

VBF Higgs to Invisible cross check analysis

J. Pela

Imperial College London

2014-11-24



were produced by two different and independent code frameworks. This a

2012 prompt results and publication

- Produced by two different and independent code frameworks
- Allowed debugging via synchronization
- Extra confidence on the final results

2012 parked results and publication

Due to lack of man power and time only one full framework. Later decided some level cross check would be beneficial for the analysis. What is being done:

- Cross check analysis starts from the same ntuples produced by the main analysis.
 - All the relevant datasets with not filtering (except golden JSON), just data reduction and parking.
 - Production of ntuples uses same framework on other validated analysis: SM and MSSM Higgs $\tau\bar{\tau}$, the Higgs to $\tau\bar{\tau}b\bar{b}$ and also the prompt invisible result.

I have created a git software repository for analysis independent software and tools about a year ago this will be the base for the analysis code:

Base

<https://github.com/joaopela/HEPFW>

This software package was already forked and was the base for the recent Run II trigger studies and now is being used for the cross check analysis.

Fork

<https://github.com/ICHiggsInv/HEPFW>

The target is to have a framework capable of replicating all the relevant plots and numbers of the main analysis.

Current status

Framework development was inspired on CMSSW and ROOT structures and features. What is the status:

Capabilities

- Access IC Dataformats
- Run over all datasets automatically
- Multiple sequence capability
- EDM filter filtering
- Event list filtering
- Collection cuts based filtering
- Collection overlap filtering

Analysis specific

- Vertex selection
- Electron selection (and veto)
- Muon selection (and veto)
- MET cuts
- Jet cuts (being finished)
- Multiple object cuts ($\text{Min}(\Delta\phi(\text{MET}, \text{jets}))$)

First results - event quality filters

We apply a set of event quality filters to exclude events with clear problems. These filters cover several issues like bad experimental conditions (like too much beam halo), detector noise and problems with reconstruction. The inclusion of the filter is recommended for analysis using MET. The following table has the percentage of rejected events by each filter individually before any other cuts are applied to data. At the end the total percentage event rejection (using an or of all filters) is provided.

Topics

Filter	Prompt A	Prompt B	Prompt C	Prompt D	Parked B	Parked C	Parked D
HBHENoiseFilter	22.900905	22.527028	24.197981	21.830762	0.190670	0.187739	0.170753
EcalDeadCellTriggerPrimitiveFilter	0.375381	2.106058	2.122628	0.838167	0.009300	0.010206	0.012526
eeBadScFilter	0.007852	0.002690	0.000087	0.001883	0.000001	0.000000	0.000009
trackingFailureFilter	3.073876	1.147820	1.638249	1.723157	0.000328	0.007464	0.000290
manystripclus53X	0.001829	0.004350	0.007730	0.005510	0.001319	0.002335	0.001327
toomanystripclus53X	0.000484	0.001765	0.003141	0.001732	0.001149	0.002006	0.001173
logErrorTooManyClusters	0.000027	0.000190	0.000379	0.000102	0.000009	0.000021	0.000016
CSCSTightHaloFilter	10.263068	7.792489	6.133730	8.346904	0.398497	0.402936	0.508025
Total	28.501208	28.317395	28.978159	26.047078	0.598417	0.601999	0.689380

Comparison with main analysis:

This values can be found on the first part of table 3 on the AN2014_243_v4. While total filter efficiency matched exactly the values presented on the note, there are small discrepancies on individual filters with very low event exclusion. This discrepancies may be due to rounding problems or double vs float conversions where precision is lot.

There are events that should not be considered due to have been recorded while the ECAL and/or HCAL laser calibration sequence was happening. The identification of this events is provided through a file list which is used by the code framework to remove those events. The following table shows the individual and total percentage of events vetoed out of the the ones already passing the event quality filters of the previous section.

Topics

Filter	Prompt A	Prompt B	Prompt C	Prompt D	Parked B	Parked C	Parked D
ECAL Laser Filter	0.928521	1.195528	0.000000	0.000000	0.008659	0.000000	0.000000
HCAL Laser Filter	0.007258	0.000027	0.004963	0.000000	0.000000	0.000270	0.000000
ECAL+HCAL Laser Filter	0.935704	1.195556	0.004963	0.000000	0.008659	0.000270	0.000000

Comparison with main analysis:

The "ECAL+HCAL Laser Filter" line of values can be compared with the one on table 3 on the AN2014_243_v4. Values match exactly the ones of the main analysis.

Summary:

- Now able to replicate some number of the analysis note.
- Some bugs already found (minimal influence in main analysis):
 - Good vertex requirement not being requested on main analysis code (effect unknown but should be small)
 - L1T met cut was > 40 and not ≥ 40
- Analysis contribution
 - Checking all definitions against POG recommendation

Next Steps:

- Replicate pre-selection results.

<https://twiki.cern.ch/twiki/bin/viewauth/CMS/VBFHInvParkedDataCrossCheck>