The LaTeX report

Generated by elijahsheridan on 23 September 2020, 11:08:18

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].

To contact us:

> **http://madanalysis.irmp.ucl.ac.be**
> **ma5team@iphc.cnrs.fr**

Contents

1 Setup

1.1 Command history

```
ma5>set main.currentdir = /Users/elijahsheridan/MG5_aMC_v2_6_5/axion_pheno/optimization/-
ma_scripts
ma5># set directory where running "./bin/ma5"
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>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># 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># cuts
ma5># select M(a[1] a[2]) > 500
ma5># select PT(a[1]) > 300
ma5># select M(jets[1] jets[2]) > 750
ma5># select sdETA(jets[1] jets[2]) > 3.6 or sdETA(jets[1] jets[2]) < -3.6
ma5>select PT(jets[1]) > 30 and PT(jets[2]) > 30
ma5>select sdETA(jets[1] jets[2]) > 3.6 or sdETA(jets[1] jets[2]) < -3.6
ma5>select M(jets[1] jets[2]) > 750
ma5># define which plots to make
ma5>plot PT(jets[1])
ma5>plot ETA(jets[1])
ma5>plot PHI(jets[1])
ma5>plot PT(jets[2])
ma5>plot ETA(jets[2])
ma5>plot PHI(jets[2])
ma5>plot DELTAR(jets[1], jets[2])
ma5>plot M(jets[1] jets[2])
ma5>plot sdETA(jets[1] jets[2])
ma5>plot M(a[1] a[2])
ma5>plot PT(a[1])
ma5>plot PT(a[2])
ma5>plot THT
ma5>plot MET
ma5>plot TET
ma5>plot DELTAR(a[1], a[2])
ma5>plot sdETA(a[1] a[2])
ma5>#set the plot/graph parameters
```

```
ma5>set selection[5].xmin = 0
ma5>set selection[5].xmax = 2000
ma5>set selection[5].nbins = 200
ma5>set selection[5].rank = PTordering
ma5>set selection[5].titleX = "p_{T}[j_{1}] (GeV)"
ma5>set selection[6].xmin = -8
ma5>set selection[6].xmax = 8
ma5>set selection[6].nbins = 160
ma5>set selection[6].rank = PTordering
ma5>set selection[6].titleX = "#eta[j_{1}]"
ma5>set selection[7].xmin = -3.2
ma5>set selection[7].xmax = 3.2
ma5>set selection[7].nbins = 64
ma5>set selection[7].rank = PTordering
ma5>set selection[7].titleX = "#phi[j_{1}]"
ma5>set selection[8].xmin = 0
ma5>set selection[8].xmax = 1000
ma5>set selection[8].nbins = 100
ma5>set selection[8].rank = PTordering
ma5>set selection[8].titleX = "p_{T}[j_{2}] (GeV)"
ma5>set selection[9].xmin = -8
ma5>set selection[9].xmax = 8
ma5>set selection[9].nbins = 160
ma5>set selection[9].rank = PTordering
ma5>set selection[9].titleX = "#eta[j_{2}]"
ma5>set selection[10].xmin = -3.2
ma5>set selection[10].xmax = 3.2
ma5>set selection[10].nbins = 64
ma5>set selection[10].rank = PTordering
ma5>set selection[10].titleX = "#phi[j_{2}]"
ma5>set selection[11].xmin = 0
ma5>set selection[11].xmax = 15
ma5>set selection[11].nbins = 75
ma5>set selection[11].rank = PTordering
ma5>set selection[11].titleX = "#DeltaR[j_{1},j_{2}]"
ma5>set selection[12].xmin = 120
ma5>set selection[12].xmax = 2000
ma5>set selection[12].nbins = 160
ma5>set selection[12].rank = PTordering
ma5>set selection[12].titleX = "M[j_{1},j_{2}] (GeV)"
ma5>set selection[13].xmin = 2.4
ma5>set selection[13].xmax = 8
ma5>set selection[13].titleX = "#Delta#eta(j_{1},j_{2})"
ma5>set selection[14].xmin = 0
ma5>set selection[14].xmax = 1000
ma5>set selection[14].nbins = 400
ma5>set selection[14].rank = PTordering
ma5>set selection[14].titleX = "M[a_{1},a_{2}] (GeV)"
ma5>set selection[15].xmin = 0
```

```
ma5>set selection[15].xmax = 1000
ma5>set selection[15].nbins = 80
ma5>set selection[15].rank = PTordering
ma5>set selection[15].titleX = "p_{T}[a_{1}]"
ma5>set selection[16].xmin = 0
ma5>set selection[16].xmax = 2000
ma5>set selection[16].nbins = 400
ma5>set selection[16].rank = PTordering
ma5>set selection[16].titleX = "p_{T}[a_{2}] (GeV)"
ma5>set selection[17].xmin = 0
ma5>set selection[17].xmax = 4000
ma5>set selection[17].nbins = 80
ma5>set selection[17].rank = PTordering
ma5>set selection[17].titleX = "THT"
ma5>set selection[18].xmin = 0
ma5>set selection[18].xmax = 1000
ma5>set selection[18].nbins = 200
ma5>set selection[18].rank = PTordering
ma5>set selection[18].titleX = "MET"
ma5>set selection[19].xmin = 0
ma5>set selection[19].xmax = 8000
ma5>set selection[19].nbins = 80
ma5>set selection[19].rank = PTordering
ma5>set selection[19].titleX = "TET"
ma5>submit vbf_eff_flow_chart
```

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.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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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_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/-post_optimization_studies/mad_analyses .
- 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_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/-post_optimization_studies/mad_analyses .
- 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_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/-post_optimization_studies/mad_analyses .
- 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_c 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/-post_optimization_studies/mad_analyses .
- 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_c 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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/-post_optimization_studies/mad_analyses .
- 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 30.0 > PT > 30.0**

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	3815.6 +/- 16.1	278.5 +/- 16.1	0.93197 +/- 0.00394	0.93197 +/- 0.00394
bg_vbf_0_10	5340.5 +/- 55.6	6809.8 +/- 56.2	0.4395 +/- 0.0045	0.4395 +/- 0.0045
bg_vbf_100_	9018.6 +/- 29.5	676.8 +/- 25.1	0.93020 +/- 0.00259	0.93020 +/- 0.00259
bg_vbf_200_	5370.9 +/- 12.6	42.34 +/- 6.48	0.9922 +/- 0.0012	0.9922 +/- 0.0012
bg_vbf_400_	984.62 +/- 2.03	2.23 +/- 1.49	0.99774 +/- 0.00151	0.99774 +/- 0.00151
bg_vbf_600_	251.73 +/- 0.67	0.35 +/- 0.59	0.99861 +/- 0.00235	0.99861 +/- 0.00235
bg_vbf_800_	114.56 +/- 0.48	0.198 +/- 0.445	0.99828 +/- 0.00387	0.99828 +/- 0.00387
bg_vbf_1200_	20.54 +/- 0.23	0.052 +/- 0.228	0.9975 +/- 0.0111	0.9975 +/- 0.0111
bg_vbf_1600_	7.51 +/- 0.38	0.147 +/- 0.380	0.9808 +/- 0.0496	0.9808 +/- 0.0496
bg_dip_0_10	849405 +/- 1634	1861441 +/- 3258	0.313336 +/- 0.000282	0.313336 +/- 0.000282
bg_dip_100_	987655 +/- 1411	107706 +/- 345	0.901670 +/- 0.000285	0.901670 +/- 0.000285
bg_dip_200_	233287 +/- 410	6261.7 +/- 78.8	0.973860 +/- 0.000326	0.973860 +/- 0.000326
bg_dip_400_	28471.3 +/- 54.7	327.4 +/- 18.0	0.988631 +/- 0.000625	0.988631 +/- 0.000625
bg_dip_600_	6629.5 +/- 28.2	44.90 +/- 6.68	0.993 +/- 0.001	0.993 +/- 0.001
bg_dip_800_	2931.24 +/- 6.04	11.10 +/- 3.33	0.99623 +/- 0.00113	0.99623 +/- 0.00113
bg_dip_1200_	512.67 +/- 2.78	0.832 +/- 0.912	0.99838 +/- 0.00178	0.99838 +/- 0.00178
bg_dip_1600_	187.672 +/- 0.435	0.112 +/- 0.335	0.99940 +/- 0.00178	0.99940 +/- 0.00178

3.2 Cut 2

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

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	1214.2 +/- 29.2	2601.3 +/- 30.8	0.31823 +/- 0.00754	0.29658 +/- 0.00714
bg_vbf_0_10	1300.3 +/- 34.2	4040.2 +/- 52.5	0.24348 +/- 0.00587	0.1070 +/- 0.0028
bg_vbf_100_	4181.8 +/- 49.3	4836.8 +/- 49.9	0.46369 +/- 0.00525	0.43132 +/- 0.00503
bg_vbf_200_	2173.4 +/- 36.3	3197.5 +/- 36.7	0.4047 +/- 0.0067	0.40150 +/- 0.00666
bg_vbf_400_	279.4 +/- 14.2	705.2 +/- 14.2	0.2838 +/- 0.0144	0.2831 +/- 0.0143
bg_vbf_600_	47.90 +/- 6.23	203.82 +/- 6.25	0.1903 +/- 0.0247	0.1900 +/- 0.0247
bg_vbf_800_	12.05 +/- 3.28	102.51 +/- 3.31	0.1052 +/- 0.0287	0.1050 +/- 0.0286
bg_vbf_1200_	0.676 +/- 0.808	19.868 +/- 0.839	0.0329 +/- 0.0393	0.0328 +/- 0.0393
bg_vbf_1600_	0.0479 +/- 0.2182	7.464 +/- 0.436	0.00638 +/- 0.02905	0.00626 +/- 0.02850
bg_dip_0_10	60724 +/- 264	788680 +/- 1536	0.07149 +/- 0.00028	2.24e-02 +/- 8.99e-05
bg_dip_100_	55757 +/- 242	931898 +/- 1351	0.056454 +/- 0.000232	0.05090 +/- 0.00021
bg_dip_200_	8768.7 +/- 93.2	224518 +/- 405	0.037588 +/- 0.000394	0.036605 +/- 0.000384
bg_dip_400_	639.8 +/- 25.0	27831.5 +/- 59.0	0.022471 +/- 0.000878	0.022215 +/- 0.000868
bg_dip_600_	89.92 +/- 9.43	6539.5 +/- 29.4	0.01356 +/- 0.00142	0.01347 +/- 0.00141
bg_dip_800_	21.86 +/- 4.66	2909.38 +/- 7.59	0.00746 +/- 0.00159	0.00743 +/- 0.00158
bg_dip_1200_	1.31 +/- 1.14	511.4 +/- 3.0	0.00256 +/- 0.00223	0.00256 +/- 0.00223
bg_dip_1600_	0.0877 +/- 0.2961	187.584 +/- 0.526	0.000468 +/- 0.001578	0.000467 +/- 0.001577

3.3 Cut 3

*** Cut: select M (jets[1] jets[2]) > 750.0**

Dataset	Events kept: K	Rejected events: R	Efficiency: K / (K + R)	Cumul. efficiency: K / Initial
signal	1071.9 +/- 28.1	142.4 +/- 11.7	0.88275 +/- 0.00923	0.26181 +/- 0.00687
bg_vbf_0_10	364.2 +/- 18.8	936.1 +/- 29.4	0.2801 +/- 0.0125	0.02997 +/- 0.00155
bg_vbf_100_	2253.7 +/- 41.8	1928.0 +/- 39.4	0.53894 +/- 0.00771	0.23246 +/- 0.00429
bg_vbf_200_	2038.9 +/- 35.9	134.5 +/- 11.5	0.93812 +/- 0.00517	0.37665 +/- 0.00659
bg_vbf_400_	279.4 +/- 14.2	0.0316 +/- 0.1777	0.999887 +/- 0.000636	0.2831 +/- 0.0143
bg_vbf_600_	47.90 +/- 6.23	0.0 +/- 0.0	1.0	0.1900 +/- 0.0247
bg_vbf_800_	12.05 +/- 3.28	0.0 +/- 0.0	1.0	0.1050 +/- 0.0286
bg_vbf_1200_	0.676 +/- 0.808	0.0 +/- 0.0	1.0	0.0328 +/- 0.0393
bg_vbf_1600_	0.0479 +/- 0.2182	0.0 +/- 0.0	1.0	0.00626 +/- 0.02850
bg_dip_0_10	1767.2 +/- 42.1	58957 +/- 260	0.029101 +/- 0.000682	6.52e-04 +/- 1.55e-05
bg_dip_100_	8038.3 +/- 90.0	47719 +/- 223	0.14417 +/- 0.00149	7.34e-03 +/- 8.16e-05
bg_dip_200_	6955.8 +/- 83.1	1812.9 +/- 42.5	0.79325 +/- 0.00432	0.029037 +/- 0.000343
bg_dip_400_	638.2 +/- 25.0	1.55 +/- 1.25	0.99758 +/- 0.00194	0.022161 +/- 0.000867
bg_dip_600_	89.92 +/- 9.43	0.0 +/- 0.0	1.0	0.01347 +/- 0.00141
bg_dip_800_	21.86 +/- 4.66	0.0 +/- 0.0	1.0	0.00743 +/- 0.00158
bg_dip_1200_	1.31 +/- 1.14	0.0 +/- 0.0	1.0	0.00256 +/- 0.00223
bg_dip_1600_	0.0877 +/- 0.2961	0.0 +/- 0.0	1.0	0.000467 +/- 0.001577

3.4 Histogram 1

*** Plot: PT (jets[1])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	343.892	252.2	0.0	2.657
bg_vbf_0_100	364	1.0	49.04	7.733	0.0	0.0
bg_vbf_100_20	2253	1.0	88.3084	19.96	0.0	0.0
bg_vbf_200_40	2038	1.0	158.943	37.96	0.0	0.0
bg_vbf_400_60	279	1.0	276.785	53.95	0.0	0.0
bg_vbf_600_80	47.9	1.0	394.444	74.39	0.0	0.0
bg_vbf_800_12	12.1	1.0	532.453	113.3	0.0	0.4533
bg_vbf_1200_1	0.677	1.0	767.08	170.4	0.0	11.26
bg_vbf_1600_i	0.0489	1.0	1036.46	289.2	0.0	31.8
bg_dip_0_100	1767	1.0	49.1374	8.061	0.0	0.0
bg_dip_100_20	8038	1.0	88.4729	20.61	0.0	0.0
bg_dip_200_40	6955	1.0	157.016	38.84	0.0	0.0
bg_dip_400_60	638	1.0	279.765	62.77	0.0	0.0
bg_dip_600_80	89.9	1.0	397.289	87.24	0.0	0.0
bg_dip_800_12	21.9	1.0	538.658	134.9	0.0	1.113
bg_dip_1200_1	1.31	1.0	760.039	186.6	0.0	11.25
bg_dip_1600_i	0.0878	1.0	1014.3	297.1	0.0	23.46

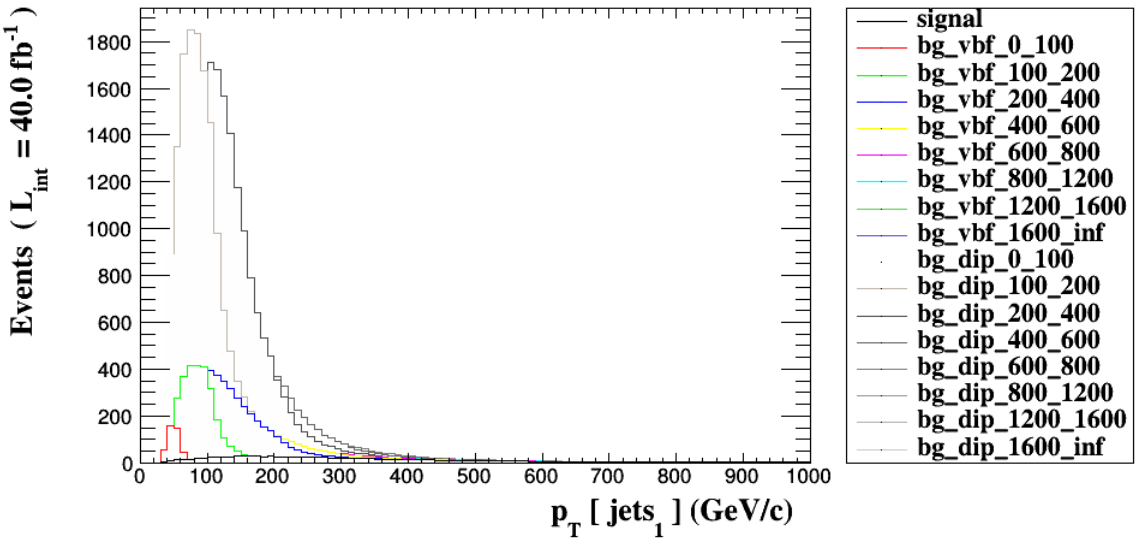

Figure 1.

3.5 Histogram 2

*** Plot: ETA (jets[1])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	-0.0081341	2.035	50.2	0.0
bg_vbf_0_100	364	1.0	0.000166543	3.364	50.01	0.0
bg_vbf_100_20	2253	1.0	0.00866776	2.868	49.87	0.0
bg_vbf_200_40	2038	1.0	0.000566865	2.413	49.98	0.0
bg_vbf_400_60	279	1.0	-0.00094651	2.161	50.04	0.0
bg_vbf_600_80	47.9	1.0	-0.00189725	2.037	50.12	0.0
bg_vbf_800_12	12.1	1.0	0.00161135	1.945	49.99	0.0
bg_vbf_1200_1	0.677	1.0	-0.0110501	1.841	50.44	0.0
bg_vbf_1600_i	0.0489	1.0	0.0430261	1.762	48.57	0.0
bg_dip_0_100	1767	1.0	0.00678619	3.325	50.15	0.0
bg_dip_100_20	8038	1.0	0.0191145	2.85	49.76	0.0
bg_dip_200_40	6955	1.0	-0.0295387	2.346	50.49	0.0
bg_dip_400_60	638	1.0	-0.02202	2.092	50.52	0.0
bg_dip_600_80	89.9	1.0	0.02674	2.002	49.51	0.0
bg_dip_800_12	21.9	1.0	-0.0213812	1.918	50.54	0.0
bg_dip_1200_1	1.31	1.0	0.00841074	1.835	49.89	0.0
bg_dip_1600_i	0.0878	1.0	-0.105628	1.768	53.09	0.0

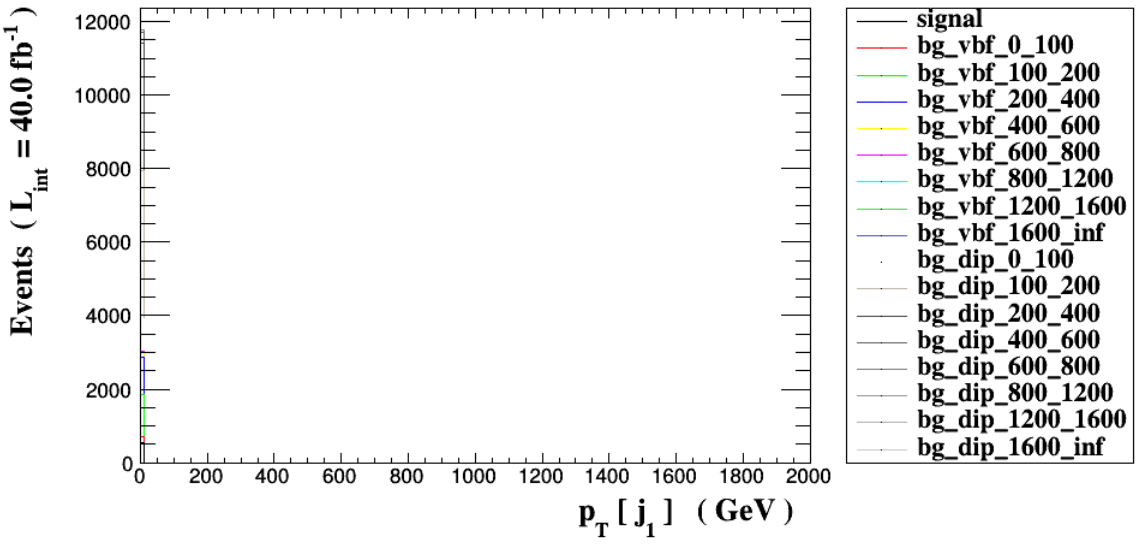

Figure 2.

3.6 Histogram 3

*** Plot: PHI (jets[1])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	-0.00110744	1.813	0.0	0.0
bg_vbf_0_100	364	1.0	0.00232715	1.806	0.0	0.0
bg_vbf_100_20	2253	1.0	-0.00635393	1.815	0.0	0.0
bg_vbf_200_40	2038	1.0	0.00218214	1.814	0.0	0.0
bg_vbf_400_60	279	1.0	-0.00497205	1.814	0.0	0.0
bg_vbf_600_80	47.9	1.0	0.00410717	1.811	0.0	0.0
bg_vbf_800_12	12.1	1.0	-0.00518227	1.811	0.0	0.0
bg_vbf_1200_1	0.677	1.0	0.0259206	1.81	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	-0.0500737	1.792	0.0	0.0
bg_dip_0_100	1767	1.0	-0.00684135	1.756	0.0	0.0
bg_dip_100_20	8038	1.0	0.0476437	1.818	0.0	0.0
bg_dip_200_40	6955	1.0	-0.00756792	1.821	0.0	0.0
bg_dip_400_60	638	1.0	-0.00608962	1.811	0.0	0.0
bg_dip_600_80	89.9	1.0	-0.0182462	1.808	0.0	0.0
bg_dip_800_12	21.9	1.0	0.0102453	1.821	0.0	0.0
bg_dip_1200_1	1.31	1.0	-0.105508	1.774	0.0	0.0
bg_dip_1600_i	0.0878	1.0	0.042703	1.806	0.0	0.0

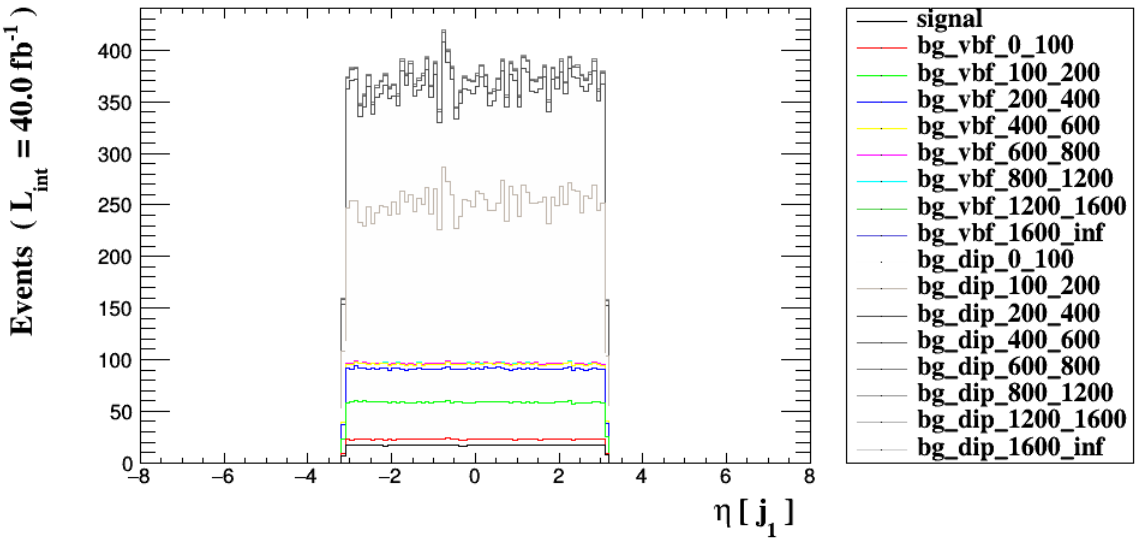

Figure 3.

3.7 Histogram 4

*** Plot: PT (jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	110.412	75.65	0.0	100.0
bg_vbf_0_100	364	1.0	37.1965	4.803	0.0	100.0
bg_vbf_100_20	2253	1.0	60.5597	15.75	0.0	100.0
bg_vbf_200_40	2038	1.0	110.453	30.92	0.0	100.0
bg_vbf_400_60	279	1.0	193.368	49.39	0.0	100.0
bg_vbf_600_80	47.9	1.0	279.205	71.27	0.0	100.0
bg_vbf_800_12	12.1	1.0	380.947	107.0	0.0	100.0
bg_vbf_1200_1	0.677	1.0	550.064	164.8	0.0	100.0
bg_vbf_1600_i	0.0489	1.0	709.68	253.2	0.0	100.0
bg_dip_0_100	1767	1.0	36.8168	4.657	0.0	100.0
bg_dip_100_20	8038	1.0	59.3023	15.73	0.0	100.0
bg_dip_200_40	6955	1.0	106.437	31.05	0.0	100.0
bg_dip_400_60	638	1.0	187.342	58.65	0.0	100.0
bg_dip_600_80	89.9	1.0	274.322	85.19	0.0	100.0
bg_dip_800_12	21.9	1.0	373.582	130.0	0.0	100.0
bg_dip_1200_1	1.31	1.0	557.191	176.2	0.0	100.0
bg_dip_1600_i	0.0878	1.0	735.455	261.9	0.0	100.0

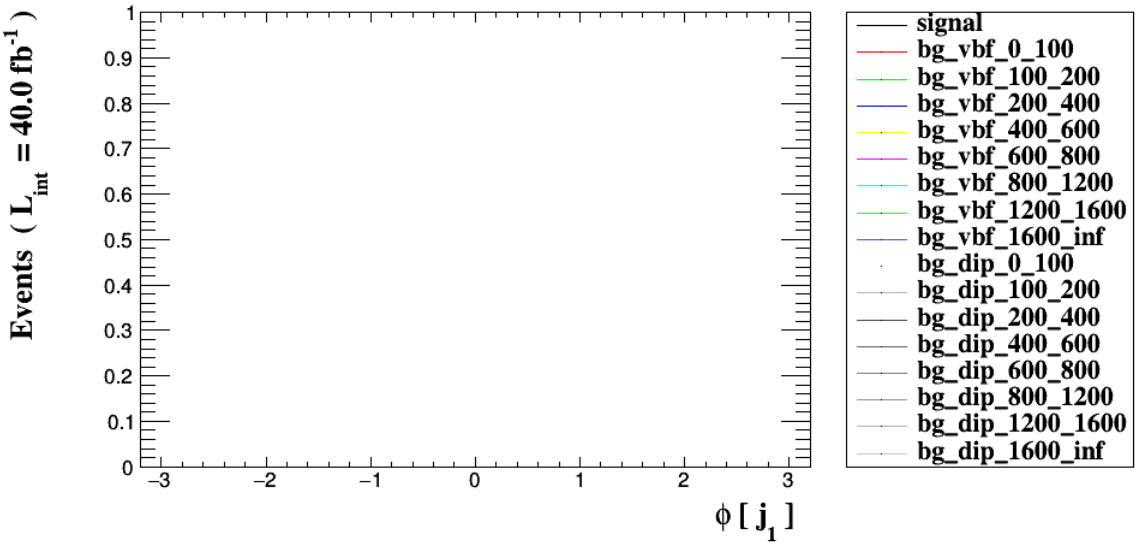

Figure 4.

3.8 Histogram 5

*** Plot: ETA (jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	0.0114933	2.943	49.8	0.0
bg_vbf_0_100	364	1.0	-0.00319227	3.461	49.99	0.0
bg_vbf_100_20	2253	1.0	-0.00774539	3.085	50.13	0.0
bg_vbf_200_40	2038	1.0	-0.00172193	2.656	50.03	0.0
bg_vbf_400_60	279	1.0	0.00254018	2.449	49.95	0.0
bg_vbf_600_80	47.9	1.0	0.00692713	2.34	49.88	0.0
bg_vbf_800_12	12.1	1.0	0.000298794	2.256	50.01	0.0
bg_vbf_1200_1	0.677	1.0	0.0228384	2.194	49.56	0.0
bg_vbf_1600_i	0.0489	1.0	-0.0594671	2.201	51.32	0.0
bg_dip_0_100	1767	1.0	0.0164847	3.245	49.85	0.0
bg_dip_100_20	8038	1.0	-0.0159359	2.793	50.28	0.0
bg_dip_200_40	6955	1.0	0.00699555	2.319	49.61	0.0
bg_dip_400_60	638	1.0	0.0183088	2.263	49.54	0.0
bg_dip_600_80	89.9	1.0	-0.0172787	2.223	50.52	0.0
bg_dip_800_12	21.9	1.0	0.011548	2.225	49.57	0.0
bg_dip_1200_1	1.31	1.0	0.0134887	2.165	49.88	0.0
bg_dip_1600_i	0.0878	1.0	0.114217	2.195	47.12	0.0

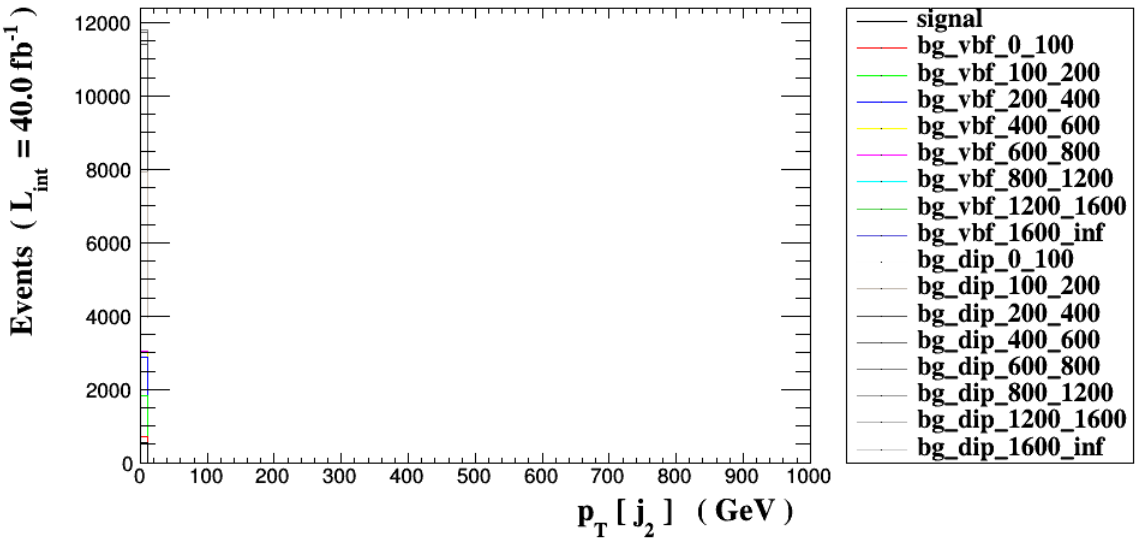

Figure 5.

3.9 Histogram 6

*** Plot: PHI (jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	-0.00115095	1.816	0.0	0.0
bg_vbf_0_100	364	1.0	-0.00253582	1.816	0.0	0.0
bg_vbf_100_20	2253	1.0	0.00482266	1.815	0.0	0.0
bg_vbf_200_40	2038	1.0	-0.00338121	1.814	0.0	0.0
bg_vbf_400_60	279	1.0	-0.000828397	1.814	0.0	0.0
bg_vbf_600_80	47.9	1.0	-0.000130577	1.816	0.0	0.0
bg_vbf_800_12	12.1	1.0	-0.00939579	1.818	0.0	0.0
bg_vbf_1200_1	0.677	1.0	-0.0114353	1.817	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	0.0734785	1.819	0.0	0.0
bg_dip_0_100	1767	1.0	-0.0502398	1.84	0.0	0.0
bg_dip_100_20	8038	1.0	0.00371512	1.806	0.0	0.0
bg_dip_200_40	6955	1.0	-0.00657528	1.807	0.0	0.0
bg_dip_400_60	638	1.0	-0.013669	1.819	0.0	0.0
bg_dip_600_80	89.9	1.0	-0.0017161	1.819	0.0	0.0
bg_dip_800_12	21.9	1.0	0.0163775	1.808	0.0	0.0
bg_dip_1200_1	1.31	1.0	-0.0172436	1.841	0.0	0.0
bg_dip_1600_i	0.0878	1.0	-0.161061	1.828	0.0	0.0

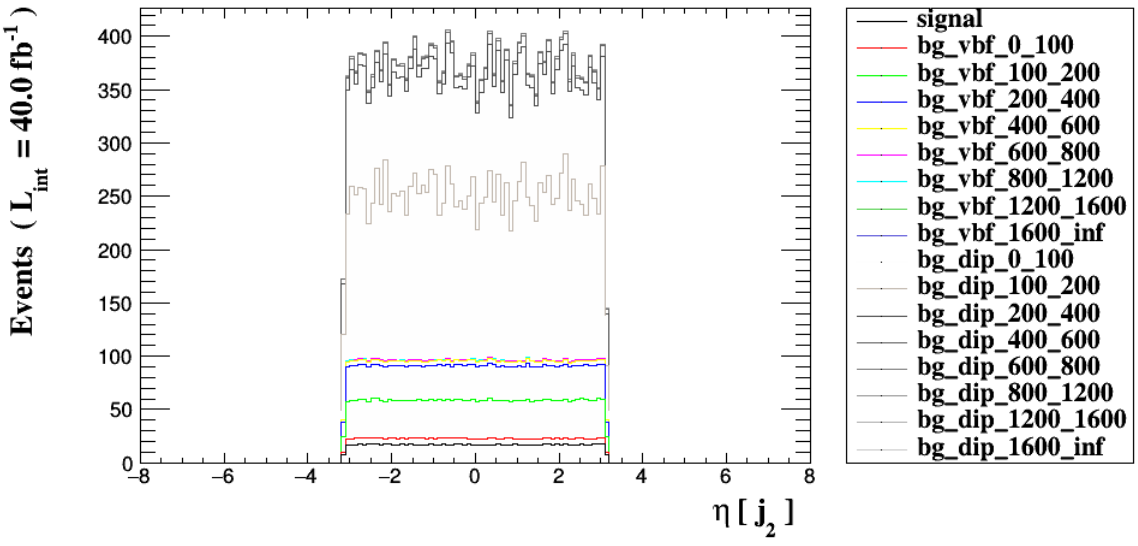

Figure 6.

3.10 Histogram 7

*** Plot: DELTAR (jets[1] , jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	5.02517	0.9314	0.0	100.0
bg_vbf_0_100	364	1.0	7.05548	0.6811	0.0	100.0
bg_vbf_100_20	2253	1.0	6.27976	0.7375	0.0	100.0
bg_vbf_200_40	2038	1.0	5.53031	0.7056	0.0	100.0
bg_vbf_400_60	279	1.0	5.226	0.5472	0.0	100.0
bg_vbf_600_80	47.9	1.0	5.08807	0.4506	0.0	100.0
bg_vbf_800_12	12.1	1.0	4.98333	0.3753	0.0	100.0
bg_vbf_1200_1	0.677	1.0	4.88035	0.3011	0.0	100.0
bg_vbf_1600_i	0.0489	1.0	4.81922	0.2711	0.0	100.0
bg_dip_0_100	1767	1.0	6.70448	0.4505	0.0	100.0
bg_dip_100_20	8038	1.0	5.87967	0.5235	0.0	100.0
bg_dip_200_40	6955	1.0	5.11228	0.4519	0.0	100.0
bg_dip_400_60	638	1.0	4.96626	0.3974	0.0	100.0
bg_dip_600_80	89.9	1.0	4.92962	0.349	0.0	100.0
bg_dip_800_12	21.9	1.0	4.89533	0.3164	0.0	100.0
bg_dip_1200_1	1.31	1.0	4.83455	0.2742	0.0	100.0
bg_dip_1600_i	0.0878	1.0	4.81616	0.2395	0.0	100.0

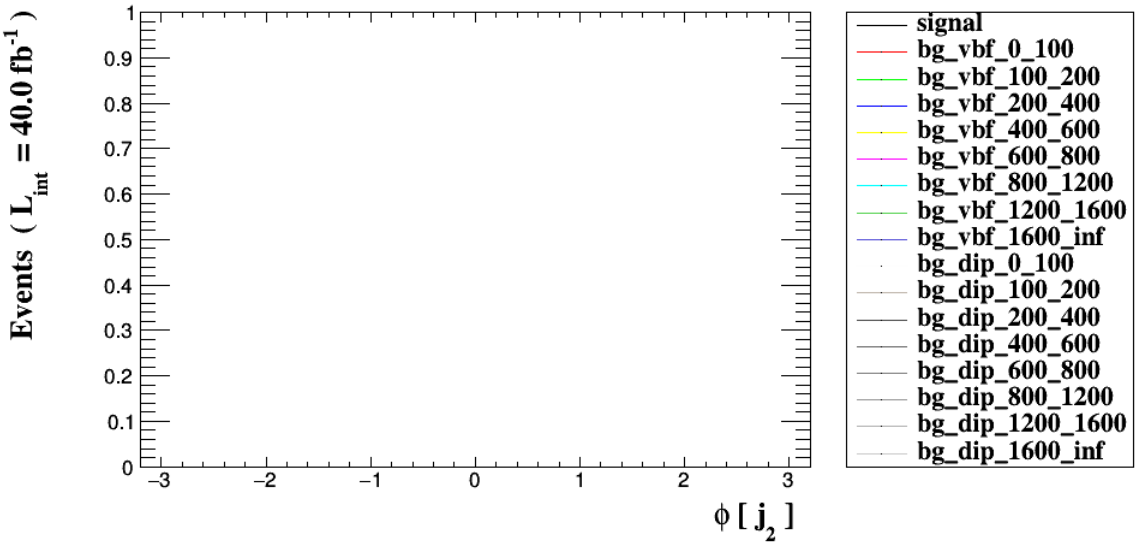

Figure 7.

3.11 Histogram 8

*** Plot: M (jets[1] jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	1782.84	805.6	0.0	100.0
bg_vbf_0_100	364	1.0	1218.46	518.8	0.0	100.0
bg_vbf_100_20	2253	1.0	1300.68	563.7	0.0	100.0
bg_vbf_200_40	2038	1.0	1525.14	681.4	0.0	100.0
bg_vbf_400_60	279	1.0	2158.83	747.9	0.0	100.0
bg_vbf_600_80	47.9	1.0	2776.13	765.8	0.0	100.0
bg_vbf_800_12	12.1	1.0	3449.71	798.9	0.0	100.0
bg_vbf_1200_1	0.677	1.0	4539.84	866.7	0.0	100.0
bg_vbf_1600_i	0.0489	1.0	5592.0	1139	0.0	100.0
bg_dip_0_100	1767	1.0	941.446	217.6	0.0	100.0
bg_dip_100_20	8038	1.0	977.574	247.5	0.0	100.0
bg_dip_200_40	6955	1.0	1100.31	326.2	0.0	100.0
bg_dip_400_60	638	1.0	1740.23	454.6	0.0	100.0
bg_dip_600_80	89.9	1.0	2400.64	565.0	0.0	100.0
bg_dip_800_12	21.9	1.0	3115.39	733.4	0.0	100.0
bg_dip_1200_1	1.31	1.0	4291.95	869.7	0.0	100.0
bg_dip_1600_i	0.0878	1.0	5430.07	1224	0.0	100.0

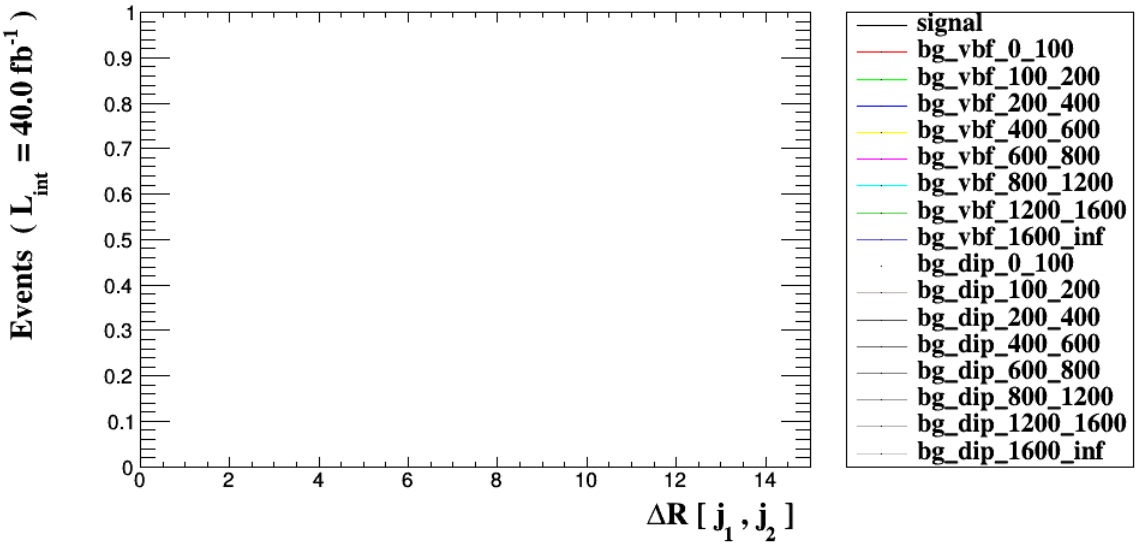

Figure 8.

3.12 Histogram 9

*** Plot: sdETA (jets[1] jets[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	-0.0196274	4.775	0.3136	0.0
bg_vbf_0_100	364	1.0	0.00335882	6.627	2.362	0.0
bg_vbf_100_20	2253	1.0	0.0164131	5.726	0.3636	0.0
bg_vbf_200_40	2038	1.0	0.0022888	4.839	0.01241	0.0
bg_vbf_400_60	279	1.0	-0.00348669	4.443	0.0	0.0
bg_vbf_600_80	47.9	1.0	-0.00882439	4.247	0.0	0.0
bg_vbf_800_12	12.1	1.0	0.00131256	4.094	0.0	0.0
bg_vbf_1200_1	0.677	1.0	-0.0338885	3.938	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	0.102493	3.852	0.0	0.0
bg_dip_0_100	1767	1.0	-0.0096985	6.187	0.0	0.0
bg_dip_100_20	8038	1.0	0.0350504	5.238	0.0	0.0
bg_dip_200_40	6955	1.0	-0.0365342	4.29	0.0	0.0
bg_dip_400_60	638	1.0	-0.0403288	4.085	0.0	0.0
bg_dip_600_80	89.9	1.0	0.0440187	4.012	0.0	0.0
bg_dip_800_12	21.9	1.0	-0.0329292	3.953	0.0	0.0
bg_dip_1200_1	1.31	1.0	-0.00507792	3.851	0.0	0.0
bg_dip_1600_i	0.0878	1.0	-0.219844	3.802	0.0	0.0

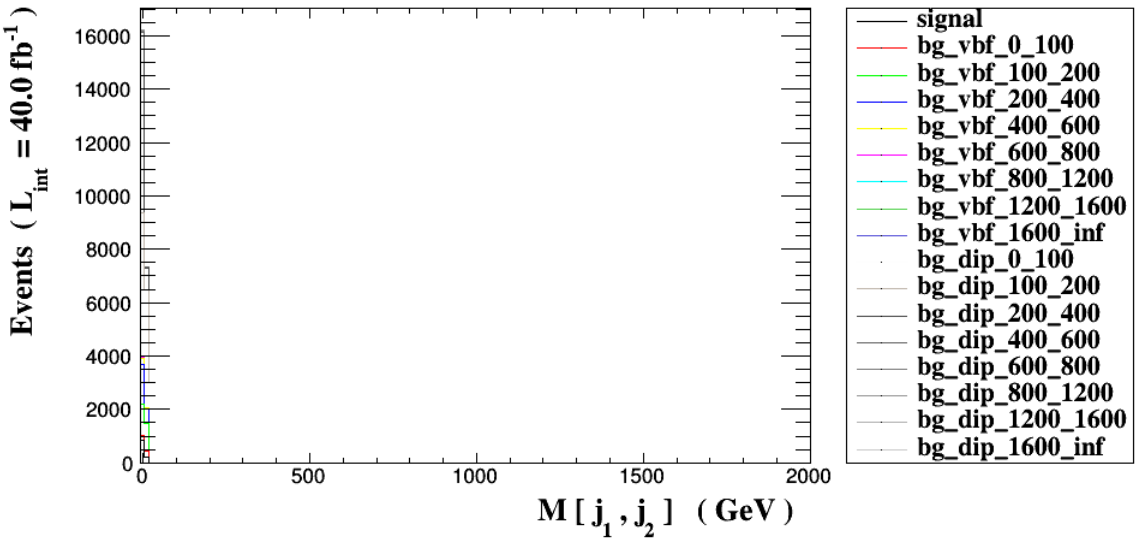

Figure 9.

3.13 Histogram 10

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

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	1011.28	775.8	0.00191	99.98
bg_vbf_0_100	364	1.0	68.7677	58.89	0.0	99.51
bg_vbf_100_20	2253	1.0	82.8463	76.05	0.0	99.65
bg_vbf_200_40	2038	1.0	106.688	106.2	0.0	99.78
bg_vbf_400_60	279	1.0	142.045	146.8	0.0	99.84
bg_vbf_600_80	47.9	1.0	166.359	177.6	0.0	99.89
bg_vbf_800_12	12.1	1.0	185.02	201.3	0.0	99.83
bg_vbf_1200_1	0.677	1.0	212.298	241.3	0.0	99.91
bg_vbf_1600_i	0.0489	1.0	250.072	300.4	0.0	100.0
bg_dip_0_100	1767	1.0	55.0914	49.81	0.0	98.38
bg_dip_100_20	8038	1.0	72.9642	79.79	0.0	99.12
bg_dip_200_40	6955	1.0	94.8297	109.3	0.0	99.35
bg_dip_400_60	638	1.0	137.775	161.9	0.0	99.6
bg_dip_600_80	89.9	1.0	166.248	201.7	0.0	99.69
bg_dip_800_12	21.9	1.0	192.898	232.4	0.0	99.75
bg_dip_1200_1	1.31	1.0	219.777	285.3	0.0	99.77
bg_dip_1600_i	0.0878	1.0	250.056	289.6	0.0	100.0

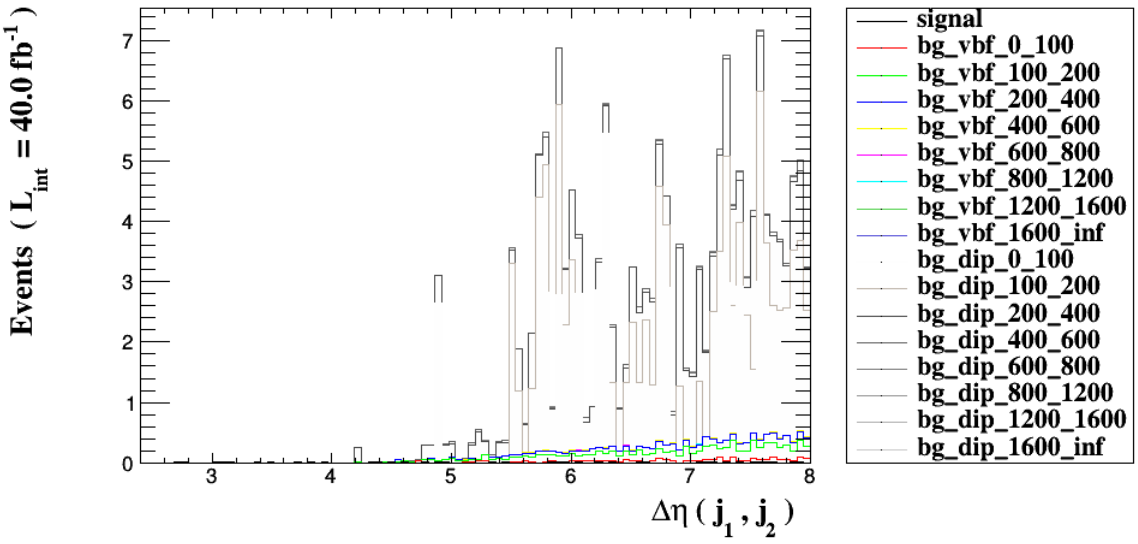

Figure 10.

3.14 Histogram 11

*** Plot: PT (a[1])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	560.533	359.9	0.0	11.28
bg_vbf_0_100	364	1.0	34.8674	20.89	0.0	0.0
bg_vbf_100_20	2253	1.0	48.7591	32.63	0.0	0.0
bg_vbf_200_40	2038	1.0	76.5836	62.39	0.0	0.0005396
bg_vbf_400_60	279	1.0	124.042	113.6	0.0	0.004942
bg_vbf_600_80	47.9	1.0	163.938	164.9	0.0	0.01894
bg_vbf_800_12	12.1	1.0	206.18	230.8	0.0	0.688
bg_vbf_1200_1	0.677	1.0	275.804	350.4	0.0	8.138
bg_vbf_1600_i	0.0489	1.0	390.518	544.5	0.0	15.49
bg_dip_0_100	1767	1.0	33.9862	21.96	0.0	0.0
bg_dip_100_20	8038	1.0	49.2095	37.35	0.0	0.0
bg_dip_200_40	6955	1.0	72.5124	67.5	0.0	0.0
bg_dip_400_60	638	1.0	120.275	129.7	0.0	0.0
bg_dip_600_80	89.9	1.0	154.217	184.2	0.0	0.02244
bg_dip_800_12	21.9	1.0	198.244	267.4	0.0	1.657
bg_dip_1200_1	1.31	1.0	236.703	375.1	0.0	9.51
bg_dip_1600_i	0.0878	1.0	309.098	544.6	0.0	12.35

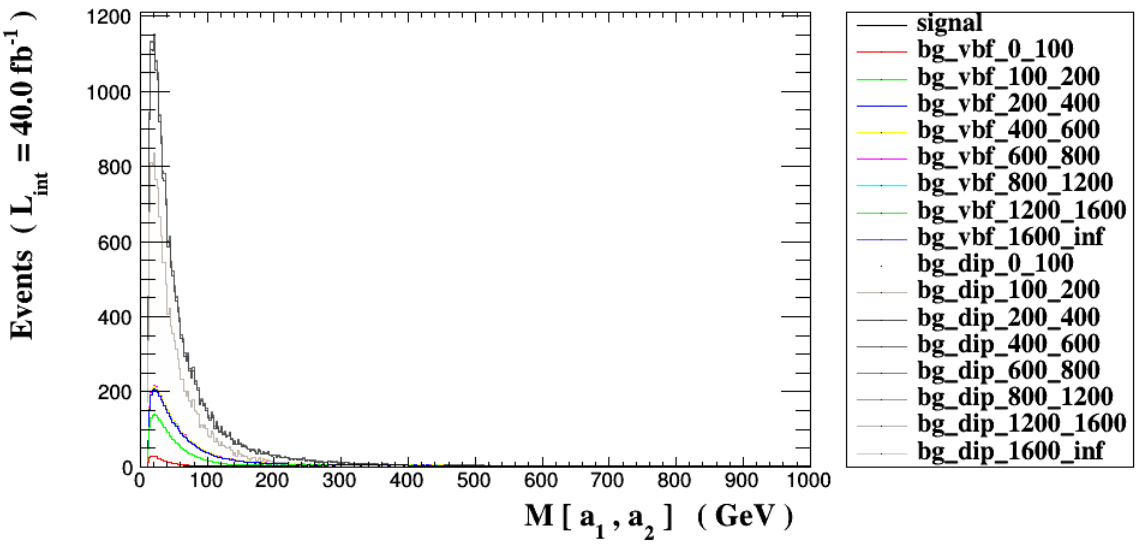

Figure 11.

3.15 Histogram 12

*** Plot: PT (a[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	354.913	315.1	0.0	4.779
bg_vbf_0_100	364	1.0	19.1603	12.64	0.0	0.0
bg_vbf_100_20	2253	1.0	22.3418	17.03	0.0	0.0
bg_vbf_200_40	2038	1.0	27.3587	24.97	0.0	0.0002704
bg_vbf_400_60	279	1.0	34.3016	36.49	0.0	0.001413
bg_vbf_600_80	47.9	1.0	39.0417	45.36	0.0	0.0005266
bg_vbf_800_12	12.1	1.0	42.1925	52.56	0.0	0.0
bg_vbf_1200_1	0.677	1.0	47.5734	66.25	0.0	0.009554
bg_vbf_1600_i	0.0489	1.0	55.212	89.43	0.0	0.1161
bg_dip_0_100	1767	1.0	18.1489	11.13	0.0	0.0
bg_dip_100_20	8038	1.0	20.6227	15.77	0.0	0.0
bg_dip_200_40	6955	1.0	24.2161	21.55	0.0	0.0
bg_dip_400_60	638	1.0	29.8364	31.48	0.0	0.0
bg_dip_600_80	89.9	1.0	33.2012	39.41	0.0	0.0
bg_dip_800_12	21.9	1.0	35.3144	43.23	0.0	0.0
bg_dip_1200_1	1.31	1.0	39.8977	60.67	0.0	0.0
bg_dip_1600_i	0.0878	1.0	38.6853	50.43	0.0	0.0

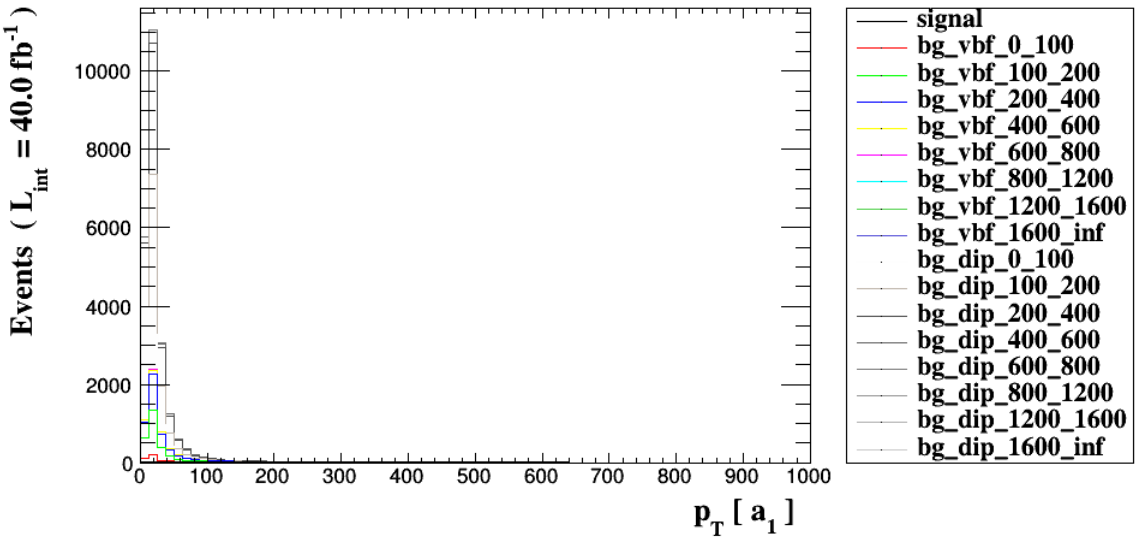

Figure 12.

3.16 Histogram 13

*** Plot: THT**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	454.304	276.1	0.0	0.06799
bg_vbf_0_100	364	1.0	86.2365	9.446	0.0	0.0
bg_vbf_100_20	2253	1.0	148.868	28.12	0.0	0.0
bg_vbf_200_40	2038	1.0	269.397	51.71	0.0	0.0
bg_vbf_400_60	279	1.0	470.153	53.21	0.0	0.0
bg_vbf_600_80	47.9	1.0	673.649	54.12	0.0	0.0
bg_vbf_800_12	12.1	1.0	913.399	95.85	0.0	0.0
bg_vbf_1200_1	0.677	1.0	1317.14	96.31	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	1746.14	153.9	0.0	6.375
bg_dip_0_100	1767	1.0	85.9542	9.466	0.0	0.0
bg_dip_100_20	8038	1.0	147.775	28.3	0.0	0.0
bg_dip_200_40	6955	1.0	263.454	48.38	0.0	0.0
bg_dip_400_60	638	1.0	467.106	52.56	0.0	0.0
bg_dip_600_80	89.9	1.0	671.611	53.46	0.0	0.0
bg_dip_800_12	21.9	1.0	912.241	94.72	0.0	0.0
bg_dip_1200_1	1.31	1.0	1317.23	95.31	0.0	0.0
bg_dip_1600_i	0.0878	1.0	1749.76	155.9	0.0	8.029

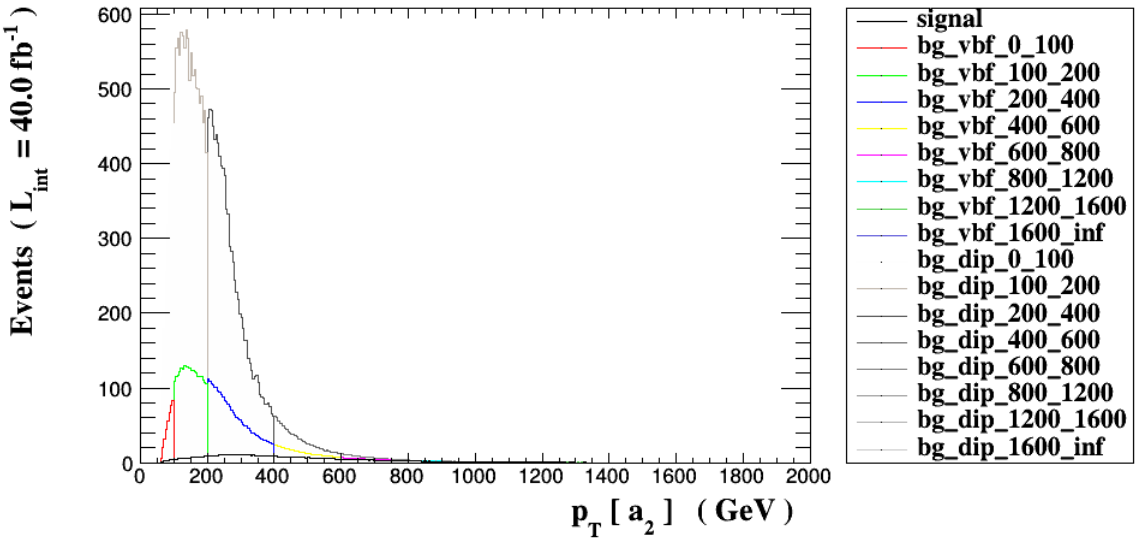

Figure 13.

3.17 Histogram 14

*** Plot: MET**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	7.65721e-09	9.954e-09	0.0	0.0
bg_vbf_0_100	364	1.0	6.1357e-10	4.53e-10	0.0	0.0
bg_vbf_100_20	2253	1.0	9.9577e-10	1.139e-09	0.0	0.0
bg_vbf_200_40	2038	1.0	3.24261e-09	2.215e-09	0.0	0.0
bg_vbf_400_60	279	1.0	4.57408e-09	2.638e-09	0.0	0.0
bg_vbf_600_80	47.9	1.0	4.96938e-09	2.751e-09	0.0	0.0
bg_vbf_800_12	12.1	1.0	5.28099e-09	3.228e-09	0.0	0.0
bg_vbf_1200_1	0.677	1.0	7.45383e-09	9.4e-09	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	1.20778e-08	1.632e-08	0.0	0.0
bg_dip_0_100	1767	1.0	6.0389e-10	5.254e-10	0.0	0.0
bg_dip_100_20	8038	1.0	1.04034e-09	1.192e-09	0.0	0.0
bg_dip_200_40	6955	1.0	3.18901e-09	2.202e-09	0.0	0.0
bg_dip_400_60	638	1.0	4.48357e-09	2.597e-09	0.0	0.0
bg_dip_600_80	89.9	1.0	4.82999e-09	2.653e-09	0.0	0.0
bg_dip_800_12	21.9	1.0	5.14727e-09	3.708e-09	0.0	0.0
bg_dip_1200_1	1.31	1.0	7.65407e-09	1.043e-08	0.0	0.0
bg_dip_1600_i	0.0878	1.0	9.90329e-09	1.373e-08	0.0	0.0

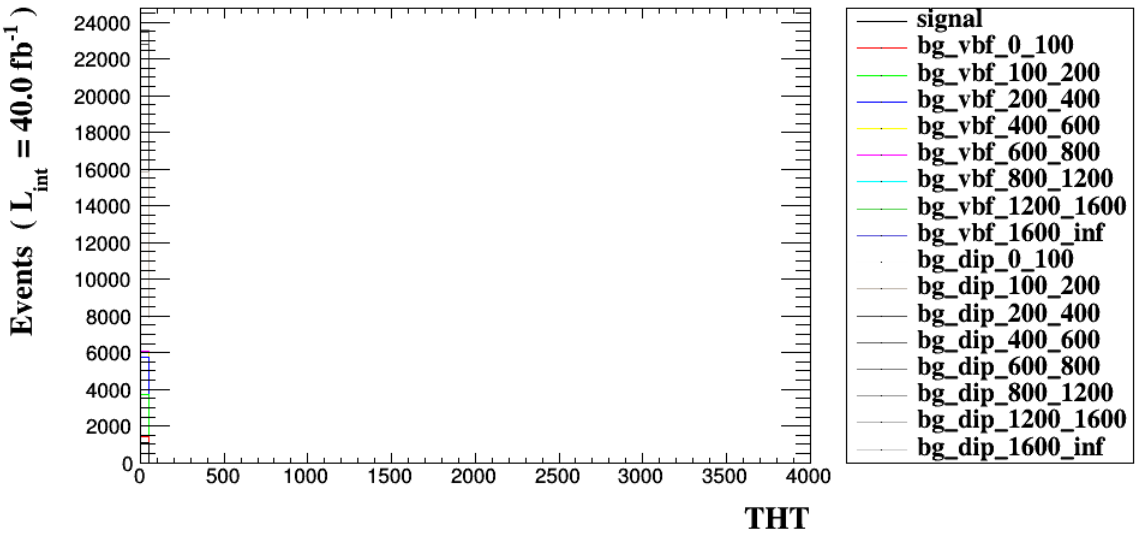

Figure 14.

3.18 Histogram 15

*** Plot: TET**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	1369.75	757.3	0.0	63.1
bg_vbf_0_100	364	1.0	140.264	32.73	0.0	0.003329
bg_vbf_100_20	2253	1.0	219.969	56.88	0.0	0.006239
bg_vbf_200_40	2038	1.0	373.339	101.3	0.0	0.06772
bg_vbf_400_60	279	1.0	628.497	147.8	0.0	2.599
bg_vbf_600_80	47.9	1.0	876.628	197.5	0.0	21.09
bg_vbf_800_12	12.1	1.0	1161.77	278.1	0.0	66.2
bg_vbf_1200_1	0.677	1.0	1640.52	394.6	0.0	100.0
bg_vbf_1600_i	0.0489	1.0	2191.87	630.1	0.0	100.0
bg_dip_0_100	1767	1.0	138.089	31.72	0.0	0.0
bg_dip_100_20	8038	1.0	217.607	59.35	0.0	0.0
bg_dip_200_40	6955	1.0	360.182	100.9	0.0	0.03972
bg_dip_400_60	638	1.0	617.218	158.6	0.0	3.545
bg_dip_600_80	89.9	1.0	859.029	211.9	0.0	17.75
bg_dip_800_12	21.9	1.0	1145.8	305.2	0.0	58.76
bg_dip_1200_1	1.31	1.0	1593.83	420.7	0.0	100.0
bg_dip_1600_i	0.0878	1.0	2097.54	619.6	0.0	100.0

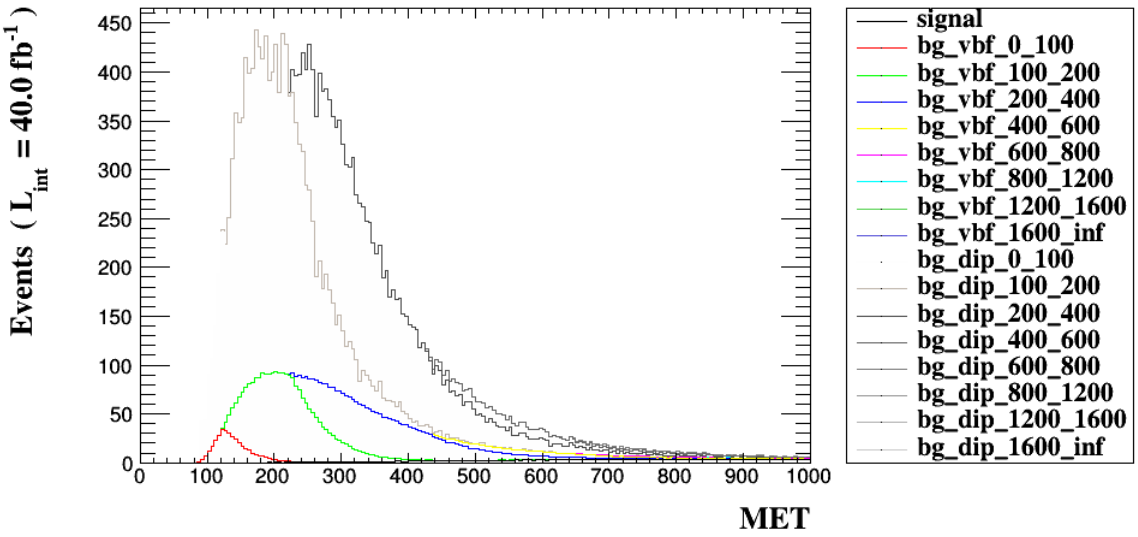

Figure 15.

3.19 Histogram 16

*** Plot: DELTAR (a[1] , a[2])**

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	2.73806	0.8532	0.0	0.0
bg_vbf_0_100	364	1.0	2.63558	0.9837	0.0	0.0
bg_vbf_100_20	2253	1.0	2.482	0.9847	0.0	0.0
bg_vbf_200_40	2038	1.0	2.40629	0.9688	0.0	0.0
bg_vbf_400_60	279	1.0	2.36998	0.9628	0.0	0.0
bg_vbf_600_80	47.9	1.0	2.35535	0.9565	0.0	0.0
bg_vbf_800_12	12.1	1.0	2.34039	0.9474	0.0	0.0
bg_vbf_1200_1	0.677	1.0	2.33111	0.9391	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	2.32373	0.9134	0.0	0.0
bg_dip_0_100	1767	1.0	2.45807	0.911	0.0	0.0
bg_dip_100_20	8038	1.0	2.30771	1.056	0.0	0.0
bg_dip_200_40	6955	1.0	2.29185	1.123	0.0	0.0
bg_dip_400_60	638	1.0	2.38449	1.211	0.0	0.0
bg_dip_600_80	89.9	1.0	2.4517	1.258	0.0	0.0
bg_dip_800_12	21.9	1.0	2.51942	1.28	0.0	0.0
bg_dip_1200_1	1.31	1.0	2.59316	1.343	0.0	0.0
bg_dip_1600_i	0.0878	1.0	2.7138	1.335	0.0	0.0

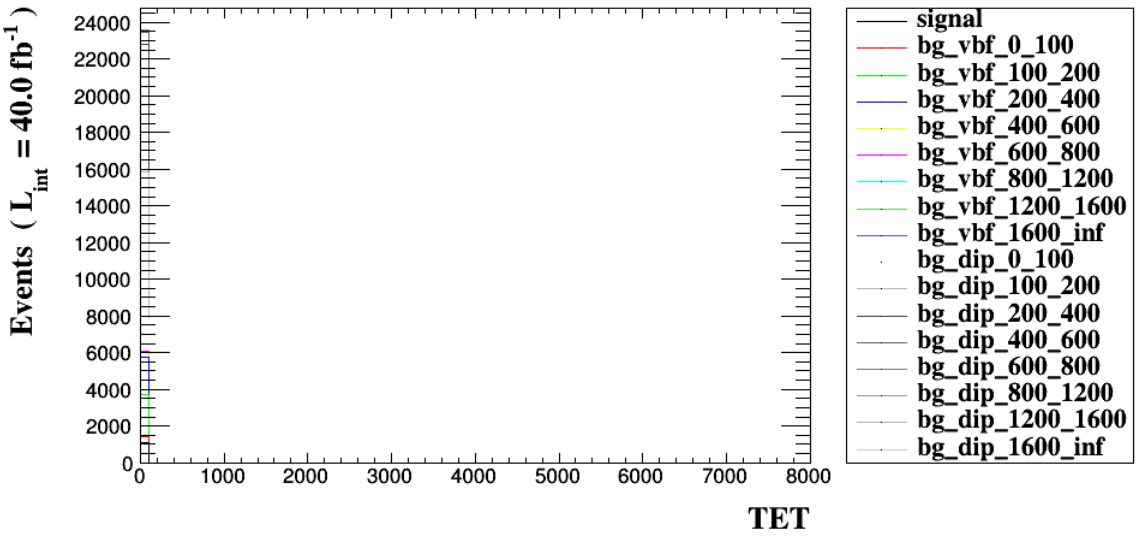

Figure 16.

3.20 Histogram 17

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

Dataset	Integral	Entries per event	Mean	RMS	% underflow	% overflow
signal	1071	1.0	0.00306436	1.57	0.001528	0.001528
bg_vbf_0_100	364	1.0	0.011358	1.887	0.0	0.0
bg_vbf_100_20	2253	1.0	0.00157671	1.85	0.0	0.0
bg_vbf_200_40	2038	1.0	0.00581319	1.788	0.0	0.0
bg_vbf_400_60	279	1.0	0.00688874	1.766	0.0	0.0
bg_vbf_600_80	47.9	1.0	-0.0031434	1.757	0.0	0.0
bg_vbf_800_12	12.1	1.0	-0.0280331	1.742	0.0	0.0
bg_vbf_1200_1	0.677	1.0	0.0094622	1.738	0.0	0.0
bg_vbf_1600_i	0.0489	1.0	-0.0612251	1.68	0.0	0.0
bg_dip_0_100	1767	1.0	-0.0927995	1.373	0.0	0.0
bg_dip_100_20	8038	1.0	0.00715226	1.571	0.0	0.0
bg_dip_200_40	6955	1.0	0.0184645	1.698	0.0	0.0
bg_dip_400_60	638	1.0	-0.00432736	1.892	0.0	0.0
bg_dip_600_80	89.9	1.0	0.0214844	2.018	0.0	0.0
bg_dip_800_12	21.9	1.0	0.0326318	2.106	0.0	0.0
bg_dip_1200_1	1.31	1.0	0.0239735	2.232	0.0	0.0
bg_dip_1600_i	0.0878	1.0	-0.0233956	2.409	0.0	0.0

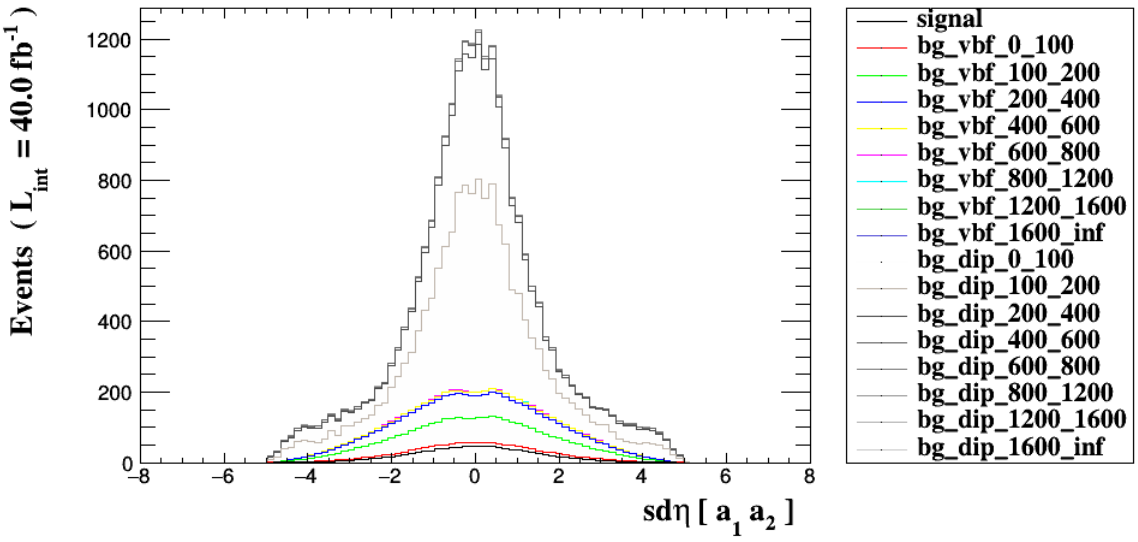

Figure 17.

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	4113516 +/- 4877	2.01760 +/- 0.00132
SEL: 30.0 > PT > 30.0	3815.6 +/- 16.1	2130189 +/- 2200	2.6119 +/- 0.0111
SEL: sdETA (jets[1] jets[2]) > 3.6 or sdETA (je	1214.2 +/- 29.2	133999 +/- 378	3.3021 +/- 0.0793
SEL: M (jets[1] jets[2]) > 750.0	1071.9 +/- 28.1	22509 +/- 145	6.98 +/- 0.18