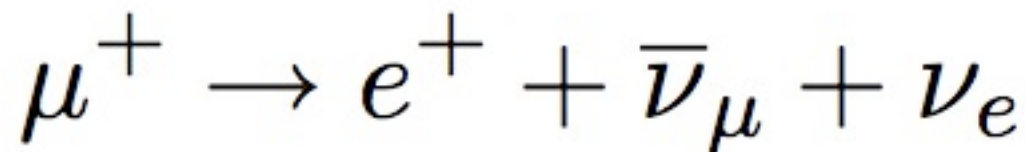
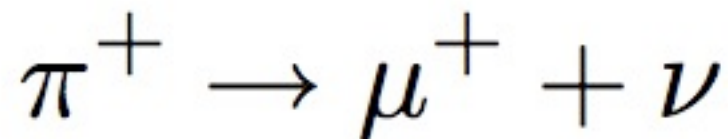
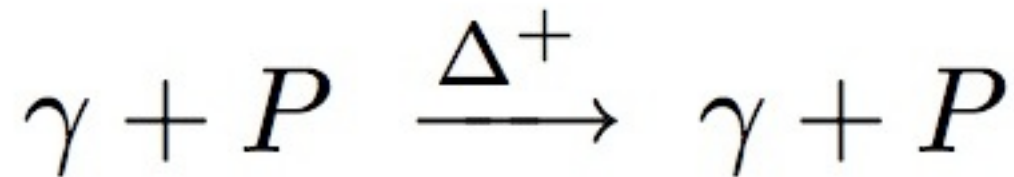
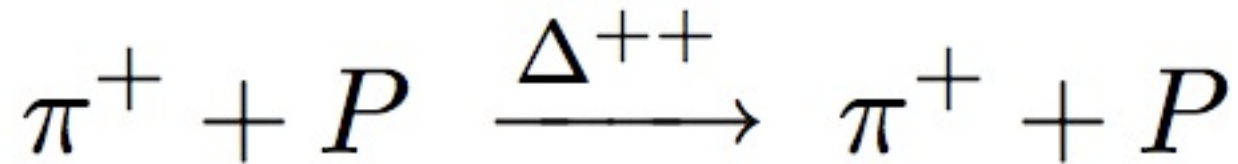


# Experiments of the last 60 years

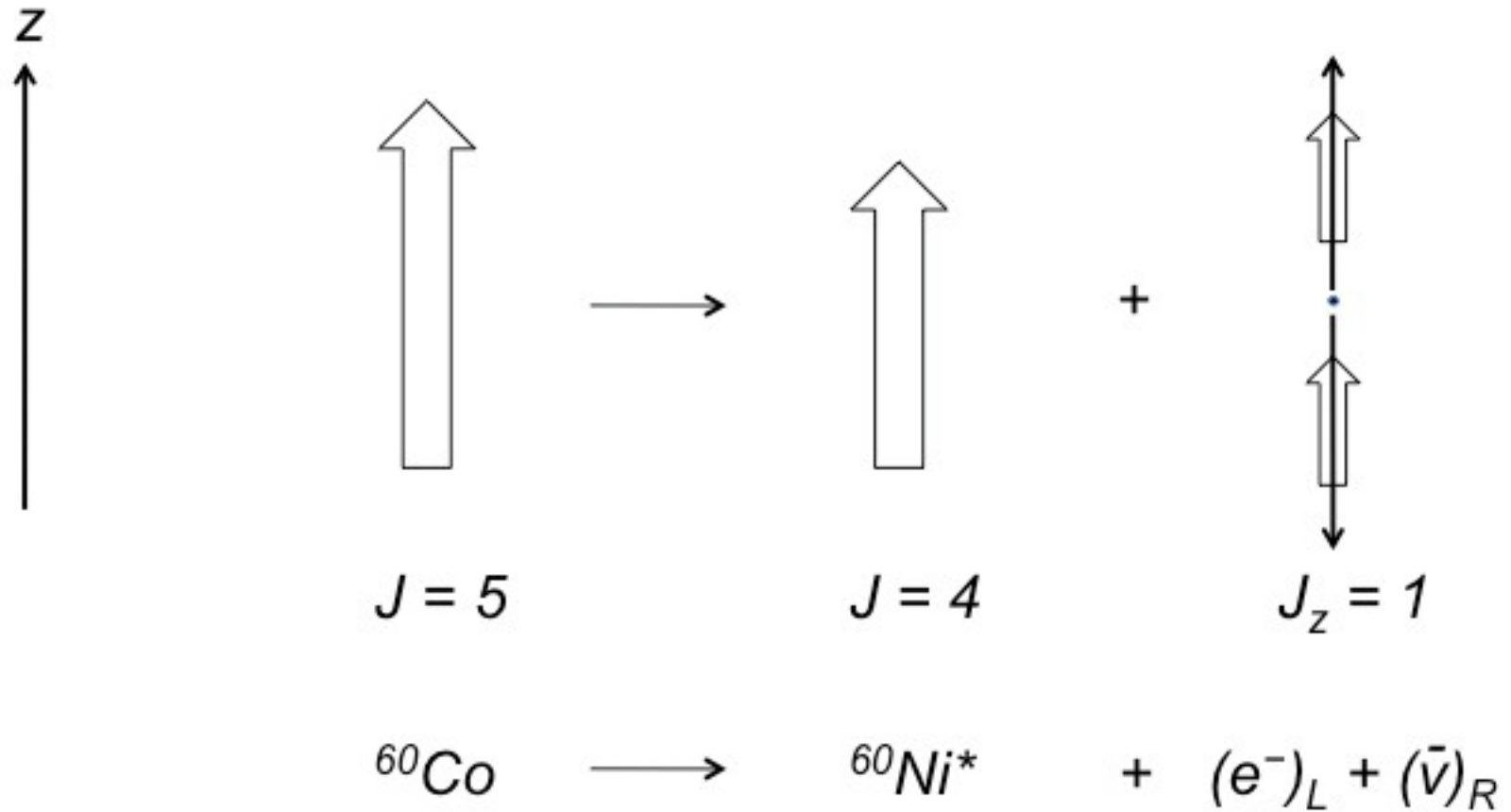
Matthew Wing (UCL)

- The early years
- Neutrino experiments
- High-energy colliding-beam experiments (and some fixed-target results)

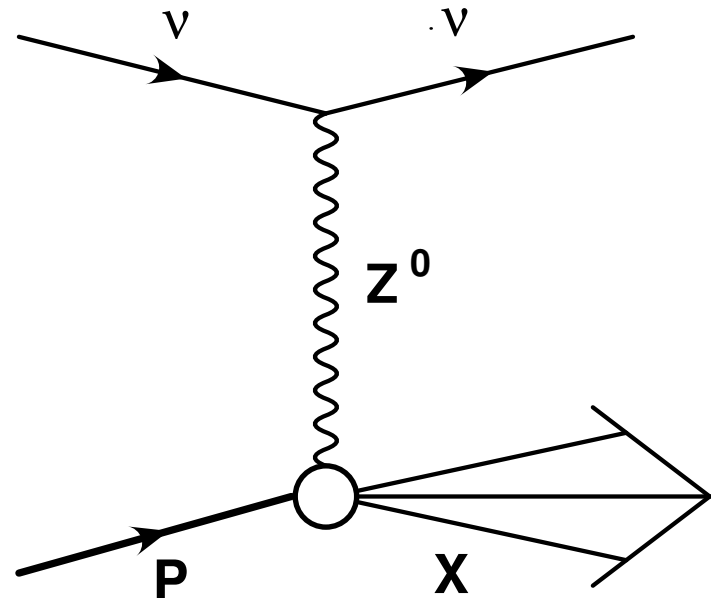
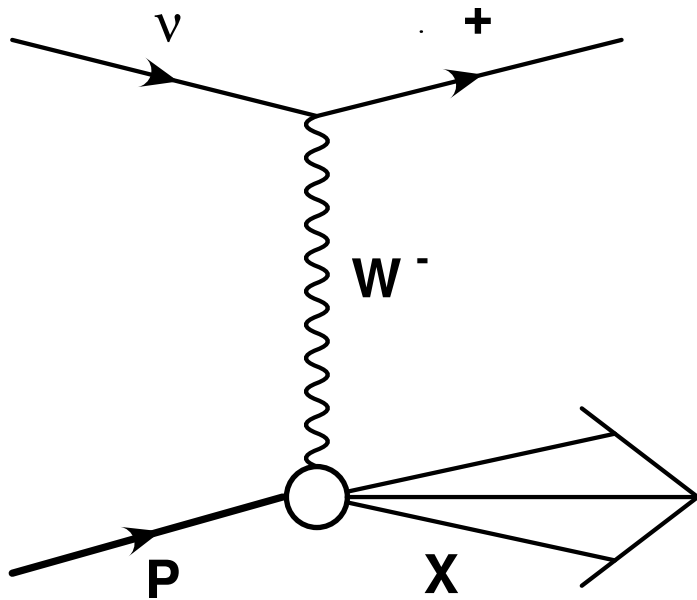
# Early years



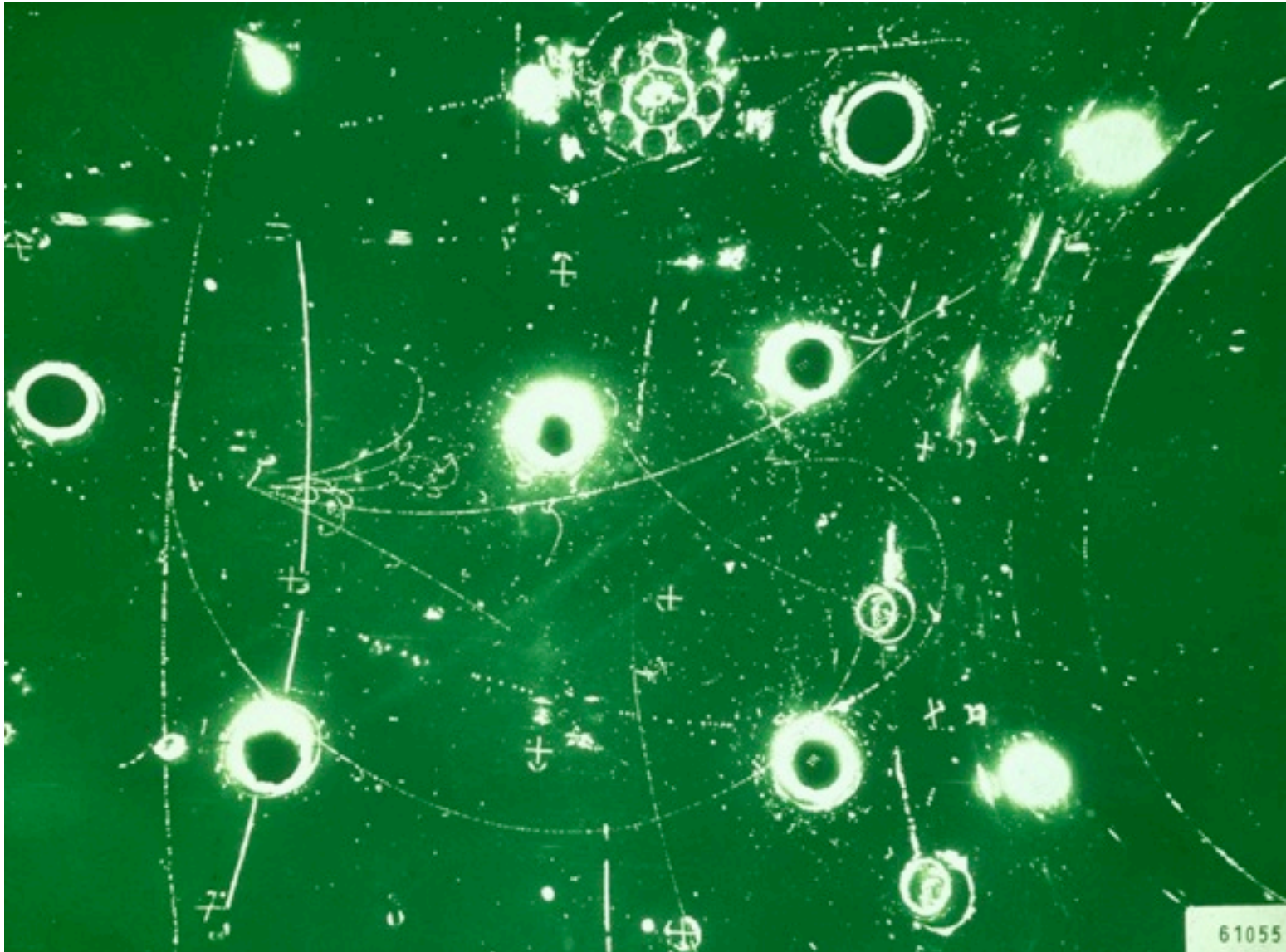
# Parity violation



# Discovery of neutral currents

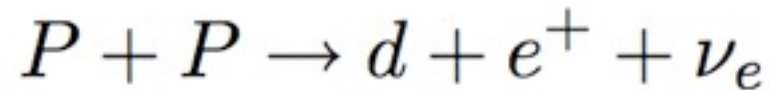


# A Gargamelle event

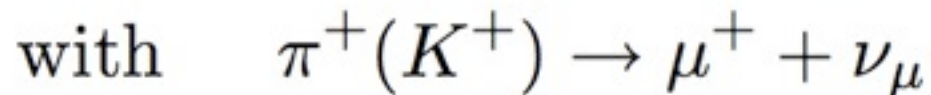
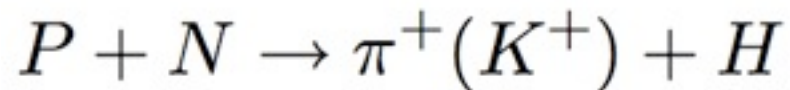


# The neutrino problem

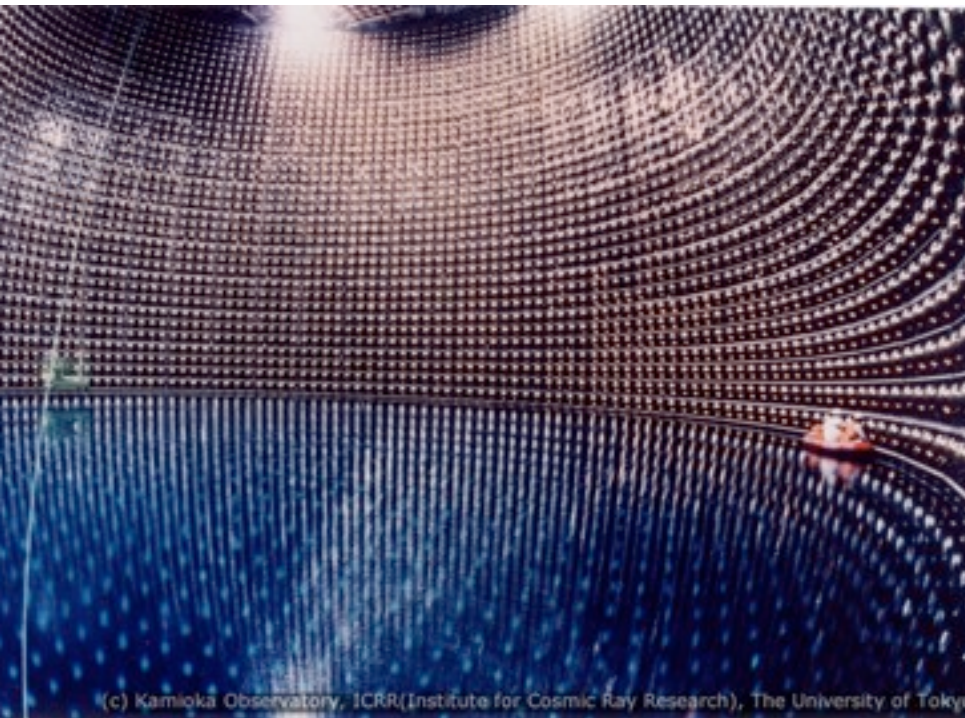
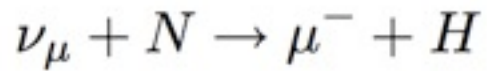
Solar neutrinos :



Atmospheric neutrinos :



# SuperKamiokande



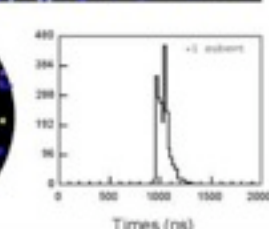
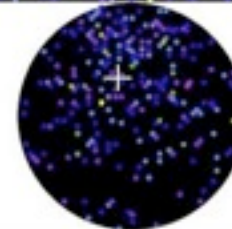
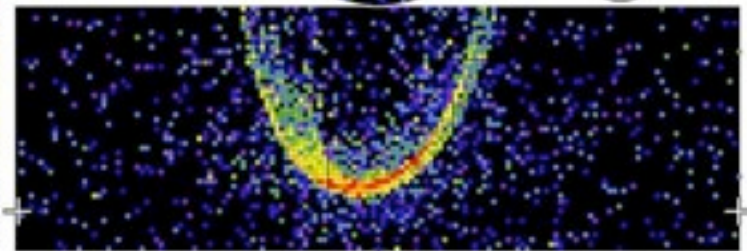
(c) Kamioka Observatory, ICRR(Institute for Cosmic Ray Research), The University of Tokyo

## Super-Kamiokande I

Run: 1728 Sub: 4 Ev: 25171  
 96-06-29-09:02:03  
 Dates: 2294 hits, 1095 pt  
 Dates: 4 hits, 52 pt (in-time)  
 Trigger ID: 0x0  
 S wall: 592.9 cm  
 PC no-100a, p = 1002.9 MeV/c

Charge (pe)

- >24.7
- 21.3-24.7
- 18.2-21.3
- 17.3-18.2
- 14.7-17.3
- 12.2-14.7
- 9.5-12.2
- 6.7-9.5
- 4.7-6.7
- 3.3-4.7
- 2.2-3.3
- 1.3-2.2
- 0.7-1.3
- 0.2-0.7
- < 0.2



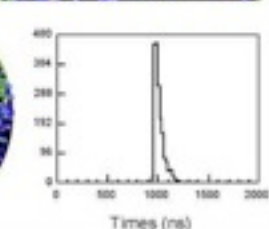
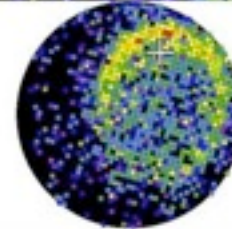
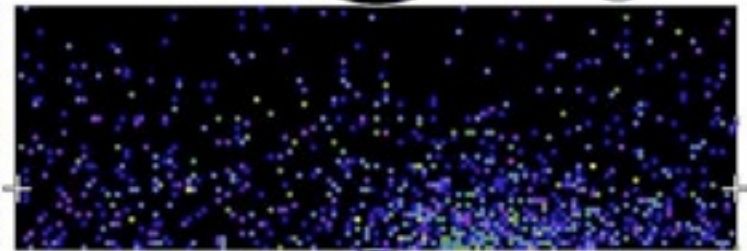
(c) Super-Kamiokande Collaboration

## Super-Kamiokande I

Run: 1757 Sub: 4 Ev: 25716  
 96-06-02-07:01:37  
 Dates: 1949 hits, 6243 pt  
 Dates: 4 hits, 56 pt (in-time)  
 Trigger ID: 0x0  
 S wall: 475.4 cm  
 PC no-100a, p = 414.1 MeV/c

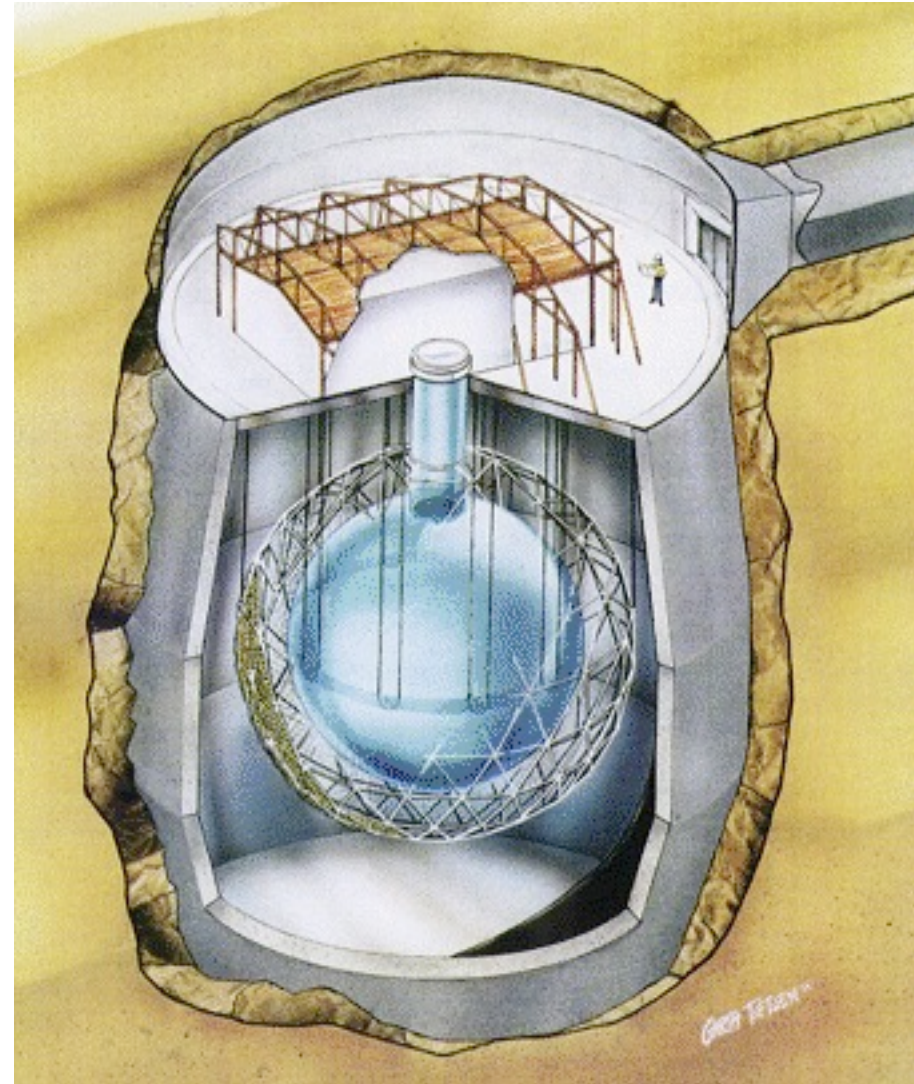
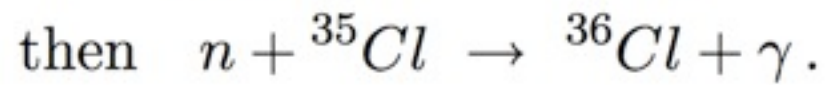
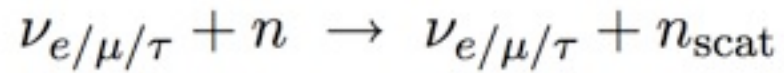
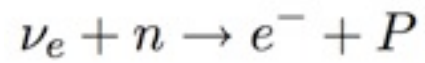
Charge (pe)

- >24.7
- 21.3-24.7
- 18.2-21.3
- 17.3-18.2
- 14.7-17.3
- 12.2-14.7
- 9.5-12.2
- 6.7-9.5
- 4.7-6.7
- 3.3-4.7
- 2.2-3.3
- 1.3-2.2
- 0.7-1.3
- 0.2-0.7
- < 0.2



(c) Super-Kamiokande Collaboration

## SNO

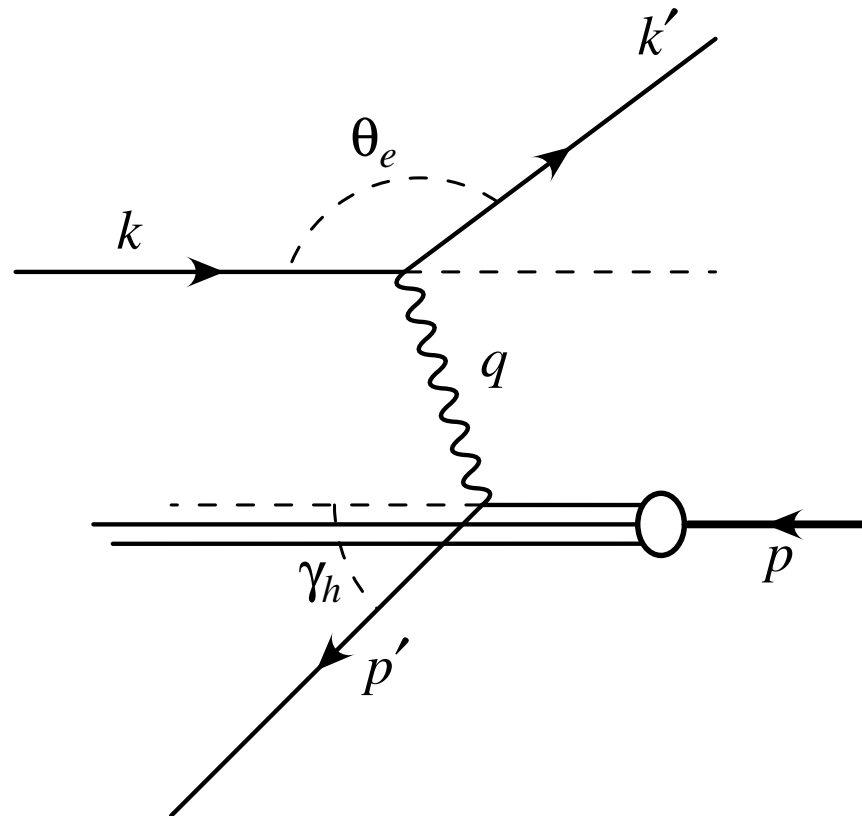




# High energy colliders (and fixed-target)

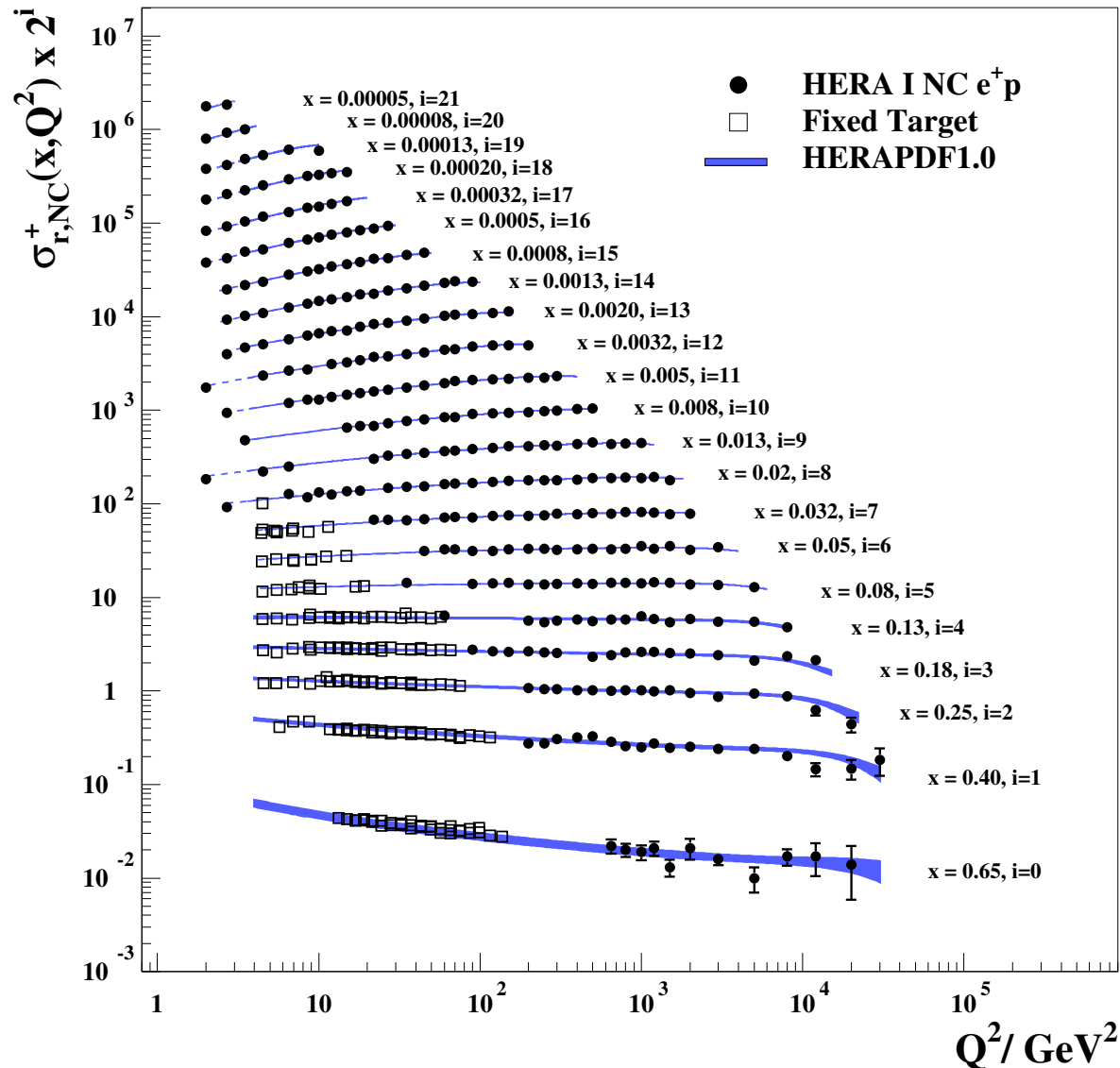
1.  $e^+e^-$  : purely leptonic, controlled centre-of-mass energy, clean. Discovery potential and precision physics. Limited by synchrotron radiation; need linear collider.
2.  $NN(pp)$  : highest energy and largest discovery potential. Messy.
3.  $IN$  : mixture of the two. One probe and one structured object.

# Deep inelastic scattering

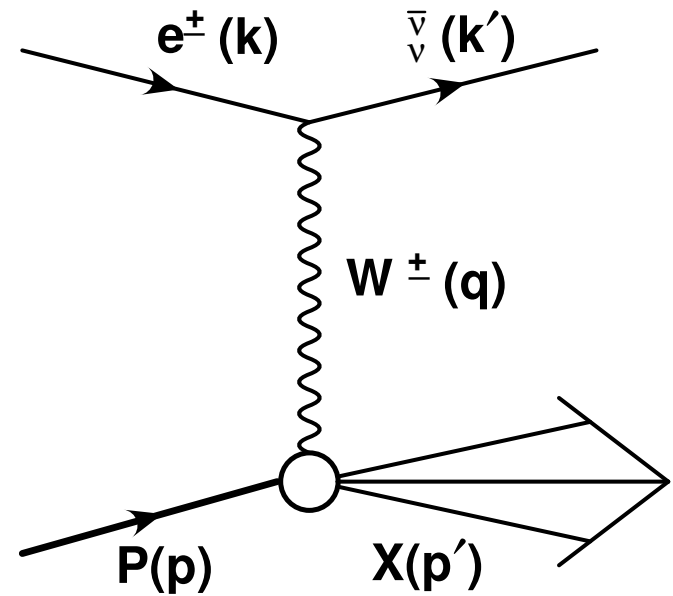
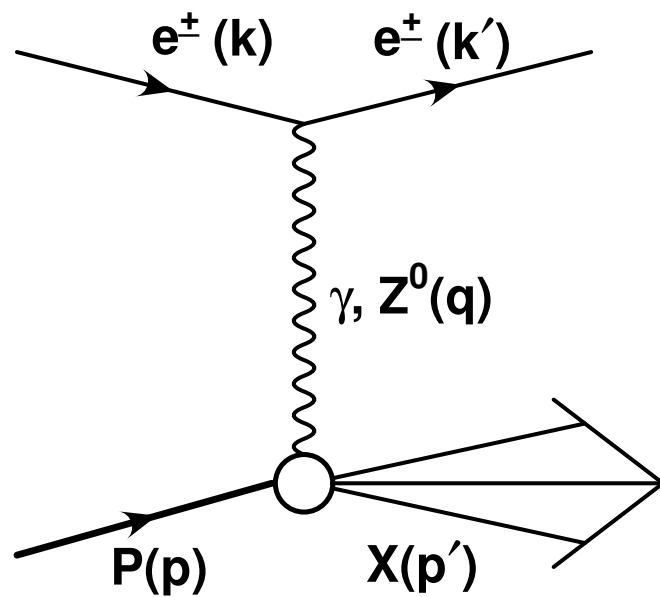


# The structure of the proton

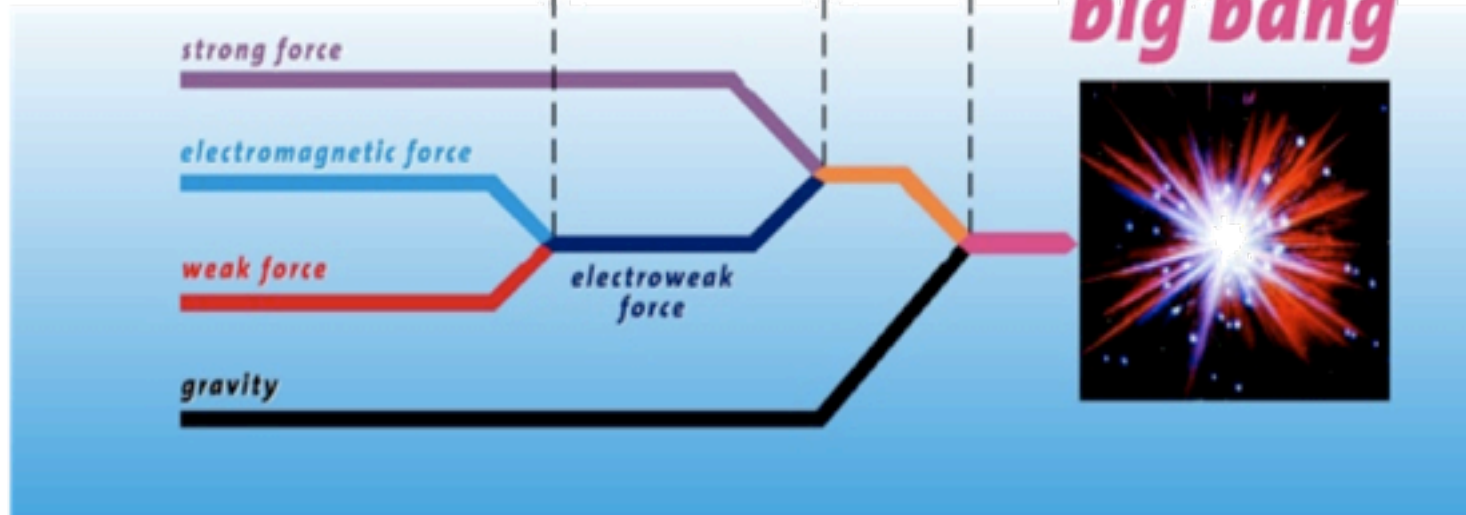
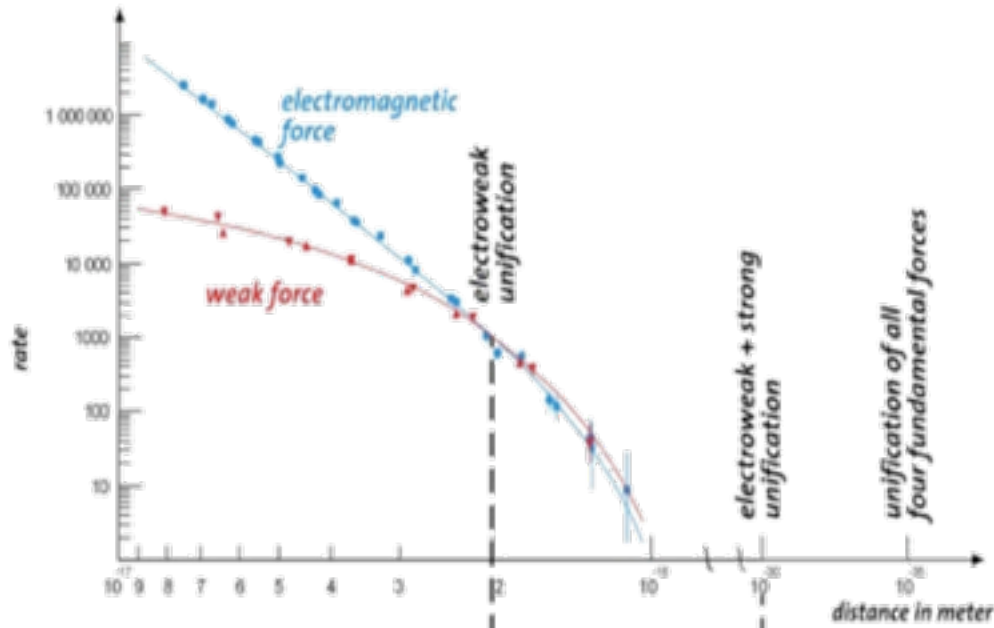
## H1 and ZEUS



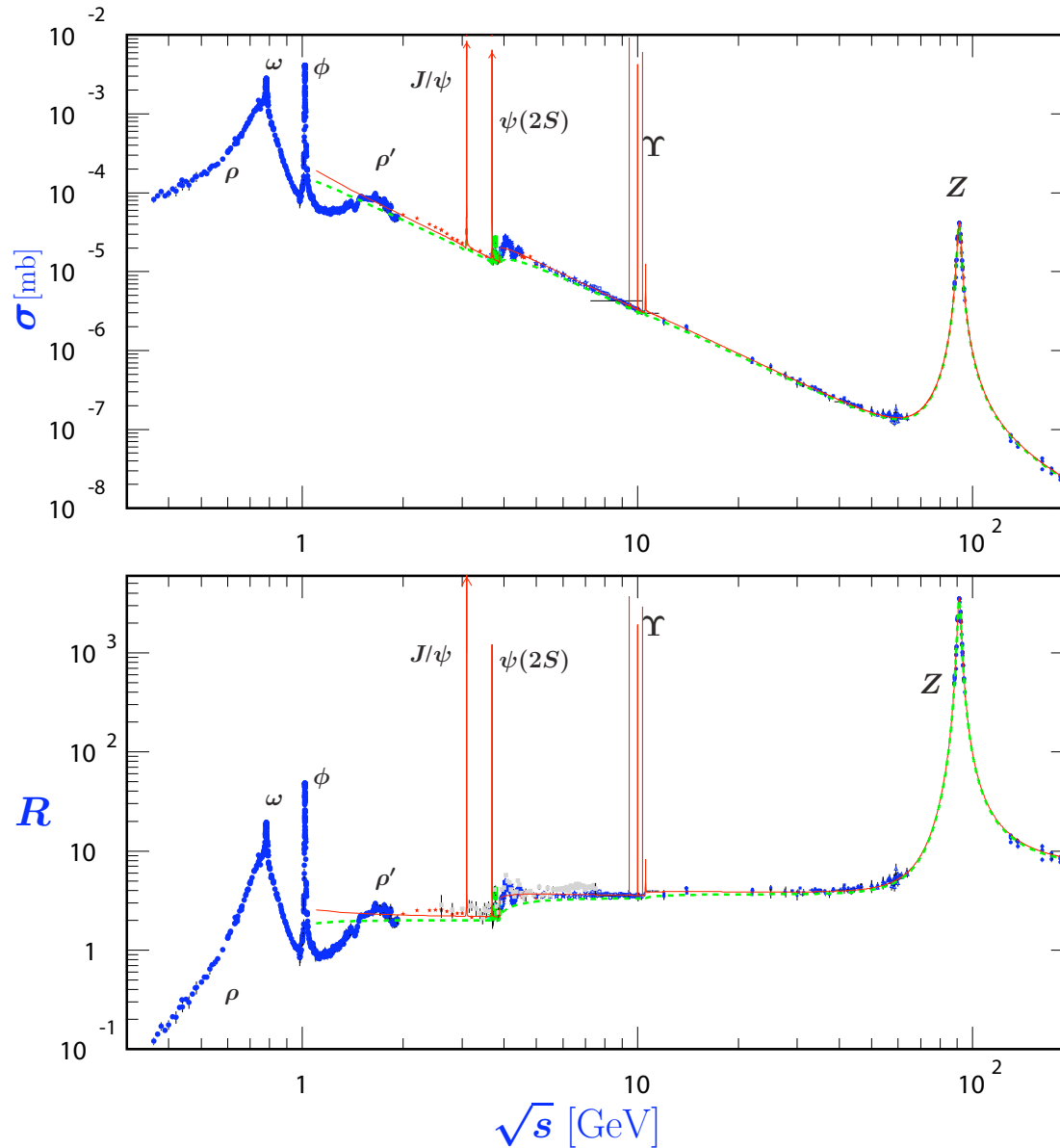
# Neutral and charge current reactions



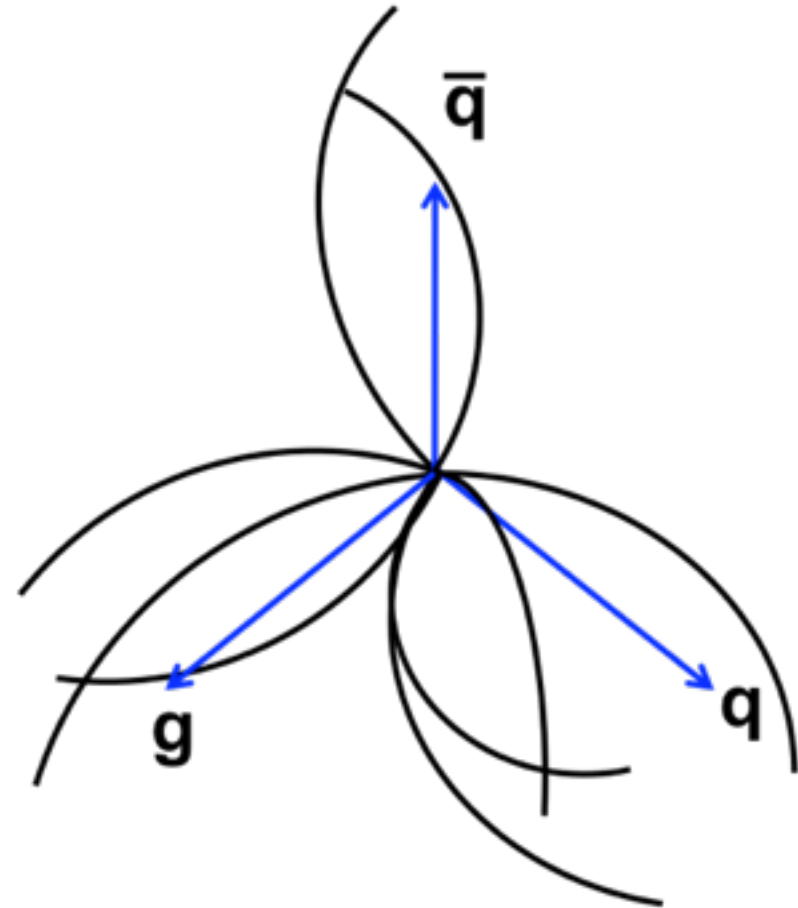
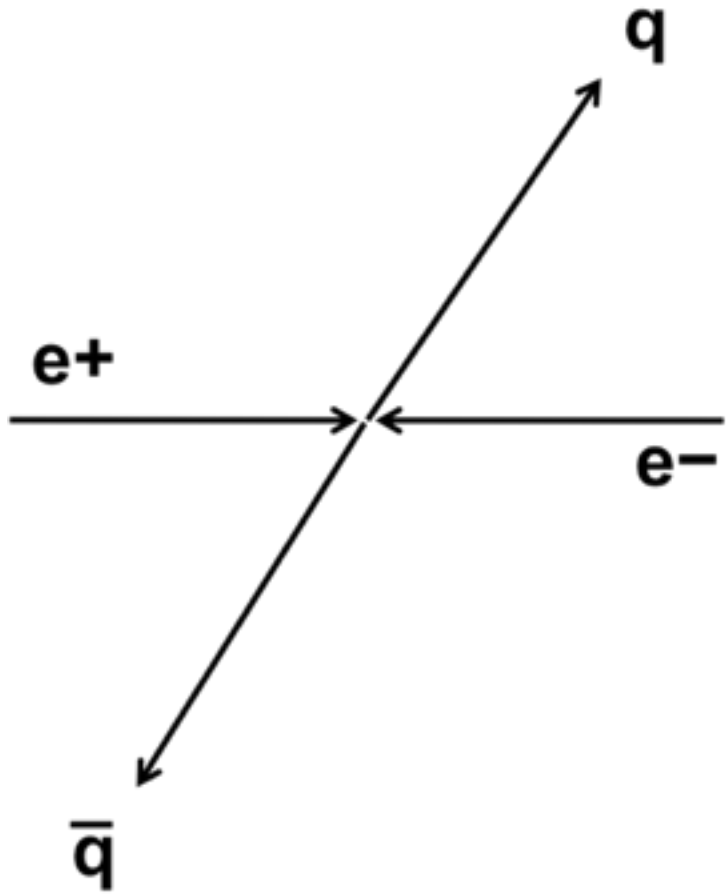
# Electroweak unification



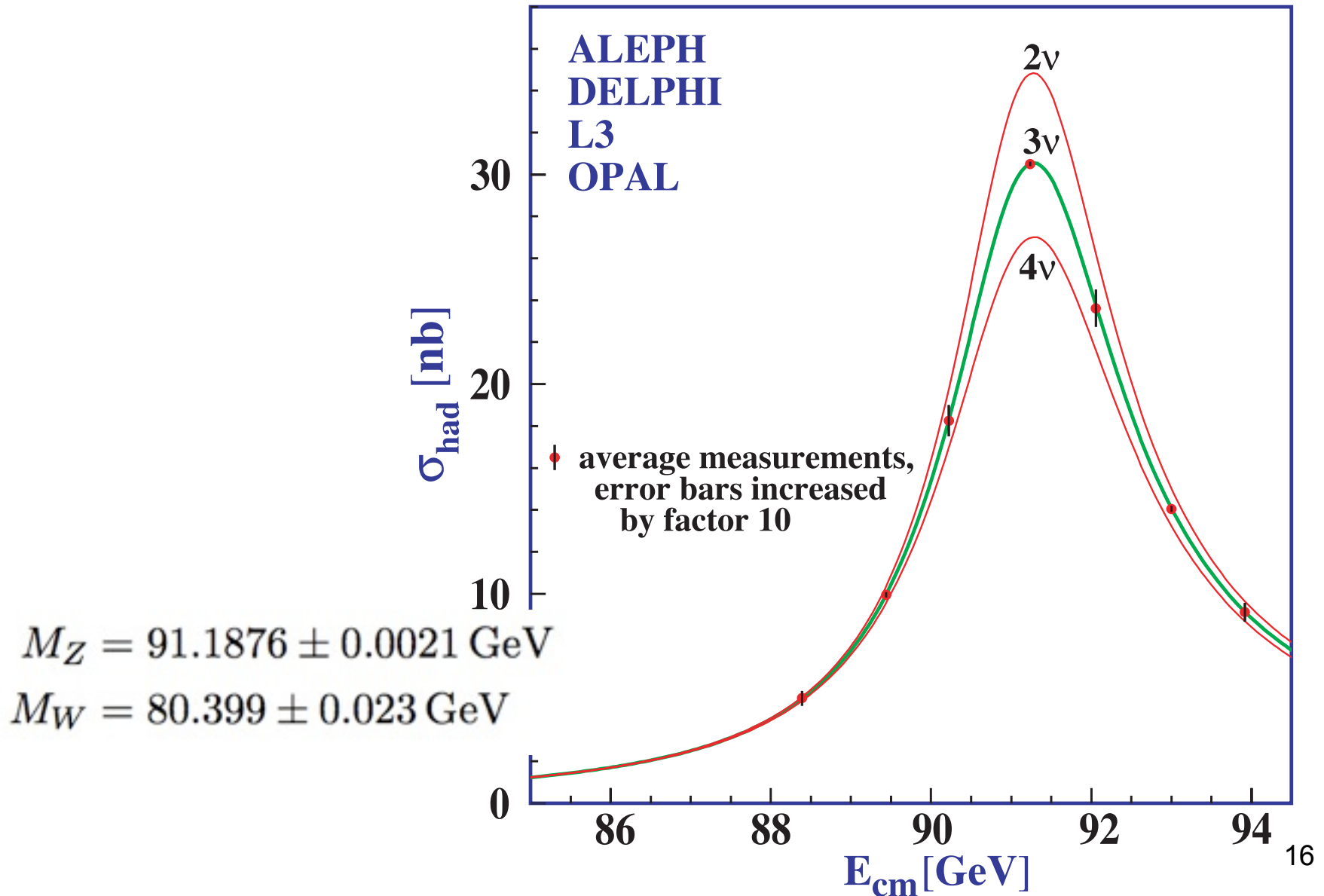
# $e^+e^-$ colliders



# Discovery of gluon

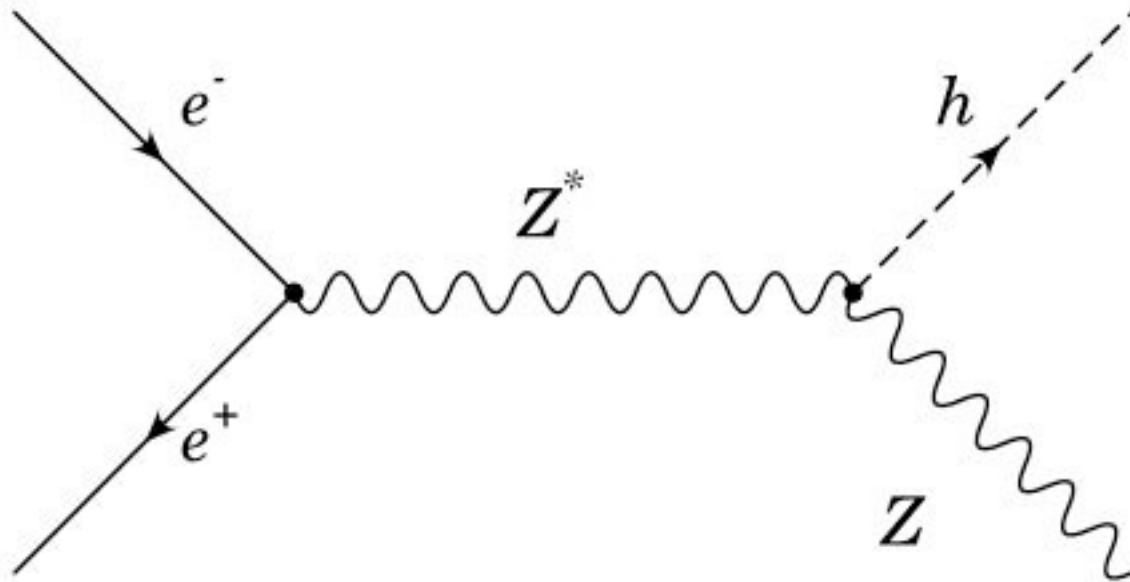


# The Z pole and three neutrinos



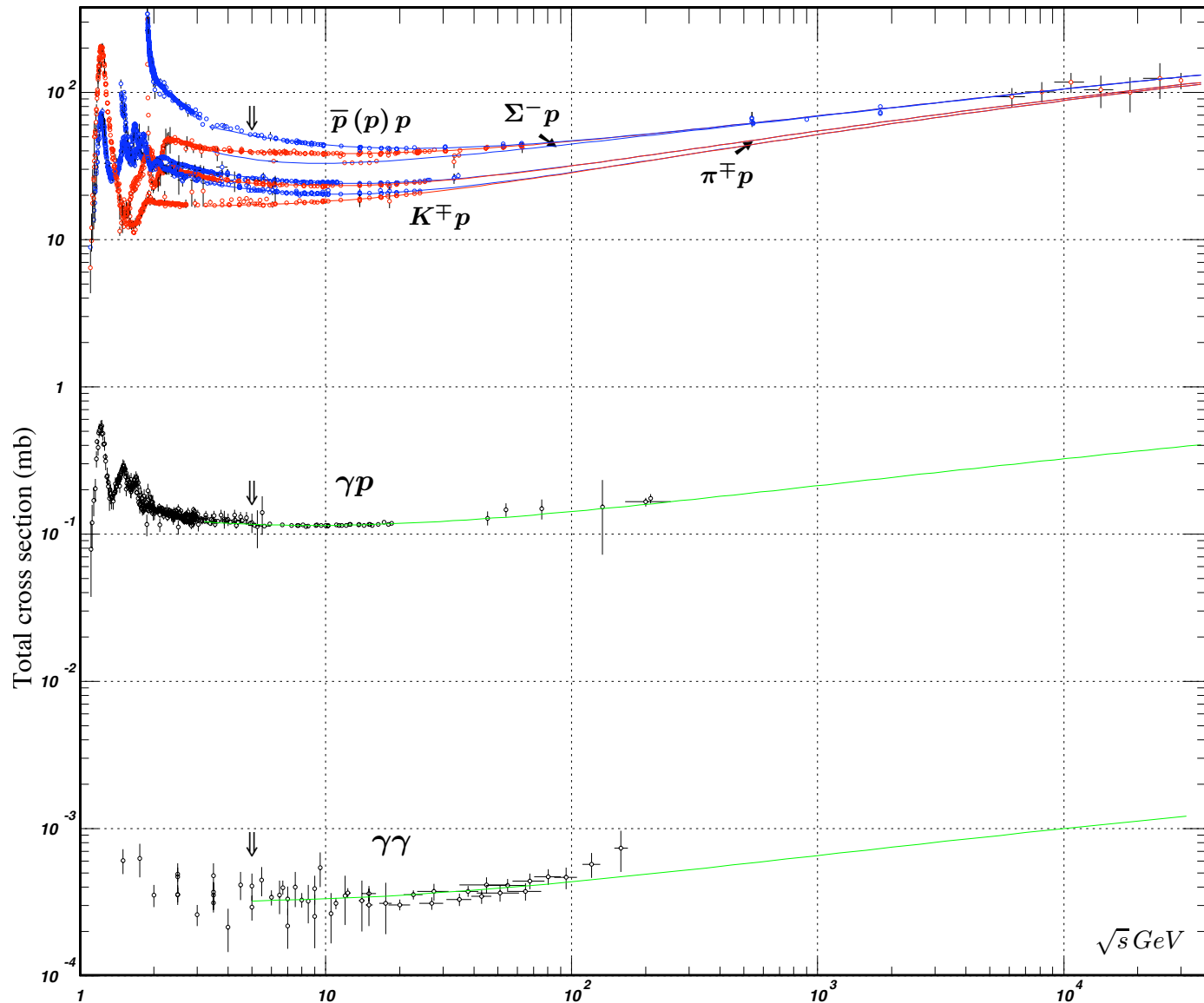


# Search for the Higgs Boson

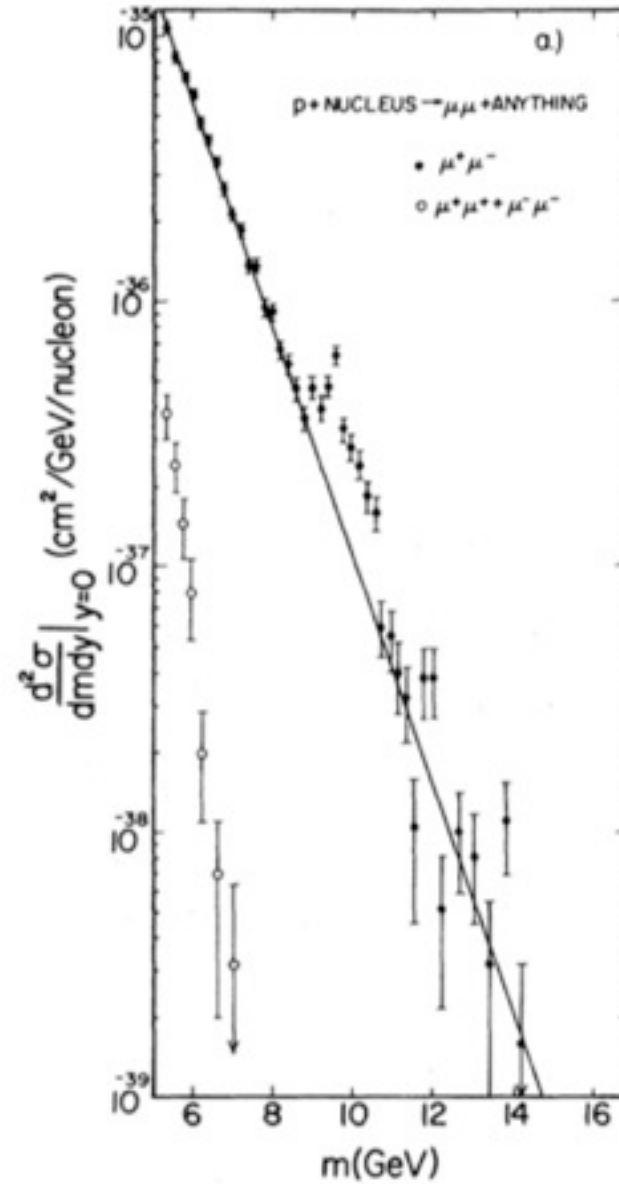


$$\sqrt{s} > M_H + M_Z$$

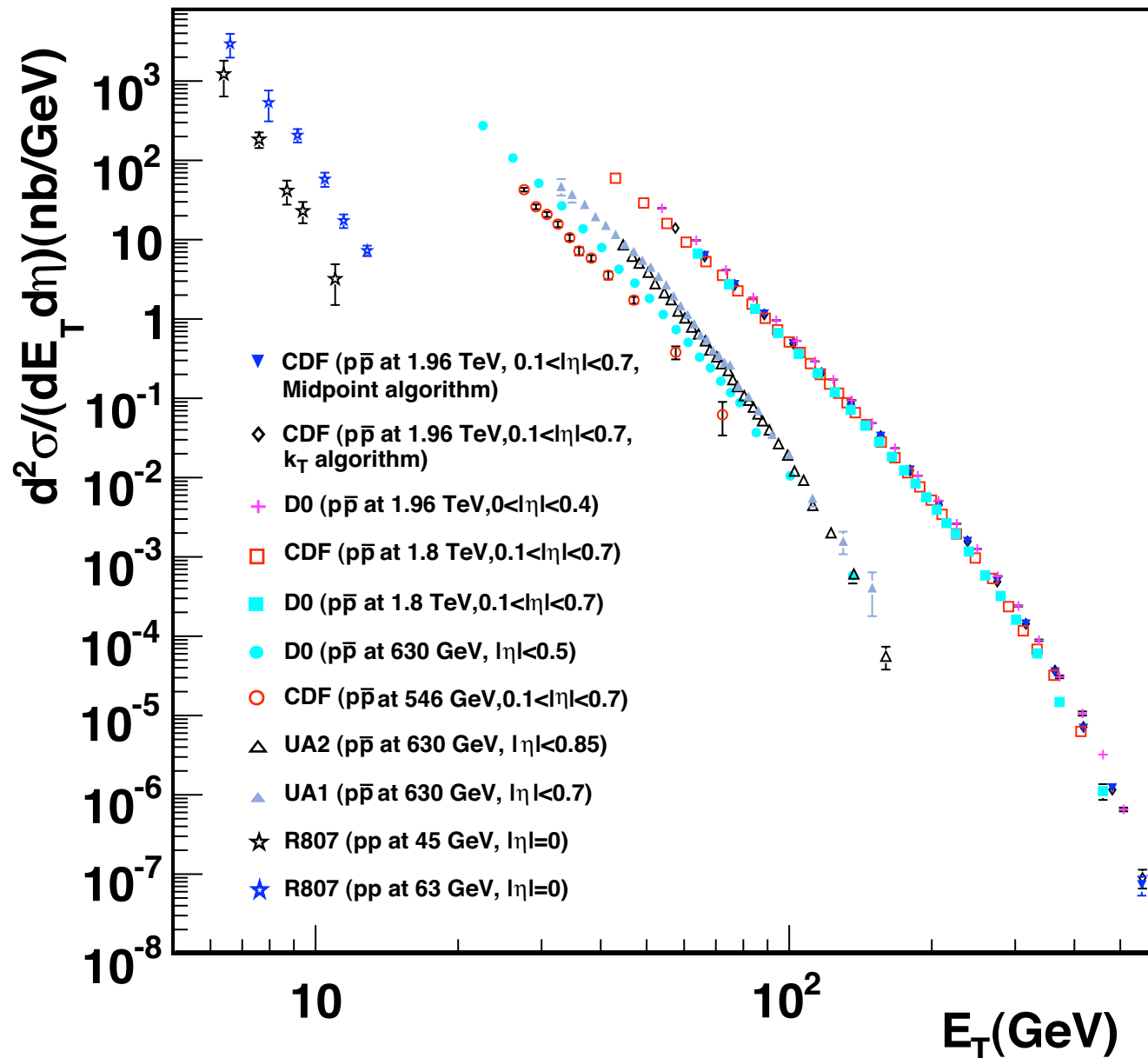
# Total cross sections



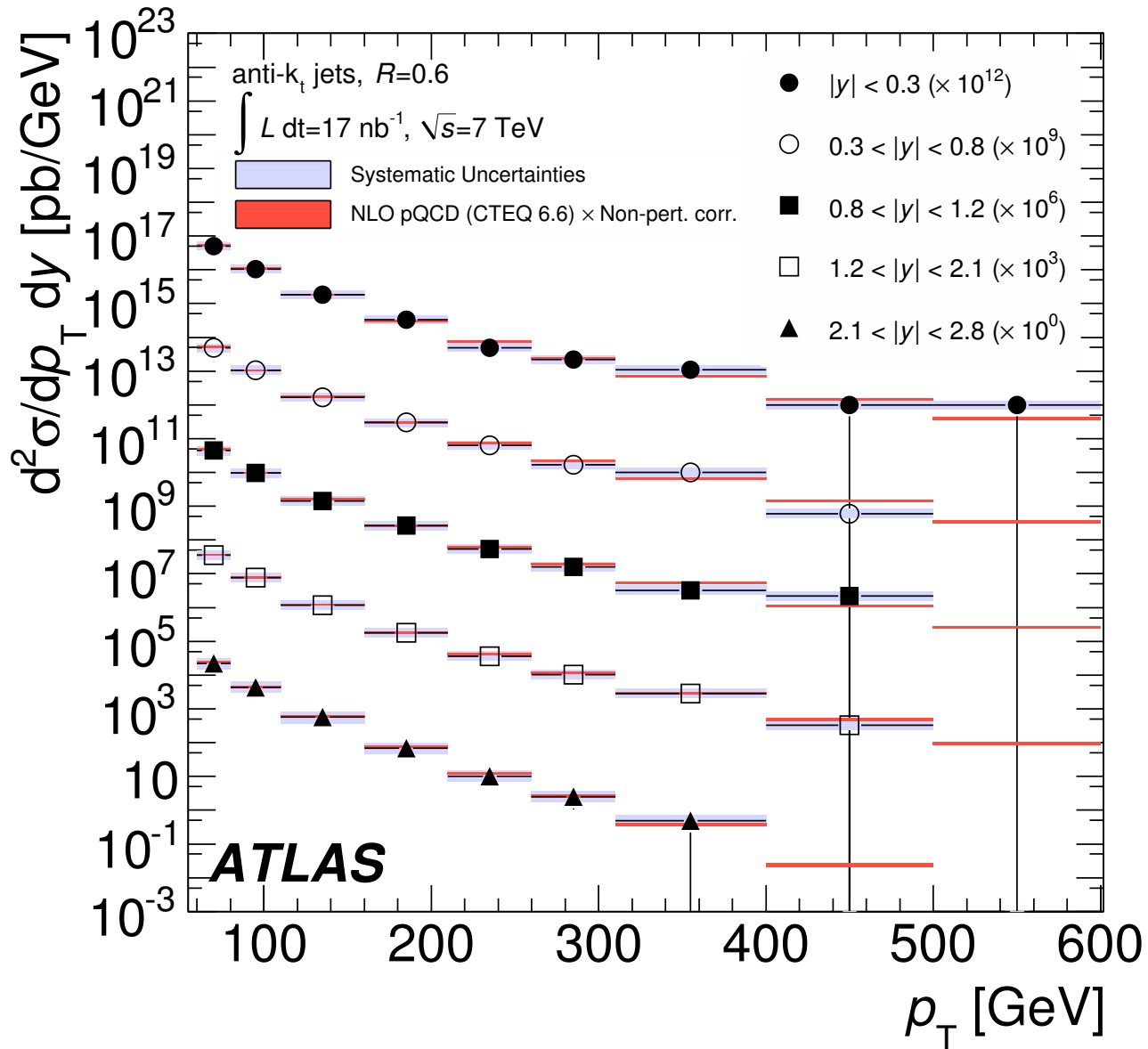
# Discovery of bottom quark



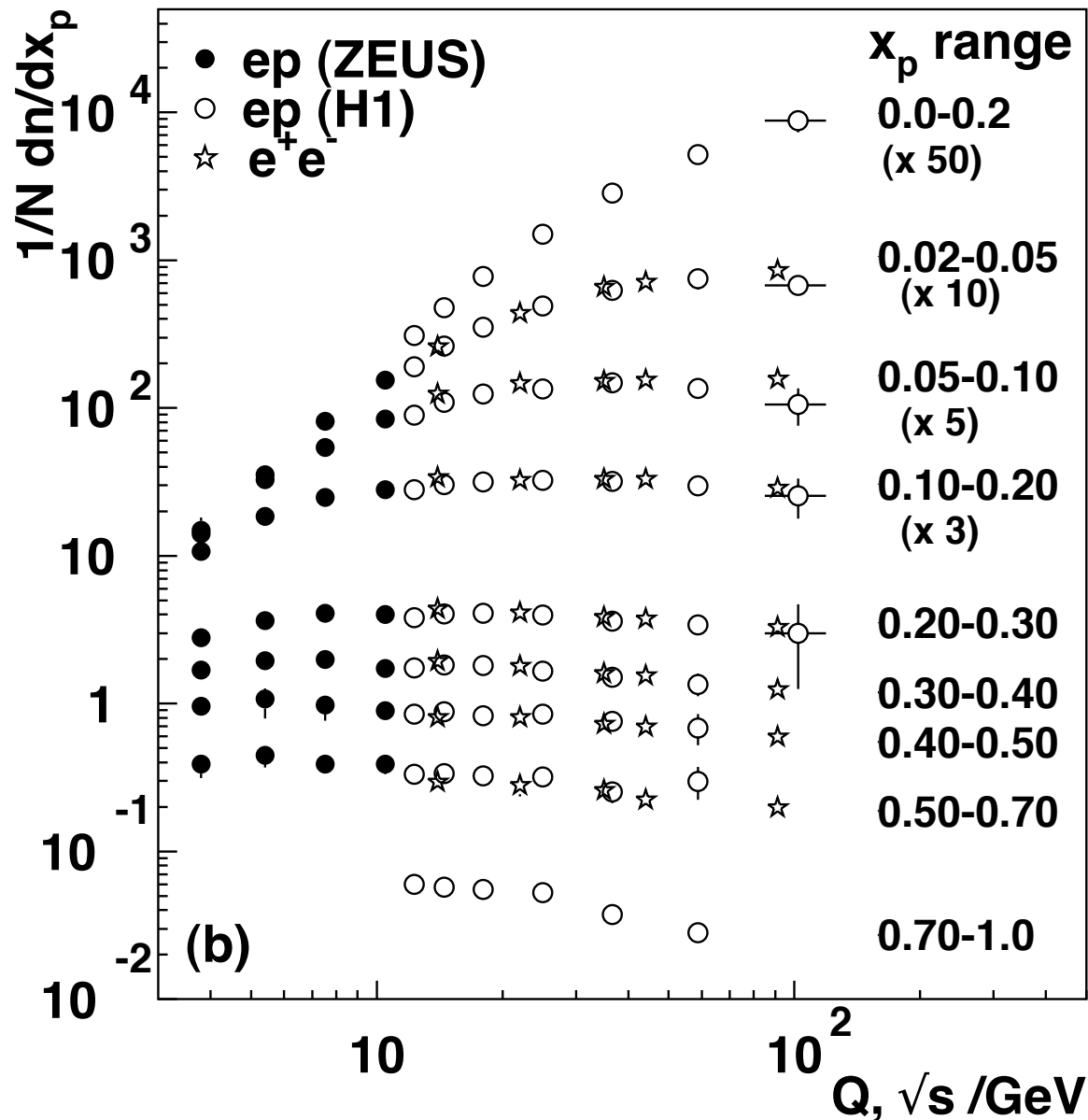
# Inclusive jet cross section



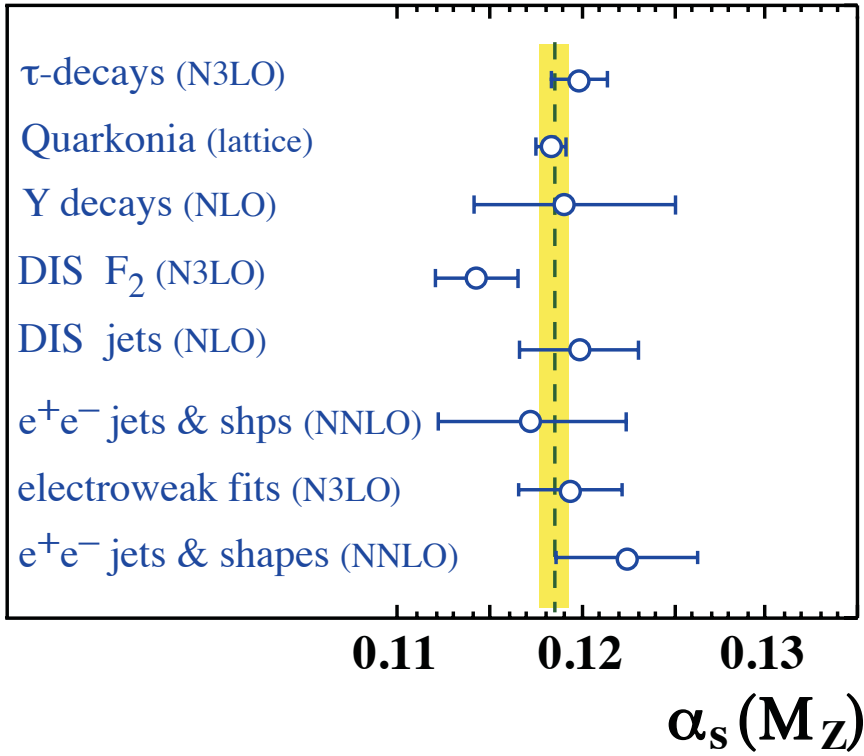
# Inclusive jet cross section



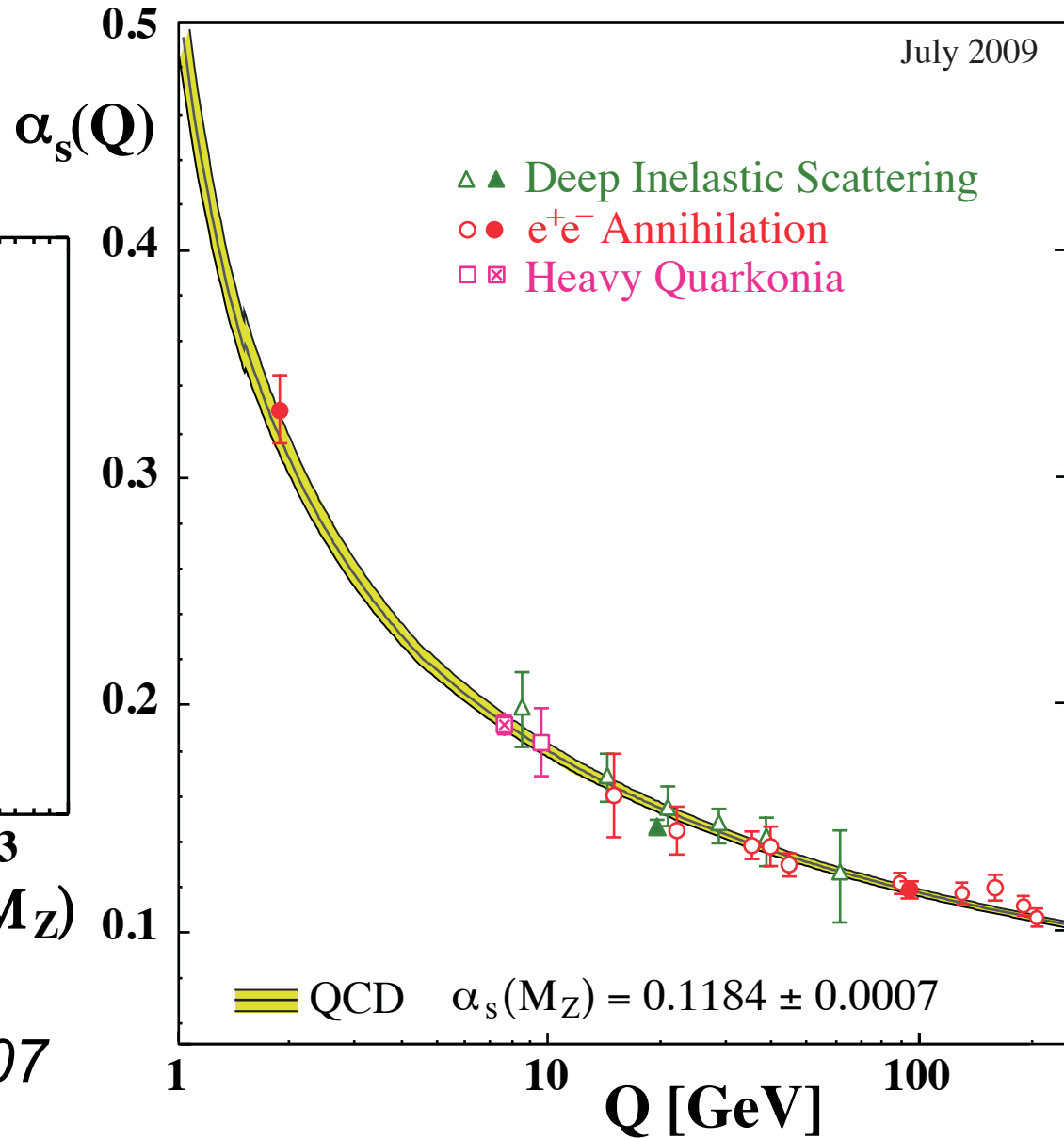
# Fragmentation universality



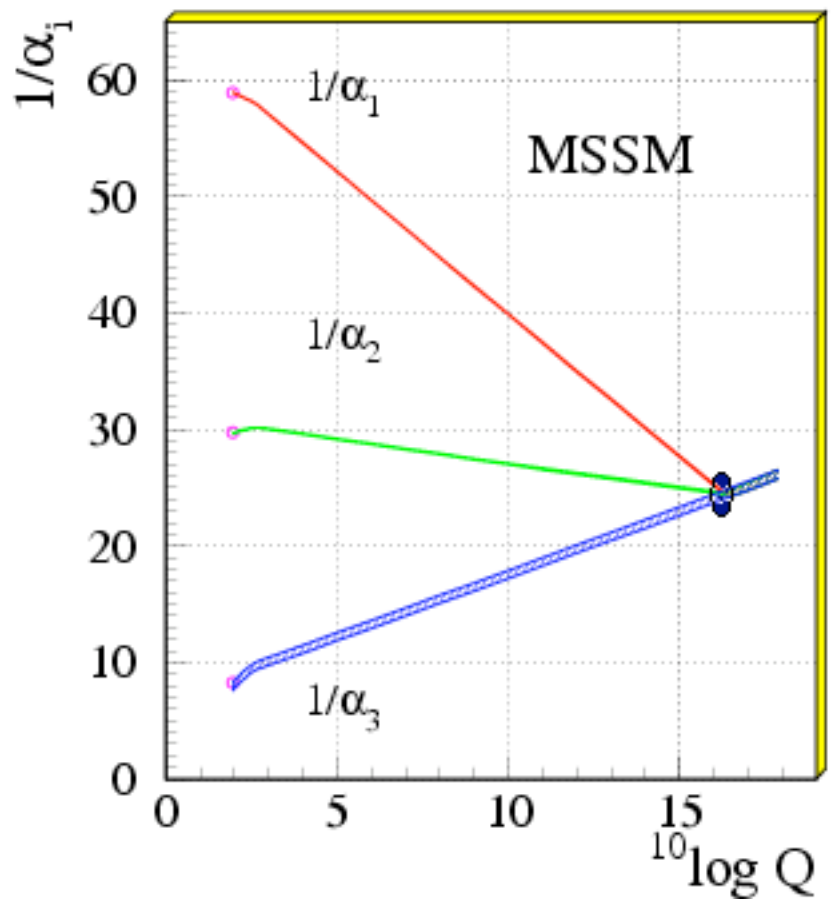
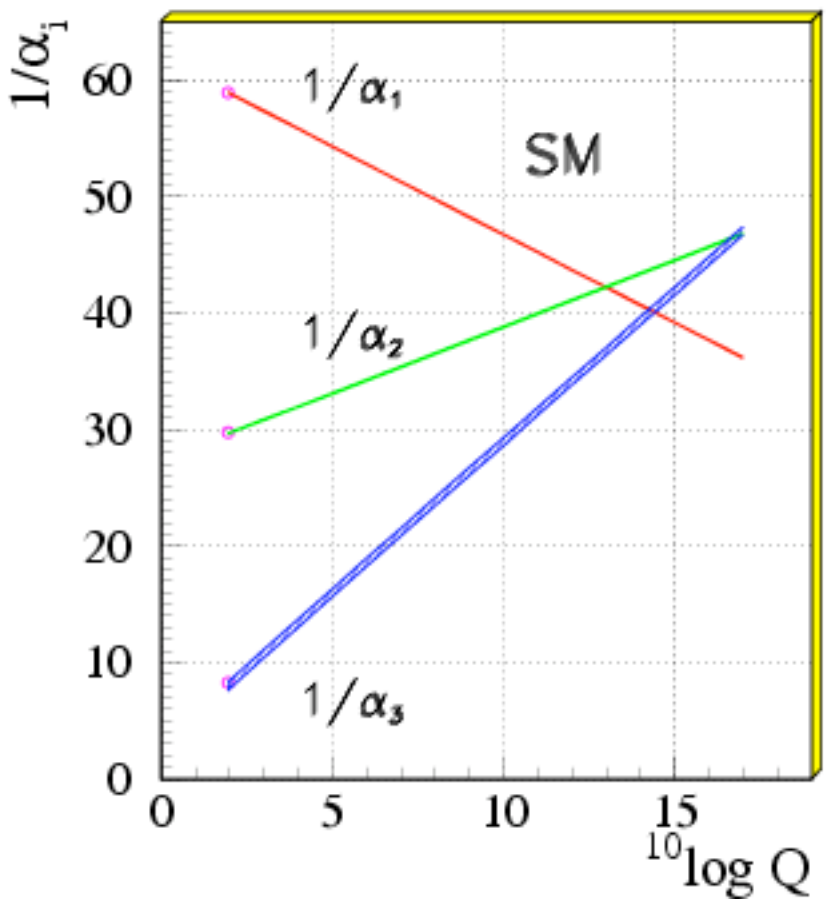
# Combination : $\alpha_s$



$$\alpha_s(M_Z) = 0.1184 \pm 0.0007$$



# Grand unification





# Higgs search

