Search for Single-charged Higgs at the LheC and FCC-eh

August 11, 2017

Introduction

Aim:
To develop one strategy to search for H^{+/-} at the LHeC & FCC-eh .

Questions:
(1) Current LHC status & HL-LHC projection ?

(2) Signal production at ep colliders ?
-> ZW-fusion: p e- > j e- H+; j e- H-, j ve H-
-> Considering W&Z decays, which final state is most sensitive ?

(3) Dominant background processes at ep colliders ?
-> Diboson ZW production: p e- > j e- z w+, j e- z w-, j ve z w-

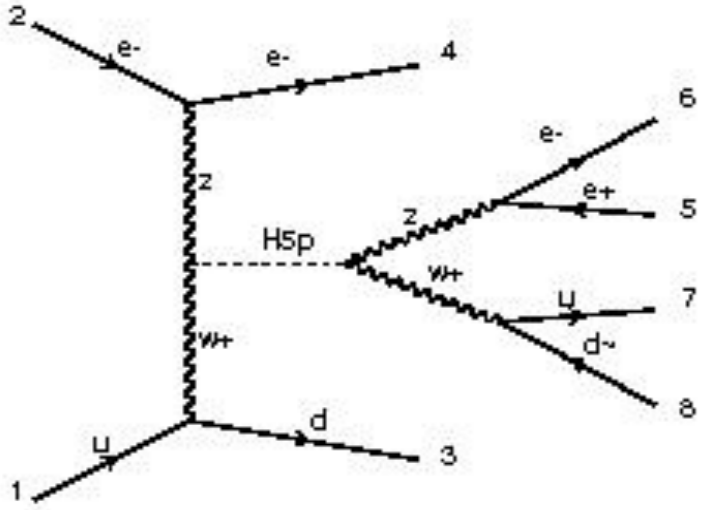
(4) How to perform analysis at ep colliders ?
-> BDT analysis at detector level.

Signal of H5+

Using MadGraph to generate

Signal:
“define p = g u c d s u~ c~ d~ s~
define j = g u c d s u~ c~ d~ s~
define l+ = e+ mu+
define l- = e- mu-

import model GM_input3_UFO
generate p e- > j e- H5p / H3z H3p,
(H5p > z w+, z > l+ l-, w+ > j j) ”



The final state: 1 e- + 1 j + 1 Z(-> l+ l-) + 1 W+(-> j j)

Background of of H5+

Using MadGraph to generate

Signal:
“import model sm
define p = g u c d s u~ c~ d~ s~
define j = g u c d s u~ c~ d~ s~
define l+ = e+ mu+
define l- = e- mu-

generate p e- > j e- z w+, z > l+ l-, w+ > j j
add process p e- > j e- z w-, z > l+ l-, w- > j j
add process p e- > j e- z z, z > l+ l-, z > j j ”

The final state: 1 e- + 1 j + 1 Z(-> l+ l-) + 1 V(-> j j)

s= 0.010276 ± 0.000306 (pb)

Graph	Cross-Section ↓	Error	Events (K)	Unwgt	Luminosity
P1 sum	0.00657415541				
P1_ql_qlzwp_z_ll_wp_qq	0.006574	0.000203	1196.041	956.0	0
P2_ql_qlzwm_z_ll_wm_qq	0.003639	0.000229	931.766	1178.0	0
P2 sum	0.00363882676				
P3_ql_qlzz_z_ll_z_qq	6.263e-05	1.25e-06	563.451	1221.0	0
P3 sum	6.2627282e-05				

Background

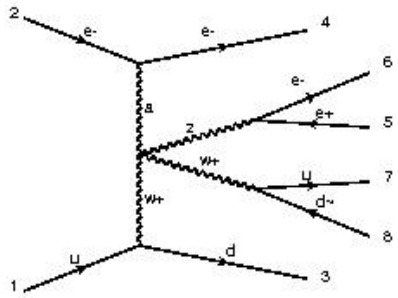


diagram 1 QCD=0, QED=6

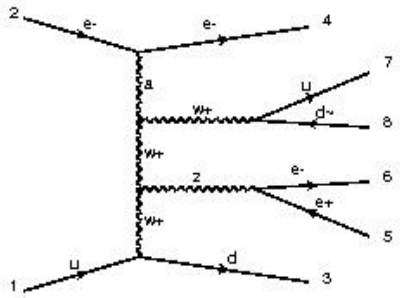
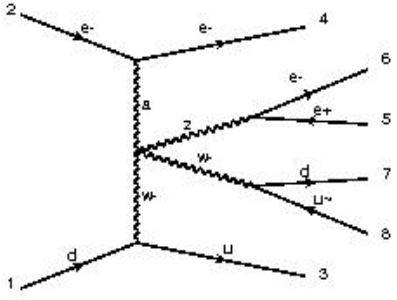


diagram 2 QCD=0, QED=6



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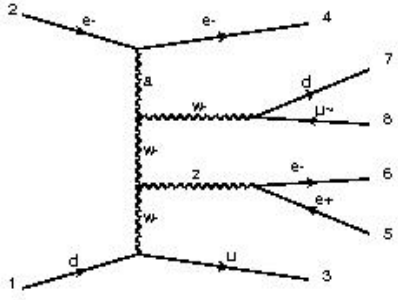

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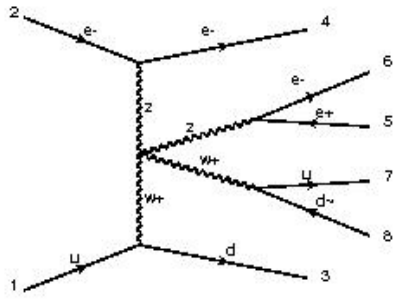


diagram 3 QCD=0, QED=6

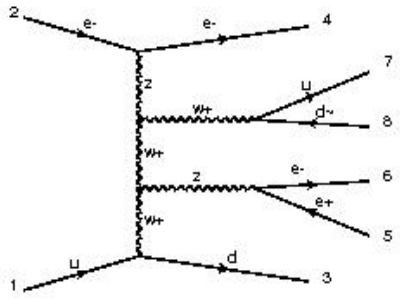
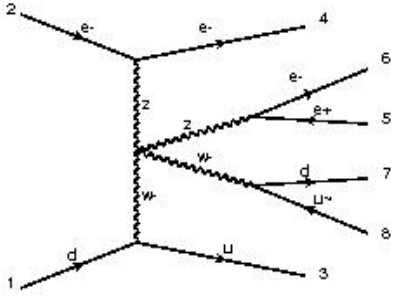


diagram 4 QCD=0, QED=6



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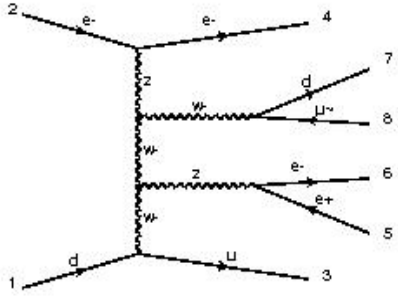

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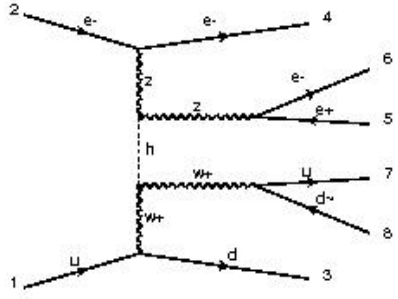
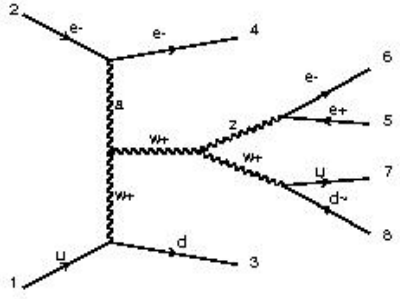


diagram 5 QCD=0, QED=6



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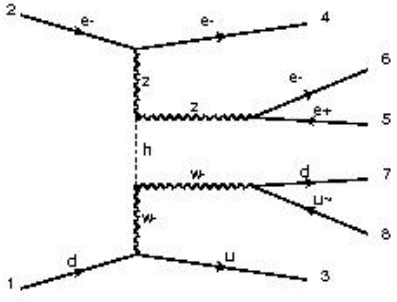

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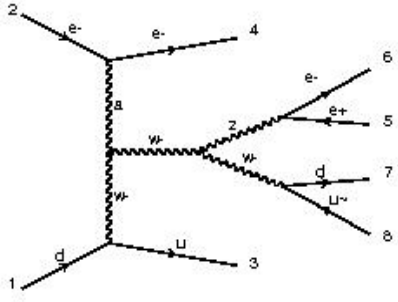
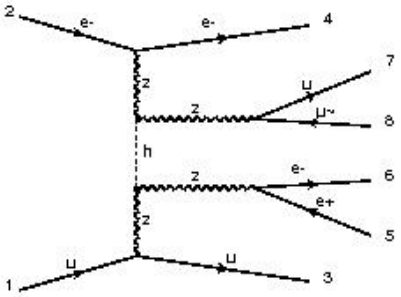


diagram 6 QCD=0, QED=6

Background



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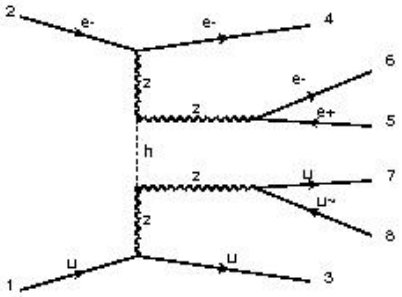

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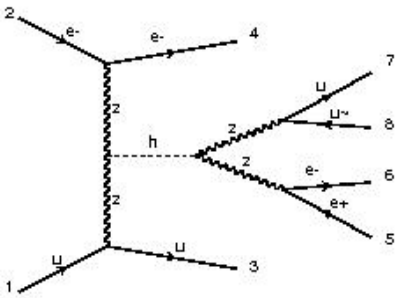

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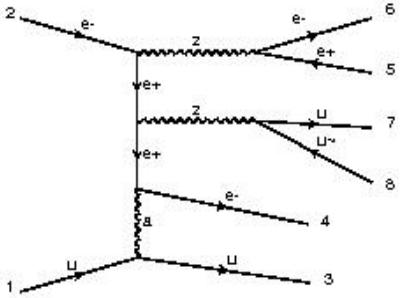

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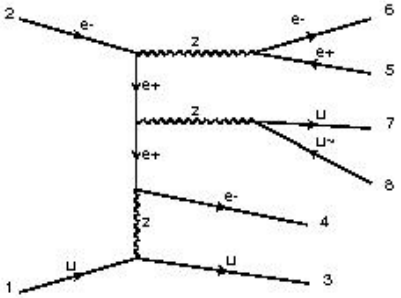

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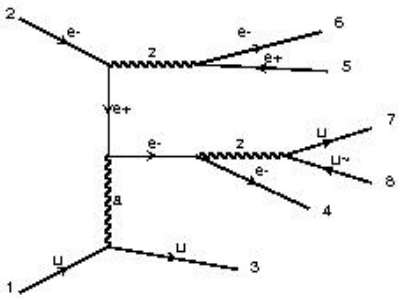

diagram 6 QCD=0, QED=6

Signal of H5-

Using MadGraph to generate

Signal:
“import model GM_input3_UFO
generate p e- > H5p~ all all ”

If H3p~, H3z are heavy,
Production via WZ-fusion.
The final state: 1 [?] + 1 j + 1 H-