.linewidth = 3
ma5>set bg_vbf_0_100.linecolor = blue-4
ma5>set bg_vbf_0_100.linestyle = dash-dotted
ma5>set bg_vbf_0_100.linewidth = 4
ma5>set bg_vbf_100_200.linecolor = blue-3
ma5>set bg_vbf_100_200.linestyle = dash-dotted
ma5>set bg_vbf_100_200.linewidth = 4
ma5>set bg_vbf_200_400.linecolor = blue-2
ma5>set bg_vbf_200_400.linestyle = dash-dotted
ma5>set bg_vbf_200_400.linewidth = 4
ma5>set bg_vbf_400_600.linecolor = blue-1
ma5>set bg_vbf_400_600.linestyle = dash-dotted
ma5>set bg_vbf_400_600.linewidth = 4
ma5>set bg_vbf_600_800.linecolor = blue
ma5>set bg_vbf_600_800.linestyle = dash-dotted
ma5>set bg_vbf_600_800.linewidth = 4
ma5>set bg_vbf_800_1200.linecolor = blue+1
ma5>set bg_vbf_800_1200.linestyle = dash-dotted
ma5>set bg_vbf_800_1200.linewidth = 4
ma5>set bg_vbf_1200_1600.linecolor = blue+2
ma5>set bg_vbf_1200_1600.linestyle = dash-dotted
ma5>set bg_vbf_1200_1600.linewidth = 4
ma5>set bg_vbf_1600_inf.linecolor = blue+3
ma5>set bg_vbf_1600_inf.linestyle = dash-dotted
ma5>set bg_vbf_1600_inf.linewidth = 4
ma5>set bg_dip_0_100.linecolor = green-4
ma5>set bg_dip_0_100.linestyle = dash-dotted
ma5>set bg_dip_0_100.linewidth = 4
ma5>set bg_dip_100_200.linecolor = green-3
ma5>set bg_dip_100_200.linestyle = dash-dotted
ma5>set bg_dip_100_200.linewidth = 4
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```
ma5>set bg_dip_200_400.linecolor = green-2
ma5>set bg_dip_200_400.linestyle = dash-dotted
ma5>set bg_dip_200_400.linewidth = 4
ma5>set bg_dip_400_600.linecolor = green-1
ma5>set bg_dip_400_600.linestyle = dash-dotted
ma5>set bg_dip_400_600.linewidth = 4
ma5>set bg_dip_600_800.linecolor = green
ma5>set bg_dip_600_800.linestyle = dash-dotted
ma5>set bg_dip_600_800.linewidth = 4
ma5>set bg_dip_800_1200.linecolor = green+1
ma5>set bg_dip_800_1200.linestyle = dash-dotted
ma5>set bg_dip_800_1200.linewidth = 4
ma5>set bg_dip_1200_1600.linecolor = green+2
ma5>set bg_dip_1200_1600.linestyle = dash-dotted
ma5>set bg_dip_1200_1600.linewidth = 4
ma5>set bg_dip_1600_inf.linecolor = green+3
ma5>set bg_dip_1600_inf.linestyle = dash-dotted
ma5>set bg_dip_1600_inf.linewidth = 4
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># apply selections
ma5>select PT(a[1]) > 250 and M(a[1] a[2]) > 350
ma5>select (sdETA(jets[1] jets[2]) > 3.1 or sdETA(jets[1] jets[2]) < -3.1) and M(jets[1]
jets[2]) > 1750
ma5>submit second_analysis_sdEta3.1_mjj1750
```

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/-optimization .
- 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.ll	1000000	0.102 @ 0.028%	0.0

2.2 bg_vbf_0_100

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1000000 events.
- Normalization to the luminosity: 12150+/- 24 events.
- Ratio (event weight): 0.012 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_0_1(	1000000	0.304 @ 0.19%	0.0

2.3 bg_vbf_100_200

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 965662 events.

- Normalization to the luminosity: 9695+/- 17 events.
- Ratio (event weight): 0.01 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_100_	965662	0.242 @ 0.17%	0.0

2.4 bg_vbf_200_400

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 984165 events.
- Normalization to the luminosity: 5413+/- 11 events.
- Ratio (event weight): 0.0055 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_200_	984165	0.135 @ 0.2%	0.0

2.5 bg_vbf_400_600

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1000000 events.
- Normalization to the luminosity: 986+/- 2 events.
- Ratio (event weight): 0.00099 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_400_	1000000	0.0247 @ 0.14%	0.0

2.6 bg_vbf_600_800

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1000000 events.
- Normalization to the luminosity: 252+/- 1 events.
- Ratio (event weight): 0.00025 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_600_	1000000	0.0063 @ 0.13%	0.0

2.7 bg_vbf_800_1200

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 400839 events.
- Normalization to the luminosity: 114+/- 1 events.
- Ratio (event weight): 0.00028 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_800_	400839	0.00287 @ 0.16%	0.0

2.8 bg_vbf_1200_1600

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 953803 events.
- Normalization to the luminosity: 20+/- 1 events.
- Ratio (event weight): 2.1e-05 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_1200	953803	0.000515 @ 0.16%	0.0

2.9 bg_vbf_1600_inf

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 270148 events.
- Normalization to the luminosity: 7+/- 1 events.
- Ratio (event weight): 2.6e-05 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-vbf_diphoton_background_data/-merged_lhe/-vbf_diphoton_background_ht_1600	270148	0.000191 @ 0.11%	0.0

2.10 bg_dip_0_100

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 2710847+/- 4614 events.

- Ratio (event weight): 2.6 - 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_pheno/madgraph_data/-diphoton_double_isr_background_c merged_lhe/-diphoton_double_isr_background_l	1040000	67.8 @ 0.17%	0.0

2.11 bg_dip_100_200

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 1095362+/- 1528 events.
- Ratio (event weight): 1.1 - 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_pheno/madgraph_data/-diphoton_double_isr_background_c merged_lhe/-diphoton_double_isr_background_l	1040000	27.4 @ 0.14%	0.0

2.12 bg_dip_200_400

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 239548+/- 414 events.
- Ratio (event weight): 0.23 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_c merged_lhe/-diphoton_double_isr_background_l	1040000	5.99 @ 0.17%	0.0

2.13 bg_dip_400_600

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 28798+/- 53 events.
- Ratio (event weight): 0.028 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_merged_lhe/-diphoton_double_isr_background_l	1040000	0.72 @ 0.18%	0.0

2.14 bg_dip_600_800

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 662009 events.
- Normalization to the luminosity: 6674+/- 28 events.
- Ratio (event weight): 0.01 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_merged_lhe/-diphoton_double_isr_background_l	662009	0.167 @ 0.41%	0.0

2.15 bg_dip_800_1200

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 2942+/- 6 events.

- Ratio (event weight): 0.0028 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_ merged_lhe/-diphoton_double_isr_background_l	1040000	0.0736 @ 0.17%	0.0

2.16 bg_dip_1200_1600

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 337115 events.
- Normalization to the luminosity: 513+/- 3 events.
- Ratio (event weight): 0.0015 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_ merged_lhe/-diphoton_double_isr_background_l	337115	0.0128 @ 0.51%	0.0

2.17 bg_dip_1600_inf

- Samples stored in the directory: /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/-optimization .
- Sample consisting of: background events.
- Generated events: 1040000 events.
- Normalization to the luminosity: 187+/- 1 events.
- Ratio (event weight): 0.00018 .

Path to the event file	Nr. of events	Cross section (pb)	Negative wgts (%)
/Users/elijahsheridan/-MG5_aMC_v2_6_5/-axion_pheno/madgraph_data/-diphoton_double_isr_background_ merged_lhe/-diphoton_double_isr_background_l	1040000	0.00469 @ 0.15%	0.0

3 Histos and cuts

3.1 Cut 1

*** Cut: select PT (a[1]) > 250.0 and M (a[1] a[2]) > 350.0**

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	3059.5 +/- 27.8	1034.6 +/- 27.8	0.74729 +/- 0.00679	0.74729 +/- 0.00679
bg_vbf_0_10	1.62 +/- 1.27	12148.7 +/- 23.1	0.000133 +/- 0.000105	0.000133 +/- 0.000105
bg_vbf_100_	9.89 +/- 3.14	9685.4 +/- 16.9	0.001020 +/- 0.000324	0.001020 +/- 0.000324
bg_vbf_200_	39.73 +/- 6.28	5373.5 +/- 12.5	0.00734 +/- 0.00116	0.00734 +/- 0.00116
bg_vbf_400_	26.52 +/- 5.08	960.33 +/- 5.25	0.02688 +/- 0.00515	0.02688 +/- 0.00515
bg_vbf_600_	11.35 +/- 3.29	240.73 +/- 3.31	0.0450 +/- 0.0131	0.0450 +/- 0.0131
bg_vbf_800_	6.71 +/- 2.51	108.06 +/- 2.52	0.0584 +/- 0.0219	0.0584 +/- 0.0219
bg_vbf_1200_	1.41 +/- 1.15	19.19 +/- 1.15	0.0685 +/- 0.0556	0.0685 +/- 0.0556
bg_vbf_1600_	0.546 +/- 0.712	7.113 +/- 0.712	0.0713 +/- 0.0930	0.0713 +/- 0.0930
bg_dip_0_10	143.4 +/- 12.0	2710703 +/- 4613	5.29e-05 +/- 4.42e-06	5.29e-05 +/- 4.42e-06
bg_dip_100_	712.0 +/- 26.7	1094650 +/- 1526	6.50e-04 +/- 2.44e-05	6.50e-04 +/- 2.44e-05
bg_dip_200_	1517.5 +/- 38.9	238031 +/- 413	0.006335 +/- 0.000162	0.006335 +/- 0.000162
bg_dip_400_	620.4 +/- 24.7	28178.3 +/- 56.7	0.021542 +/- 0.000856	0.021542 +/- 0.000856
bg_dip_600_	208.8 +/- 14.2	6465.5 +/- 30.3	0.03129 +/- 0.00213	0.03129 +/- 0.00213
bg_dip_800_	112.2 +/- 10.4	2830.1 +/- 11.5	0.03813 +/- 0.00353	0.03813 +/- 0.00353
bg_dip_1200_	22.64 +/- 4.65	490.86 +/- 5.29	0.04409 +/- 0.00906	0.04409 +/- 0.00906
bg_dip_1600_	9.43 +/- 2.99	178.35 +/- 3.01	0.0502 +/- 0.0159	0.0502 +/- 0.0159

3.2 Cut 2

*** Cut: select (sdETA (jets[1] jets[2]) > 3.1 or sdETA (jets[1] jets[2]) < -3.1) and M (jets[1] jets[2]) > 1750.0**

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	537.5 +/- 21.6	2522.0 +/- 31.1	0.17567 +/- 0.00688	0.13127 +/- 0.00528
bg_vbf_0_10	0.0 +/- 0.0	1.62 +/- 1.27	0.0 +/- 0.0	0.0 +/- 0.0
bg_vbf_100_	0.612 +/- 0.783	9.28 +/- 3.04	0.0619 +/- 0.0766	6.32e-05 +/- 8.07e-05
bg_vbf_200_	5.8 +/- 2.4	33.95 +/- 5.81	0.146 +/- 0.056	0.001069 +/- 0.000444
bg_vbf_400_	6.50 +/- 2.54	20.02 +/- 4.43	0.2450 +/- 0.0835	0.00659 +/- 0.00257
bg_vbf_600_	3.62 +/- 1.89	7.73 +/- 2.74	0.319 +/- 0.138	0.0144 +/- 0.0075
bg_vbf_800_	1.97 +/- 1.39	4.73 +/- 2.13	0.294 +/- 0.176	0.0172 +/- 0.0121
bg_vbf_1200_	0.219 +/- 0.466	1.19 +/- 1.06	0.156 +/- 0.305	0.0107 +/- 0.0226
bg_vbf_1600_	0.0289 +/- 0.1697	0.517 +/- 0.694	0.053 +/- 0.303	0.00378 +/- 0.02216
bg_dip_0_10	0.0 +/- 0.0	143.4 +/- 12.0	0.0 +/- 0.0	0.0 +/- 0.0
bg_dip_100_	0.0 +/- 0.0	712.0 +/- 26.7	0.0 +/- 0.0	0.0 +/- 0.0
bg_dip_200_	4.14 +/- 2.04	1513.4 +/- 38.9	0.00273 +/- 0.00134	1.73e-05 +/- 8.50e-06
bg_dip_400_	6.06 +/- 2.46	614.3 +/- 24.5	0.00977 +/- 0.00395	2.11e-04 +/- 8.55e-05
bg_dip_600_	4.93 +/- 2.22	203.9 +/- 14.1	0.0236 +/- 0.0105	0.000739 +/- 0.000333
bg_dip_800_	3.36 +/- 1.83	108.8 +/- 10.2	0.0299 +/- 0.0161	0.001141 +/- 0.000622
bg_dip_1200_	0.431 +/- 0.656	22.21 +/- 4.61	0.019 +/- 0.029	0.00084 +/- 0.00128
bg_dip_1600_	0.0495 +/- 0.2224	9.38 +/- 2.99	0.00524 +/- 0.02351	0.000263 +/- 0.001184

4 Summary

4.1 Cut-flow charts

- How to compare signal (S) and background (B): S/sqrt(S+B) .
- 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	4113516 +/- 4877	2.01760 +/- 0.00132
SEL: PT (a[1]) > 250.0 and M (a[1] a[2]) > 350	3059.5 +/- 27.8	3444.2 +/- 58.5	37.937 +/- 0.314
SEL: (sdETA (jets[1] jets[2]) > 3.1 or sdETA (	537.5 +/- 21.6	37.72 +/- 6.13	22.410 +/- 0.495