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Update of SECVTX Tagging for the Top SVX Analysis

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Abstract

We update the SECVTX tagging results using the entire run 1B W + jets data. Previous results can be found in Ref. [1]. In the W + $\geq$3 jets sample we observe 37 tags in 30 events. The background is estimated to be 6.49$\pm$1.32. Kinematic distributions of the tags are consistent with expectations derived from Monte Carlo simulations. Summing the results from 1A and 1B we find 42 tags in 34 events with an estimated background of 7.96$\pm$1.69. We also report on the effect for using different alignment parameter sets in SVX$'$ retracking. Systematic checks of tag rates in the inclusive electron sample and recent studies of the scale factor and background for top SVX analysis are summarized.

1 Introduction

We report on the results of SECVTX tagging in the entire run 1B W + jets data. The sample contains an integrated luminosity of 90.1 pb^{-1} [2]. We observe 37 tags in 30 events in the W + 3 or more jets top signal sample with an estimated background 6.49$\pm$1.32 after correction for the top contribution. Combining both 1A and 1B yields 42 tags in 34 events with background of 7.96$\pm$1.69. Results of SECVTX tagging is summarized in section 2.

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The alignment parameter set used to retrack the SVX′ in run 1B data is in SVX$ALIGN: SVXP_INTERNAL3.ALIGN. This differs from the previous one, SVXP_LATEST.ALIGN, used to obtain the PRL [3] and summer conference [1] results. We find negligible effect on tagging performance using low E_T inclusive electron sample. The study is described in section 3.

Section 4 summarizes the update of tag rates in the inclusive electron sample. We study the instantaneous luminosity, run number and E_T dependence of electron jet tag rates using entire 1B data.

Measurement of b-tagging efficiency in top SVX analysis is studied using tracking efficiency degradation in the Monte Carlo simulations described in Ref. [4] and [5]. Background study for run 1B is also described in Ref. [6]. We copy the summaries into Section 5.

Comparison of kinematic distributions between tags in data and in Monte Carlo simulations is described in section 6. We conclude in section 7.

	1 jet	2 jets	3 jets	≥4 jets
N_{event}	9003	1382	212	61
N_{ele} events	5175	747	114	24
N_{muo} events	3828	635	98	37
N_{mistag} jets	15	8	2	0
N_{tag} jets	64	43	22	15
N_{tag} events	64	38	16	14

Table 1: Results of SECVTX tagging using entire run 1B W + jets data sample.

2 SECVTX tagging in the W + Jets Samples

W + jets sample selection is described in Ref [7]. The results of SECVTX tagging in the entire run 1B W + jets sample are summarized in table 1. Results from run 1A+1B are also shown in table 2 where the 1A numbers are taken from previous PRL result.

	1 jet	2 jets	3 jets	≥4 jets
N_{event}	10716	1663	254	70
N_{ele} events	6233	938	144	31
N_{muo} events	4483	725	110	39
N_{tag} jets	71	51	24	18
N_{tag} events	71	45	18	16

Table 2: Results of SECVTX tagging using entire run 1A+1B W + jets data sample.

3 Alignments of SVX′

The precision of the SVX′ alignment is critical to the lepton + jets analysis. The alignment parameter set in the file SVX$ALIGN: SVXP_LATEST.ALIGN was used in the run 1B data retracking before. Another set of alignments [8] in the file SVXP_INTERNAL3.ALIGN determined using data from both before and after the quad roll now is used to retrack the SVX′ for entire run 1B data in the top analysis.

Effects on the tagging performance induced by using different alignment parameter sets is studied using low E_T inclusive electron data. Beginning with 488K ECLB_5P stream events, we select electron jets with E_T greater 10 Gev and awayjets present in the events. After the W, Z and conversion electrons removed, number of taggable jets [2] found are 57,581 and 57,572 respectively. Difference in the taggable fraction of electron jets resulting from the use of two different alignment parameter sets is negligible.

To compare the tagging performance, we define

$$\Delta\ Rate(j) = N(j)/N(svxp\_latest) - 1$$

and

$$Overlap(j) = N(j.and.svxp\_latest)/N(j)$$

where $N(j)$ is number of tags observed using alignment file j. By definition, $\Delta\ Rate(svxp\_latest) = 0.0$ and $Overlap(svxp\_latest) = 100\%$

[2] jets with at least 2 pass 0 tracks

Table 3 shows the comparisons of tagging results using two different alignment files. We find number of tags are about equal and overlap in the positive tags is close to 100%. Less overlap seen in the negative tags is consistent with expectations that most negative tags are fakes and more randomly distributed.

Alignment file	+/- tagged	tags	Δ *Rate*	*Overlap*
svxp_latest	+	6096	0.0%	100%
svxp_internal3	+	6070	-0.4%	96%
svxp_latest	-	319	0.0%	100%
svxp_internal3	-	318	-0.3%	87%

Table 3: Comparisons of using two different alignment files.

4 Systematic Checks of Tag Rates in Inclusive Electron Sample

We update the systematic checks of tag rates using entire run 1B inclusive electron data. Event selection is the same as described in Ref. [9]. The luminosity environment of the sample shown in fig. 1 is similar to the W + jets sample.

SECVTX tagging performance in the inclusive electron sample is summarized in table 4. The tag rates are consistent with results from previous study described in Ref. [9] table 2. Figure 2 and 3 show the electron jet tag rates as a function of the run number, integrated luminosity, instantaneous luminosity and the electron jet E_T. Results are consistent with those shown in Ref [1].

	E_T cut	taggable jets	tags	tag rate	mistags
single electron	10 Gev	118707	16767	13.5%	765
single electron	15 Gev	90849	14082	14.8%	626
single away jet	15 Gev	66935	4054	6.1%	238
double electron	10 Gev	4054	1209	29.8%	25
double electron	15 Gev	3225	1063	33.0%	22

Table 4: SECVTX tagging rates in run1B inclusive electron data.

5 Tagging Efficiency and Background Summary in W + Jets Sample

The efficiency of SVX b-tagging used in the search for $t\bar{t}$ events was determined using top Monte Carlo and degraded by a scale factor, the ratio of tagging efficiency between numbers derived from low E_T inclusive lepton data and $b\bar{b}$ Monte Carlo simulations. In the previous scale factor calculation [10], electron jets sample in the low E_T inclusive electron data was used. The disadvantages of this technique are: (1) limitation by the low statistics of higher E_T jets in the inclusive lepton samples; (2) the different kinematics between semileptonic b decay and the totally inclusive b decay for $t\bar{t}$ events. An improved method that applies results from studies of the combined CTC+SVX tracking efficiency [4] is now used to measure the top b-tagging efficiency. Our best estimate for the scale factor right now is 0.87 ± 0.06 (Data/QFL') [5]. The event b-tagging efficiency is estimated to be 0.41 ± 0.04 [11] in the top events which decays to W $+ \geq 3$ jets.

Summary of background studies for the top SVX analysis can be find in Ref [6]. The overall background after SVX tagging for run 1b is shown in table 5.

6 Kinematic Distributions

We made comparisons between the data and a Herwig top175 + background Monte Carlo simulation for tagged jets in the W $+ \geq 3$ jets sample. The

Njet	1	2	3	4
Total 1b Bkg(evts)	58.0±11.4	23.0±3.9	5.31±0.96	2.37±0.48

Table 5: Overall background after SVX tagging for run 1b only.(cdfnote 3513 table 10.)

background shape includes relative contributions from $Wb\bar{b}$, $Wc\bar{c}$, Wc and diboson sources. The total background has been corrected for the contribution from top. Figures 4 and 5 compare the $c\tau$ and E_T distributions of the tagged jets. Figure 6 compares the number of tracks used in the vertex. Figures 7 and 8 compare the transverse mass and the H_T distribution of the tagged events. In all cases the distributions are consistent.

7 Conclusions

References

[1] The B-Tag working Group,
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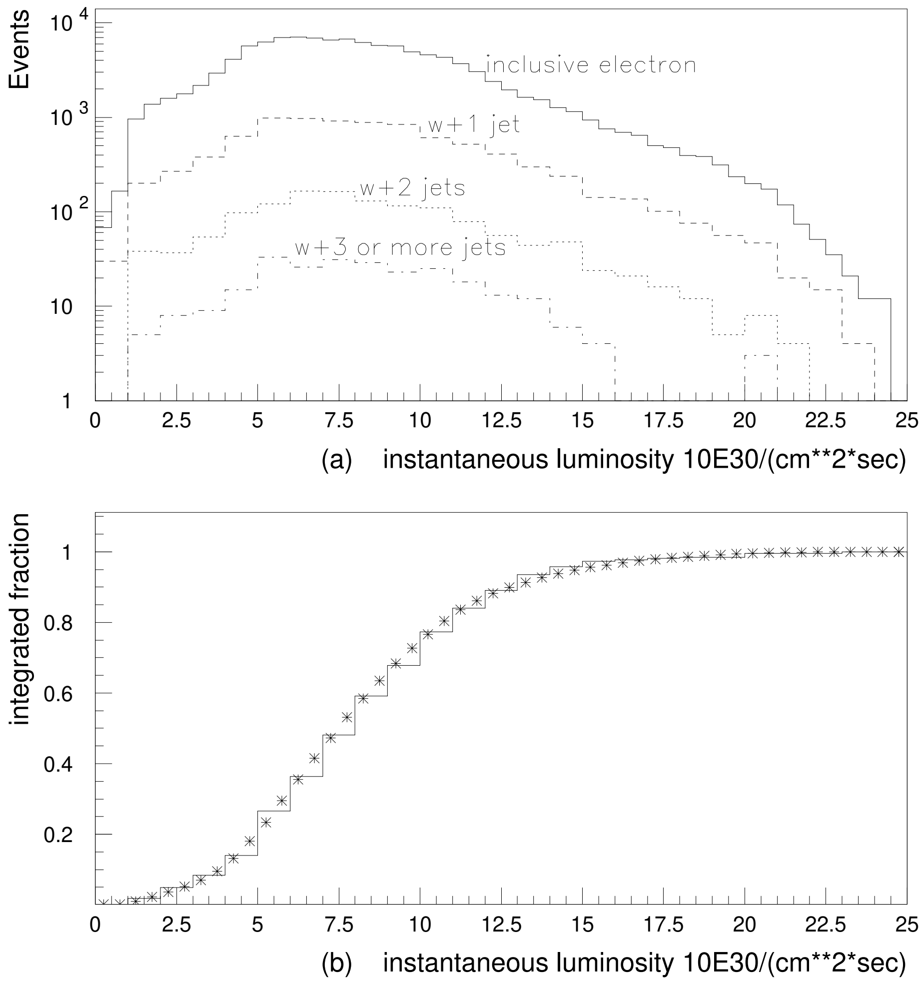

Figure 1: (a) Instantaneous-luminosity distributions for low P_T inclusive electron data and w + n jets samples. (b) Integrated fractions for electron data and w + 3 or more jets sample.

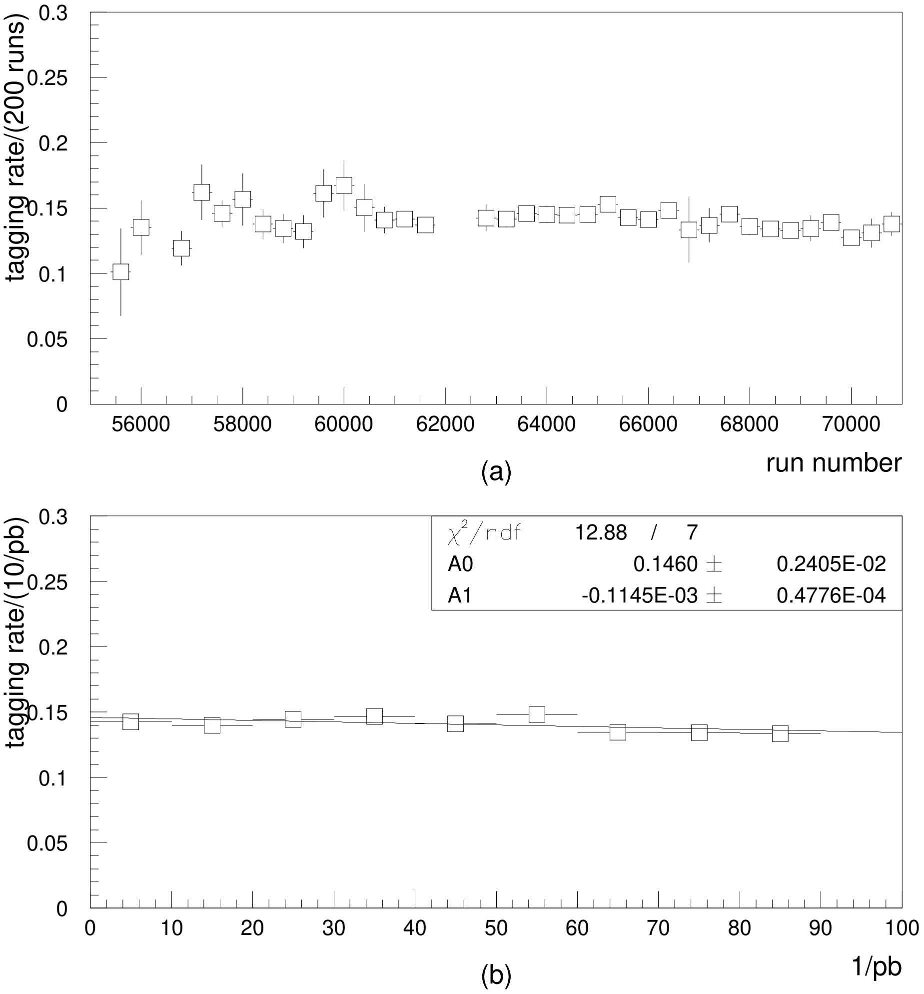

Figure 2: The electron jet tag rates as a function of (a) run number and (b) integrated luminosity.

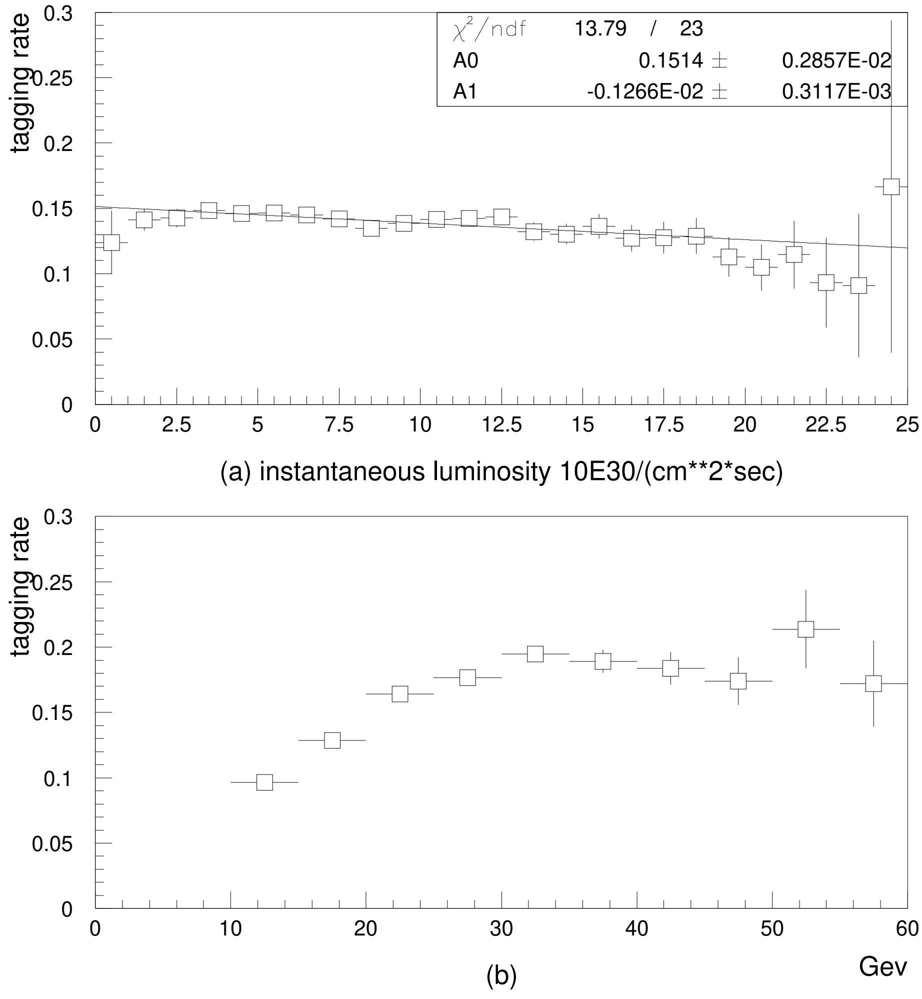

Figure 3: The electron jet tag rates as a function of (a) instantaneous luminosity and (b) electron jet E_T.

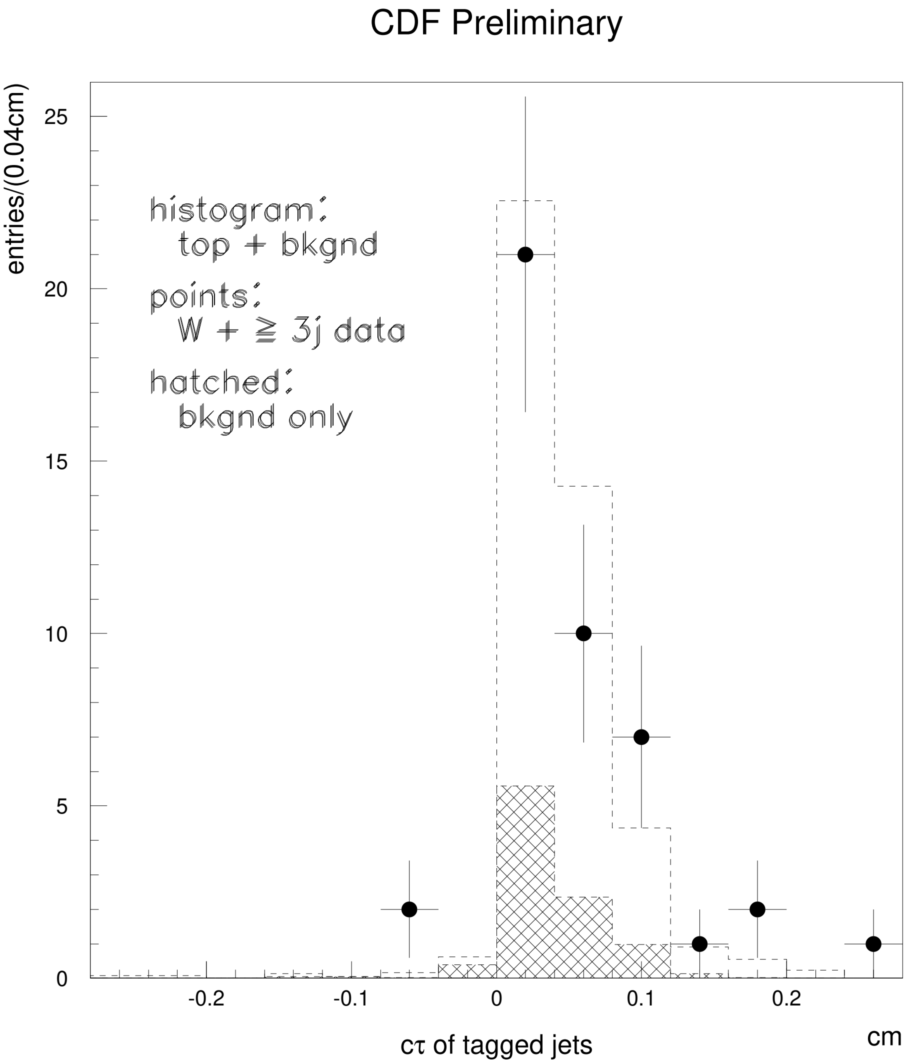

Figure 4: The dash histogram is the $c\tau$ of the tagged jets in the top signal region for a Herwig + QFL top175 + background Monte Carlo. The points are the data. The two distributions are normalized to the same number of events. The hatched histogram is the background shape normalized to its relative contribution.

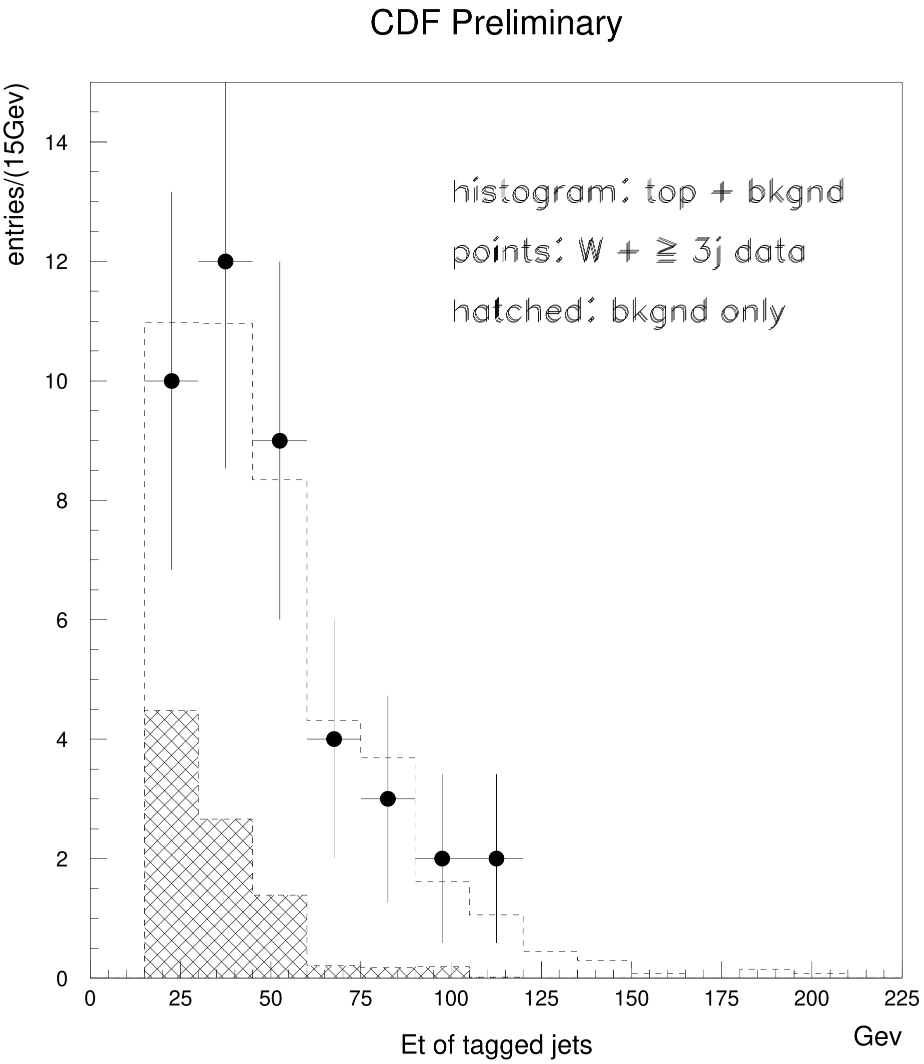

Figure 5: The dash histogram is the E_T of the tagged jets in the top signal region for a Herwig + QFL top175 + background Monte Carlo. The points are the data. The two distributions are normalized to the same number of events. The hatched histogram is the background shape normalized to its relative contribution.

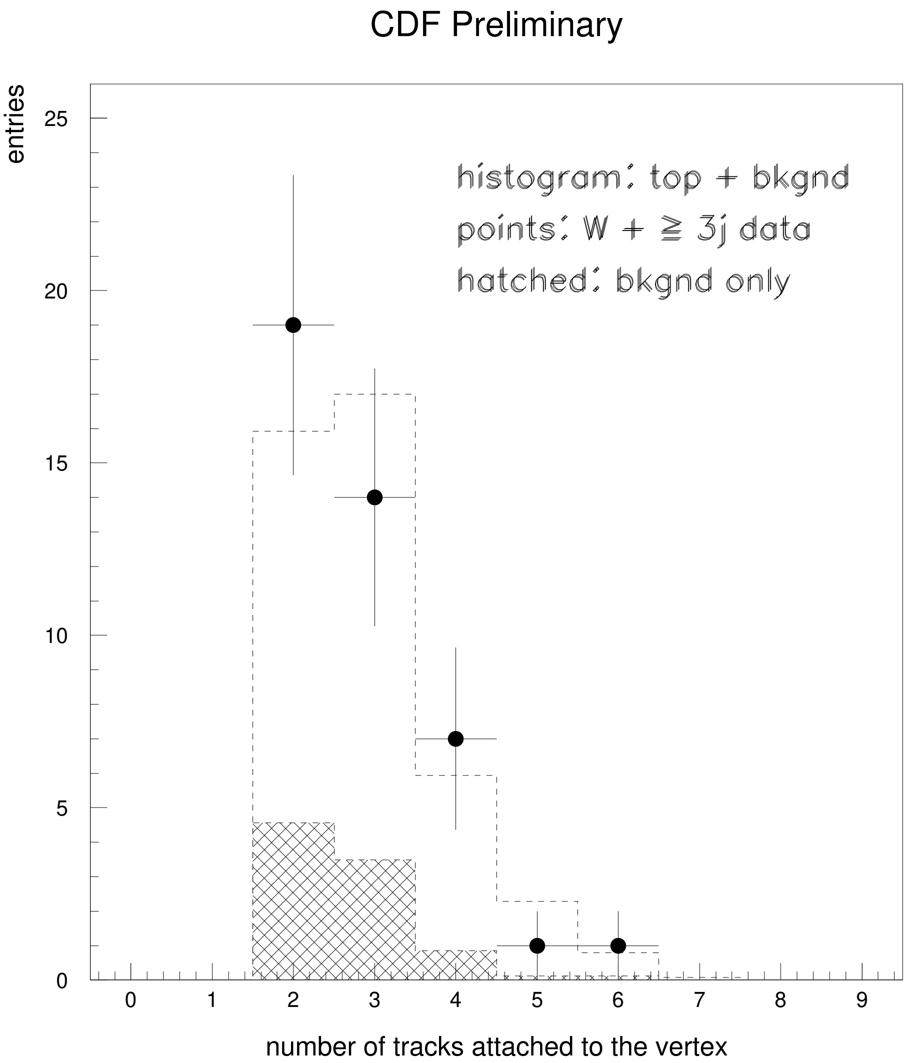

Figure 6: The dash histogram is the number of tracks attached to the vertex for the tagged jets in the top signal region for a Herwig + QFL top175 + background Monte Carlo. The points are the data. The two distributions are normalized to the same number of events. The hatched histogram is the background shape normalized to its relative contribution.

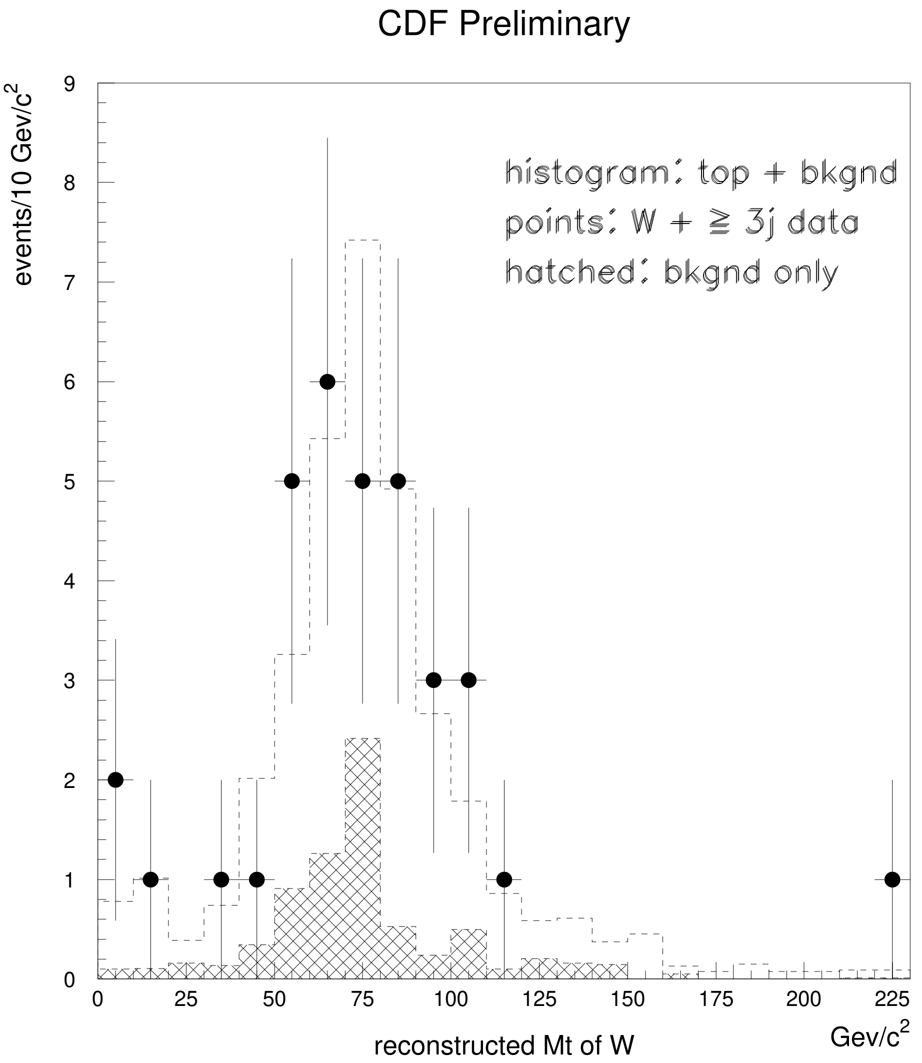

Figure 7: The dash histogram is the transverse mass distribution of the lepton and neutrino (whose momentum is estimated using the missing E_T vector) for a Herwig + QFL top175 + background Monte Carlo. The points are the data. The two distributions are normalized to the same number of events. The hatched histogram is the background shape normalized to its relative contribution.

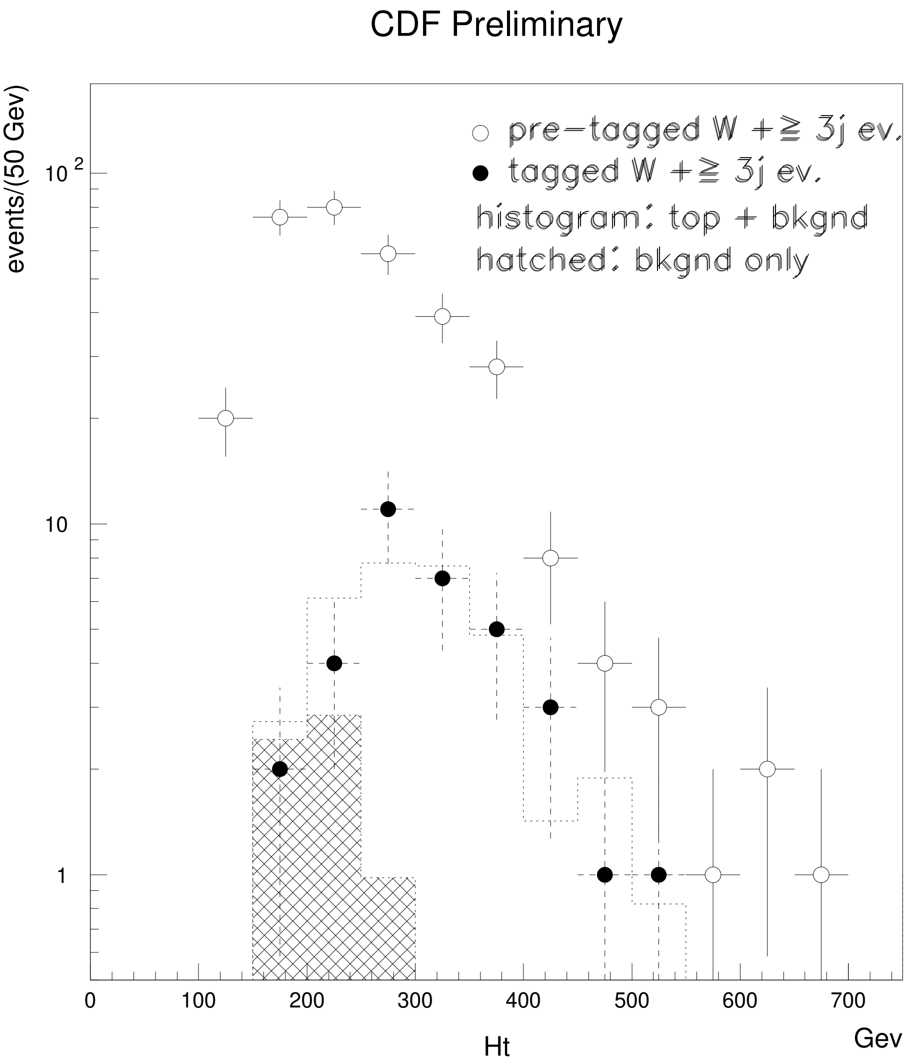

Figure 8: The dash histogram is the H_T distribution for a Herwig + QFL top175 + background Monte Carlo. The points are the data. The two distributions are normalized to the same number of events. The hatched histogram is the background shape normalized to its relative contribution.