Anomalous interactions

Before discovery new heavy particles inherent New Physics, it reveals itself at lower energies as some *anomalies in the interactions of known particles*. Our goal is to find these anomalies and discriminate as better as possible. The correlation between coefficients of different anomalies will be the key to understand the nature of New Physics.

Gauge bosons.

The e^+e^- mode. Main process under interest is $e^+e^- \to W^+W^-$. At suitable electron polarization the neutrino exchange contribution disappear, and residual cross section (obliged by photon and Z boson exchange) has maximum about 2 pb within LEP operation interval, next it decreases with energy. The cross sections of other processes with W production are small at $\sqrt{s} < 1$ TeV.

At Photon collider main processes are $\gamma e \to W\nu$, $\gamma\gamma \to W^+W^-$. Their cross sections are about 80 pb and energy independent at $\sqrt{s} > 200$ GeV *(at least 40 times higher than for e^+e^- collisions, about $2 \cdot 10^7$ W's per year)*.

However, one can happen that the opposite scenario is realized

No new particles and interactions will be discovered at the Tevatron, LHC and e^+e^- LC except Higgs boson.

In this case

the main goal of studies at new colliders will be the hunting for indirect signals of New Physics –
deviations of observed quantities from $\mathcal{SM}$ predictions.

The corresponding results from LHC will have low precision due to high background, this precision will be better for e^+e^- LC,

Photon Colliders are the best machines for solving of this problem

Due to high value of these basic cross sections, many processes of 3-rd and 4-th order have large enough cross sections: $\gamma e \to eWW$, $\gamma\gamma \to ZWW$, $\gamma e \to \nu WZ$, $\gamma\gamma \to WWWW$, ... Large variety of these processes permit to discover and separate well anomalies in specific processes and (or) distributions. For example, the following line of procedures is almost evident:

- (a) To extract γWW anomalies from $e\gamma \to \nu W$ pro
(b) To extract ZWW anomalies from $e^+e^- \to W^+W$
(c) To extract $\gamma\gamma\, WW$ anomaly from $\gamma\gamma \to W^+W^-$.
- The process $\gamma e \to eWW$ permit to study anomaly γZWW when consider events with transverse momentum of scattered electron $p_\perp \geq 30$ GeV.

This subject needs for detail studies of all processes enumerated.

The cross section $e\gamma \to \nu W$ is $\propto (1-2\lambda_e)$, it is switched on or off with variation of electron helicity λ_e. It gives very precise test of absence of right handed currents in the interaction of W with the matter.

The charge asymmetry of produced W's in the process $\gamma e \to eWW$ looks most sensitive key for the study of strong interaction in Higgs sector.

The two–loop radiative corrections to $\gamma\gamma \to W^+W^-$ and $e\gamma \to \nu W$ should be considered. They are measurable and sensitive to the problems of

- construction of S–matrix of theory with unstable particles

and to

- gluon corrections like Pomeron exchange between quark components of W's.