Measurement of Wg production at CDF

Naho Tanimoto, Okayama University, Japan
For the CDF Collaboration

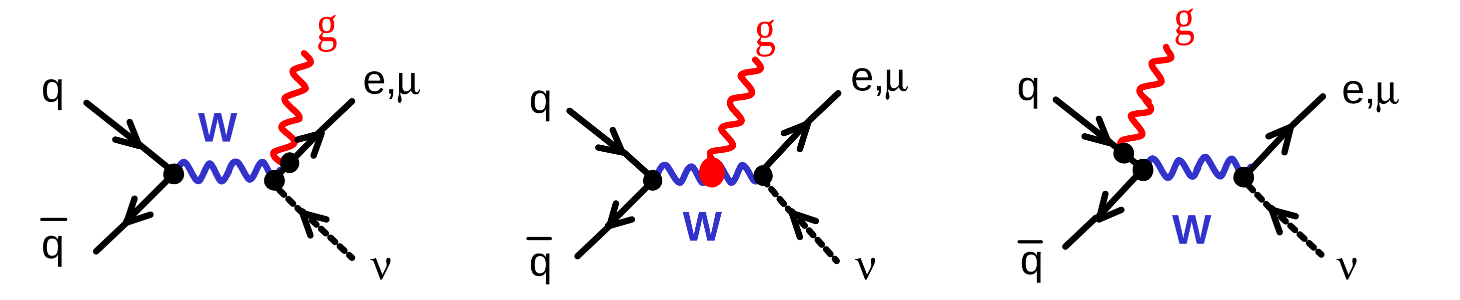
Abstract

Diboson production provides a sensitive test of the Standard Model. We present an analysis of W+g events, using 128 pb^{-1} of Run 2 CDF data, produced in $p\bar{p}$ collisions at the Tevatron with Ös=1.96TeV. Both electron and muon channels of the W boson are analyzed and compared to the Standard Model expectation.

1. Introduction

The Standard Model γ, W and Z gauge bosons are fundamental particles having no internal structure.The gauge symmetry for W and Z bosons severely constrains their couplings to each other. Measuring processes that are sensitive to these couplings provides a test of the gauge theory.

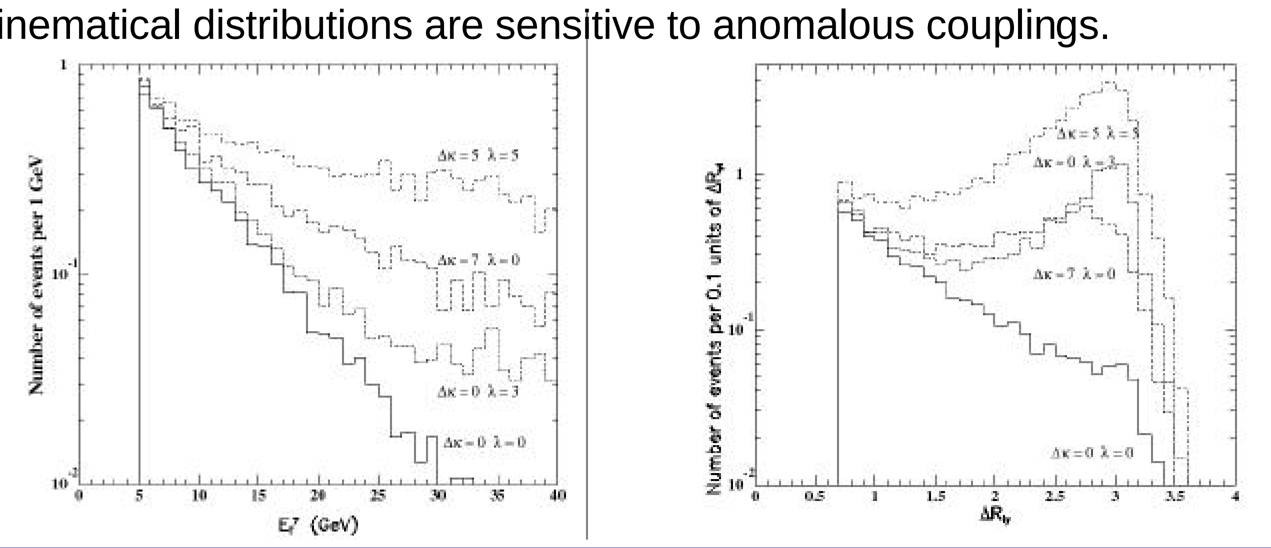
At a $p\bar{p}$ collider, these processes can produce a W and γ in the final state.



Radiative W decay | s-channel decay | Initial state radiation

The s-channel diagram contains the trilinear gauge couplings or vector boson self couplings, Δκ and λ.

In the Standard Model, the trilinear gauge couplings, Δκ = κ - 1 and λ, are 0. If there is any deviation from the Standard Model, Wγ cross section will be enhanced and the kinematical distributions are sensitive to anomalous couplings.



Theoretical prediction : s(Wg)´Br(W®ln)=18.6 ± 1.3 (sys.) [pb]
(E$_T$(g) > 7 GeV and DR(lepton, g) > 0.7)

2. Analysis

Event Selection

W selection

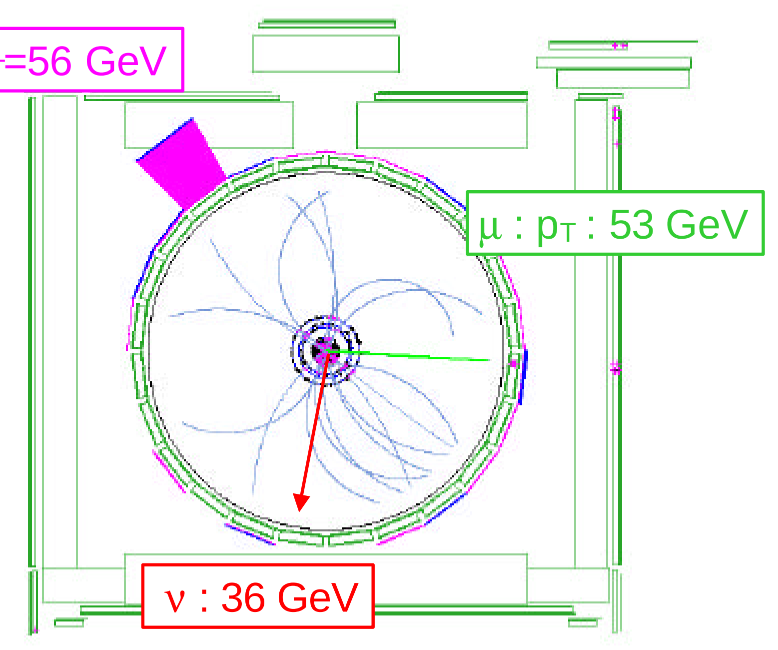
- Isolated electron with E_T>25GeV and |η|<1.1
- Isolated muon with P_T> 20 GeV and |η|<0.6
- Large Missing E_T>25(20 for μ) GeV

γ selection

- Isolated photon with $E_T(\gamma)$ > 7GeV and |η|<1.1
- Quality cuts to reject π^0 background

Wγ selection

- Separation between lepton and photon, ΔR(l,γ) > 0.7



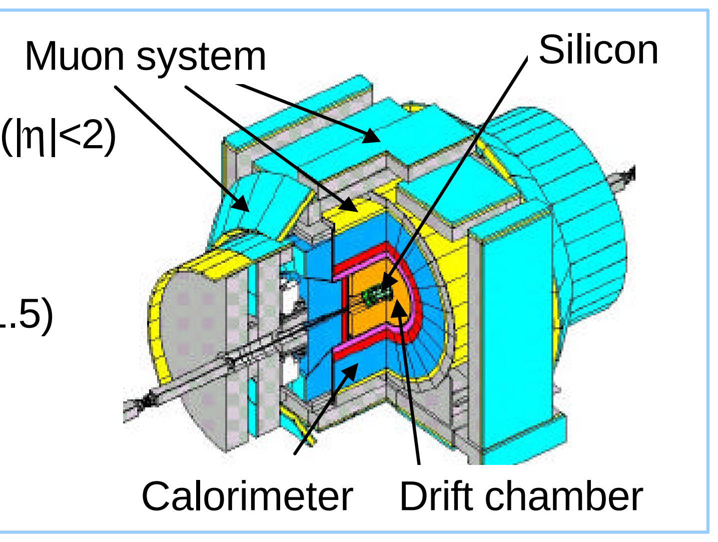
r-φ view of a Wγ candidate

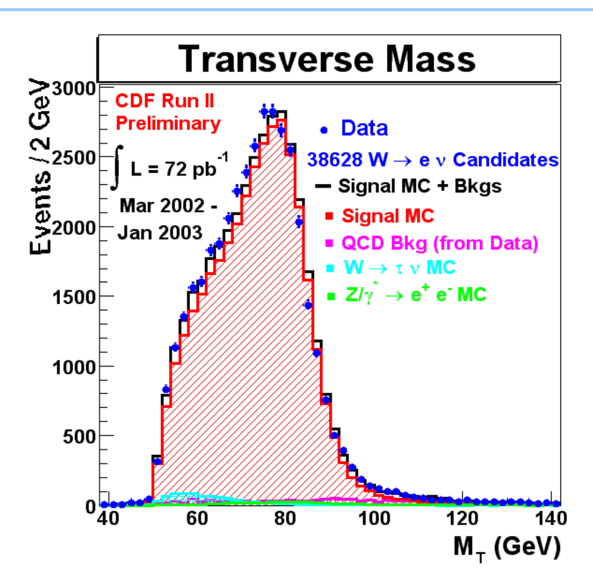
Backgrounds to Wg events

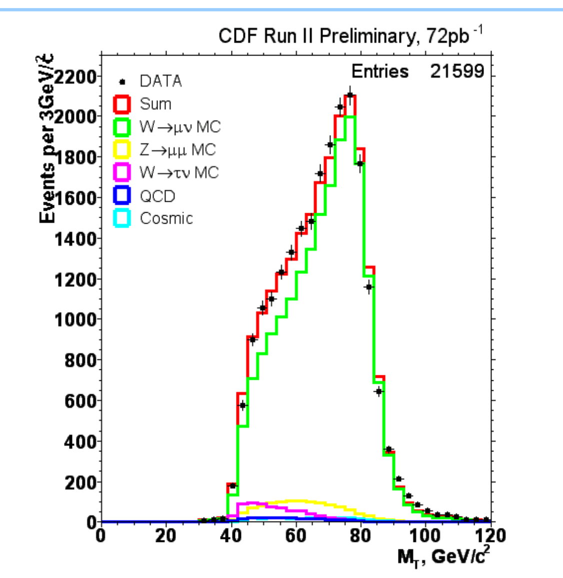
- QCD background : jet fakes to photon (67%)
- Zγ, Z→ ll : one lepton is misidentified (29%)
- Wγ, W→τν, τ→lν$\bar{\nu}$ (4%)

CDF Run2 Detector

- New silicon tracker (7-8 layers) (|η|<2)
- New central drift chamber
- New time of flight detector
- Extended muon coverage (|η|<1.5)
- New DAQ
  - Track based trigger at L1
  - Impact parameter trigger at L2





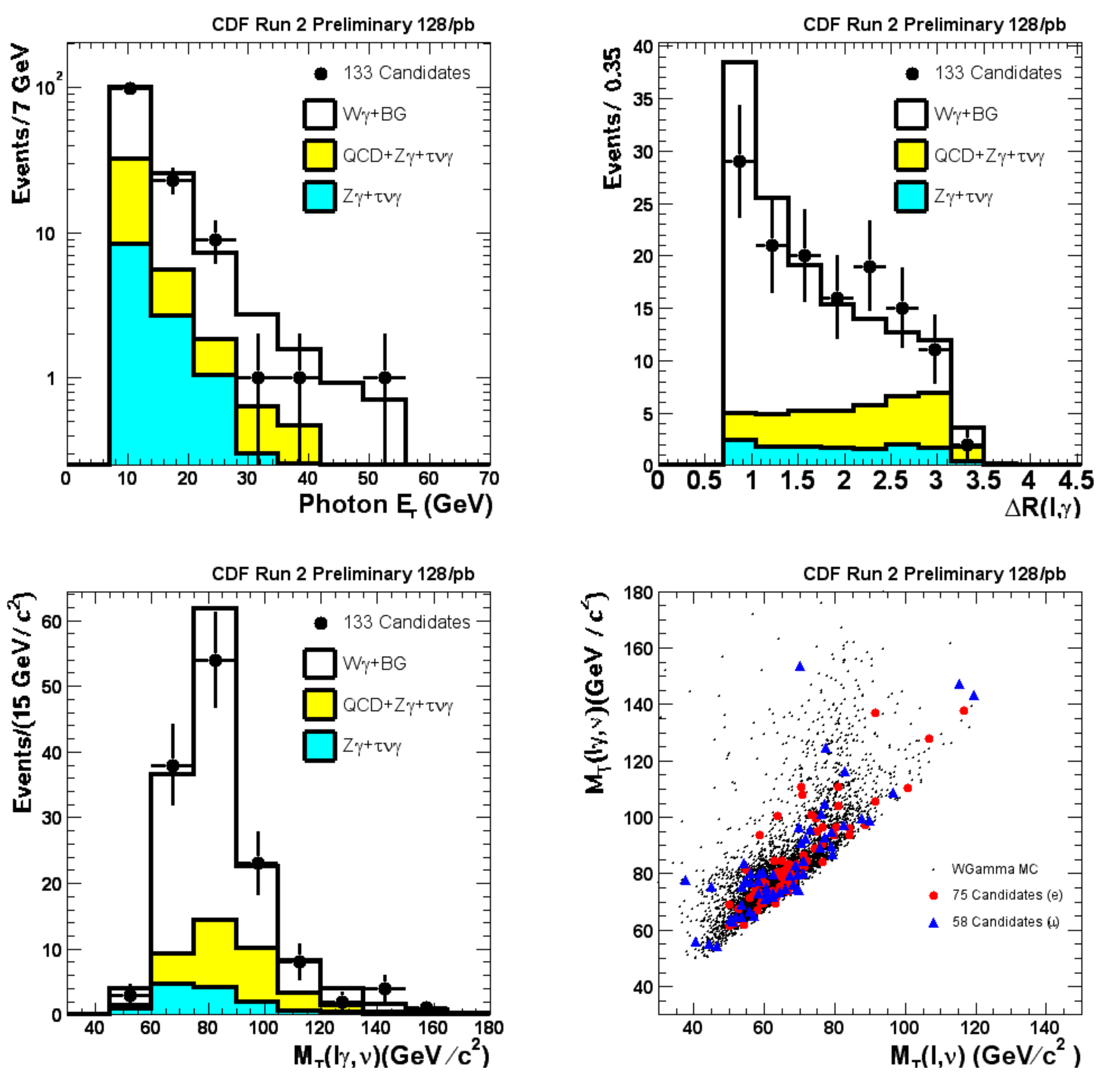


3. CDF Run2 Preliminary Results

The number of expected and observed events of Wγ combining both electron and muon channels using integrated luminosity 128 pb^{-1}. The major source of background is the misidentification of a jet as a photon.

Standard Model Wγ signal	98.9 ± 1.5 (stat.) ± 5.6 (sys.)
QCD background	28.1 ± 0.1 (stat.) ± 9.4 (sys.)
Zγ background	12.0 ± 0.34 (stat.) ± 0.69 (sys.)
Wγ, W→τν background	1.74 ± 0.16 (stat.) ± 0.14 (sys.)
Signal + Background	140.7 ± 1.6 (stat.) ± 11.0 (sys.) ± 6.8(lum.)
Data	**133**

s(Wg)´Br(W®ln) =17.2 ± 2.2 (stat.) ± 2.0 (sys.) ± 1.1 (lum.) [pb]
s(Wg)´Br(W®en) =18.0 ± 3.3 (stat.) ± 2.5 (sys.) ± 1.2 (lum.) [pb]
s(Wg)´Br(W®mn) =16.1 ± 3.4 (stat.) ± 1.7 (sys.) ± 1.1 (lum.) [pb]
(E$_T$(g) > 7 GeV and DR(lepton,g)>0.7)



Kinematical distributions of photon E_T(up, left), ΔR(lepton, γ) (up, right), cluster transverse mass(down, right) and cluster transverse mass versus transverse mass(down, right)

4. Conclusion

We measured Wγ production cross section in $E_T(\gamma)$ > 7 GeV and ΔR(lepton, γ) > 0.7 both electron and muon channels, and found it consistent with the Standard Model prediction.

Lepton-Photon 2003, Fermi National Accelerator Laboratory, Batavia, Illinois, USA, 11th-16th Aug. 2003

Naho Tanimoto, Okayama University, 3-1-1 Tsushima-naka, Okayama, Japan