Update on studies of F_2^γ

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Photon structure function & its measurement

X

The single-tag process

$$e^+e^- \rightarrow e^+e^- \gamma\gamma \rightarrow e^+e^- X$$

$$\frac{d\sigma(e\gamma \to eX)}{dxdQ^2} = \frac{2\pi\alpha^2}{xQ^4} \cdot \left[\{1 + (1-y)^2\} F_2^{\gamma}(x,Q^2) - y^2 F_L^{\gamma}(x,Q^2) \right]$$



$$Q^{2} = 4E_{b}E'sin^{2}(\theta/2)$$
$$y = 1 - \frac{E'}{E_{b}}cos^{2}\left(\frac{\theta}{2}\right)$$

$$x = \frac{Q^2}{Q^2 + W^2 + P^2}$$

$$W^2 = \left(\sum E_h\right)^2 - \left(\sum \vec{p}_h\right)^2$$

- fraction of parton momentum with respect to the target photon
- *y* energy lost by the inelastically scattered electrons
- E_b (E') energy of the beam electrons (the scattered electrons)
- E_h (\vec{p}_h) energies (momenta) of final state particles



Polar angles of scattered electrons





Expected values of kinematic variables – generation level, various structure functions

GRV-LO

SAS

GS

DG

Energy distribution of tagged electrons



At the reconstruction level events with small values of E_{tag} are observed.

- \rightarrow particles which pass through the detector leaving in it only part of their energies
- \rightarrow particles which were scattered



х

х

Background – first results



Summary and Outlook

• At ILC/CLIC it will be possible to extend the available kinematical range for the measurement of the photon structure functions.

• Information from forward detectors can be used to study the photon structure functions. However, at higher energies tagging of the scattered electrons is difficult.

• The comparison of the PYTHIA generator level results with predictions of other Monte Carlo generators (HERWIG, TWOGAM) using various structure functions (SAS, GRV-LO, GS, DG) has been made.

• Results for photon structure functions were obtained at generation and reconstruction levels.

• First steps towards estimating the background were made.

• It is necessary to consider systematic effects and the determined kinematical variables should be corrected due to the detector effects.