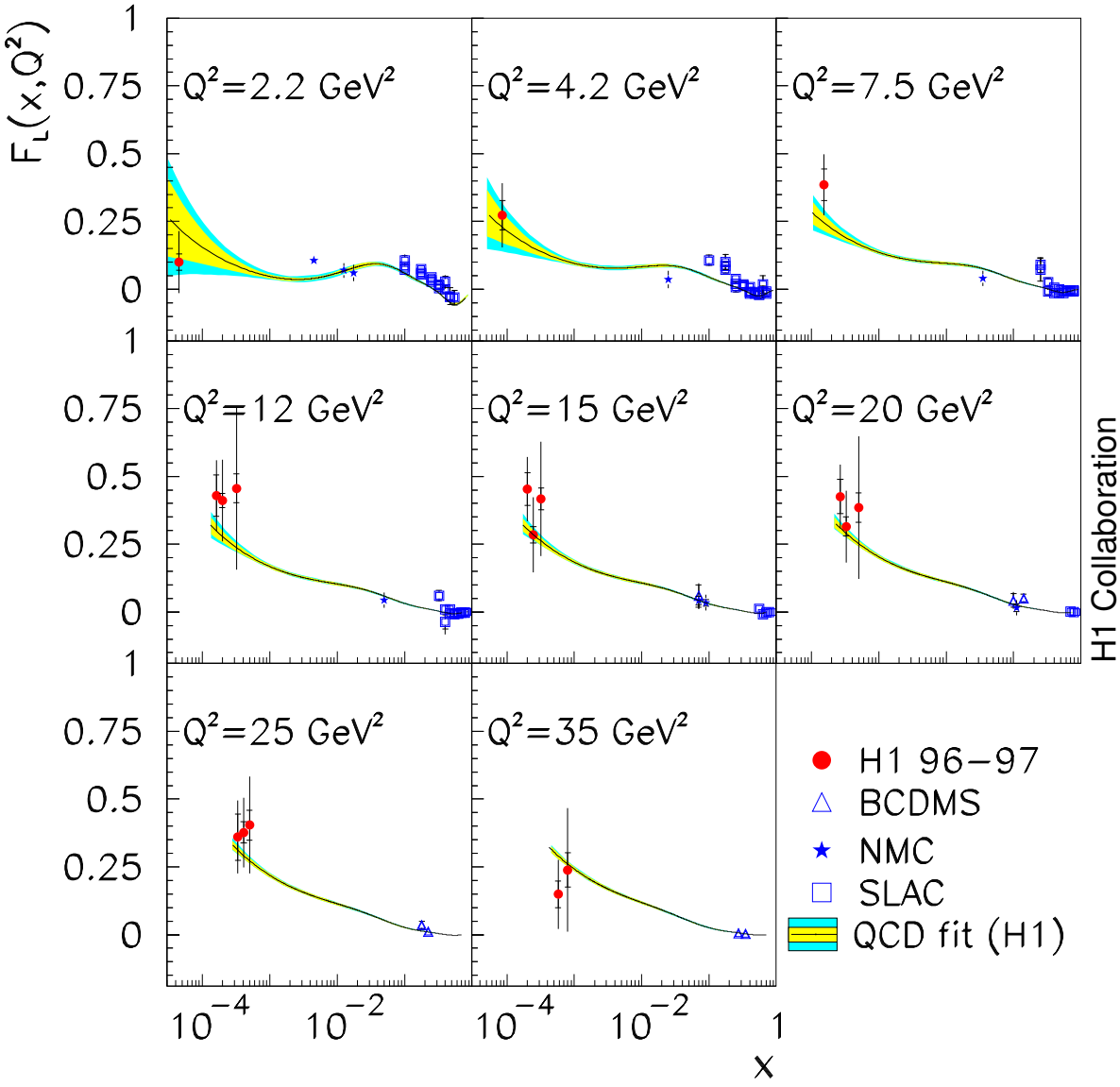
Longitudinal Structure function $F_L(x, Q^2)$

"subtraction" method

$$F_L = \frac{Y_+}{y^2}(F_2^{QCDfit} - \tilde{\sigma}_{NC})$$

"derivative" method

$$\left(\frac{\partial \tilde{\sigma}_{NC}}{\partial \ln y}\right)_{Q^2} = \left(\frac{\partial F_2}{\partial \ln y}\right)_{Q^2} - F_L \cdot 2y^2 \cdot \frac{2-y}{Y_+^2} - \frac{\partial F_L}{\partial \ln y} \cdot \frac{y^2}{Y_+}$$



- extention of F_L to much lower x
- rise of F_L towards low x
- consistent with QCD

- *direct measurement in future by varying beam energies*