

HERA and Cosmic Rays

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Outline

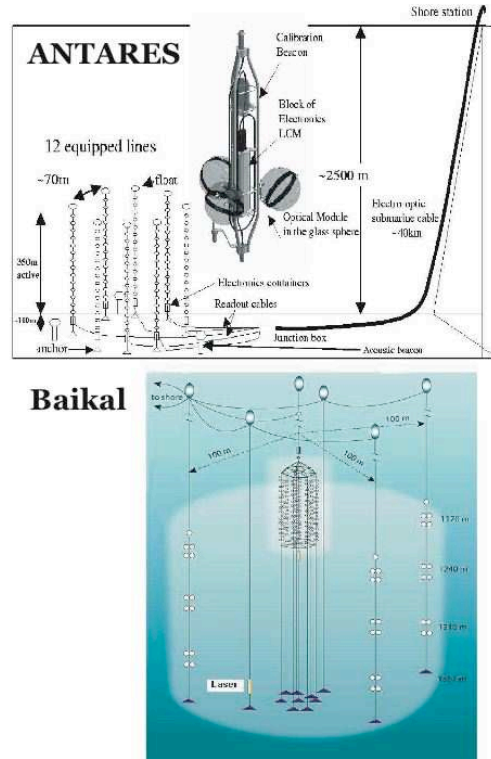
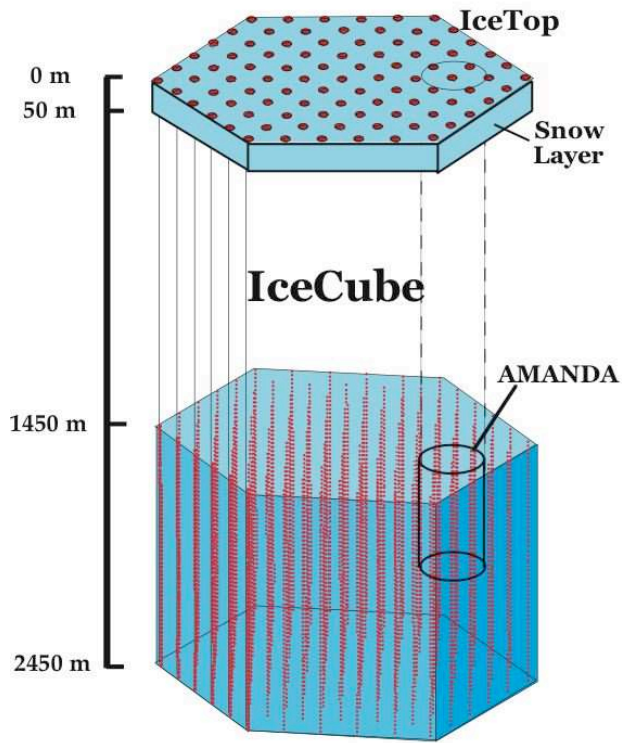
ZEUS, HI-Det. at HERA

Cosmic Rays at very high Energy

Photons and Neutrinos

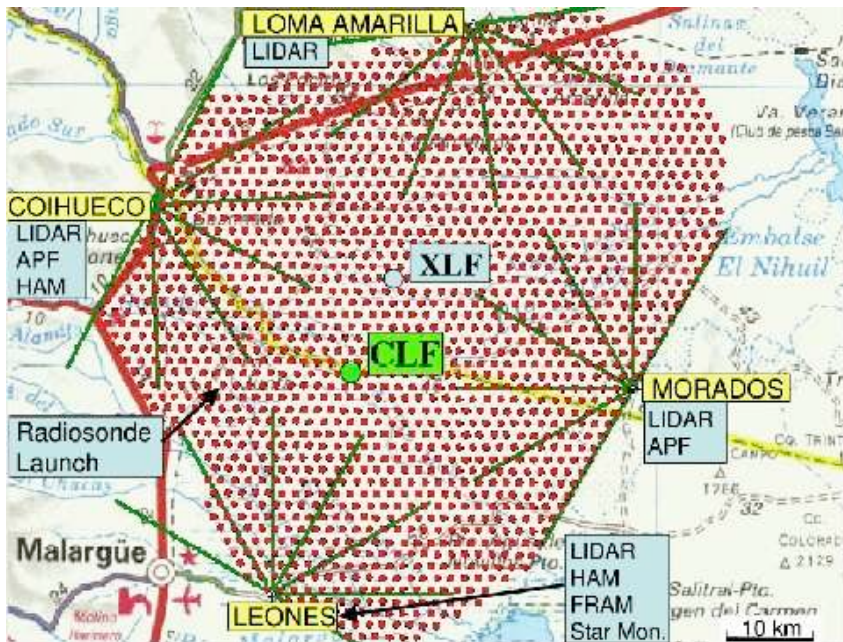
x-sections vs. energy

Active CR Experiments



Water-Tscherenkov Experiments

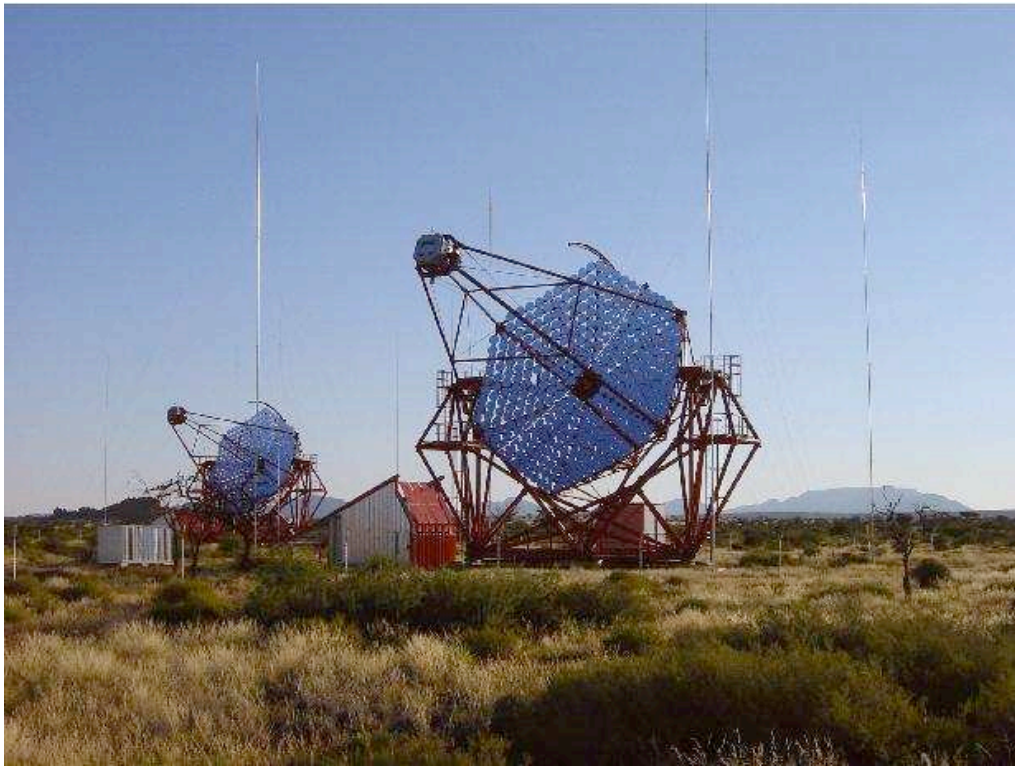
Neutrino Detectors - active and in the near Future



AUGER South

Hadrons
Photons
Neutrinos

In particular for zenith angles larger than 70 degrees
a contribution from very high energy neutrinos
is HOPED for (expected)



TeV Astronomy
less than
80 Tev photons
(from CRAB)
and larger 80GeV

H.E.S.S. in Namibia

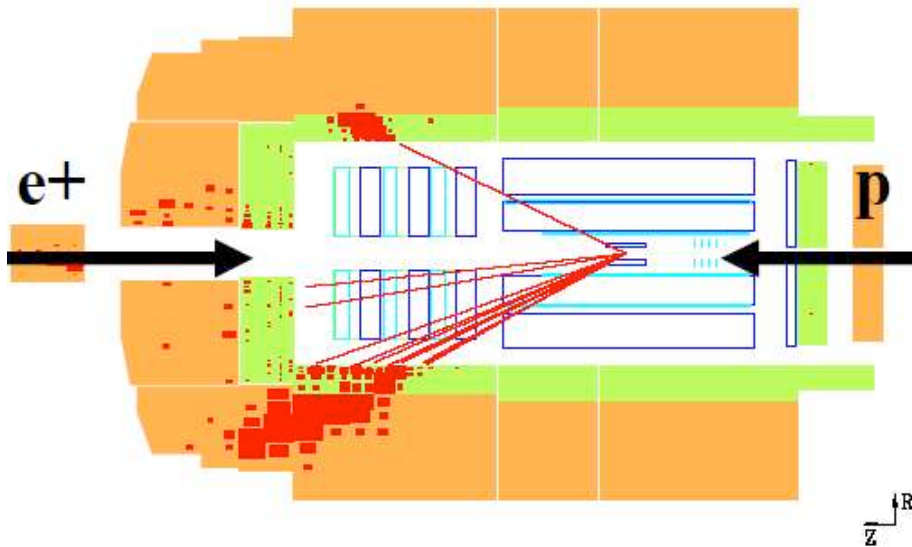


MAGIC at LaPalma

Very successful, more than 40 sources found recently

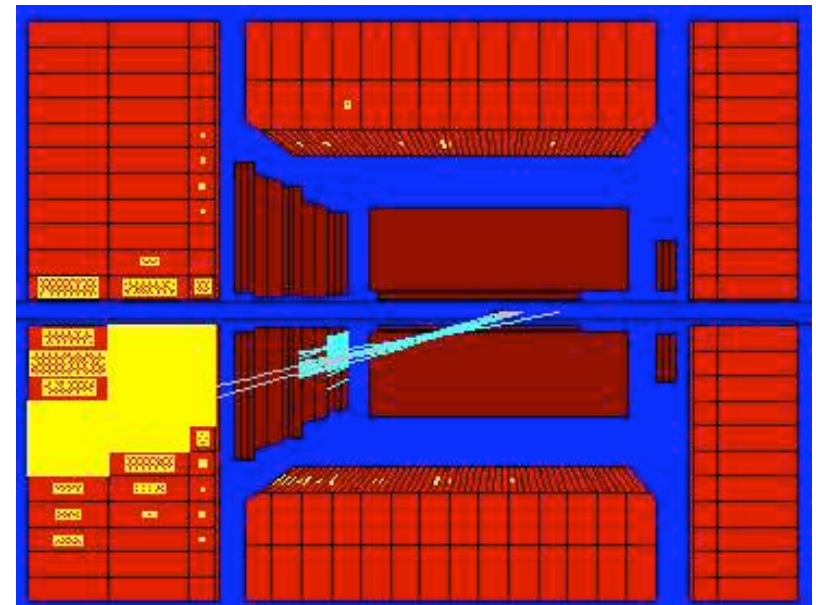
HI Detector

Neutral Current (NC)



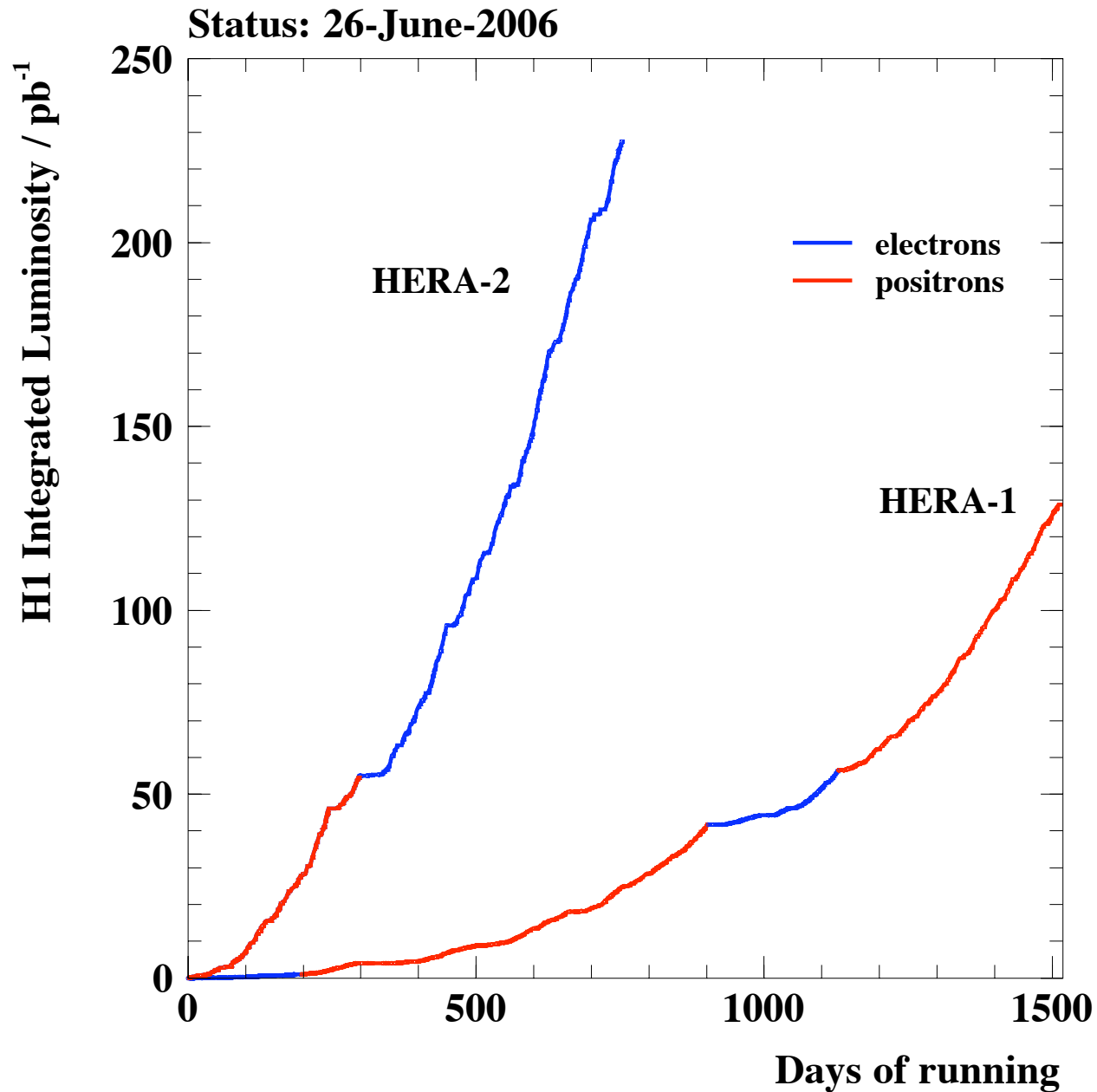
ZEUS Detector

Charged Current (CC)

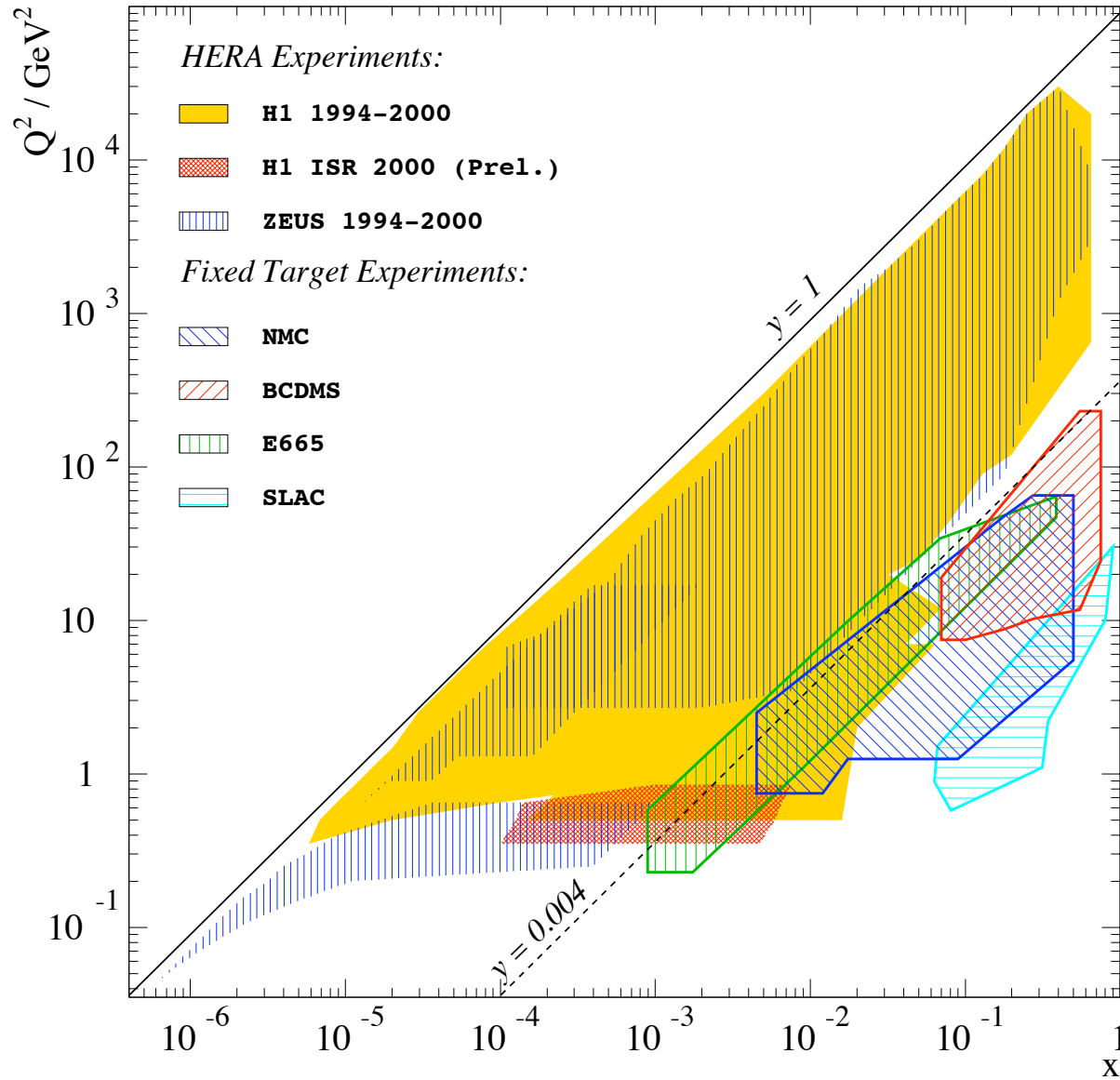


long. polarised $e(-)(+)$ at 27,6GeV on p of 920Gev

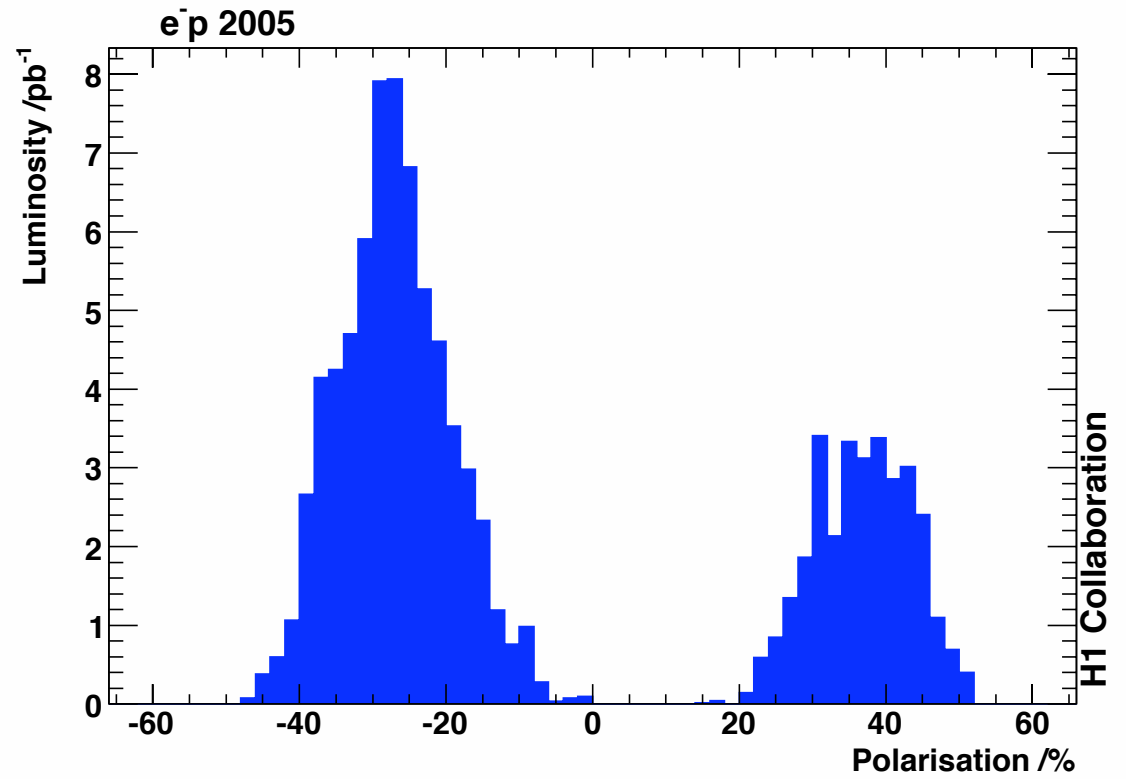
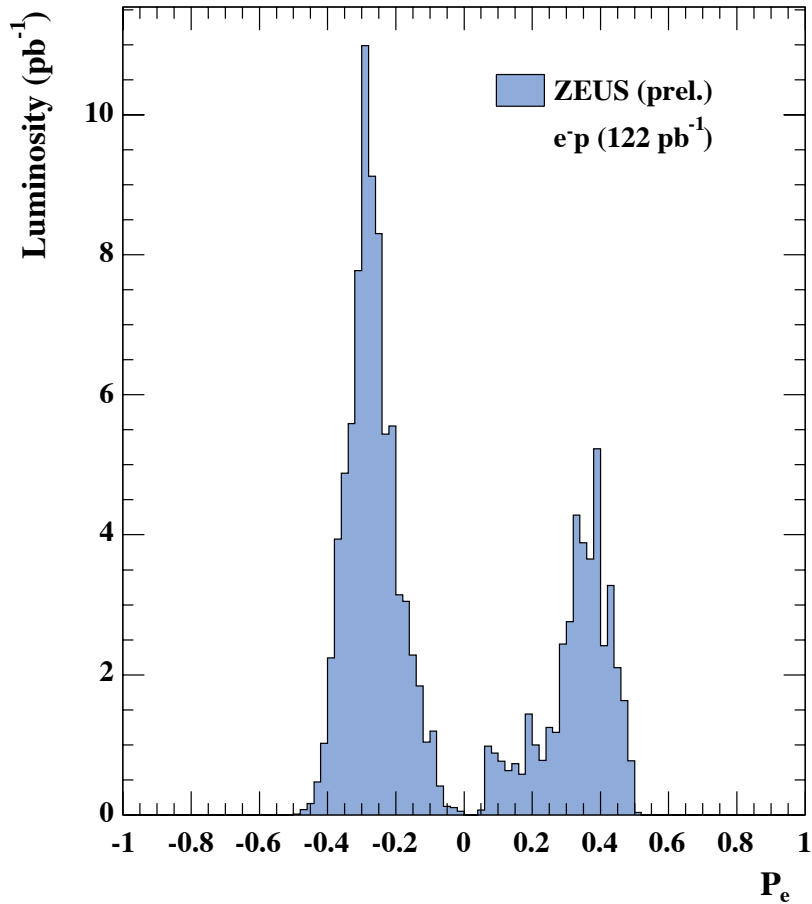
Luminosity collected until recently



kinematic range covered in x and Q(2)

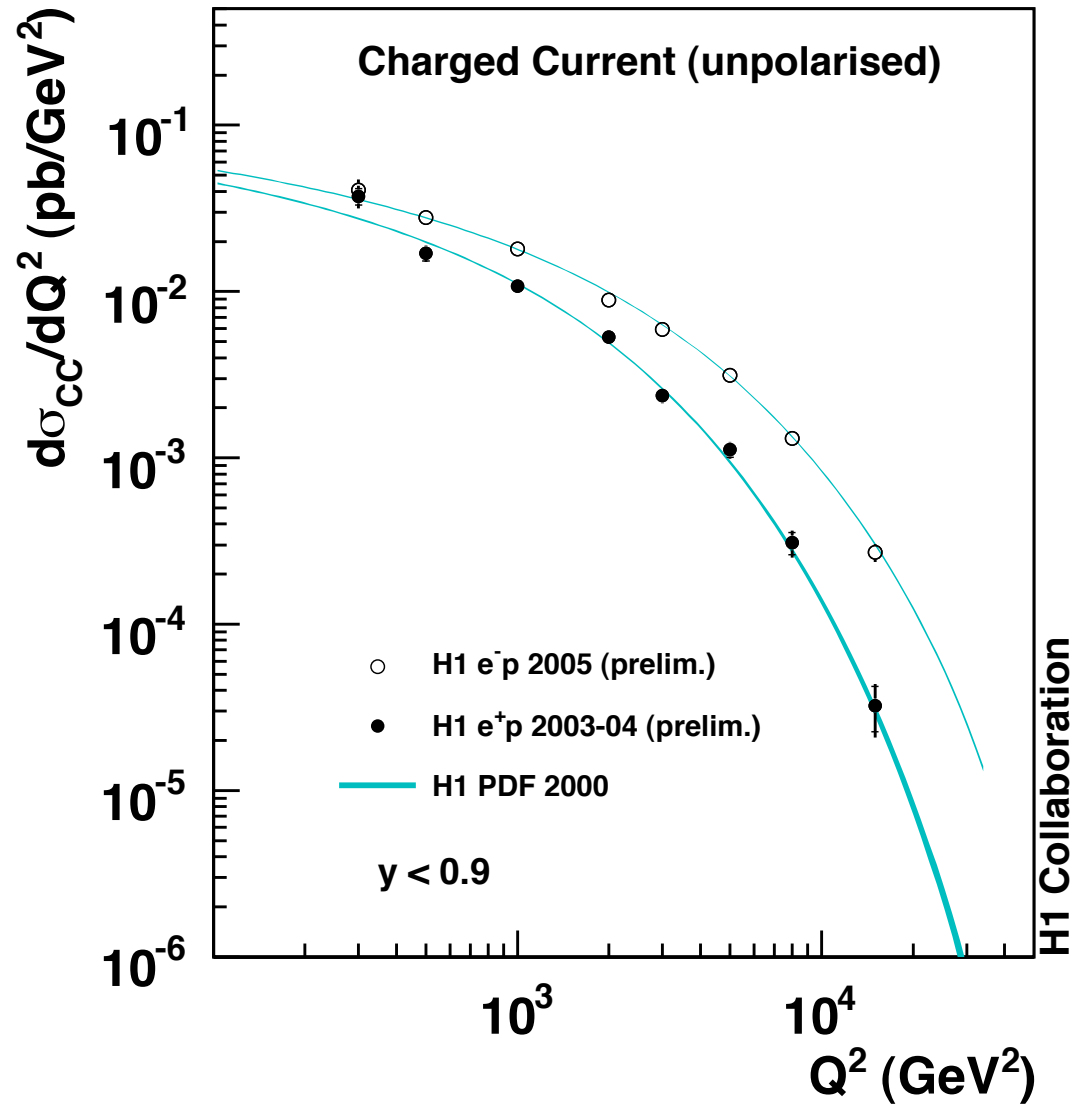
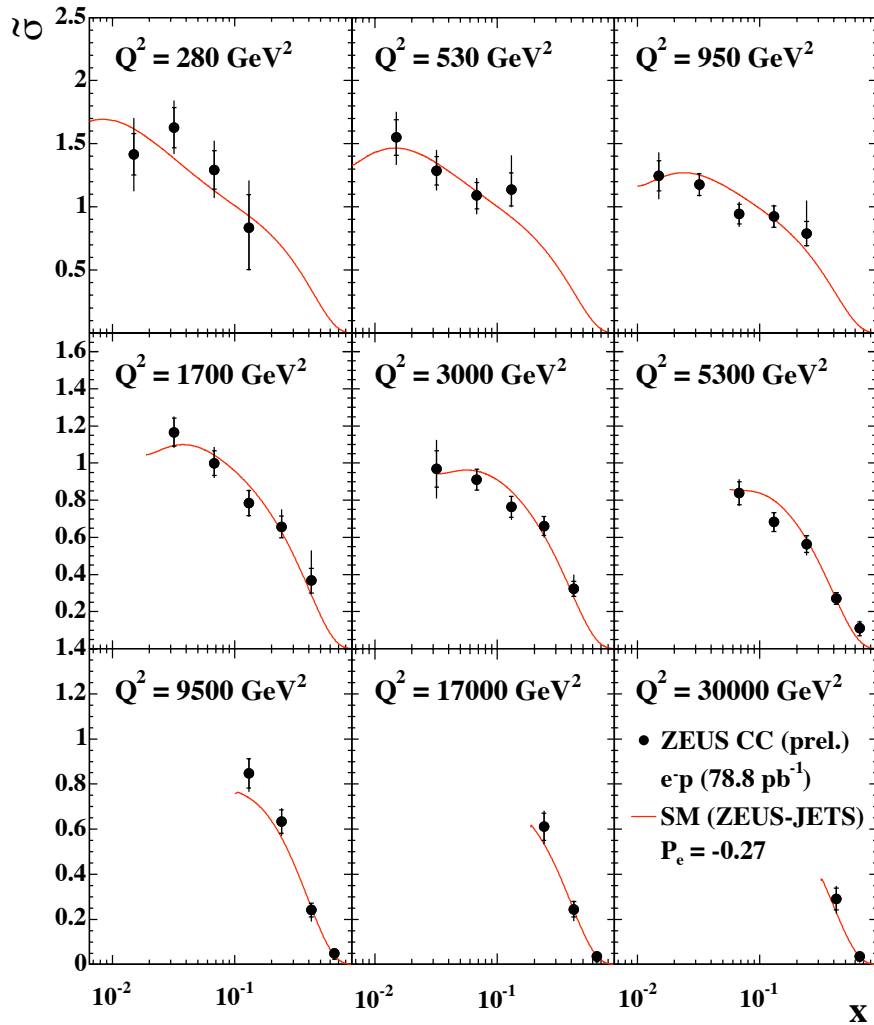


ZEUS

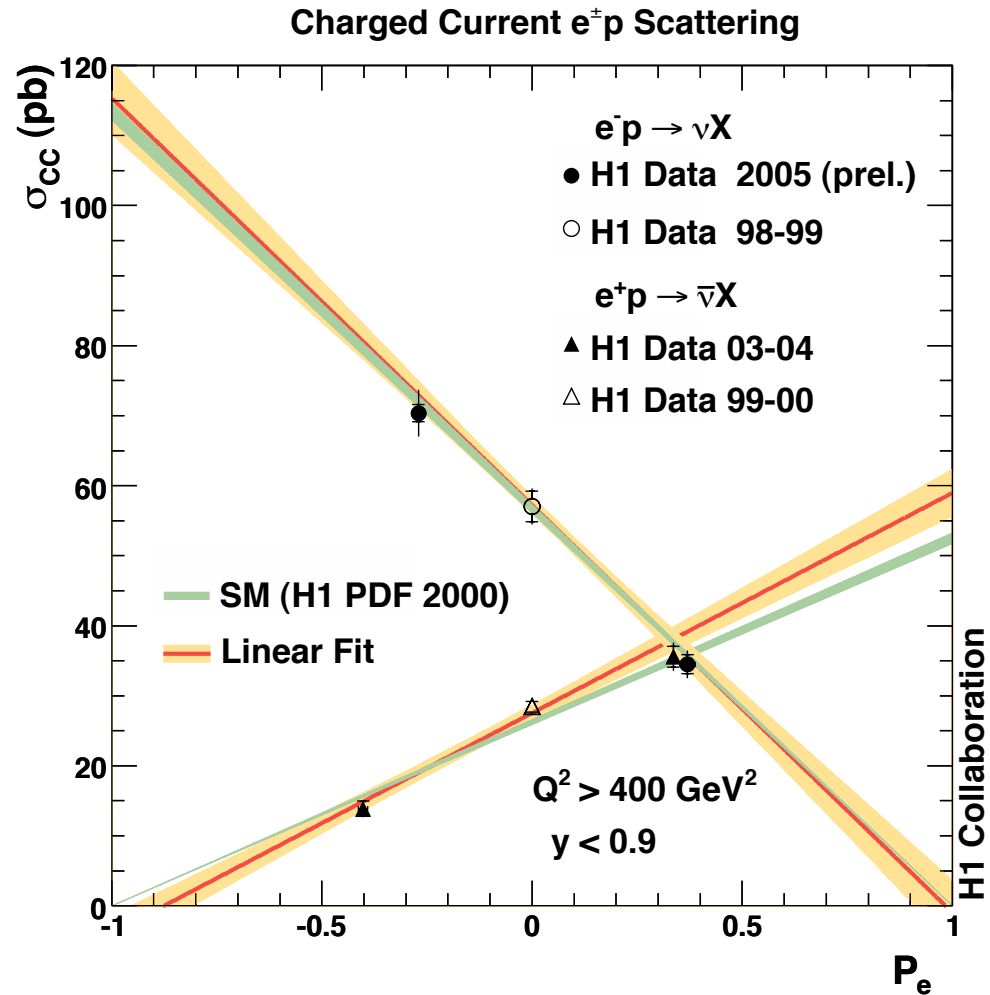
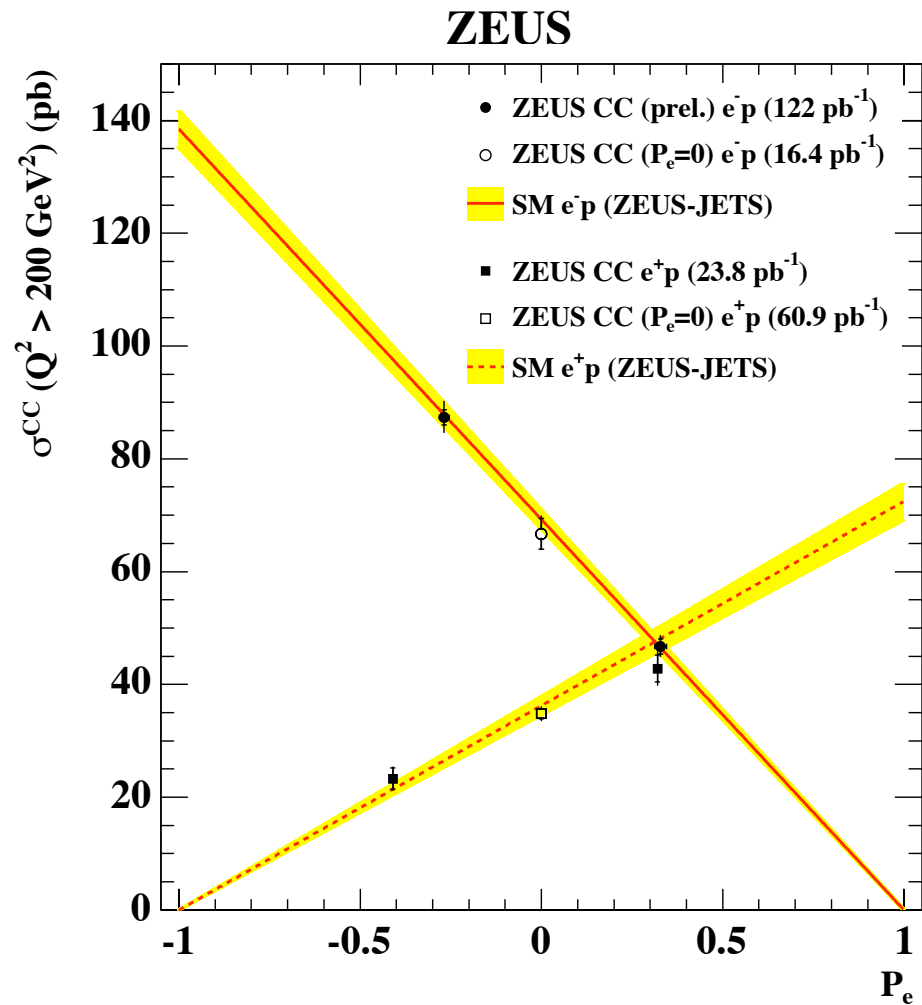


e(-) long. polarisation for ZEUS and H1

ZEUS

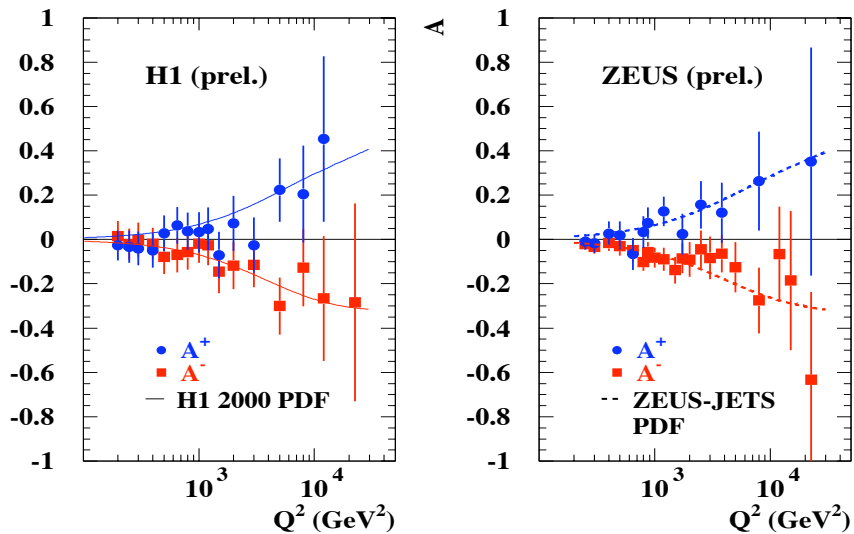


charged current structure functions
and pdf fits (ZEUS and H1)

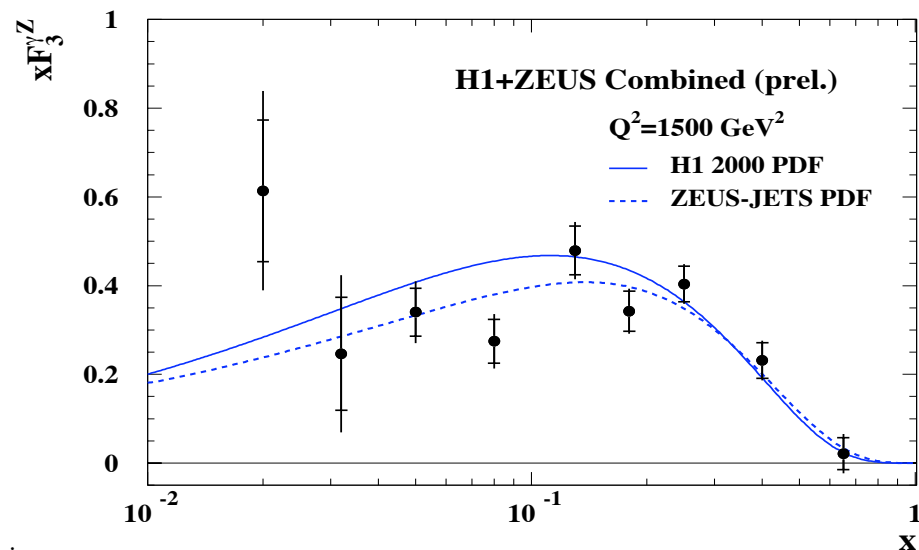
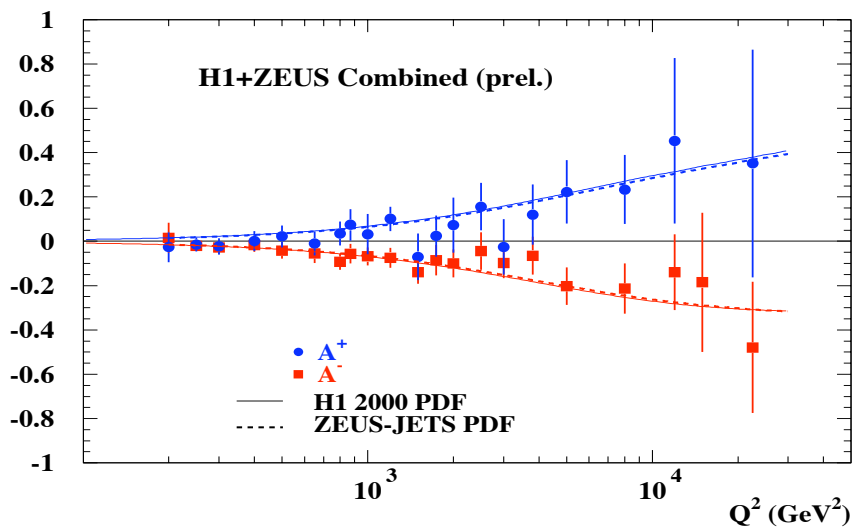
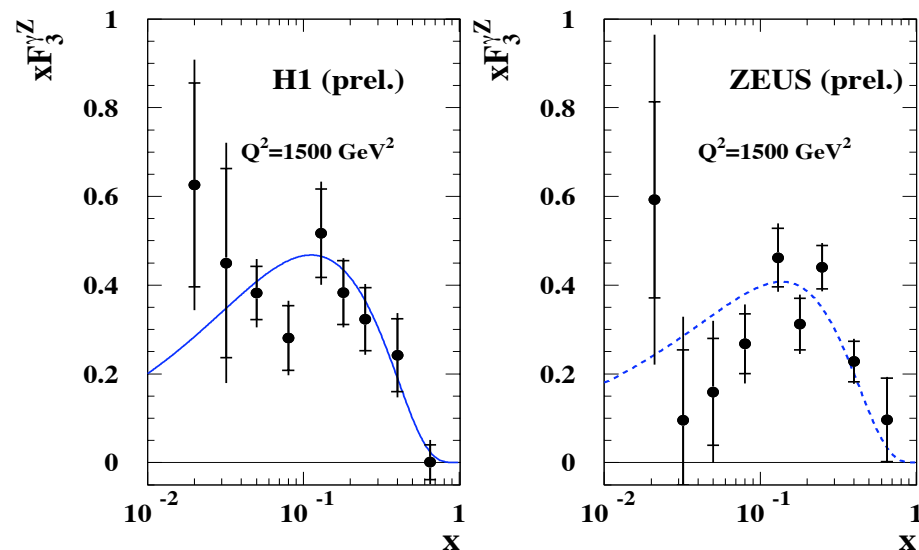


polarisation dependend charged current x-sections
at HERA for ZEUS and H1

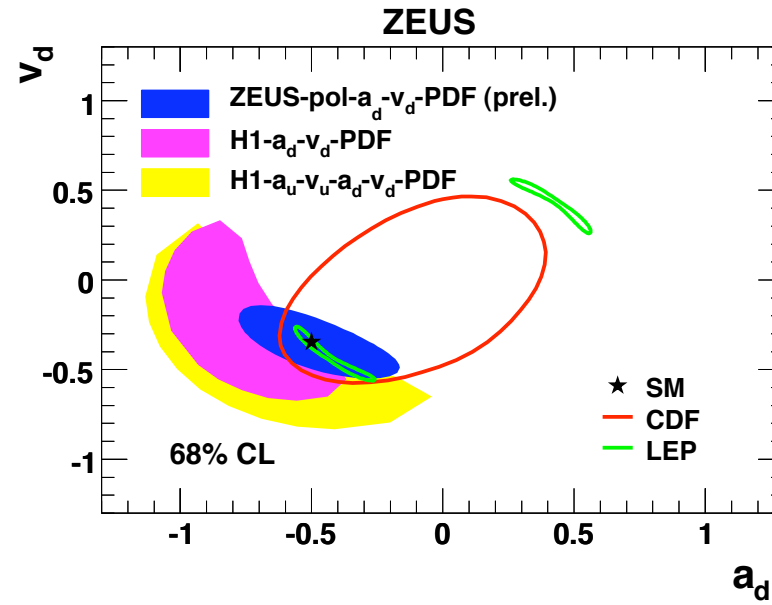
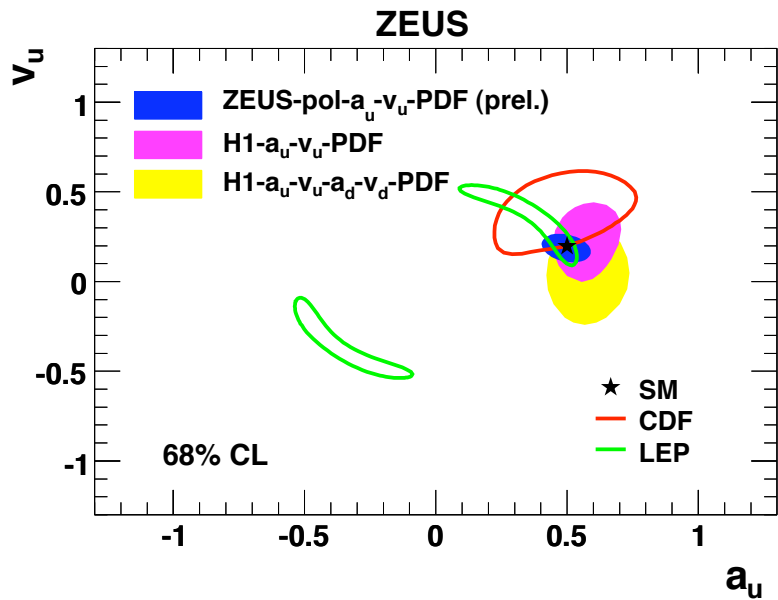
HERA



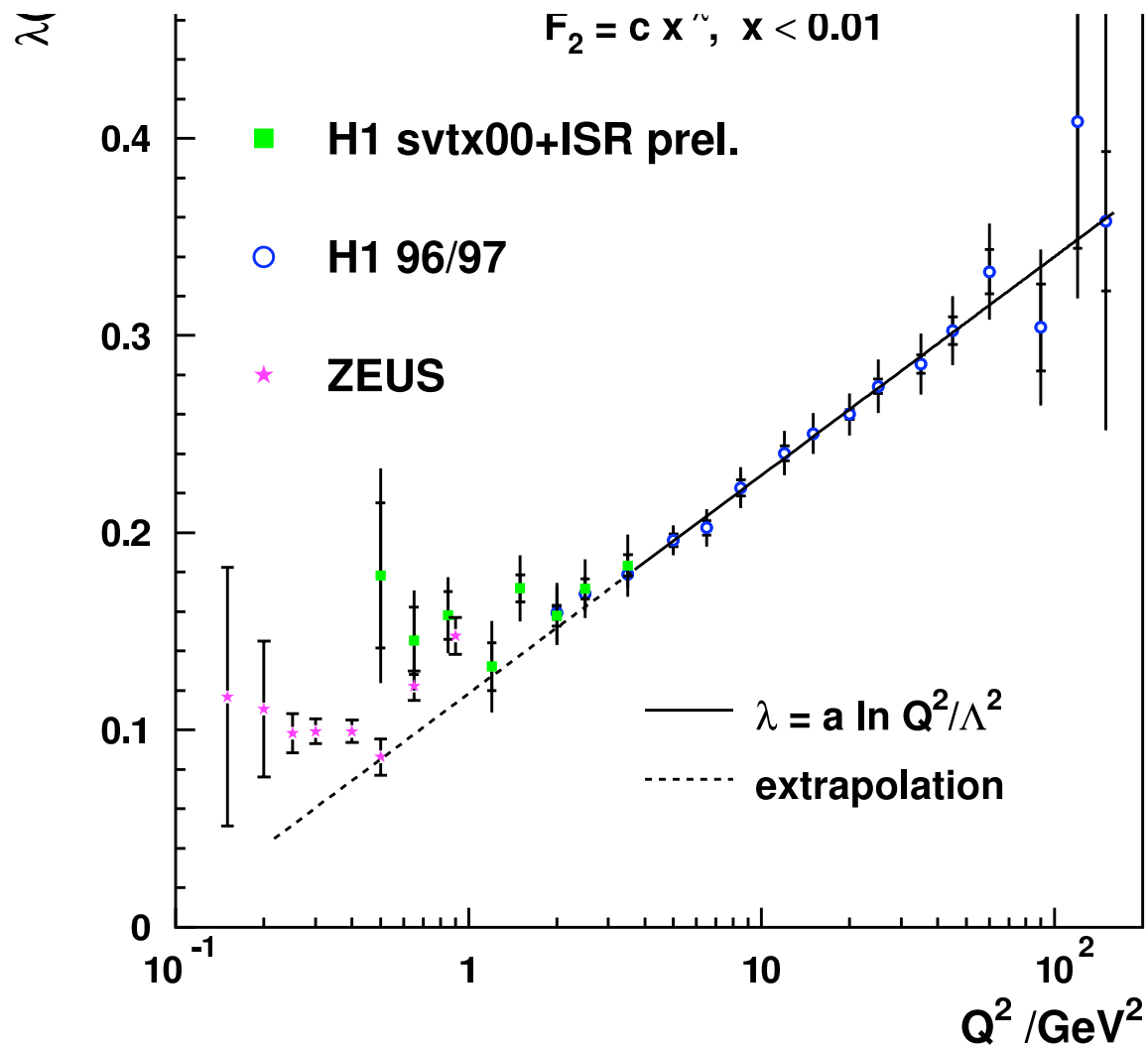
HERA

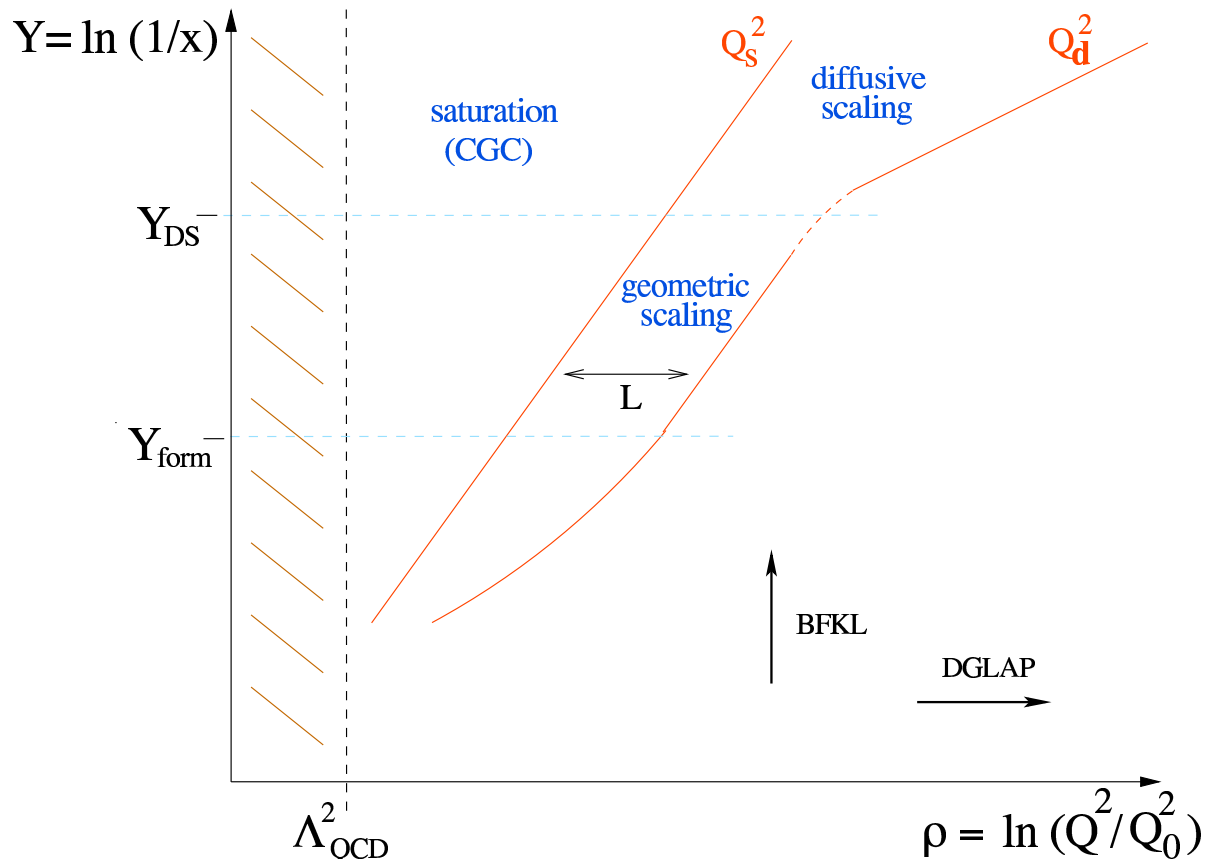


Pol. dependence of neutral current scattering

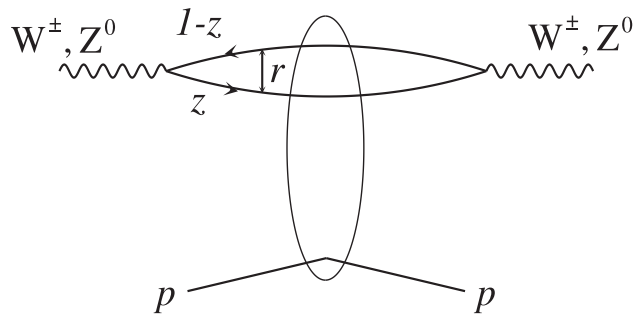


weak couplings of u,d quarks
from PDF's at HERA



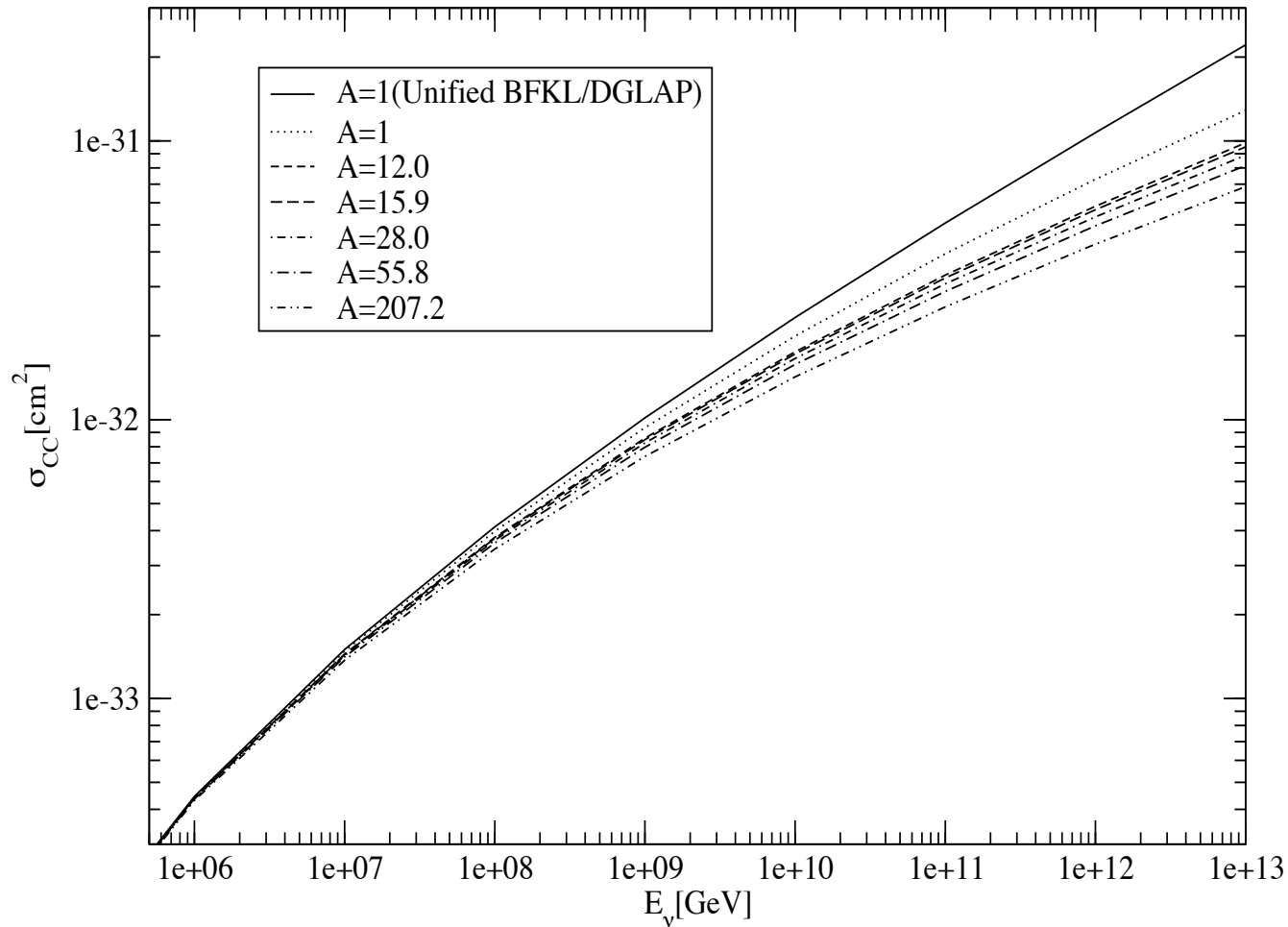


for extrapolations to very high energies from the HERA x-range a quantitative understanding of the data on the basis of well defined physical models is required



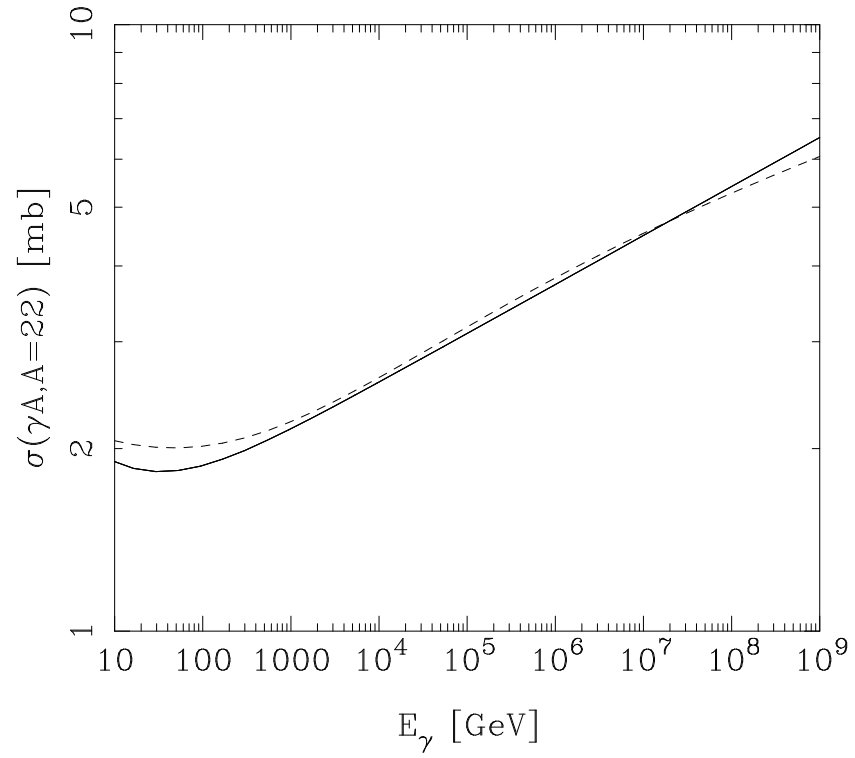
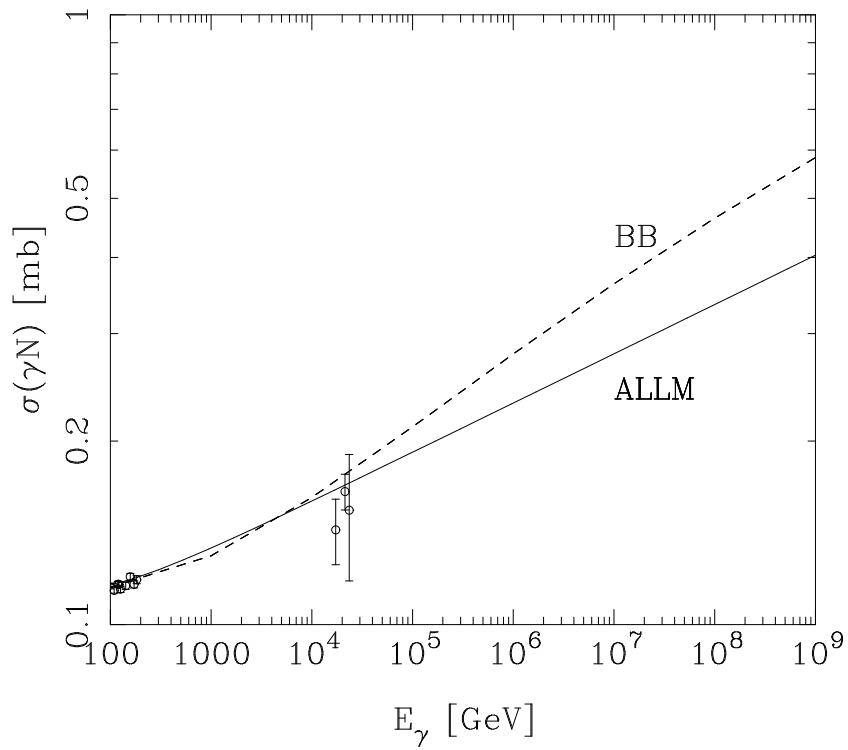
Color Dipole Model

commonly used to extrapolate photon and neutrino x-sections to very high energies



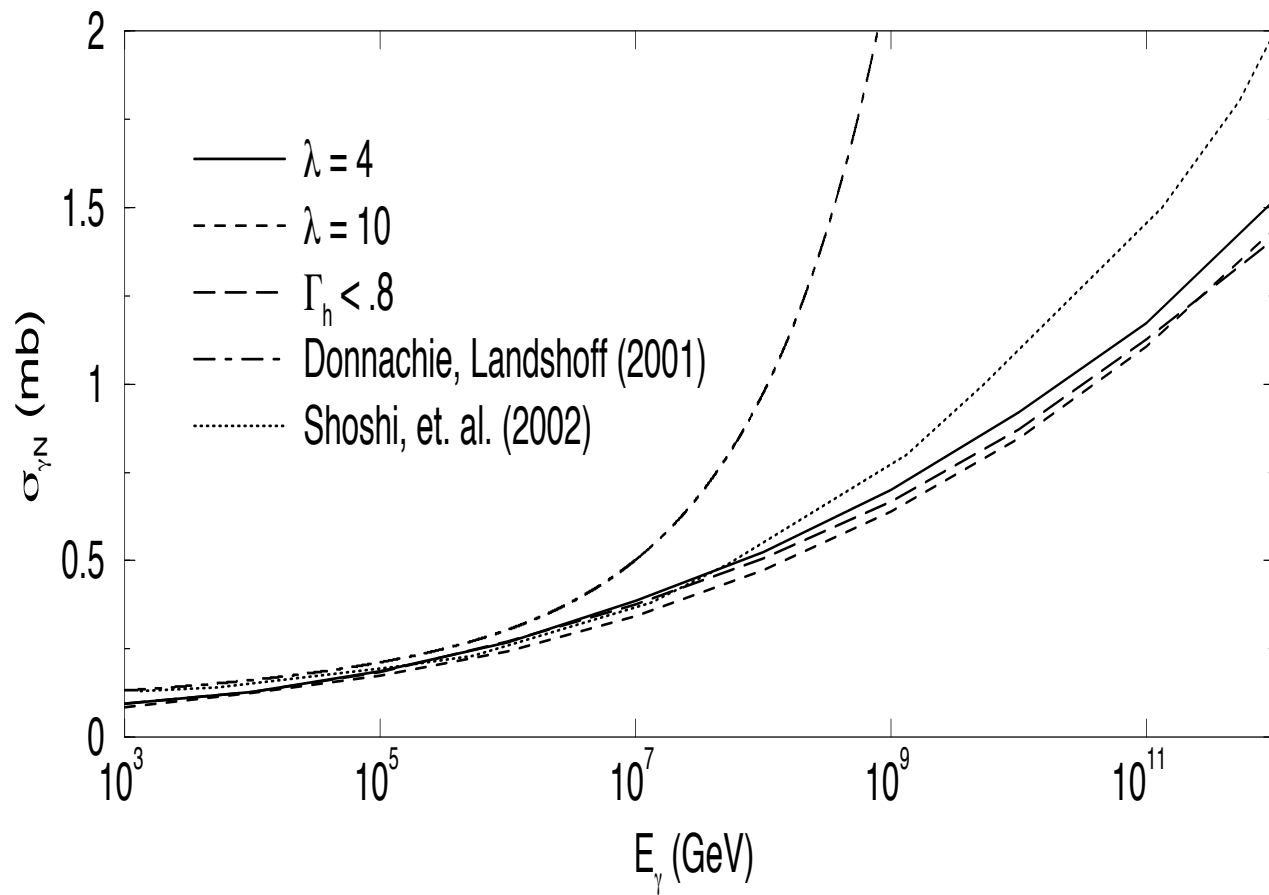
Neutrino x-section extrapolated to very high energy (considering screening effects)

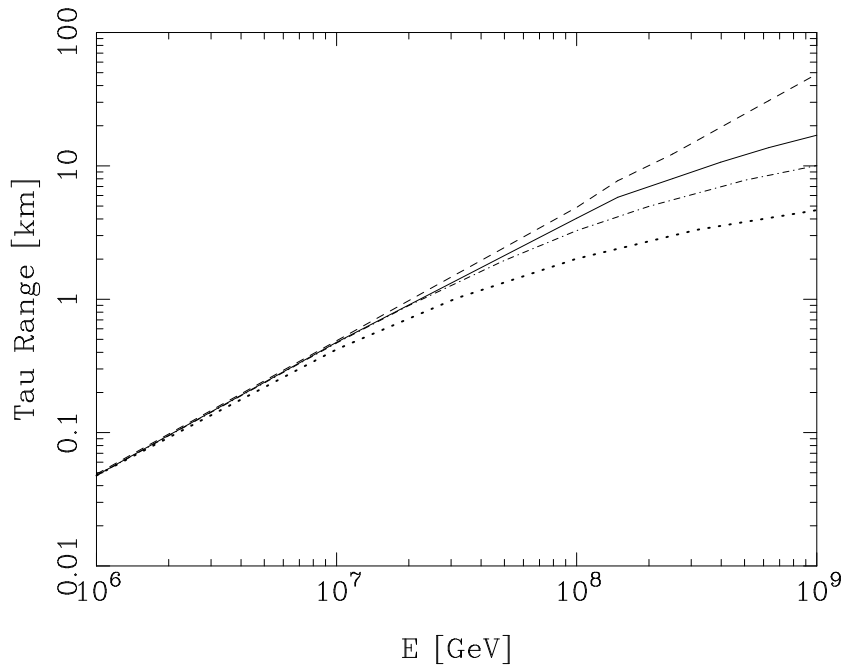
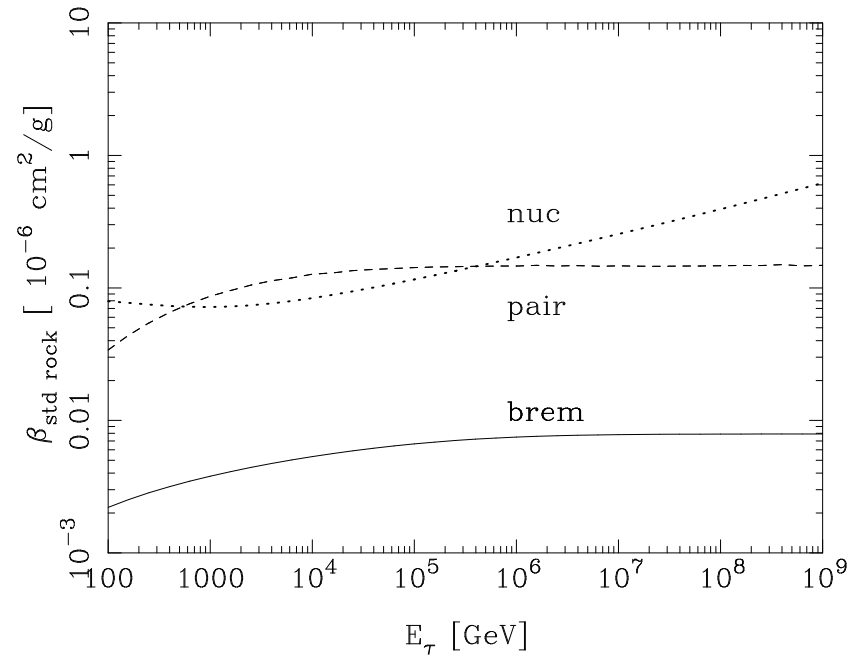
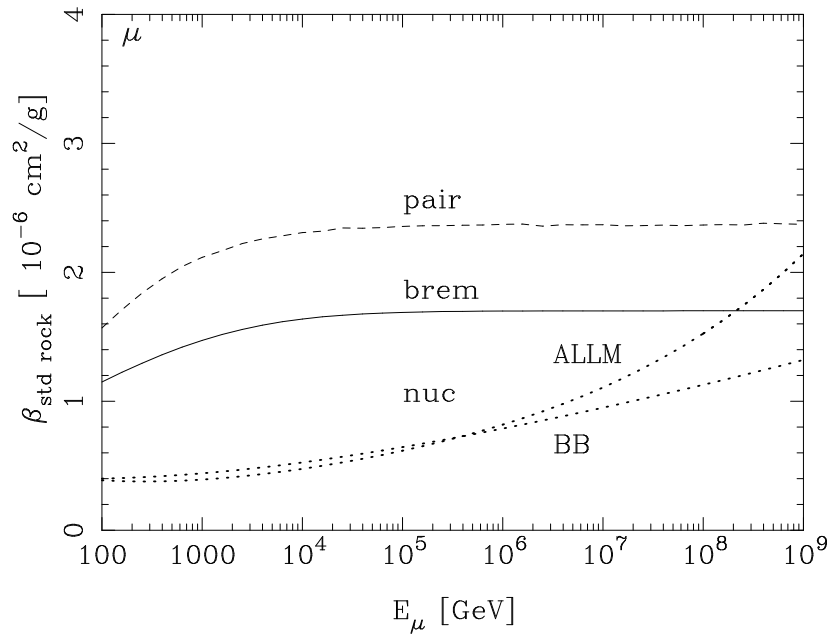
FIGURES



total photoproduction x-section from HERA
and extrapolations to very high energies

γ -proton cross section





**energy loss of muons
 and taus
 extrapolated to
 very high energies**

HERA data on PDF's provide a firm basis
for extrapolations to the highest energies

both for photons
and neutrinos

CR detections at the highest
energies
would provide interesting
constraints on the physics
at HERA