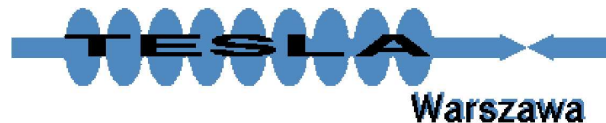


# Tools for photon physics

What do we need for photon-photon studies ?  
(as far as generators are concerned)

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NŻK

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of Physics and Detectors for a Linear Collider  
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# $\gamma\gamma$ spectra

Variable photon beam energy and polarization (in event generation):

⇒ as user routine

eg. CompAZ spectra can be interfaced with CompHEP

⇒ as user event input

eg. CIRCE2 with PYTHIA

Circular photon polarization:

- fixed polarization available ⇒ generate  $J = 0$  and  $J = 2$  separately  
eg. in CompHEP, for some processes in PYTHIA
- variable polarization would allow for generating complete process in one run...

**Linear polarization !?**

## $\gamma\gamma$ processes

For studying different models:

- Higgs tree-level couplings defined by user eg. 2HDM(II)  
⇒ calculation of loop couplings eg.  $\gamma\gamma \rightarrow h$
- generic Higgs couplings (eg. models with CP-violation)

For detailed background analysis:

- higher order corrections to different processes  
eg. in  $\gamma\gamma \rightarrow Q\bar{Q}(g)$ , NLO crucial for  $J = 0$
- processes with loop couplings  
 $\gamma\gamma \rightarrow ZZ, \gamma\gamma \rightarrow Z\gamma, \gamma\gamma \rightarrow \gamma\gamma$

**Resolved photon processes**

Routines calculating differential cross sections should be available to the user.

# Interference and correlations

Calculations performed on **helicity amplitude** level

⇒ **interference** between different processes taken into account

This is crucial for many studies

i.e.  $\gamma\gamma \rightarrow (h) \rightarrow W^+W^-$ ,  $\gamma\gamma \rightarrow (h) \rightarrow ZZ$ ,  $\gamma\gamma \rightarrow (h) \rightarrow t\bar{t}$

Secondary decays with proper treatment of angular correlations

both for signal **and background !**

i.e.  $\gamma\gamma \rightarrow ZZ \rightarrow l^+l^-jj$ ,  $\gamma\gamma \rightarrow \tau^+\tau^- \rightarrow \pi^+\pi^0\pi^-\pi^0\nu\nu$ ,  
 $\gamma\gamma \rightarrow t\bar{t} \rightarrow 6 \text{ jets}$

PYTHIA properly describes all angular correlations for Higgs decays

(eg.  $h \rightarrow ZZ \rightarrow l^+l^-jj$ ), but NOT for background!...

# Interface

## Other codes

Proper interface of parton-level NLO simulation with PS and hadronization...

## User

Easy user interface, well defined (“physical”) input parameters

Detailed documentation for non-experts (experimentalists !)

Possibility of including user defined processes

## General

Monte Carlo Guide for non-experts and/or web page,  
with description and comparison of all generators would be very nice...