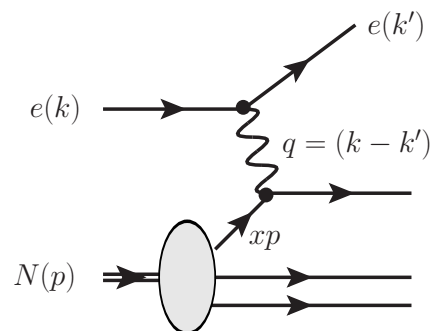
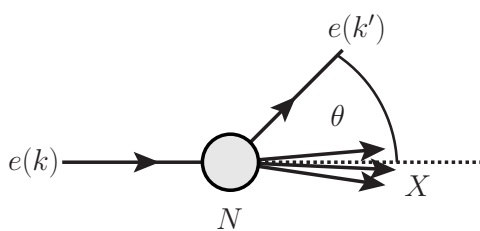


# Experimentelle Elementarteilchenphysik

Ulrich Husemann  
Humboldt-Universität zu Berlin  
Sommersemester 2009

## Tiefinelastische Streuung

- Kinematik:



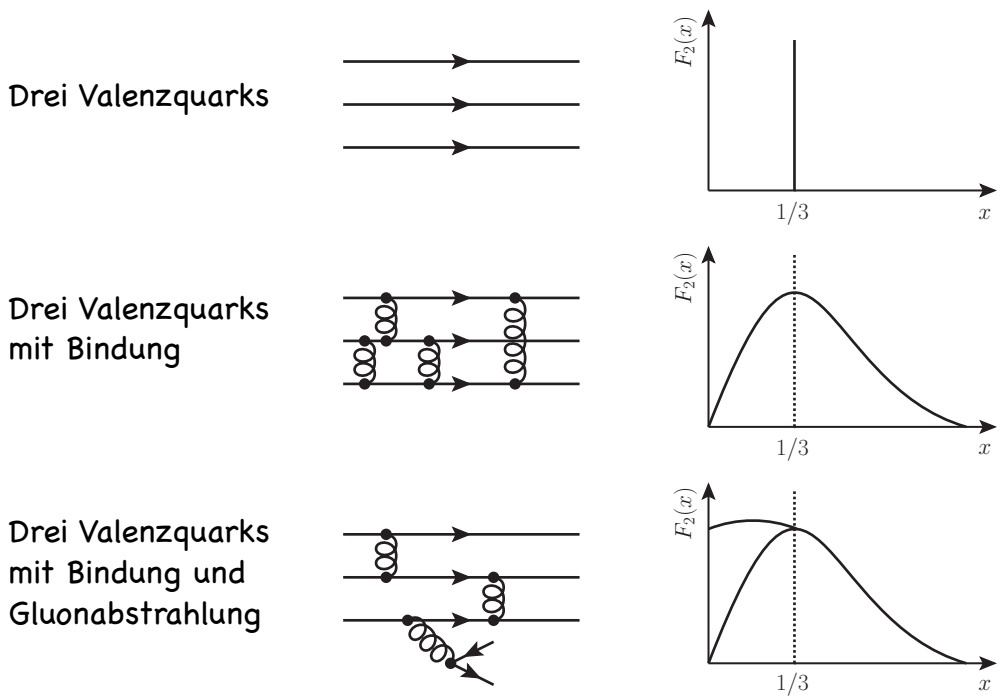
$$Q^2 := -q^2 = -(k - k')^2$$

$$\nu := \frac{p \cdot q}{m_N}$$

$$y := \frac{p \cdot q}{p \cdot k}$$

$$x_{Bj} := \frac{Q^2}{2m_N \nu} = \frac{Q^2}{2pq}$$

# Proton-Strukturfunktion $F_2$



Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 3

## QCD-Korrekturen in DIS

$$\frac{1}{x} F_2 = \left| \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \\ \text{Diagram 3} \end{array} \right|^2 + \dots$$

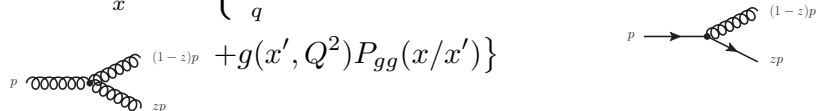
The diagrams represent different Feynman diagrams for deep inelastic scattering (DIS) at order  $\alpha_s^2$ . Diagram 1 is the leading-order process. Diagrams 2 and 3 show corrections involving gluon exchange and gluon emission.

● DGLAP-Evolutionsgleichungen:

$$\frac{dq(x, Q^2)}{d \ln Q^2} = \frac{\alpha_S(Q^2)}{2\pi} \int \frac{dx'}{x'} \{ q(x', Q^2) P_{qq}(x/x') + g(x', Q^2) P_{qg}(x/x') \}$$



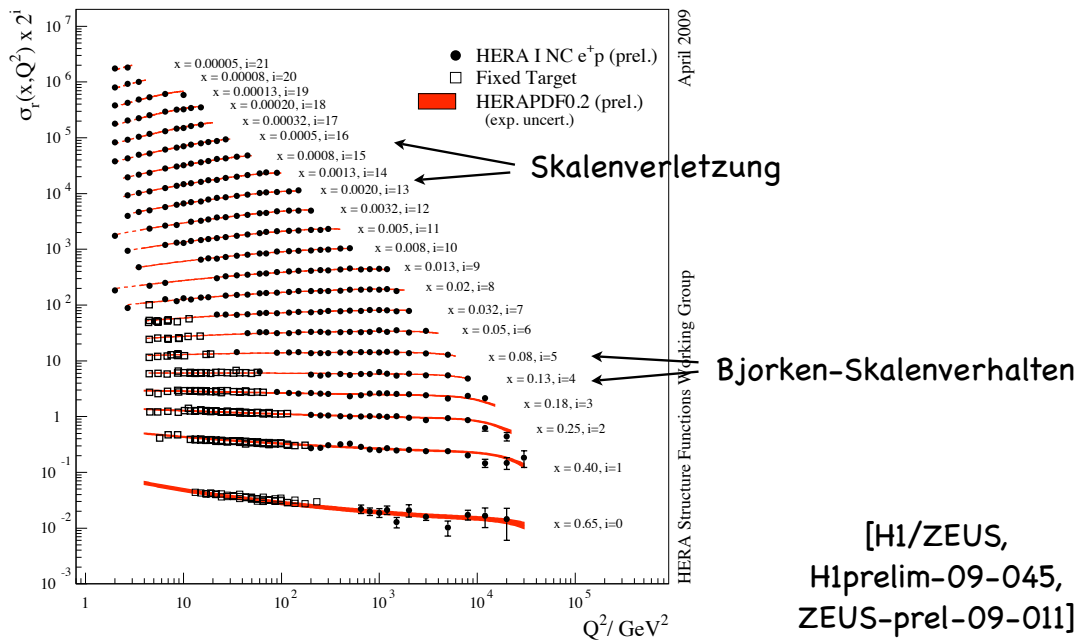
$$\frac{dg(x, Q^2)}{d \ln Q^2} = \frac{\alpha_S(Q^2)}{2\pi} \int \frac{dx'}{x'} \left\{ \sum_q [q(x', Q^2) + \bar{q}(x', Q^2)] P_{gq}(x/x') + g(x', Q^2) P_{gg}(x/x') \right\}$$



Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 4

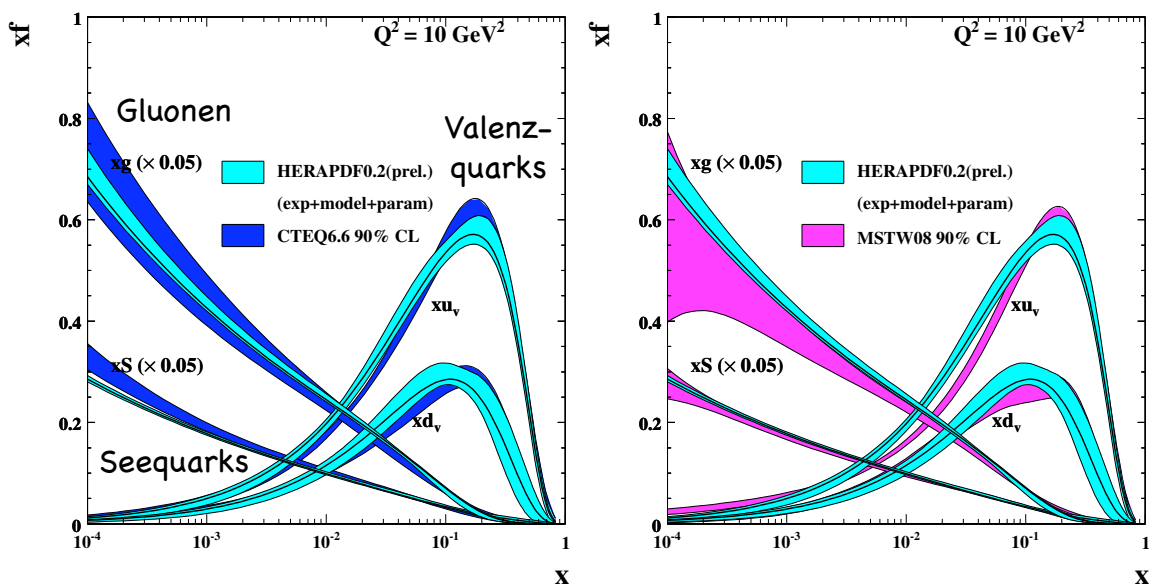
# Messungen von $F_2$

H1 and ZEUS Combined PDF Fit



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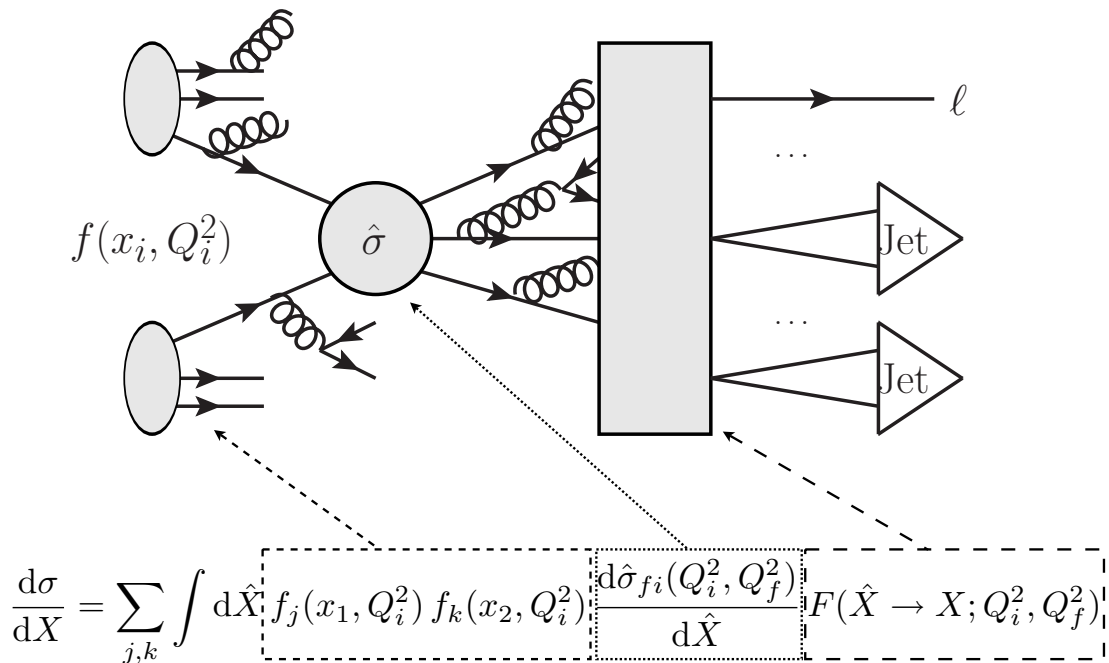
# Partonverteilungen



[H1/ZEUS, H1prelim-09-045, ZEUS-prel-09-011]

Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 6

# QCD-Faktorisierung



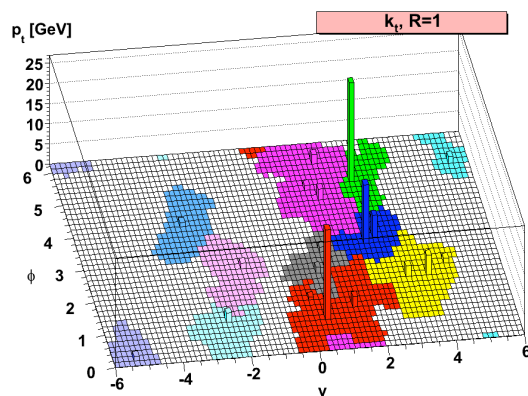
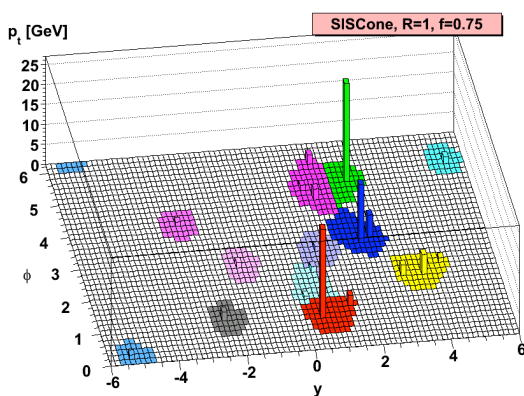
Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 7

# Jet-Algorithmen

$$\Delta_{ij} = \sqrt{(y_i - y_j)^2 + (\phi_i - \phi_j)^2} < R$$

Kegelalgorithmus (R=1)

Rekombinationsalgorithmus (R=1)

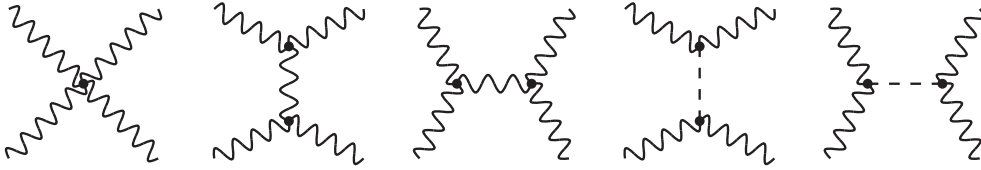


[M. Cacciari, G. P. Salam, G. Soyez, JHEP 04 (2008) 063]

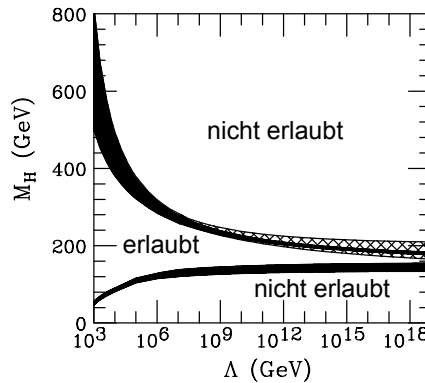
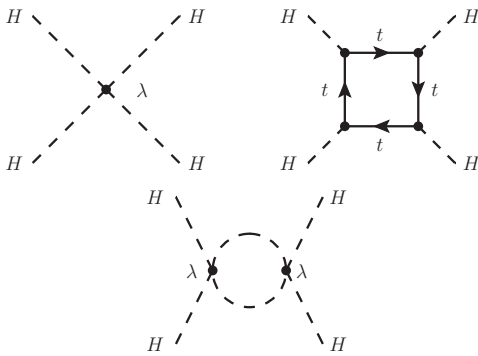
Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 8

# Higgs-Massenschranken

Streuung longitudinaler  $W^+W^-$



Higgs-Selbstkopplung

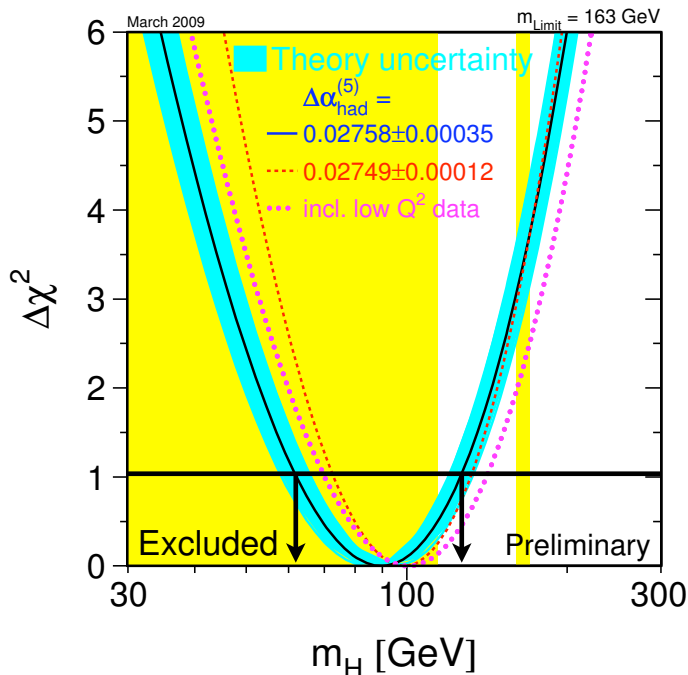


[T. Hambye, K. Riesselmann,  
Phys. Rev. D55 (1997), 7255]

Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung

9

# Blue-Band-Plot

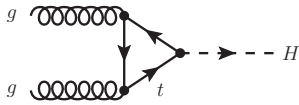


[<http://lepewwg.web.cern.ch/LEPEWWG/>]

Exp. Elementarteilchenphysik (P23.1.1), HU Berlin, Sommersemester 2009, 11. Vorlesung 10

# Higgs-Produktion: Tevatron

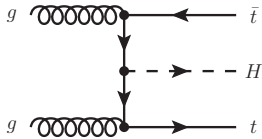
Gluon-Gluon-Fusion



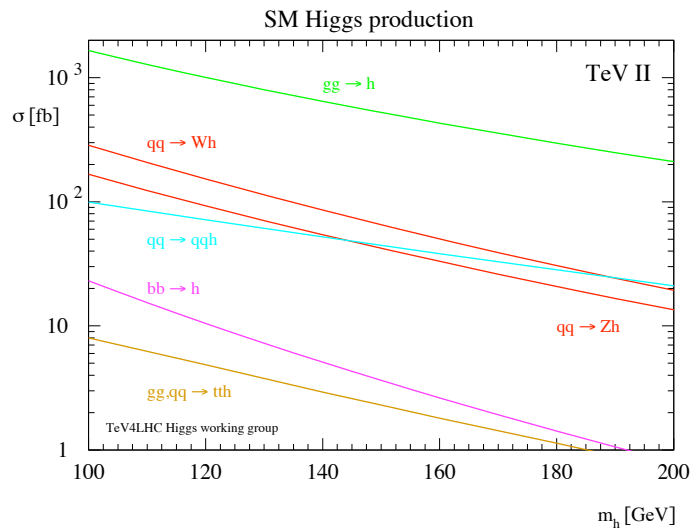
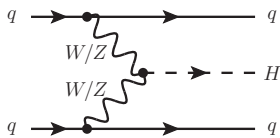
Assoziierte Produktion



Assoziierte Produktion



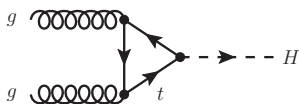
Vektorboson-Fusion



[<http://maltoni.home.cern.ch/maltoni/TeV4LHC/index.html>]

# Higgs-Produktion: LHC

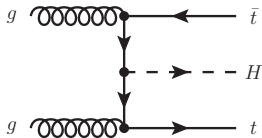
Gluon-Gluon-Fusion



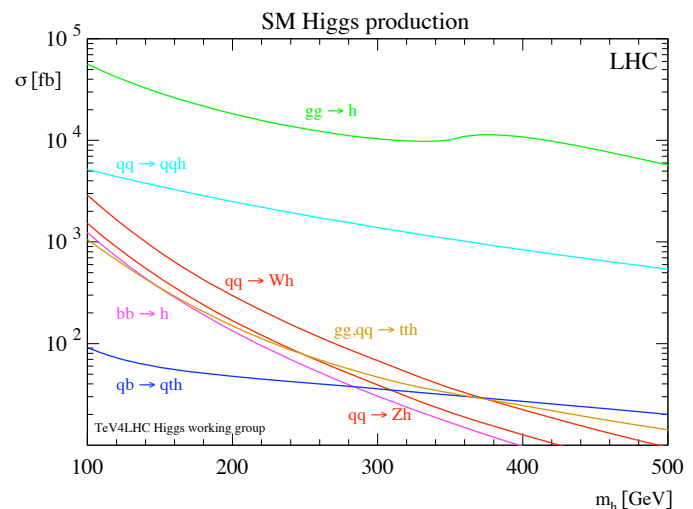
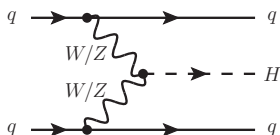
Assoziierte Produktion



Assoziierte Produktion



Vektorboson-Fusion



[<http://maltoni.home.cern.ch/maltoni/TeV4LHC/index.html>]