

$H \rightarrow W W + 2 \text{ jets}$ Analysis



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Optimization of Neural Net Inputs

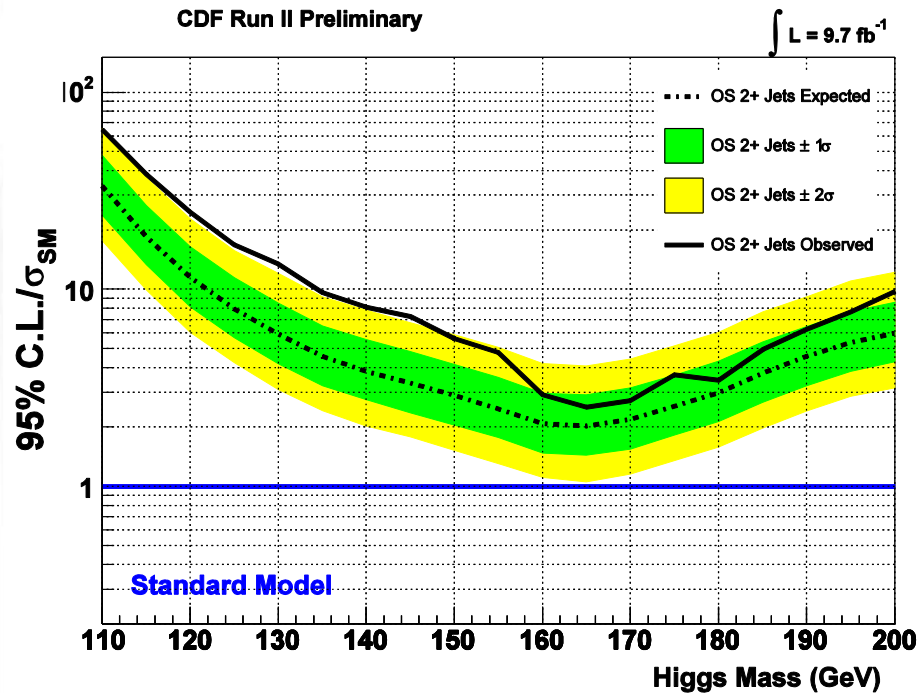
- Inputs for the HWW OS analysis were chosen for maximum sensitivity at 160 GeV
- Pedro Fernandez tested a larger set of inputs and found a set that improves sensitivity in the OS 2 jet bin by up to ten percent
 - Used individual jet kinematics
 - Because of stability problems, he tried sets of 14, 18, and 28 inputs
- We tested the current set of inputs, plus **Pedro's inputs** and the individual jet kinematics (for VH/VBF only)
 - Larger training sample allowed us to keep 23 most significant inputs for optimal training
 - 17 inputs for ggH neural net
 - Optimized at four mass points: 125, 140, 160, and 185 GeV and extrapolated to nearby masses

NN Inputs in order of significance at 125 GeV, new inputs in bold:

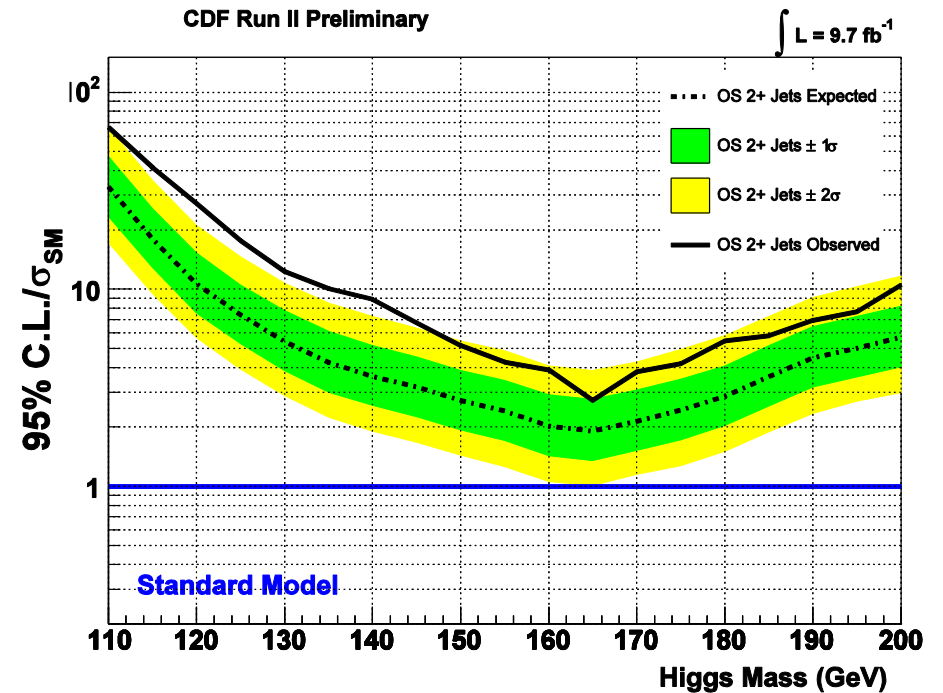
dimass
JetMass
Ht
dPhiLepSumMet
dRLeptons
MetSpec
CosDPhiLeptons_CM
sumJetPt
JetdEta
Mt_H
MetSig
jet2_Eta
Mt_Hincl
CosPsiLepton2
dPhiLeptons
jet2_E
DeltaRJet12
jet1_Eta
jet2_Et
jet1_Et
addEt
lep1_Pt
SumEtLeptonsJets
lep2_Pt
Aplanarity_wMet
JetAngle
jet1_E

Results

Old NN Inputs



Optimized NN Inputs

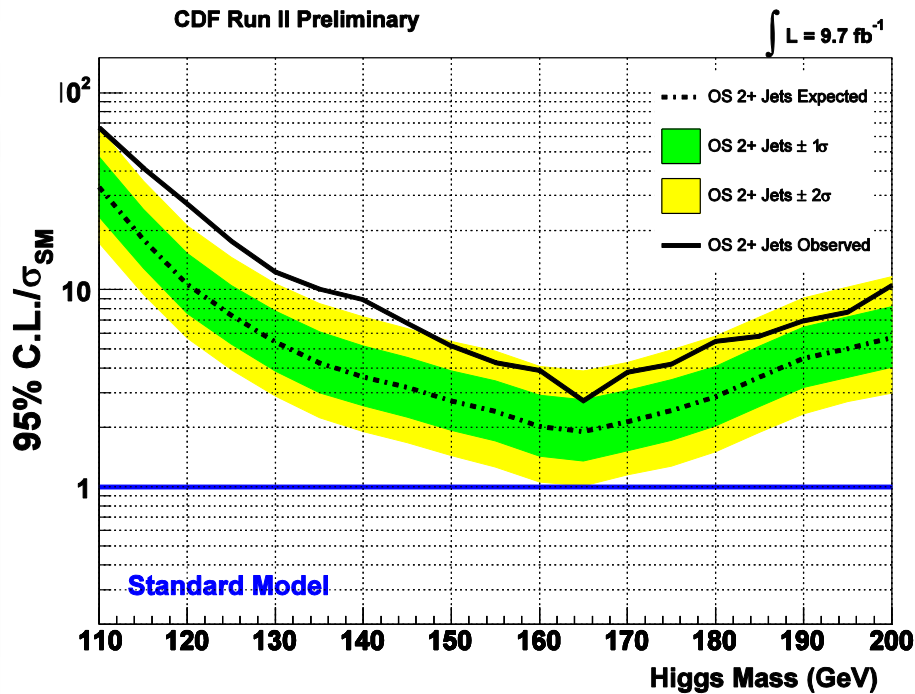


OS 2+ Jets	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
$-2\sigma/\sigma_{SM}$	17.25	9.44	5.68	3.93	2.88	2.24	1.91	1.68	1.44	1.26	1.06	1.01	1.15	1.27	1.50	1.90	2.35	2.70	2.98
$-1\sigma/\sigma_{SM}$	23.39	12.85	7.57	5.28	3.86	3.01	2.57	2.26	1.93	1.71	1.43	1.35	1.52	1.72	2.04	2.56	3.19	3.58	4.04
Median/σ_{SM}	33.07	17.92	10.65	7.41	5.43	4.25	3.61	3.19	2.72	2.41	2.02	1.90	2.15	2.44	2.87	3.60	4.48	5.04	5.70
$+1\sigma/\sigma_{SM}$	47.02	25.60	15.29	10.51	7.79	6.09	5.17	4.54	3.87	3.44	2.90	2.77	3.08	3.50	4.08	5.19	6.45	7.28	8.19
$+2\sigma/\sigma_{SM}$	65.94	35.63	21.11	14.59	10.71	8.52	7.29	6.35	5.45	4.87	4.08	3.87	4.27	4.95	5.83	7.31	9.10	10.34	11.67
Observed/σ_{SM}	66.35	41.33	27.22	17.66	12.27	10.08	8.91	6.75	5.17	4.27	3.89	2.73	3.80	4.21	5.49	5.84	6.95	7.72	10.51
Improvement in expected limit	1.8%	2.6%	8.5%	6.9%	8.1%	6.8%	5.7%	4.6%	6.6%	3.6%	1.9%	5.6%	2.3%	4.9%	4.5%	3.4%	1.4%	5.8%	4.6%

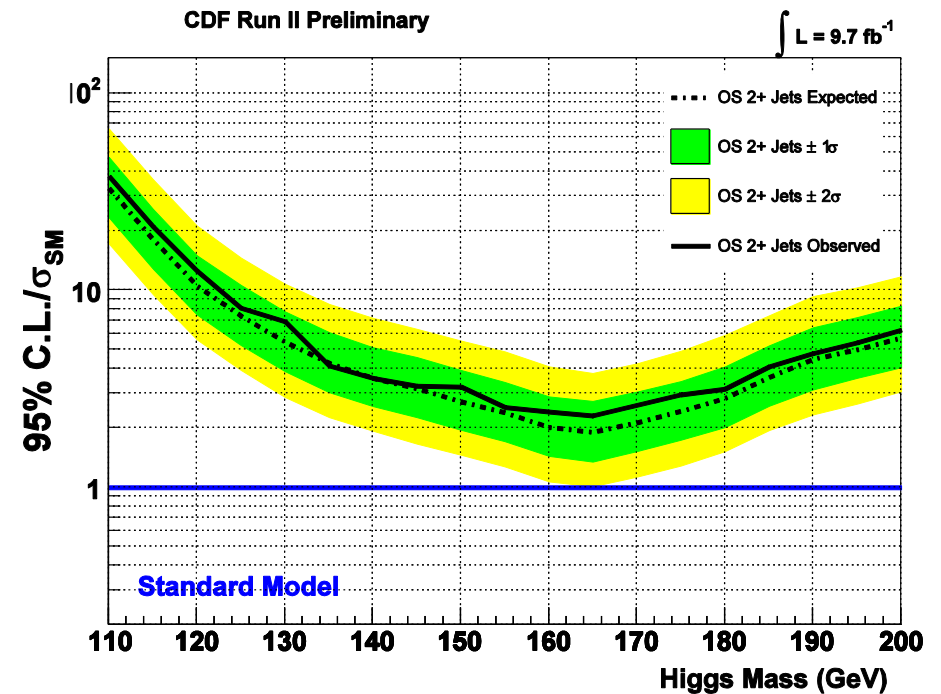
- Expected limit improves at all mass points by up to 8%
- Observed limit generally higher

Signal Injection

Optimized NN Inputs



125 GeV signal



- Add MC 125 GeV Higgs signal to background at each mass point, and use as data sample
- Effect is broad, but $<1\sigma$

Control Region NNs

- Run control region through neural net for 125 and 160 GeV

