H1prelim-02-064, April 2002

A search for leptoquarks at HERA

H1 Collaboration

Abstract

A search for scalar and vector leptoquarks coupling to first generation fermions is performed in the H1 experiment using data collected from 1994 to 2000. No significant evidence for the direct production of such particles is found in a data sample with a large transverse momentum final state electron or with large missing transverse momentum, and constraints on leptoquark models are established. For leptoquark couplings of electromagnetic strength, leptoquark masses up to 290 GeV are ruled out.

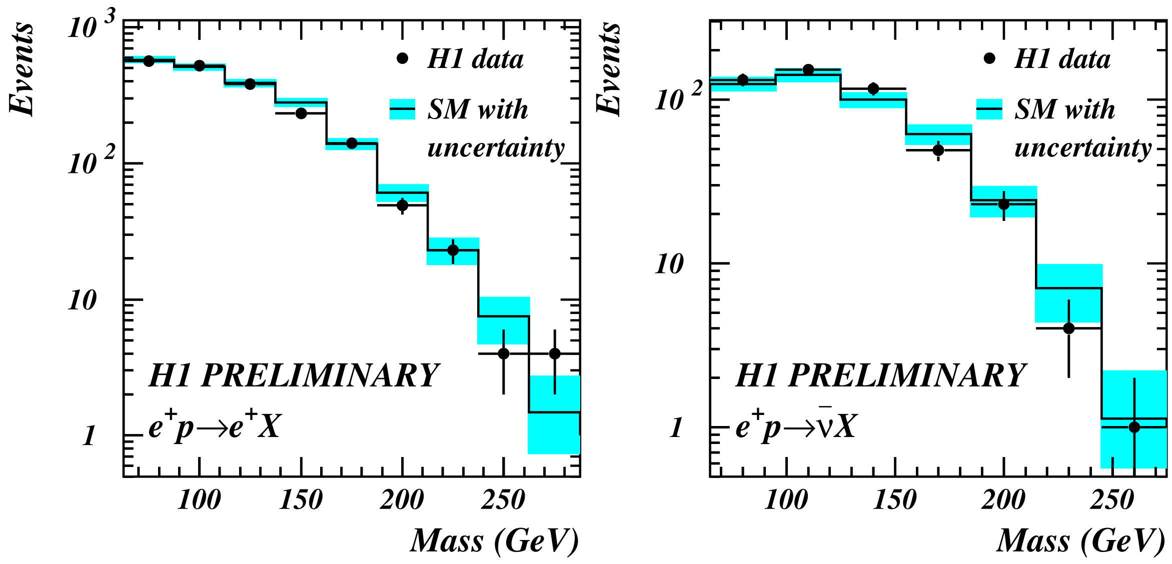

Figure 1: Mass spectra for the events from (a) neutral current (NC) and (b) charged current (CC) deep inelastic scattering (DIS) selections, together with the corresponding DIS expectations (histograms). The grey bands indicate the $\pm 1\sigma$ uncertainty due to the systematic errors on the NC and CC DIS expectations.

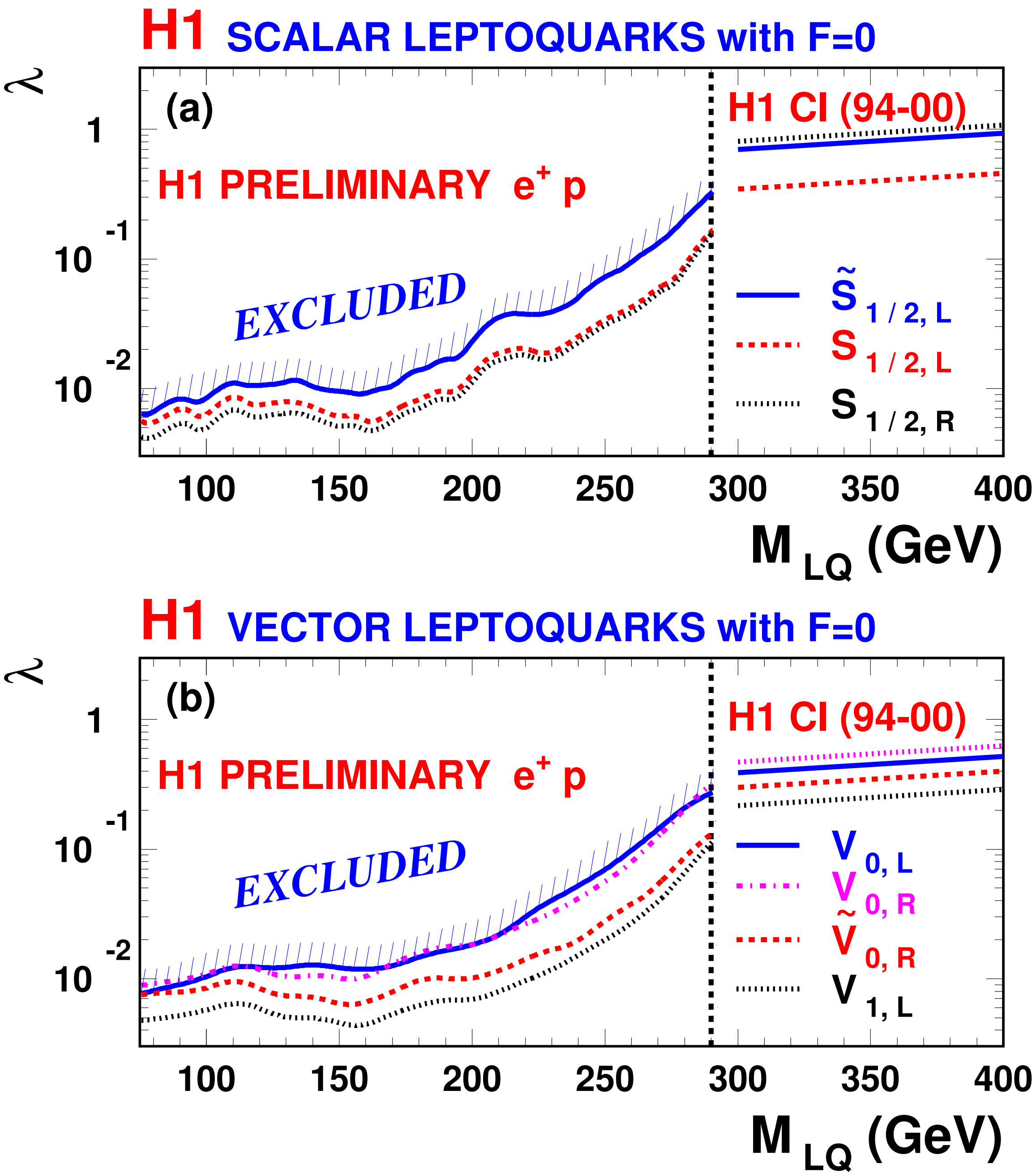

Figure 2: Exclusion limits for the 7 $F = 0$ leptoquarks (LQs) described by the Buchmüller, Rückl and Wyler (BRW) model. The limits are expressed at 95% CL on the Yukawa coupling λ as a function of the leptoquark mass for (a) scalar LQs and (b) vector LQs. Domains above the curves are excluded. Constraints on LQs with masses above the HERA centre-of-mass energy, obtained from a contact interaction (CI) analysis, are shown in the rightmost part of each plot.

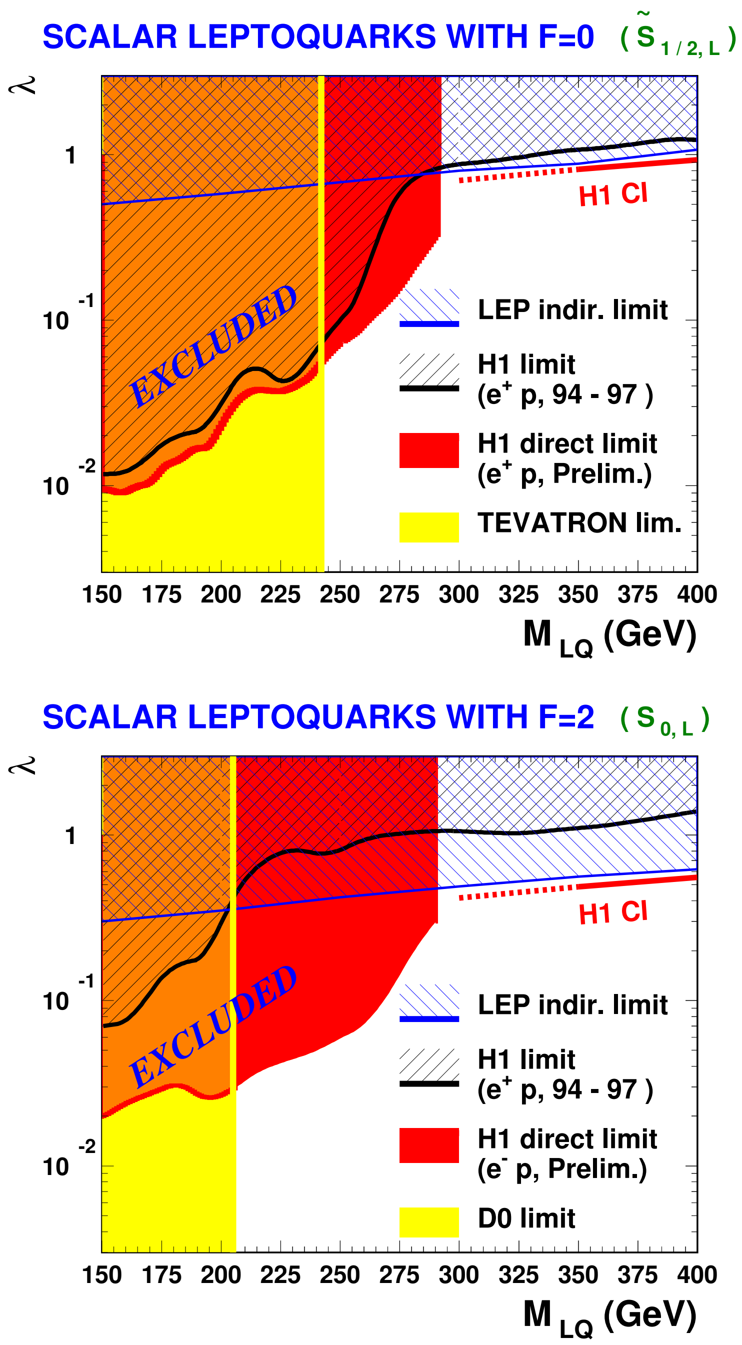

Figure 3: Exclusion limits at 95% CL on the Yukawa coupling λ as a function of the leptoquark (LQ) mass for (top) a scalar with $F = 0$ and (bottom) a scalar LQ with $F = 2$ described by the BRW model. Shaded and hatched domains are excluded.

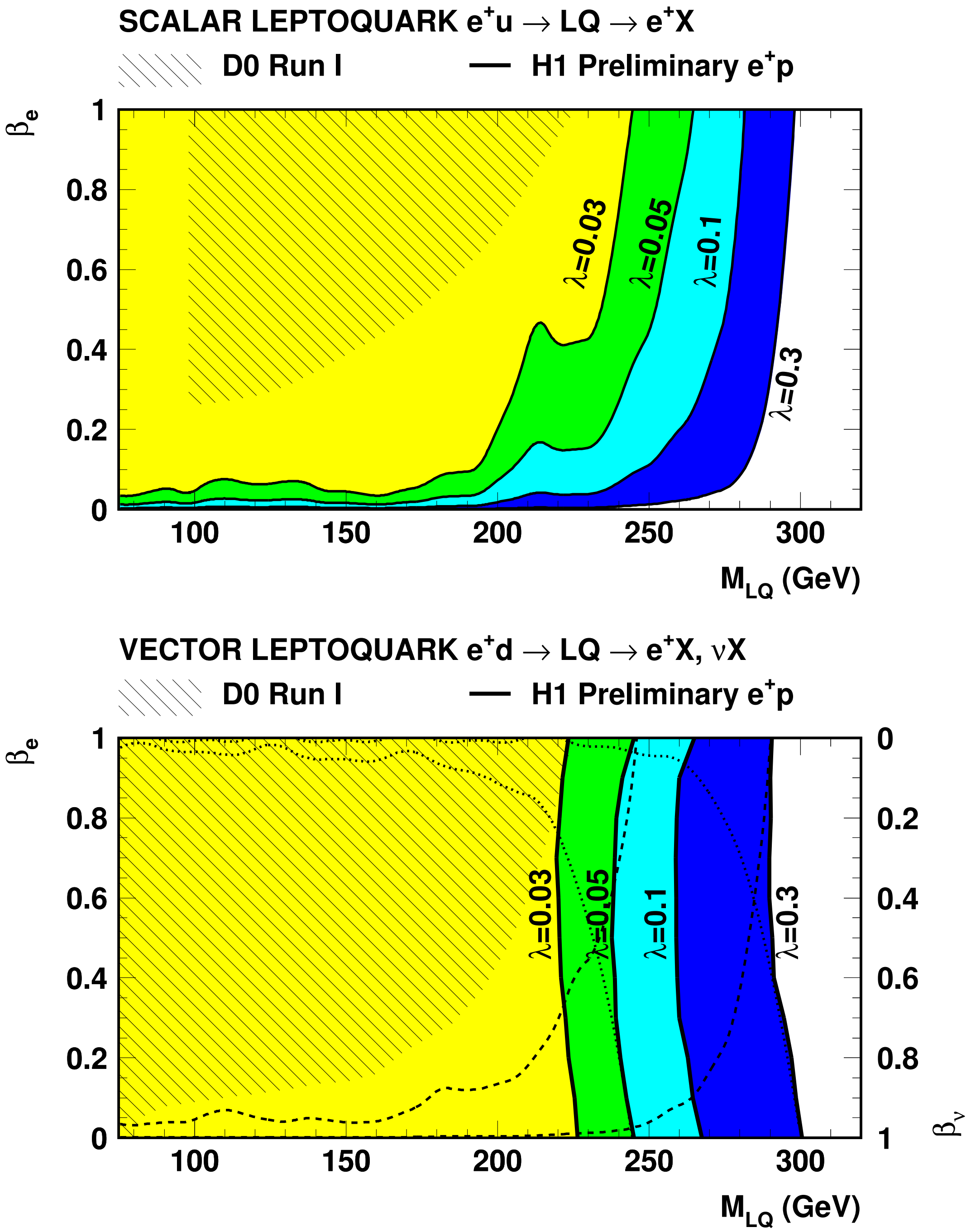

Figure 4: (a) Mass dependent exclusion limits at 95% CL on the branching ratio β_e of a scalar leptoquark (LQ) which couples to e^+u (with the quantum numbers of the $S_{1/2,L}$). (b) Domains ruled out by the combination of the NC and CC analyses, for a vector LQ which couples to e^+d (with the quantum numbers of the $V_{0,L}$) and decaying only into eq and νq for four values of the Yukawa coupling λ. The regions on the left of the full curves are excluded at 95% CL. For $\lambda = 0.05$ and 0.3, the part of the $\beta_e - M_{\mathrm{LQ}}$ ($\beta_\nu - M_{\mathrm{LQ}}$) plane on the left of the dashed (dotted) curve is excluded by the NC (CC) analysis. The branching ratios β_e and β_ν are shown on the left and right exes respectively. In (a) and (b), the hatched region represents the domain excluded by the D0 experiment. The D0 bounds do not depend on the value of the Yukawa coupling.

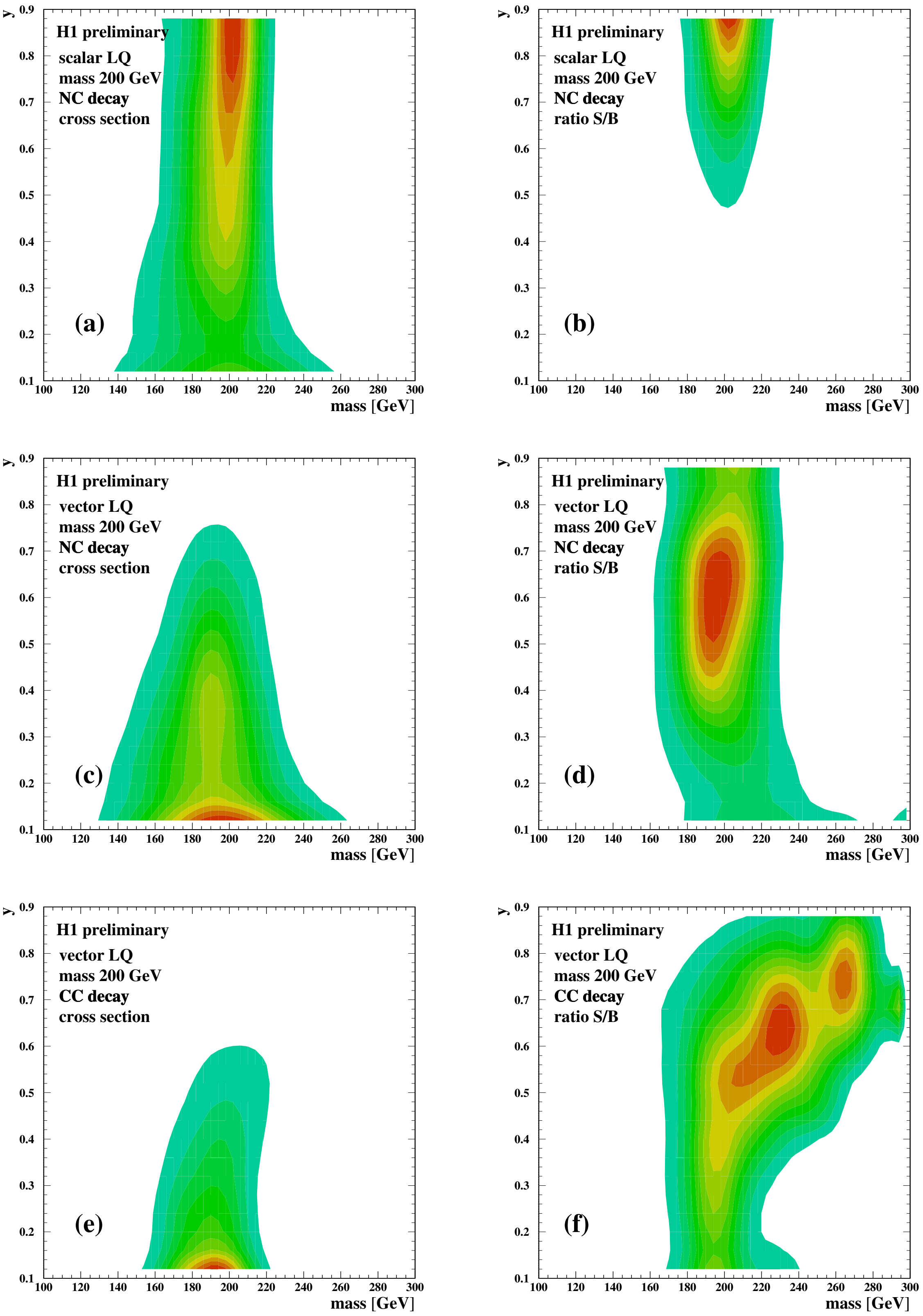

Figure 5: Leptoquarks (LQs) event distribution at 200 GeV for (a) NC-like scalar, (c) NC-like vector, and (e) CC-like vector LQs, and the corresponding signal over the Standard Model background ratios (b), (d), and (e).

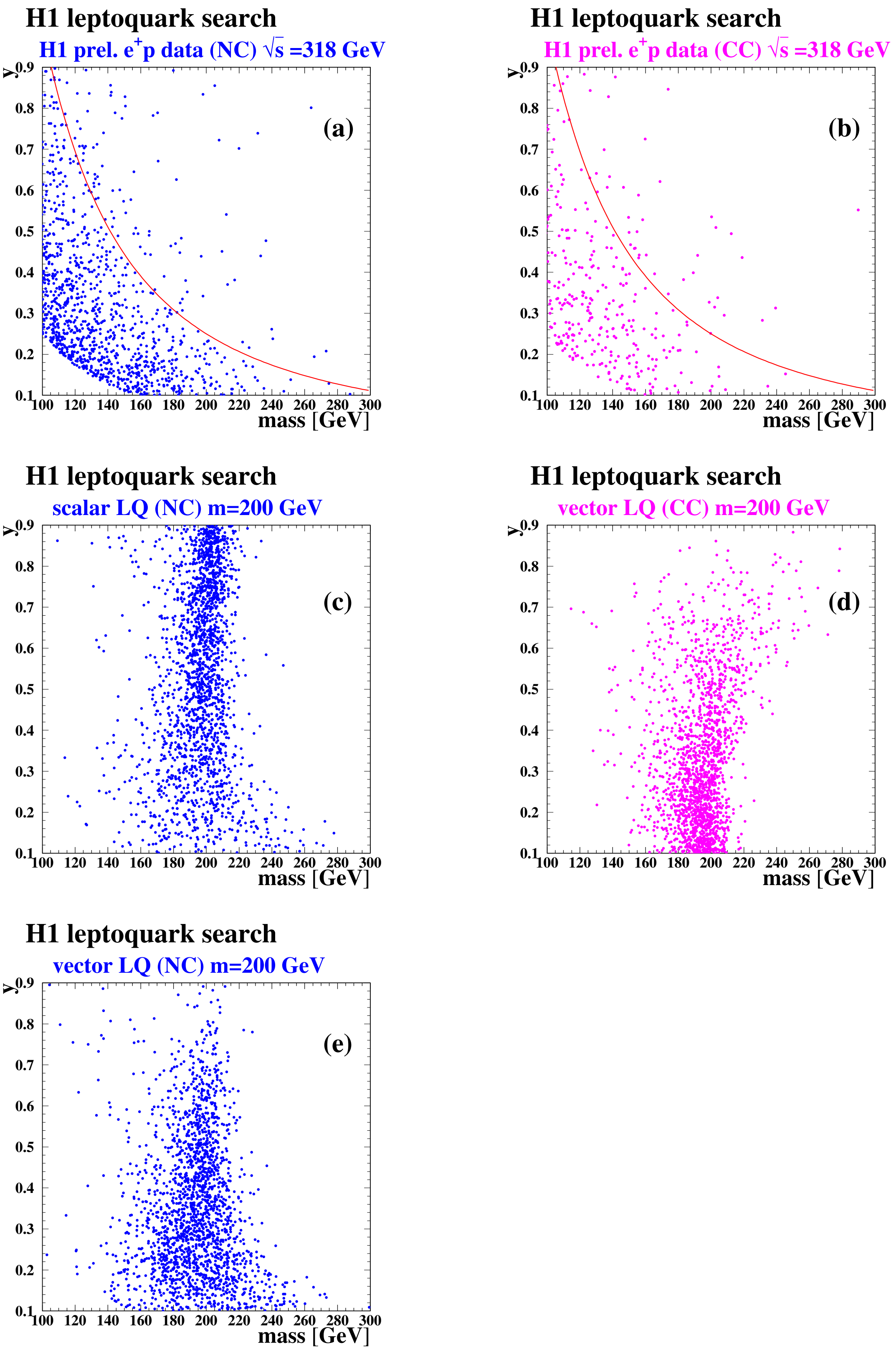

Figure 6: Data events selected in the NC (a) and CC (b) analyses and the corresponding Monte Carlo events at 200 GeV for (c) NC-like scalar, (d) CC-like vector LQ, and (e) NC-like vector LQs.