



Triboson in Dim8

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Operators containing $D_\mu \Phi$ and field strength

The operators in this class are:

$$\mathcal{L}_{M,0} = \text{Tr} [\hat{W}_{\mu\nu} \hat{W}^{\mu\nu}] \times [(D_\beta \Phi)^\dagger D^\beta \Phi] \quad (8)$$

$$\mathcal{L}_{M,1} = \text{Tr} [\hat{W}_{\mu\nu} \hat{W}^{\nu\beta}] \times [(D_\beta \Phi)^\dagger D^\mu \Phi] \quad (9)$$

$$\mathcal{L}_{M,2} = [B_{\mu\nu} B^{\mu\nu}] \times [(D_\beta \Phi)^\dagger D^\beta \Phi] \quad (10)$$

$$\mathcal{L}_{M,3} = [B_{\mu\nu} B^{\nu\beta}] \times [(D_\beta \Phi)^\dagger D^\mu \Phi] \quad (11)$$

$$\mathcal{L}_{M,4} = [(D_\mu \Phi)^\dagger \hat{W}_{\beta\nu} D^\mu \Phi] \times B^{\beta\nu} \quad (12)$$

$$\mathcal{L}_{M,5} = [(D_\mu \Phi)^\dagger \hat{W}_{\beta\nu} D^\nu \Phi] \times B^{\beta\mu} \quad (13)$$

$$\mathcal{L}_{M,6} = [(D_\mu \Phi)^\dagger \hat{W}_{\beta\nu} \hat{W}^{\beta\nu} D^\mu \Phi] \quad (14)$$

$$\mathcal{L}_{M,7} = [(D_\mu \Phi)^\dagger \hat{W}_{\beta\nu} \hat{W}^{\beta\mu} D^\nu \Phi] \quad (15)$$

<http://feynrules.irmp.ucl.ac.be/wiki/AnomalousGaugeCoupling>

Quartic Vertex



	WWWW	WWZZ	ZZZZ	WWAZ	WWAA	ZZZA	ZZAA	ZAAA	AAAA
$\mathcal{L}_{S,0}, \mathcal{L}_{S,1}$	X	X	X	O	O	O	O	O	O
$\mathcal{L}_{M,0}, \mathcal{L}_{M,1}, \mathcal{L}_{M,6}, \mathcal{L}_{M,7}$	X	X	X	X	X	X	X	O	O
$\mathcal{L}_{M,2}, \mathcal{L}_{M,3}, \mathcal{L}_{M,4}, \mathcal{L}_{M,5}$	O	X	X	X	X	X	X	O	O
$\mathcal{L}_{T,0}, \mathcal{L}_{T,1}, \mathcal{L}_{T,2}$	X	X	X	X	X	X	X	X	X
$\mathcal{L}_{T,5}, \mathcal{L}_{T,6}, \mathcal{L}_{T,7}$	O	X	X	X	X	X	X	X	X
$\mathcal{L}_{T,9}, \mathcal{L}_{T,9}$	O	O	X	O	O	X	X	X	X

Table 1: Quartic vertices modified by each dimension-8 operator are marked with X .

Each Operator has different effects on different quartic boson vertex



General survey of triboson production at 14TeV

- Compare X_{sec} between coupling value $1\text{E-}10\text{GeV-}4$ and the SM value
- Determine best channels for each operator

Packages:

MG version : 5.1.5.10

Pythia version : 6.426

Delphes : 3.0.10

Generic Cuts:

photon/lepton ($p_T > 10\text{GeV}$, $|\eta| < 2.5$)



photon/lepton ($p_T > 10\text{GeV}$, $|\eta| < 2.5$)

1.00E-10	WAA		ZAA	
SM	0.04899	ratio	0.003306	ratio
fS0	-		-	
fS1	-		-	
fM0	0.04913	1.002	0.00331	1.001
fM1	0.04908	1.002	0.00330	0.99
fM2	0.0505	1.031	0.00341	1.02
fM3	0.04914	1.002	0.00331	0.985
fT8	-		0.9018	272.77
fT9	-		0.2248	67.99



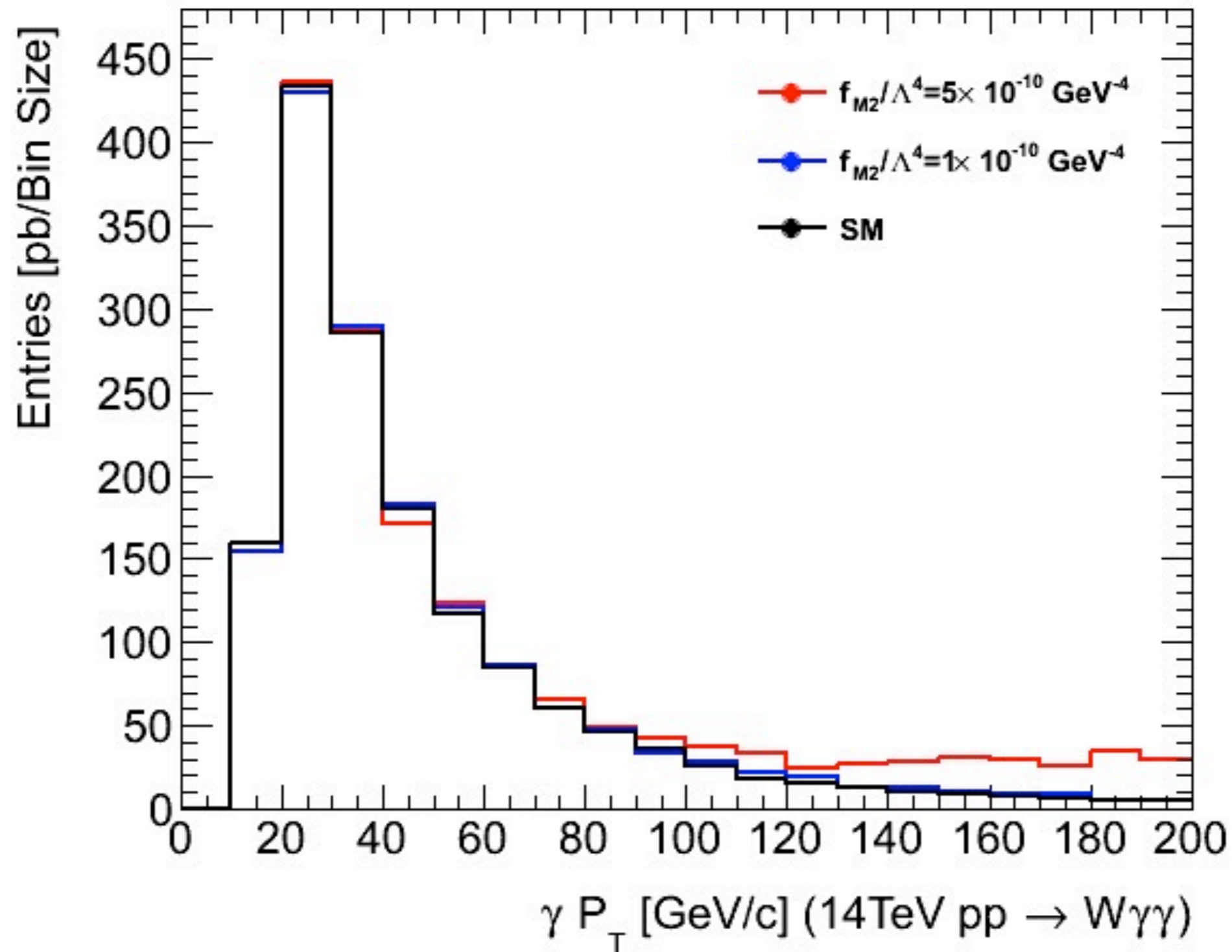
photon/lepton ($p_T > 10\text{GeV}$, $|\eta| < 2.5$)

1.00E-10	WVA		ZZA	
SM	0.0053	ratio	2.03E-05	ratio
fS0	-		-	
fS1	-		-	
fM0	0.0091	1.72	2.75E-05	1.35
fM1	0.0066	1.25	2.31E-05	1.14
fM2	0.1336	25.21	0.000293129	14.44
fM3	0.0132	2.49	3.57E-05	1.76
fT8	-		0.0030722	151.34
fT9	-		0.00075	36.99



photon/lepton ($p_T > 10\text{GeV}$, $|\eta| < 2.5$)

1.00E-10	WWW		WWZ		ZZZ	
SM	6.91E-05	ratio	1.40E-05	ratio	1.21E-07	ratio
fS0	7.15E-05	1.03	1.40E-05	1.00	-	
fS1	6.98E-05	1.01	1.40E-05	1.00	-	
fM0	0.00351	50.8	0.000161	11.5	6.82E-07	5.63
fM1	0.00123	17.8	5.18E-05	3.7	3.33E-07	2.75
fM2	-		0.0134	957.14	1.80E-06	14.79
fM3	-		3.44E-05	2.46	2.21E-07	1.83
fT8	-		-			
fT9	-		-		1.29E-06	10.66



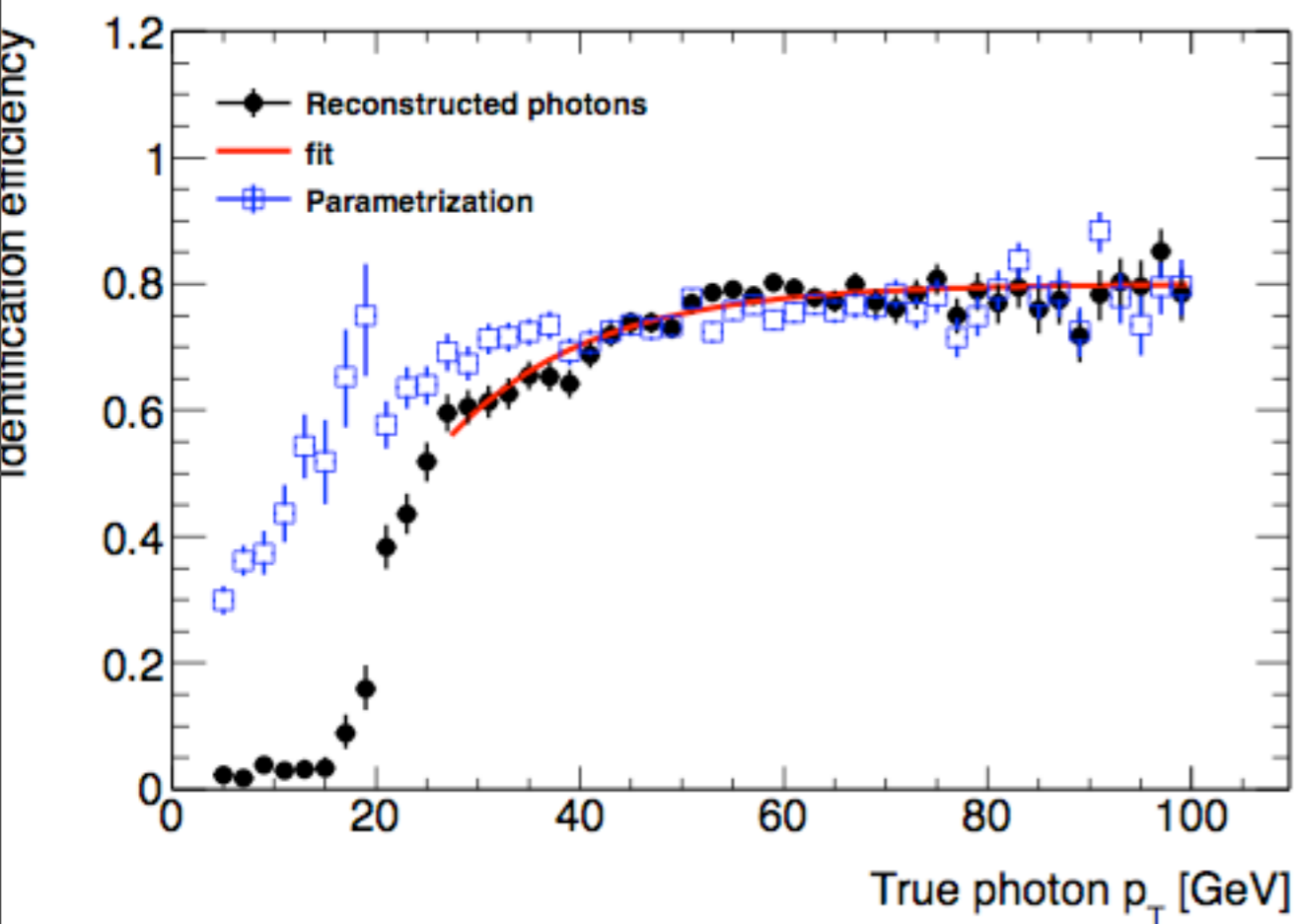


EuroStrategy
photon section

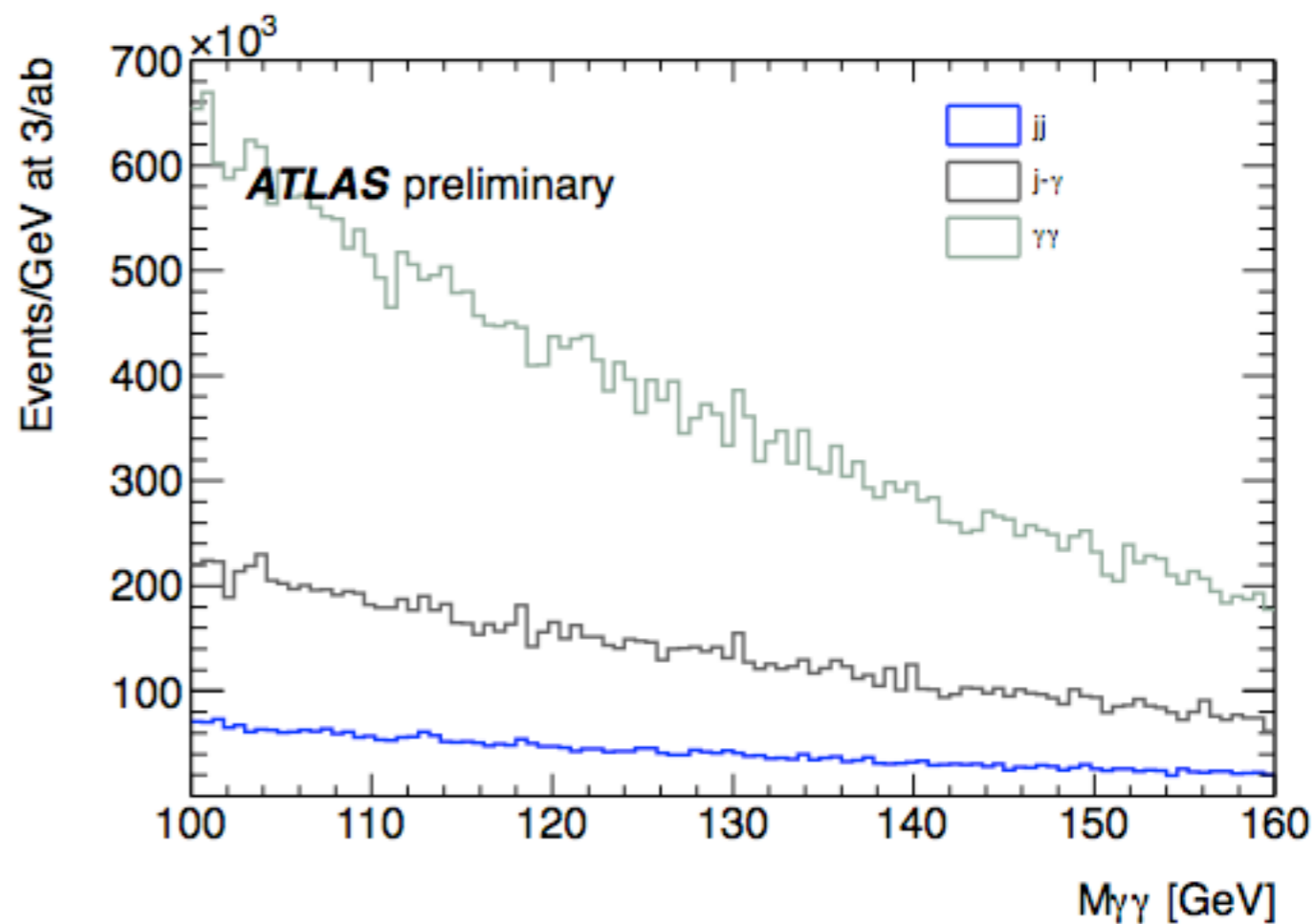
ATL-COM-UPGRADE-2012-032
<https://cds.cern.ch/record/1483523>

Olivier Arnaez, et. al.

- Photon Efficiency



- Photon Fake Rate





- Recommended Triboson channels for each Dim8 operator
 - LS0/LS1: WWW/WWZ
 - LM0/LM1: WWW
 - LM2: WWZ, LM3: WWA
 - LT8/LT9: ZAA, ZZA
- To do:
 - Use ATLAS EuroStrategy photon efficiency/resolution/fake
 - Use Chris Pollands' limit calculator
 - Cross-check results with FNAL colleagues:
Lindsey/Kalanand/Mandy/Jenny

W



Backup



photon/lepton ($p_T > 10\text{GeV}$, $|\eta| < 2.5$)

1.00E-08	WAA		ZAA	
SM	0.04899	ratio	0.003306	ratio
fS0	-		-	
fS1	-		-	
fM0	0.1230	2.51	0.0082	2.48
fM1	0.0767	1.56	0.00466	1.409
fM2	15.704	320.47	0.99758	301.75
fM3	1.246	25.43	0.0659	19.93
fT8	-			
fT9	-			