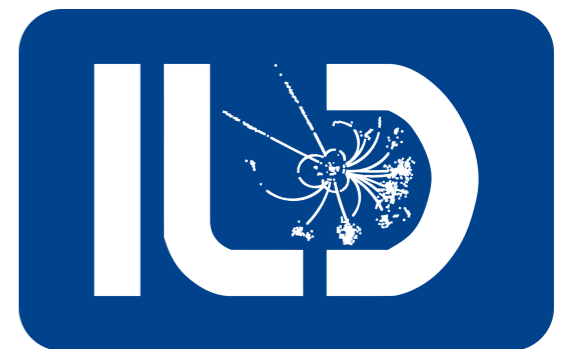


# Recent progress on $e^+e^- \rightarrow \text{gamma}Z$ analysis

Takahiro Mizuno



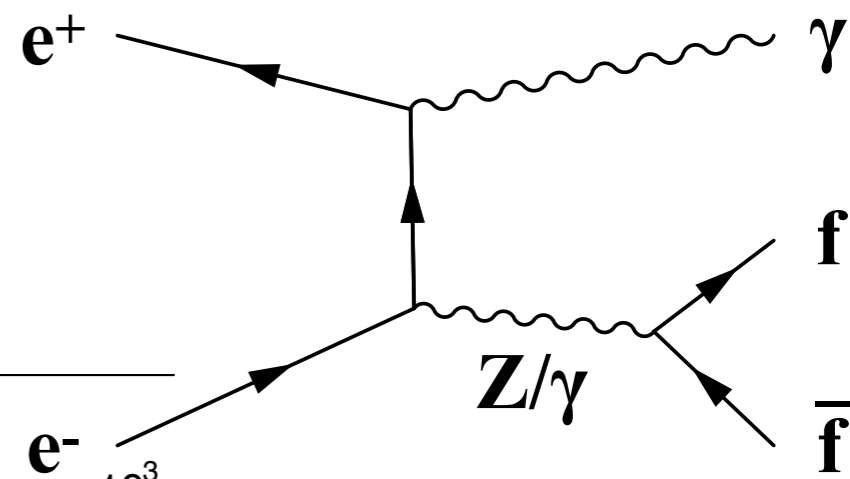
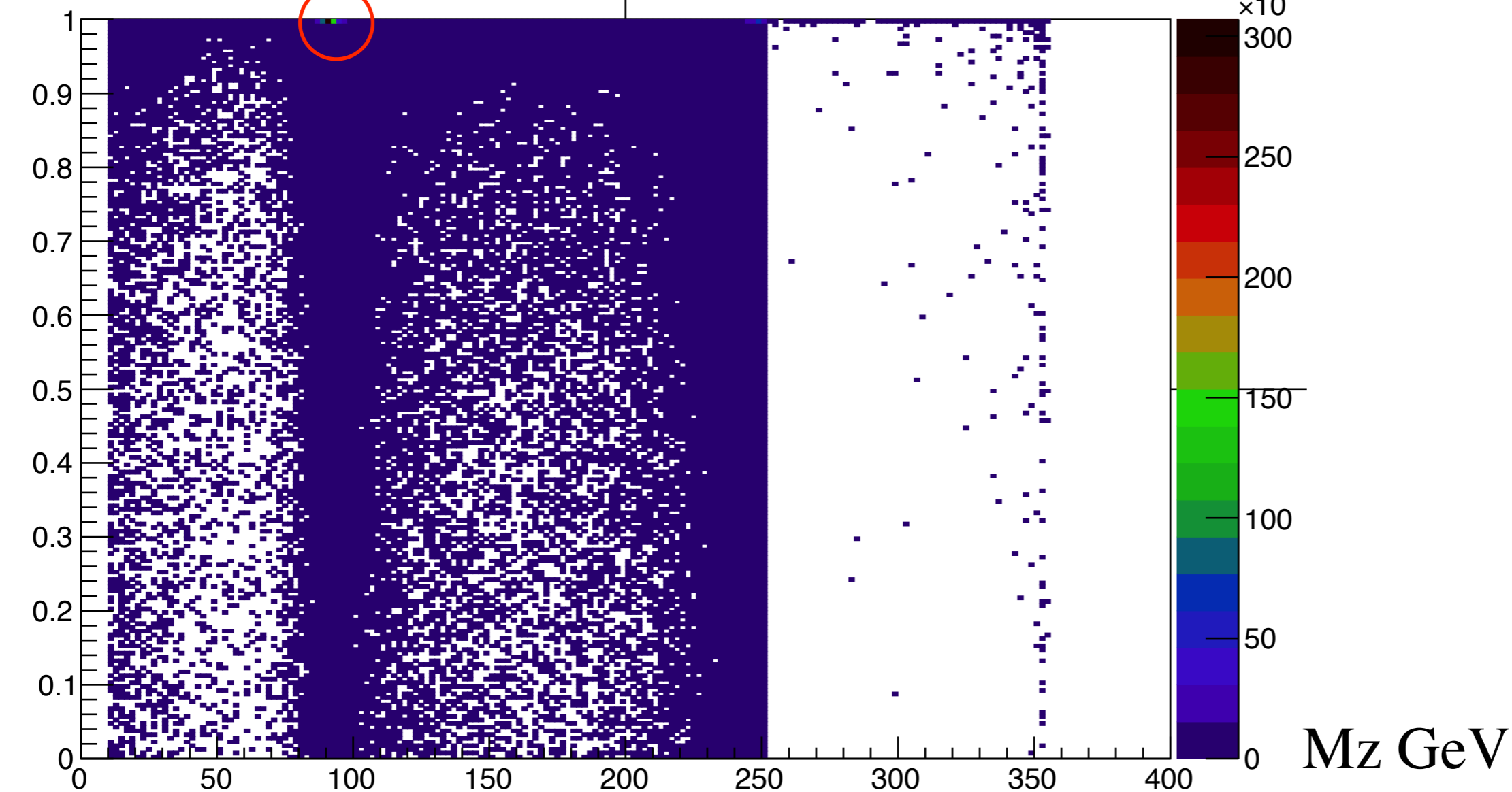
# Signal event definition

Signal event: radiative return

eLpR events

$|\cos \theta_\gamma|$

`abs(cos(photonthetaMC)):mzgen`

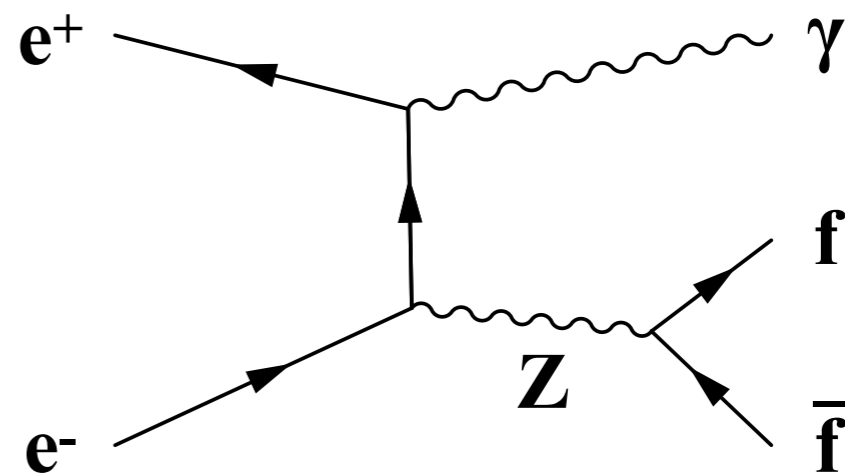


# Signal event definition

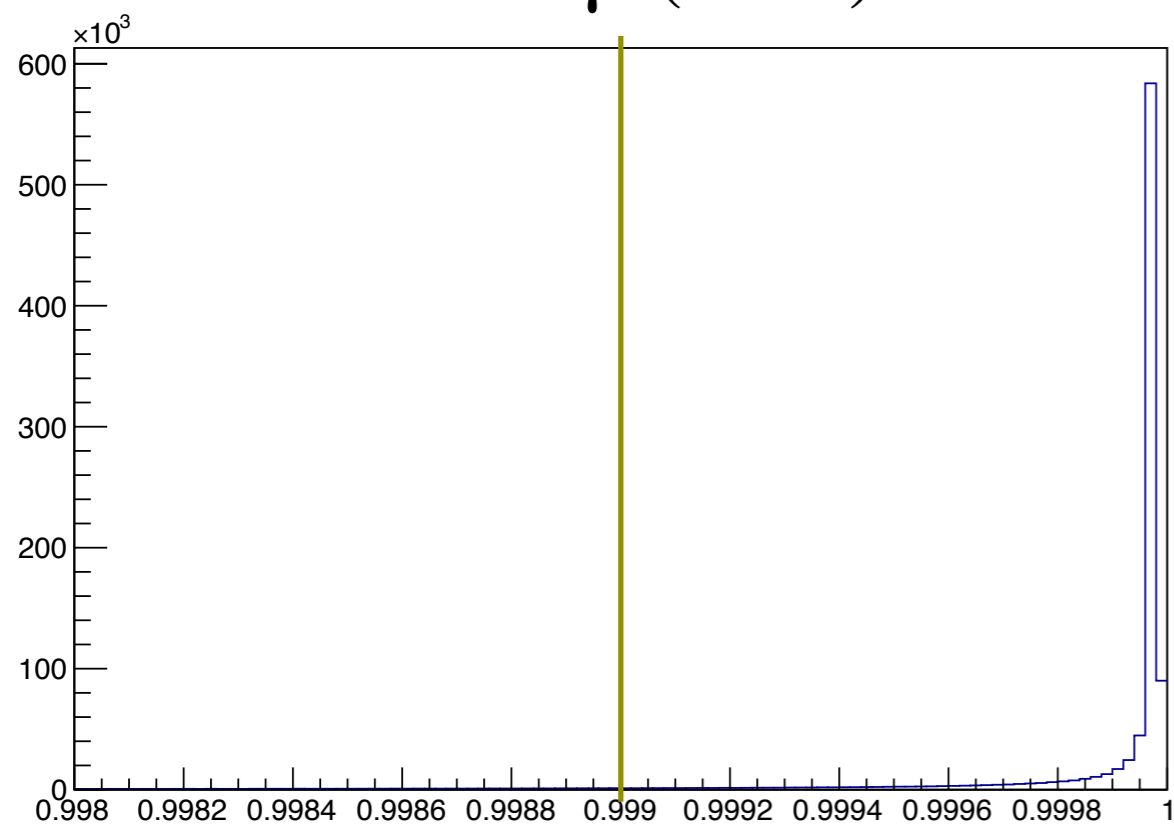
Signal event ( $e^+e^- \rightarrow \text{gamma } Z$ ):

A.  $80 \text{ GeV} < M_{Z(\text{truth})} < 100 \text{ GeV}$

B.  $|\cos\theta_{\gamma(\text{truth})}| > 0.999$

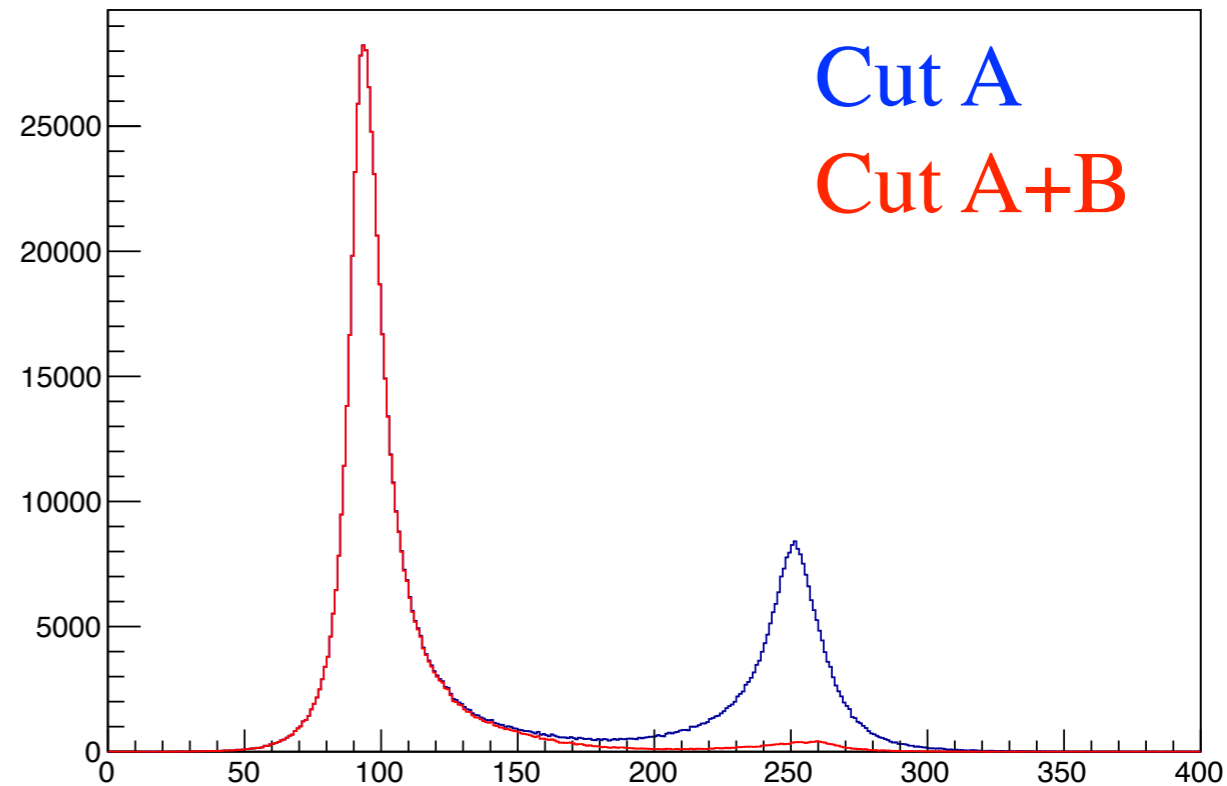


$|\cos\theta_{\gamma}|$  (truth)



$|\cos\theta_{\gamma}|$

$M_Z$  (PFO)



$M_Z \text{ GeV}$

# Background exclusion

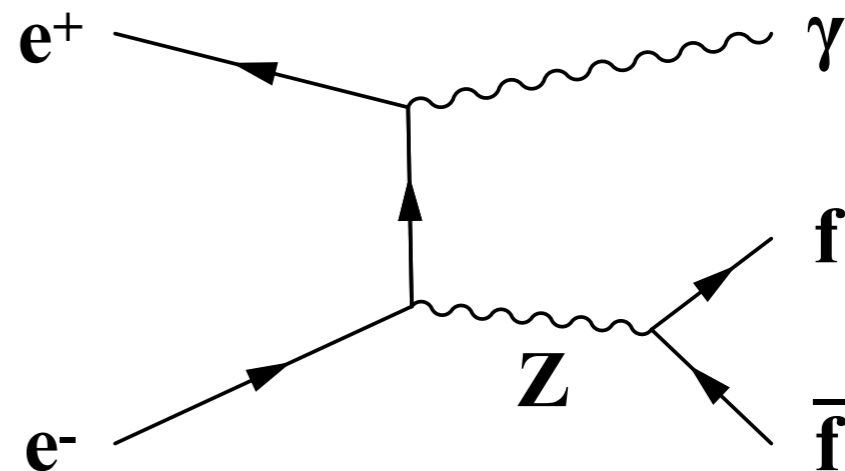
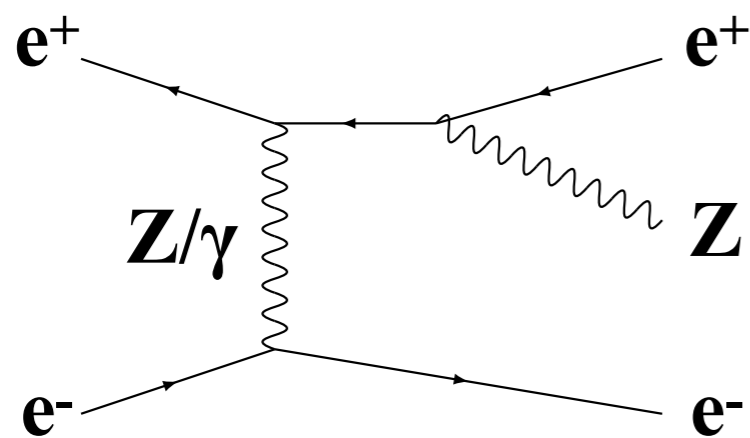
Signal event ( $e^+e^- \rightarrow \text{gamma Z}$ ):

A.  $80 \text{ GeV} < M_{Z(\text{truth})} < 100 \text{ GeV}$

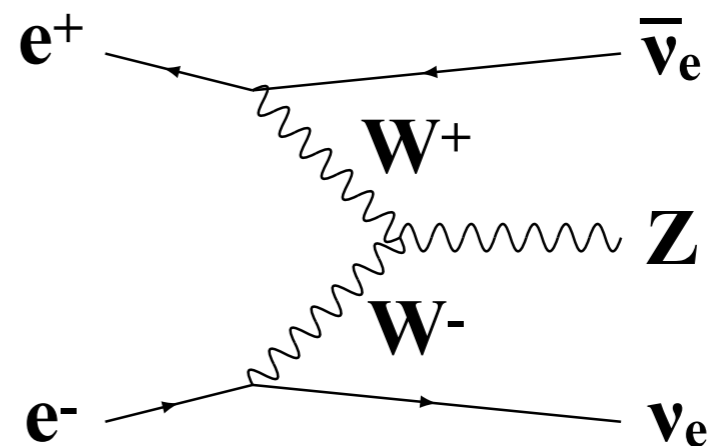
B.  $|\cos\theta_{\gamma(\text{truth})}| > 0.999$

Background event examples:

$e^+e^- \rightarrow Z$   $e^+e^- \rightarrow 2 \text{ jets} + e^+e^-$



$e^+e^- \rightarrow Z$   $\nu\nu \rightarrow 2 \text{ jets} + \nu\nu$



## Selection cuts:

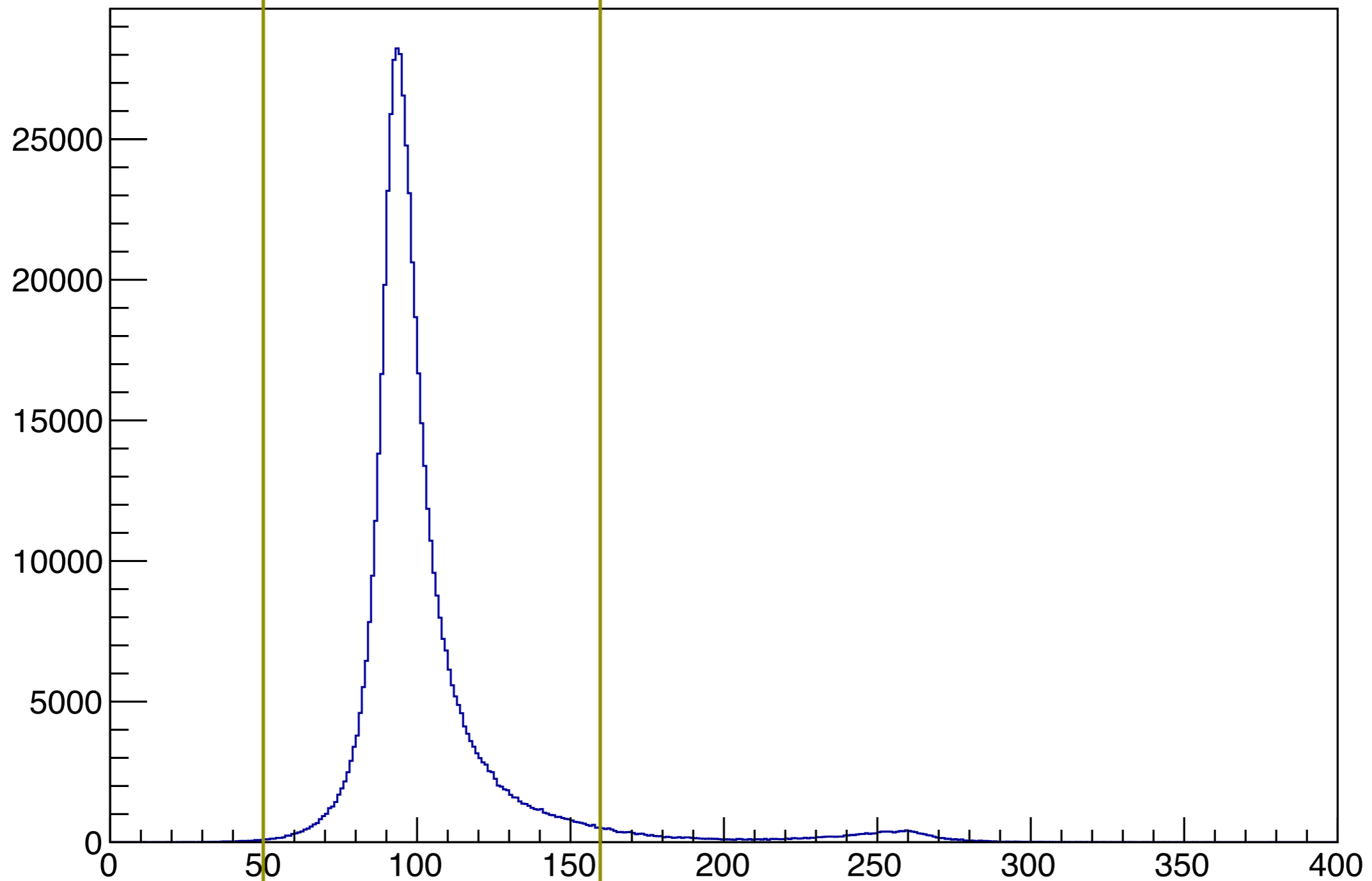
**1. veto events which have energetic photons ( $>50 \text{ GeV}$ ) detected, since we focus on first the signal events in which photon is collinear in the beam direction**

**2.  $50 \text{ GeV} < \text{reconstructed Z mass (Mz)} < 160 \text{ GeV}$**

# Background exclusion

S  
A  
B  
E  
e

`mz {mzgen>80 && mzgen<100 && abs(cos(photonthetaMC))>0.999}`



Se  
1.  
fo  
di

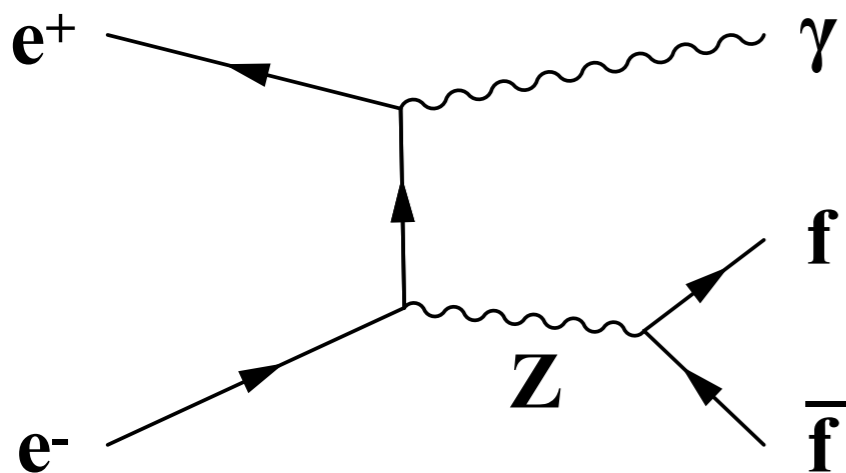
**2.  $50 \text{ GeV} < \text{reconstructed Z mass (Mz)} < 160 \text{ GeV}$**

Mz GeV

# Efficiency Tables

## Signal & Background efficiencies

### Signal



Signal event ( $e^+e^- \rightarrow \text{gamma } Z$ ):  
 A.  $80 \text{ GeV} < M_{Z(\text{truth})} < 100 \text{ GeV}$   
 B.  $|\cos\theta_{\gamma(\text{truth})}| > 0.999$

### Cut A+B Signal

	$2f_{z_h}$ $e_{LPR}$	$2f_{z_h}$ $e_{RPL}$
<b>Before selection</b>	1.000	1.000
<b>#Photon = 0</b>	0.957	0.956
<b><math>50 \text{ GeV} &lt; M_z &lt; 160 \text{ GeV}</math></b>	0.939	0.939

### Cut A Signal

	$2f_{z_h}$ $e_{LPR}$	$2f_{z_h}$ $e_{RPL}$
<b>Before selection</b>	1.000	1.000
<b>#Photon = 0</b>	0.712	0.711
<b><math>50 \text{ GeV} &lt; M_z &lt; 160 \text{ GeV}</math></b>	0.670	0.669

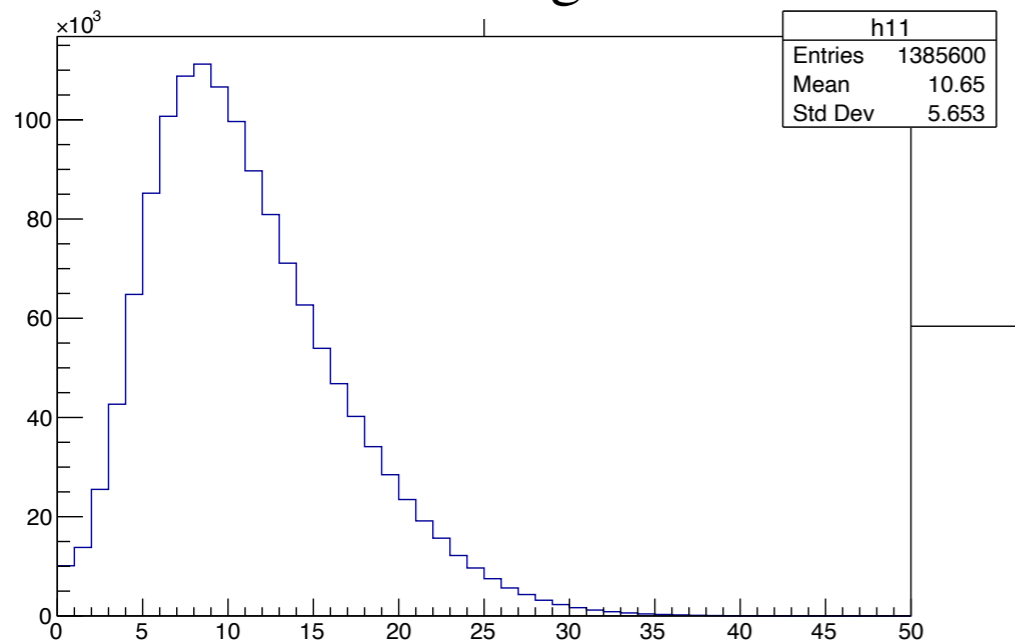
# Definition of Mz in the background<sup>7</sup>

Now considering the case signal is  $e^+e^- \rightarrow \text{gamma } Z$ ,  $Z \rightarrow 2\text{jets}$ .

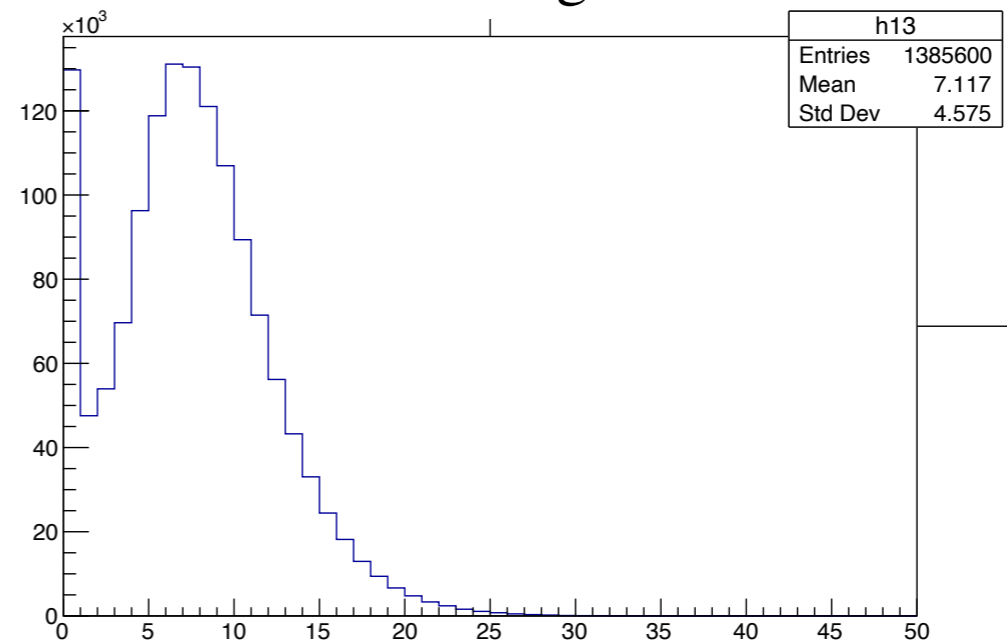
2jets events in the bkg can be mistaken as the signal. Need to extract those events.

## eLpR Signal

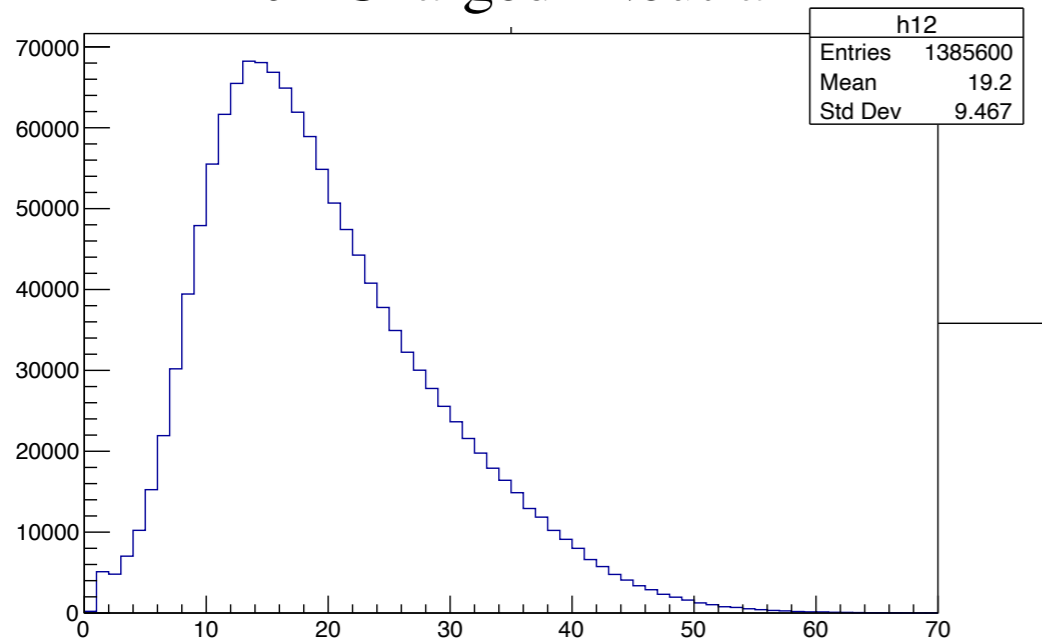
#J1 Charged



#J2 Charged



#J1 Charged+Neutral



#J2 Charged+Neutral

