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Inclusive $t\bar{t}$ Cross Section in the Single Lepton Channel (Korean Group)

This twiki contains all the information about this analysis.

Manpower:

1. Tae Jeong Kim (Profesor)
2. Su Yong Choi (Profesor)
3. Javier Brochero (Post-Doc)
4. Dooyeon Gyun (Phd student)
5. Ari Lee (Master student)

On this page:

1. Workflow
2. Code
3. Tasks
4. Additional material

1. Workflow

1. *Flat-ntuple production*: It is done using CATTools. the codes are located at:
 1. CATTools/CatAnalyzer/plugins/TtbarSingleLeptonAnalyzer.cc: It contains the basic selection of the objects as electrons, muons, jets, b-tagged jets, etc.
 2. CATTools/CatAnalyzer/prod/ttbarSingleLeptonAnalyzer_cfg.py: Python config file.
 3. CATTools/CatAnalyzer/prod/create-batch: It sends the jobs to condor (tested only in KISTI).
2. *Flat-ntuple analyzer*: After make the first object selection and save the output in a flat-Trees, the histograms are produced with a code wrote in C++. The code is located in:
 1. <https://github.com/brochero/TopCodeljets/blob/master/TreeReader.C>
3. The output of TreeReader.C is divided in two files:
 1. Root file with all the RAW histograms (fully normalized), and
 2. *.h file with all the yields.
4. *Final histograms production*: In this step the final plots with all the style requirements are produced. Code is located at
 1. https://github.com/brochero/TopCodeljets/blob/master/Plot.*
5. *Yield tables, systematic variations and cross section (C&C)*: (Work in progress) Using the output from TreeReader.C, a root macro produces the tables of yields and systematic variations in LaTeX format. Code in:
 1. https://github.com/brochero/TopCodeljets/blob/master/*****

2. Code

In this section you will find some general comments about the code. More details can be found in README of each package.

1. Flat-ntuples production

- Check the TtbarSingleLeptonAnalyzer.cc code. Here you can modify/include basic cuts. The output of this step includes all the events that contain **only** one lepton passing the selection requirements.
- Compile with:

TtbarXsecLepJets < Sandbox < TWiki

```
% scram b -j 20
```

- Test the code using only one sample. Go to prod directory and run ttbarSingleLeptonAnalyzer_cfg.py

```
% cmsRun ttbarSingleLeptonAnalyzer_cfg.py
```

In this config file you should specify if you are running over DATA or MC:

```
#-----  
#-----  
# Data or MC Sample  
runOnMC = True  
# runOnTTbarMC = 0, No ttbar  
# runOnTTbarMC = 1, ttbar Signal  
# runOnTTbarMC == 2, ttbar Background  
runOnTTbarMC = 1  
#-----  
#-----
```

- ♦ runOnMC: True if the sample is MC; False if it is DATA.
♦ runOnTTbarMC: 0 to run all MC except ttbar; 1 ttbar signal; 2 ttbar background.

Comment this part when you are running over MC.

```
# json file
```

```
= #import FWCore.PythonUtilities.LumiList as LumiList=
```

```
= #process.source.lumisToProcess = LumiList (filename =  
'Cert_246908-251883_13TeV_PromptReco_Collisions15_JSON_v2.txt').getVLuminosityBlockRange(=
```

- Check that the output file (vallot.root) has the correct information.
- Run over the full available samples. This procedure is performed sample by sample running over all the files using the create-batch file.

```
./create-batch --jobName v7-3-6_DataSingleEG_json-Trigger --fileList  
List_v7-3-6/DataSingleEG_PromptReco-Run251643-251883.list --maxFiles 1  
--cfg ttbarSingleLeptonAnalyzer_cfg.py --queue batch6
```

Where DataSingleEG_PromptReco-Run251643-251883.list is a plain file which includes the list of all the files of the process (in this case DATA) with the full path as:

```
root://cms-xrd.sdsc.com//xrd/store/group/CAT/SingleElectron/v7-3-6_Run2015B-PromptReco-v1/1  
root://cms-xrd.sdsc.com//xrd/store/group/CAT/SingleElectron/v7-3-6_Run2015B-PromptReco-v1/1  
root://cms-xrd.sdsc.com//xrd/store/group/CAT/SingleElectron/v7-3-6_Run2015B-PromptReco-v1/1
```

2. Histograms production

- Download the git repository:

```
=% git clone https://github.com/brochero/TopCodeLjets.git=↗
```

- Check the correct path of all input/output directories.
- To compile:

```
% make
```

- It creates a TreeReader.run. You can check the how to use it with

```
% ./TreeReader.run -h
```

- To run, the most recommended way is

```
% ./TreeReader.run -i Tree_LepJets_v7-3-6_Spring15-bx50_40pb-1_WJets
-o NewPlots _v0
```

Where:

- ◆ -i: Input file. remove the ".root"
- ◆ -o: additional name to the output
- The file name in this part of the code is the main axis. You must be careful with the structure name. To avoid any inconvenient, I suggest to use the follow structure:

- ◆ Tree_LepJets_"additional info of the sample"_ "Luminosity in pb-1"_ "SAMPLE".root
- ◆ Example:

```
=Tree_LepJets_v7-3-6_Spring15-bx50_40pb-1_ttbar-PowhegPythia.root
```

- ◆ Tree_LepJets_v7-3-6_Spring15-bx50_40pb-1_DataSingleEG.root
- ◆ Tree_LepJets_v7-3-6_Spring15-bx50_40pb-1_WW.root=

- ◆ Where

- ◇ v7-3-6 is the CATTools version.
- ◇ Spring15-bx50 is the MC info.
- ◇ 40pb-1 Luminosity to use in the MC normalization.

- Finally, the final plots are produced with `Plot.C` and `Plot.h` root macros.
 - ◆ The code runs over cut level for all the channels (mu+jets, e+jets and lep+jets)
 - ◆ each histogram that you want to produce must be add at line 466 of `Plots.C`
 - ◆ To run:

```
% root -l -b -q 'Plots.C(CutLevel,SystematicVariation,
Normalization)'
```

- ◆ Where:

- ◇ CutLevel takes the values: "lepton", "4Jets", "MET" and "2btag".
- ◇ SystematicVariation: To be implemented.
- ◇ Normalization: To be implemented or removed.

- ◆ Example:

```
% root -l -b -q 'Plots.C("4Jets","", false)'
```

3. Tasks

Here you will find some of the most urgent task which must be performed for the analysis. Please, feel free to put your name in those in which you can contribute and/or add another tasks.

1. b-tagging code: Implementation of SF_b-tag. (Javier Brochero)
2. b-tag efficiencies for each MC process. (Javier Brochero and ????)
3. Comparison between MET_{PF} , MET_{noHF} and PuppiMET (Should we add all of them to our ntuples?). (Dooyeon Gyun ????)
4. Optimization of the event selection cuts. (Ari Lee)
5. Production of the file list for every CATNtuple production. (Ari Lee)
6. Tag & Pro package to estimate SF_ID_ISO and SF_Trigger. (Dooyeon Gyun ????)
7. QCD Daata-Driven method. (Javier Brochero and ????)
8. Analysis note. (????)
9. Code to produce yields (C&C). (Javier Brochero)
10. CMS Fireworks (to display some interesting events. [Link HERE](#)). (Ari Lee ????)
11. PUPPI isolation studies. (Javier Brochero)
12. Code to normalize MC to the available Luminosity (automatization). (Dooyeon Gyun and Ari Lee????)
13. Check Br on MADGRAPH ttbar sample. (????)
14.

4. Additional Documentation

1. EA TOP-15-005: Inclusive and differential tt cross section in the 1 jets channel at $\sqrt{s}=13$ TeV

- CADI entrie:

<http://cms.cern.ch/iCMS/analysisadmin/viewanalysis?id=1452&field=id&value=1452&name=EA:%20Differ>

- Twiki: <https://twiki.cern.ch/twiki/bin/view/CMS/PASTop15005>

- EA TOP-15-013: ttbar differential cross sections as function of HT etc. in the 1+jets channel at 13 TeV

- [http://cms.cern.ch/iCMS/analysisadmin/viewanalysis?id=1521&field=id&value=1521&name=EA:%20ttbar%](http://cms.cern.ch/iCMS/analysisadmin/viewanalysis?id=1521&field=id&value=1521&name=EA:%20ttbar%20)

- <https://twiki.cern.ch/twiki/bin/viewauth/CMS/PASTop15013>

- Legacy TOP-12-006: Top pair cross section in e/mu+jets at 8 TeV and ratio (8 TeV)/(7 TeV)

- <http://cms.cern.ch/iCMS/analysisadmin/viewanalysis?id=828&field=id&value=828&name=Top%20pair%20>

- <https://twiki.cern.ch/twiki/bin/viewauth/CMS/PaperTop12006>

Our presentations:

- September 04, 2015 Top & SM Working Meeting:

<https://indico.cern.ch/event/443256/contribution/6/attachments/1149466/1649377/presentation.pdf>

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