measured the rate of top quark production and identified a subset of their candidate lepton+jet events where it is possible to directly measure the mass of the top quark.

These measurements allow us to test the standard model prediction for the cross section as a function of the top quark mass. The initial evidence for top quark production published by CDF [9] implied a top quark production cross section almost two standard deviations above the theoretically predicted value. Moreover, other standard model measurements, and in particular those performed at LEP, constrain the top quark mass. It is important to directly verify that these predictions agree with the top quark mass inferred from the Collider data.

8.1 The $t\bar{t}$ Cross Section

The acceptance of the DØ and CDF top quark searches depend on the top quark mass. We can therefore infer the $t\bar{t}$ production cross section as a function of the top quark mass given the number of observed events in each channel.

If we observe N_i^o candidate events in a particular channel i, with an acceptance ϵ_i, with N_i^b expected background events in a data sample with integrated luminosity $\mathcal{L}$, then the maximum likelihood solution for the cross section of the process is

$$\sigma = \frac{\sum_i \left(N_i^o - N_i^b\right)}{\mathcal{L}\left(\sum_i \epsilon_i\right)}. \tag{15}$$

This assumes that the observed number of events has a Poisson distribution and that uncertainties on the acceptance can be ignored. The latter restriction can be relaxed by numerically solving for the maximum likelihood solution allowing for uncertainties in ϵ_i and N_i^b, and any correlations in the acceptances.

The CDF collaboration has performed a preliminary measurement of the $t\bar{t}$ cross section using the SVX tagged sample. This is the single most significant measurement and can be performed only knowing the SVX tagging efficiency and background rates. The addition of the SLT sample and the dileptons into the cross section measurement requires a knowledge of the efficiency correlations in the samples and is work in progress. The $t\bar{t}$ acceptance was determined using the ISAJET Monte Carlo programme, and found to be 0.034 ± 0.009. The uncertainties associated with this acceptance calculation are listed in Table 7. The expected background in the 21 tagged events is $N^b = 5.5 \pm 1.8$ events[4]

The resulting cross section determined from the SVX sample is $6.8^{+3.6}_{-2.4}$ pb for a nominal top quark mass of 175 GeV/c^2. This is approximately one standard deviation lower than the cross section determined in the Run 1A CDF data. It is in good agreement with the theoretically predicted value of 4.9 ± 0.6 pb for the same top quark mass.

The DØ collaboration estimates the $t\bar{t}$ cross section using the information from all the channels. They also perform a background subtraction and then correct for the

[4]The previous estimate of the expected SVX background tags assumed that there was no contribution from $t\bar{t}$ production to the 203 events in the $W+\geq 3$ jet sample prior to tagging.