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Single Top Polarization analysis

Group info

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Useful papers

- Mahlon, Parke, "Single top quark production at the LHC: Understanding spin" (2000) - theoretical definition of the angular observables
- TOP-11-021 - single top t-channel cross section measurement at 7 TeV in CMS with 1.1/fb (muon channel) and 1.5/fb (electron channel)
- AN-2011-229 - internal document corresponding to TOP-11-021 (many more details, including technical ones) - warning: a few details in the latest version are outdated! When in doubt, refer to the approval talk
- "The Angular Correlations in Top Quark Decays in Standard Model Extensions", S. Batebi, S. M. Etesami, M. Mohammadi Najafabadi
- ...add some beyond-SM papers here...

Models to investigate

Flavor-Changing Neutral Currents (FCNC) in tgq (q=u,c) coupling

The best limits come from ATLAS (ref.):

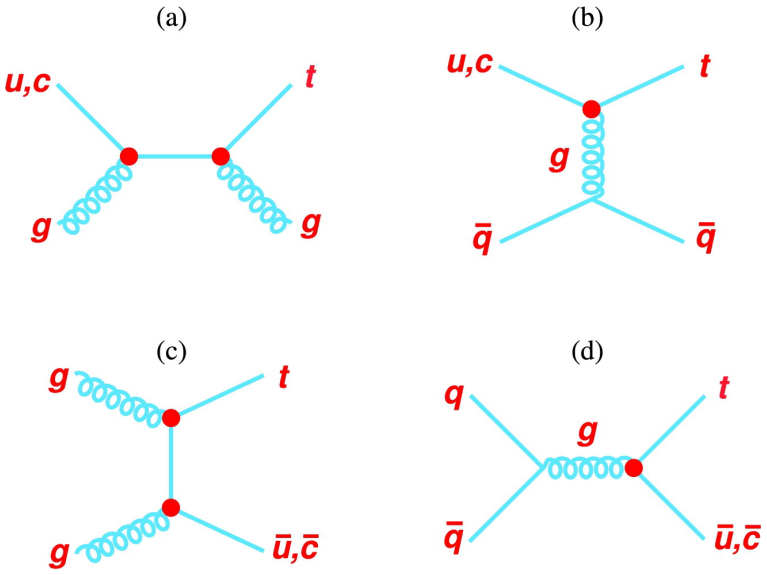
- K_tgu/ < 0.0069 TeV^{-1}
- K_tgc/ < 0.016 TeV^{-1}

A different kind of search, with the same topology as we will investigate, has been performed by D0 (ref.) obtaining these limits:

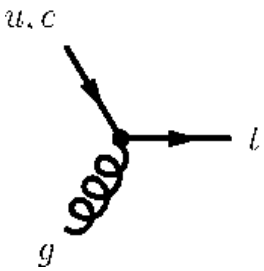
- K_tgu/ < 0.013 TeV^{-1}
- K_tgc/ < 0.057 TeV^{-1}

The D0 analysis is performed with 2.3/fb, with a Bayesian Neural Network, optimized for the processes in the figure below in the **lepton + 2 jets** topology. See the references in the Introduction for a nice list of new-physics models that can give an effective FCNC coupling of this kind.

FCNC tgq interactions at leading order, from D0's paper:



The CDF (ref.1, ref.2) and ATLAS experiments optimize instead for the diagram qg->t and therefore they investigate the **lepton + 1 jet** topology, see figure below (from ATLAS):



Additional jets can come from gluon radiation, therefore our kind of analysis (which needs a second jet to define the approximate spin axis) can be also sensitive to this diagram.

Comparing D0 (lepton + 2 jets) with 2.3/fb and CDF (lepton + 1 jet) with 2.2/fb, one sees that for a similar statistics the strongest limits come from D0. Therefore, the lepton + 2 jets selection might be intrinsically more sensitive to FCNC signals in the tgq coupling.

Suggestion by Lev Dudko:

```
since there are no any interference between Ktcg/L and Ktug/L couplings
and cross section depends quadratically from these couplings it is
enough to generate two samples for each process. One with one coupling
and another sample for the second coupling and use one of the value for
the coupling. All other values one can simulate with the same sample
with quadratic renormalization to the new value of the coupling.
Therefore, it is very simple, you can take one sample, use quadratic
parameter of the FCNC sample normalization (e.g. in distribution of the
cos_theta) and apply Theta package to find the limit for this quadratic
coupling.
```

Flavor-Changing Neutral Currents (FCNC) in t q (q=u,c) coupling

For this kind of coupling, it is difficult to improve over HERA limits from q->t search. An alternative strategy pursued in hadron colliders is the search for t-> q decays in ttbar events (see an old MC study in CMS).

Flavor-Changing Neutral Currents (FCNC) in tZq (q=u,c) coupling

For this kind of coupling, it is difficult to improve over LEP limits from Z->tq search (see paper by ALEPH). An alternative strategy pursued in hadron colliders is the search for t->Zq decays in ttbar events (see the latest study from ATLAS and from CMS)

Anomalous tWb couplings

Latest results are from D0 (ref.)

Samples with generic (non-left-handed) tWb couplings are being produced in Moscow.

Useful links

- Reference selection for the t-channel analysis with 2011 data
- Systematics in t-channel analysis
- Central wiki of the Single Top group
- Central wiki of the Top PAG
- Single-top hypernews (hn-cms-singletop@cernNOSPAMPLEASE.ch)
- Agenda of the Top PAG group and subgroup meetings; search for "Single Top"
- Single-top cross sections
- Recommended MC samples in the Top group
- theta - tool for profile-likehood fits (very popular in the single top group)
    - A general, physics-focused introduction
    - Some recommendations
- Utilities for integrated luminosity calculation
- Running on the GRID
- What shapes the cos distribution (from an old MC study): 1 - 2

General Work Plan

Analysis at 7 TeV with ~1/fb

- Reproduce TOP-11-021 selection numbers in both data and MC
- Produce FastSim samples for models with A < 100%
- Set up statistics macros to extract A and set upper limits on non-SM models
- Extract from dedicated control samples the abundance and the cos * shape for W + light jets, ttbar, QCD
- Evaluate all the systematics (see this wiki)
- Get the results. No need to keep the analysis "blind" at this stage, as the main result will be the 8 TeV one. In case we will decide to use the full 7 TeV dataset, the additional statistics will be handled with the same work plan as for 8 TeV below.

Question to be answered once all data-driven background estimations and all systematics are included in the analysis: is the current definition of the * angle the most optimal for this analysis? What about using the "beam-line basis" instead of the "spectator basis"? (See Mahlon, Parke 2000)

- Which of the two gives the best ΔA and the best limits when running on MC only? (Use pseudo-data diced from the overall MC expectation.)
- Is the data-MC agreement equally satisfactory for both?
- Is the model dependence for the W + heavy flavor background roughly the same?

Synchronization to 2011

To be performed as specified in https://twiki.cern.ch/twiki/bin/viewauth/CMS/SingleTopSync2011

The datafiles on phys are copied to /hdfs/local/stpol/sync2011

Joosep START42_V17	Lepton Veto	Jet Cut	MTW	B-tagging
Monte Carlo, muon sel.	1183	565	263	182
Monte Carlo, electron sel.	805	426	155	101

Joosep START42_V13	Lepton Veto	Jet Cut	MTW	B-tagging
Monte Carlo, muon sel.	1183	563	263	183
Monte Carlo, electron sel.	805	419	154	100

Synchronization of the 4_2_X code to the Naples group

Process the SbarChannel dataset `/Tbar_TuneZ2_s-channel_7TeV-powheg-tauola/Summer11-PU_S4_START42_V11-v1/AODSIM` and try to get the following numbers after the cuts:

globalTag=START42_V17 and doResol=True in TChannel_cfg.py

lepton id	lepton	jet	met	btag
mu	8156	3838	2103	1456
ele	5508	2560	1079	752

Correlation between costheta in the eta beamline basis and the spectator jet basis

Plots are here: http://phys.hep.kbfi.ee/~joosep/stpol/costheta_corr/

Done using `UserCode/STPol/util_scripts/costheta_corr.py`

Forward jet selection bias

Plots are here: http://phys.hep.kbfi.ee/~joosep/stpol/fwdJet_selection_bias/ The forward jet selection is `(abs(fwdJetEta)<4.5 && abs(fwdJetEta)>2.5 && fwdJetPt>30)`

The probability is calculated using the Kolmogorov test, the areas are normalized to 1.

Forward jet eta

Plots are here: http://phys.hep.kbfi.ee/~joosep/stpol/fwdJet_plots/

Analysis at 8 TeV

Note: please don't take the 7 and 8 TeV analyses as necessarily sequential. As soon as 8 TeV data arrive, it is mandatory to look at those (to validate many things: the quality of the detector and of the reconstruction, the effect of the worse pile-up conditions, to check the scaling of the backgrounds from 7 to 8 TeV) even if the 7 TeV analysis is not complete yet. Ideally, things should be done in parallel; priorities would be rediscussed at each of our weekly meetings.

- Check data-MC agreement (in rate and in cos * shape) in the control samples for W + light jets, ttbar, QCD

- Perform a MC only analysis to assess the expected sensitivity of the analysis. (Use pseudo-data diced from the overall MC expectation.)
- Re-optimize if needed, using the control samples to quantify the non-single-top backgrounds
- Use FastSim for non-SM signals, SM backgrounds that don't arrive quickly enough, systematic variations around the generation parameters of the SM backgrounds
- Keep the analysis blind. In our case this means that we should abstain from looking at cos * in the single-top-dominated region until we are really confident that we understand the background-dominated regions and we are considering at least the main systematic uncertainties that can affect the shape of this observable and the rate of events.

Processed datasets for code HEP-KBFI/stpol

List of datasets

DYJets	/DYJetsToLL_M-50_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_STA
GJets1	/GJets_HT-200To400_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AO
GJets2	/GJets_HT-400ToInf_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AOI
QCD_BCtoE1	/QCD_Pt_20_30_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53
QCD_BCtoE2	/QCD_Pt_30_80_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53
QCD_BCtoE3	/QCD_Pt_80_170_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START5
QCD_BCtoE4	/QCD_Pt_170_250_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START
QCD_BCtoE5	/QCD_Pt_250_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START
QCD_BCtoE6	/QCD_Pt_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V
QCD_EM1	/QCD_Pt_20_30_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_STA
QCD_EM2	/QCD_Pt_30_80_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_STA
QCD_EM3	/QCD_Pt_80_170_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_ST
QCD_EM4	/QCD_Pt_170_250_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_S
QCD_EM5	/QCD_Pt_250_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_S
QCD_EM6	/QCD_Pt_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_STAR
QCD_Mu	/QCD_Pt_20_MuEnrichedPt_15_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_ST
SingleElectron _RunABCD	/SingleElectron/Run2012D-22Jan2013-v1/AOD
SingleMu _RunABCD	/SingleMu/Run2012D-22Jan2013-v1/AOD
Tbar_s	/Tbar_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_
Tbar_t_mass166_5	/TBarToLeptons_t-channel_mass166_5_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_S
Tbar_t_mass178_5	/TBarToLeptons_t-channel_mass178_5_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_S
TbarToLeptons _t-channel	/TBarToLeptons_t-channel_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V
Tbar_t_scaledown	/TBarToLeptons_t-channel_scaledown_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_ST
Tbar_t_scaleup	/TBarToLeptons_t-channel_scaleup_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_STA
Tbar_t	/Tbar_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_
Tbar_tW	/Tbar_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_STAR
T_s	/T_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7
TTbar_FullLept2	/TTJets_FullLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-
TTbar_SemiLept2	/TTJets_SemiLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A
TTbar	/TTJets_MassiveBinDECAY_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S1
TTJets_mass166_5	/TTJets_mass166_5_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_STAR
TTJets_mass178_5	/TTJets_mass178_5_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_STAR
TTJets_matchingdown	/TTJets_matchingdown_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_ST
TTJets_matchingup	/TTJets_matchingup_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_STAR
TTJets_scaledown	/TTJets_scaledown_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START
TTJets_scaleup	/TTJets_scaleup_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53

T_t_mass166_5	/TToLeptons_t-channel_mass166_5_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_STA
T_t_mass178_5	/TToLeptons_t-channel_mass178_5_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_STA
TToBENu _anomWtb-0100	/TToBENu_anomWtb-0100_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-PU_
TToBENu _anomWtb-unphys	/TToBENu_anomWtb-unphys_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-PU
TToBMuNu _anomWtb-0100	/TToBMuNu_anomWtb-0100_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-PU
TToBMuNu _anomWtb-unphys	/TToBMuNu_anomWtb-unphys_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-
TToBTauNu _anomWtb-0100	/TToBTauNu_anomWtb-0100_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-PU
TToBTauNu _anomWtb-unphys	/TToBTauNu_anomWtb-unphys_t-channel_TuneZ2star_8TeV-comphep/Summer12_DR53X-
TToLeptons _t-channel	/TToLeptons_t-channel_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-
T_t_scaledown	/TToLeptons_t-channel_scaledown_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_STAR
T_t_scaleup	/TToLeptons_t-channel_scaleup_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START5
T_t	/T_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A
T_tW	/T_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START5
WJets1	/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_
WJets2	/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_
WJets_excl1	/W1JetsToLNu_TuneZ2Star_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-
WJets_excl2	/W2JetsToLNu_TuneZ2Star_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-
WJets_excl3	/W3JetsToLNu_TuneZ2Star_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-
WJets_excl4	/W4JetsToLNu_TuneZ2Star_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-
WJets_matchingdown	/WJetsToLNu_matchingdown_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START5
WJets_matchingup	/WJetsToLNu_matchingup_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53_
WJets_scaledown	/WJetsToLNu_scaledown_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53_V
WJets_scaleup	/WJetsToLNu_scaleup_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53_V7A
WW	/WW_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/A
WZ	/WZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AO
ZZ	/ZZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AO

step1

Here are the datasets processed by the (skim) + PF2PAT + (slim) code. Use the following snippet to get the list of files:

```
das_cli.py --query="file
dataset=/T_t-channel_TuneZ2star_8TeV-powheg-tauola/jpata-stpol_step1_v2_1_noSkim-6d0886f8efd932bc
instance=cms_dbs_ph_analysis_02" --limit=0
```

all MC	skim, mu, ele	DAS
T_t	noSkim, ele, mu	/T_t-channel_TuneZ2star_8TeV-powheg-tauola/jpata-stpol_step1_v2_1_noSkim-6d0886f8efd932
Tbar_t	noSkim, ele, mu	/Tbar_t-channel_TuneZ2star_8TeV-powheg-tauola/jpata-stpol_step1_v2_1_noSkim-6d0886f8efd9
SingleMu RunA +RunB	ele, mu, 5238 pb^-1	/SingleMu/jpata-stpol_step1_v3_1-60389801c9c75bd7ec94ff0c7c5a7358/USER

step1 Feb6 rerun

source dataset	destination dataset
/SingleElectron/Run2012A-recover-06Aug2012-v1/AOD	/SingleElectron/joosep-step1_Data_Feb6-a67a46c387bb052
/SingleElectron/Run2012A-13Jul2012-v1/AOD	/SingleElectron/joosep-step1_Data_Feb6-2cdd420c4c72509
/SingleElectron/Run2012B-13Jul2012-v1/AOD	/SingleElectron/joosep-step1_Data_Feb6-2cdd420c4c72509
/SingleElectron/Run2012C-24Aug2012-v1/AOD	/SingleElectron/joosep-step1_Data_Feb6-2d70b925c06acab
/SingleElectron/Run2012C-PromptReco-v2/AOD	/SingleElectron/joosep-step1_Data_Feb6-14d3879a0dccd7e
/SingleElectron/Run2012D-PromptReco-v1/AOD	/SingleElectron/joosep-step1_Data_Feb6-4ad4eefaf926ac72
/SingleMu/Run2012A-13Jul2012-v1/AOD	/SingleMu/joosep-step1_Data_Feb6-2cdd420c4c725097a43
/SingleMu/Run2012A-recover-06Aug2012-v1/AOD	/SingleMu/joosep-step1_Data_Feb6-2cdd420c4c725097a43
/SingleMu/Run2012B-13Jul2012-v1/AOD	/SingleMu/joosep-step1_Data_Feb6-2cdd420c4c725097a43
/SingleMu/Run2012C-24Aug2012-v1/AOD	/SingleMu/joosep-step1_Data_Feb6-14d3879a0dccd7e6c1f
/SingleMu/Run2012C-PromptReco-v2/AOD	/SingleMu/joosep-step1_Data_Feb6-14d3879a0dccd7e6c1f
/SingleMu/Run2012D-PromptReco-v1/AOD	/SingleMu/joosep-step1_Data_Feb6-4ad4eefaf926ac722f9a

/DYJetsToLL_M-50_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSI
/GJets_HT-200To400_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/GJets_HT-400ToInf_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
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/QCD_Pt_30_80_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/QCD_Pt_80_170_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/QCD_Pt_170_250_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/QCD_Pt_250_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/QCD_Pt_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM
/QCD_Pt_20_30_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSI
/QCD_Pt_30_80_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSI
/QCD_Pt_80_170_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODS
/QCD_Pt_250_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AOD
/QCD_Pt_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/QCD_Pt_20_MuEnrichedPt_15_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODS
/Tbar_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/TBarToLeptons_t-channel_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/Tbar_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/Tbar_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/T_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/TTJets_FullLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/TTJets_FullLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM
/TTJets_SemiLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/TTJets_SemiLeptMGDecays_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A_ext-v1/AODSIM
/TTJets_MassiveBinDECAY_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/
/T_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/T_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM
/WW_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/WZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/ZZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

Synchronization to 2012 / CMSSW_5_3_4

Analysis steps are the same as described in
https://twiki.cern.ch/twiki/bin/view/CMS/TWikiTopRefEventSel#Single_Top_Channels

Tbar_t data file:
`/store/mc/Summer12_DR53X/T_t-channel_TuneZ2star_8TeV-powheg-tauola/AODSIM/PU_S10_START53_V7A-v1/0`

Muon channel

name	processed	skim + HLT	iso lepton	loose muon veto	loose electron veto	nJets==2	MTW	nBTags==1	Remarks
Joosep	10566	3355	626	625	622	244	197	77	Skim, noHLT, TCHP tight, START53_V7A, CMSSW_5_3_4
Joosep	10566	10566	626	625	622	244	197	77	noSkim, noHLT, TCHP tight, START53_V7A, CMSSW_5_3_4
Mario	10566	665	590	589	589	210	167	84	noSkim, HLT (IsoMu24 _eta2p1_v13), Loose PU jet veto, CSV medium, START53_V7F (the recommended tag for analysis), CMSSW_5_3_4
Mario	10566	10566	657	656	656	236	190	94	noSkim, noHLT, rest is the same
Joosep	10566	665	589	588	586	227	182	72	HLT (IsoMu24 _eta2p1_v13), loose PU jet veto, TCHP tight, START53_V7F, CMSSW_5_3_4, rho corr rel iso (muons)
Mario	10566	665	590	589	589	211	168	83	HLT, loose PU veto, CSVM b-tag, MC smearing, START53_V7F, CMSSW_5_3_4, rho corr rel iso

Code

Naples ntuplizer

- Naples code can be found here
- Instructions here

CMSSW version: in the first stage, let's stick to 4_2_8 in order to reproduce Naples results. We will have to move to later releases (5_2_X) for the analysis of 2012 data. If we decide to perform the 7 TeV analysis with the full 2011 data set, moving to 4_4_4 is recommended (or to 5_2_X if a re-reco of the 2011 data and MC in this version is ready in time.)

Setting up SingleTop _52X on phys.hep.kbfi.ee

First export the SCRAM_ARCH as

```
export SCRAM_ARCH=slc5_amd64_gcc462
```

Now follow the instructions, but instead of CMSSW_5_2_5 use CMSSW_5_2_5_patch1. The datafiles mentioned in the instructions are copied to `/hdfs/local/stpol/sync_5_2_X`

Producing the trees using trees_wrapper_cfg.py

In order to do step 2 to produce the trees from the ntuples, the script UserCode /STPol/util_scripts/trees_wrapper_cfg.py can be used. Place the script in the CMSSW_4_2_8/src/TopQuarkAnalysis/SingleTop/test directory.

```
cd CMSSW_4_2_8/src
cvs co UserCode/STPol
cp UserCode/STPol/util_scripts/trees_wrapper_cfg.py TopQuarkAnalysis/SingleTop/test/
cd TopQuarkAnalysis/SingleTop/test/
```

Also copy the latest version of the file TChannel_cfg.py from the directory
`TopQuarkAnalysis/SingleTop/test/synch/`

```
cp synch/TChannel_cfg.py ./
```

Now run the treemaker as

```
cmsRun trees_wrapper_cfg.py inputFiles_load=infiles.txt outputFile=out.root maxEvents=-1 channel=
```

CHAN is taken from the file SingleTopPSetsSummer _cfi.py and removing the Ele/Mu suffix. So when running on the TChannel ntuples, **channel=TChannel**.

Producing the W-split samples

In order to produce the W-split samples, the input dataset must be the one corresponding to WJets and the channel must be one of

channel=WJets_wlight, **channel=WJets_wbb**, **channel=WJets_wcc**

Producing trees from data

To process data, the following changes have to be made in TChannel_cfg:

```
process.TreesMu.doResol = cms.untracked.bool(False)
process.TreesEle.doResol = cms.untracked.bool(False)
process.TreesMu.doPU = cms.untracked.bool(False)
process.TreesEle.doPU = cms.untracked.bool(False)
MC_instruction = False

channel_instruction = "mu"
```

for muons or

```
channel_instruction = "ele"
```

for electrons

```
process.WeightProducer +
```

needs to be commented out from the

```
channel_instruction
```

Troubleshooting the naples code on phys for CMSSW_4_2_8

A working tagset seems to be

```
--- Tag ---    -------- Package --------
V03-03-07      DataFormats/METReco
V06-04-19-01   DataFormats/PatCandidates
V02-03-00      JetMETCorrections/Algorithms
V05-00-17-01   JetMETCorrections/Modules
V03-01-00      JetMETCorrections/Objects
V04-05-07      JetMETCorrections/Type1MET
CMSSW_4_2_8    PhysicsTools/PatAlgos
V00-05-24      PhysicsTools/PatExamples
b4_2_X_cvMEtCorr_30Nov11 PhysicsTools/PatUtils
V00-03-24      PhysicsTools/SelectorUtils
V08-02-14      PhysicsTools/UtilAlgos
V08-03-10      PhysicsTools/Utilities
V00-04-11      RecoBTag/PerformanceDB
V00-03-31      RecoEgamma/ElectronIdentification
V03-03-05      RecoLuminosity/LumiDB
SingleTop_42X  TopQuarkAnalysis/SingleTop
```

Error occurred while creating for module of type 'SingleTopLeptonCounter' with label 'countLeptons'

```
StatusMismatch: Parameter 'minNumberTight' is designated as untracked in the code,
but is not designated as untracked in the configuration file.
Please change the configuration file to 'untracked <type> minNumberTight'.
```

Change the following things in the source files from untracked to tracked

src/SingleTopLeptonCounter.cc

```
  minTight_ =  iConfig.getParameter<int>("minNumberTight");
  maxTight_ =  iConfig.getParameter<int>("maxNumberTight");
  minLoose_ =  iConfig.getParameter<int>("minNumberLoose");
  maxLoose_ =  iConfig.getParameter<int>("maxNumberLoose");
```

python/SingleTopSelectors_cff.py

```
countLeptons = cms.EDFilter("SingleTopLeptonCounter",
                            looseMuons = cms.InputTag("looseMuons"),
                            looseElectrons = cms.InputTag("looseElectrons"),
                            tightMuons = cms.InputTag("tightMuons"),
                            tightElectrons = cms.InputTag("tightElectrons"),
                            qcdMuons = cms.InputTag("tightMuonsZeroIso"),
                            qcdElectrons = cms.InputTag("tightElectronsZeroIso"),

                            minNumberTight = cms.int32(1),
                            maxNumberTight = cms.int32(1),
                            minNumberLoose = cms.int32(0),
                            maxNumberLoose = cms.int32(0),

                            minNumberQCD = cms.untracked.int32(1),
                            maxNumberQCD = cms.untracked.int32(1),
                            rejectOverlap = cms.untracked.bool(True),
                            doQCD = cms.untracked.bool(True),
                            )
```

SelectionCuts_Skim_cff.py

```
minTightLeptons = cms.int32(1)
maxTightLeptons = cms.int32(99)
minLooseLeptons = cms.int32(0)
maxLooseLeptons = cms.int32(99)
```

Error occurred while creating for module of type 'SingleTopSystematicsTreesDumper' with label 'TreesMu'

```
Error occurred while creating for module of type 'SingleTopSystematicsTreesDumper' with label 'Tr
---- JetCorrectorParameters BEGIN
No definitions found!!!
---- JetCorrectorParameters END
```

You need to copy the file from
CMSSW_4_2_8/src/TopQuarkAnalysis/SingleTop/test/JEC11_V12_AK5PF_UncertaintySources.txt to
CMSSW_4_2_8/src/TopQuarkAnalysis/SingleTop/test/synch

terminate called after throwing an instance of 'boost::exception_detail::clone_impl >'

You need to set the LHAPATH environment variable

```
export LHAPATH=/cvmfs/cms.cern.ch/slc5_amd64_gcc434/external/lhapdf/5.8.5-cms3/share/lhapdf/PDFse
```

python encountered the error:

Comment the following in `SingleTopMC_PF2PAT_cfg.py`

```
process.load("PhysicsTools.PatUtils.patPFMETCorrections_cff")
process.selectedPatJetsForMETtype1p2Corr.src = cms.InputTag('selectedPatJets')
process.selectedPatJetsForMETtype2Corr.src = cms.InputTag('selectedPatJets')
process.patPFJetMETtype1p2Corr.type1JetPtThreshold = cms.double(10.0)
process.patPFJetMETtype1p2Corr.skipEM = cms.bool(False)
process.patPFJetMETtype1p2Corr.skipMuons = cms.bool(False)
```

and remove producePatPFMETCorrections from the path

```
process.pathPreselection = cms.Path(
        process.patseq #+  process.producePatPFMETCorrections
        )
```

crab weirdness introducing a lumi discrepancy

Somehow, the results from crab -report and lumiCalc2.py are inconsisent. Diff between **83a02e9_Jul22** (Mario - old) and **Aug4_c6a4b11(Joosep - new)**. The former was used for the previous presentation at the single top meeting, and for the plots in the AN/PAS. The latter includes MET-PHI corrections, PU reweighting systematics, top/ttbar reweighting by pt.

data block A

label	subpath	parent	int lum (/ph
old	not available, added by lumisection diffs		
new	./Aug1/WD_SingleMu_miss	/SingleMu/joosep-missing_data-8c29f3a4ed8afc34a59f7c305acd4b13/USER	109

data block B

label	subpath	parent	int. lumi

Error occurred while creating for module of type 'SingleTopLeptonCounter' with label 'countLeptons'

			(/pb)
old	./Jul15/WD_SingleMu2	/SingleMu/joosep-Jul8_51f69b-7cb0fdcb434651e6fe30ffadc793c329/USER	4918
new	WD_SingleMu2	/SingleMu/joosep-Jul8_51f69b-7cb0fdcb434651e6fe30ffadc793c329/USER	6398

data block C

label	subpath	parent	int. lumi (/pb)
old	./Jul15/WD_SingleMu1	/SingleMu/joosep-Jul16_7d17c5-7cb0fdcb434651e6fe30ffadc793c329/USER	6823
new	WD_SingleMu1	/SingleMu/joosep-Jul16_7d17c5-7cb0fdcb434651e6fe30ffadc793c329/USER	6784

data block D

label	subpath	parent	int. lumi (/pb)
old	WD_SingleMu3	/SingleMu/jpata-Jul16_7d17c5-7cb0fdcb434651e6fe30ffadc793c329/USER	5277
new	./Jul15/WD_SingleMu3	/SingleMu/jpata-Jul16_7d17c5-7cb0fdcb434651e6fe30ffadc793c329/USER	5319

Differences between WD_SingleMu2

new

```
CMSSW.datasetpath : /SingleMu/joosep-Jul8_51f69b-7cb0fdcb434651e6fe30ffadc793c329/USER
CMSSW.dbs_url : https://cmsdbsprod.cern.ch:8443/cms_dbs_ph_analysis_02_writer/servlet/DBSServlet
CMSSW.get_edm_output : 1
CMSSW.lumi_mask : /home/joosep/singletop/stpol/crabs/lumis/Cert_190456-208686_8TeV_22Jan2013ReRec
CMSSW.lumis_per_job : 100
2013-08-04 02:23:54,216 [INFO]  528 jobs created to run on 67196 lumis
/home/joosep/singletop/stpol/crabs/Aug4_c6a4b11/step2/data/iso/Jul15/WD_SingleMu2
Total Events read: 42747328
Total Files read: 1133
Total Jobs : 528
Luminosity section summary file: /home/joosep/singletop/stpol/crabs/Aug4_c6a4b11/step2/data/iso/J
   # Jobs: Done:1
   # Jobs: Retrieved:527
```

old

```
CMSSW.datasetpath : /SingleMu/joosep-Jul8_51f69b-7cb0fdcb434651e6fe30ffadc793c329/USER
CMSSW.dbs_url : https://cmsdbsprod.cern.ch:8443/cms_dbs_ph_analysis_02_writer/servlet/DBSServlet
CMSSW.get_edm_output : 1
CMSSW.lumi_mask : /home/mario/Summer13/stpol/crabs/lumis/Cert_190456-208686_8TeV_22Jan2013ReReco_
CMSSW.lumis_per_job : 100
2013-07-22 17:13:32,755 [INFO]  520 jobs created to run on 66059 lumis
/home/mario/Summer13/stpol/crabs/83a02e9_Jul22/step2/data/iso/Jul15/WD_SingleMu2
Total Events read: 55737606
Total Files read: 1480
Total Jobs : 520
Luminosity section summary file: /home/mario/Summer13/stpol/crabs/83a02e9_Jul22/step2/data/iso/Ju
   # Jobs: Done:3
   # Jobs: Retrieved:517
```

So somehow, the number of lumis is the same, but the number of events read is different, and thus is the final luminosity! How can that be?

crab -report

lumiCalc2.py -i lumiSummary.json overview

Tallinn analysis code 1 for CMSSW_5_3_X

Access is via github: `https://github.com/HEP-KBFI/stpol`. Instructions are located on github as well.

Analysis macros and other shared material

Our own private macros must be committed in UserCode/STPol. At the moment this directory is empty, but it will be useful to share macros, scripts, etc.

To check out code from our directory: `cvs co UserCode/STPol`; this creates a directory UserCode/STPol inside the directory where you are located.

Plenty of instructions to use cvs are available on the web, but here follow the few essential ones:

To commit a file or a directory:

```
cvs add [yourfile]
cvs commit -m 'brief description' [yourfile]
```

The `cvs add` command is only needed when the file is new on cvs.

If you are already working on an old version of this directory and you know there are updates, type `cvs update`.

See also this how to

(We will want to use "tags" at some point, but let's start with the basics...)

GRID utilities

The users and passwords have been distributed to everyone. The server name is `phys.hep.kbfi.ee`. To get access to Grid and CMSSW tools you should add this to your .bash_profile file to be included at every login:

```
export SCRAM_ARCH=slc5_amd64_gcc434
export LCG_GFAL_INFOSYS=bdii.balticgrid.org:2170

source /opt/software/cms/cmsset_default.sh
export CVSROOT=:ext:mario@cmscvs.cern.ch:/cvs_server/repositories/CMSSW
```

replacing mario with your CERN username in the CVSROOT environment. To use CRAB you first do cmsenv in some CMSSW software area and then you can source it:

```
source /opt/software/CRAB_2_7_8/crab.sh
```

This version of CRAB doesn't have the 500 job limitation if you want to submit without a CRAB server. However over 2500 jobs might be problematic as job ID lists will exceed command line limits etc that are way harder to debug out of CRAB. It's possible, but then we should coordinate as one needs to modify some parts of CRAB temporarily.

For local storage access (there is no CASTOR access from Tallinn) you have /hdfs/ mounted that is the whole storage. You can access anything that's already transferred to Estonia under /hdfs/cms/store/... including your stageout directory that is for example /hdfs/cms/store/user/mario/... The storage is Hadoop meaning that files that are in there can be either written from scratch or read. You cannot open files in read/write mode.

You can also use VNC on phys, but we recommend using a client that enables ssh tunneling as the default VNC protocol sends cleartext passwords. On Mac the best and fastest possible VNC (that actually allows live working on remote machine with close to 0 lag if the network is decent) is Jolly's Fast VNC. It's not free, but it costs only a few USD on Mac App Store and is well worth the money due to the speed increase as well as all the ssh tunneling etc features. For other OS's you'll have to figure it out on your own

GRID with remoteGlidein

Get a proper clean environment, then initialize crab:

```
source /opt/software/CRAB_2_8_3/crab.sh
```

In crab.cfg you must have

```
[CRAB]
scheduler = remoteGlidein
use_server = 0

[GRID]
se_white_list = kbfi
```

GRID with local submission from *.hep.kbfi.ee

You need to use a modified version of CRAB:

```
source /opt/software/CRAB2/crab.sh
```

Also, the following modifications are necessary in crab.cfg

```
[CRAB]
jobtype = cmssw
scheduler = pbsv2withsrm
use_server = 0

[PBSV2WITHSRM]
forceTransferFiles = 1
workernodebase = /home/USERNAME
use_proxy = 1
```

You can check whether the jobs are running using `qstat`.

Datasets

An essential tool for finding out the datasets you need is the DAS webpage or the corresponding command-line instructions. See the FAQs
You can also use DBS queries. Example:

```
dbs --search --query='find file where dataset like /T_TuneZ2_t-channel_7TeV-powheg-tauola/Summer1
```

this lists the names of all the files corresponding to that dataset. Type `dbs --help` to know more. See also these instructions.

Accessing the desired run range in real data requires the use of JSON files. Their use is explained here (and links within). The repository of officially validated JSON files is here.

Checking for local datasets in Tallinn using the DAS CLI

```
das_cli.py --query="dataset site=T2_EE_Estonia" --limit=0 | grep
"/Tbar_TuneZ2_s-channel_7TeV-powheg-tauola"
```

or to find the Summer11+START42 datasets

```
das_cli.py --query="dataset
dataset=/T_TuneZ2_s-channel_7TeV-powheg-tauola/Summer11*START42*AODSIM" --limit=0
```

Checking the sites of a dataset

```
das_cli.py --query="site
dataset=/T_TuneZ2_s-channel_7TeV-powheg-tauola/Summer11-PU_S4_START42_V11-v1/AODSIM"
--limit=0
```

Getting the list of files for a (local) dataset that has been stored on the instance cms_dbs_ph_analysis_02

```
das_cli.py --query="file
dataset=/SingleMu/atiko-SingleTopPol-Summer11-v42_OldScript_data-75dcb0b28b0100c77354e3c05053de97
instance=cms_dbs_ph_analysis_02" --limit=0
```

8 TeV analysis:

- Recommendations for 2012 data analysis (releases, global tags, etc.)
- Recommended samples in the Top group for 8 TeV analysis
- Cross sections at 8 TeV

5_3 datasets:

/T_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/T_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM

/Tbar_t-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/T_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/Tbar_tW-channel-DR_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/T_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/Tbar_s-channel_TuneZ2star_8TeV-powheg-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/TTJets_MassiveBinDECAY_TuneZ2star_8TeV-madgraph-tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/A

/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM

/DYJetsToLL_M-50_TuneZ2Star_8TeV-madgraph-tarball/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/WW_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/WZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/ZZ_TuneZ2star_8TeV_pythia6_tauola/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_20_MuEnrichedPt_15_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODS

/QCD_Pt_20_30_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_30_80_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_80_170_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_170_250_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_250_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/QCD_Pt_350_BCtoE_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v2/AODSIM

/QCD_Pt_20_30_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSI

/QCD_Pt_30_80_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSI

/QCD_Pt_80_170_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODS

/QCD_Pt_170_250_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AOD

/QCD_Pt_250_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AOD

/QCD_Pt_350_EMEnriched_TuneZ2star_8TeV_pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/GJets_HT-200To400_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM
/GJets_HT-400ToInf_8TeV-madgraph/Summer12_DR53X-PU_S10_START53_V7A-v1/AODSIM

/SingleMu/Run2012A-13Jul2012-v1/AOD
/SingleMu/Run2012B-13Jul2012-v1/AOD
/SingleMu/Run2012C-PromptReco-v1/AOD
/SingleMu/Run2012C-PromptReco-v2/AOD

/SingleElectron/Run2012A-recover-06Aug2012-v1/AOD 190782 - 190949

/SingleElectron/Run2012A-13Jul2012-v1/AOD 190456 - 193621
/SingleElectron/Run2012B-13Jul2012-v1/AOD 193834 - 196531
/SingleElectron/Run2012C-24Aug2012-v1/AOD 198022 - 198523
/SingleElectron/Run2012C-PromptReco-v1/AOD 197770 - 198913
/SingleElectron/Run2012C-PromptReco-v2/AOD 198934 - 202998

The 24th Aug rereco is only a subrange of 2012C v1 so probably a recovery of something. The recover-06Aug2012 seems to be the 2012A ECAL corruption recovery (looking at run ranges). So we need to use them all and just make sure the overlaps are removed. The 13 Jul, 6th aug and 24th aug rerecos have their separate JSON's that should be handled accordingly and the prompt recos need to use the golden JSON and remove the rereco sections.

8TeV samples

Some missing Datasets were produced by Dmitri using FastSim. The results are collected in the following table. SInce the RECO filter was applied, the effective number of generated events necessary for correct

normalization is to be determined. The correct CMSSW.dbs_url to use in crab.cfg is

```
CMSSW.dbs_url= https://cmsdbsprod.cern.ch:8443/cms_dbs_ph_analysis_02_writer/servlet/DBSServlet
```

name	dataset
t-channel	/T_t-channel_TuneZ2star_8TeV-powheg-tauola_CAF_EDM/dkonst-T_t-channel_TuneZ2star_8TeV-powhe
WJets1	/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball_EDM_1/dkonst-WJetsToLNu_TuneZ2Star_8TeV-mad
WJets2	/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball_EDM_2/dkonst-WJetsToLNu_TuneZ2Star_8TeV-mad
WJets3	/WJetsToLNu_TuneZ2Star_8TeV-madgraph-tarball_EDM_3/dkonst-WJetsToLNu_TuneZ2Star_8TeV-mad

Systematic samples with 7 to 8 TeV PDF reweighing

Since MC samples for 8 TeV for some systematics were not available, the TopMonteCarloReweighting tool was used to reweight Fall11 7 TeV samples using CMSSW_4_2 and the corresponding SingleTop _42X code.

name	7 TeV dataset
T_t default	/T_TuneZ2_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AODSIM
T_t scaleup	/T_TuneZ2_scaleup_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AODSIM
T_t scaledown	/T_TuneZ2_scaledown_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AODSIM
Tbar_t default	/Tbar_TuneZ2_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AODSIM
Tbar_t scaleup	/Tbar_TuneZ2_scaledown_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AOD
Tbar_t scaledown	/Tbar_TuneZ2_scaledown_t-channel_7TeV-powheg-tauola/Fall11-PU_S6_START42_V14B-v1/AOD
TTJets default	/TTJets_TuneZ2_7TeV-madgraph-tauola/Fall11-PU_S6_START42_V14B-v2/AODSIM
TTJets matchingup	/TTjets_TuneZ2_matchingup_7TeV-madgraph-tauola/Fall11-PU_S6_START42_V14B-v2/AODSIM
TTJets matchingdown	/TTjets_TuneZ2_matchingdown_7TeV-madgraph-tauola/Fall11-PU_S6_START42_V14B-v2/AODSI
TTJets scaleup	/TTjets_TuneZ2_scaleup_7TeV-madgraph-tauola/Fall11-PU_S6_START42_V14B-v1/AODSIM
TTJets scaledown	/TTjets_TuneZ2_scaledown_7TeV-madgraph-tauola/Fall11-PU_S6_START42_V14B-v2/AODSIM

Orso's EDM-ntuples for 8 TeV

Due to their size the latest tuples are on the Naples storage element which can be accessed as follows.

```
voms-proxy-init -voms cms
lcg-ls -b -D srmv2 -T srmv2 "srm://cmsse02.na.infn.it:8446/srm/managerv2?SFN=/dpm/na.infn.it/home
lcg-cp -b -D srmv2 -T srmv2 "srm://cmsse02.na.infn.it:8446/srm/managerv2?SFN=/dpm/na.infn.it/home
```

7 TeV analysis

As written above, at least in a first stage we want to use 7 TeV data and MC to make sure that we are synchronized with the cross section analysis of TOP-11-021.
Therefore, data and MC samples must be the same as listed in slides 5 and 75 of the TOP-11-021 approval talk (in principle also in tables 1 and 2 of AN-2011-229).
This means that CMSSW_4_2_8 must be used, and only the first 1.14/fb in the muon channel and 1.51/fb in the electron channel will be analyzed. This corresponds to the following JSON files:

- Cert_160404-163869_7TeV_May10ReReco_Collisions11_JSON_v3.txt
- Cert_160404-180252_7TeV_PromptReco_Collisions11_JSON.txt
- Cert_170249-172619_7TeV_ReReco5Aug_Collisions11_JSON_v3.txt

The complete dataset names for the MC samples in Table 2 are obtained by adding `/Summer11-PU_S4_START42_V11-v1/AODSIM` (e.g., `/T_TuneZ2_t-channel_7TeV-powheg-tauola/Summer11-PU_S4_START42_V11-v1/AODSIM`) Is this true? 42_V11 no longer exists in Tallinn, instead there is 42_V14B.

The MC datasets from the analysis present in Tallinn (under the conditions of tag=START42 and either Fall11 or Summer11) are

```
/T_TuneZ2_t-channel_7TeV-powheg-tauola
/Tbar_TuneZ2_t-channel_7TeV-powheg-tauola
/T_TuneZ2_s-channel_7TeV-powheg-tauola -> /T_TuneZ2_s-channel_7TeV-powheg-tauola/Fall11-PU_S6_STA
/Tbar_TuneZ2_s-channel_7TeV-powheg-tauola
/T_TuneZ2_tW-channel-DR_7TeV-powheg-tauola
/Tbar_TuneZ2_tW-channel-DR_7TeV-powheg-tauola
/TTJets_TuneZ2_7TeV-madgraph-tauola
/WJetsToLNu_TuneZ2_7TeV-madgraph-tauola
/DYJetsToLL_TuneZ2_M-50_7TeV-madgraph-tauola
/QCD_Pt-20_MuEnrichedPt-15_TuneZ2_7TeV-pythia6
/QCD_Pt-80to170_EMEnriched_TuneZ2_7TeV-pythia7
```

And the ones missing are:

```
/WW_TuneZ2_7TeV_pythia6_tauola
/WZ_TuneZ2_7TeV_pythia6_tauola
/ZZ_TuneZ2_7TeV_pythia6_tauola
/QCD_Pt-20to30_BCtoE_TuneZ2_7TeV-pythia7
/QCD_Pt-30to80_BCtoE_TuneZ2_7TeV-pythia6
/QCD_Pt-80to170_BCtoE_TuneZ2_7TeV-pythia6
/QCD_Pt-20to30_EMEnriched_TuneZ3_7TeV-pythia6
/QCD_Pt-30to80_EMEnriched_TuneZ2_7TeV-pythia6
/GJets_TuneD6T_HT-40To100_7TeV-madgraph
/GJets_TuneD6T_HT-100To200_7TeV-madgraph
/GJets_TuneD7T_HT-200_7TeV-madgraph
```

All the MC datasets processed with

```
SingleTopMC_PF2PAT_cfg.py
```

are available here and data here.

FCNC samples:

- t,j -> b,l,nu,j with tug coupling.(MCDB 3655)

```
/TJetToBLNuJet_FCNC_tug_TuneZ2_7TeV-comphep-EDM/dkonst-TJetToBLNuJet_FCNC_tug_TuneZ2_7TeV-comphep
dbs_url= https://cmsdbsprod.cern.ch:8443/cms_dbs_ph_analysis_02_writer/servlet/DBSServlet
```

- t,j -> b,l,nu,j with tcg coupling.(MCDB 3655) 1 job is still running.
- t,j -> b,l,nu,j with tug and tcg (MCDB 3654) are still running

FCNC datasets after step one are here

Unfolding

Documentation about the KIT-style unfolding, as used in the ttbar A_C analysis (courtesy by Jeannine and collaborators):

- Thomas Peiffer (PhD thesis, 2011)

- Frank Roscher (diploma thesis, 2012)
- Christian Boeser (diploma thesis, 2011)
- AN for inclusive measurement (1D unfolding)
- AN for differential measurement (2D unfolding)

TSVDUnfolding:

- SVD Approach to Data Unfolding

RooUnfold:

- Unfolding algorithms and tests using RooUnfold

Statistics Committee interim note on unfolding:

- Interim Recommendations on Unfolding, Cousins

MET-phi modulation studies

Private productions with Fast Simulation

Eventually, we will request official samples of non-SM signals from interesting models to be produced with Full Simulation. But before requesting an official production we need to validate the generation parameters, and anyway they will take time before being ready.
Ad interim, then, we should use FastSim for private productions.

In this section we will list and describe several configuration files (to be stored somewhere in our UserCode /STPol directory).

It is useful to use the cmsDriver script to create standard configuration files.
To be coherent with 4_2_X samples from the "Summer11" production, the following string must be used (in 4_2_8):

```
cmsDriver.py GEN-fragment --step GEN,FASTSIM,HLT:GRun --beamspot Realistic7TeV2011Collision --con
```

Documentation

```
The URL of the svn web browser for our documents is
https://svnweb.cern.ch/cern/wsvn/tdr2/?. Your AN is under notes.

Instructions for retrieving the template version and building it are now
available on the wiki at
https://twiki.cern.ch/twiki/bin/view/CMS/Internal/TdrProcessing There are
additional hints in the template document itself, which is available
formatted as
https://svnweb.cern.ch/cern/wsvn/tdr2/papers/XXX-08-000/trunk/XXX-08-000_temp.pdf
Please note the use of our standard definitions for particle names
and commonly used HEP terms as shown in the appendices. BibTeX hints are in
both the tex and bib files. A more thorough treatment of many CMS document
production tasks may be found at
https://svnweb.cern.ch/cern/wsvn/tdr2/utils/branches/dev/general/notes_for_authors.pdf
 (for the development version). The general CMS style guide is
currently located at
https://twiki.cern.ch/twiki/bin/view/CMS/Internal/PubGuidelines, and the
publications wiki page is
https://twiki.cern.ch/twiki/bin/viewauth/CMS/Internal/Publications
```

Analysis Note 2012/448

```
> svn co -N svn+ssh://svn.cern.ch/reps/tdr2 myDir # where myDir is a placeholder for a name of yo
> cd myDir
> svn update utils
> svn update -N notes
> svn update notes/AN-12-448
> eval `./notes/tdr runtime -csh` # for tcsh. use -sh for bash.
> cd notes/AN-12-448/trunk
# (edit the template, then to build the document)
> tdr --style=an b AN-12-448

You can commit your changes with
> svn commit -m "commit message"
New files will first need to be added with
> svn add NewFileNames
before they can be committed.
```

Note: I committed a script MAKENOTE for compiling without having to remember the exact command line.

PAS TOP-13-001

```
> svn co -N svn+ssh://svn.cern.ch/reps/tdr2 myDir # where myDir is a placeholder for a name of yo
> cd myDir
> svn update utils
> svn update -N notes
> svn update notes/TOP-13-001
> eval `./notes/tdr runtime -csh` # for tcsh. use -sh for bash.
> cd notes/TOP-13-001/trunk
# (edit the template, then to build the document)
> tdr --style=pas b TOP-13-001

You can commit your changes with
> svn commit -m "commit message"
New files will first need to be added with
> svn add NewFileNames
before they can be committed.
```

Note: I committed a script MAKEPAS for compiling without having to remember the exact command line.

I also committed a couple of shell scripts (.sh) to compare some files that are supposed to be the same in AN and PAS, and to copy from AN to PAS.

Wiki of answers to reviewers

PasTop13001QA

PaperTop13001QA

To-do-list towards the final paper

- Why so much QCD in muon channel? [Joosep]
- Check if more statistics can be produced for the MC-limited systematic samples, especially for Wjets and Zjets
- Move from TCHP to CSV at step 2 [Joosep]
- BDT anti-QCD [Morten]
    - ♦ QCD estimation based on fit to its output [Andres]
- Specialized anti-Wjets and anti-ttbar BDTs [Mario?, Morten?]

    - 2D fit in the plane of their two outputs [Steffen]
    - or, in alternative, train super-BDT using as input the outputs of the specialized BDTs (including the anti-QCD one?)
- Find a solid way to choose the optimal cut (not necessarily a rectangular cut, in case of the 2D plane)
- "Real" linearity check with anomalous comphep samples
- Find optimal binning size [Steffen]
- Combine muon+electron channels without using BLUE, i.e. immediately after unfolding [Steffen,Thorsten]
- Verify that TopFit is well behaving, and resurrect anomalous limits [Matthias]
- Resurrect cut-based cross-check analysis (based on C instead of eta_j'?) [Andres, Steffen]
- Separate measurements for top and antitop (in addition, not as replacement to the global result.)

From the ARC, Sep.26:

```
 ---> the difference of event selection between the electron and muon channels are inducing s

 --->  There is some lack of statistics in some systematic samples => These statistical fluct

---> while a conservative approach was followed by the authors, we would like to see some mor

---> Concerning TopFit, the correlations of measurements in the limit calculation are neglect

---> We would also suggest to investigate the reliability of jet-ID up to |eta|

---> The usage of a the CSV tagger should help to remove more backgrounds with a possible inc

---> We understood that the BDT selection would benefit from a re-optimization.

---> As discussed (and proposed) by the authors, the QCD background normalization in the seco

---> In the combination of the top polarization, it might help to investigate better the corr

---> Some synchronization with the W helicity in single-top could be investigated.
```

From Jeremy, Sep.27:

```
That would be great if you
could at least redo the nice analysis from Nadjieh. In particular,
instead of inverting the isolation cut on electron isolation >0.1, one
could try to investigate how the mTW bias is behaving by bins of
isolation, like   0.1 < iso < X. There might be some intervals with smaller
bias.

Also, the fact that Nadjieh is looking at the 2jets0tag category make
the sample enriched in jet reconstructed as electrons, while there could
be a significant effect of btagging for the fraction of non-prompt
electron from heavy hadron decays. The bias can be smaller in the signal
region.

One could also investigate a combination of a loose MET cut and a
tighter mWT cut, which would have to be optimized.
```

From Jeannine, August 8, 2014

```
1) I've only noticed several issues/problems with the QCD modeling:
a) Looking at Figure 27 it makes no sense to have one QCD template and one template for non-QCD p
b) Looking at Figure 28, inparticular at BDT_antiQCD in the region above the cut value, the conta
c) Concerning table 7-10, the number that really matters, is the number of QCD events (plus uncer
d) How can we trust the cosTheta* shape of QCD at all? Does it probably peak at -1? How can we ex
Just thinking loud, would it help to use QCD MC (isolated, anti-iso sel) in the 2j0t region with
```

```
The W+jets modeling was already carefuly attacked in the PAS and the new studies will certainly a

2) One comment on the BDT trainings, figure 5 and 11, for both BDTs it seems that there is overtr

3) Looking at Figure 9 it seems that the BDT_W,tt output has a small peak in the signal region. T
```

On fig. 9, only ttbar and W+jets are included in the background. The templates for all subcomponents will be plotted. In general, this "second peak" has been discussed some time ago , the reason seems to be that for some events, the BDT is unable to deduce them from signal and the gradient boosting does not reweight those trees down by a large enough factor. The style (hatching) of Fig. 9 will also be changed.

```
4) Figure 24 and 25 (BDT,W,tt in the 2j0t and the 3j2t regions) look ok, as the observed deviatio

5) Fitting:
a) The W+jets template is a bit spiky. What subset causes the spikes? Can we safely ignore this p
b) the single top scale factor for mu is 1.22. How does this compare to the published single top
```

Joosep will plot the subcomponent templates, however, it s just mostly an issue of nominal MC becoming depleted also in W+2,3, for which we have no excellent approach.

```
6) Correlation of BDT_W,tt and cosTheta*:
Looking at figure 48 and 49 it is clear that a cut on BDT_W,tt results in ttbar and W+jets shapes
```

Joosep will add additional plots with cut points.

```
7) Comphep study and neyman construction:
It seems that the difference between Powheg and Comphep SM is for some distributions larger than
```

Talks in CMS meetings

- Update talk on 23.01.2014 (Andres)
- Single Top Workshop in Naples, 20.12.2013 (Joosep)
- Approval talk on 10.09.2013 (Joosep)
- Pre-approval talk on 06.08.2013 (Matthias)
- Update talk on 25.07.2013 (Joosep)
- Update talk on 18.07.2013 (Andres)
- Update talk on 06.06.2013 (Matthias)
- Update talk on 02.05.2013 (Liis)
- Update talk on 21.03.2013 (Steffen)
- FastSim/FullSim comparisons and W+jets statistics (Andrea)
- Update talk on 11.01.2013 (Andres)
- Update talk on 09.11.2012 (Joosep)
- Plans Louvain+Estonia, 05.10.2012 (Andrea)
- Round table on single top anomalous couplings, 04.05.2012 (Andrea)

-- AndreaGiammanco - 16-Mar-2012

This topic: Main > SingleTopPolarization
Topic revision: r108 - 2015-01-19 - MatthiasKomm

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