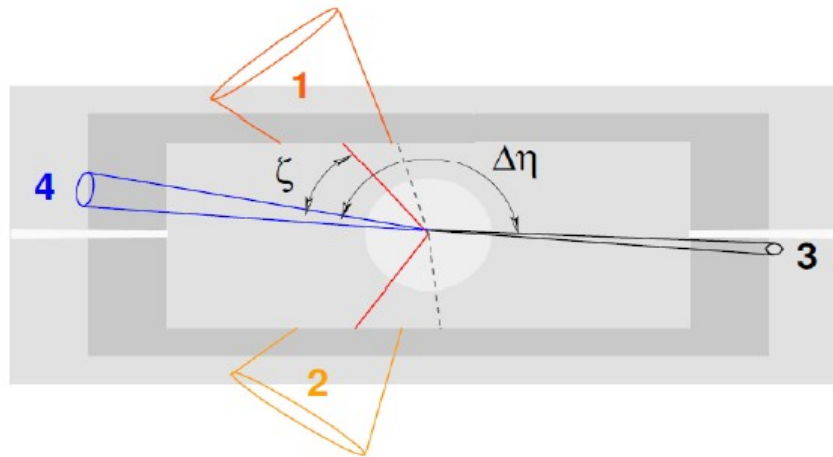


CJV WG status report

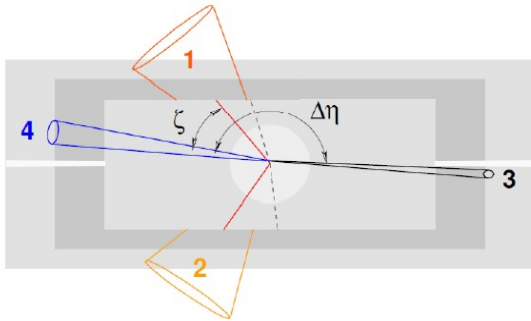
Barbara Jäger (THEP Mainz)

Ulla Blumenschein (II Physik, Uni Göttingen)

5th annual workshop of the
Helmholtz Alliance, Dec 8th, 2011, Bonn



CJV status report

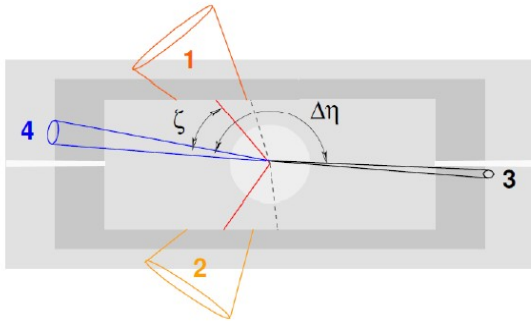


Group wiki: <https://wiki.terascale.de/index.php/CJV>
mailing list: hgfa-cjv@desy.de

Participating institutes:

- THEP Mainz: NLO+PS matching in VBF processes
- KIT Karlsruhe: CJV, NLO calculations of VBF Higgs, VBF V(V), VBFNLO
- Uni Goettingen: VBF H- \rightarrow tautau \rightarrow ll, Z+Jets background to VBF
- Uni Bonn: VBF H- \rightarrow tautau \rightarrow ll, , JES, Pile-up, Z+jets background
- Uni Freiburg: VBF H- \rightarrow tautau \rightarrow ll
- ETAP Mainz: VBF H- \rightarrow WW, Top background to VBF
- Uni Wuppertal: VBF Z cross section at LHC
- Dresden: Vector Boson scattering at LHC
- HAWK Collaboration (Aachen, Freiburg, Würzburg)

CJV status report



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mailing list: hgfa-cjv@desy.de

Workshops in 2010/11:

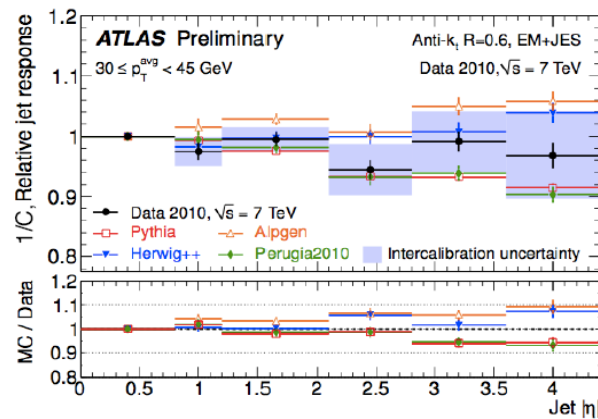
- 1st meeting : 4th annual workshop, Dresden:
<https://indico.desy.de/sessionDisplay.py?sessionId=29&confId=3094#20101202>
Definition of common interests
- Workshop in Göttingen, June 9th -10th 2011:
<https://indico.desy.de/conferenceDisplay.py?confId=4276>
Exchange Theory-Experiment
- Meeting in Bonn, Dec 8th 2011:
<https://indico.desy.de/sessionDisplay.py?sessionId=20&confId=4421#20111208>
New theory inputs and 2011 data analysis

Status of LHC experiments

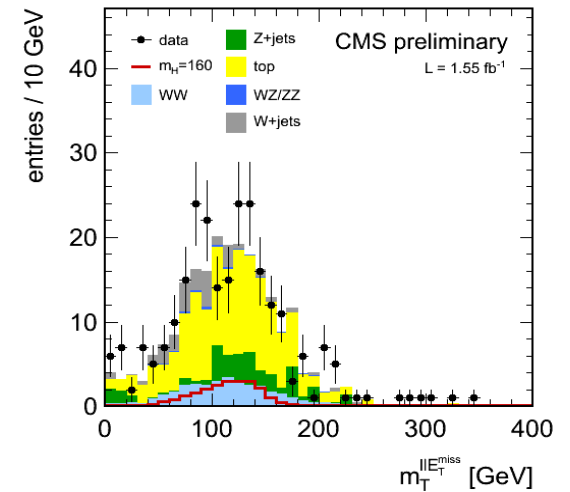
2x5fb-1 on disc in 2011, 4x more expected in 2012
 → sensitivity for large part of the Higgs mass region favored by precision measurements.

- Inclusive Higgs searches → Jet-binned analysis
 Signal in 2-jets channel: dominated by VBF production: typically: large di-jet mass, larger $\Delta\eta$ (jet,jet)
 CJV added in Atlas cut-based WW+2jets
- Preparations for extraction of VBF Z in 2012, (multivariate techniques)

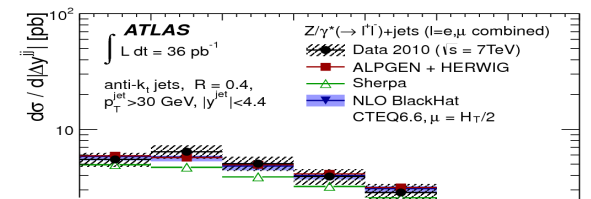
- Challenges:
 - Forward JES
 - Pile-UP
 - Z+Jets, Top bkg



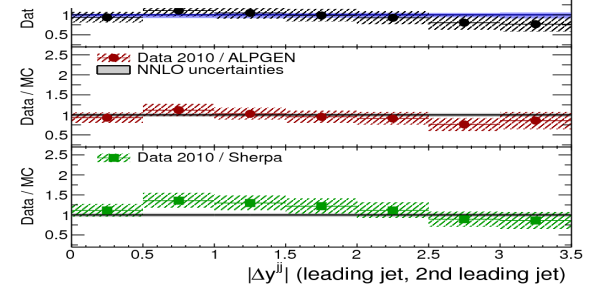
Atlas Forward JES scale: eta intercalibration



Search for VBF H → WW: Higgs MT (CMS PAS HIG-11-01)



Atlas: Z+jets differential cross sections
 arXiv:1111.2690



Theory

- NLO QCD corrections for QCD $W^+W^- + 2$ jets

T. Melia, Ki. Melnikov, R. Rontsch, G. Zanderighi. arXiv:1104.2327
Phys.Rev. D83 (2011) 114043

- Matching NLO EW+QCD $W^+W^- + 2$ jets in Powheg Box

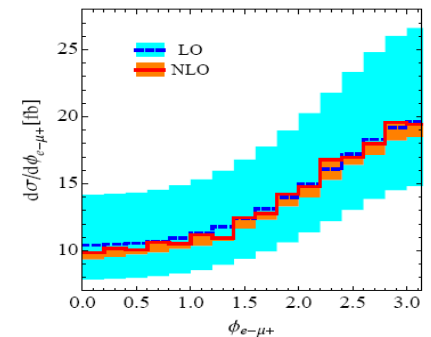
B. Jager, G. Zanderighi, JHEP 1111 (2011) 055, arXiv:1108.0864
QCD $W^+W^- + 2$ jets : T. Melia, P. Nason , R. Rontsch, G. Zanderighi
Eur.Phys.J. C71 (2011) 1670, arXiv:1102.4846

- VBF Higgs at NNLO in QCD (total cross section)

P. Bolzoni, F. Maltoni, S.-O. Moch, M. Zaro. , arXiv:1109.3717

- QCD $Z/\gamma + 3j/4$ jets NLO:

- $W+3$ jets: C.F. Berger et al., Phys.Rev.D80:074036,2009
- $Z/\gamma+3$ jets: C.F. Berger et al., arXiv:1004.165
- $W+4$ jets: C.F. B et al. , Phys. Rev. Lett. 106,0 92001(2011)
- $Z/\gamma+4$ jets: H. Ita et.al., arXiv:1108.222



WW+2j NLO: $\Delta\phi$ (II)
arXiv:1104.2327

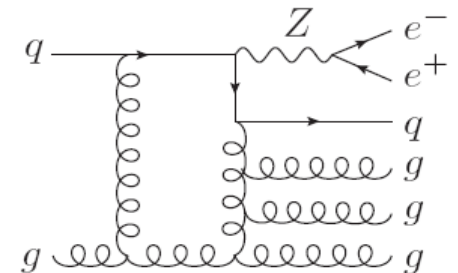


Diagram for Z-point loop amplitudes
H. Ita et.al., arXiv:1108.2229, Sept '11

VBF H cross section tools: NLO(EW) and NLO/NNLO(QCD)

- VBFNLO [D. Zeppenfeld *et al.*]: only t-channel, NLO QCD + NLO EW
- HAWK [M. Ciccolini, A. Denner, A. Dittmaier, A. Mück]: NLO QCD and NLO EW, s- and t-channel included
- POWHEG [C. Oleari, P. Nason]: only t-channel, NLO QCD + PS
- VBF@NNLO [P. Bolzoni, F. Maltoni, S.-O. Moch, M. Zaro] NNLO QCD, only total cross section

CJV WG: theory ↔ experiment

Major theory objective:

- development and improvement of tools for simulation of CJV observables (signal and bkg)
- providing forum for exchange between developers and users
 - improved programs for CJV observables in VBF signal processes
 - improved predictions for technically challenging background processes,
- marketplace for presenting and advertising new tools / studies
 - direct contact to potential users
- ← get direct feedback from experimentalists
 - what is needed / meaningful
 - which experimental limitations should be taken into account in theoretical work

Experimentalist view

- get in contact with authors of major tools, calculations
- New ideas for measurements

CJV WG: Exchange between experimentalists

Exchange between physics groups

- address common problems over several physics groups/experiments

Example: V+jets in ATLAS SUSY - Standard Model - Higgs

Collaboration within a physics group

- coordinate efforts of German groups within a certain physics group:

Example: - Standard model QCD Z+Jets, EW Z+jets

- VBF $H \rightarrow \tau\tau \rightarrow ll$ (\leftrightarrow WW)

Exchange between experiments

- Attempts have been made but no results yet

Achievements in 2011

- NLO calculations/tools

State-of-the art programs for VBF including NLO-QCD and EW corrections (HAWK & VBFNLO) presented by the authors to LHC experimentalists

- QCD V+jets between physics groups

Comparison of QCD V+jets assessment in Higgs, SUSY and Standard Model → Spin-off: coordinated ME+PS MonteCarlo production effort in Atlas (EW,QCD V+jets) (4 German groups)

- Blackhat+Sherpa: W/Z+3jets, W/Z+4jets

Established contact to BlackHat coll. for NLO predictions on W/Z+3/4 jets observables → Atlas publication on QCD Z+Jets, arXiv:1111.2690 (2 German institutes in CJV WG)

- H → WW and H → $\tau\tau$ → ll

Collaboration between German LHC groups on EW and QCD Backgrounds for VBF H in lljj final states H → WW and H → $\tau\tau$ → ll → Atlas publication in preparation for January 2012 (3 institutes in CJV WG)

Plans for 2012/13

General plans:

- Discover the Higgs Boson in the low-mass region
- First observation of VBF Z production
- Measurement of Weak Boson scattering

More specific plans:

- Reduce systematics from Z+Jets and Top background in searches for VBF $H \rightarrow WW$ and VBF Higgs $\rightarrow \tau\tau \rightarrow ll$
- Reduce systematics from JES and Pile-up in searches for VBF $H \rightarrow WW$ and VBF Higgs $\rightarrow \tau\tau \rightarrow ll$
- Prepare public BH+Sherpa ntuples for V+0-4jets NLO with tools and instructions for interested users
- Provide improved programs for CJV observables in VBF background processes, such as NLO-QCD calculations matched to PS programs
- Provide improved predictions for technically challenging background processes, as for example WZjj