



The LaTeX report

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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 # 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

```

```

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]) > 400
ma5>select (sdETA(jets[1] jets[2]) > 3.6 or sdETA(jets[1] jets[2]) < -3.6) and M(jets[1]
jets[2]) > 1500
ma5>submit second_analysis_sdEta3.6_mjj1500

```

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.lh	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_100	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 \pm 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 \pm 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 \pm 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_cmerged_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_cmerged_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_c 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_c 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_c 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 $M(a[1] a[2]) > 400.0$

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	2954.1 +/- 28.7	1140.0 +/- 28.7	0.72154 +/- 0.00701	0.72154 +/- 0.00701
bg_vbf_0_10	1.62 +/- 1.27	12148.7 +/- 23.1	0.000133 +/- 0.000105	0.000133 +/- 0.000105
bg_vbf_100_	9.26 +/- 3.04	9686.1 +/- 16.9	0.000955 +/- 0.000314	0.000955 +/- 0.000314
bg_vbf_200_	31.85 +/- 5.63	5381.4 +/- 12.2	0.00588 +/- 0.00104	0.00588 +/- 0.00104
bg_vbf_400_	20.7 +/- 4.5	966.19 +/- 4.69	0.02094 +/- 0.00456	0.02094 +/- 0.00456
bg_vbf_600_	8.98 +/- 2.94	243.10 +/- 2.96	0.0356 +/- 0.0117	0.0356 +/- 0.0117
bg_vbf_800_	5.42 +/- 2.27	109.34 +/- 2.28	0.0472 +/- 0.0198	0.0472 +/- 0.0198
bg_vbf_1200	1.15 +/- 1.04	19.44 +/- 1.04	0.0560 +/- 0.0507	0.0560 +/- 0.0507
bg_vbf_1600	0.446 +/- 0.648	7.212 +/- 0.648	0.0583 +/- 0.0846	0.0583 +/- 0.0846
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_	621.5 +/- 24.9	1094741 +/- 1526	5.67e-04 +/- 2.28e-05	5.67e-04 +/- 2.28e-05
bg_dip_200_	1110.1 +/- 33.3	238438 +/- 413	0.004634 +/- 0.000139	0.004634 +/- 0.000139
bg_dip_400_	465.3 +/- 21.4	28333.4 +/- 55.6	0.016158 +/- 0.000743	0.016158 +/- 0.000743
bg_dip_600_	162.7 +/- 12.6	6511.7 +/- 29.7	0.02437 +/- 0.00189	0.02437 +/- 0.00189
bg_dip_800_	90.22 +/- 9.35	2852.1 +/- 10.6	0.03066 +/- 0.00318	0.03066 +/- 0.00318
bg_dip_1200	18.47 +/- 4.22	495.04 +/- 4.92	0.03596 +/- 0.00822	0.03596 +/- 0.00822
bg_dip_1600	7.70 +/- 2.72	180.09 +/- 2.73	0.0410 +/- 0.0145	0.0410 +/- 0.0145

3.2 Cut 2

* Cut: select (sdETA (jets[1] jets[2]) > 3.6 or sdETA (jets[1] jets[2]) < -3.6) and M (jets[1] jets[2]) > 1500.0

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	485.7 +/- 20.7	2468.4 +/- 31.3	0.16442 +/- 0.00682	0.11864 +/- 0.00505
bg_vbf_0_10	0.0 +/- 0.0	1.62 +/- 1.27	0.0 +/- 0.0	0.0 +/- 0.0
bg_vbf_100_	0.823 +/- 0.907	8.4 +/- 2.9	0.0889 +/- 0.0935	8.49e-05 +/- 9.36e-05
bg_vbf_200_	6.70 +/- 2.59	25.1 +/- 5.0	0.2105 +/- 0.0722	0.001239 +/- 0.000478
bg_vbf_400_	6.67 +/- 2.57	13.99 +/- 3.71	0.323 +/- 0.103	0.00676 +/- 0.00261
bg_vbf_600_	2.65 +/- 1.62	6.33 +/- 2.48	0.295 +/- 0.152	0.01052 +/- 0.00643
bg_vbf_800_	1.003 +/- 0.997	4.42 +/- 2.06	0.185 +/- 0.167	0.00874 +/- 0.00869
bg_vbf_1200_	0.0795 +/- 0.2813	1.07 +/- 1.01	0.0688 +/- 0.2357	0.00386 +/- 0.01366
bg_vbf_1600_	0.00757 +/- 0.08694	0.439 +/- 0.643	0.017 +/- 0.193	0.000988 +/- 0.011352
bg_dip_0_10	0.0 +/- 0.0	143.4 +/- 12.0	0.0 +/- 0.0	0.0 +/- 0.0
bg_dip_100_	1.05 +/- 1.03	620.4 +/- 24.9	0.00169 +/- 0.00165	9.61e-07 +/- 9.37e-07
bg_dip_200_	6.22 +/- 2.49	1103.8 +/- 33.2	0.00560 +/- 0.00224	2.60e-05 +/- 1.04e-05
bg_dip_400_	7.95 +/- 2.82	457.4 +/- 21.2	0.01708 +/- 0.00601	2.76e-04 +/- 9.79e-05
bg_dip_600_	3.50 +/- 1.87	159.2 +/- 12.5	0.0215 +/- 0.0114	0.00052 +/- 0.00028
bg_dip_800_	1.48 +/- 1.22	88.74 +/- 9.28	0.0164 +/- 0.0134	0.000503 +/- 0.000413
bg_dip_1200_	0.122 +/- 0.349	18.35 +/- 4.21	0.0066 +/- 0.0188	0.000237 +/- 0.000680
bg_dip_1600_	0.0128 +/- 0.1132	7.69 +/- 2.71	0.00167 +/- 0.01470	6.83e-05 +/- 6.03e-04

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]) > 400	2954.1 +/- 28.7	2698.7 +/- 51.8	39.291 +/- 0.334
SEL: (sdETA (jets[1] jets[2]) > 3.6 or sdETA (485.7 +/- 20.7	38.27 +/- 6.18	21.219 +/- 0.501