

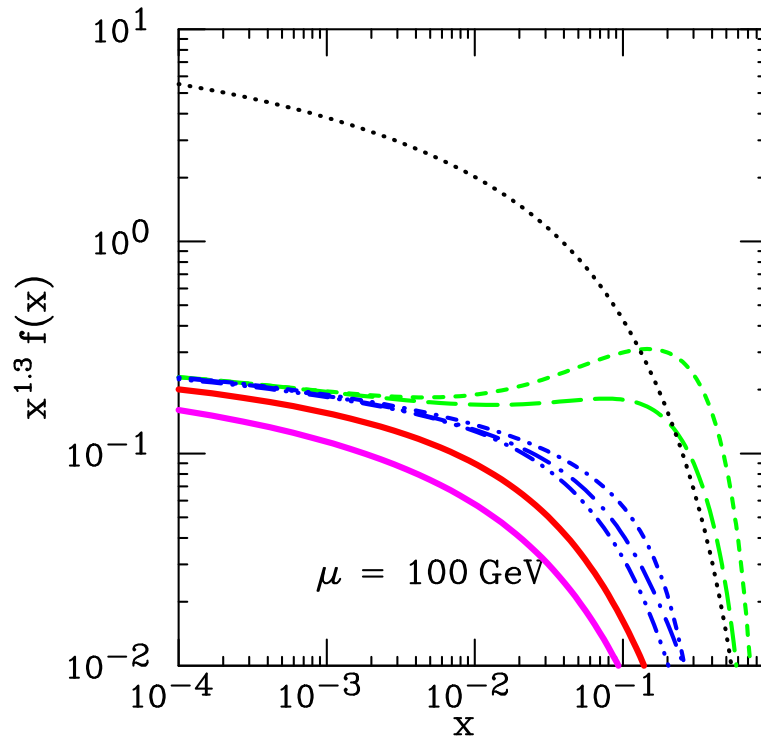
Remarks on b-quark and c-quark PDFs

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TOP09 Top Quark Institute (CERN 5 June, 2009)

- PDFs at $\mu = 100 \text{ GeV}$
- PDF uncertainties and CT09
- Intrinsic charm and bottom – i.e., charm and bottom that are present in the non-perturbative proton wave function at the initial scale of evolution, as opposed to being generated by gluon splitting.

Parton Distributions at $\mu = 100 \text{ GeV}$



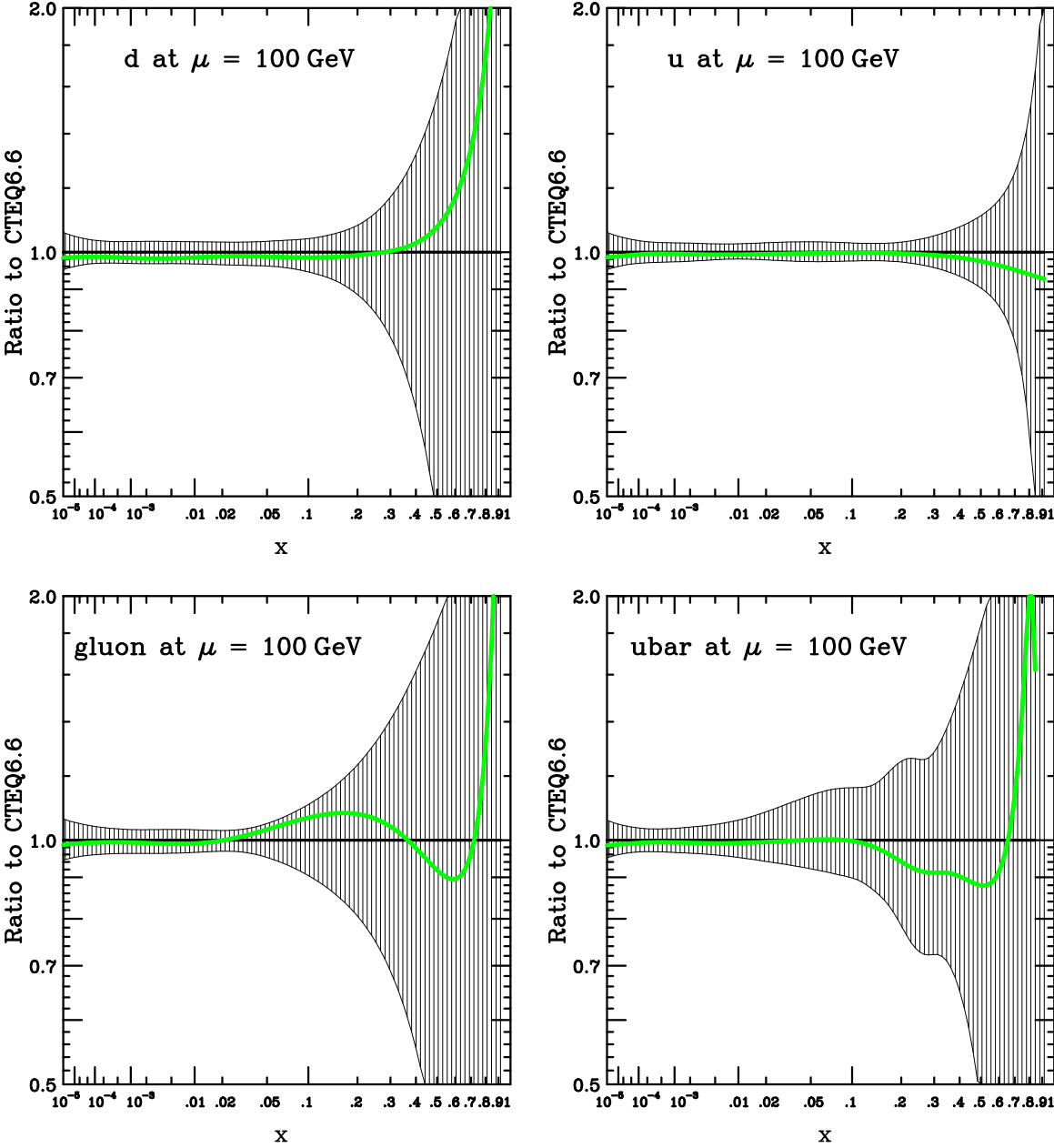
dotted = g dashed = u, d

dot dashed = $\bar{u}, \bar{d}, s = \bar{s}$ solid = c, b

Straight line behavior at small x : Regge theory

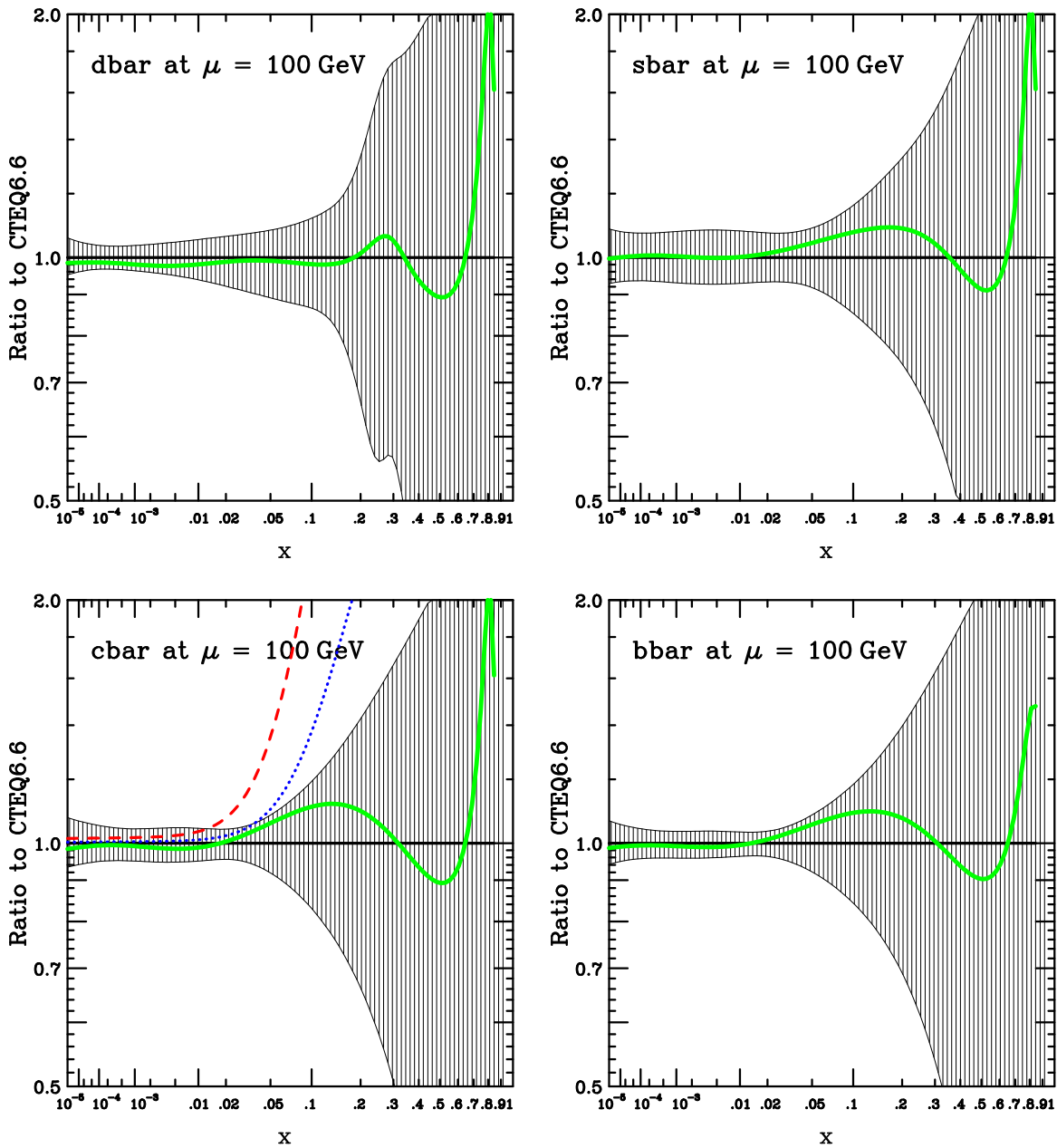
- Gluon dominant at small x
- Valence quarks dominant at large x
- Rapid fall-off at $x \rightarrow 1$ – many partons share the total momentum
- c suppressed by less than a factor of 2 compared to light sea quarks.
- b suppressed by a factor ~ 3 compared to light sea quarks.

PDF uncertainties in CTEQ6.6 at $\mu = 100$ GeV



solid = CT09 (most recent fit)

PDF uncertainties in CTEQ6.6 at $\mu = 100$ GeV

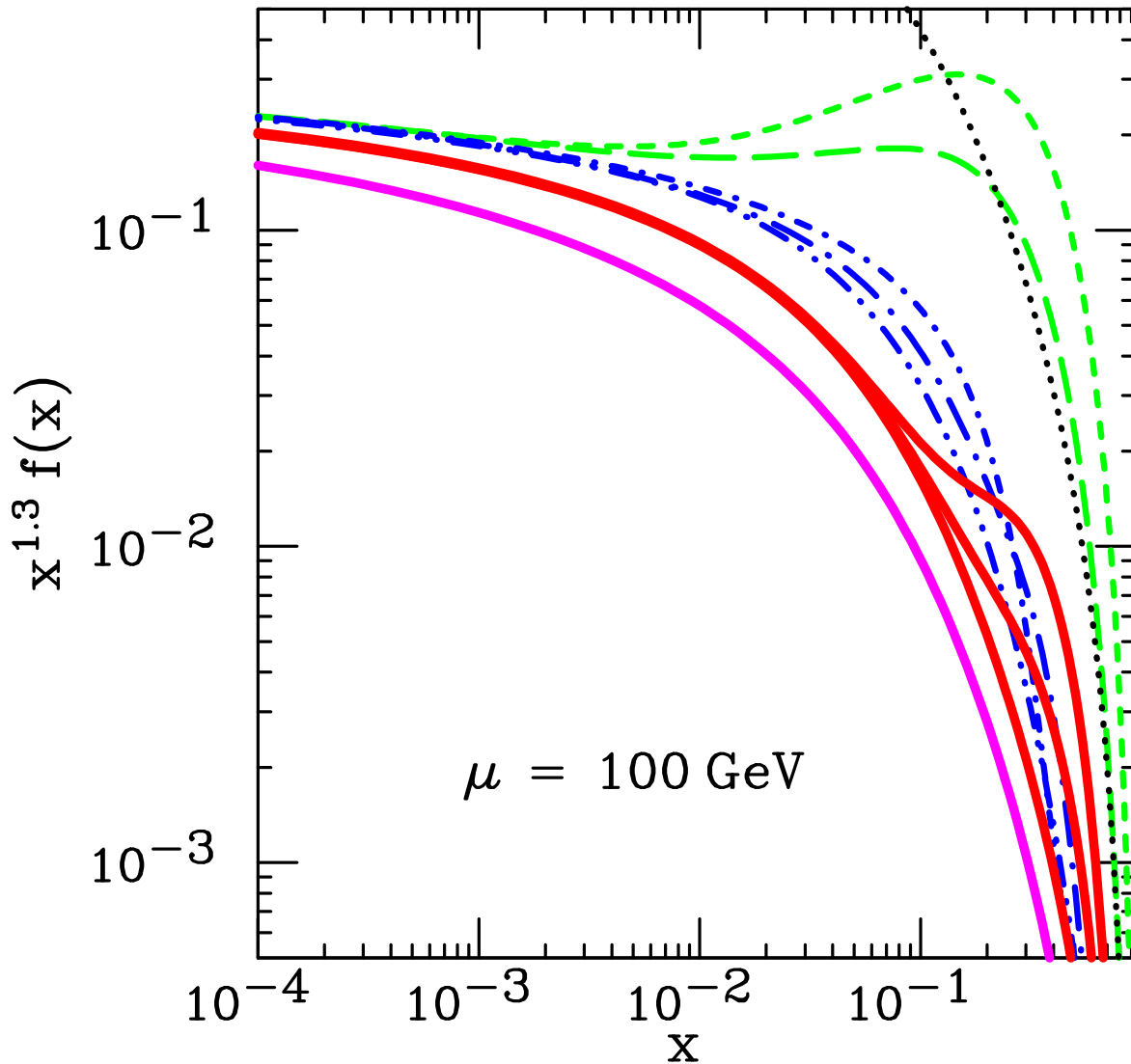


solid = CT09 (most recent fit)

dotted = CTEQ6.6 with 1% Intrinsic Charm
(consistent with estimates)

dashed = CTEQ6.6 with 3.5% Intrinsic Charm
(consistent with known constraints)

Intrinsic Charm at $\mu = 100$ GeV



dotted = g

dashed = u, d

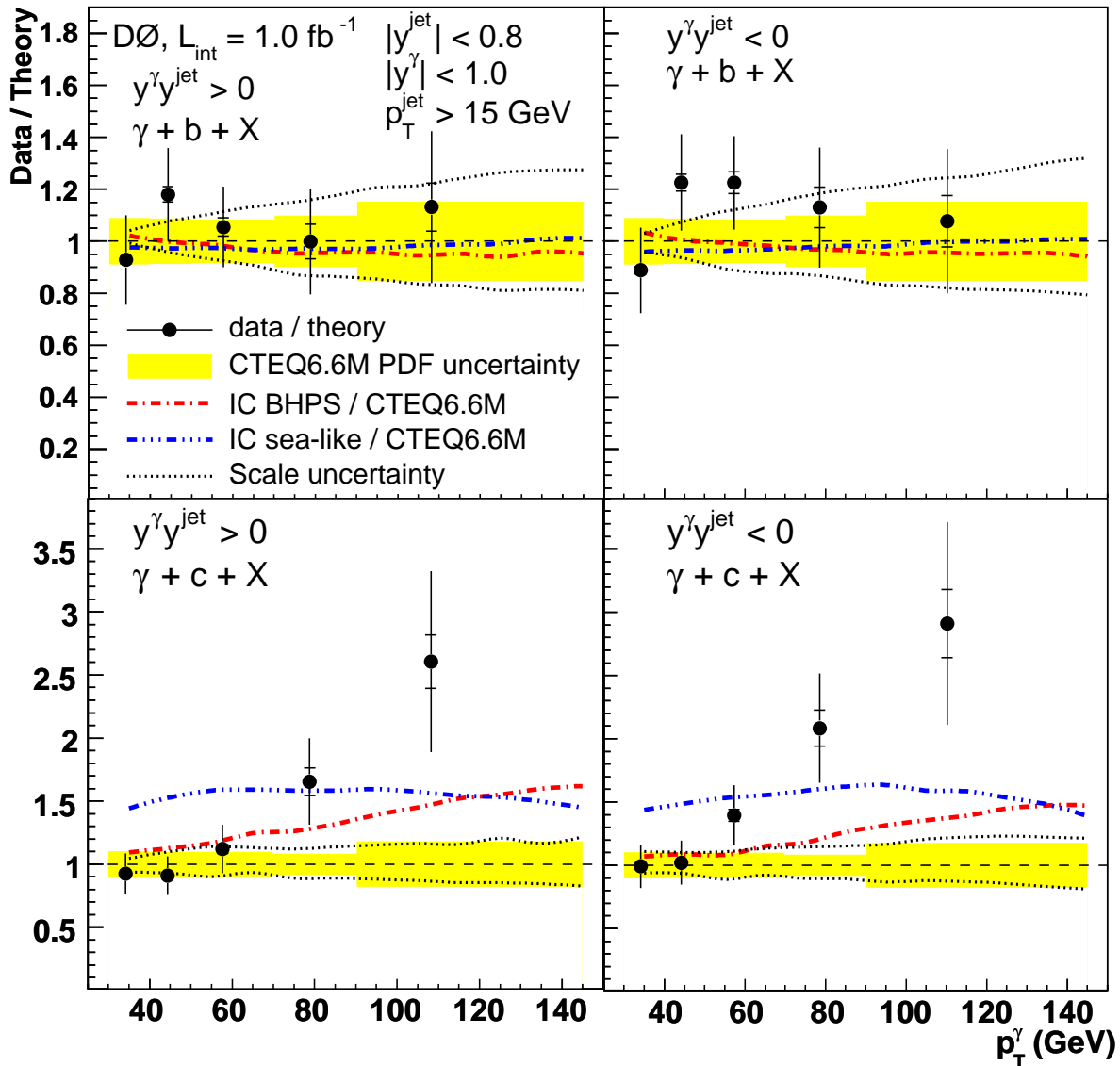
dot dashed = $\bar{u}, \bar{d}, s = \bar{s}$

solid = c (including 0, 1%, 3.5% IC from CTEQ6.6)

solid = b

In principle, Intrinsic b is also possible; but it is supposed to be suppressed at least by m_c/m_b .

Recent D0 measurements of $\gamma + b$ -jet and $\gamma + c$ -jet



- Agreement with theory is good for $\gamma + b$, so the current PDFs have the b -distribution about right.
- Data lies above theory for $\gamma + c$ at large p_T — possible evidence for non-perturbative (“intrinsic”) charm.

The evidence for IC is not overwhelming here; but some systematic errors must cancel in the ratio $\frac{\gamma + b}{\gamma + c}$