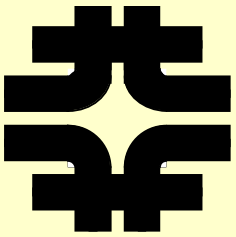
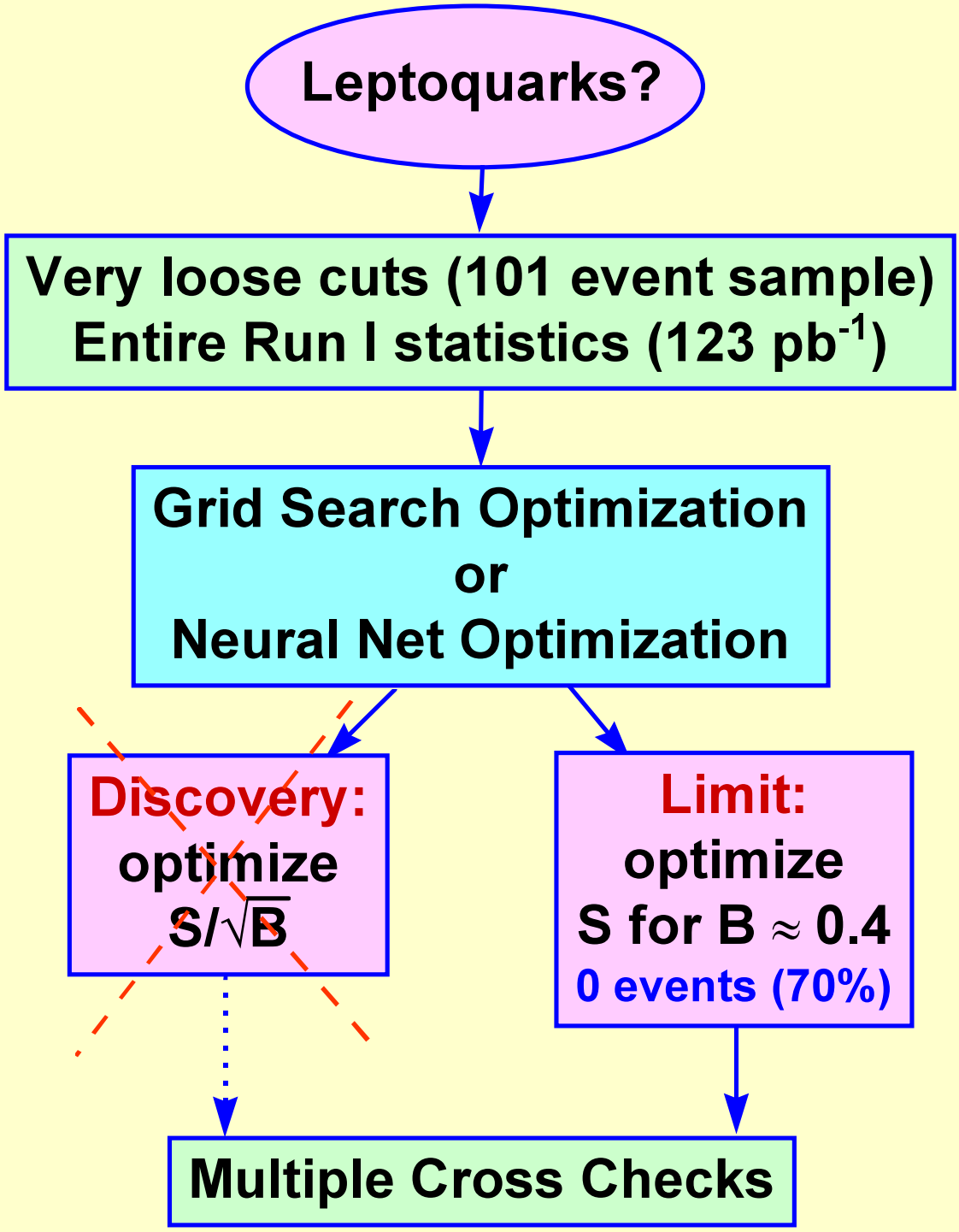


Search for Leptoquarks at DØ

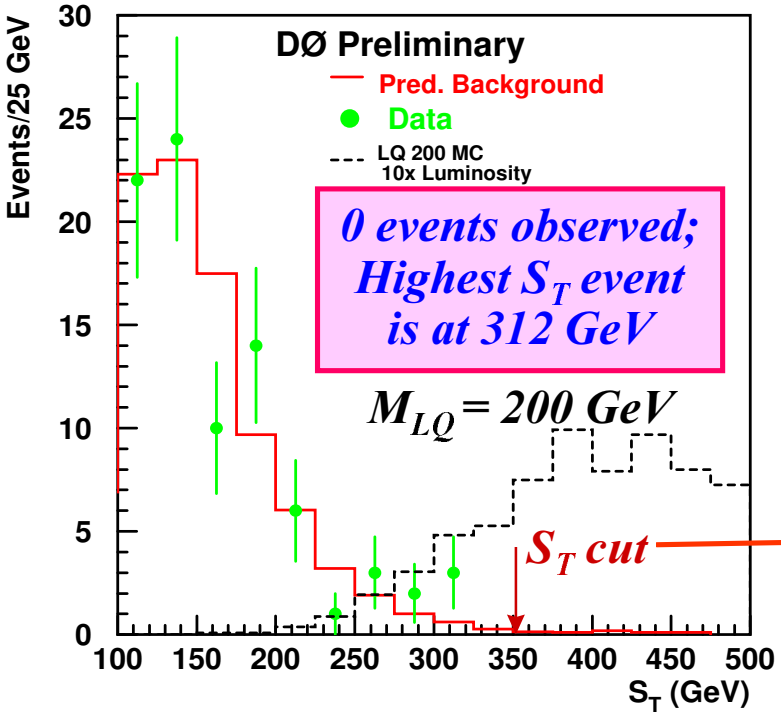
- **Since Moriond '97 DØ has carried out an optimized search for the first generation LQ suggested by HERA data (β = 1, eejj channel)**
- **An improved particle ID (including information from the TRD) - gained factor of two in efficiency**
- **Very loose initial cuts**
- **Advanced multivariate cut optimi-zation techniques were used to optimize the search sensitivity at high LQ masses**
- **Switched to the NLL cross section**
- **An optimization of the eνjj analysis was also done**
- **Second and third generation limits were updated**

eejj Optimization Strategy



S_T Analysis: Data vs. Background

Grid Searches: tried 20+ variables in 50+ combinations;
the single most effective cut is $S_T = \Sigma E_T^e + \Sigma E_T^j > 350$ GeV
Main backgrounds: Drell-Yan + 2j, QCD, Top



S_T Cut (GeV)	Background prediction	Data
0	93 ± 14	101
100	86 ± 13	85
150	41 ± 6	39
200	13 ± 2	15
250	4.2 ± 0.6	8
300	1.4 ± 0.2	3
350	0.44 ± 0.06	0
400	0.20 ± 0.03	0

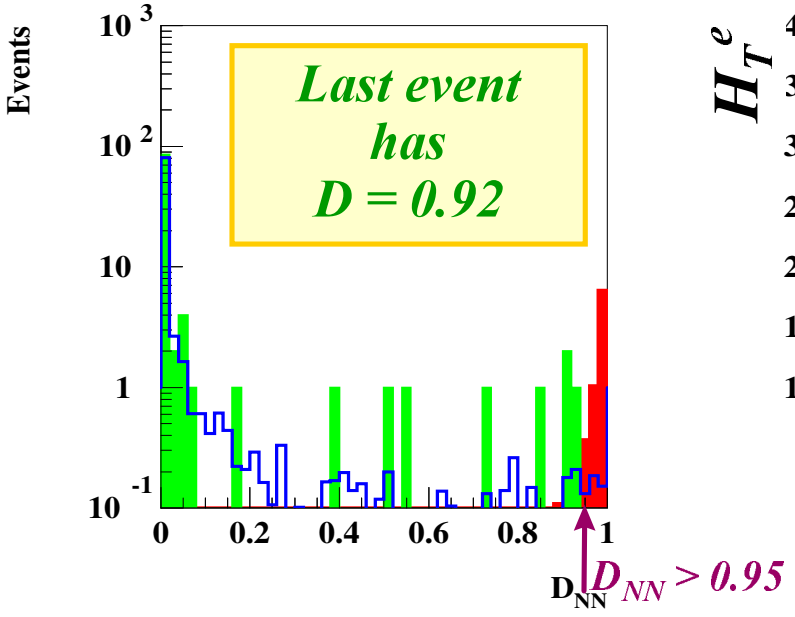
Source of error	Error
Particle ID	5%
Detector Smearing	3%
Jet Energy Scale	2% @ 260 GeV; 11% @ 120 GeV
Gluon Radiation	7%
PDF and Q^2	7%
MC Statistics	2%
Luminosity	5%
Total	13% @ 260 GeV; 16% @ 120 GeV

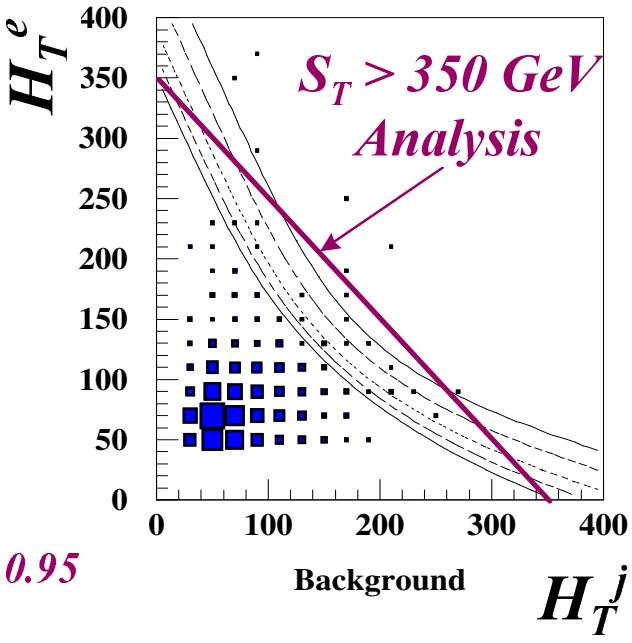
←**Signal systematics**

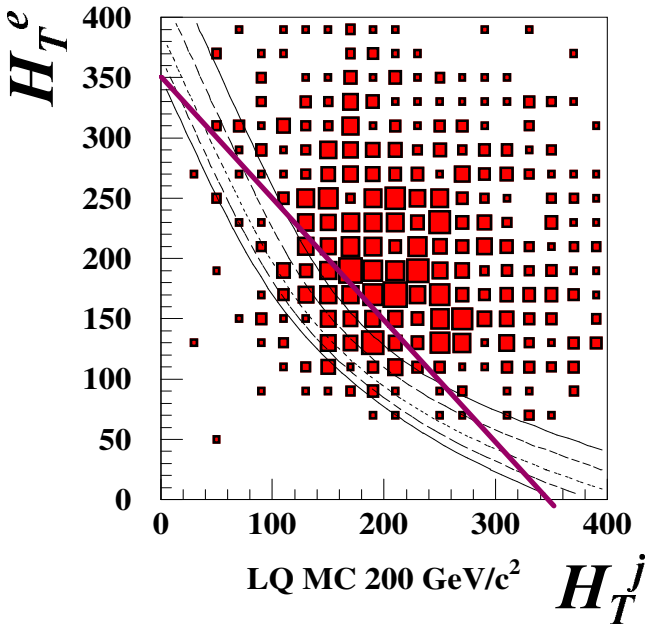
Overall efficiency:
36% @ M_{LQ} = 225 GeV

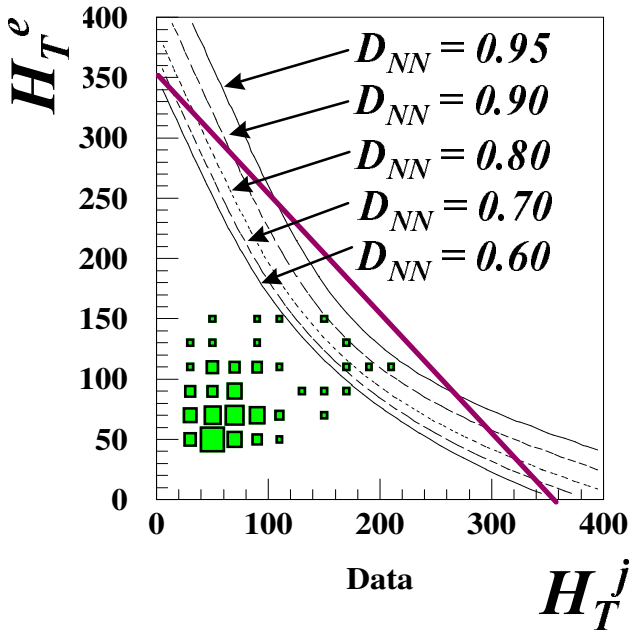
eejj Neural Network Analysis

Efficiency, backgrounds, systematics turned out to be essentially the same as for the S_T analysis



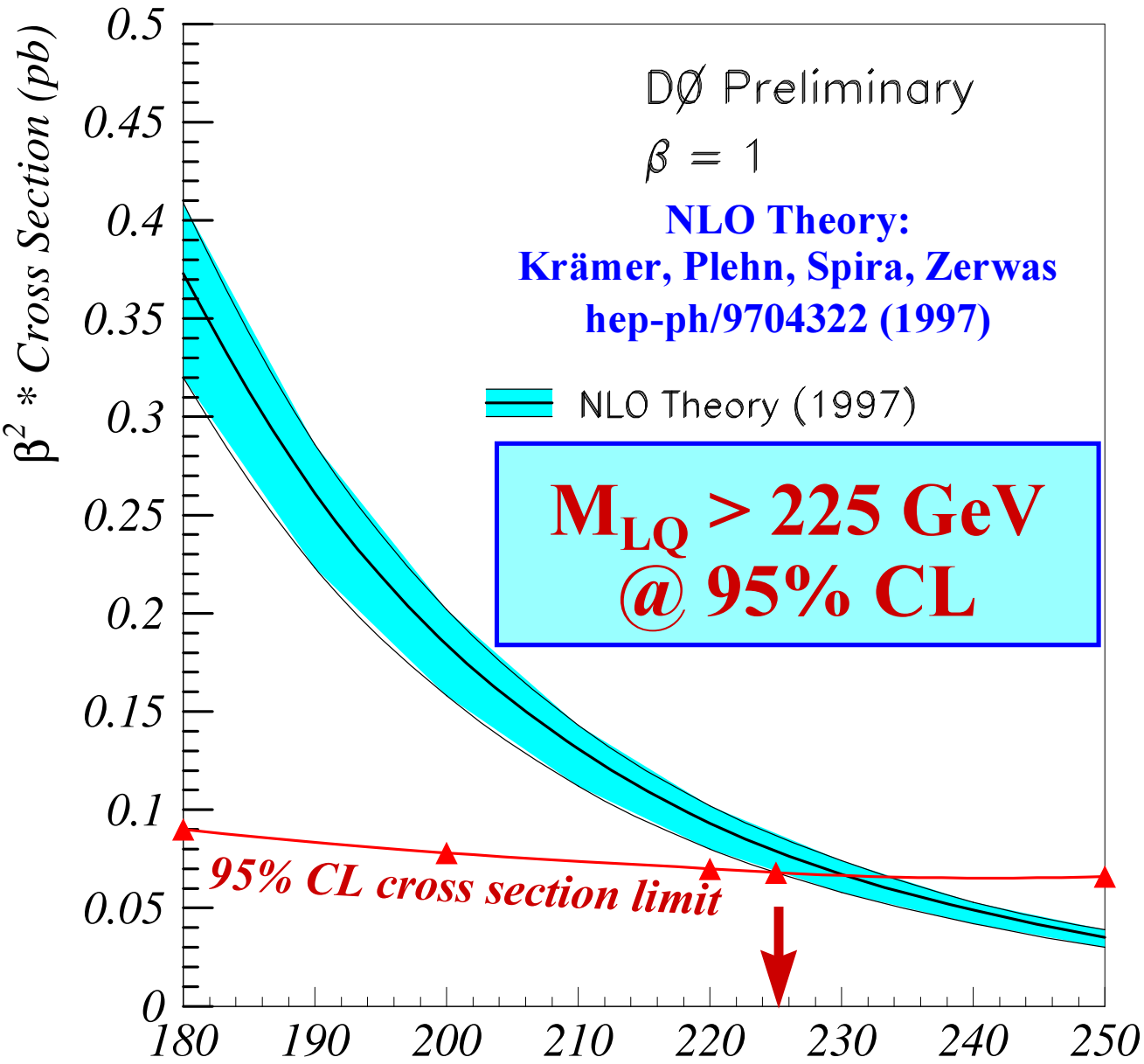






eejj Limits on the First Generation LQ

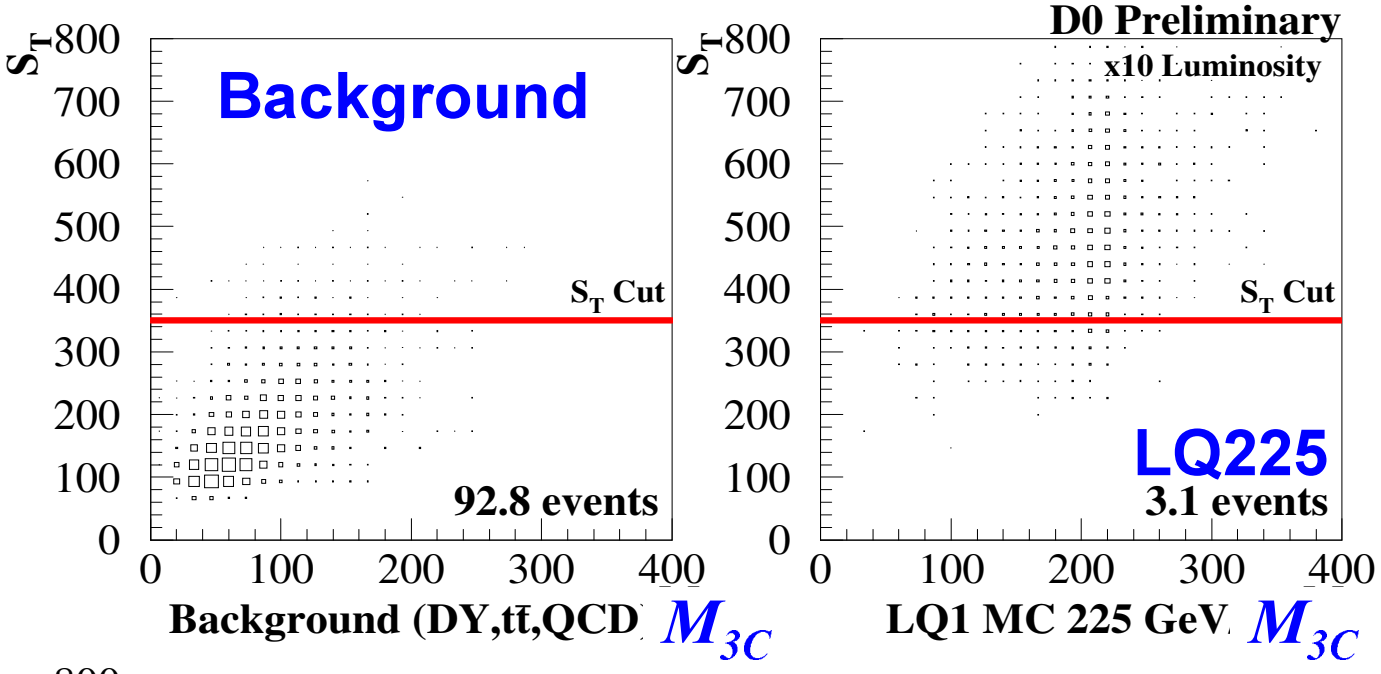
- *No background subtraction (limits are independent of the background and its uncertainty) - PDG method*
- *Account for systematic uncertainty for the signal*

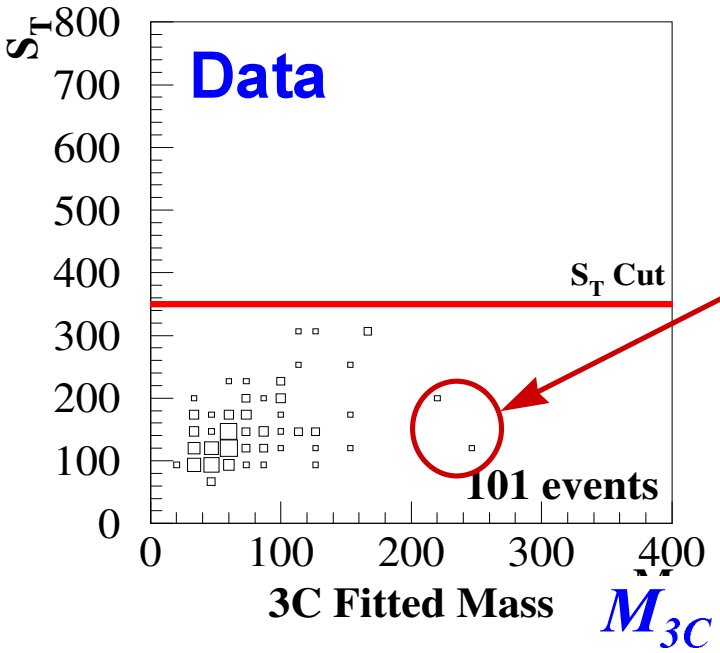


$\beta = 1/2$: $M_{LQ} > 176$ GeV @ 95% CL

eejj Analysis: S_T versus 3C-fit Mass

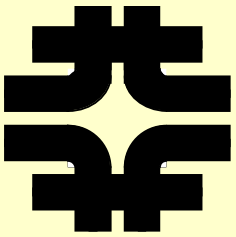
Applied full-fledged 3C mass fitter on the 101 event sample to look for possible high mass LQ candidates





Two events with high mass do not look like the LQ signal due to very low S_T

Conclusions:
No evidences for the LQ signal are seen in the mass analysis



Summary of Recent DØ LQ Results

- ***The DØ Collaboration has performed a search for scalar LQ and set the following 95% CL lower LQ mass limits based on the NLO theory:***
  - **First Generation:**
    - $\beta = 1$ **225 GeV**
    - $\beta = 1/2$ **192 GeV** *(includes eνjj data)*
  - **Second Generation:**
    - $\beta = 1$ **184 GeV**
    - $\beta = 1/2$ **140 GeV**
  - **Third Generation:**
    - $\beta = 0$ **98 GeV**

all limits are given @ 95% CL

- ***Our measurement in the eejj channel is the single most sensitive Yukawa-coupling-independent search for the first generation LQ. It rules out at 95% CL an interpretation of the HERA data with LQ masses below 225 GeV. This excludes the large class of models which require*** $\beta = 1$.

  [see J. Hewett, T. Rizzo - hep-ph/9703337 for discussion]

- ***Combined Tevatron results are expected to yield even higher mass limits on the LQ***