New Results on NC and CC-like events at Very High Q^2 in DIS Collisions at HERA

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for the

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H1 BSM Working Group

H1 Collaboration

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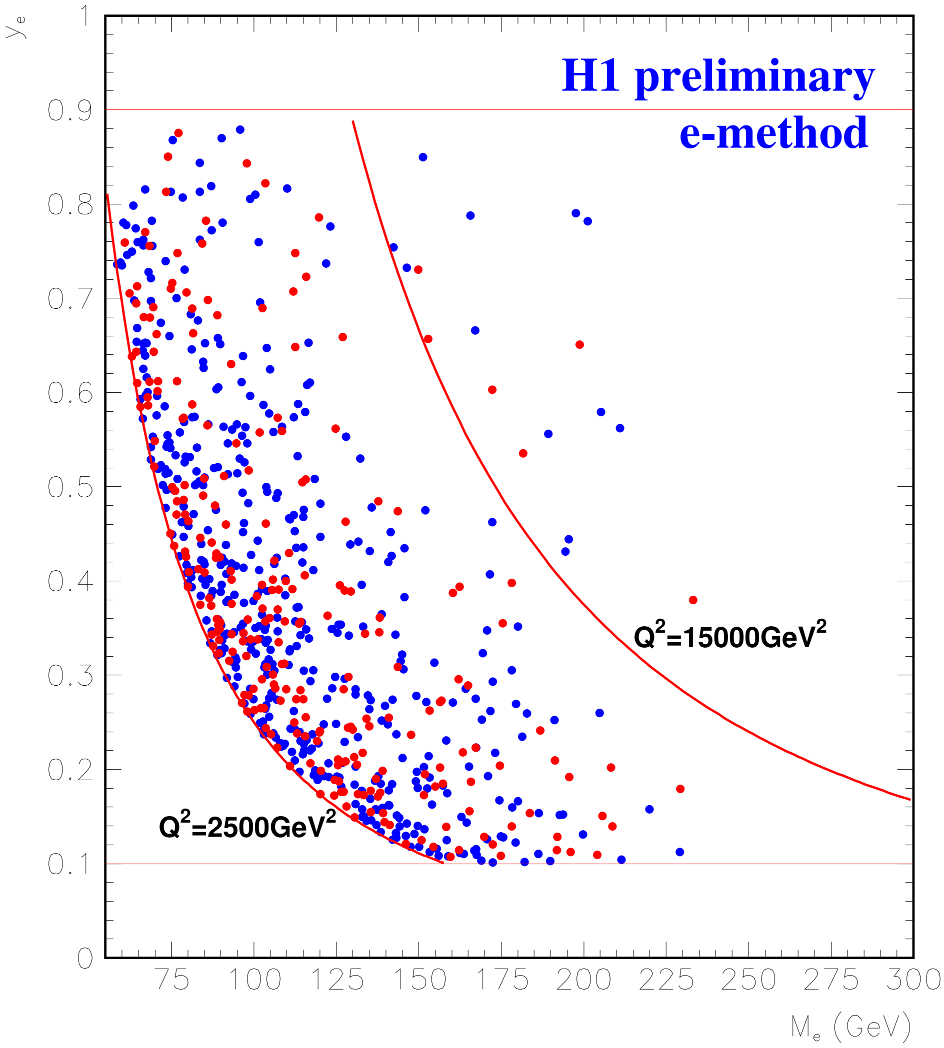
DESY

NC Data Sample in the M-y Plane



• 1994-96 Data • 1997 Data

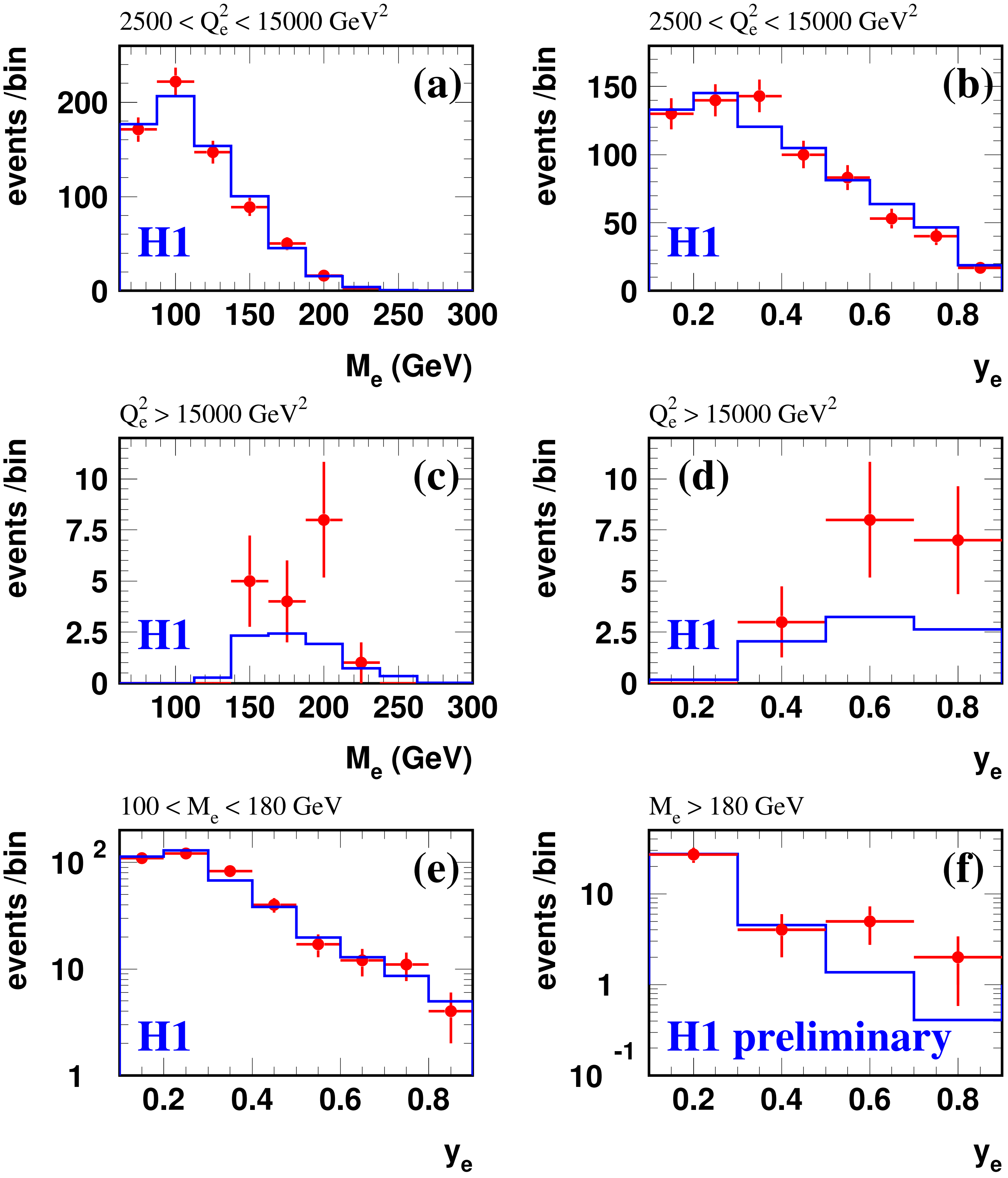
$0.1 < y_e < 0.9 \quad \mathcal{L} = 23.69 \pm 0.35 \ \mathrm{pb}^{-1}$

$Q_e^2 > 2500 \ \mathrm{GeV}^2$ Obs. $= 724 \ \Leftrightarrow$ Exp. $= 714 \pm 69$

$Q_e^2 > 15000 \ \mathrm{GeV}^2$ Obs. $= 18 \ \Leftrightarrow$ Exp. $= 8.0 \pm 1.2$

Notes : NC DIS yield given after simulation and event selection; Kinematics directly from reconstructed electron; Efficiency from geometrical acceptance and event selection $\sim 80\%$ for events generated within measured kinematic range.

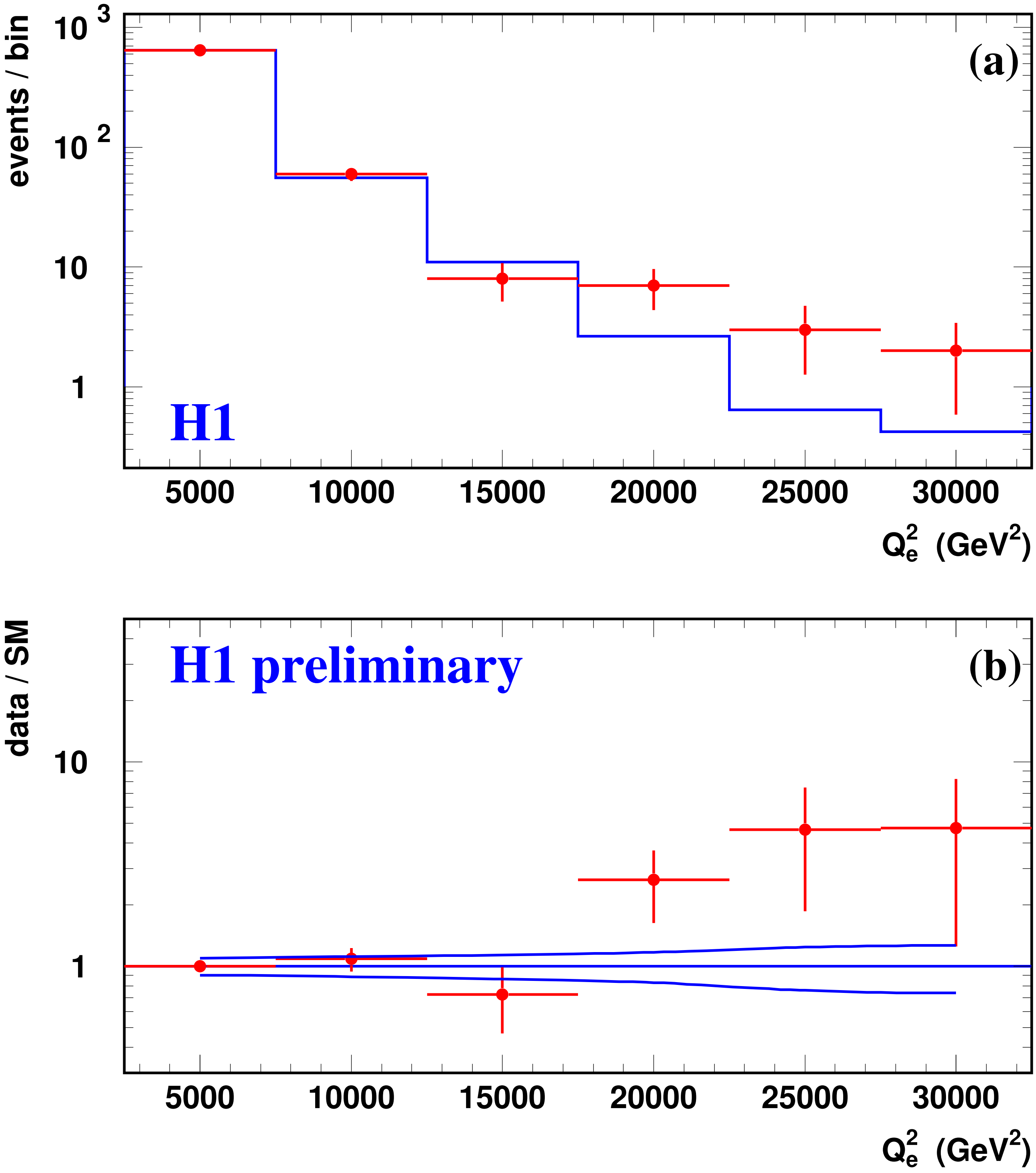
Basic Kinematics



The basic observations remain:

- data exceeds NC DIS expectation at high Q^2 (especially at $M_e \sim 200$ GeV);
- at high $M_e \Rightarrow$ difference apparent at large y_e.

Q^2 Dependence



Significant excess for Q_e^2 above ~ 15000 GeV^2

Note: Errors dominated by uncertainty on e.m. energy scale
$\sim 8.5\%$ at low Q_e^2 $\sim 30\%$ at highest Q_e^2

Q^2 Dependence, Integrals

1994 - 1996 Data						
Q^2_{min}/ GeV^2	2500	5000	10000	15000	20000	30000
N_{obs}	443	122	20	12	5	2
N_{DIS}	426.7 ± 38.4	116.2 ± 11.6	18.3 ± 2.4	4.71 ± 0.76	1.32 ± 0.05	0.23
$\mathcal{P}$	0.35	0.35	0.39	6×10^{-3}	1.4×10^{-2}	2.3×10^{-2}
1994 - 1997 Data						
Q^2_{min}/ GeV^2	2500	5000	10000	15000	20000	30000
N_{obs}	724	193	31	18	7	2
N_{DIS}	714.1 ± 69.0	193.9 ± 20.7	31.0 ± 3.90	8.00 ± 1.16	2.28 ± 0.38	0.40 ± 0.14
$\mathcal{P}$	0.44	0.51	0.49	3.4×10^{-3}	1.1×10^{-2}	6.6×10^{-2}

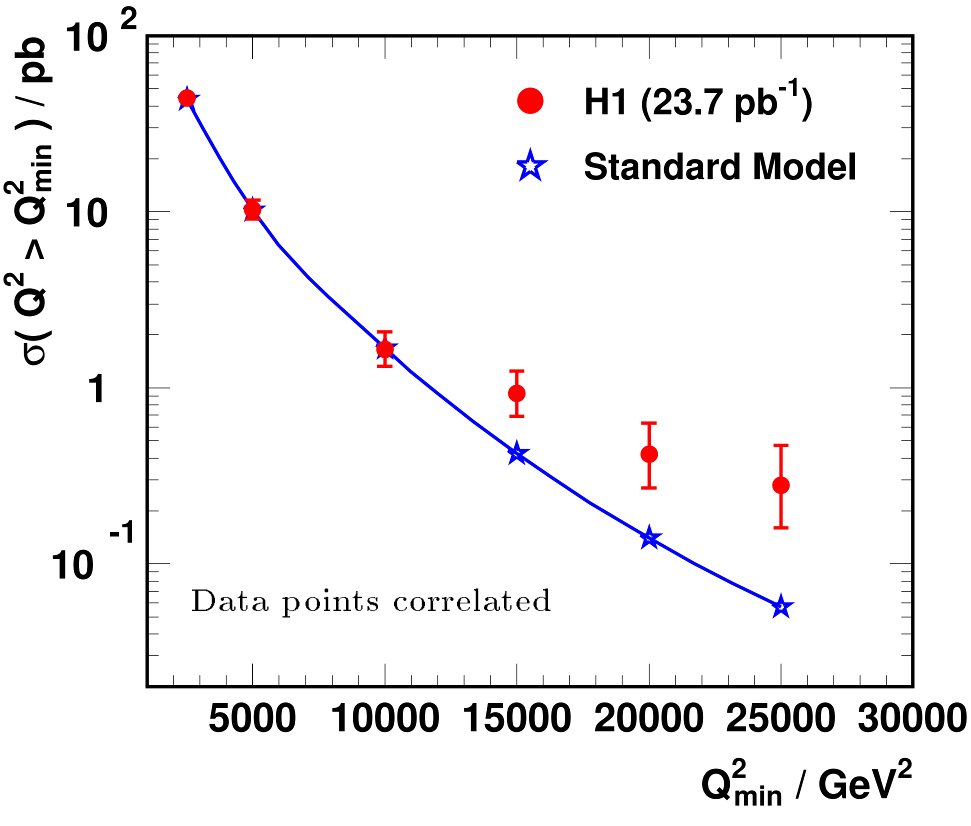
$\mathcal{P} \equiv \mathcal{P}(N \geq N_{obs.})$

- Excellent agreement up to $Q^2_{min} = 10000 GeV^2$ with NC DIS Standard Model
- The significance of the deviations increases with 1997 data above $Q^2_{min} = 15000 GeV^2$

Integrated Cross-sections for $Q^2 > Q^2_{min}$

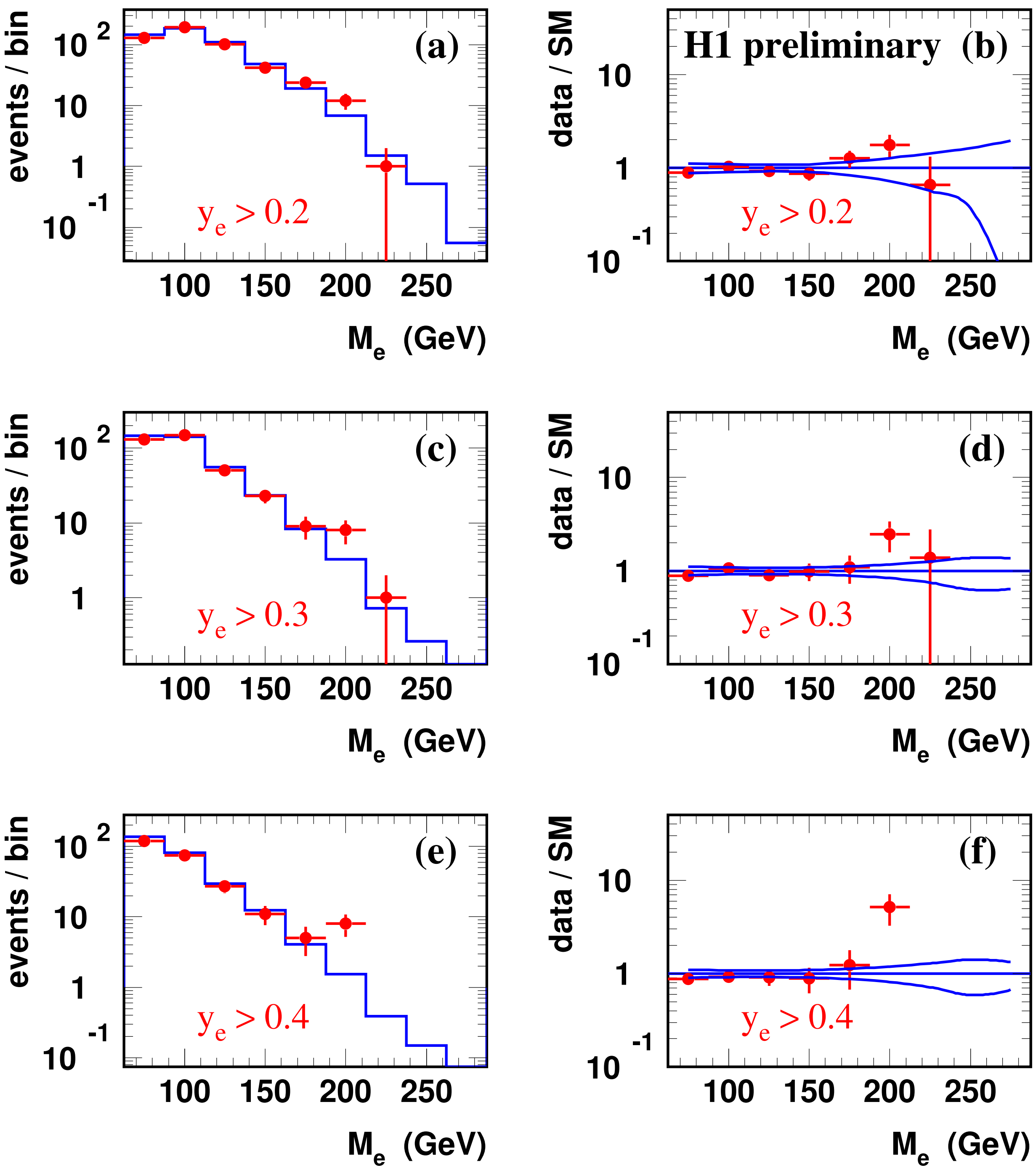
H1 Preliminary

Q^2_{min}	$N_{\rm obs}$	σ/pb	σ_{SM}/pb
2500	724	$43.3^{+4.6}_{-3.9}$	43.7
5000	193	$10.3^{+1.4}_{-1.2}$	10.6
10000	31	$1.66^{+0.42}_{-0.33}$	1.79
15000	18	$0.93^{+0.32}_{-0.24}$	0.49
20000	7	$0.42^{+0.21}_{-0.15}$	0.16
25000	4	$0.28^{+0.19}_{-0.12}$	0.059



- Error combination assumes Gaussian systematics and Poisson distributed N_{obs}.
- Corrected (assuming NC DIS Standard Model) for migrations due to real QED emission, acceptance and resolution $\rightarrow$ the Q^2 scale = true hard scale from exchanged EW bosons.

Mass Dependence



The basic observations remain:

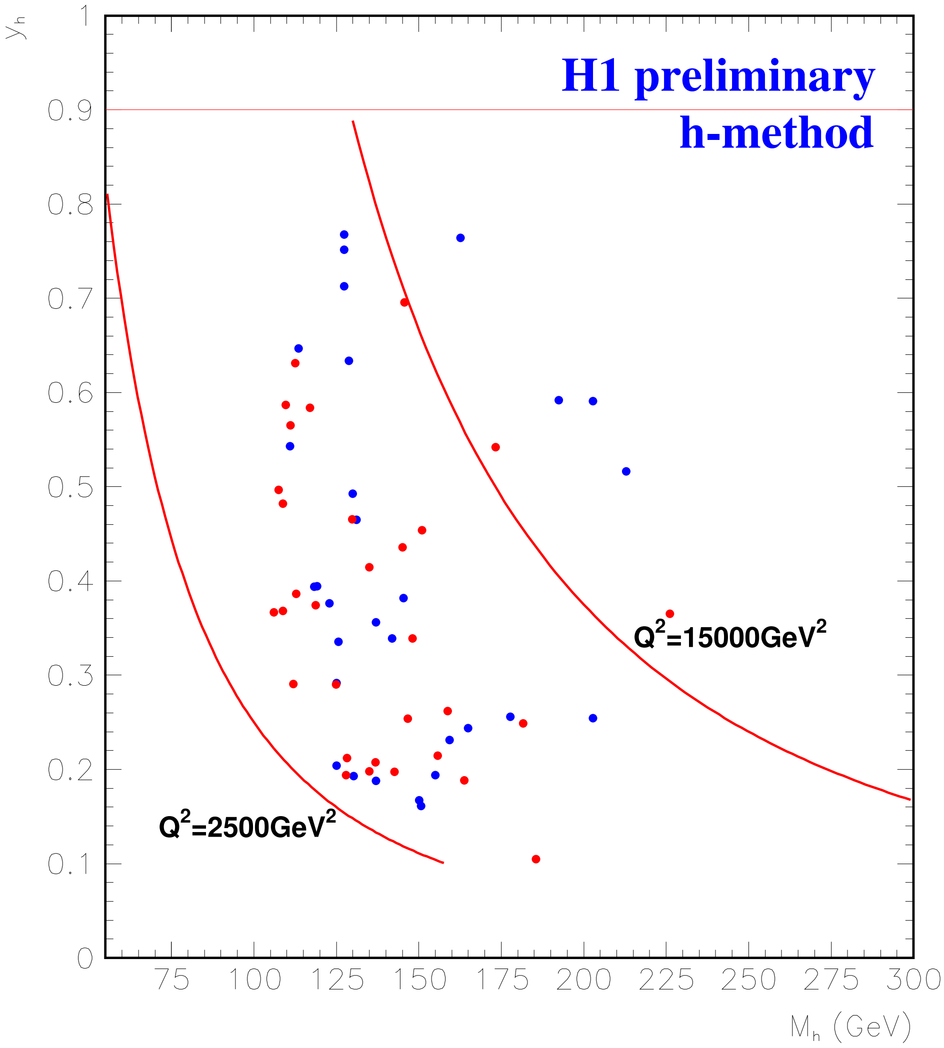
- Excess seen at highest mass
- More visible at large y_e

Mass Windows

1994 - 1996 Data, $y_e > 0.4$				
ΔM_e (GeV)	20	25	30	40
N_{obs}	5	7	7	7
N_{DIS}	0.63 ± 0.13	0.95 ± 0.18	1.10 ± 0.19	1.57 ± 0.28
$\bar{\mathcal{P}}(N \geq N_{obs})$	5.0×10^{-4}	2.6×10^{-4}	2.5×10^{-4}	1.6×10^{-3}
1994 - 1997 Data, $y_e > 0.4$				
ΔM_e (GeV)	20	25	30	40
N_{obs}	6	8	8	9
N_{DIS}	1.01 ± 0.21	1.53 ± 0.29	1.75 ± 0.32	2.54 ± 0.49
$\mathcal{P}(N \geq N_{obs})$	9.1×10^{-4}	3.3×10^{-4}	7.3×10^{-4}	2.2×10^{-3}
1994 - 1997 Data, $M_e > 180$ GeV				
y_{min}	0.2	0.3	0.4	0.5
N_{obs}	18	11	9	7
N_{DIS}	12.9 ± 3.58	6.1 ± 1.04	2.96 ± 0.52	1.73 ± 0.27
$\mathcal{P}(N \geq N_{obs})$	0.18	6.1×10^{-2}	5.3×10^{-3}	2.6×10^{-3}

- Lower rate of entries at large y_e around $M_e \sim 200$ GeV in 1997 $\rightarrow$ slight decrease of significance.

CC Data Sample in the M-y Plane



● 1994-96 Data ● 1997 Data

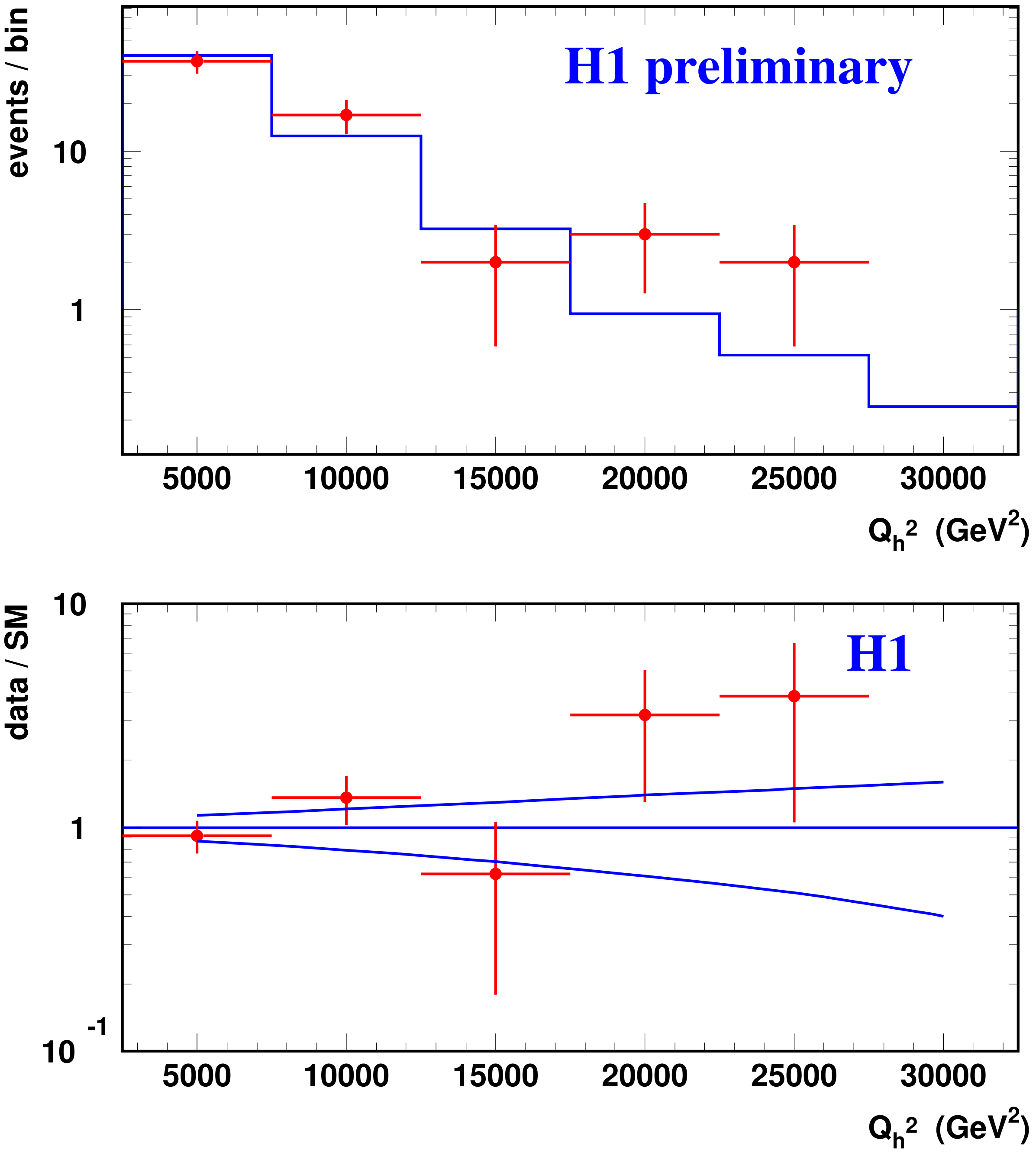
$y_h < 0.9 \quad \mathcal{L} = 23.69 \pm 0.35 \text{ pb}^{-1}$

$Q_h^2 > 2500 \text{ GeV}^2$ Obs. $= 61 \Leftrightarrow$ Exp. $= 56.3 \pm 9.4$

$Q_h^2 > 15000 \text{ GeV}^2$ Obs. $= 6 \Leftrightarrow$ Exp. $= 2.9 \pm 1.4$

Notes : CC DIS yield given after simulation and event selection; Kinematics directly from reconstructed hadrons; Efficiency from geometrical acceptance and event selection $\sim 80\%$ for events generated within measured kinematic range.

Q^2 Dependence



- A slight excess of events is observed at high Q_h^2

Q^2 Dependence: CC

1994 - 1996 Data					
Q^2_{min}(GeV^2)	2500	5000	10000	15000	20000
N_{obs}	31	24	10	4	3
N_{DIS}	34.2 ± 5.8	21.1 ± 4.2	5.07 ± 1.88	1.77 ± 0.87	0.74 ± 0.39
$\mathcal{P}(N \geq N_{obs})$	0.64	0.31	7×10^{-2}	0.14	5.4×10^{-2}
1994 - 1997 Data					
Q^2_{min} (GeV^2)	2500	5000	10000	15000	20000
N_{obs}	61	43	13	6	4
N_{DIS}	56.3 ± 9.4	34.7 ± 6.9	8.33 ± 3.10	2.92 ± 1.44	1.21 ± 0.64
$\mathcal{P}$	0.34	0.18	0.16	0.13	5.7×10^{-2}

$\mathcal{P} \equiv \mathcal{P}(N \geq N_{obs.})$

- Good agreement up to $Q^2_{min} = 10000 GeV^2$ with CC DIS Standard Model
- The significance of the deviations remains with 1997 data above $Q^2_{min} = 10000 GeV^2$