# 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>
# 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
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># 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># selections
ma5>select (sdETA(jets[1] jets[2]) > 2.6 or sdETA(jets[1] jets[2]) < -2.6) and M(jets[1]
jets[2]) > 1250
ma5>select PT(a[1]) > 150 and M(a[1] a[2]) > 500
ma5>submit analysis_loose_pta150_maa500
```

### 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_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 ( sdETA ( jets[1] jets[2] ) > 2.6 or sdETA ( jets[1] jets[2] ) < -2.6 ) and M ( jets[1] jets[2] ) > 1250.0**

| Dataset | Events kept: K | Rejected events: R | Efficiency: K / (K + R) | Cumul. efficiency: K / Initial |
|---|---|---|---|---|
| signal | 1711.8 +/- 31.6 | 2382.3 +/- 31.6 | 0.41812 +/- 0.00771 | 0.41812 +/- 0.00771 |
| bg_vbf_0_10 | 204.2 +/- 14.2 | 11946.1 +/- 26.8 | 0.01681 +/- 0.00117 | 0.01681 +/- 0.00117 |
| bg_vbf_100_ | 950.9 +/- 29.3 | 8744.4 +/- 32.9 | 0.09808 +/- 0.00302 | 0.09808 +/- 0.00302 |
| bg_vbf_200_ | 1147.9 +/- 30.2 | 4265.4 +/- 31.3 | 0.21205 +/- 0.00556 | 0.21205 +/- 0.00556 |
| bg_vbf_400_ | 349.4 +/- 15.0 | 637.5 +/- 15.0 | 0.3540 +/- 0.0152 | 0.3540 +/- 0.0152 |
| bg_vbf_600_ | 111.21 +/- 7.88 | 140.87 +/- 7.89 | 0.4412 +/- 0.0313 | 0.4412 +/- 0.0313 |
| bg_vbf_800_ | 40.31 +/- 5.11 | 74.45 +/- 5.12 | 0.3513 +/- 0.0446 | 0.3513 +/- 0.0446 |
| bg_vbf_1200_ | 4.49 +/- 1.87 | 16.10 +/- 1.87 | 0.218 +/- 0.091 | 0.218 +/- 0.091 |
| bg_vbf_1600_ | 0.784 +/- 0.839 | 6.874 +/- 0.839 | 0.102 +/- 0.110 | 0.102 +/- 0.110 |
| bg_dip_0_10 | 229.4 +/- 15.1 | 2710617 +/- 4612 | 8.46e-05 +/- 5.59e-06 | 8.46e-05 +/- 5.59e-06 |
| bg_dip_100_ | 990.1 +/- 31.5 | 1094372 +/- 1526 | 9.04e-04 +/- 2.87e-05 | 9.04e-04 +/- 2.87e-05 |
| bg_dip_200_ | 1641.8 +/- 40.5 | 237907 +/- 412 | 0.006854 +/- 0.000169 | 0.006854 +/- 0.000169 |
| bg_dip_400_ | 1066.5 +/- 32.1 | 27732.1 +/- 59.6 | 0.03703 +/- 0.00111 | 0.03703 +/- 0.00111 |
| bg_dip_600_ | 531.3 +/- 22.2 | 6143.1 +/- 33.7 | 0.07960 +/- 0.00331 | 0.07960 +/- 0.00331 |
| bg_dip_800_ | 193.3 +/- 13.4 | 2749.1 +/- 14.2 | 0.06568 +/- 0.00457 | 0.06568 +/- 0.00457 |
| bg_dip_1200_ | 21.80 +/- 4.57 | 491.71 +/- 5.22 | 0.0424 +/- 0.0089 | 0.0424 +/- 0.0089 |
| bg_dip_1600_ | 4.1 +/- 2.0 | 183.71 +/- 2.01 | 0.0217 +/- 0.0106 | 0.0217 +/- 0.0106 |

### 3.2 Cut 2

*** Cut: select PT ( a[1] ) > 150.0 and M ( a[1] a[2] ) > 500.0**

| Dataset | Events kept: K | Rejected events: R | Efficiency: K / (K + R) | Cumul. efficiency: K / Initial |
|---|---|---|---|---|
| signal | 1244.5 +/- 29.4 | 467.4 +/- 20.3 | 0.7270 +/- 0.0108 | 0.30396 +/- 0.00719 |
| bg_vbf_0_10 | 0.0364 +/- 0.1908 | 204.2 +/- 14.2 | 0.000178 +/- 0.000934 | 2.99e-06 +/- 1.57e-05 |
| bg_vbf_100_ | 2.40 +/- 1.55 | 948.5 +/- 29.3 | 0.00252 +/- 0.00163 | 0.00025 +/- 0.00016 |
| bg_vbf_200_ | 11.83 +/- 3.44 | 1136.0 +/- 30.0 | 0.01031 +/- 0.00298 | 0.002186 +/- 0.000635 |
| bg_vbf_400_ | 8.02 +/- 2.82 | 341.3 +/- 14.9 | 0.02294 +/- 0.00801 | 0.00812 +/- 0.00286 |
| bg_vbf_600_ | 3.7 +/- 1.9 | 107.54 +/- 7.85 | 0.0330 +/- 0.0169 | 0.01458 +/- 0.00755 |
| bg_vbf_800_ | 1.89 +/- 1.36 | 38.43 +/- 5.06 | 0.0468 +/- 0.0333 | 0.0164 +/- 0.0119 |
| bg_vbf_1200_ | 0.273 +/- 0.519 | 4.22 +/- 1.83 | 0.0608 +/- 0.1127 | 0.0133 +/- 0.0252 |
| bg_vbf_1600_ | 0.0504 +/- 0.2237 | 0.734 +/- 0.815 | 0.0642 +/- 0.2768 | 0.00658 +/- 0.02920 |
| bg_dip_0_10 | 0.0 +/- 0.0 | 229.4 +/- 15.1 | 0.0 +/- 0.0 | 0.0 +/- 0.0 |
| bg_dip_100_ | 3.16 +/- 1.78 | 986.9 +/- 31.4 | 0.00319 +/- 0.00179 | 2.89e-06 +/- 1.62e-06 |
| bg_dip_200_ | 16.8 +/- 4.1 | 1625.0 +/- 40.3 | 0.01025 +/- 0.00249 | 7.02e-05 +/- 1.71e-05 |
| bg_dip_400_ | 18.5 +/- 4.3 | 1048.1 +/- 31.8 | 0.017 +/- 0.004 | 0.000642 +/- 0.000149 |
| bg_dip_600_ | 12.3 +/- 3.5 | 519.0 +/- 22.0 | 0.02315 +/- 0.00652 | 0.001843 +/- 0.000525 |
| bg_dip_800_ | 7.49 +/- 2.73 | 185.8 +/- 13.2 | 0.0388 +/- 0.0139 | 0.002547 +/- 0.000929 |
| bg_dip_1200_ | 1.09 +/- 1.04 | 20.70 +/- 4.46 | 0.0502 +/- 0.0468 | 0.00213 +/- 0.00203 |
| bg_dip_1600_ | 0.212 +/- 0.461 | 3.86 +/- 1.94 | 0.0522 +/- 0.1103 | 0.00113 +/- 0.00245 |

# 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: ( sdETA ( jets[1] jets[2] ) > 2.6 or sdETA ( | 1711.8 +/- 31.6 | 7487.3 +/- 82.9 | 17.848 +/- 0.309 |
| SEL: PT ( a[1] ) > 150.0 and M ( a[1] a[2] ) > 500 | 1244.5 +/- 29.4 | 87.75 +/- 9.35 | 34.095 +/- 0.446 |