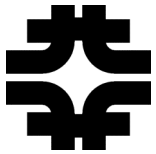
Physics strategy in a nutshell



Supervisor: Jeffrey Berryhill

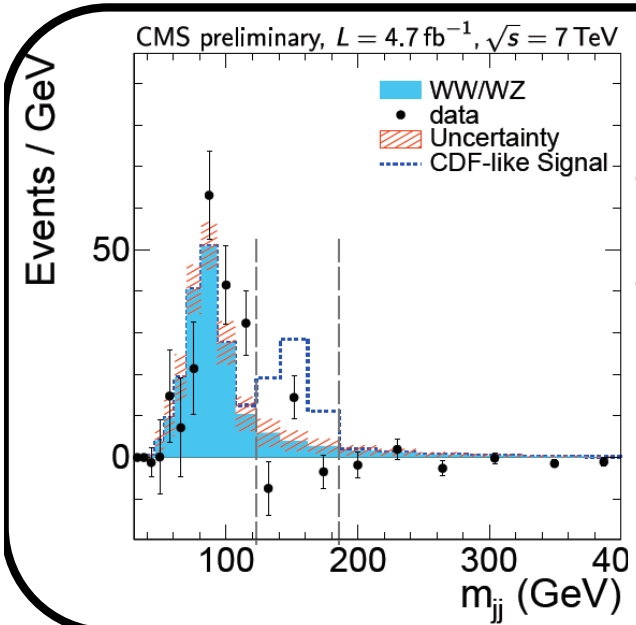
2010
0–36 pb^{-1}
Inclusive W,Z cross section and properties
2 papers (both published)

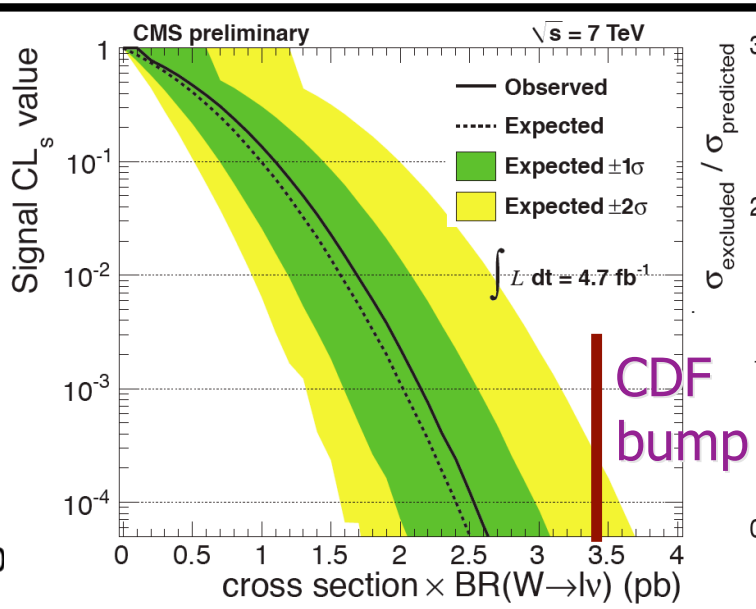
2011
5 fb^{-1}
W+jets: M_{jj} (a.k.a. "CDF bump")
1 paper (result approved/ public, paper in pipeline)

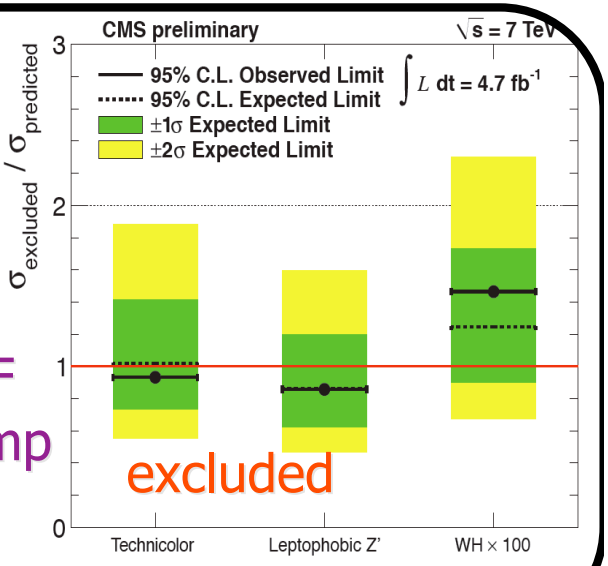
2011
5 fb^{-1}
WW semi-leptonic ($l\nu jj$, with 0,1 extra jet)
2 papers: H→WW pre-approved, pub likely. Diboson (WW+WZ) cross section & aTGC, aim pub

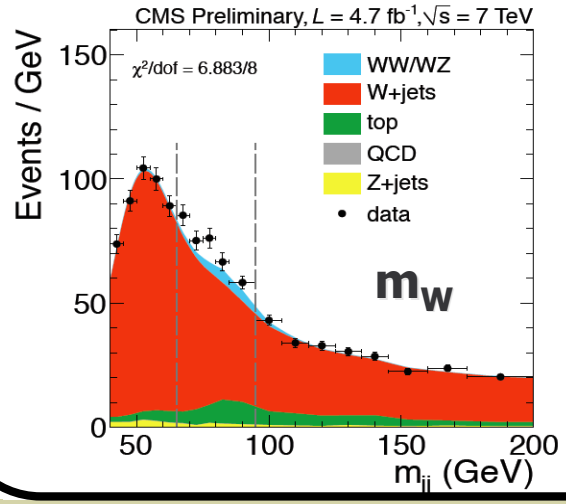
2012
20 fb^{-1}
WW semi-leptonic ($l\nu jj$ + 2 tag/"forward" jets)
1–2 papers: Jet substructure, High mass H, WW scattering, understand merged jets in boosted W

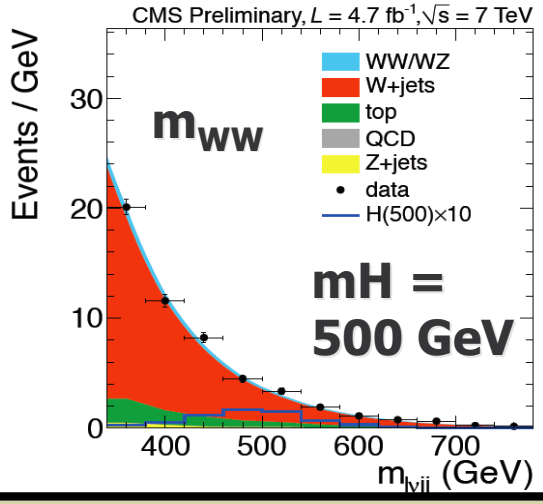
Some results from 2011 data

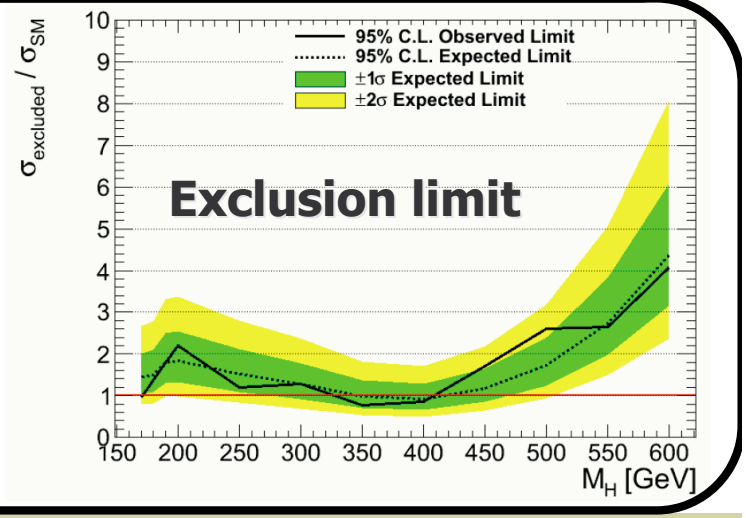




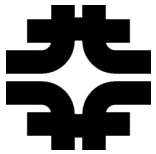








Contributions & accomplishments



Inclusive W,Z analysis: Co-led the Z analysis team, delivered the first cross section results for ICHEP 2010, and two papers w/ 3 pb^{-1} & 35 pb^{-1}. A high visibility analysis.

Mjj in W+jj analysis: Co-led the analysis team; edited the paper. Exclude CDF bump & several models to explain the effect (technicolor, leptophobic Z'). A high visibility analysis.

$H \rightarrow WW \rightarrow l\nu jj$: Led the analysis effort; edited the paper/PAS. Exclude SM Higgs in mass range 320–420 GeV. Important channel for 2012 analysis of VBF/ WW scattering/ boosted W.

Diboson $WW/WZ \rightarrow l\nu jj$: Leading the analysis effort, and the possible publication. Important channel to investigate tripple gauge couplings with good sensitivity in 2012.

People I work with: LPC lνjj team

Nural Akchurin[1], Jake Anderson[2], Andrew Beretvas[2], Jeffrey Berryhill[2], Pushpa Bhat[2], Phil Dudero[1], Ricardo Eusebi[3], Dan Green[2], Pratima Jindal[4], Sung-Won Lee[1], Kalanand Mishra[2], Ilya Osipenkov[3], Alexx Perloff[3], Andre Sznajder[5], Nhan V. Tran[2], Fan Yang[2], and Francisco Yumiceva[2]

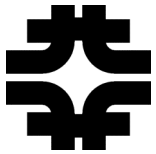
[1] Texas Tech University, Lubbock, Texas, USA
[2] Fermi National Accelerator Laboratory, Batavia, Illinois, USA
[3] Texas A&M University, College Station, Texas, USA
[4] University of Nebraska at Lincoln, Nebraska, USA
[5] Universidade do Estado do Rio de Janeiro (UERJ), Brazil

In addition

- Inclusive W,Z: included people from KSU, MIT, Princeton, …
- Mjj analysis: included Wisconsin
- HWW: included Milano, Notre Dame, Virginia
- Diboson: includes Wayne State.

Well established team, well oiled machinery

Calibration and POG works



- ✓Jet commissioning with early data in 2009–10
- ✓JES absolute calibration using Z+jet balance ⇒ included in JINST paper
- ✓Commissioning of electron with early data ⇒ calibration using Z peak
- ✓Led Egamma electron reco. & trigg eff in 2008-10
- ✓Led the development CMS Tag & Probe package

Calibration works for POGs.
Resulted in ≥ 5 ANs + 1 PAS

Smaller involvement in other analyses

- Dijet resonance search
- Z forward-backward asymmetry in 2010

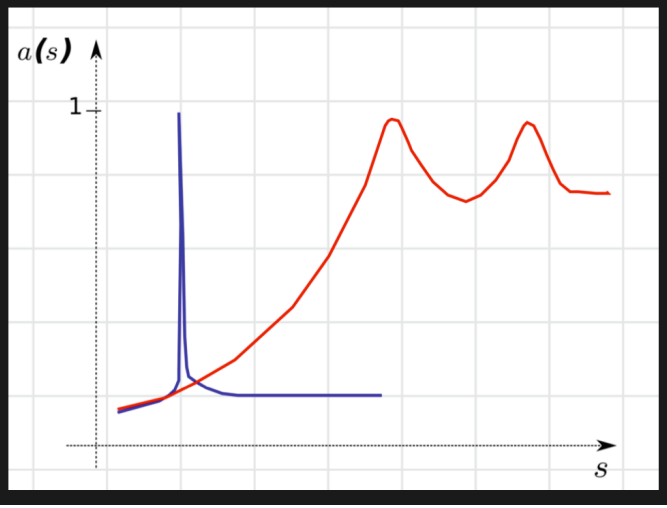
Plan to contribute to calibrating forward jets and merged jets

Upgrade studies after analysis of 2012 data is done

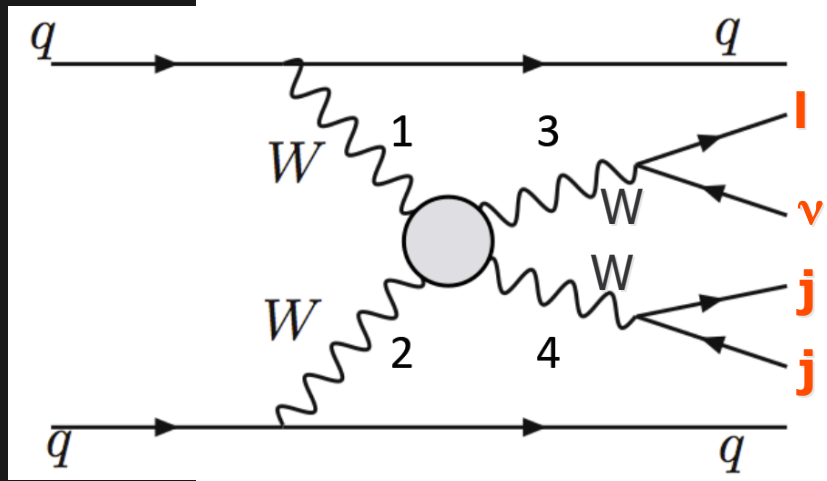
Plans for 2012 analysis & beyond

If the Higgs is found: VV scattering amps predicted to remain small
Ultimate test of SM description of EWSB

If the Higgs is NOT found: VV scattering amps grow with s at "threshold"
Nothing in the SM to tame this growth
In the absence of new physics violate unitarity ~1.7 TeV
Best hunting ground for hints of new physics of EWSB



- High mass Higgs
- Higgs/exotics in VBF
- WW scattering
- Merged jets from boosted W



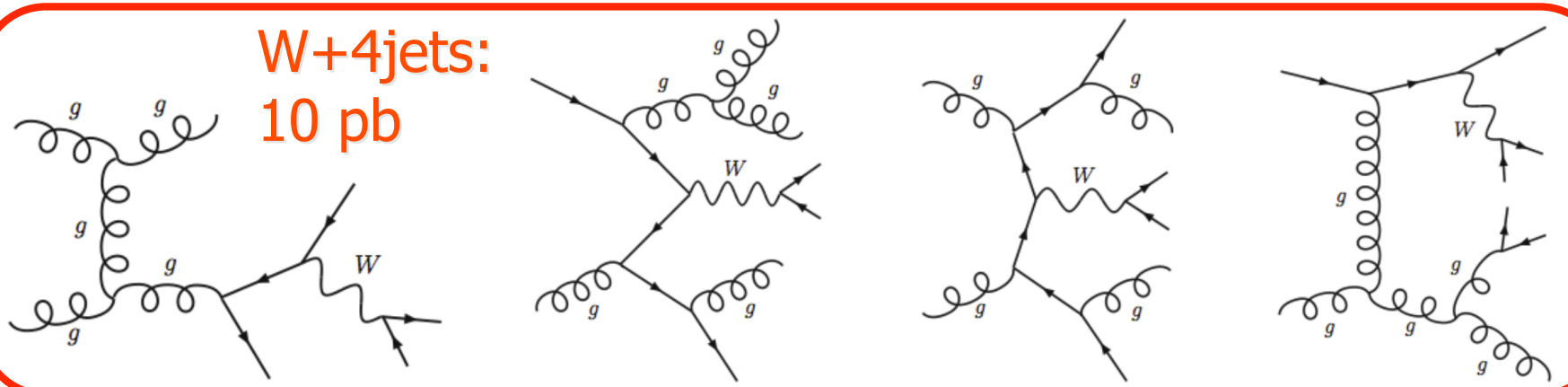
With 20/fb, lνjj channel sensitive to weakly produced NP at 1 TeV

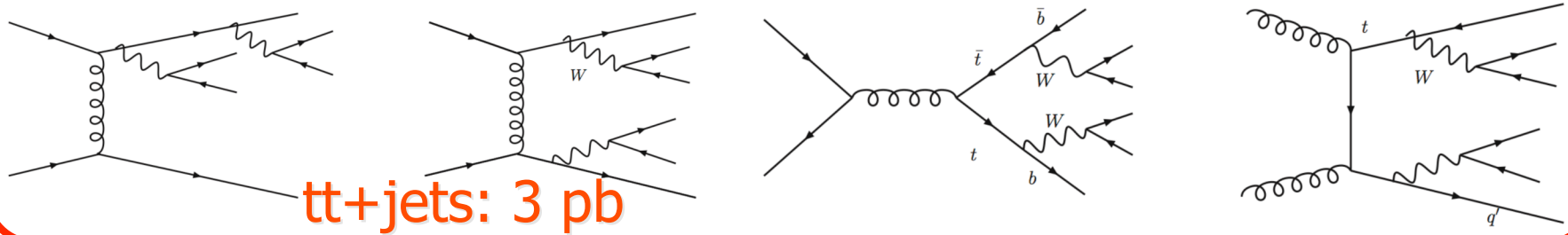
Signal over noise ….

VBF Higgs cross for MH = 1 TeV : 0.011 pb

EWK VBF WW cross section (WW + 2tag jets): ~ 1 pb

W+4jets:
10 pb





tt+jets: 3 pb

Only a small fraction of these bkg contribute, better S/B than gg analysis.

Miscellaneous ….

Talks in last 3 years

- Two invited conference talks: EWSB11 @UWisc. Madison, Lattice Meets Experiment 2011 - Beyond the SM @FNAL
- Two regular CMS conference talks (Conf on First LHC Data @UMich. Ann Arbor 2010, DPF @Providence 2011)
- 288 hits in CMS Indico, many seminar talks in universities

Community Service

- CMSDAS tutorials on jets: 2009-2012
- MC tutorial during HCPSS 2010

Mentoring

(Undergrad, grad)

- 2011: Kristina Krylova (Buffalo, this year Summer REU at UMich), Kellen McGee (Hopkins)
- 2009-10: Mikhail Makouski (KSU), Sunil Bansal (Punjab, now PD at Antwerp, Belgium), Mehmet Deliomeroglu (Bogazici, now Scientist at Ericsson Turkey), Anil Singh (Punjab, now PD at NCU Taiwan), Kittikul Kovitangoon (TTU), David Bjergaard (JHU, now grad at Duke)