Search for Events with Isolated Leptons and Missing Transverse Momentum: Update

H1 Collaboration

This document presents an update of the previous preliminary results in the search for events with isolated leptons and missing transverse momentum in $e^{\pm}p$ collisions with the H1 detector at HERA in the period 1994–2004 [1]. The analysed data sample corresponds to an integrated luminosity of 192 pb^{-1}, which includes 53 pb^{-1} of $e^{+}p$ data and 21 pb^{-1} of $e^{-}p$ data recently taken in the new HERA II phase.

Nine events in the electron channel and one event in the muon channel are observed in the 2003-04 HERA II $e^{+}p$ data sample, compared to Standard Model (SM) predictions of 4.8 $\pm$ 0.8 and 1.3 $\pm$ 0.2 repectively. Five events in the electron channel and no events in the muon channel are observed in the new 2004-05 HERA II $e^{-}p$ data sample compared to SM expectations of 2.2 $\pm$ 0.3 and 0.6 $\pm$ 0.1 respectively.

In the combined electron and muon channel of the complete HERA data set 34 events are observed, compared to a SM prediction of 23.3 $\pm$ 3.2. Events with large transverse momentum are observed in both the HERA I and II samples. Further details of the analysis may be found in [2].

H1 Preliminary, HERA II e$^+$p data $\mathcal{L} = 53$ pb^{-1}

Electron	H1 Data	SM Expectation	SM Signal
Total	9	4.75 $\pm$ 0.76	3.11 $\pm$ 0.47
P_T^X >25 GeV	5	0.84 $\pm$ 0.19	0.58 $\pm$ 0.09

Muon	H1 Data	SM Expectation	SM Signal
Total	1	1.33 $\pm$ 0.19	1.03 $\pm$ 0.16
P_T^X >25 GeV	0	0.85 $\pm$ 0.13	0.63 $\pm$ 0.10

Combined	H1 Data	SM Expectation	SM Signal
Total	10	6.08 $\pm$ 0.92	4.14 $\pm$ 0.62
P_T^X >25 GeV	5	1.69 $\pm$ 0.28	1.21 $\pm$ 0.18

Table 1: The results of the search for events with isolated electrons or muons and missing transverse momentum in the HERA II e^+p data ($\mathcal{L}$=53 pb^{-1}): observed and predicted numbers of events in the electron channel, the muon channel and the sum of electron and muon channels. The signal component of the SM expectation, dominated by real W production, is also given. The quoted errors contain statistical and systematic uncertainties added in quadrature.

H1 Preliminary, HERA II e$^-$p data $\mathcal{L} = 21$ pb^{-1}

Electron	H1 Data	SM Expectation	SM Signal	SM Background
Total	5	2.15 $\pm$ 0.33	1.36 $\pm$ 0.22	0.79 $\pm$ 0.25
P_T^X >25 GeV	1	0.30 $\pm$ 0.05	0.23 $\pm$ 0.04	0.07 $\pm$ 0.03

Muon	H1 Data	SM Expectation	SM Signal	SM Background
Total	0	0.59 $\pm$ 0.09	0.45 $\pm$ 0.07	0.14 $\pm$ 0.05
P_T^X >25 GeV	0	0.36 $\pm$ 0.06	0.26 $\pm$ 0.04	0.10 $\pm$ 0.04

Combined	H1 Data	SM Expectation	SM Signal	SM Background
Total	5	2.75 $\pm$ 0.40	1.81 $\pm$ 0.27	0.94 $\pm$ 0.30
P_T^X >25 GeV	1	0.66 $\pm$ 0.10	0.50 $\pm$ 0.08	0.17 $\pm$ 0.06

Table 2: The results of the search for events with isolated electrons or muons and missing transverse momentum in the HERA II e^-p data ($\mathcal{L}$=21 pb^{-1}): observed and predicted numbers of events in the electron channel, the muon channel and the sum of electron and muon channels. The signal (dominated by real W production) and background components of the SM expectation are also given. The quoted errors contain statistical and systematic uncertainties added in quadrature.

H1 Preliminary 1994-2005 $e^{\pm}p$ 192 pb^{-1}	Electron obs./exp. (Signal contribution)	Muon obs./exp. (Signal contribution)	Combined obs./exp. (Signal contribution)
Full Sample	25 / 18.4 $\pm$ 2.5 (70%)	9 / 4.9 $\pm$ 0.8 (85%)	34 / 23.3 $\pm$ 3.2 (73%)
$P_T^X > 25$ GeV	11 / 2.9 $\pm$ 0.6 (81%)	6 / 2.9 $\pm$ 0.6 (86%)	17 / 5.8 $\pm$ 1.1 (84%)

Table 3: Summary of the H1 results of searches for events with isolated electrons or muons and missing transverse momentum in the full HERA data set ($\mathcal{L}$=192 pb^{-1}). The results are shown for the full selected sample and for the subsample at large $P_T^X > 25$ GeV. The number of observed events is compared to the SM prediction. The signal component of the SM expectation, dominated by real W production, is given as a percentage in parentheses. The quoted errors contain statistical and systematic uncertainties added in quadrature.

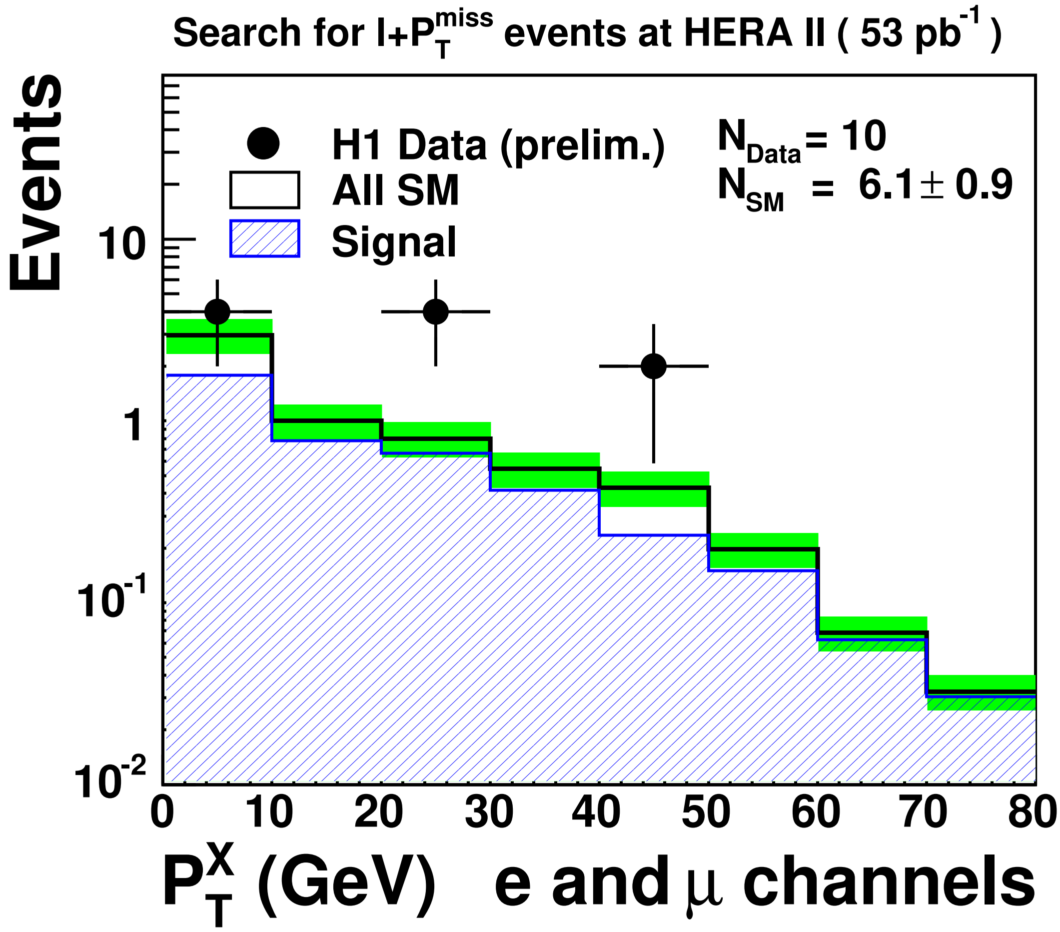

Figure 1: The hadronic transverse momentum distribution in the electron and muon channels combined: data (HERA II e^+p, $\mathcal{L} = 53$ pb^{-1}) is compared to the SM expectation (open histogram). The signal component of the SM expectation, dominated by real W production, is given by the hatched histogram. $\mathrm{N_{Data}}$ is the total number of data events observed, $\mathrm{N_{SM}}$ is the total SM expectation. The total error on the SM expectation is given by the shaded band.

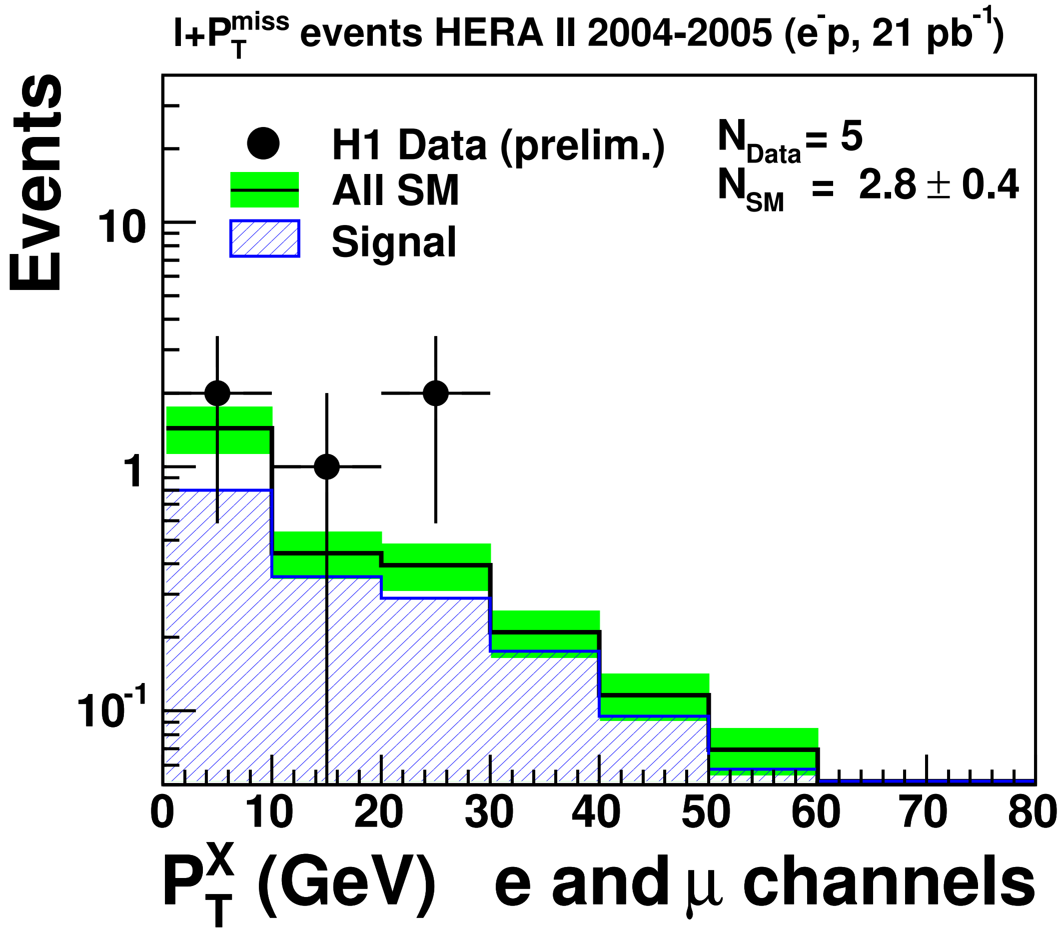

Figure 2: The hadronic transverse momentum distribution in the electron and muon channels combined: data (HERA II e^-p, $\mathcal{L} = 21$ pb^{-1}) is compared to the SM expectation (open histogram). The signal component of the SM expectation, dominated by real W production, is given by the hatched histogram. $\mathrm{N_{Data}}$ is the total number of data events observed, $\mathrm{N_{SM}}$ is the total SM expectation. The total error on the SM expectation is given by the shaded band.

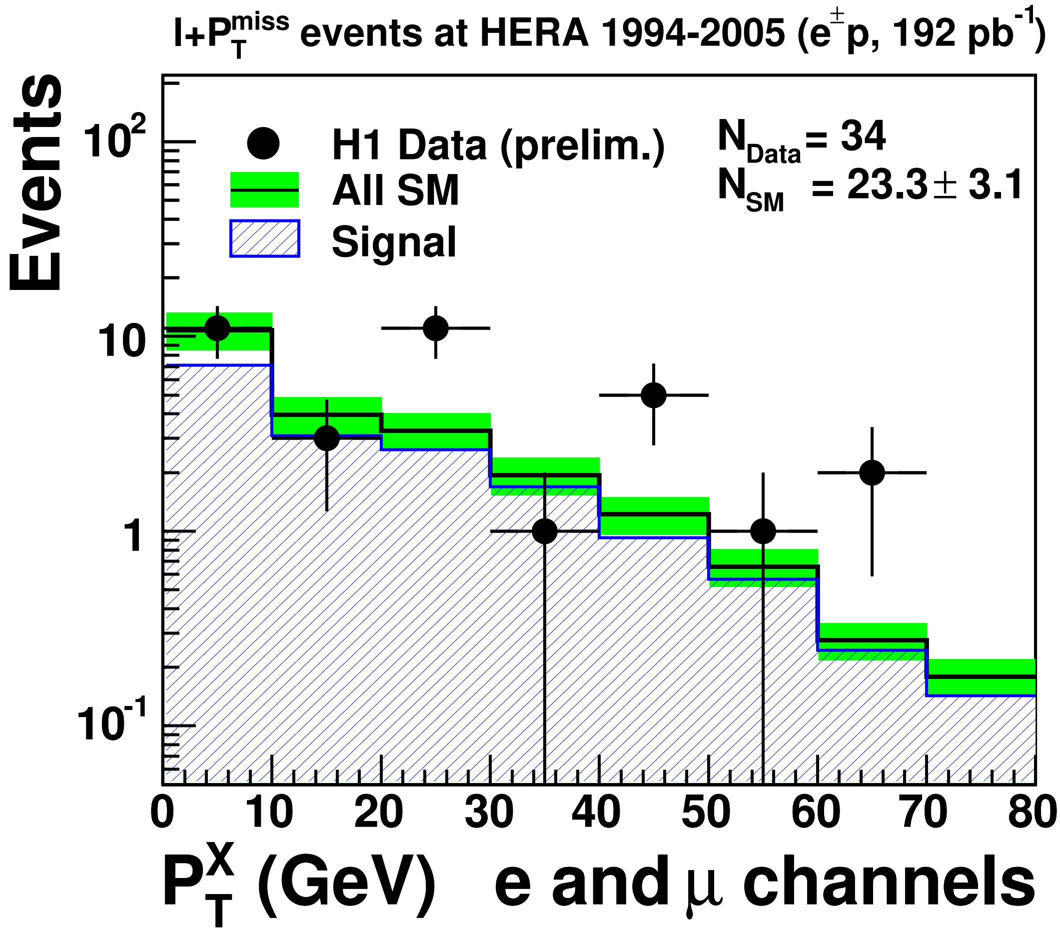

Figure 3: The hadronic transverse momentum distribution in the electron and muon channels combined: data (full HERA data set, $\mathcal{L} = 192$ pb^{-1}) is compared to the SM expectation (open histogram). The signal component of the SM expectation, dominated by real W production, is given by the hatched histogram. $\mathrm{N}_{\mathrm{Data}}$ is the total number of data events observed, N_{SM} is the total SM expectation. The total error on the SM expectation is given by the shaded band.

References

[1] H1 Collaboration; *Analysis of High P_T HERA II Data*, contributed paper to *The 32nd International Conference on High Energy Physics*, Bejing 2004, **Abstract 12-0765**.

[2] V. Andreev *et al.* [H1 Collaboration], Phys. Lett. B **561** (2003) 241 [hep-ex/0301030].