

# Tief-inelastische Elektron-Proton Streuung

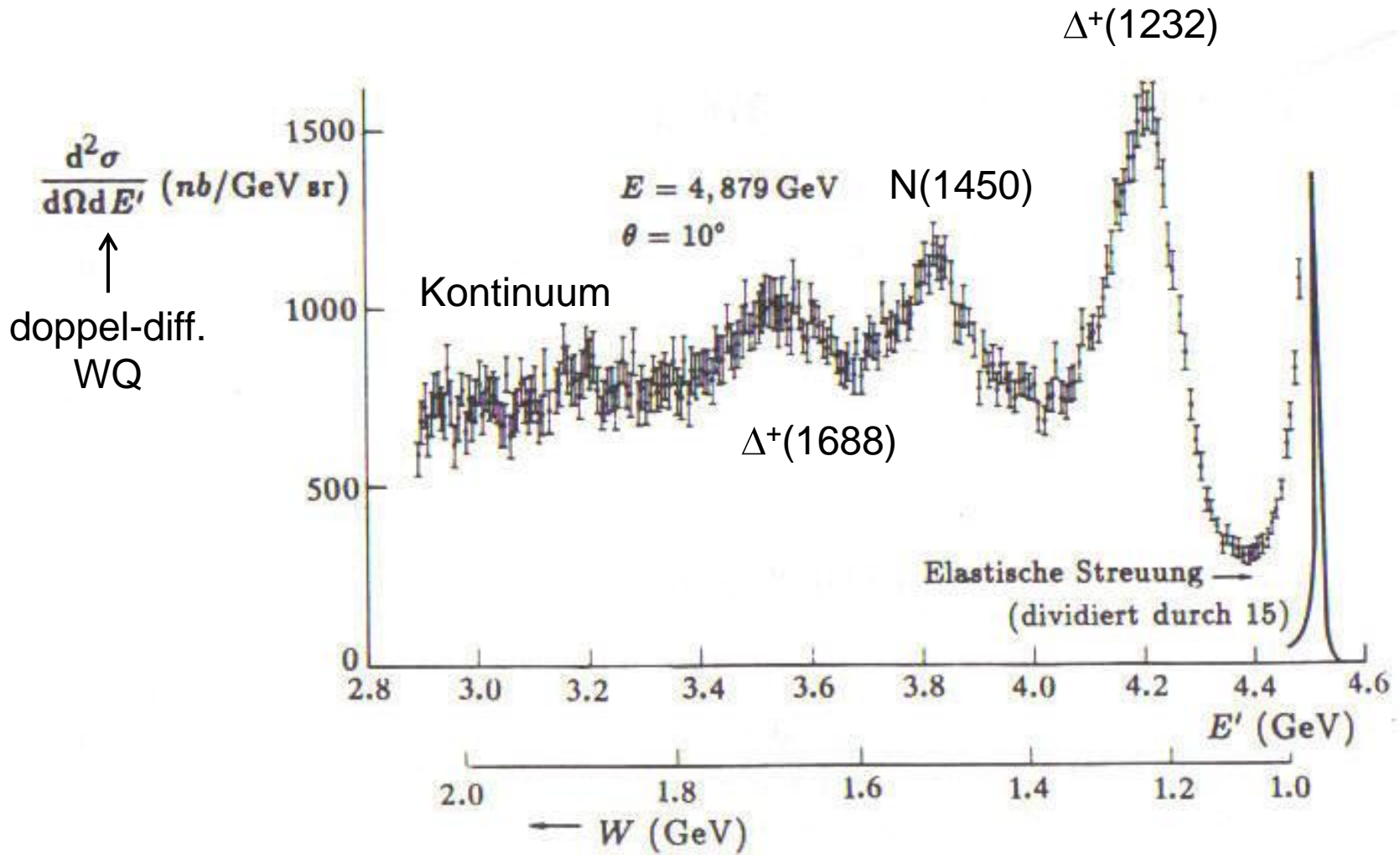


Fig-TP-4.10

# Erste Messung der Strukturfunktion $W_2$

## OBSERVED BEHAVIOR OF HIGHLY INELASTIC ELECTRON-PROTON SCATTERING

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(Received 22 August 1969)

SLAC & MIT  
Experiment 1969

Spectrometer at given  $\theta$

$$\frac{\Delta p}{p} \sim 0.1\% \quad \Delta\theta \sim 0.7\text{mrad}$$

$e^-$  beam, up to 20 GeV

$$\frac{\Delta p}{p} \in [0.1\%; 0.25\%]$$

Dipole and quadrupole magnets

Cherenkov counter for  $e/\pi$  separation

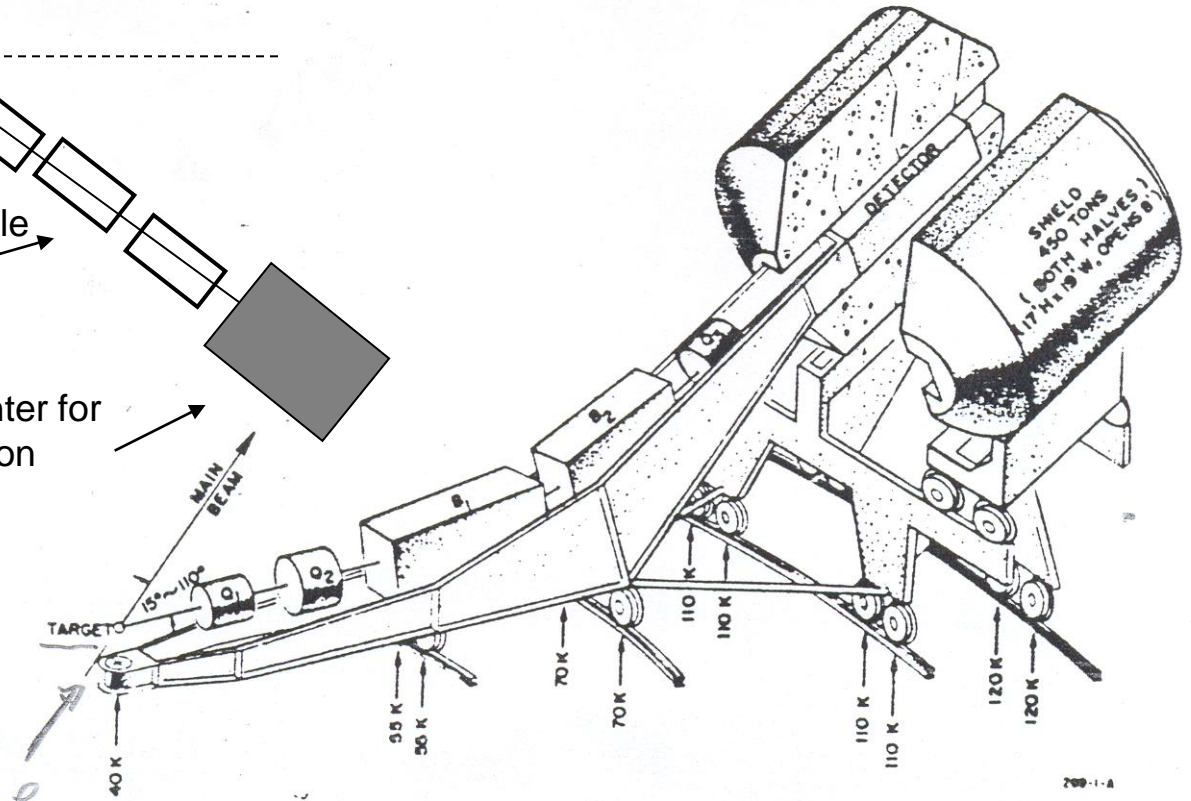
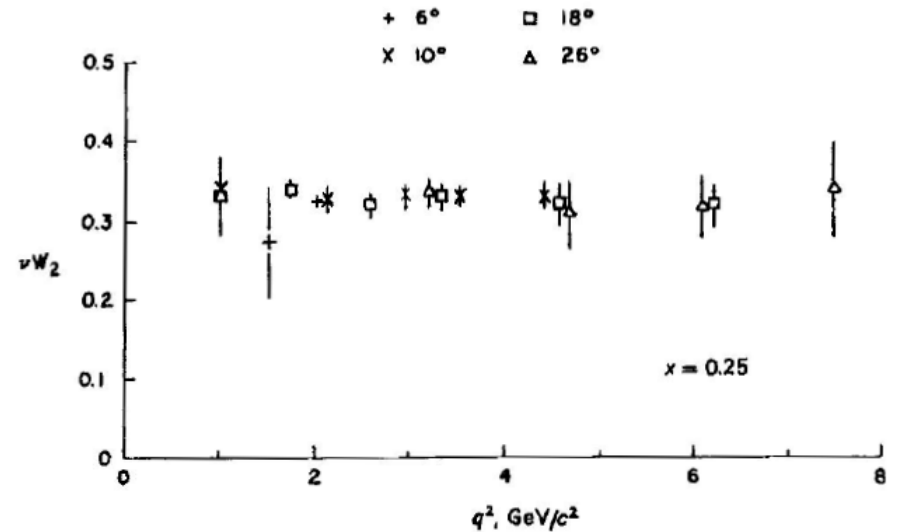
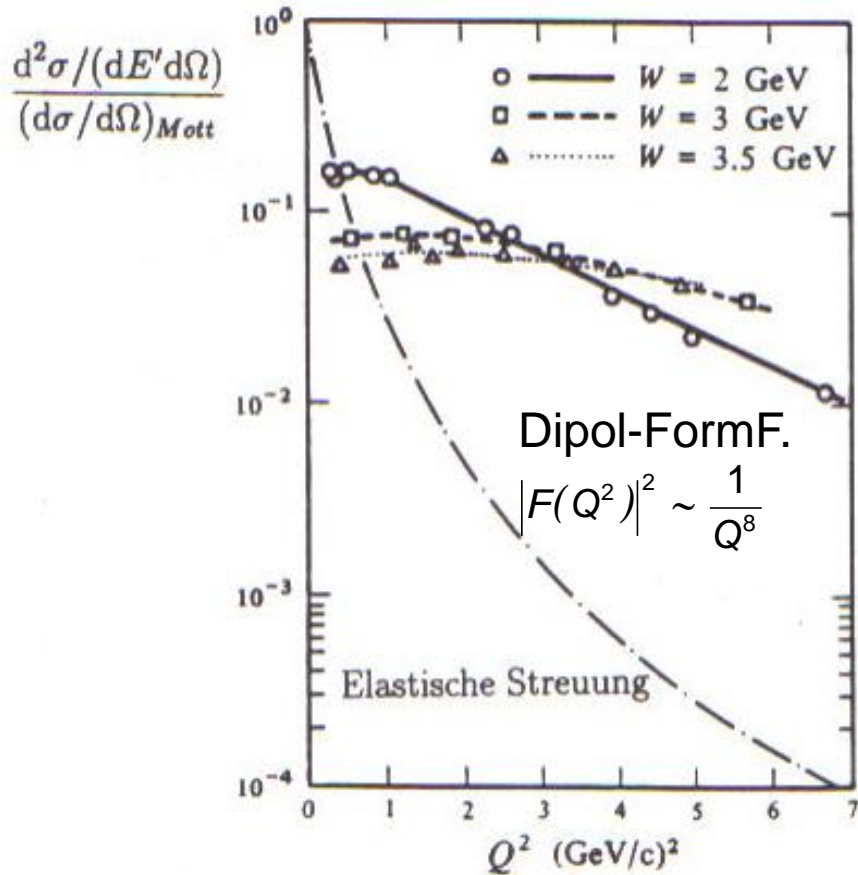


Fig-TP-4.11



Fig-TP-4.12





Structure function  $\nu W_2$  does not depend explicitly on  $Q^2$  but depends only on the dimensionless variable  $x_{Bj}$ :

Bjorkensche  
 SkalenvARIABLE  $x_{Bj} = \frac{Q^2}{2M\nu}$

→  **$Q^2$  Scale invariance: “scaling”**

Fig-TP-4.13

# Callan-Gross Relation: Spin-1/2 Partonen

$$\frac{2xF_1}{F_2}$$

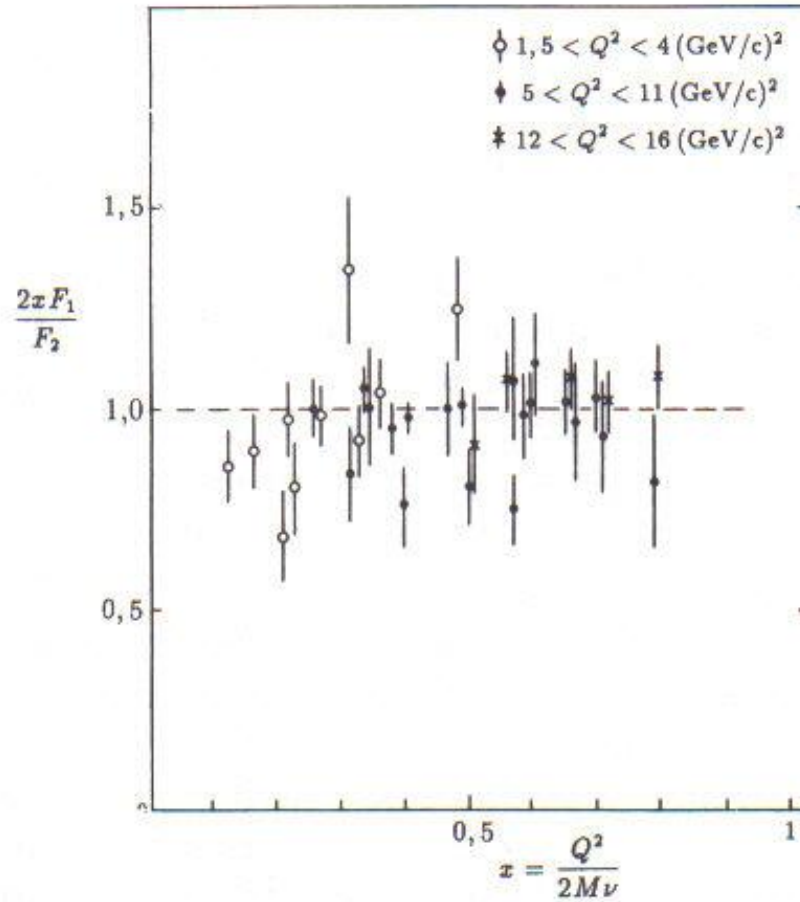


Fig-TP-4.14

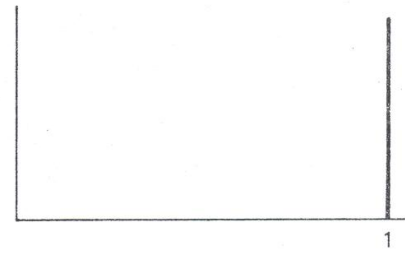
# Proton Modell

If the Proton is

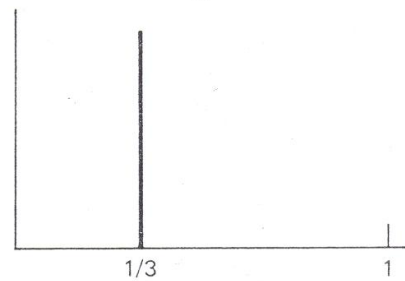
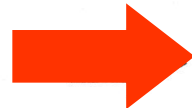
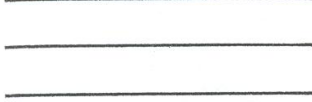
A quark



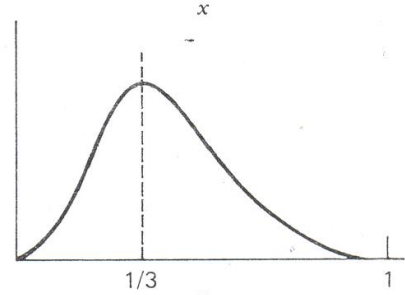
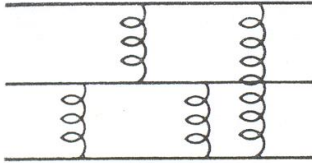
Partonverteilung (Partondichte)  $f(x)$



Three valence quarks



Three bound valence quarks



Three bound valence quarks + some slow debris, e.g.,  $g \rightarrow q\bar{q}$

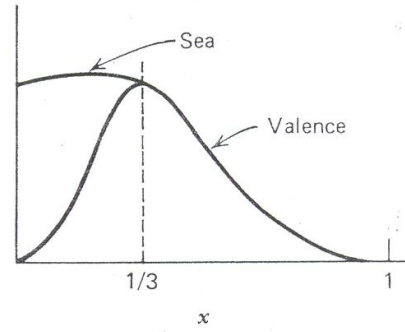
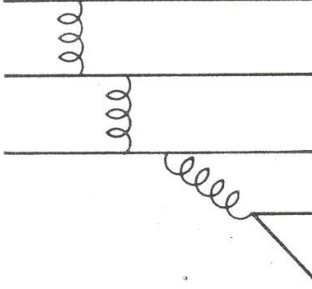


Fig-TP-4.15

# Partondichten im Proton

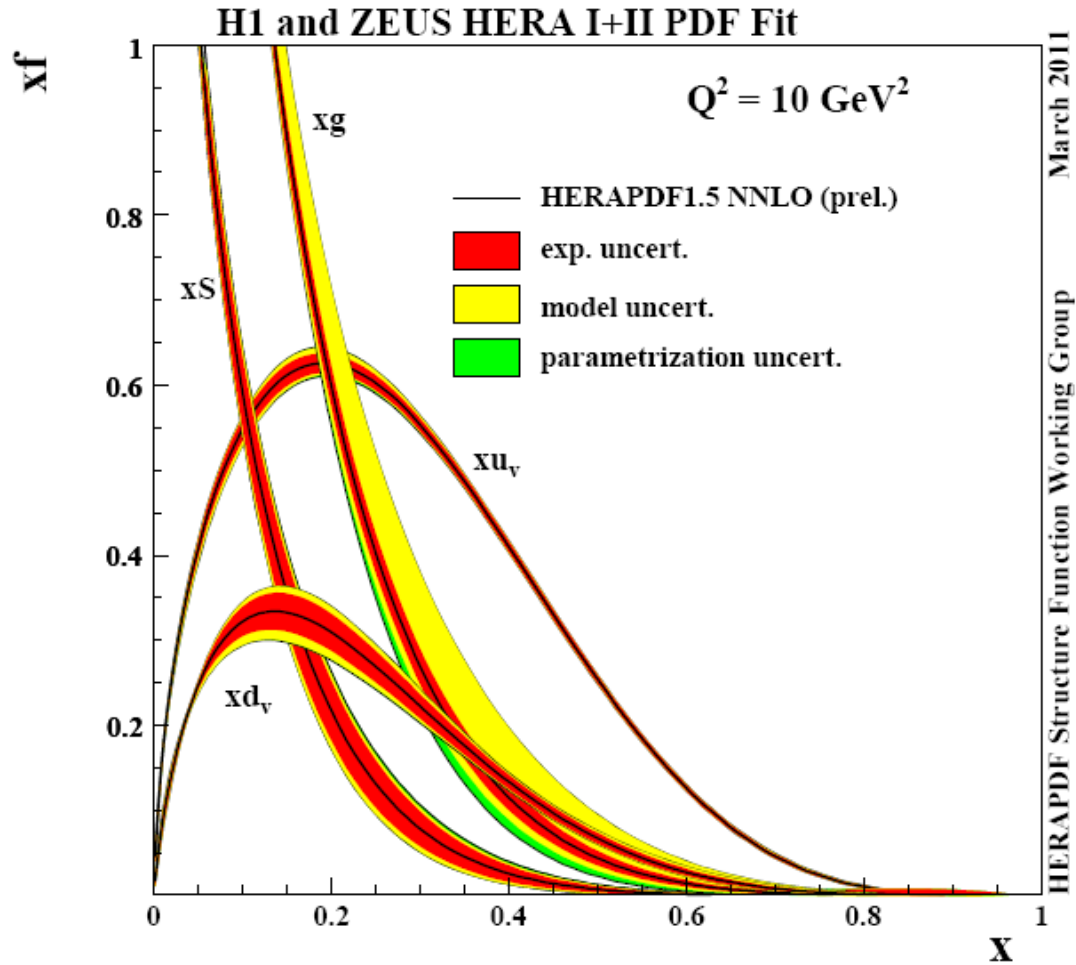


Fig-TP-4.16



$Q^2 = 25030 \text{ GeV}^2; \quad y = 0.56; \quad \mathbf{x} = 0.50$

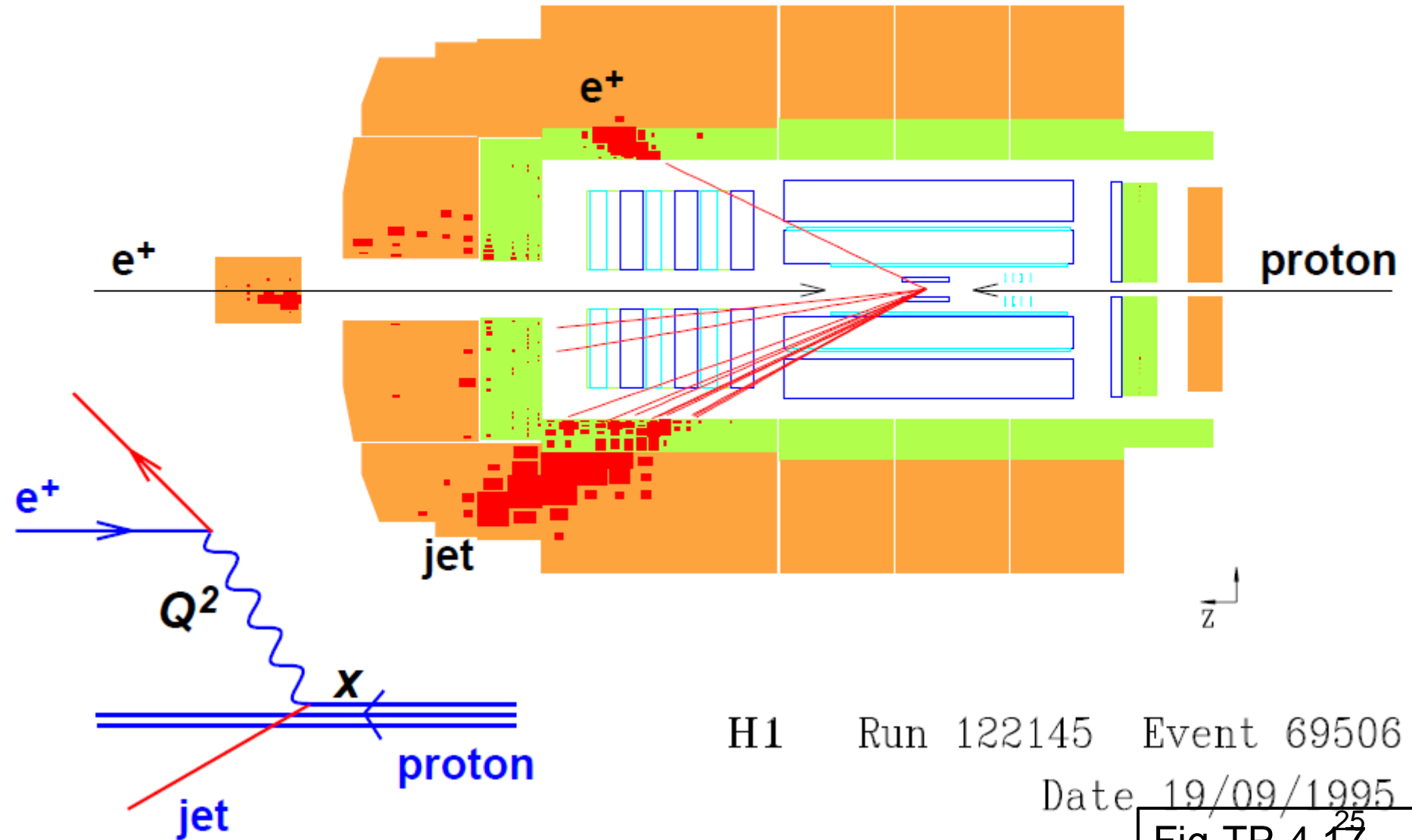


Fig-TP-4.17