W cross section at 162 GeV

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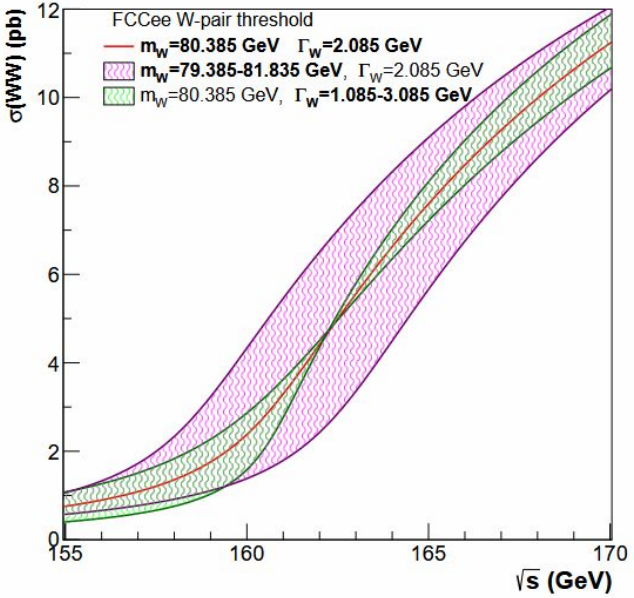
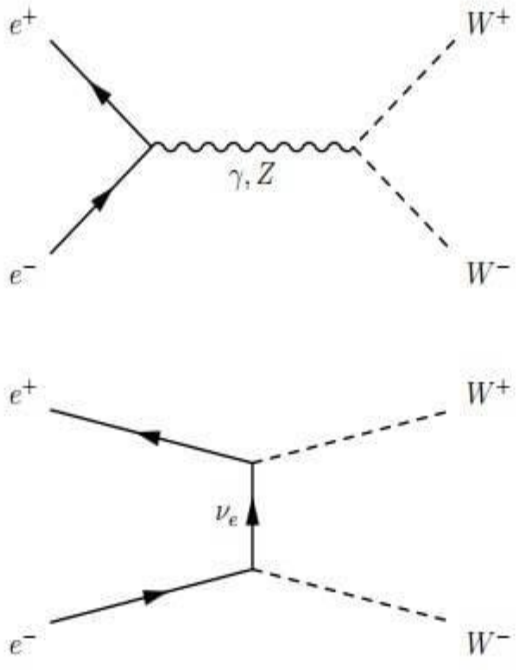
Motivation:

- Consistency of simulated detector data
- Understanding of background events
  - Effects on signal
  - Cuts
- Findings can be compared to using other channels to investigate W bosons (WW to leptons, etc)
- Mass can be determined from cross section at √s = 160-165 GeV



Process

- e+e- → W+W- → W(qq)W(qq) channel to find the mass of the W boson
- W→qq Highest branching ratio (primarily to quarks)



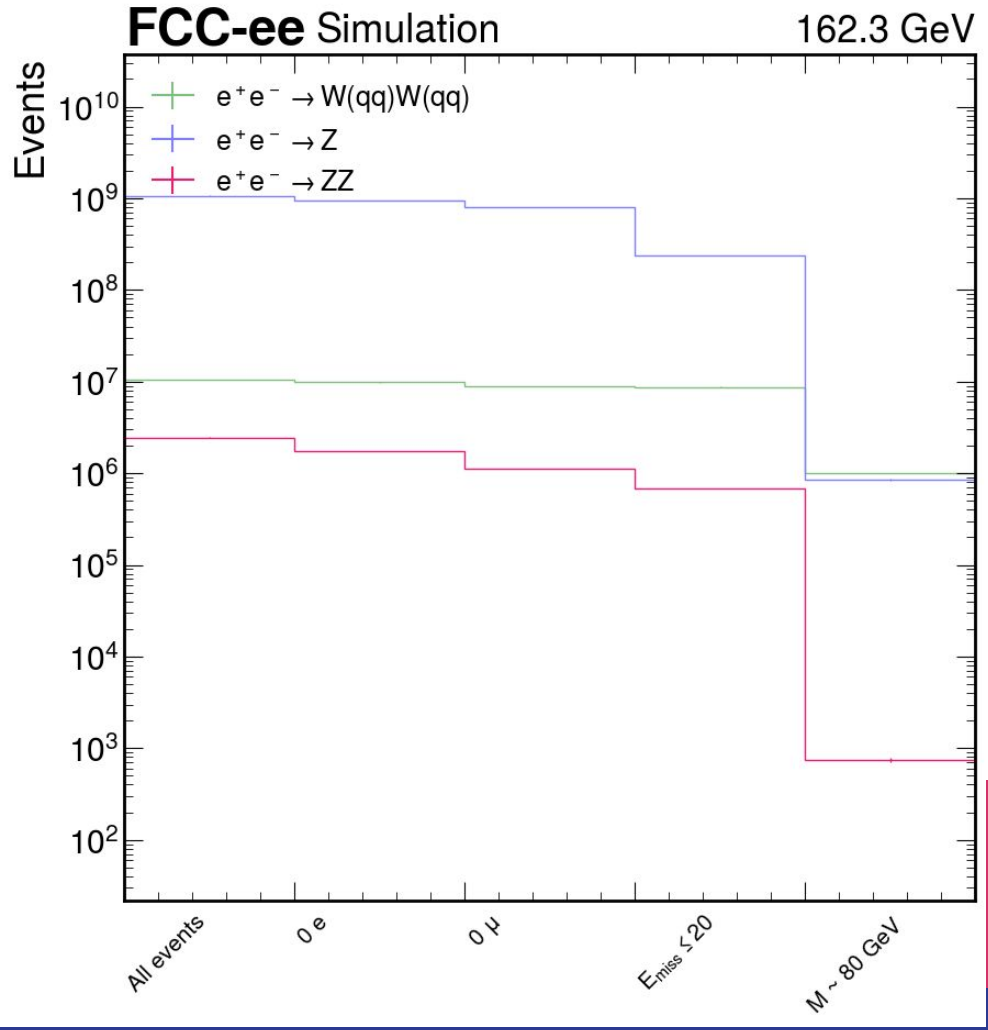
Method

- Samples used: Pythia 8, ee->WW,ee->ZZ, ee->Z, ecm: 162.3
- Jet clustering to exactly 4 quark jets
- Minimize chi squared to find best pairing of jets for each W boson

$$\chi^2 = (m(qq) - m_W)^2 + (m(qq) - m_W)^2$$

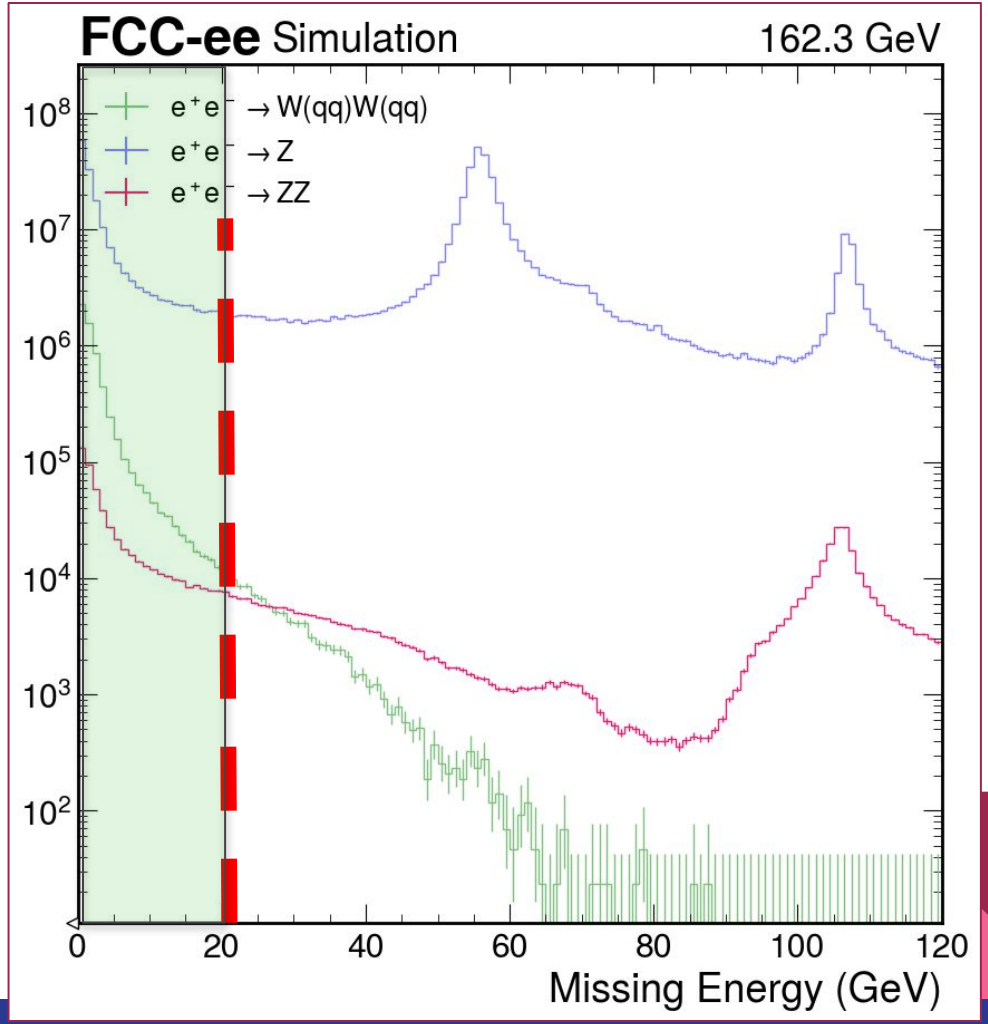
Cut Flow

- Remove muons and electrons
- Missing mass less than 20 GeV
- M ~ 80 GeV (will explain in next slides)

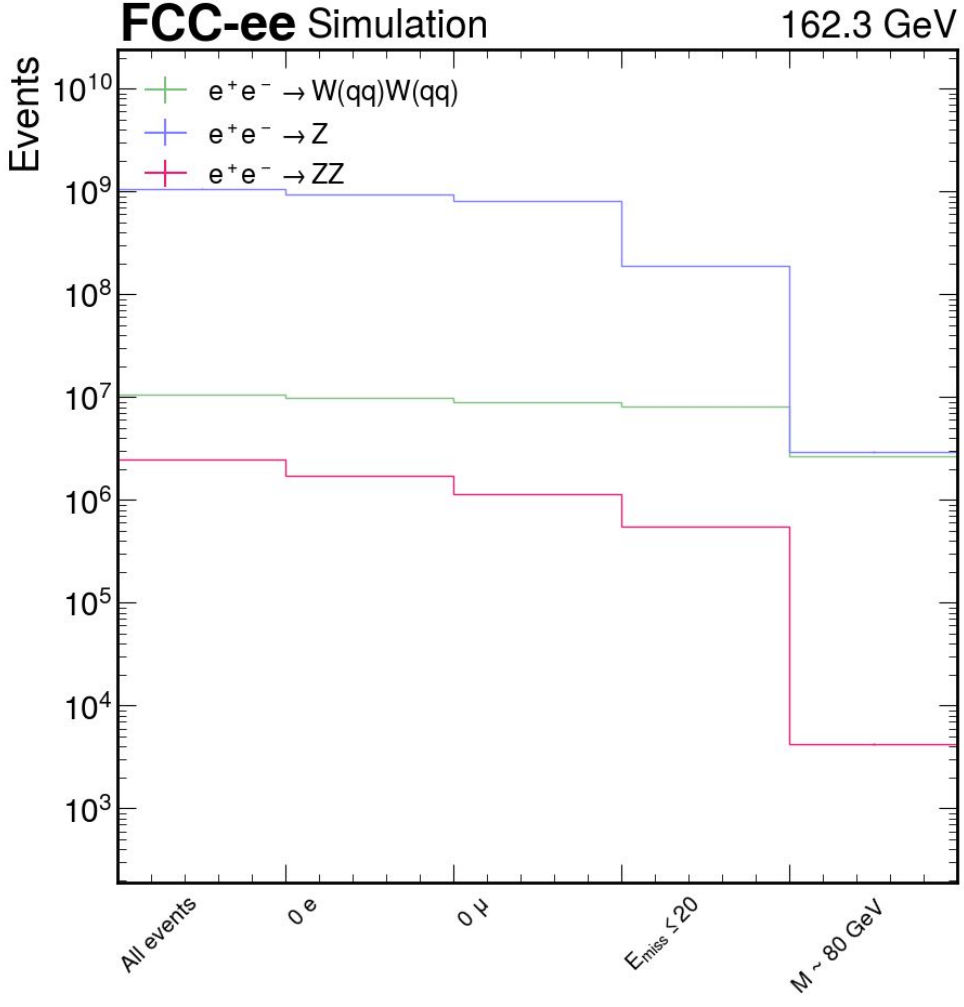


Cut 3:
Missing Energy ≤ 20 Gev

- W(qq)W(qq) expected to have zero/small missing energy
- Reduction of lot of backgrounds ZZ Z/g

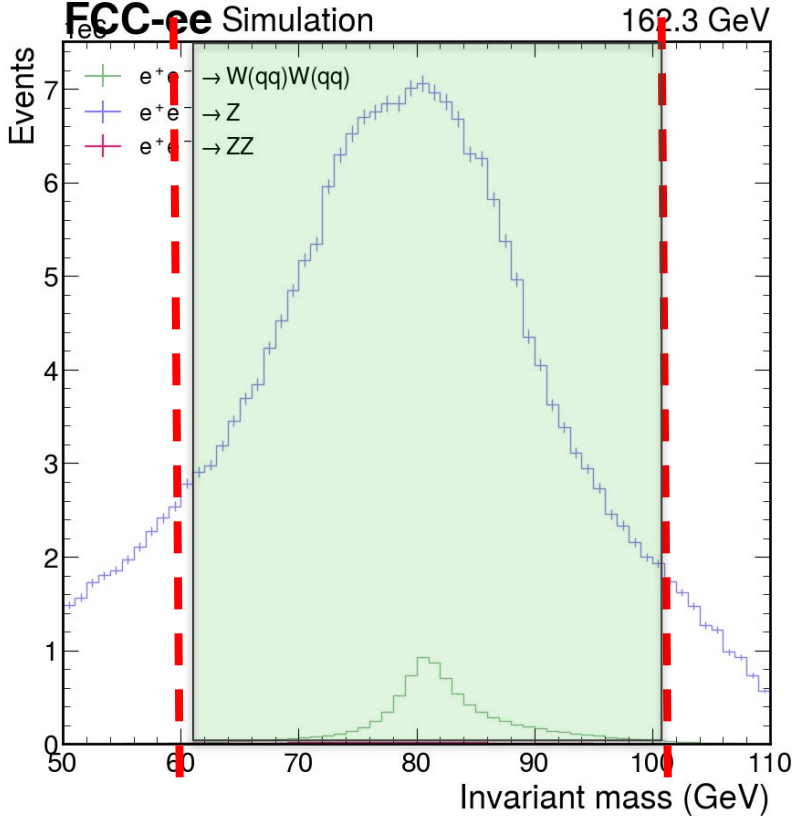


Cut Flow

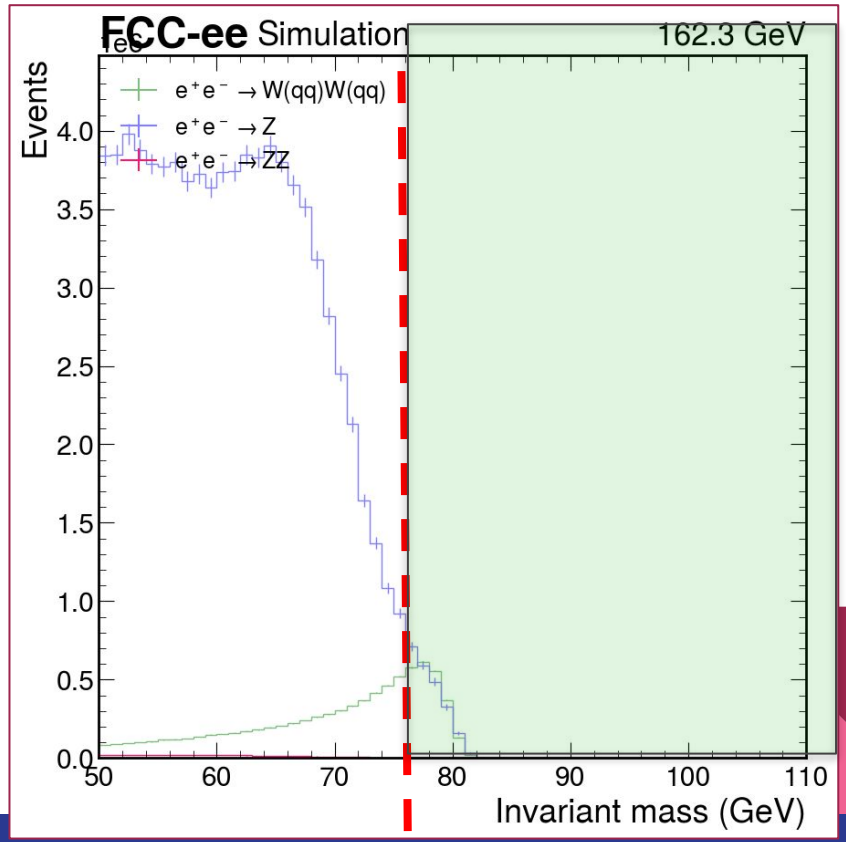

FCC-ee Simulation
162.3 GeV
Events
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
$e^+e^- \to W(qq)W(qq)$
$e^+e^- \to Z$
$e^+e^- \to ZZ$
All events
0 e
0 μ
$E_{miss} \leq 20$
M ~ 80 GeV

Cut 4: M ~ 80 GeV

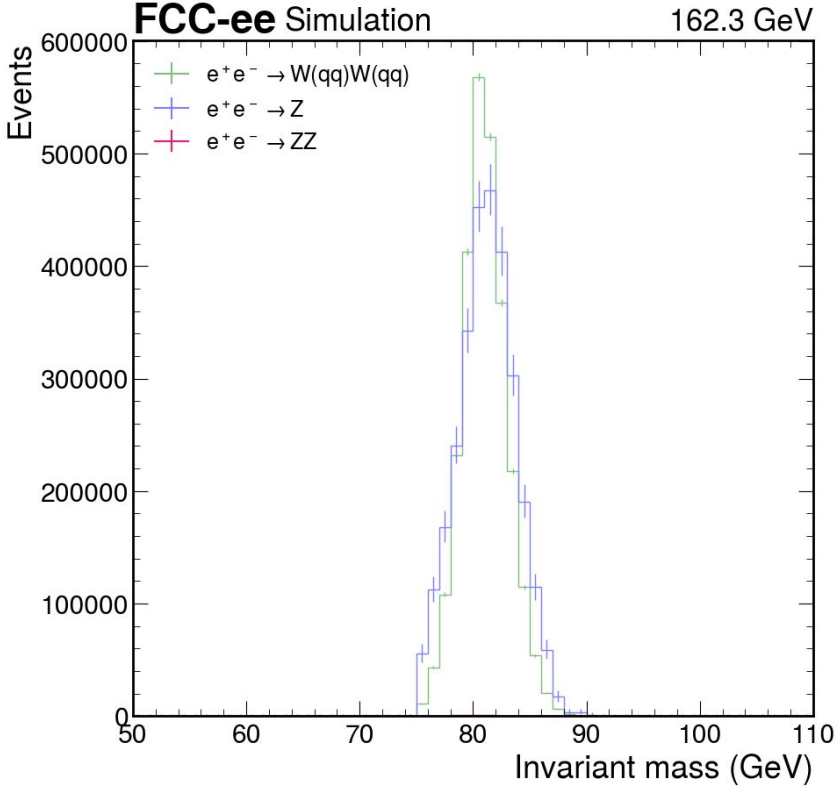
more massive jet pair

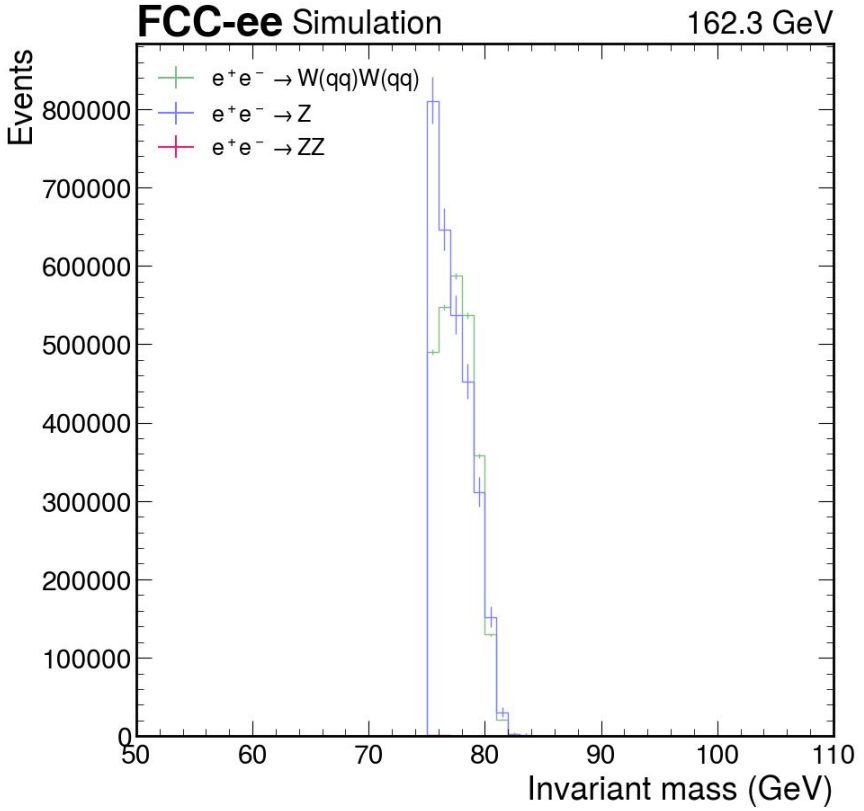


Less massive jet pair



After Cut 4


FCC-ee Simulation
162.3 GeV
Events
600000
500000
400000
300000
200000
100000
0
50
60
70
80
90
100
110
Invariant mass (GeV)
e⁺e⁻ → W(qq)W(qq)
e⁺e⁻ → Z
e⁺e⁻ → ZZ


FCC-ee Simulation
162.3 GeV
Events
800000
700000
600000
500000
400000
300000
200000
100000
0
50
60
70
80
90
100
110
Invariant mass (GeV)
e⁺e⁻ → W(qq)W(qq)
e⁺e⁻ → Z
e⁺e⁻ → ZZ

Cross Section

At √s = 162.3 Gev, I got a measurement of about **2.1048**

- xsec = (Nobs - Nbkg)/(A*L)

Expected Cross Section: **4.613** from the sample

p8_ee_WW_ecm162p3	WW	4.613	5