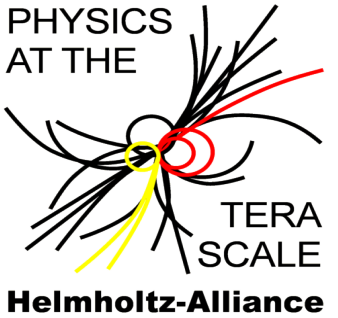
CJV working group report

Barbara Jäger, THEP, Uni Mainz
Ulla Blumenschein, II Physik, Uni Göttingen



Intro: VBF Higgs selection @ 8TeV

Channel	VBF selection				CJV	
	pt(j1)	m(jj)[GeV],	Δη(jj)		pt(j)[GeV]	gap
CMS						
$H \to ZZ \to 4l$	-					-
$H \to WW \to lvlv$	>30	>500	>3.5		30	η1<η3<η2
$H \to \tau_h\tau_h$	>30	>250	>2.5	pT(jH) > 110		-
$H \to \tau_l\tau_x$	>30	>500	>3.5		30	η1<η3<η2
$H \to \gamma\gamma$ (1)	>30	>250	>3.5	Δη(H,jj) <2.5, Δφ(H,jj) >2.6		-
(2)	>30	>500	>3.5	Δη(H,jj) <2.5,Δφ(H,jj) >2.6		-
ATLAS						
$H \to ZZ \to 4l$	-					-
$H \to WW \to lvlv$	>30(25)	>500	>3.8		20	η1<η3<η2
$H \to \tau_h\tau_h$	>35(30)	>500	>3.0	centrality		-
$H \to \tau_l\tau_l$	> 40	>400	>3.0		25	|ηj3| < 2.4
$H \to \tau_l\tau_h$	> 40	>500	>3.0	centrality	25	|ηj3| < 2.4
$H \to \gamma\gamma$	>30(25)	>400	>2.8	Δφ(H,jj) >2.6		-

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$H \to ZZ \to 4l$	-					-
$H \to WW \to lvlv$	>30	>500	>3.5		30	$\eta 1 < \eta 3 < \eta 2$
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$H \to \tau_l\tau_x$	>30	>500	>3.5		30	$\eta 1 < \eta 3 < \eta 2$
$H \to \gamma\gamma$ (1						-
(2						-
ATLAS						
$H \to ZZ$						-
$H \to WW$						$<\eta 3<\eta 2$
$H \to \tau_h\tau_h$	>35(30)	>500	>3.0	centrality		-
$H \to \tau_l\tau_l$	> 40	>400	>3.0		25	$\lvert\eta j3\rvert < 2.4$
$H \to \tau_l\tau_h$	> 40	>500	>3.0	centrality	25	$\lvert\eta j3\rvert < 2.4$
$H \to \gamma\gamma$	>30(25)	>400	>2.8	$\Delta\varphi(H,jj) > 2.6$		-

Most Higgs channels maintain separate VBF cathegorie

Kinematic selection of VBF signature and CJV varies with the channel and between experiments

CJV Topics in 2012

◊ VBF NLO development:

Barbara Jäger, THEP Mainz
Sophy Palmer, KIT, Karlsruhe

◊ VBF Higgs Selection

Pai-Hsien Hsu, Christian Schmitt, ETAP, Mainz
Ralf Bernhard, Uni Freiburg

◊ V+jets Background

Katharina Bierwagen, Eric Drechsler, Ulla B. Uni Mainz

◊ VBF W:

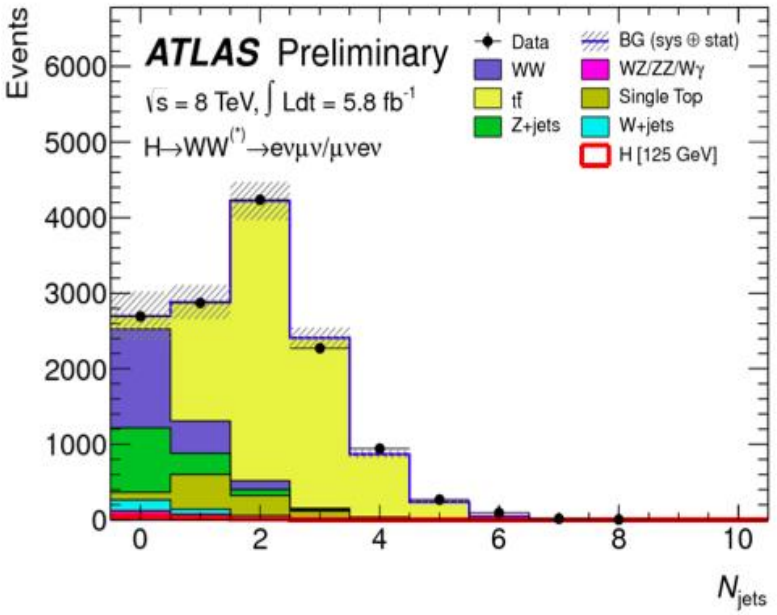
Julia Fischer, Wuppertal
Guest: Robert King, Gerhard Brandt, Oxford

◊ VBS

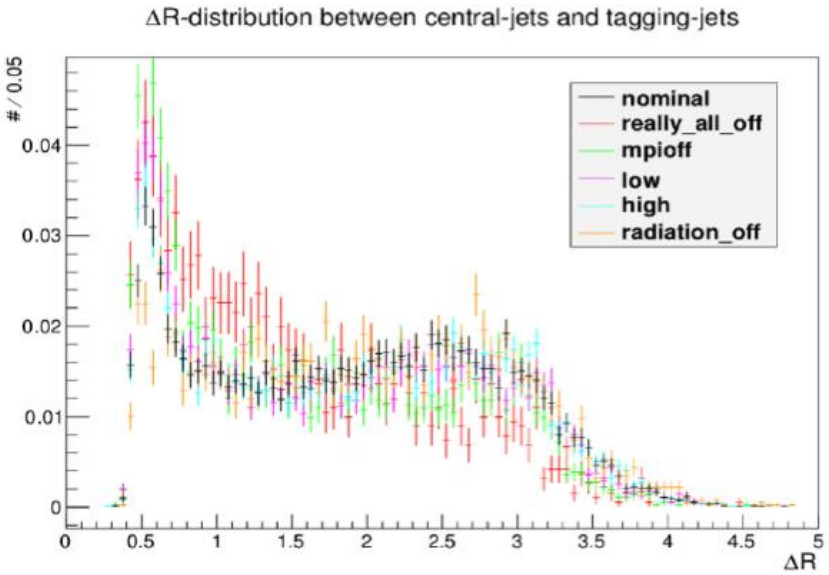
Felix Socher, Anja Vest, Michael Kobel, Dresden

CJV in H → WWjj → lvlvjj

◊ Main background: ttbar
→ Optimization of
- b-jet veto
- CJV



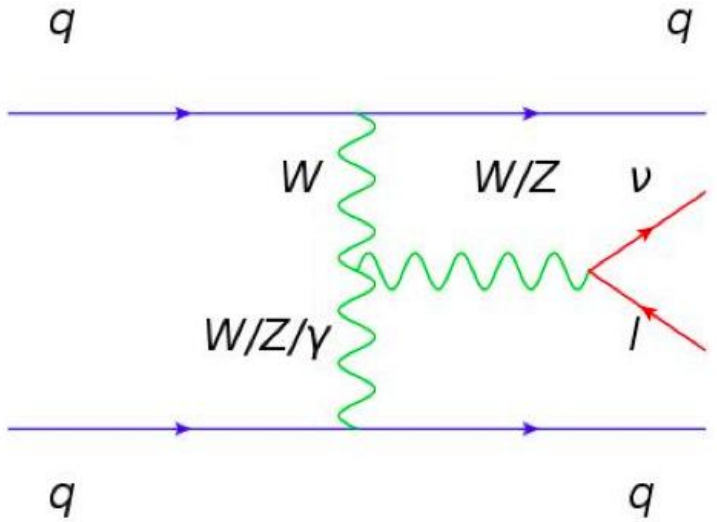
ATLAS-CONF-2012-098.

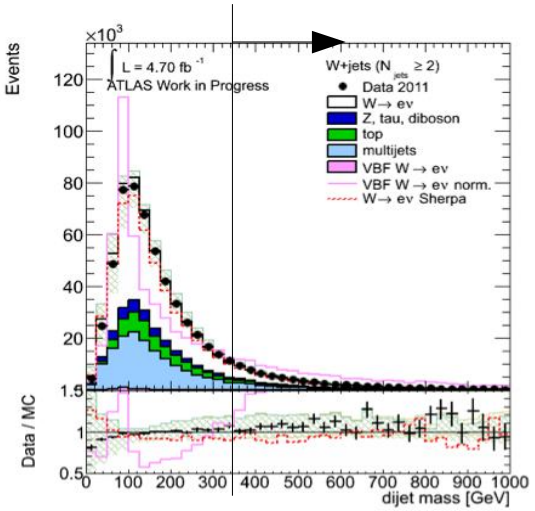


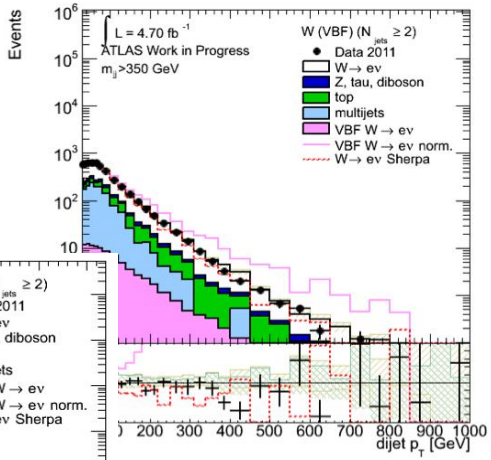
Pai-Hsien Hsu, Uni Mainz:
Origin of central jets in VBF
→ FSR from tag jets, Pile up?
→ study additional ΔR and/or a χ2 cuts

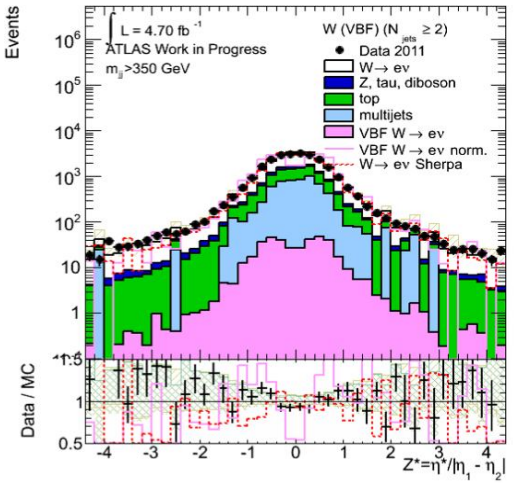
CJV working group meeting, 5.12.12
6th Annual workshop, DESY

VBF Z/W









Experiment: VBF W → lνjj (and VBF Z)

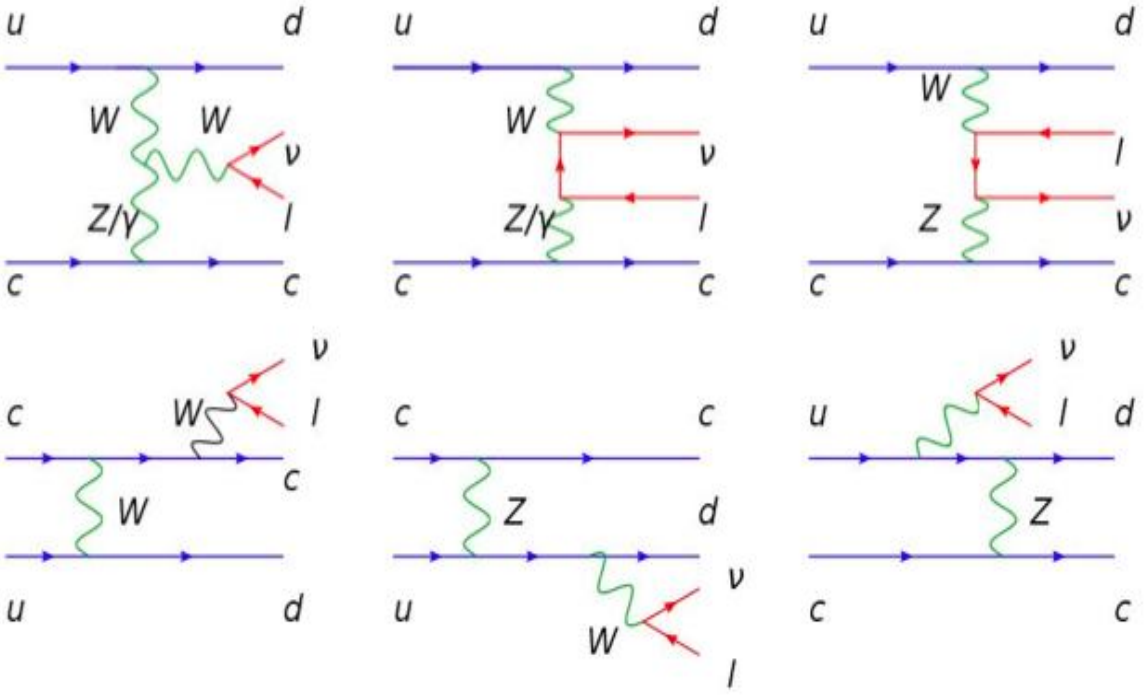
- ◊ **Description of background in VBF phase space (large m(jj)**
- ◊ **Central jet veto → bkg suppression?**
  → no improvement of S/√B

Interaction Experiment – Theory

- ◊ VBFNLO: Diagrams with ≥ 1 EW t-channel
- ◊ Sherpa 1.3.1: additional contributions (2/3 of evts)
- ◊ New in Sherpa 1.4: Possibility to generate only ≥ 1 EW t-channel

Robert King, Oxford
CJV workshop Mainz, 4/12

VBF Z/W



t-channel diagrams: VBFNLO, new Sherpa

Experiment: VBF W → lνjj

◊ Description of background in VBF phase space (large m(jj)

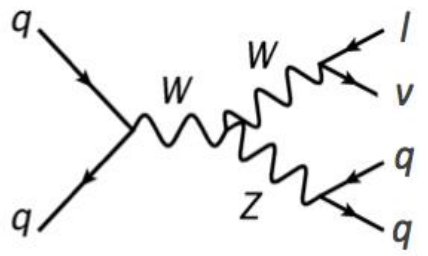
◊ Central jet veto→ bkg suppr.?
→ no improvement of S/√B

Interaction Experiment – Theory

◊ **VBFNLO: Diagrams with at least one EW t-channel: gauge invariant**

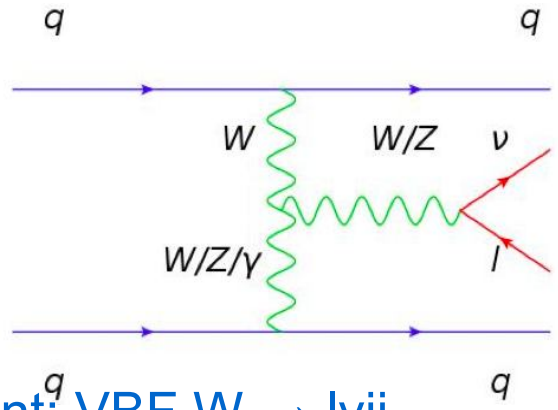
◊ **Sherpa 1.3.1: including s-channel and QCD t-channel Contributions (2/3 of events!)**

◊ **New in Sherpa 1.4.1: Possibility to generate ≥1EW t-channel**



Example s-channel contribution

VBF Z/W



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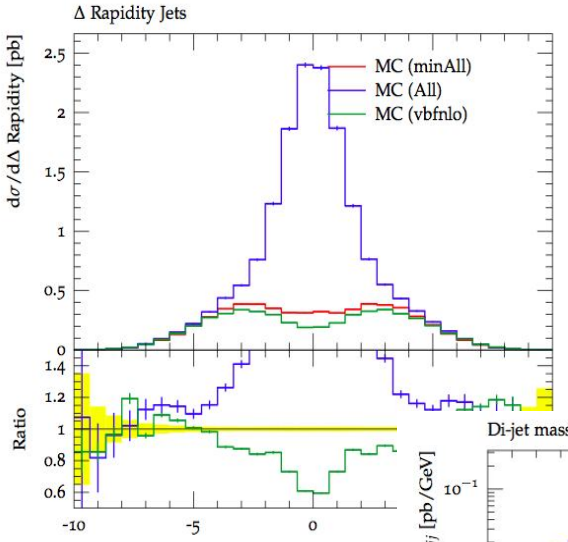
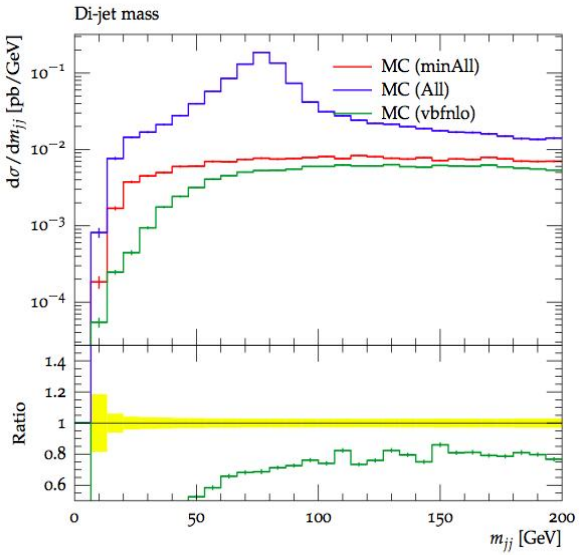




Interaction Experiment – Theory

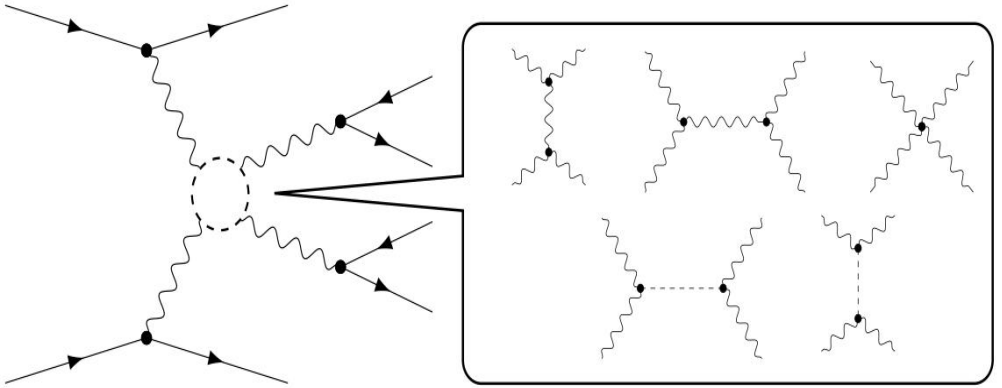
◊ **VBFNLO: Diagrams with at least one EW t-channel: gauge invariant**

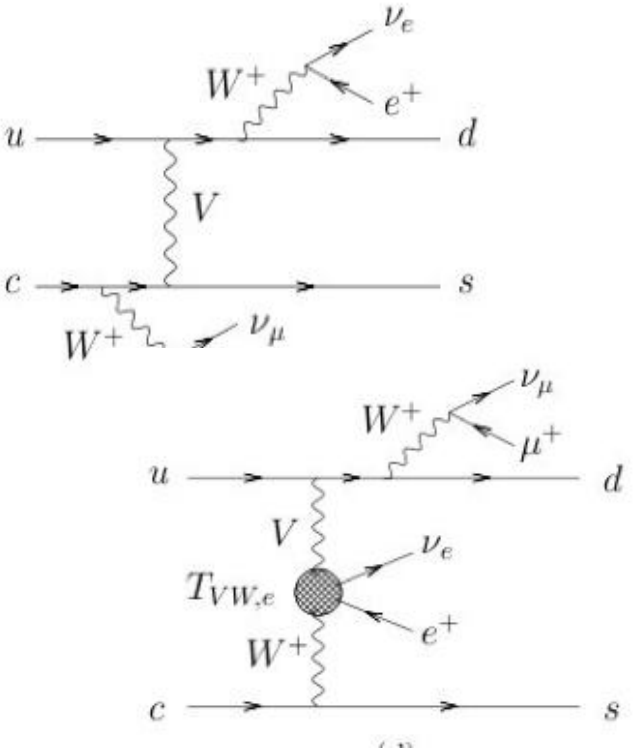
◊ **Sherpa 1.3.1: including s-channel and QCD t-channel Contributions (2/3 of events!)**

◊ **New in Sherpa 1.4.1: Possibility to generate ≥1EW t-channel**

Δη(jj) and m(jj): Sherpa old/new, VBFNLO:
- Agreement btw new Sherpa and VBFNLO
- Some effects of PS visible

Vector Boson Scattering





EW production

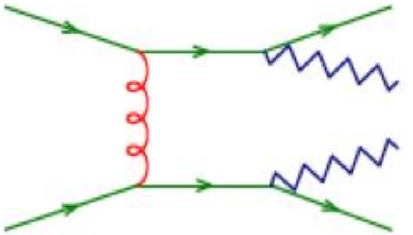
Oleari, Zeppenfeld, B.J. (2009);
Zanderighi, B.J. (2011)

Experiment: WZ → WZ and W±W± → W±W±

◊ Description of background with VBF features (V+jets, qq->VV, top)
◊ Central jet veto → bkg suppression?

Interaction Experiment – Theory

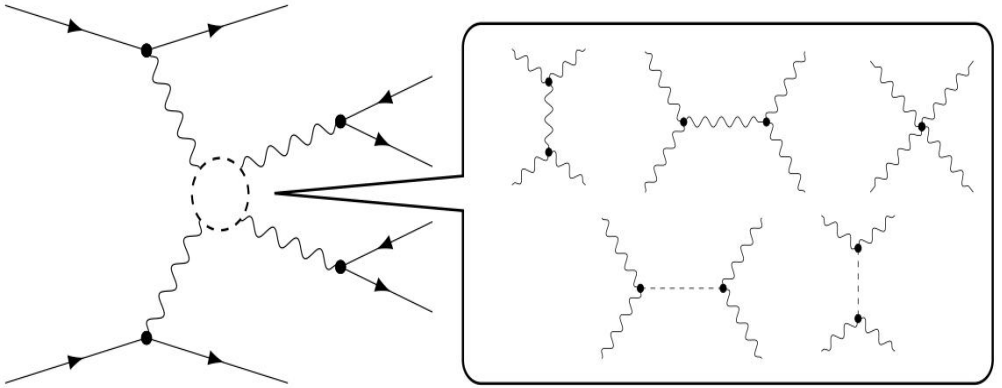
◊ **complete EW production of qq->WWjj at NLO QCD**
◊ **QCD-induced production of WWjj**
◊ NLO +PS (Powheg Box)



QCD induced production

Melia, Melnikov, Rontsch, Zanderighi (2010);
Melia, Nason, Rontsch, Zanderighi (2011)

Vector Boson Scattering



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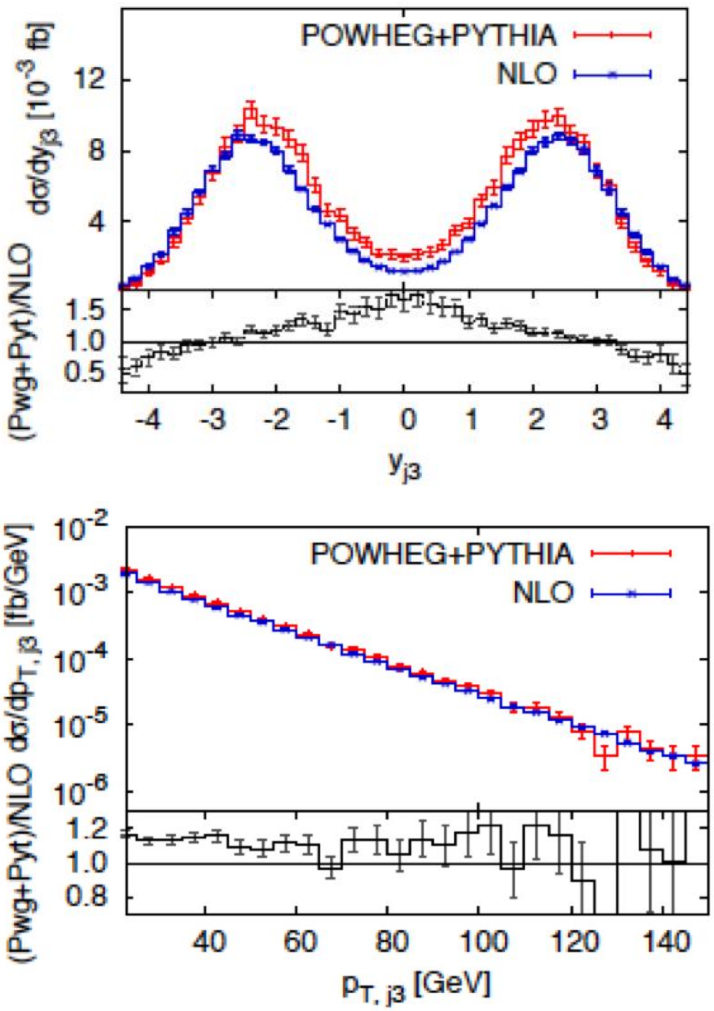
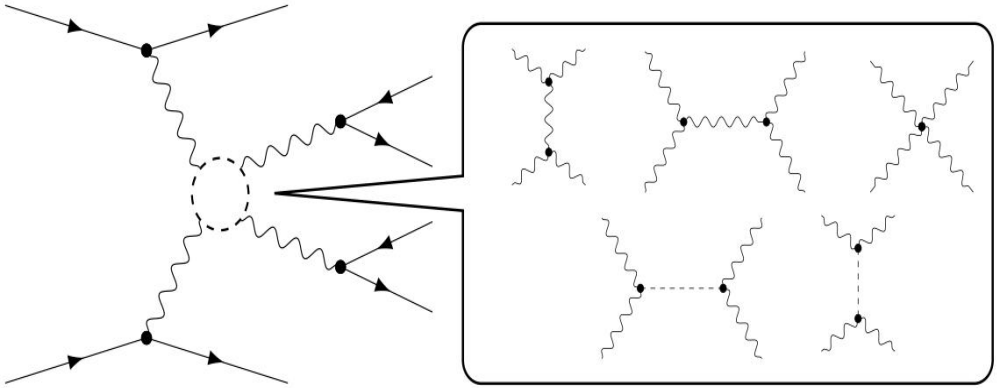
◊ **NLO +PS (Powheg Box)**

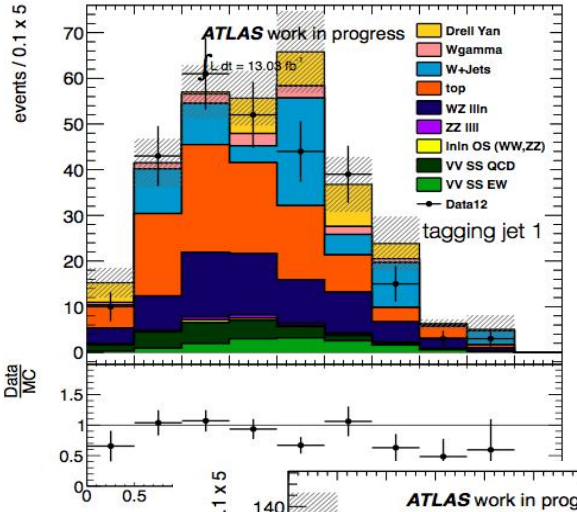
Zanderighi, B.J. (2011)

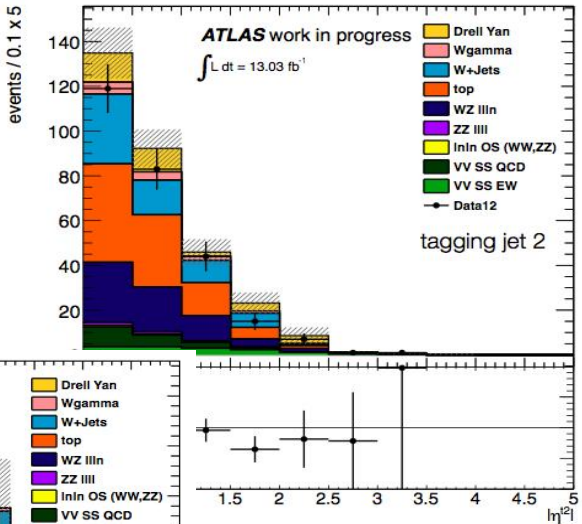


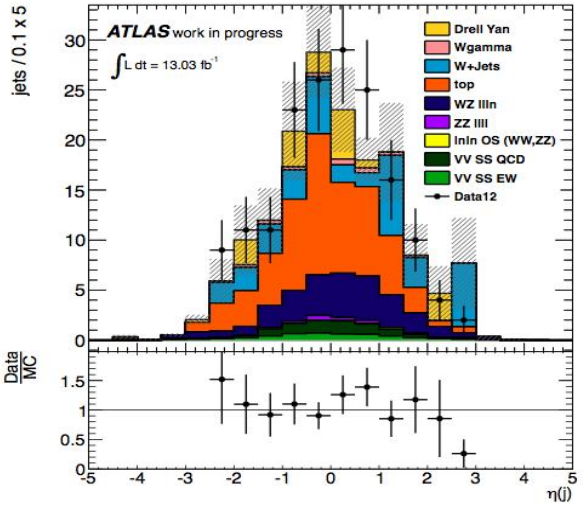
Parton shower effects slightly
Enhance central jet activity

Vector Boson Scattering









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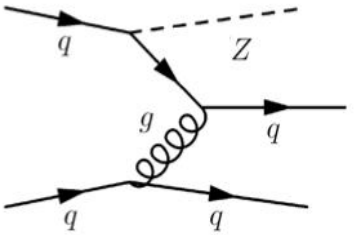
Interaction Experiment – Theory

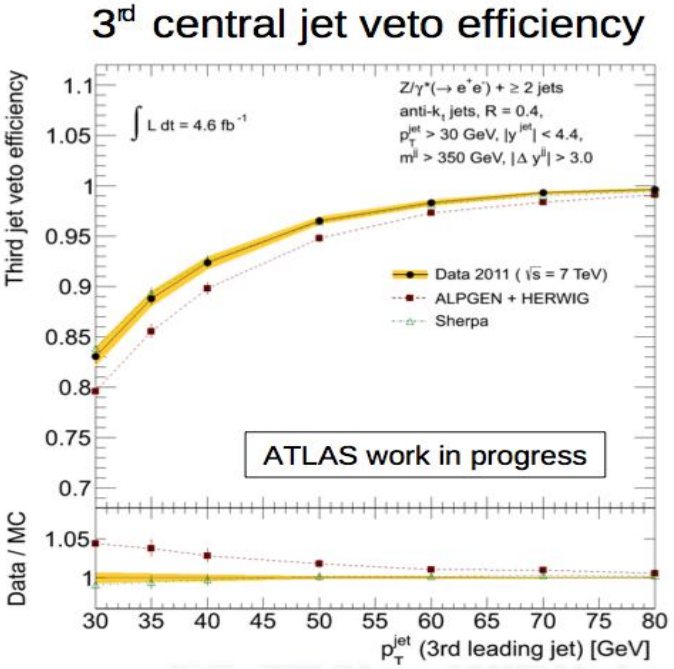
- ◊ complete EW production of qq->WWjj at NLO QCD
- ◊ QCD-induced production of WWjj
- ◊ NLO +PS (Powheg Box)

η 1st/ 2nd/ 3rd jet after VBS WZ preselection
Felix Socher, Dresden,
CJV Parallelsession 6th annual Workshop

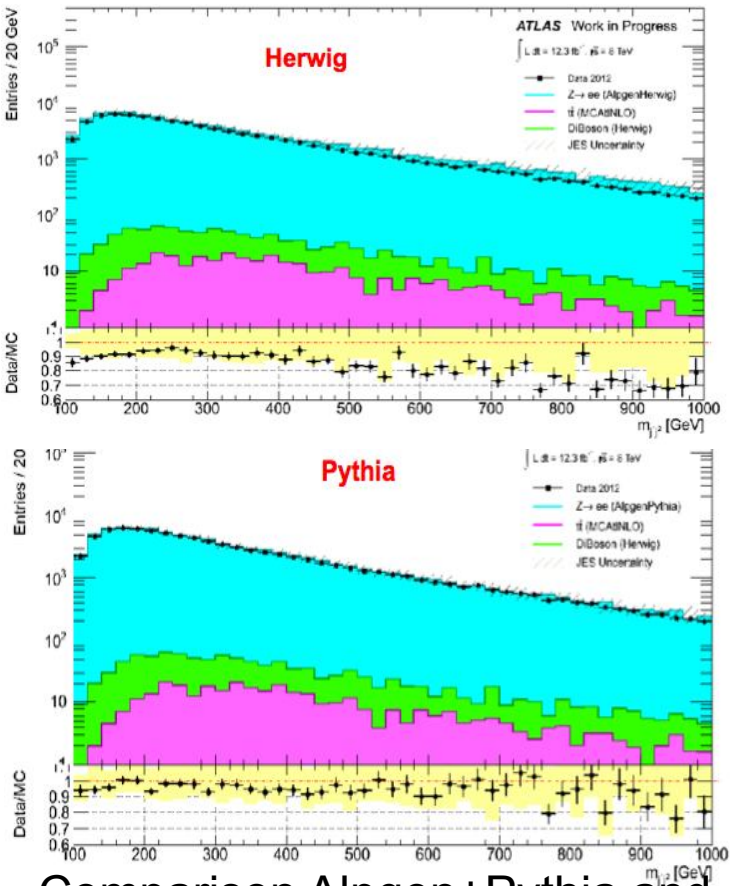
Background from V+jets



◊ Simulation with ME+PS generators
◊ Validate simulation of forward jets
large m(jj), jet multiplicity after VBF cuts
→ Z+jets control region
◊ Large JES uncertainty in forward regime
◊ Simulation of CJV efficiency: larger precision



CJV efficiency simulation in 7TeV:
Alpgen+Herwig and Sherpa



Comparison Alpgen+Pythia and
Alpgen + Herwig in 8TeV

Katharina Bierwagen and
Eric Drechsler, Uni Göttingen

Upcoming activities

CJV working group meeting auf dem Allianztreffen:

Mittwoch, 5.12.12, 14:00-16:00

CJV Session

Conveners: Ulla Blumenschein (Goettingen) , Barbara Jaeger (Universitaet Mainz)

Location: DESY Hamburg (4 a)

14:00 **VBF and Powheg** *30'*
Speaker: Barbara Jaeger (Universitaet Mainz)

14:30 **CJV studies in H->WW** *30'*
Speaker: Pai-Hsien Hsu

15:00 **VBF W in Sherpa** *30'*
Speaker: Julia Fischer (Uni Wuppertal)

15:30 **VBS in Atlas** *30'*
Speaker: Felix Socher

16:00 **Z+jets background for VBF** *20'*
Speakers: Katharina Bierwagen (University of Goettingen) , Eric Drechsler Goettingen)