# Table of Contents

MC program......................................................................................................................................................1

Precision physics...............................................................................................................................................2

Multiboson Twiki..............................................................................................................................................3
  LHC Upgrade Note......................................................................................................................................3
  QGC............................................................................................................................................................3
  Neutral QGC.............................................................................................................................................3
  High Energy WW scattering.......................................................................................................................3

Results................................................................................................................................................................6

Generator...........................................................................................................................................................7

Diffractive physics.............................................................................................................................................8

Analysis Twiki..................................................................................................................................................9
  Approval for ICHEP.....................................................................................................................................9
  W/Z paper approval.................................................................................................................................9

Zee forward electron.......................................................................................................................................10

Wjet analysis....................................................................................................................................................11

Zjet analysis.....................................................................................................................................................12

Ztautau analysis..............................................................................................................................................13
MC program

- VBFNLO
- MCFM: MCFM
Precision physics

- 0510061: G.J. Gounaris, Contrasting the anomalous and the SM-MSSM couplings at the Colliders
- 1205.4991: Why precision?
- Hall C Summer 2007: Susan Gardner, Hunting Traces of TeV-Scale Physics in Low-Energy Processes
- TASI lecture: Konstantin Matchev, LECTURES ON PRECISION ELECTROWEAK PHYSICS
Multiboson Twiki

LHC Upgrade Note

- ATLAS-PHYS-PUB-2012-005: Studies of Vector Boson Scattering with an Upgraded ATLAS Detector at a High-Luminosity LHC

QGC

- CMS WWgam/WZgam: http://cds.cern.ch/record/1563302?ln=en
  - https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopMC12DiTopGamma
- arXiv:1211.1641: Probing W+W-gamma Production and Anomalous Quartic Gauge Boson Couplings at the CERN LHC by Daneng Yang, Yajun Mao, Qiang Li, Shuai Liu, Zijun Xu, Ke Ye
- arXiv:1305.5979: The CERN LHC Sensitivity on measuring WZGamma Production and Anomalous WWZGamma Coupling by Ke Ye, Daneng Yang, Qiang Li
- arXiv:0907.5299: Quartic Gauge Couplings and the Radiation Zero in pp to l nu gamma gamma events at the LHC by Paul Bell
- hep-ph/9702364: $W\gamma\gamma$ Production at the Fermilab Tevatron Collider: Gauge Invariance and Radiation Amplitude Zero by U. Baur (SUNY-Buffalo), T. Han (UC-Davis), N. Kauer (UW-Madison), R. Sobey (UC-Davis), D. Zeppenfeld (UW-Madison)

Neutral QGC

- hep-ph/0009262: Anomalous Quartic Gauge Boson Couplings at Hadron Colliders, ZAjj, AAjj
- C02-07-24: Anomalous triple neutral and quartic gauge boson couplings by S. Wynhoff
- arXiv:1111.3354: Probing Quartic Neutral Gauge Boson Couplings using diffractive photon fusion at the LHC by Rick S. Gupta

High Energy WW scattering

- http://feynrules.irmp.ucl.ac.be/wiki/AnomalousGaugeCoupling#no1
- pdf: EWSB QandA by Chivukula
- 1201.2768: The WLWL scattering at the LHC: improving the selection criteria by Krzysztof Dorobba, et. al.
- 1212.4158: Longitudinal WW scattering in light of the Higgs discovery by Dom’anec Espriu and Brian Yencho
- 9611454: T. Barklow et al, Anomalous Gauge Boson Couplings
  - TEV 33 Convener Reports url
- 9804322: John Ellison, Jose Wudka, Study of Trilinear Gauge Boson Couplings at the Tevatron Collider, reviewing the effective Lagrangian formalism, the indirect constraints on the couplings from low-energy experiments, and the expected values of the couplings in theories beyond the standard
There are eight P and C even dimension six operators that modify the Higgs couplings to the electroweak gauge bosons, while there is just one operator containing gluons.

The dimension six effective operators in Eq. (2) give rise to Higgs interactions with SM gauge boson pairs that take the following form in the unitary gauge.

The dimension six operators modifying the Higgs interactions with fermion pairs and the Yukawa interactions are also considered.

all dimension-six operators related to WWA, WWZ are also expressed.

Dimension-six operators (3 CP-eve and 2 CP-odd) are implemented in the MadGraph.

Relation to the WWA and WWZ effective Lagrangian is also discussed.

Dimension-six operators in Eq. (2) give rise to Higgs interactions with SM gauge–boson pairs that take the following form in the unitary gauge.

The dimension six operators modifying the Higgs interactions with fermion pairs and the Yukawa interactions are also considered.

all dimension-six operators related to WWA, WWZ are also expressed.

Mother QCD corrections to tri-boson production

Triboson

Neutral triple electroweak gauge boson production in the large extra-dimension model at the LHC

Neutral Gauge Coupling

3 CP-even operators and their dependence to the WLWL, WLWT and WTWT scattering are described.

Michael Rauch, Diboson-VBF-production in VBFNLO

describe the EFT approach in Dim6 and Dim8 operators and unitarity bound in VBF process

Oscar Eboli, Anomalous QGC in the effective lagrangian framework

motivate the Dim8 operators for QGC studies


LEP2 coupling:

triple: WWA, WWZ, ZAA, ZZA, ZZZ

Quartic: WWAA, WWZA, WWZZ, WWWW, ZZAA; final state ee->nunuAA, qq~AA to probe a0^Z, ac^Z or a0^W, ac^W; ee->WAA to probe a0^W, ac^W, an
charged TGC - WWA, WWZ: final state - WW, single W, single photon
   ◊ most general effective Lagrangian has 7+7 parameters
   ◊ ask for C and P invariance: 5 \((g_{1z}, k_A, k_Z, \lambda_A, \lambda_Z)\)
   ◊ low energy constraint and gauge invariance: \(k_Z= g_{1Z} - (k_{A-1}) \tan^2 \theta_W, \ LamA=LamZ\)
   ◊ W electro-magnetic structure: W charge = e \(g_{1A}\), magnetic dipole: \(\mu_W = e/2m_W (g_{1A}+k_A+\lambda_A)\)
   ◊ electric quadrupole: \(q_W = -e/[m_W^2(k_A-\lambda_A)]\)

neutral TGC - ZA \(h_i^V\), ZZ \(f_i^V\)
   ◊ ee->ZA, qQA, nuNuA
      • CP conserving: h3A, h4A, h4Z, h4Z
      • CP violating: h1A, h2A, h1Z, h2Z
   ◊ ee->ZZ (4l, llvv, llqq, qqvv, qqqq)
      • CP conserving: f5A, f5Z
      • CP violating: f4A, f4Z

quartic gauge coupling - final state: WWA, nuNu~AA, QQ~AA
   ◊ only look at quartic terms not associate to the TGC
   ◊ WWAA: a0W, acW: probe with final state WWA, AA-nuNu-
   ◊ WWZA: an: probe with final state WWA
   ◊ ZZAA: a0Z, acZ: probe with final state AA-nuNu-, AAQQ-
   ◊ WWWW and WWZZ not accessible at LEP (why?)

Snowmass 2013
   ◊ Snowmass EWK 2013
Results

- Z coupling
  - PDG 2012
    - $\cdot \ ZZ, \ Z \gamma, \ Z\gamma, \ AND \ ZZ \ V \ (hep-ex/0511027)$
    - $\cdot \ ZA: \ h1Z, \ h2Z, \ h3Z, \ h4Z, \ h1A, \ h2A, \ h3A, \ h4A$
    - $\cdot \ ZZ: \ f4Z, \ f5Z, \ f4A, f5A$
    - $\cdot \ QGC: \ a0/\Lambda^2, \ ac/\Lambda^2using \ AA\nu\nu~, \ AAqq~ \ W \ coupling \ [\ [}$
Generator

- Eboli and Gozalez-Garcia: AGQC
- VBFNLO
  - VBF WW: CP-even Dim6 operators: FBW, FDW, FWW, FBB
  - VBF WW: CP-odd Dim6 operators: FWWt, FWt, FBt, FBWt, FDWt, FWWt, FBBt
  - triboson: dimension 8 operators $\tilde{fi}/4$: FS0, FS1, FM0, FM7, FT0, FT2, FT5, FT7
  - 400/10/20/30/40 pp->WWZ, WZZ, WWW
  - 610/20 pp->W Aj, 630/40WZj
- O. J. P. Eboli, M. C. Gonzalez-Garcia and J. K. Mizukoshi, “$pp \rightarrow jje\pm\mu\pm\nu\nu$ and $jje\pm\mu/\nu\nu$ at $O(\alpha^6)$ and $O(\alpha^4\alpha^2)$ for the study of the quartic electroweak gauge boson vertex at LHC”, Phys. Rev. D74 (2006) 073005, hep-ph/0606118.

- 1205.4231: MadGraph, EwkDim6 - Effective Field Theory: A Modern Approach to Anomalous Couplings
Diffractive physics

- 1111.3354: Probing Quartic Neutral Gauge Boson Couplings using diffractive photon fusion at the LHC.
  - Rick S. Gupta. pZZp, pZgamp, pGamGamp
- Royon's talk: Quartic WWGamGam and ZZGamGam at LHC, Christoph Royon's talk in diff2010
Analysis Twiki

- CMS EWK results
- WZObservation7TeV
- WZjetsSubgroup

Approval for ICHEP

- ATLAS-CONF-2010-051: Measurement of the W→\nu production cross-section and observation of Z→ll production in proton-proton collisions at \(\sqrt{s}=7\) TeV with the ATLAS detector
- ATLAS-CONF-2010-076: Measurement of the Z to ll production cross section in proton-proton collisions at \(\sqrt{s}=7\) TeV with the ATLAS detector
- ATL-COM-PHYS-2010-264
- ATL-COM-PHYS-2010-265: Observation of W→\mu\nu and Z→\mu\nu in proton-proton collisions at \(\sqrt{s}=7\) TeV with the ATLAS Detector
- ATL-COM-PHYS-2010-297: W to e \nu and Z to ee Observations supporting note
- ATL-COM-PHYS-2010-325: Double differential Z,W cross sections and their ratios in the electron channels

W/Z paper approval

- arXiv:1010.2130: Measurement of the Wl and Zll production cross sections in proton-proton collisions at \(s=7\) TeV with the ATLAS detector
- ATL-COM-PHYS-2010-701: Wenu and Zee cross-section measurements in proton-proton collisions at \(p_s=7\) TeV with the ATLAS Detector
- ATL-COM-PHYS-2010-685: W\mu\nu and Z\mu\mu cross-sections measurements in proton-proton collisions at \(p_s=7\) TeV with the ATLAS Detector
- ATL-COM-PHYS-2010-703: Supporting Document:Total inclusive W and Z boson cross-section measurements and cross-section ratios in the electron and muon decay channels at \(p_s=7\) TeV
Zee forward electron

• ATL-COM-PHYS-2010-1057: Title Z->ee cross-section measurement at forward rapidity in proton-proton collisions at sqrt(s) = 7 TeV with the ATLAS Detector, Aharrouche, M, et. al.
• Talk: Inclusive Z Cross-section using forward electrons, status report (15 mins) by ELLINGHAUS, Frank
**Wjet analysis**

- Supporting doc: [http://cdsweb.cern.ch/record/1292774](http://cdsweb.cern.ch/record/1292774)
- PR plot: [http://cdsweb.cern.ch/record/1309845](http://cdsweb.cern.ch/record/1309845)
- Talk: Alexander Paramonov, Discussion on jet and Etmiss object for W+jets analysis
- ATL-PHYS-INT-2011-020: Measurement of the cross-section for jets produced in association with a W-boson in pp collisions at $\sqrt{s} = 7$ TeV
Zjet analysis

- Sep 28 2010 Zmumu+jets Jet Energy Resolution Uncertainty by M.Schram and R.Mantifel
- JES/JER/Flavour systematics so far from: McGill, Barcelona, Goettingen
Ztautau analysis

- ZToTwoTausToLepHad

-- ShihChiehHsu - 12-Nov-2010