Commissioning analysis at 10TeV

B. Acharya, M.Cobal, M. Pinamonti, Kerim Suruliz

INFN Gruppo Collegato di Udine & ICTP, Trieste

May 13, 2009

Essential aim: redo the counting analysis for $t\bar{t}$ cross-section measurement at 10TeV.

This involves reevaluating expected numbers of events for signal and all the backgrounds; redoing plots (such as top/W peak), and computing the systematics.

Assuming 200pb^{-1} of data in the study.

Status

Presented preliminary results two weeks ago. At that time, was missing some backgrounds and PDF uncertainty.

Yesterday had long discussions about object definitions and triggers.

Major changes with respect to previous selections (and wrt CSC): muon/jet overlap, trigger choice (so far have been using e22i_tight), $|\eta| < 2.47$ for electrons.

Once the dust settles, produce a final set of results. PDF errors done by Duc Bao Ta (Bonn).

Compare with other groups to make sure all numbers are OK.

Triggers

Need to select a trigger to be used for the note. So far no serious study of this!

If we have 200pb^{-1}, the initial luminosity will be 10^{32}cm^{-2}s^{-1}. If much less than that, the luminosity is 10^{31}.

Options: early data 10^{31} menu has e10_medium (13Hz rate) and e20_loose (4Hz).

e10_medium may have to be prescaled if rate is off by a factor of 2 or so.

e20_loose is an option, or an intermediate trigger such as e15_medium (not yet in the menu but have low rate).

At 10^{32}, e20_med (11 Hz), e25_med (4.5 Hz), e15i_med (11 Hz), e17i_med (6.5 Hz), e20i_med (9 Hz).

e15_medium, e15i_medium are in the MC AODs.

$S, B, S/B$ after Selection A for different choices of trigger. The background includes W+jets, single top, Z+jets, hadronic ttbar, diboson, $Wb\bar{b}$.

trigger	e22i_tight	e10_medium	e20_loose
S	2432 (2434)	2633 (2540)	2674 (2593)
B	1650	1796	1848
S/B	1.47	1.47	1.45

Electron channel. All numbers normalised to 200pb^{-1}.
The numbers in brackets for signal are obtained by applying a $P_T > 22\text{GeV}$ cut on the electron, rather than $P_T > 20\text{GeV}$.

QCD background

We wish to investigate the behaviour of the QCD background depending on trigger choice and lepton P_T cut.
Consider pythia dijet samples 105011-105015. Cross-sections are:

Sample	x-sec (pb)
5011 (J2)	$5.6 \cdot 10^7$
5012 (J3)	$3.3 \cdot 10^8$
5013 (J4)	151610
5014 (J5)	5178
5015 (J6)	112

Compare numbers of fakes for different triggers (electron channel).

Sample	e22i_tight	e10_medium	e20_loose
J2	0	0	0
J3	0	0	0
J4	156 ± 110	467 ± 190	467 ± 190
J5	21 ± 8	46 ± 11	45 ± 11
J6	0.9 ± 0.2	1 ± 0.3	1 ± 0.2
QCD tot	178 ± 110	514 ± 191	514 ± 191

HEC off problem is responsible for so many events passing the selection cuts - jets hitting the missing sector are creating fake $\not{E}_T$ (Tommaso).

Cutflows for QCD

Cut flow for J5 (sample 5014): (numbers not normalised!)

trigger	tot	EF	lep	Etmiss	Jet 1	Jet 2
e22i_tight	385817	310	25	13	9	8
e10_medium	385817	11055	62	36	22	17
e20_loose	385817	2565	61	36	23	17

QCD: numbers

	12GeV	14GeV	16GeV	18GeV	20GeV
J3	0	0	0	0	0
J4	1712 ± 365	1012 ± 281	778 ± 246	701 ± 234	467 ± 190
J5	161 ± 21	112 ± 17	72 ± 14	59 ± 13	46 ± 11
J6	4	3	2	2	1

Numbers of events normalised to 200pb^{-1} after selection A with
e10_medium trigger and various cuts on electron P_T. 1 event
passes from the J2 sample, not shown in table.

trigger	e22i_tight	e15_medium	e15i_medium
S	2432	2592	2503
B	1650	1772	1692
S/B	1.47	1.46	1.48
QCD	178 ± 110	433 ± 174	189 ± 110

Conclusions

CSC-type counting analysis at 10TeV almost finished, up to final adjustments of object selections.

A trigger study in progress - producing trigger efficiency curves to make sure the right threshold/electron P_T cuts are selected.

As for muon triggers, essentially have two options: mu20, used in CSC note, and mu15. Intend to perform a quick comparison study for these as well.