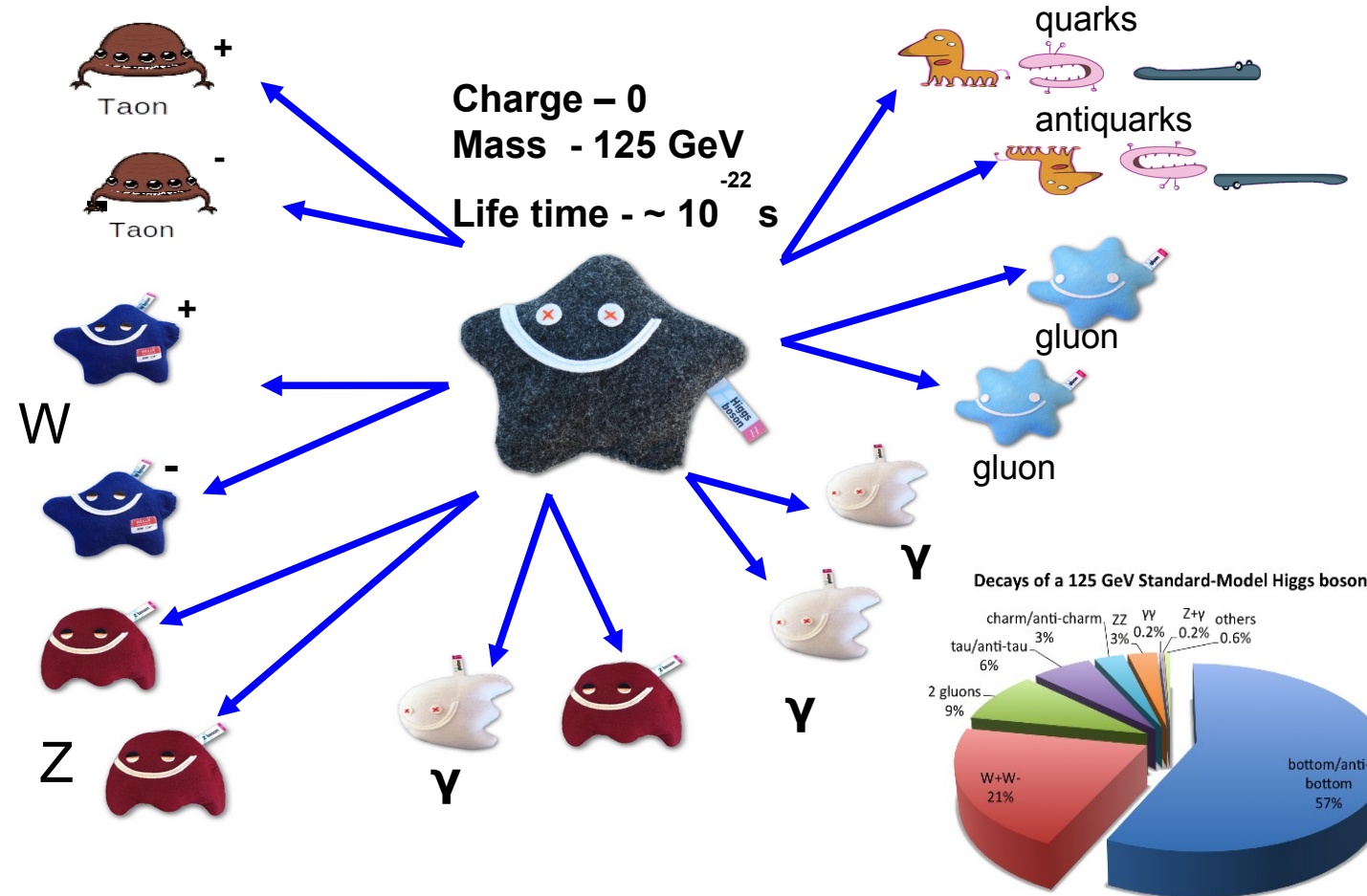


Background estimation from fake taus in double boson Higgs production with leptons in a final state

Bartłomiej Zabiński

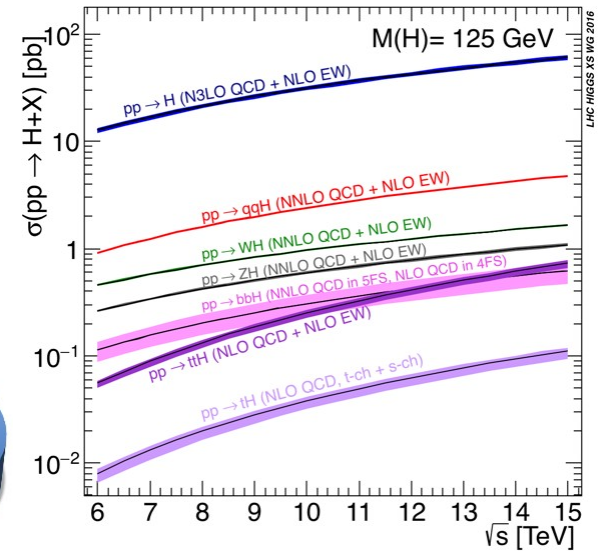
Bartlomiej.zabinski@ifj.edu.pl

The Higgs boson



Postulated in 1964 by Peter Higgs, Francois Englert, and Rober Brout.

In 2012 the first observation of the Higgs boson at LHC by the ATLAS and CMS experiments



A double Higgs bosons production

HH decay mode	bb	WW	$\tau\tau$	ZZ	$\gamma\gamma$
bb	33%				
WW	25%	4.6%			
$\tau\tau$	7.4%	2.5%	0.39%		
ZZ	3.1%	1.2%	0.34%	0.076%	
$\gamma\gamma$	0.26%	0.10%	0.029%	0.013%	0.0005%

Double Higgs decay modes.

Fields marked by dashed line are represent di-Higgs production modes with leptons in a final state

The total cross-section for di-Higgs production is ~ 35 fb, but for multileptons in final state, the cross-section is < 1 fb. A 1000 times smaller than cross-section for single Higgs production.

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Do we have a chance to observe di-Higgs production at the LHC?

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Yes, we have*.

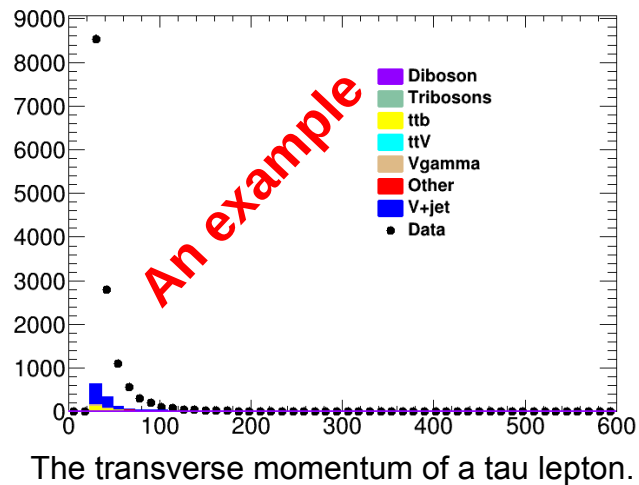
A lot of particle physics theoretical models predicting enhancement of the di-Higgs production at least 100 times with respect to the Standard Model.

An observation of the di-Higgs production can bring proof for physics beyond the Standard Model.

* the chances are small but are worth it.

The goal of the task.

The main goal of the task is to estimate a fake taus contribution to backgrounds.



The empty space between data (black dots) and background (colored histograms) suggest a significant contribution of fake taus, or ...

Signal process:

$$HH \rightarrow 2l (SS) + 1\tau + X$$

How to estimate:

- 1) Define two regions where we should expect a significant number of wrong reconstructed taus
- 2) Using data-driven technics estimate fake factors and present them in pt , η , .. functions
- 3) Apply fake factors in the second region and validate obtained background.

Thank you !