Searching for a low mass Higgs Boson at CDF

Bodhitha Jayatilaka
Duke University

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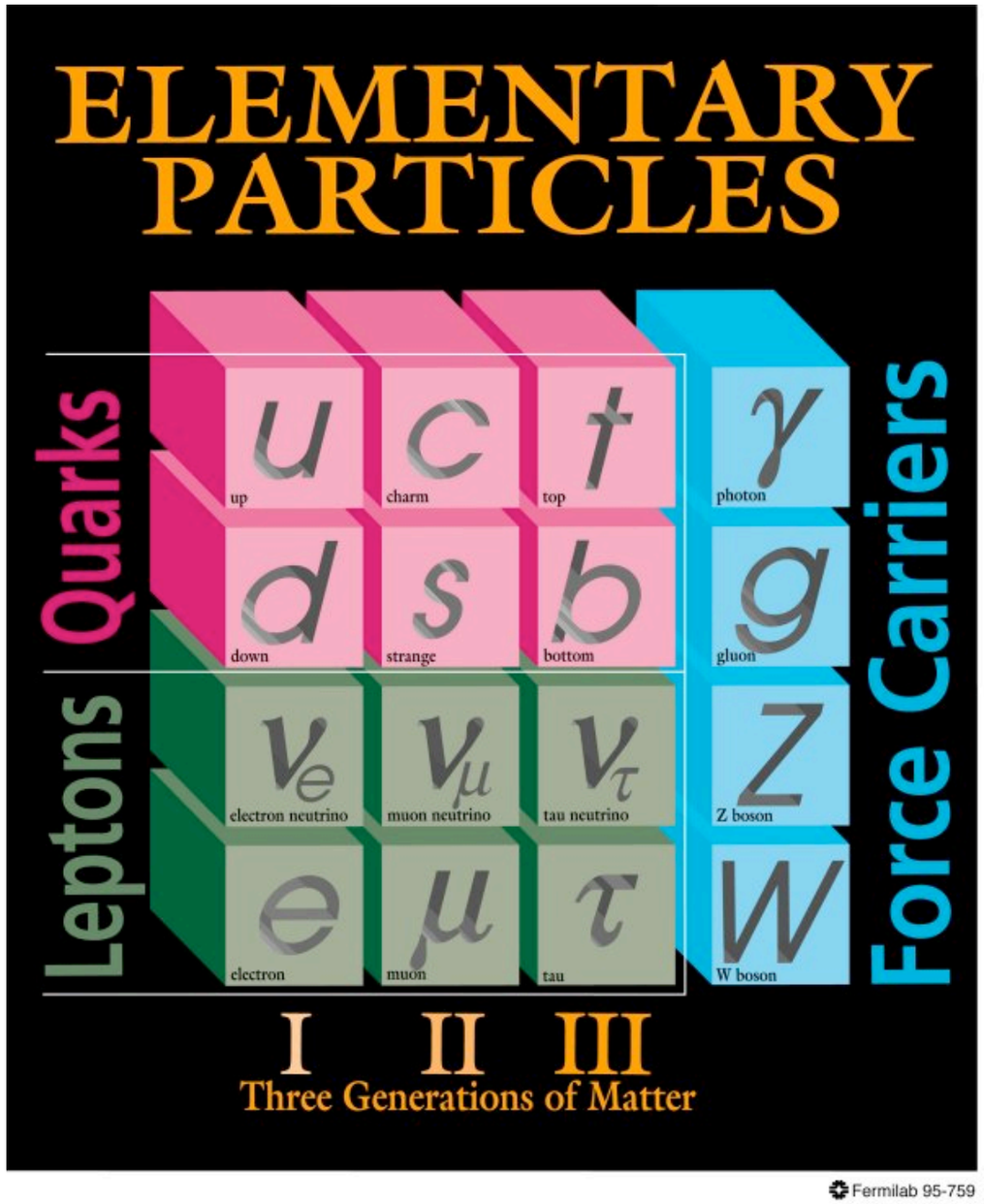
What do we know?

- The standard model
  - Describes known particles and interactions
  - Does not describe
    - Spontaneous symmetry breaking of U(1)×SU(2)
    - Fermion masses

- Simple explanation: **Higgs mechanism**
  - Explains EWSB and fermion masses
  - Would result in physical particle: **Higgs boson** (spin-0)
  - Higgs boson yet unobserved
  - Production and decay predicted
    - Mass has to be determined experimentally



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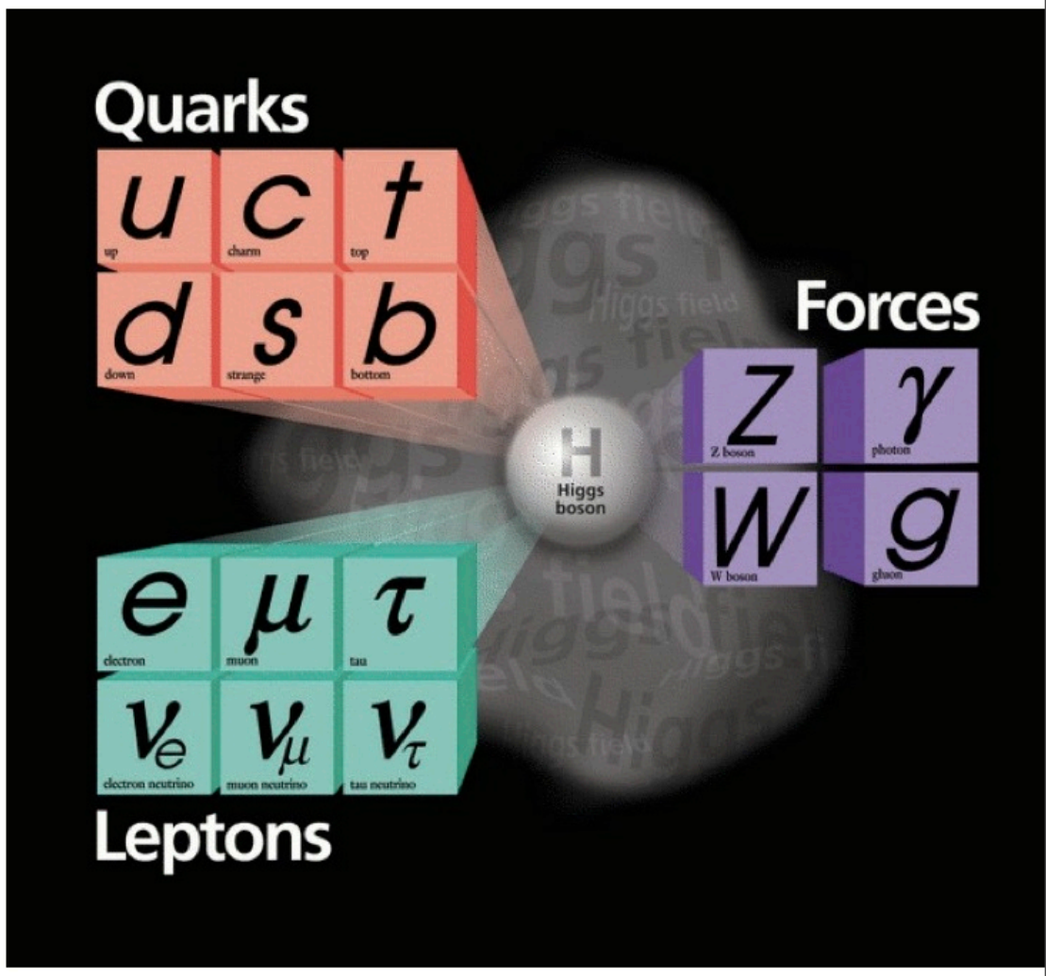

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What do we know (about the unknown)?

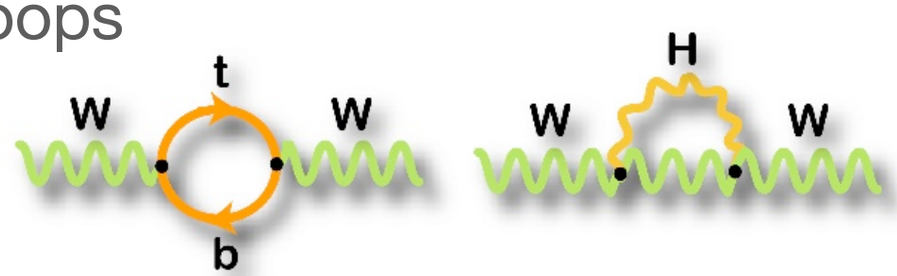
- Electroweak sector of the standard model (SM) is constrained by

$$G_F = 1.16637(1) \times 10^{-5}\ \mathrm{GeV}^{-2}$$
$$\alpha_{EM}(Q^2 = M_Z^2) = 1/127.918(18) \quad m_Z = 91.1876(21)\ \mathrm{GeV}/c^2$$

- These constants are all related to m_W by

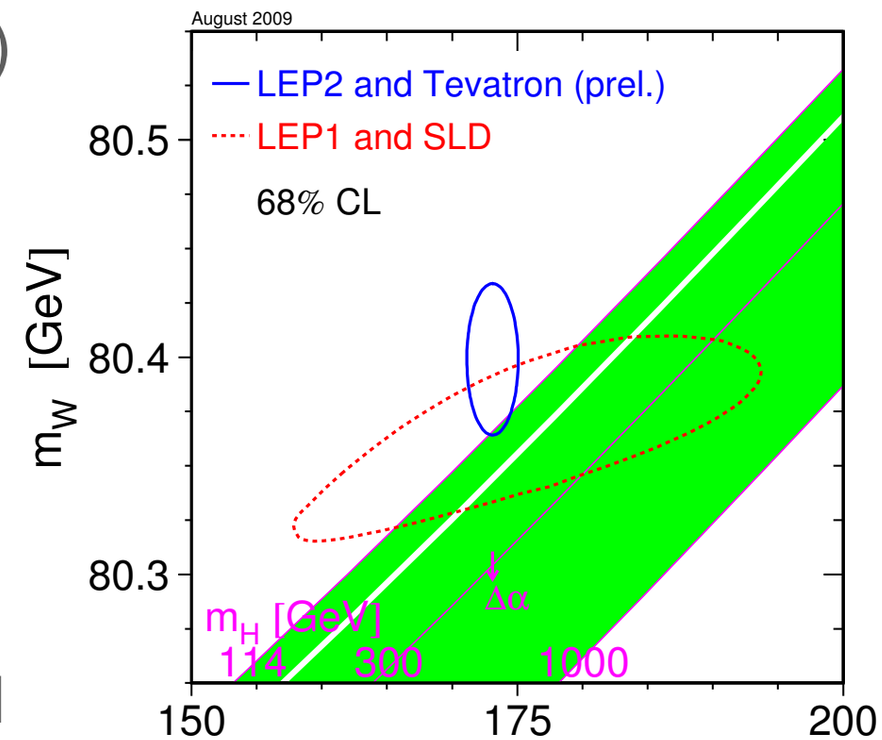
$$m_W^2 = \frac{\pi \alpha_{em}}{\sqrt{2} G_F \sin^2\theta_W (1 - \Delta r)}$$

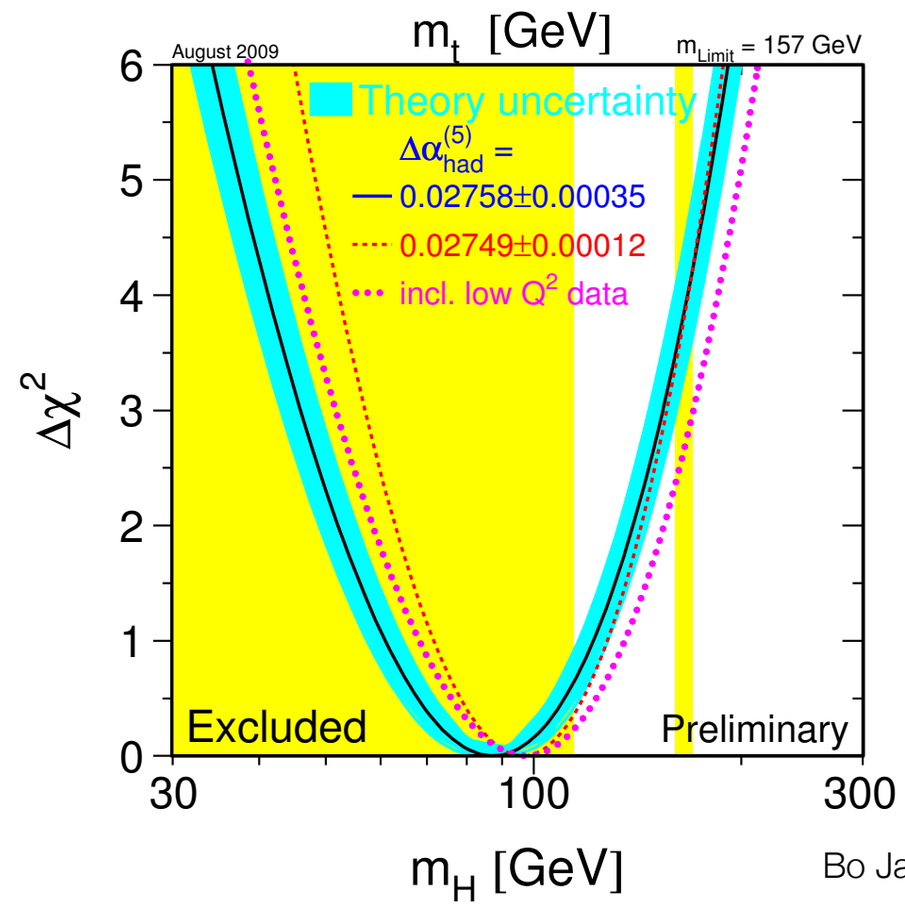
- Radiative corrections Δr dominated by top and Higgs loops



- Precision measurements in m_W and m_{top} constrain SM Higgs mass
  - m_H<157 GeV/c^2 @ 95% CL
  - Direct searches at LEP: m_H>114 GeV/c^2
    - Low mass preferred?

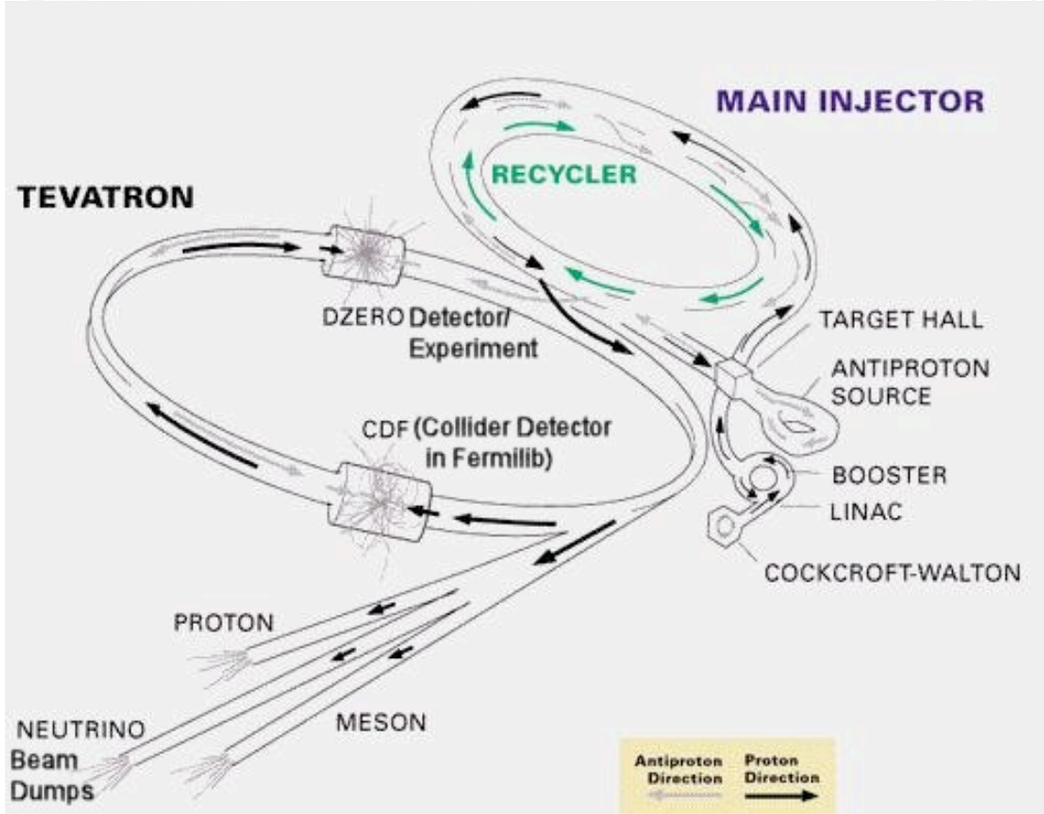
From LEPEWWG



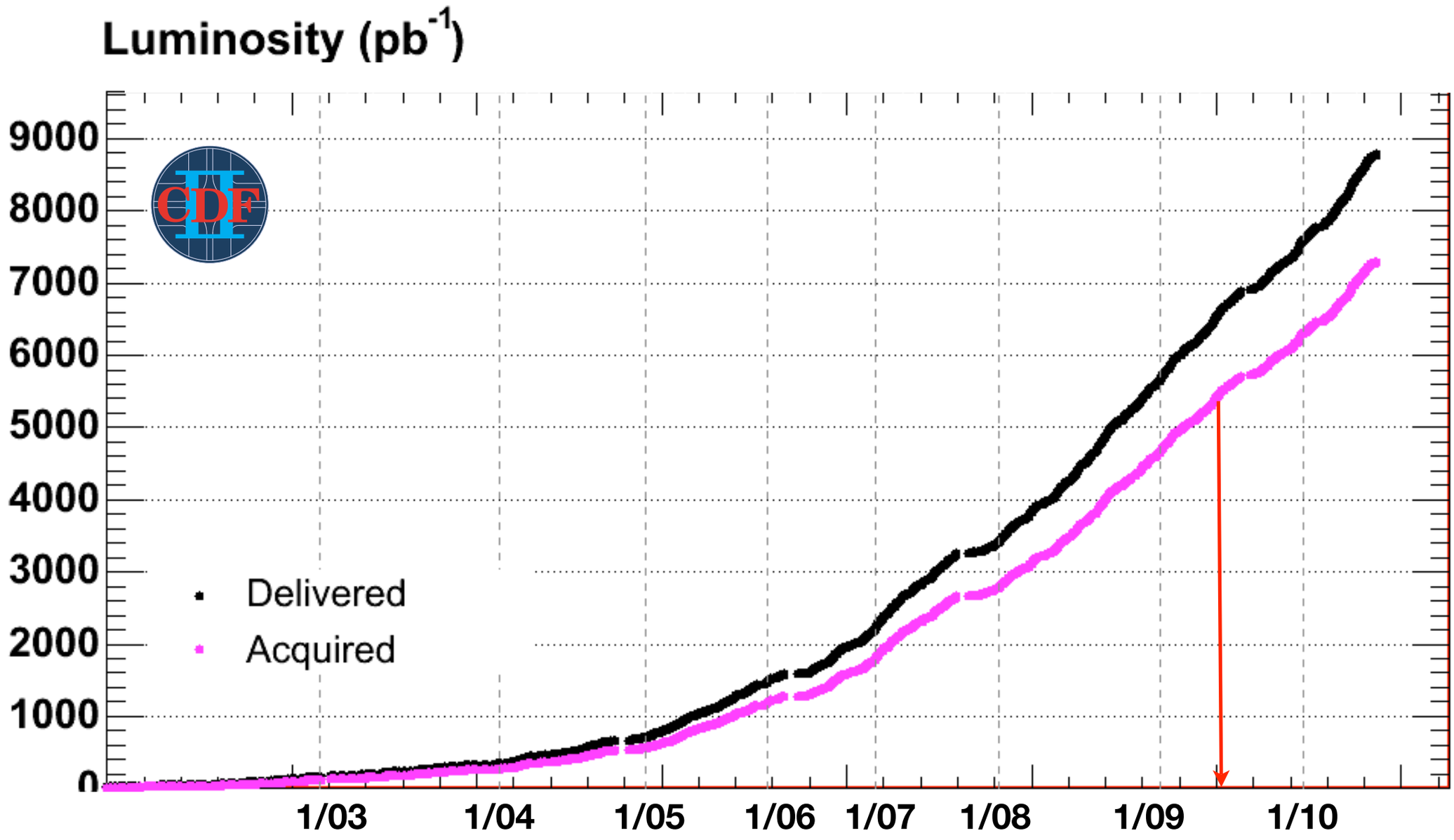


The Tevatron at Fermilab

- 1.96 TeV ppbar collider
  - Highest energy p-pbar collider in the world
- Some numbers:
  - Typical initial luminosity > 3×10^{32} $cm^{-2}s^{-1}$
    - Record: **4.0×10^{32} $cm^{-2}s^{-1}$**!!
  - Typical week: ~50 pb^{-1}
    - Record: **73 pb^{-1}**
  - 2009 LHC run ($10\mu b^{-1}$): Tevatron in 0.1s!
- Nearly 9 fb^{-1} delivered to each experiment
- Long-term plans: >10 fb^{-1} per experiment
  - Run through FY2011
    - Maybe more?

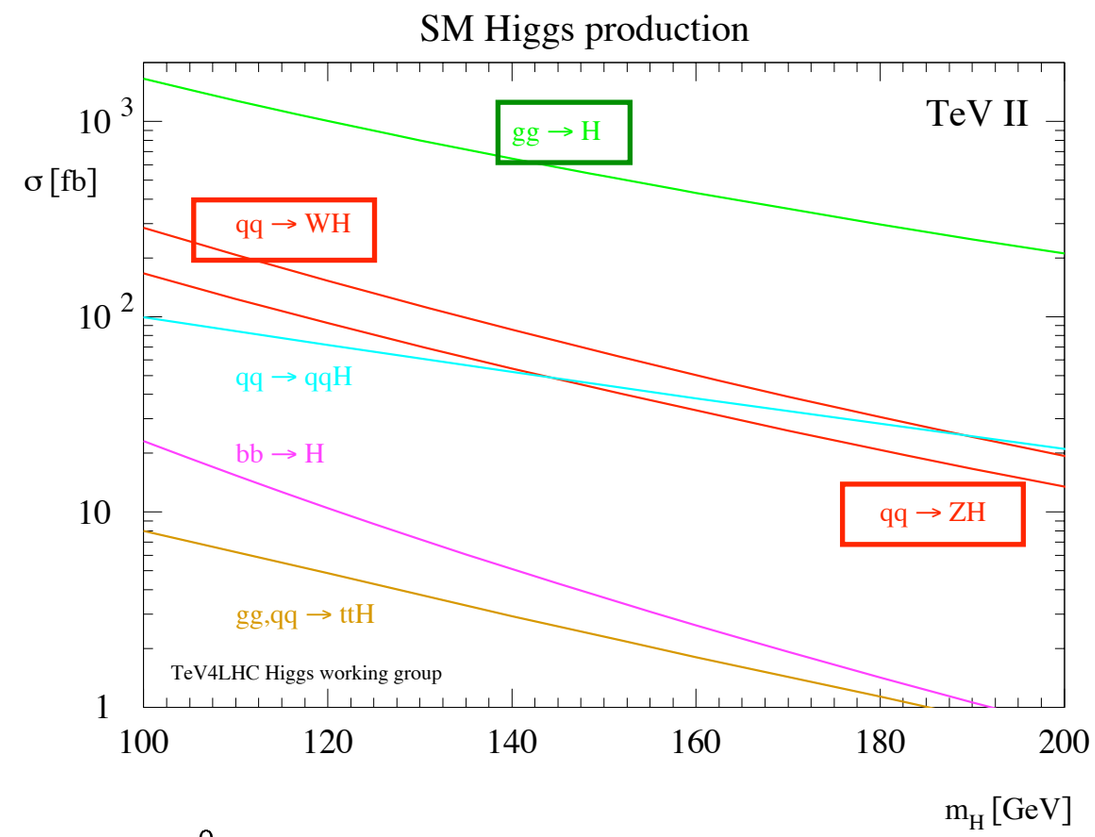


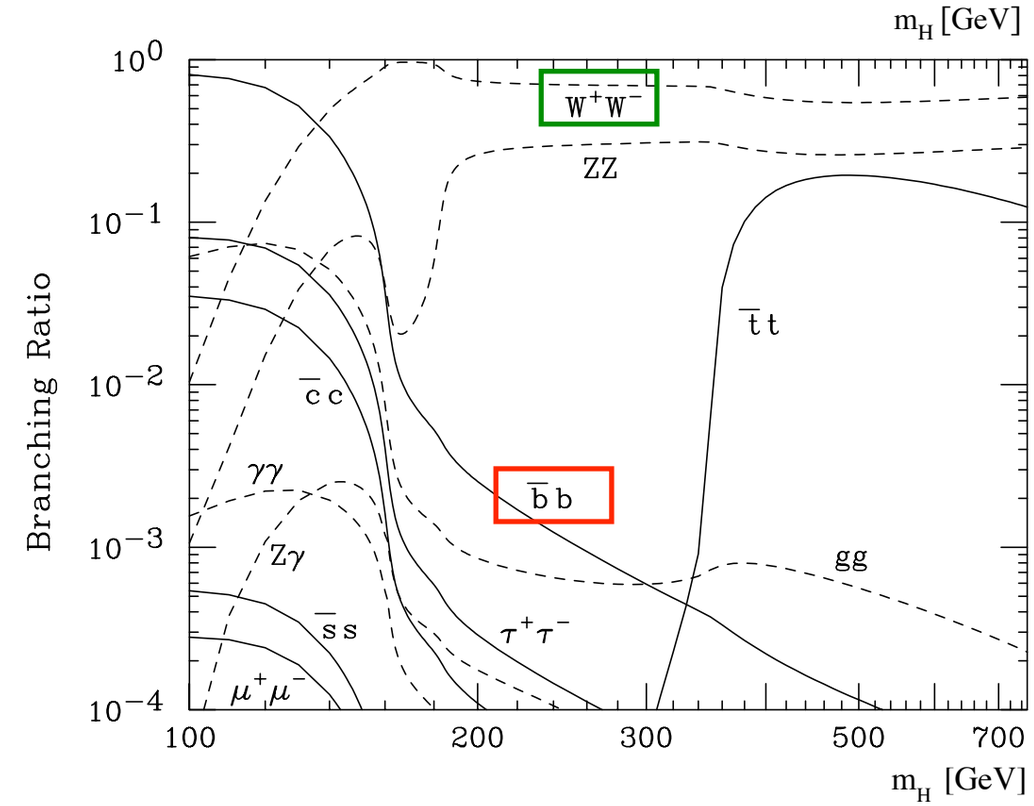
Integrated luminosity at CDF



What to look for?

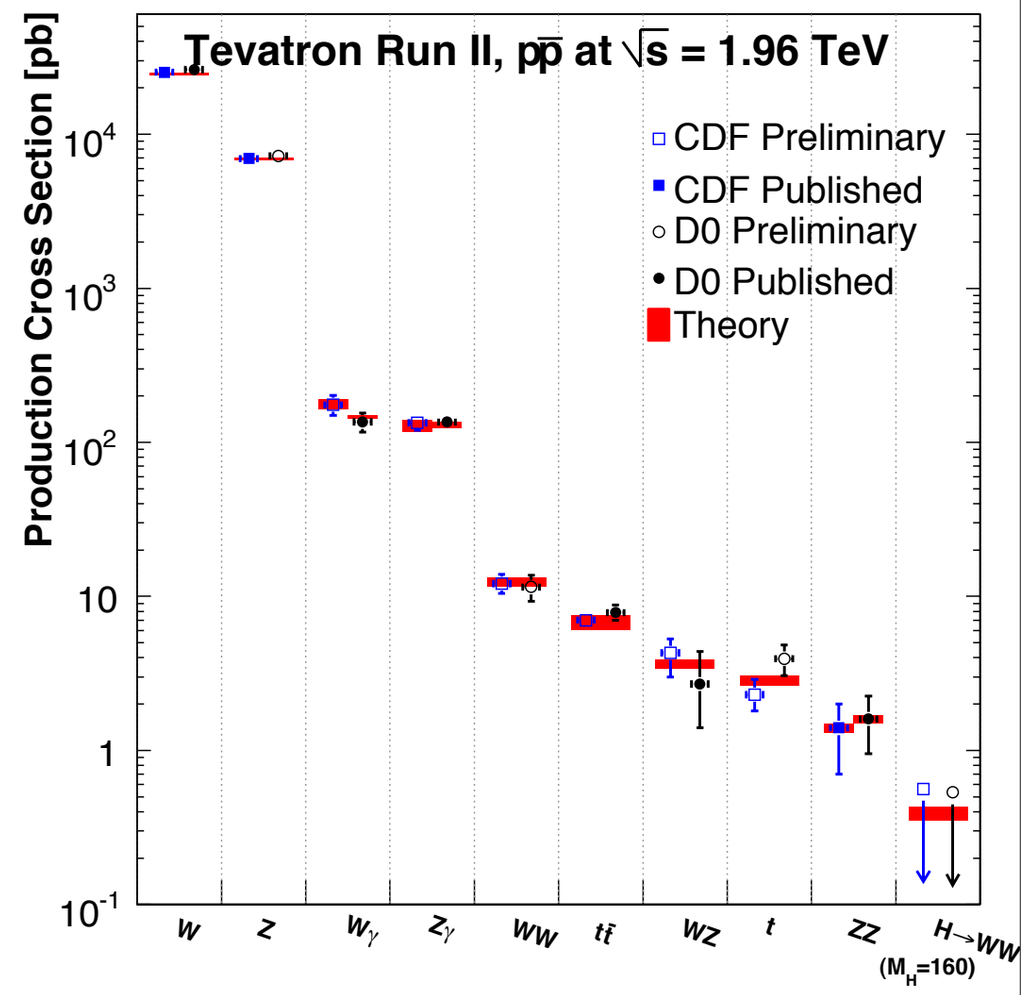
- Separate according to decays:
- Low mass [m_H<135 GeV]:
  - Decays dominated by $H \to b\bar{b}$
  - $gg \to H \to b\bar{b}$ difficult to see experimentally
  - Rely on primarily on associated production with W or Z
- High mass [m_H>135 GeV]:
  - Decays dominated by $H \to W^+W^-$
  - Easiest to look for leptonic decays of Ws
  - Considerable contribution from VBF and associated production





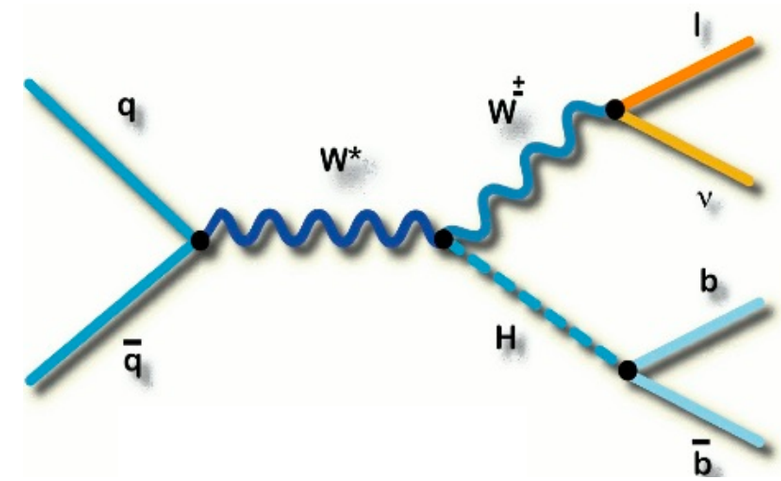
The strategy

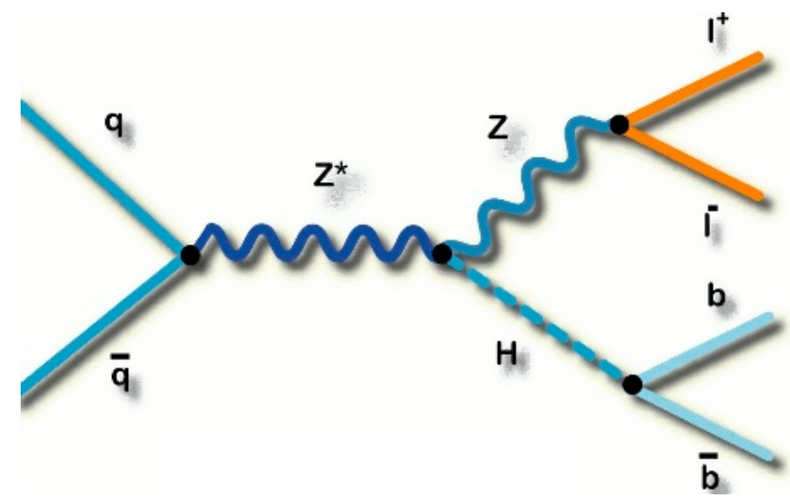
- Searching for a low mass SM Higgs needs:
  1. A good detector
  2. Defining a data sample
     a. Trigger
     b. Event selection
  3. Extracting a small signal: advanced analysis tools
  4. Open the box: set a limit if no signal seen
  5. Go back and improve on 1-4
- Not unique to Higgs searches
  - All steps have been successfully applied to other rare processes observed at the Tevatron (*e.g.* single top, diboson)
- Cover as many decay channels as possible
- Combine CDF+DØ

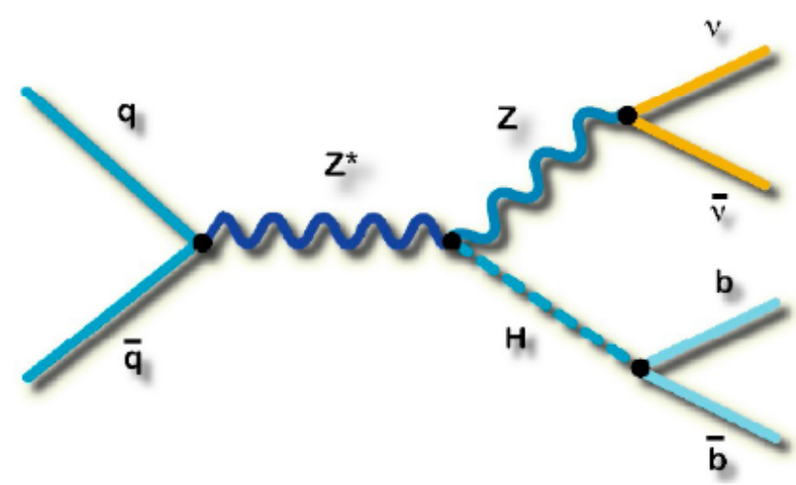


Low mass Higgs searches at CDF

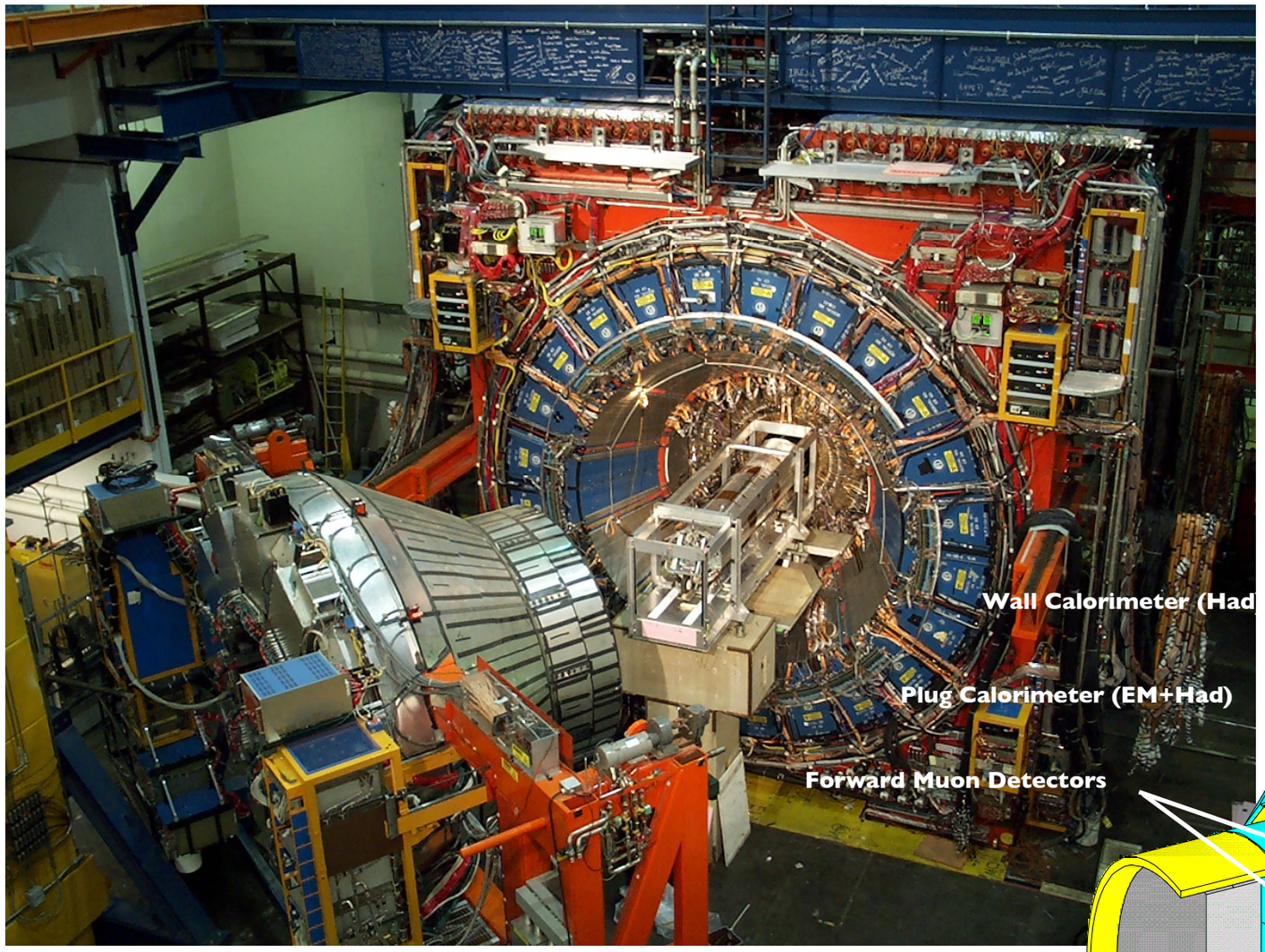
- Associated production
  - Identified leptons (*e*, *μ*)
    - *WH*→*lνbb̄*
    - *ZH*→*llbb̄* ← Will focus on this
  - Invisible leptons
    - WH→(l)νbb̄, ZH→ννbb̄
- Other channels
  - All jets: *VH*→*qqbb* + VBF
  - Numerous final states involving taus
  - *H*→*γγ*
  - *H*→*WW*
- Combine all channels to establish best limits
  - Or see a signal!

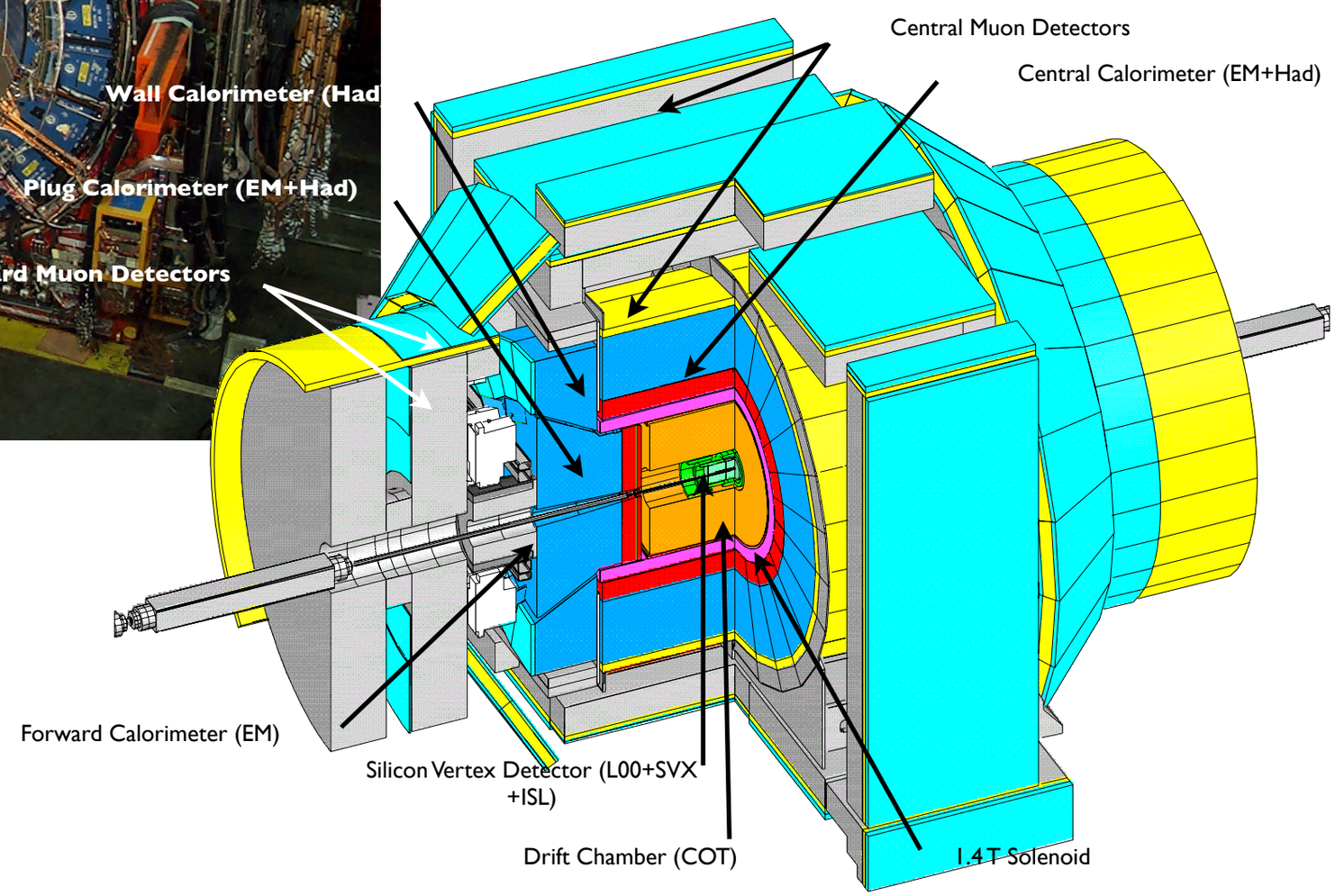






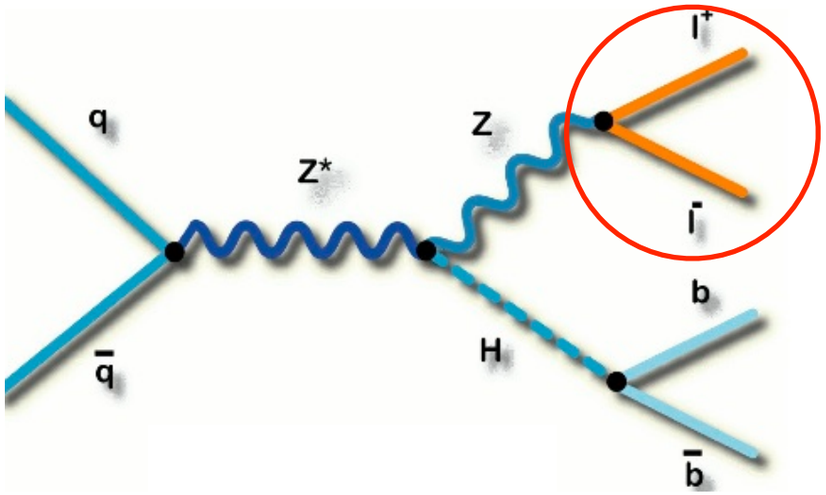
Step 1: The Detector





Step 2a: Defining a sample for $ZH \rightarrow llbb$

- $Z \rightarrow e^+e^-, \mu^+\mu^-$, trigger on high-$p_T$ lepton
  - e, μ, with p_T>18 GeV, central
- Missed anything?
  - Try not requiring tracks
  - "Z-no track" trigger
    - 2 EM towers, E_T>18 GeV each
- Trigger requirements define first ("probe") lepton in event



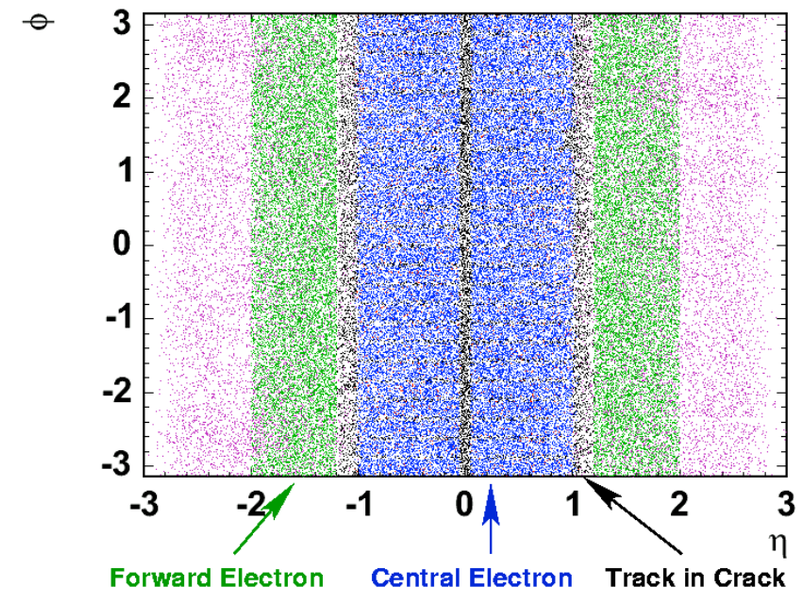
ZH:Background
~8:400,000,000

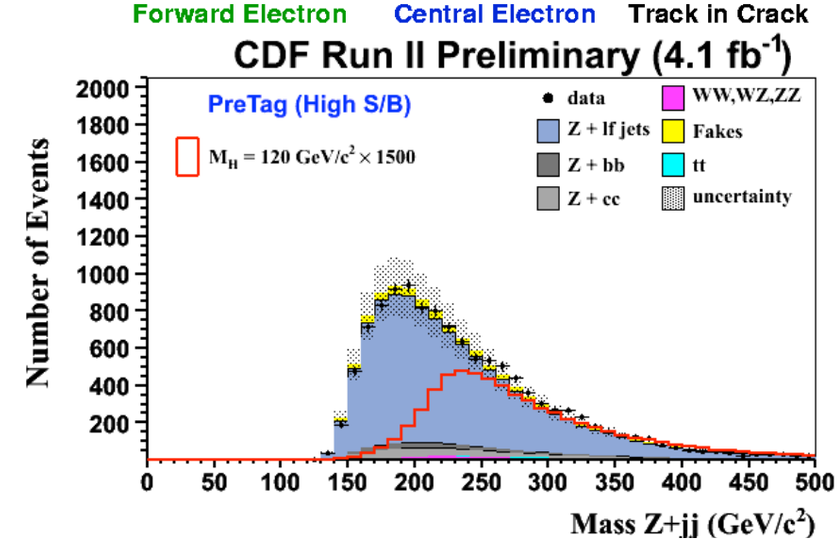
Step 2b: Further event selection

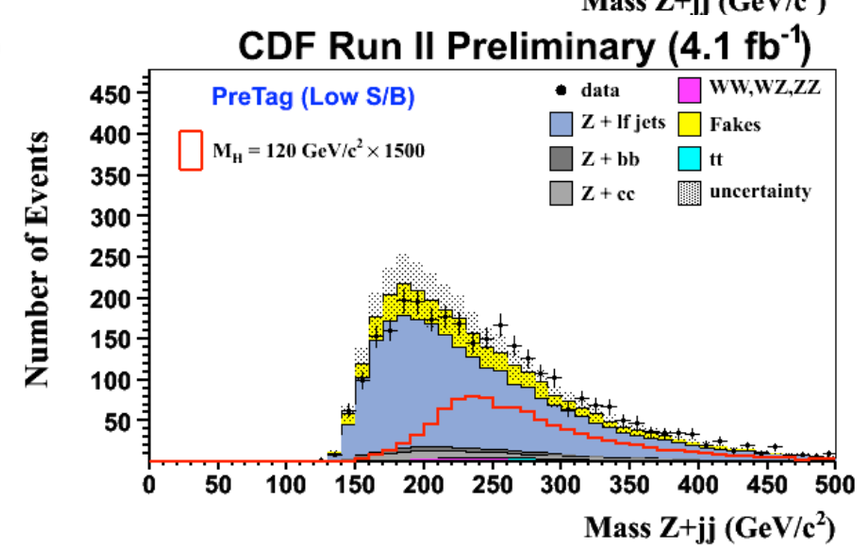
- Reconstruct a *Z*
  - Allow second lepton to have much looser selection
    - p_T>10 GeV
    - Forward electrons
    - Electrons in un-instrumented calorimeter region ("crack tracks")
  - Require 76 < m_{ll} < 106 GeV
  - Divide sample by expected sample purity

ZH:Background
~6:700,000

- Reconstruct the Higgs
  - Require ≥2 jets, E_T>15 GeV (at least one E_T>25 GeV)
  - This sample is our "PreTag" sample

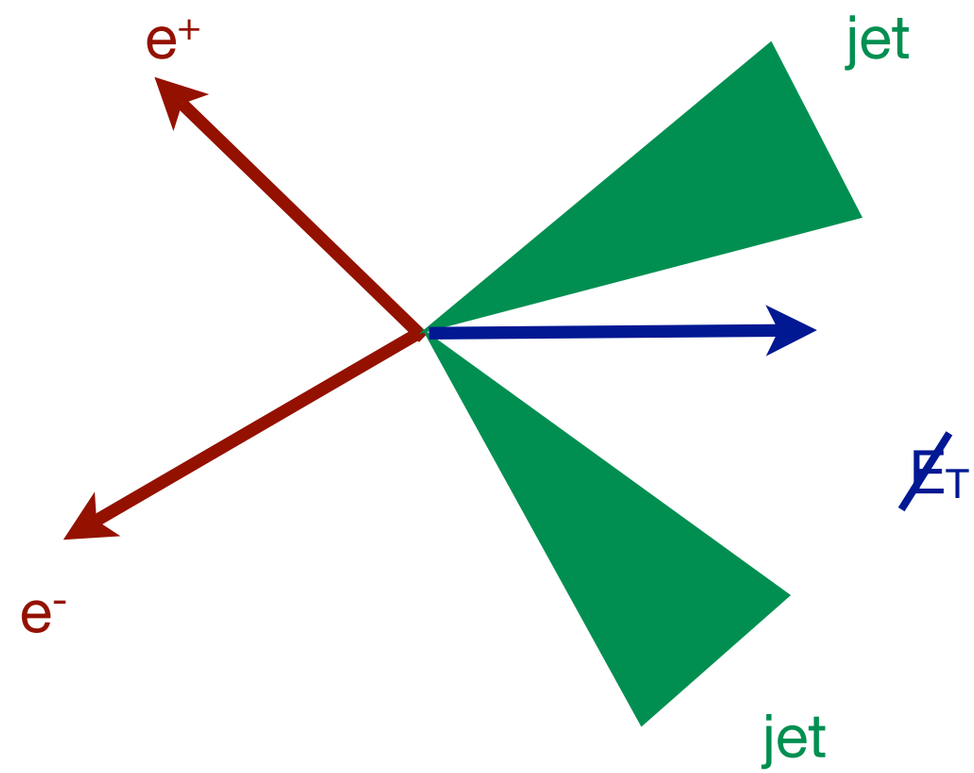






Refining events: neural network jet correction

- No neutrinos in *ZH* events
  - Missing E_T primarily results from jet mis-measurement
- Correct jet energies to parton level
  - Topology specific vs. generic jet corrections
  - (Jet1, Jet2) = F(Jet variables, MET variables)
  - Train a Neural Network
    - Use simulated ZH events
- Improves dijet mass resolution by 10-18%



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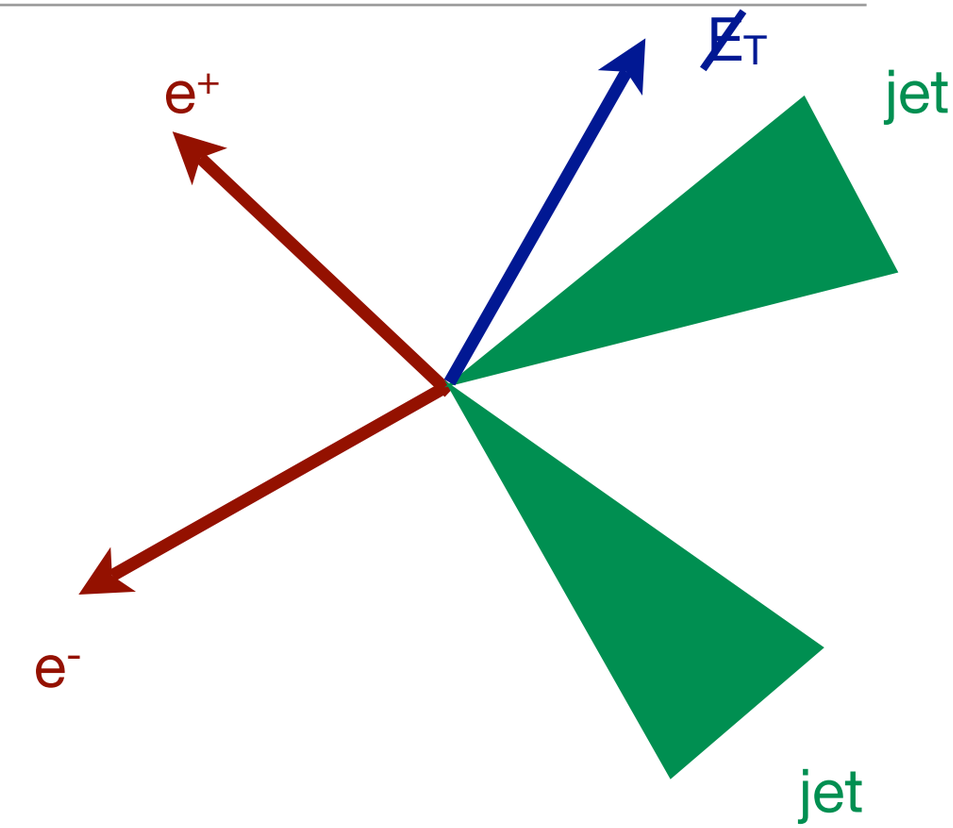

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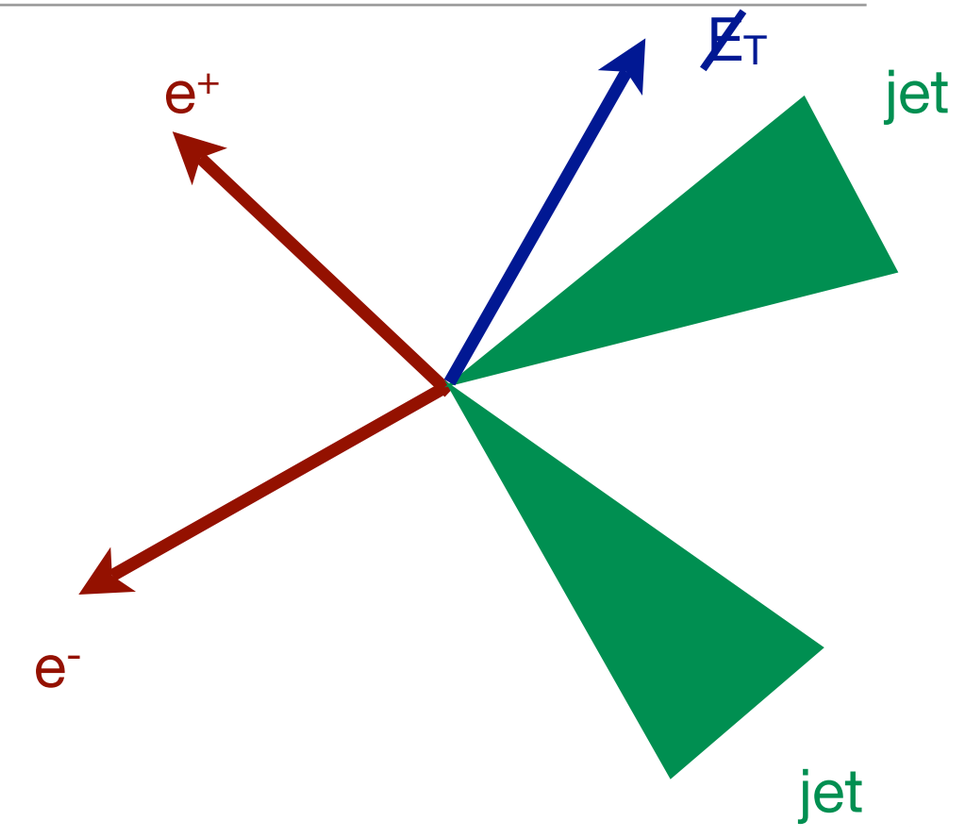
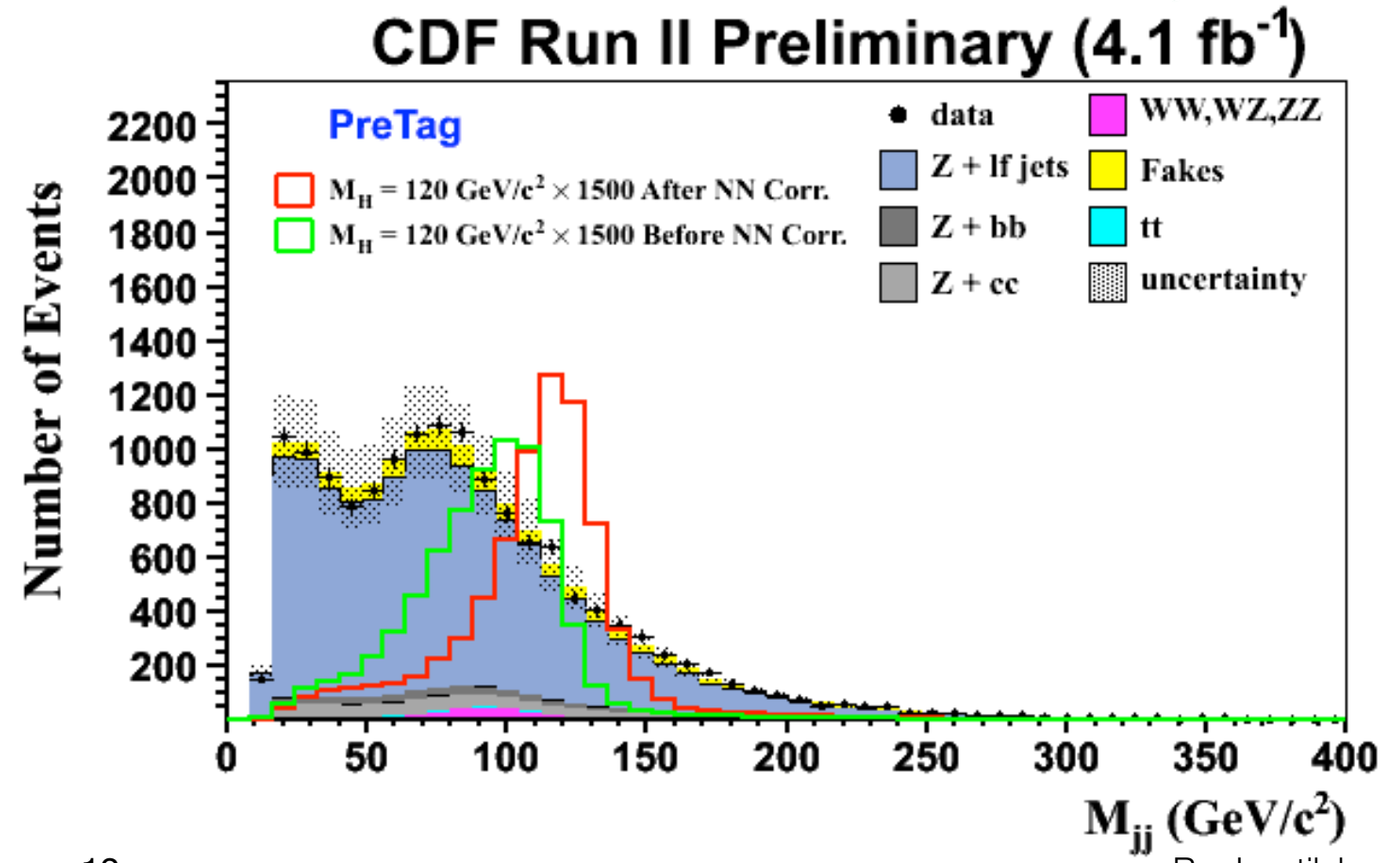




A word about backgrounds

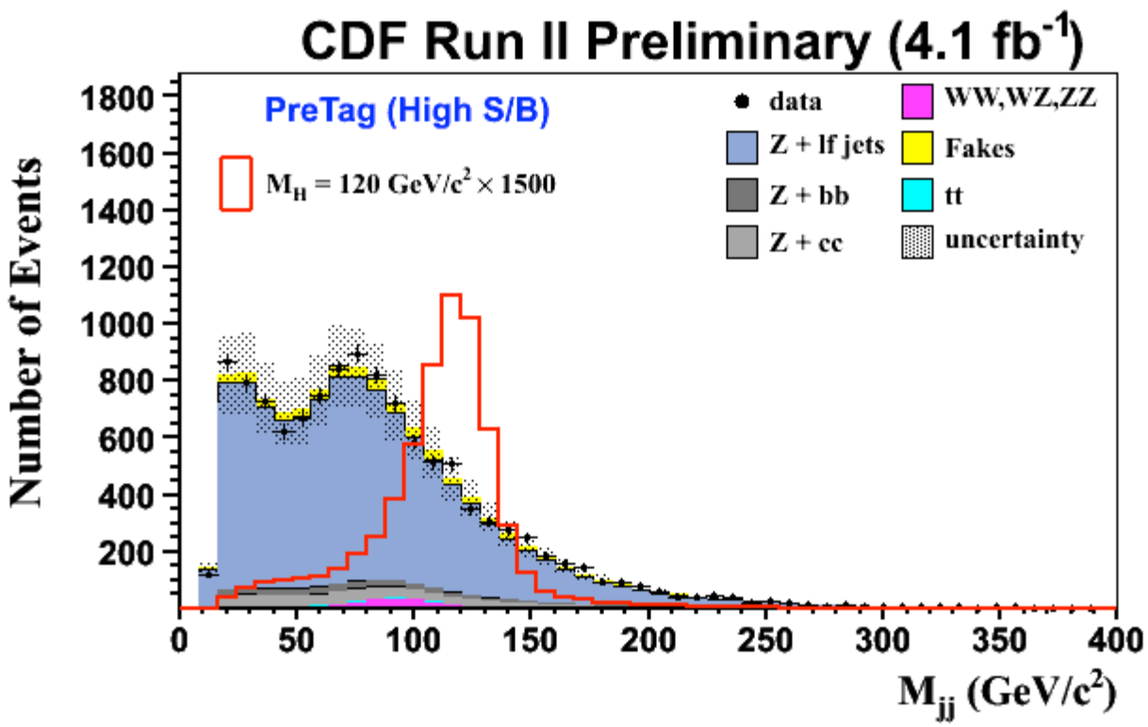
- Backgrounds with real Zs
  - Dominant background
  - Model separately for events with real heavy flavor and without
    - Incorrect tagging rate determined from data
- Backgrounds without real Zs
  - ttbar
  - Heavy diboson (WW, WZ, ZZ)
  - Instrumental fakes
    - Modeled using data
    - Much higher rate for low S/B sample

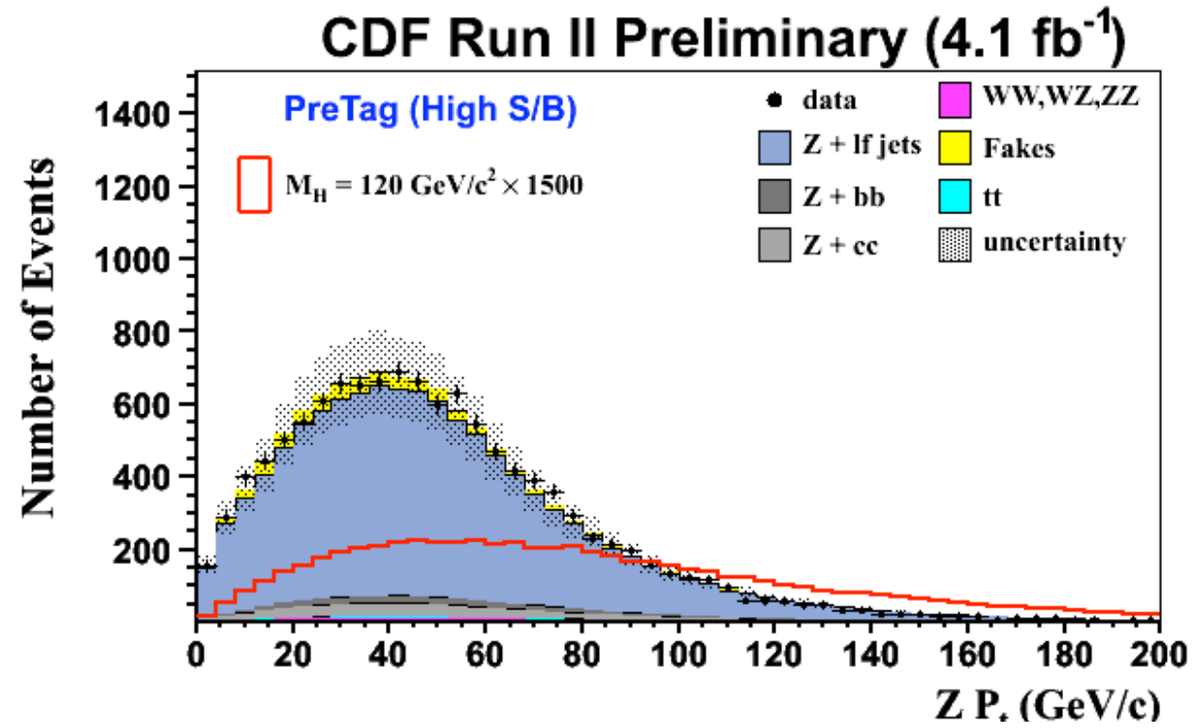
Sample validation: PreTag

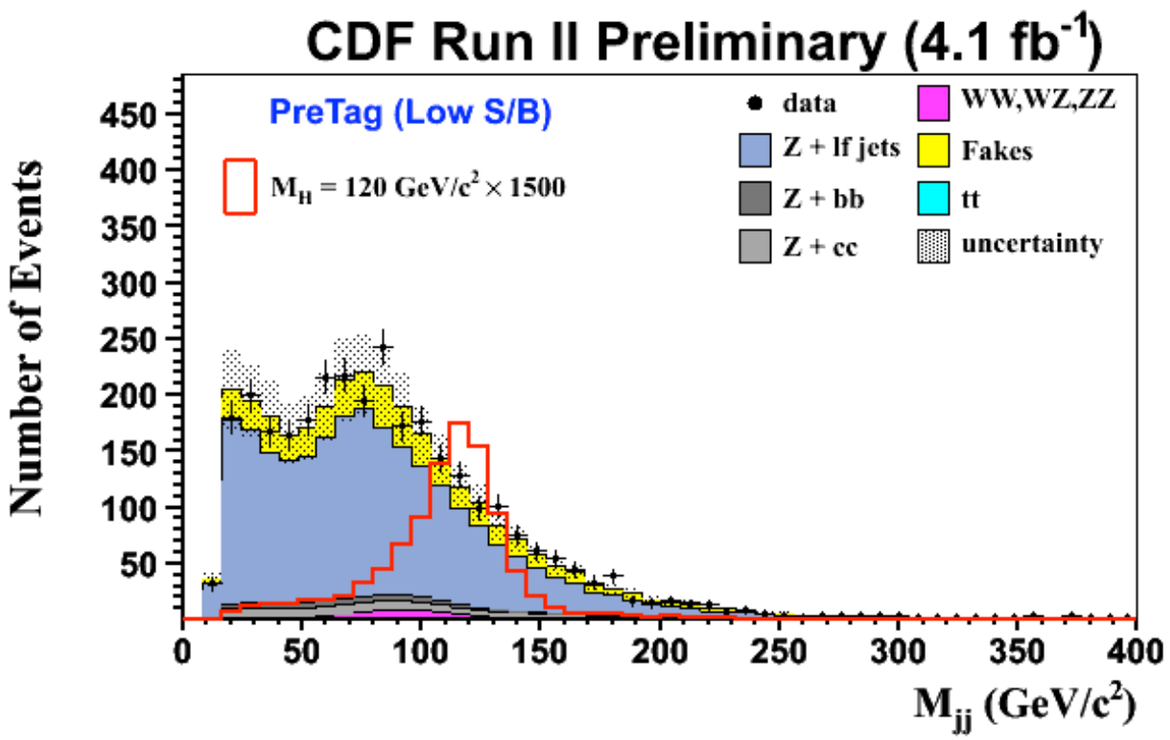
Source	PreTag High S/B	PreTag Low S/B
tt	53.01 ± 11.26	27.12 ± 5.76
WW	5.22 ± 0.71	4.3 ± 0.58
WZ	117.89 ± 15.95	27.04 ± 3.66
ZZ	118.14 ± 15.98	23.28 ± 3.15
Z $\rightarrow \tau\tau$	2.98 ± 1.21	4.33 ± 1.76
Z+jets (bb)	370.93 ± 150.71	74.51 ± 30.28
Z+jets (cc)	682.59 ± 277.34	142.25 ± 57.79
Z+jets (lf)	9977.08 ± 1995.42	2206.9 ± 441.38
fakes	541.02 ± 270.51	504.44 ± 252.22
ZH $(120\,\mathrm{GeV}/c^2)$	4.25 ± 0.32	0.67 ± 0.05
Total Background	11868.9 ± 2038.4	3014.17 ± 512.6
Data	11806	3061

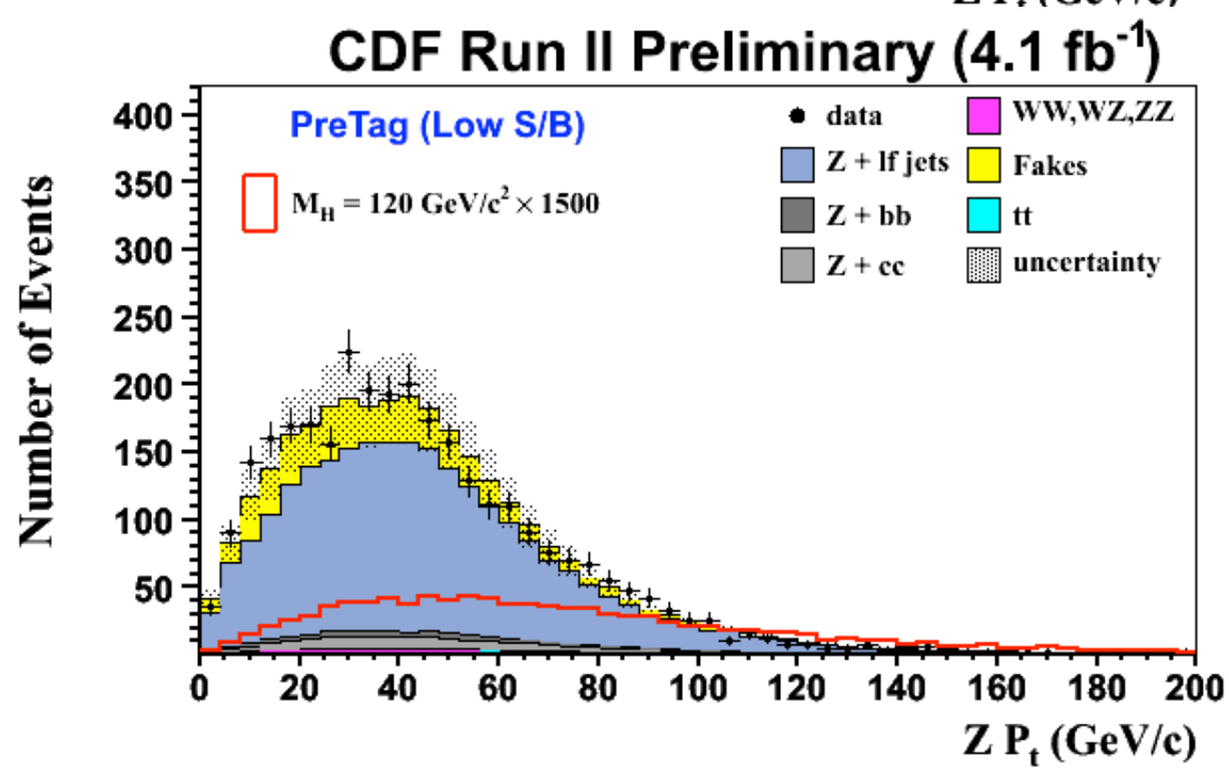
ZH:Background
~5:14,000

Sample validation: PreTag





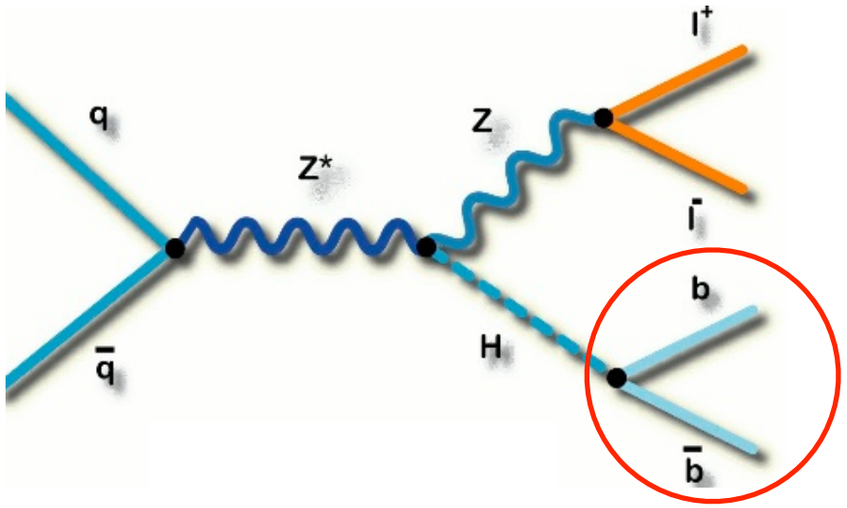


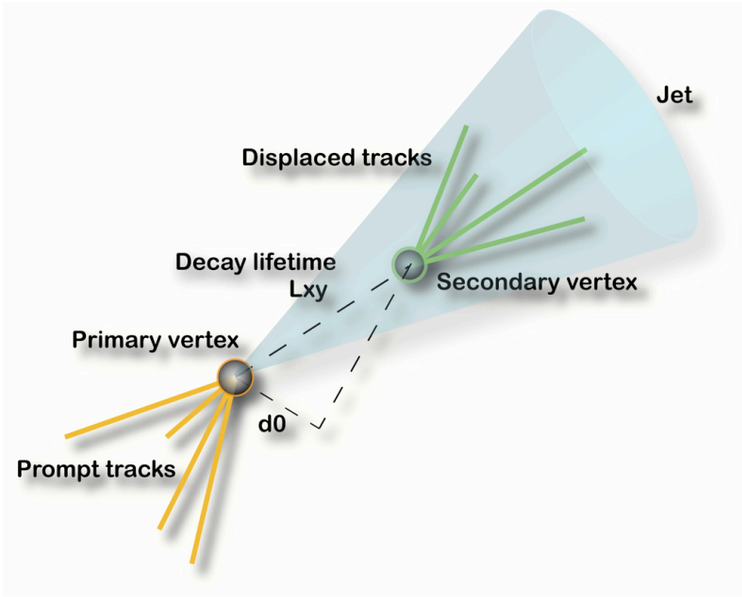


Identifying *b*-jets

- Displaced secondary vertices: indicative of long-lived B hadrons
- Two algorithms
  - Decay lifetime ("SecVtx")
    - Considered at two operating points ("tight" and "loose")
  - Impact parameter ("JetProb")
- Require at least one tag in all events

- Split sample up further by tags present
  - 2 tight SecVtx tags, **or**
  - 1 loose SecVtx+1 JetProb, **or**
  - 1 tight SecVtx tag only





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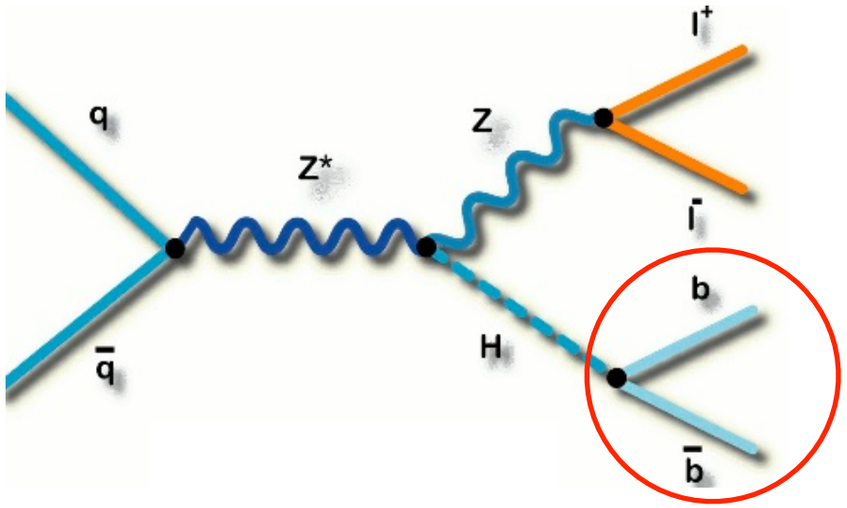
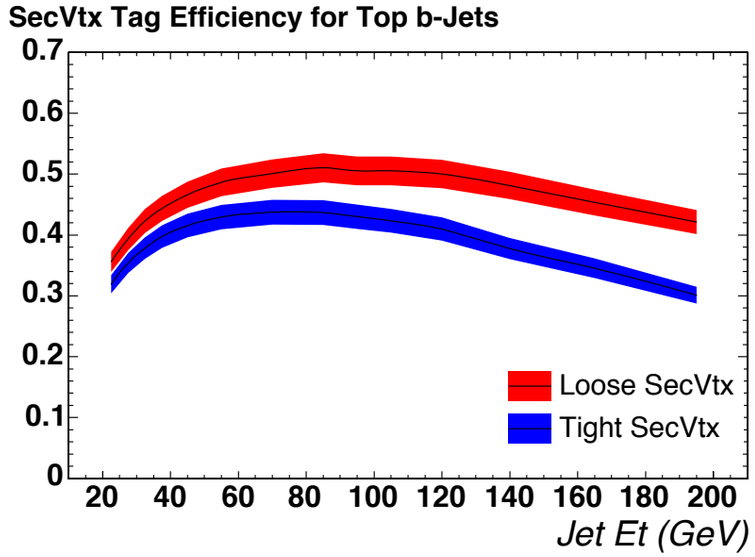
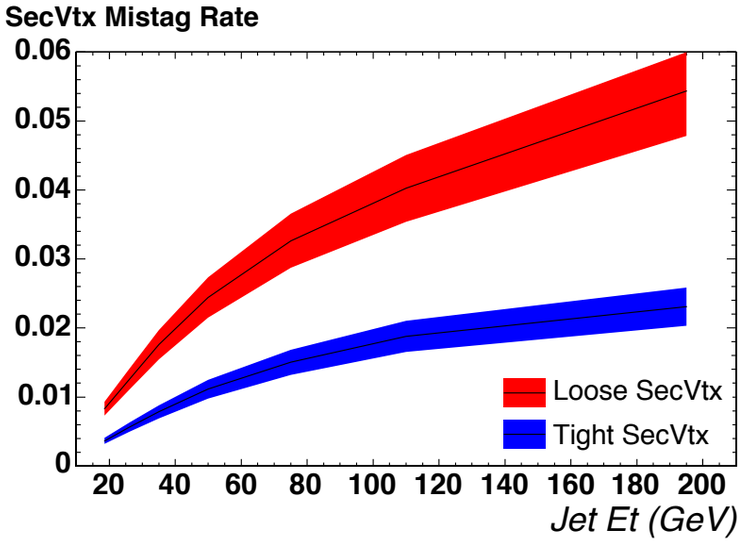






Analysis samples

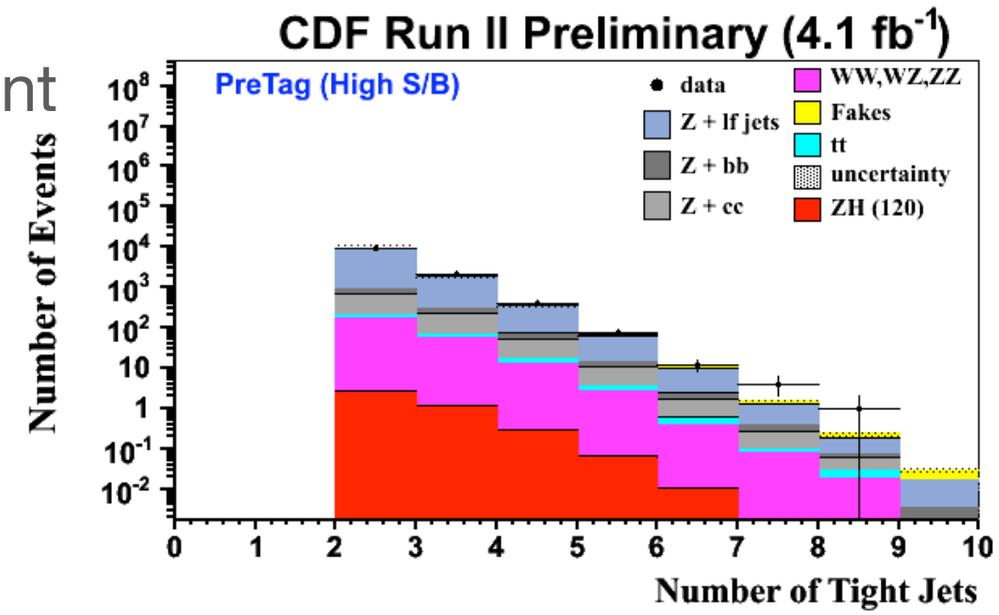
Source	Double T Tag	L+JP Tag	Single T Tag
	(High S/B Categories)		
tt	7.0 ± 1.5	8.1 ± 1.9	17.3 ± 3.6
WW	0.02 ± 0.003	0.1 ± 0.01	0.2 ± 0.03
WZ	0.1 ± 0.01	0.5 ± 0.1	4.8 ± 0.7
ZZ	2.7 ± 0.4	3.4 ± 0.6	11.1 ± 1.5
Z+jets (bb)	16.1 ± 6.8	21.5 ± 9.2	105.4 ± 44.3
Z+jets (cc)	1.8 ± 0.7	8.0 ± 3.3	53.7 ± 22.6
Z+Mistags	0.9 ± 0.3	9.4 ± 3.2	151.6 ± 22.7
fakes	0.7 ± 0.3	1.8 ± 0.9	22.0 ± 11.0
ZH $(120\,\mathrm{GeV}/c^2)$	0.5 ± 0.1	0.6 ± 0.1	1.4 ± 0.1
Total Background	29.3 ± 7.0	52.8 ± 10.5	366.1 ± 55.9
Data	23	56	406

Source	Double T Tag	L+JP Tag	Single T Tag
	(Low S/B Categories)		
tt	2.9 ± 0.6	3.2 ± 0.8	8.9 ± 1.9
WW		0.02 ± 0.003	0.1 ± 0.02
WZ		0.1 ± 0.02	1.2 ± 0.2
ZZ	0.5 ± 0.1	0.5 ± 0.1	2.0 ± 0.3
Z+jets (bb)	3.2 ± 1.4	4.0 ± 1.7	21.1 ± 8.9
Z+jets (cc)	0.3 ± 0.1	1.6 ± 0.7	11.0 ± 4.6
Z+Mistags	0.4 ± 0.1	3.8 ± 1.3	50.0 ± 7.5
fakes	1.4 ± 0.7	1.1 ± 0.5	22.5 ± 11.3
ZH $(120\,\mathrm{GeV}/c^2)$	0.1 ± 0.01	0.1 ± 0.02	0.2 ± 0.03
Total Background	8.7 ± 1.7	14.3 ± 2.4	116.8 ± 17.0
Data	12	14	116

ZH:Background
~3:600

Step 3: Extracting a signal

- Expected signal rate makes counting experiment impossible



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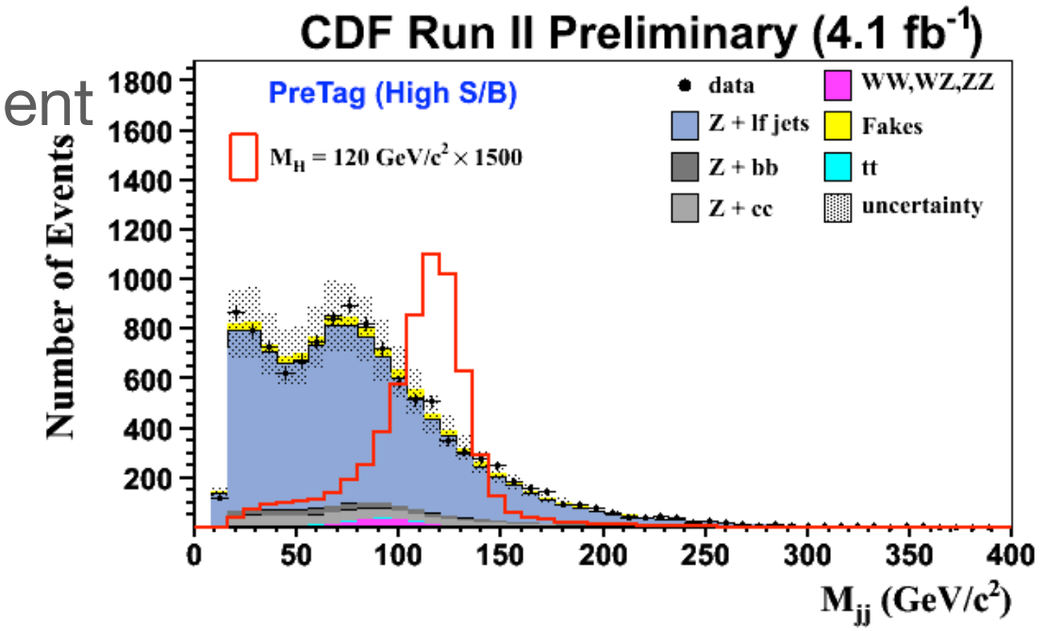

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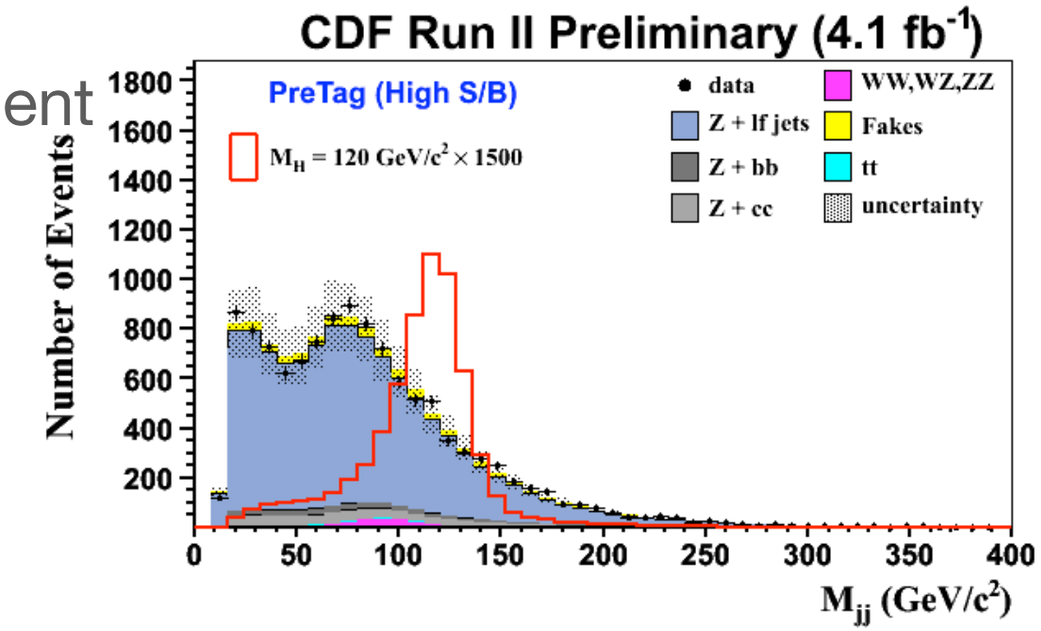
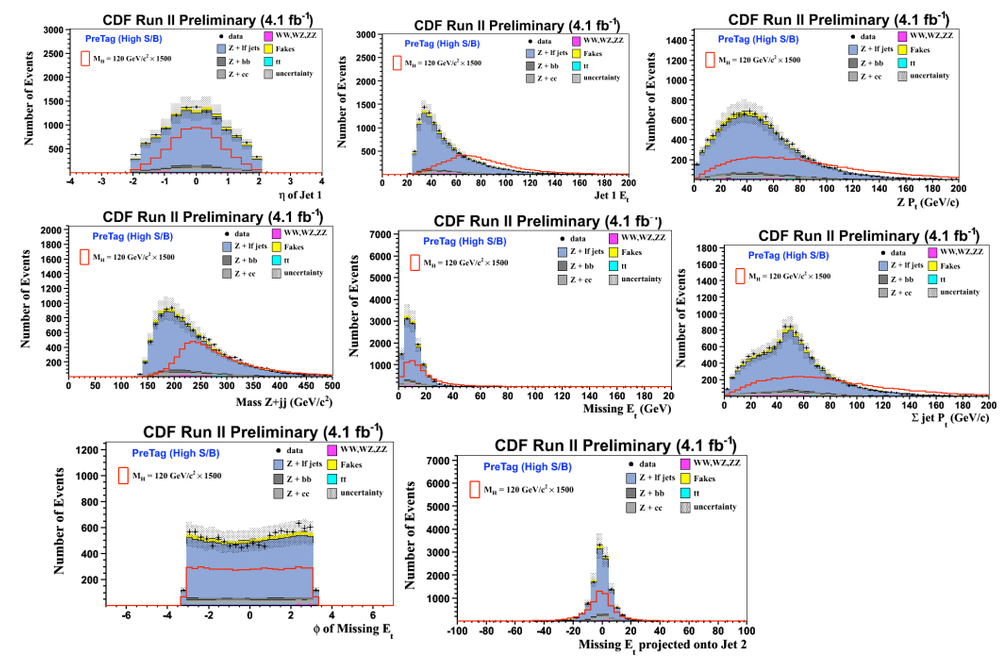
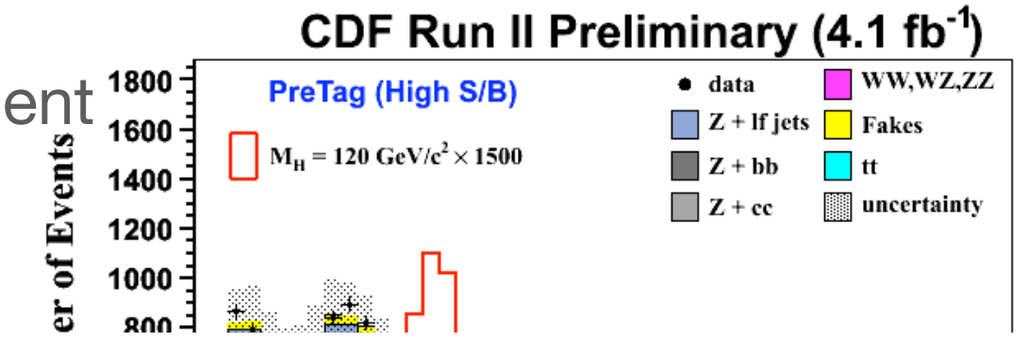
- So are a bunch of other variables

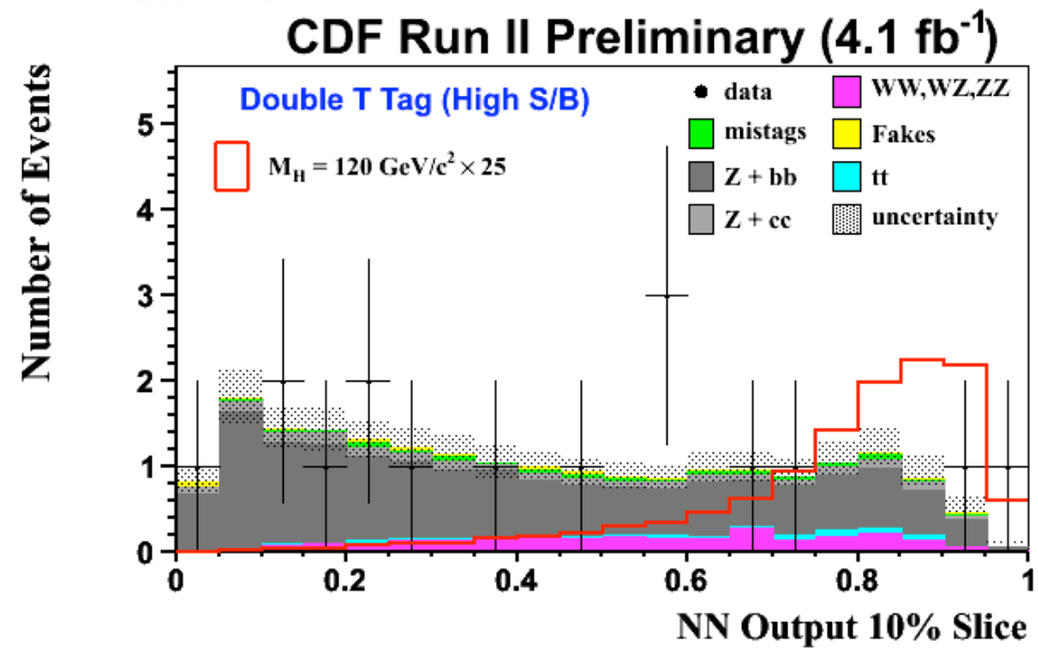


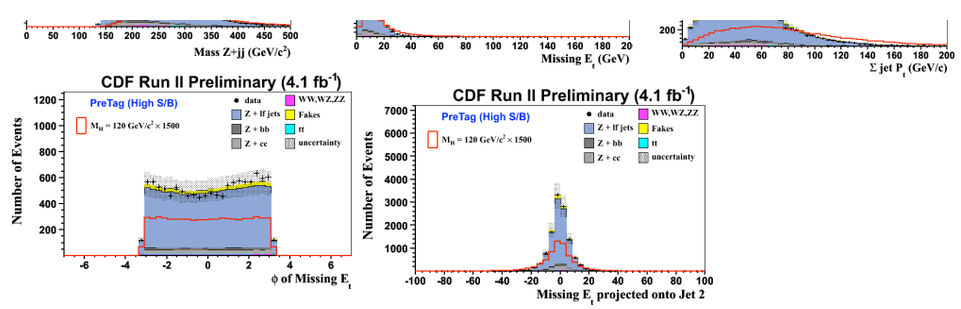


Step 3: Extracting a signal

- Expected signal rate makes counting experiment impossible
- Dijet mass is a better discriminator
- So are a bunch of other variables
- Exploit all possible information in an event: multivariate discriminants
- Devise function that discriminates signal-like events from background-like
  - Takes in as many measured quantities as possible
  - Examples:
    - Matrix element (ME) probabilities
    - Artificial neural networks (NN)
    - Boosted decisions trees

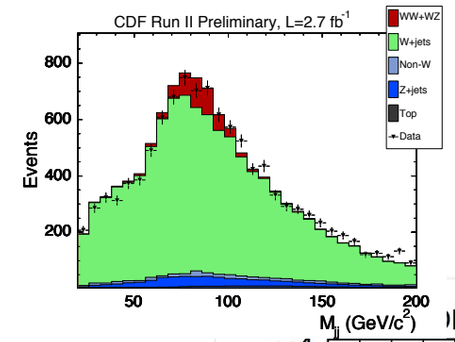




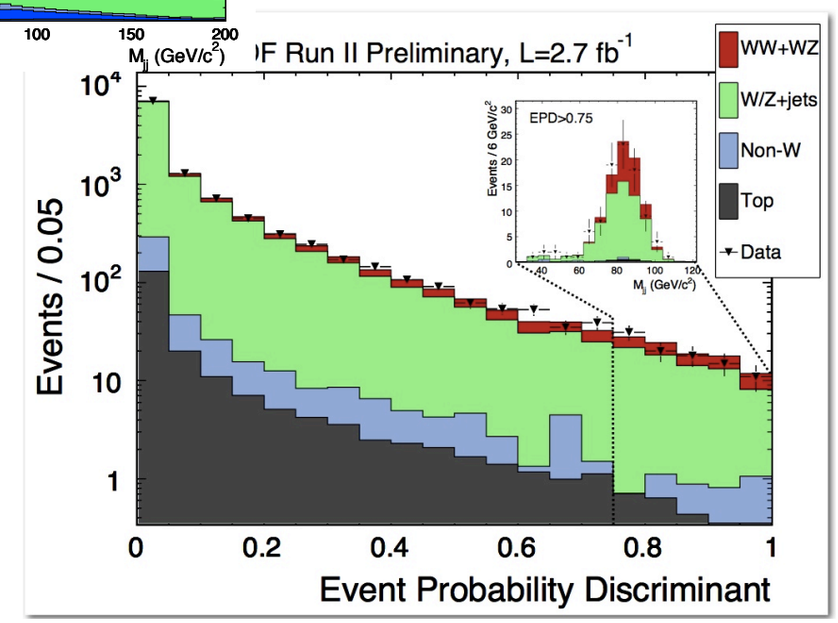


Do they work?

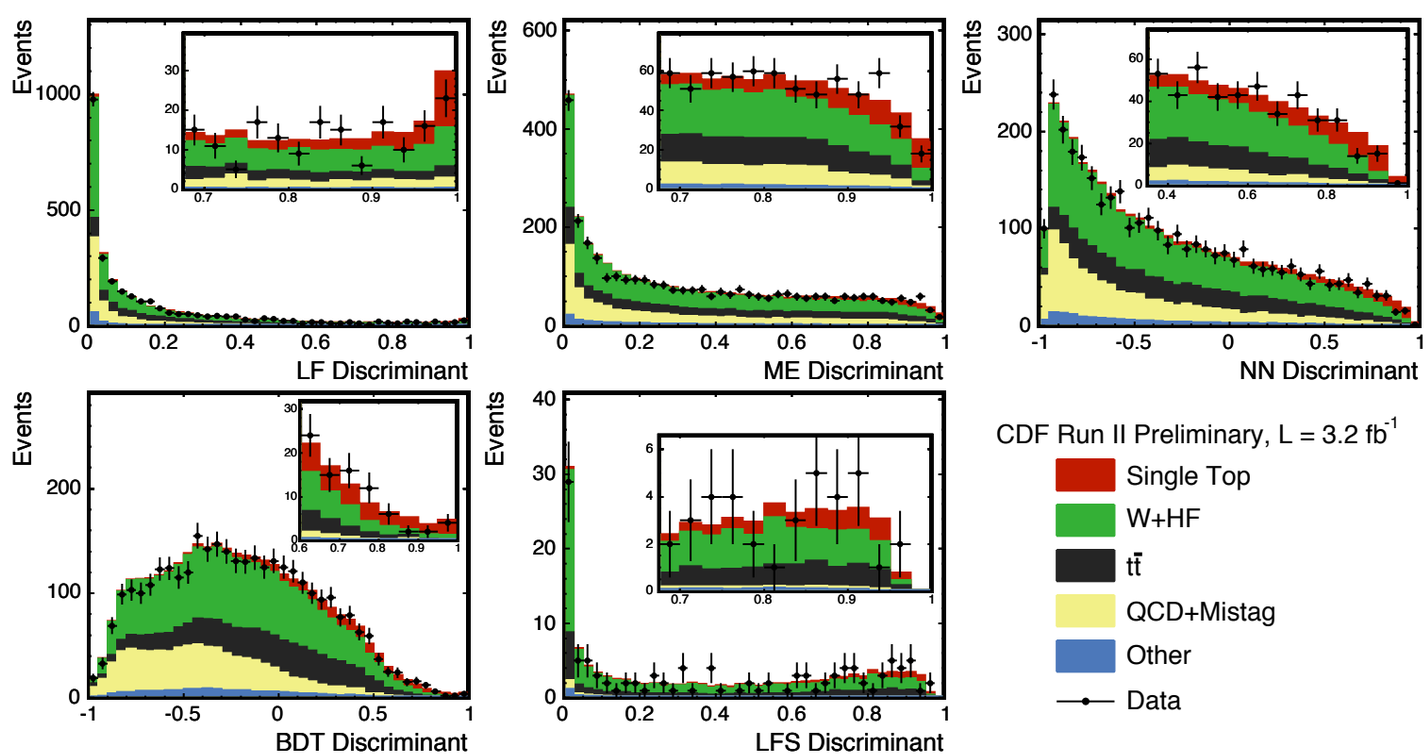
- Can we discover rare processes using these techniques? Yes
  - Single top at both CDF and DØ
  - Hadronic decays of dibosons: very similar final states to low mass Higgs



WW/WZ→lνjj



Single top

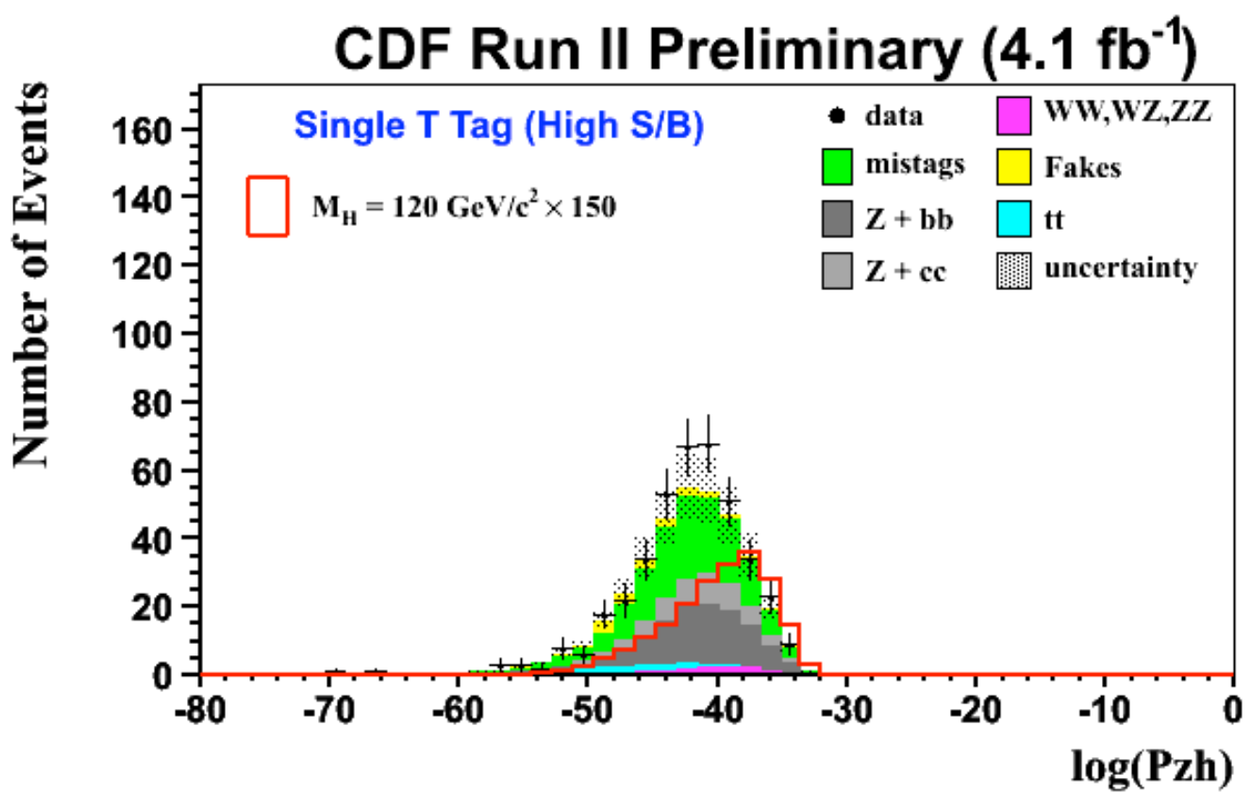


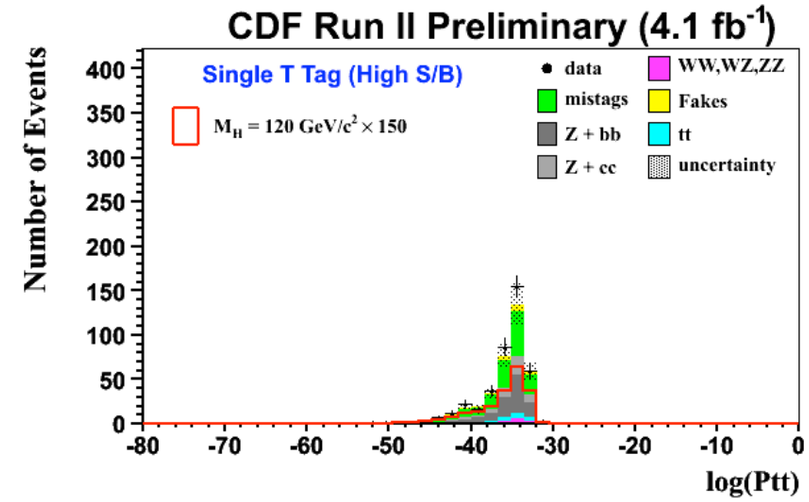
Signal enhancement: ME probabilities

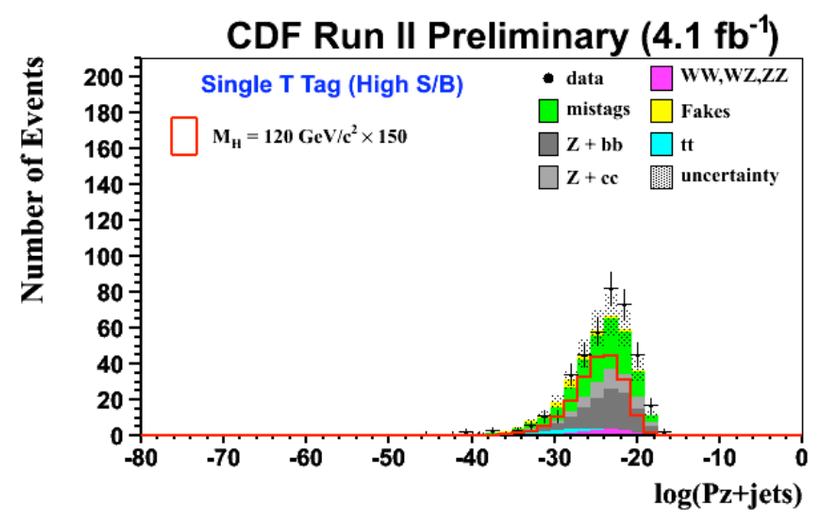
- Calculate differential cross section for a given process

$$P(\mathbf{x}|M_H) \propto \frac{d\sigma(M_H)}{d\mathbf{x}} = \int d\Phi |\mathcal{M}_{ZH}(p_i; M_H)|^2 \prod W(p_i, \mathbf{x}) f_{PDF}(q_1) f_{PDF}(q_2)$$

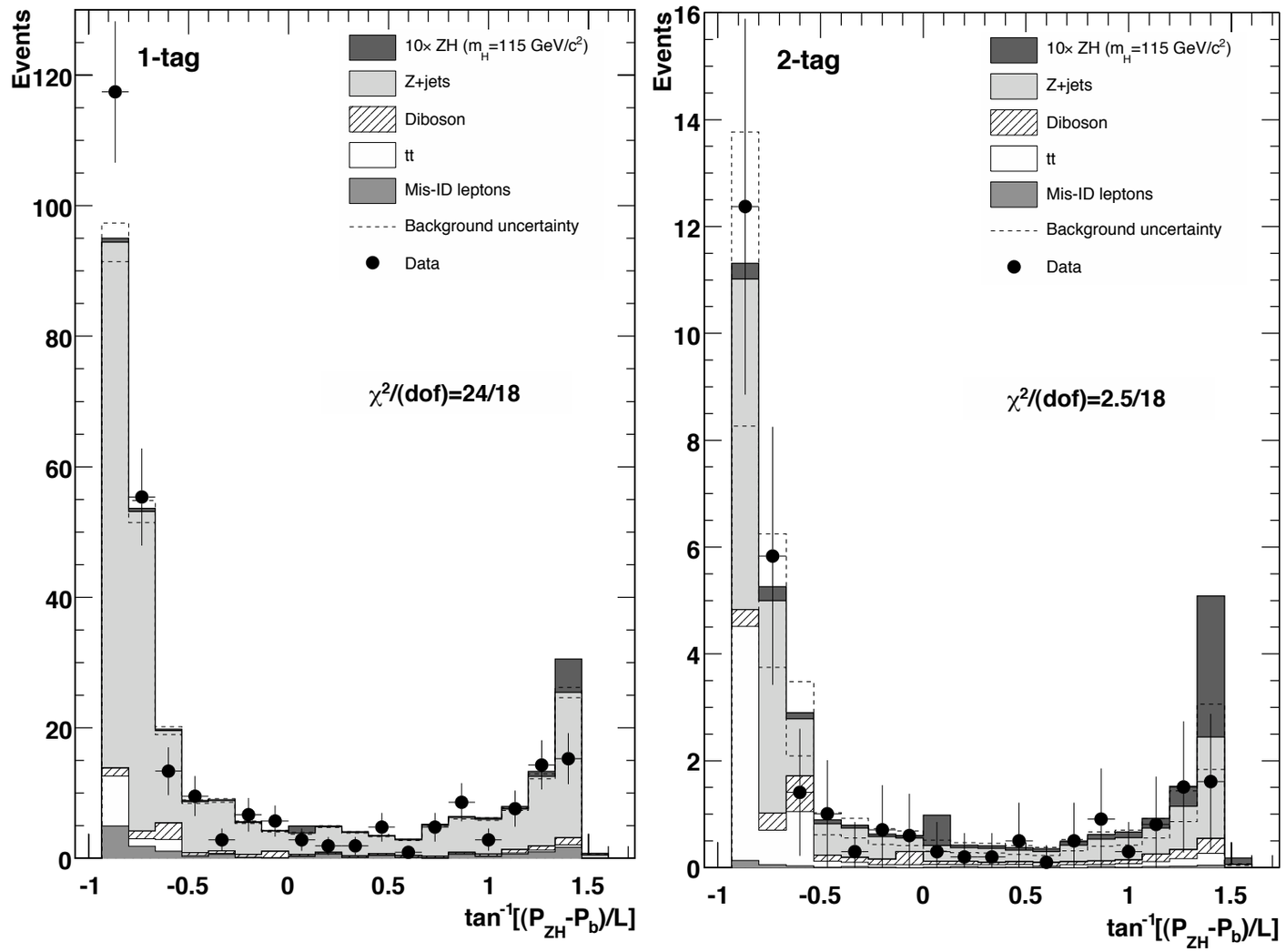
  - Uses leading-order matrix element
    - Easily obtained from ME generators
  - Transfer functions to link measured quantities to parton-level quantities
- Calculate for signal and background processes







Discriminating with ME probabilities



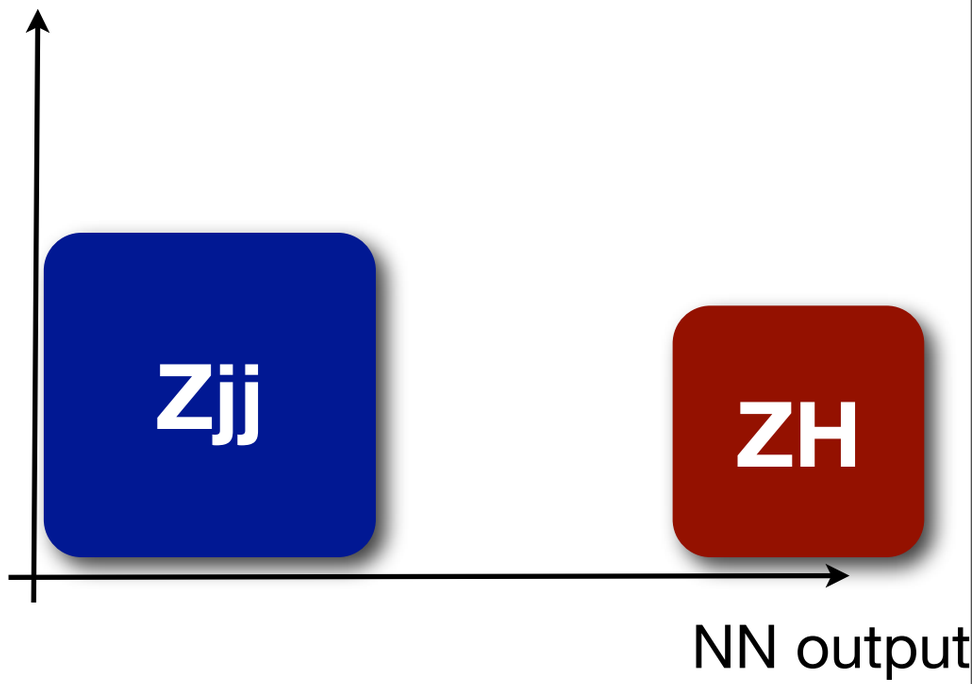
- Combined probability

$$P(\mathbf{x}|s, M_H) = s \cdot P_{ZH}(\mathbf{x}|M_H) + (1-s) \cdot P_b(\mathbf{x})$$

- Form likelihood as function of signal fraction

Signal enhancement: Neural networks

- Train NN to separate Z+jets from ZH
  - Consider ~40 variables (dijet mass, MET, Z p_T, etc)
  - Push ZH-like events high, Z+jet events low
  - Network does great until we consider ttbar



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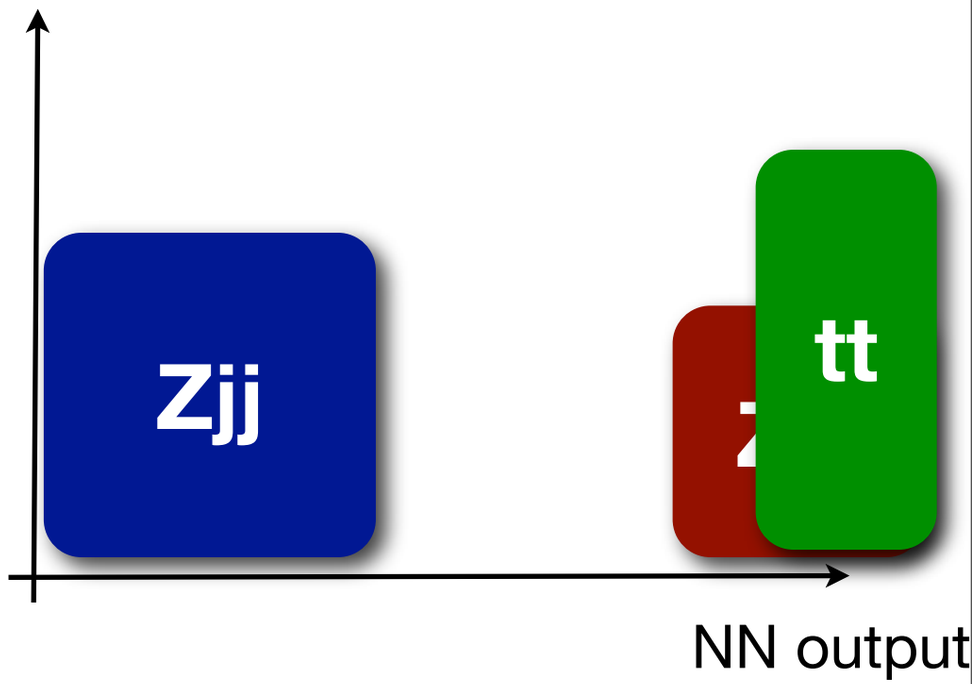
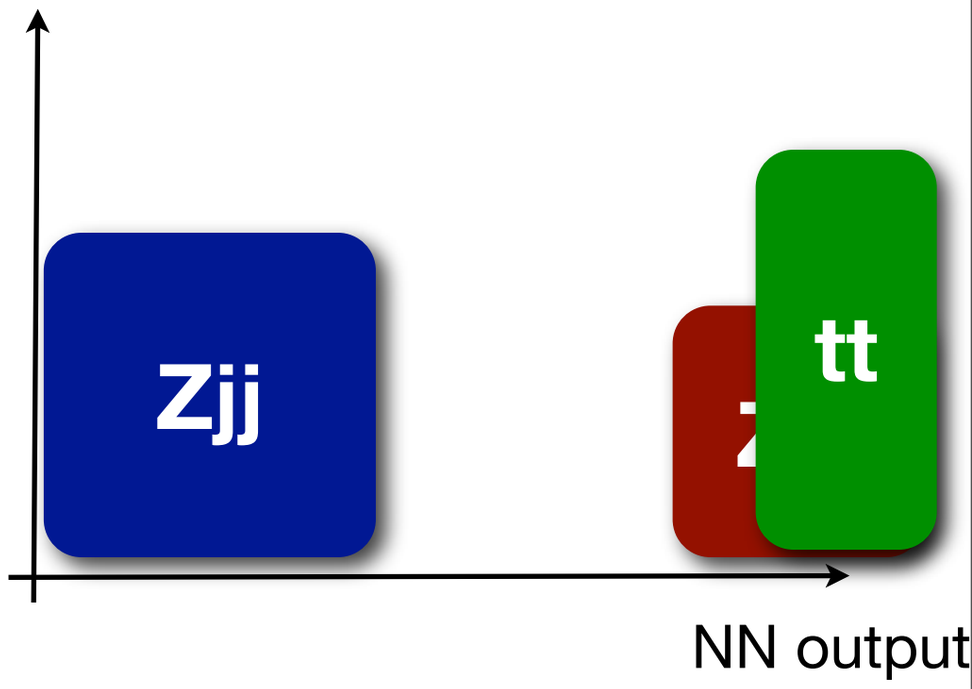


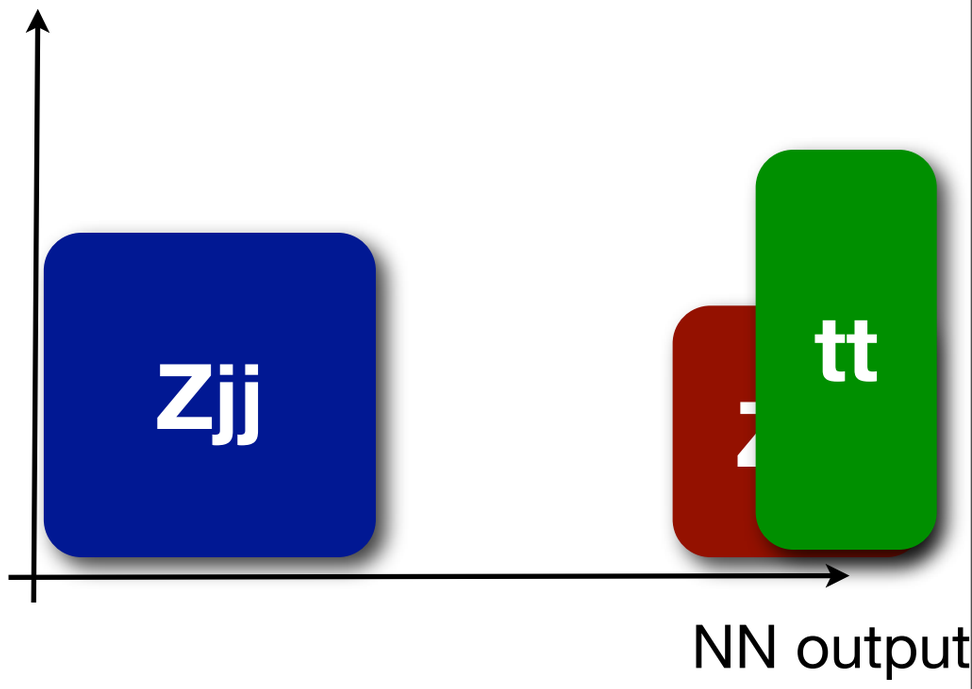
Signal enhancement: Neural networks

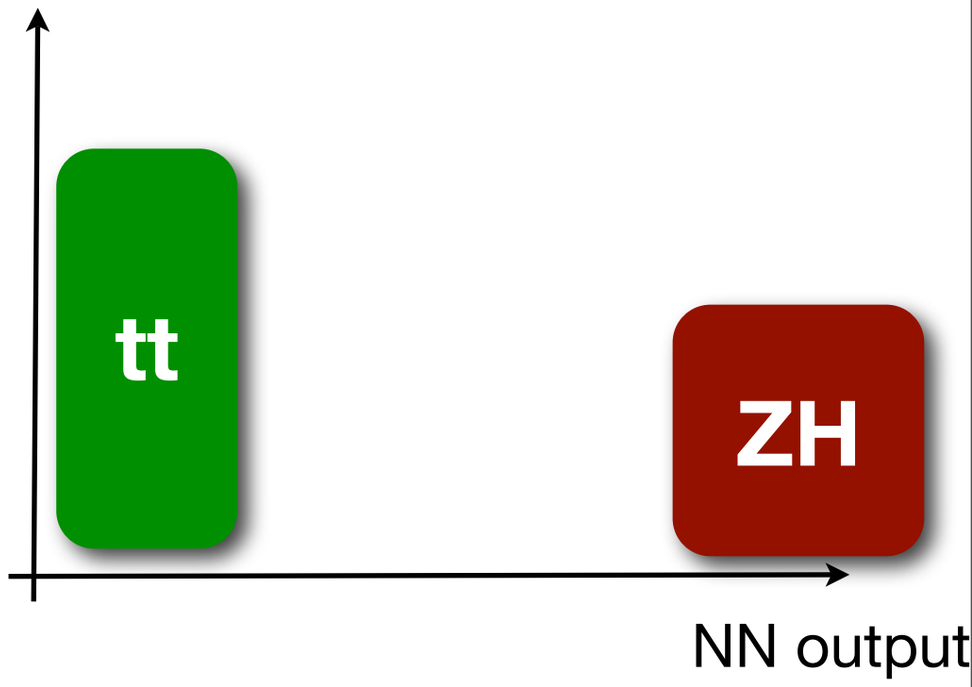
- Train NN to separate Z+jets from ZH
  - Consider ~40 variables (dijet mass, MET, Z p_T, etc)
  - Push ZH-like events high, Z+jet events low
  - Network does great until we consider ttbar
- Can cut on ttbar but placing a MET cut
  - sacrifices signal



Signal enhancement: Neural networks

- Train NN to separate Z+jets from ZH
  - Consider ~40 variables (dijet mass, MET, Z p_T, etc)
  - Push ZH-like events high, Z+jet events low
  - Network does great until we consider ttbar
- Can cut on ttbar but placing a MET cut
  - sacrifices signal
- Train another NN to separate ttbar from ZH
  - Cut on the output of this NN?





Signal enhancement: Neural networks

- Train NN to separate Z+jets from ZH
  - Consider ~40 variables (dijet mass, MET, Z p_T, etc)
  - Push ZH-like events high, Z+jet events low
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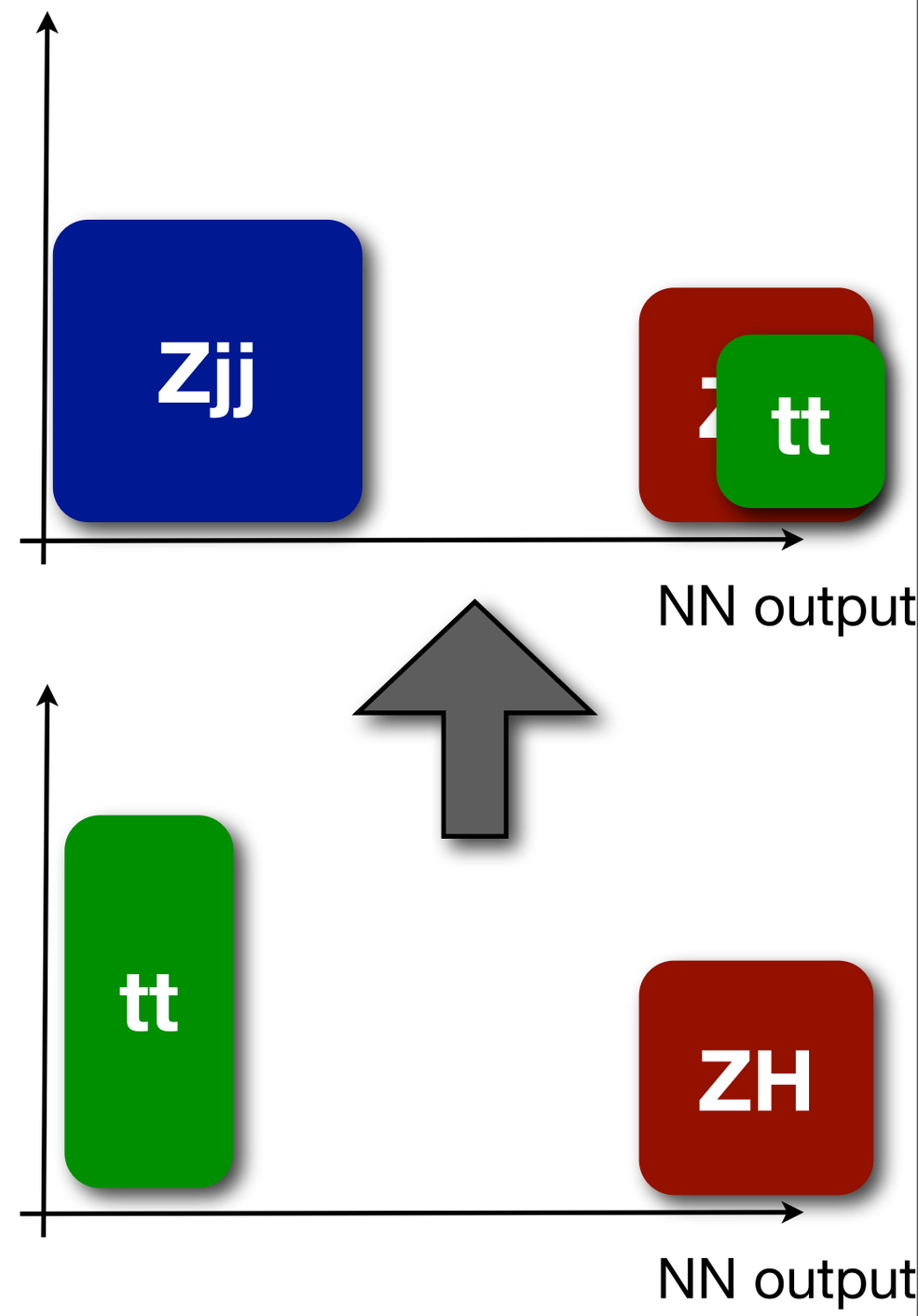
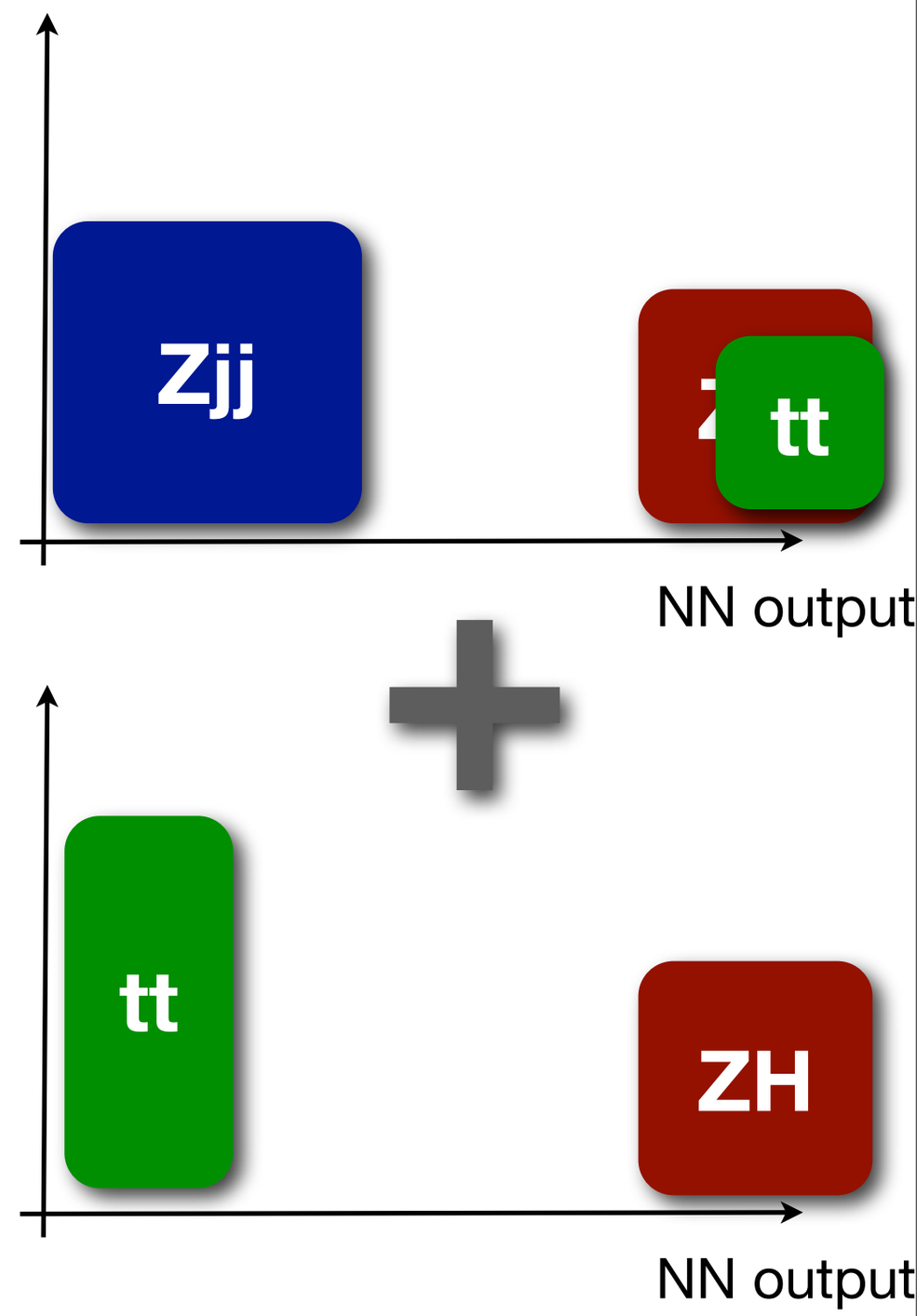
- Train another NN to separate ttbar from ZH
  - Cut on the output of this NN?



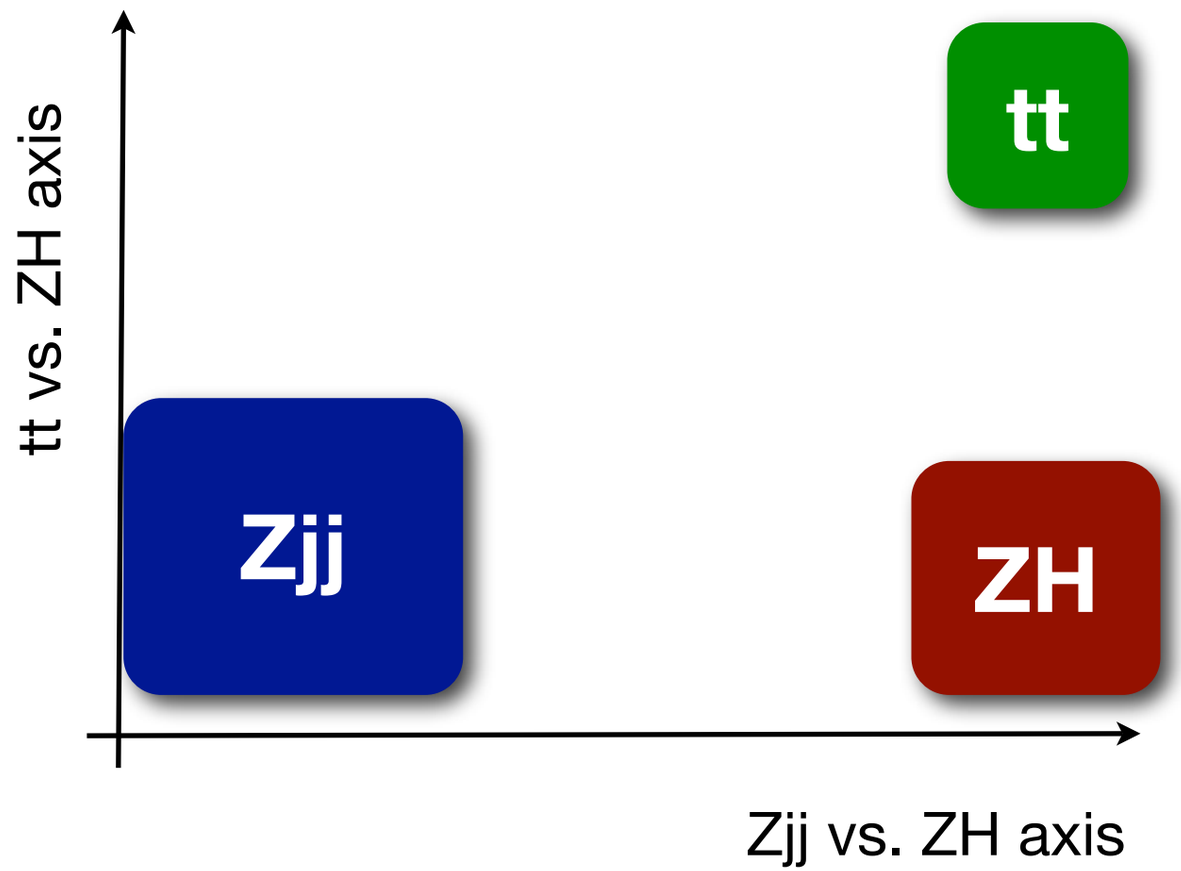
Signal enhancement: Neural networks

- Train NN to separate Z+jets from ZH
  - Consider ~40 variables (dijet mass, MET, Z p_T, etc)
  - Push ZH-like events high, Z+jet events low
  - Network does great until we consider ttbar
- Can cut on ttbar but placing a MET cut
  - sacrifices signal
- Train another NN to separate ttbar from ZH
  - Cut on the output of this NN?
- Really need both NNs



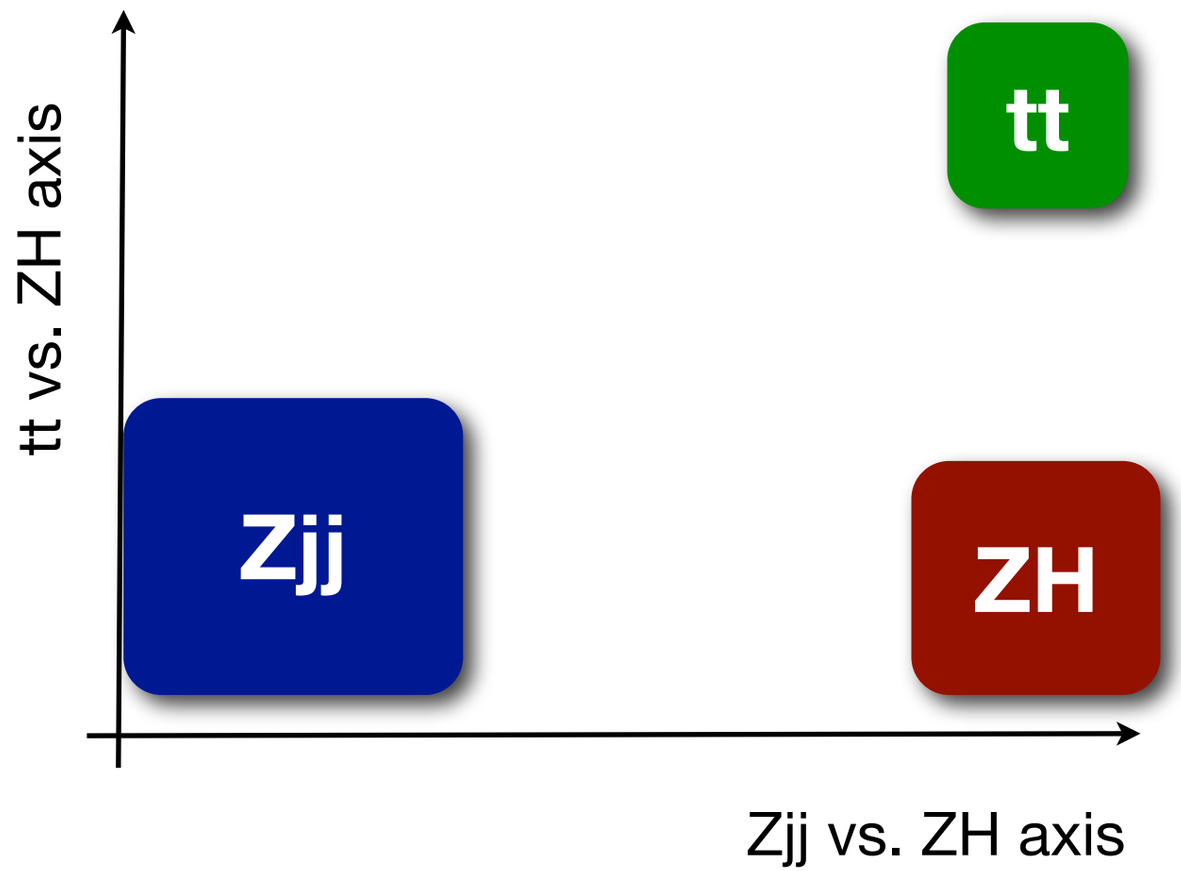
2D Neural Net

- Train NN with two outputs, using Z+jj, ttbar and ZH events



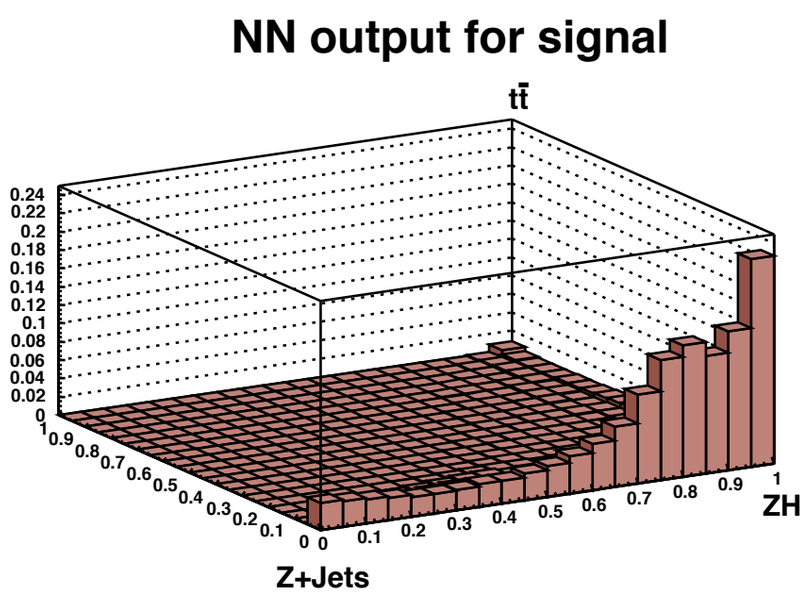
2D Neural Net

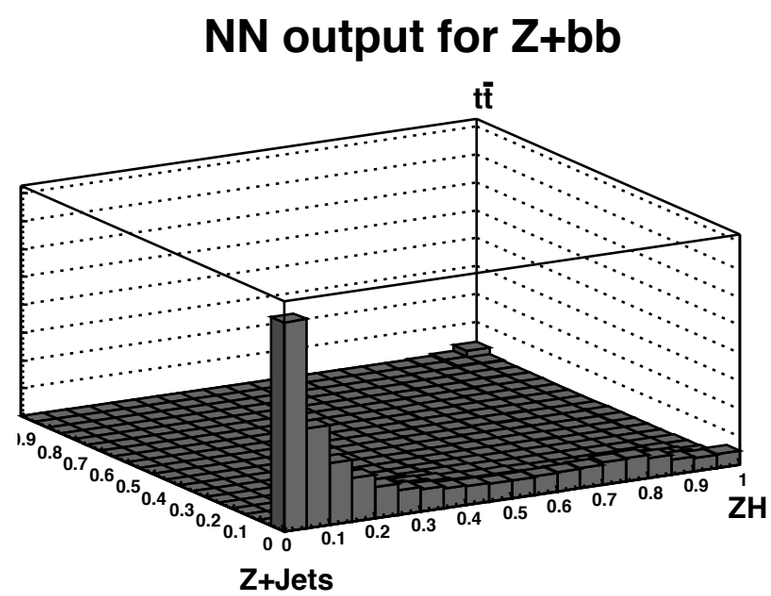
- Train NN with two outputs, using Z+jj, ttbar and ZH events

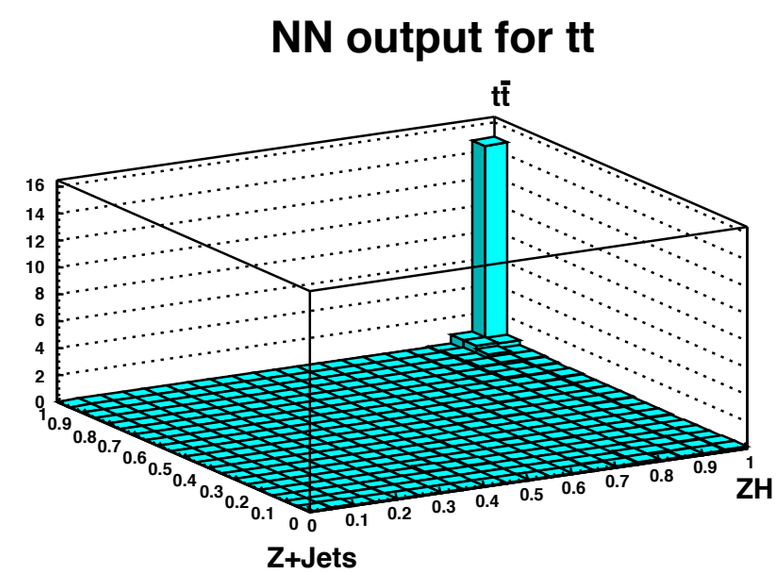


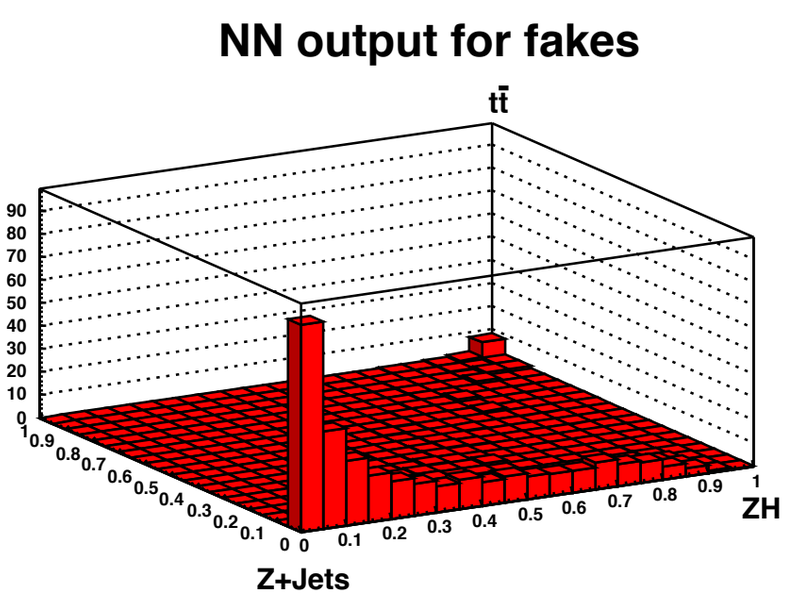
- Train separate NNs for each sample (low vs. high S/B, tagging categories)

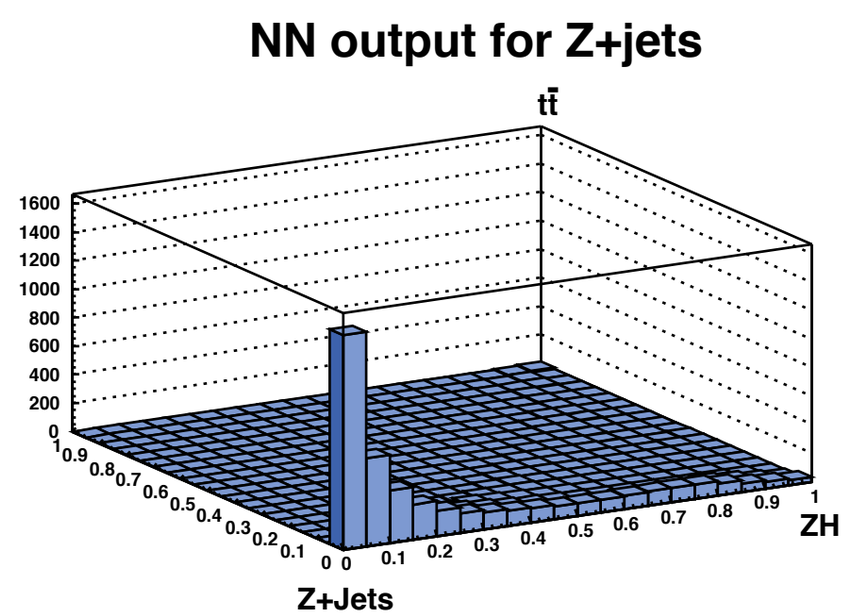
2D Neural Net

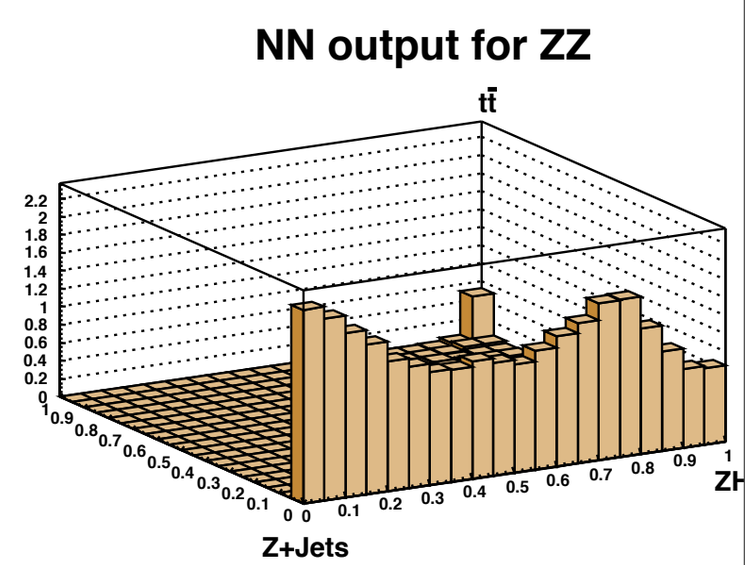






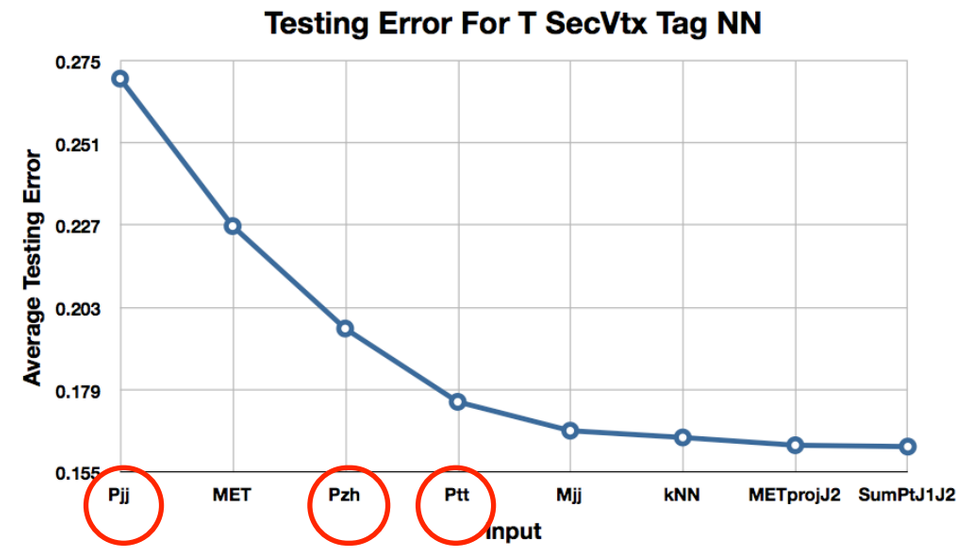


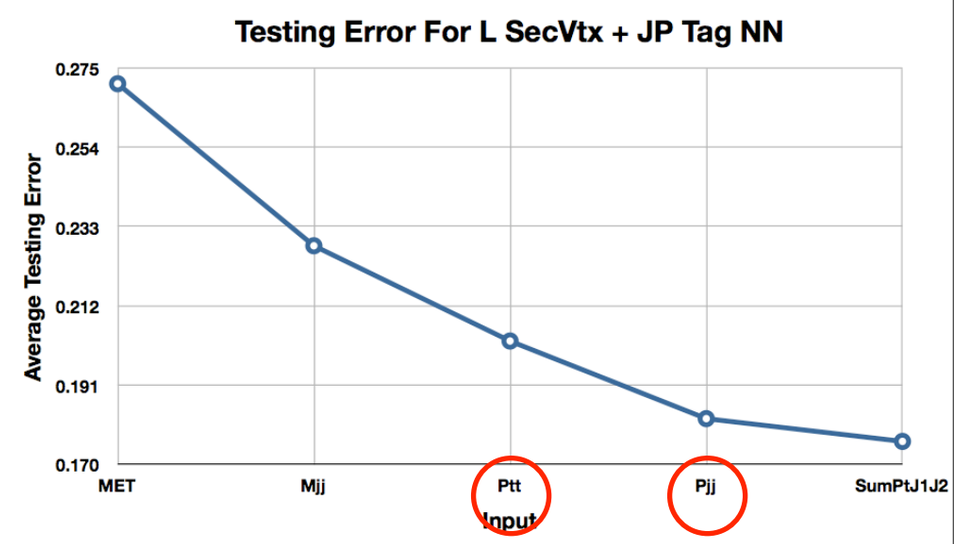


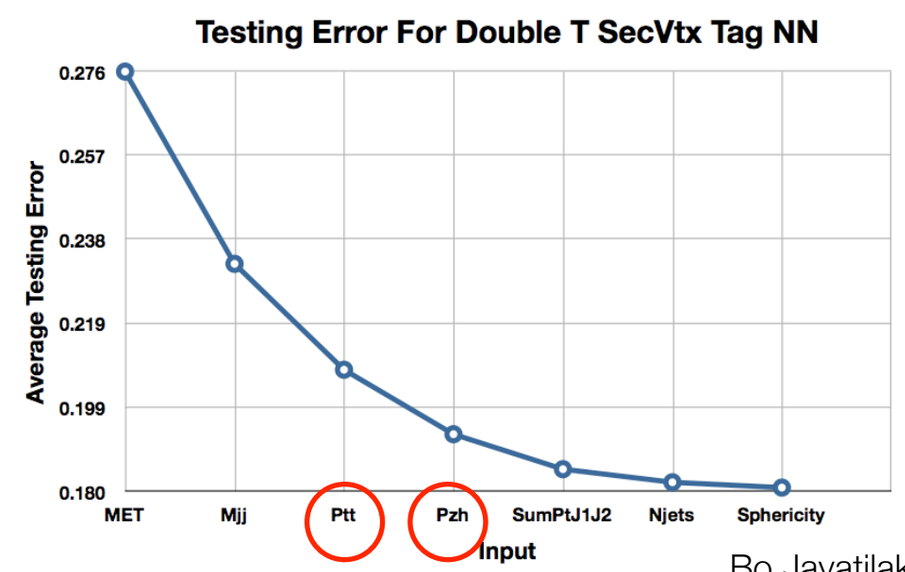


With 2.4-2.7 fb^{-1}

- Perform analysis with 2D NN and ME separately
- 2D NN, 2.4 fb^{-1}
  - Observe (expect) 11.6 (11.8)×σ_{SM} @95% CL for m_H=115 GeV
- ME, 2.7 fb^{-1}
  - Observe (expect) 8.2 (12.1)×σ_{SM} @95% CL for m_H=115 GeV
  - Phys. Rev. D **80,** 071101 (2009) Rapid Comm.
- How overlapping is the information?
  - Feed in ME probabilities as potential input variables for ME
  - ME probabilities consistently rank high
- Including ME probabilities improves results over NN alone by up to 15%

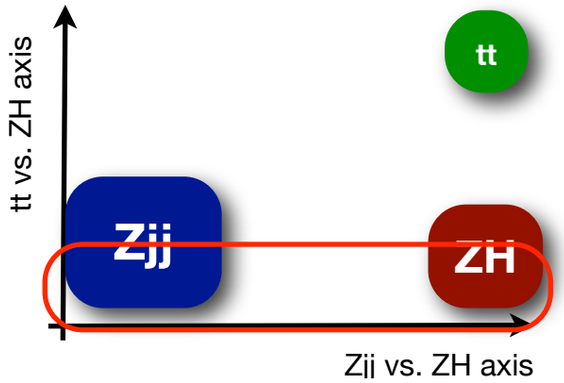


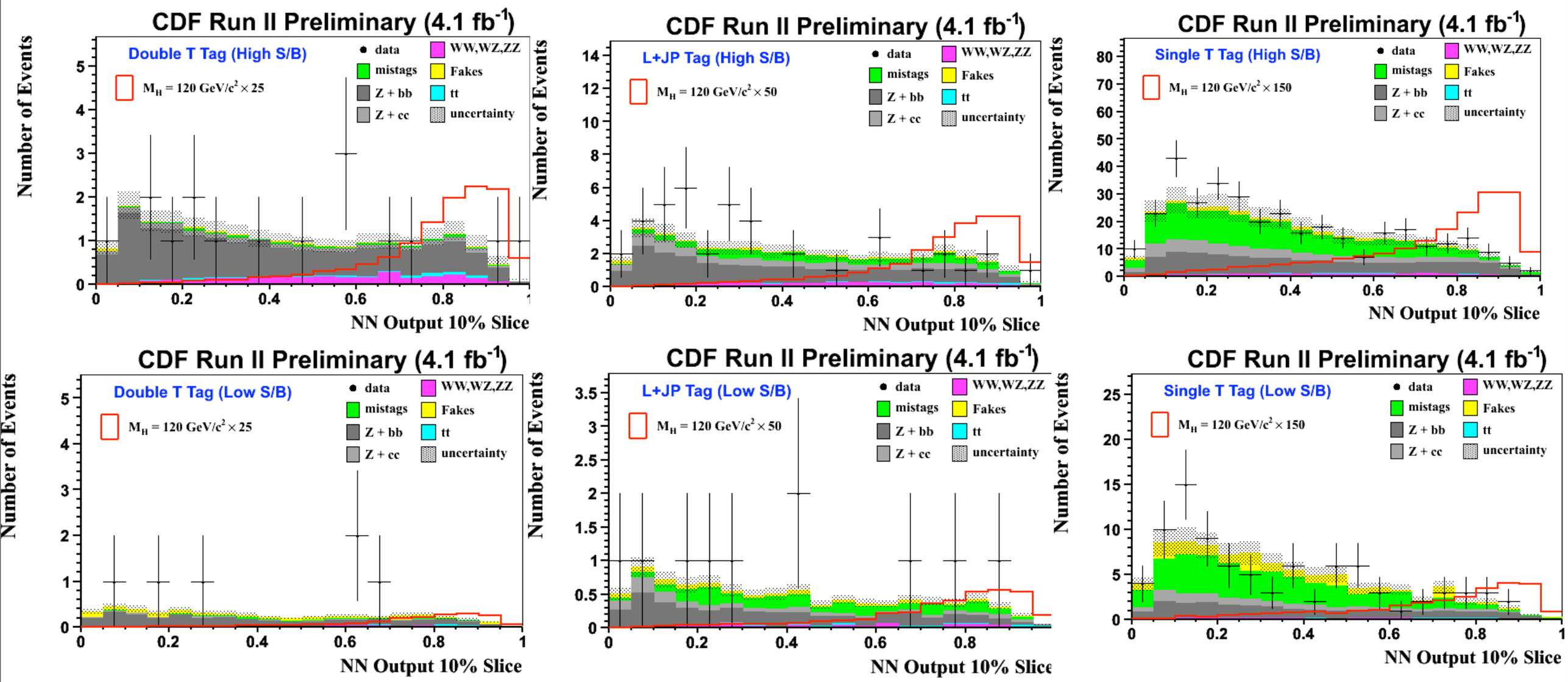




NN Validation

- Project 10% slice in ttbar direction along Zjj vs. ZH axis
  - Train separate NN for each subsample





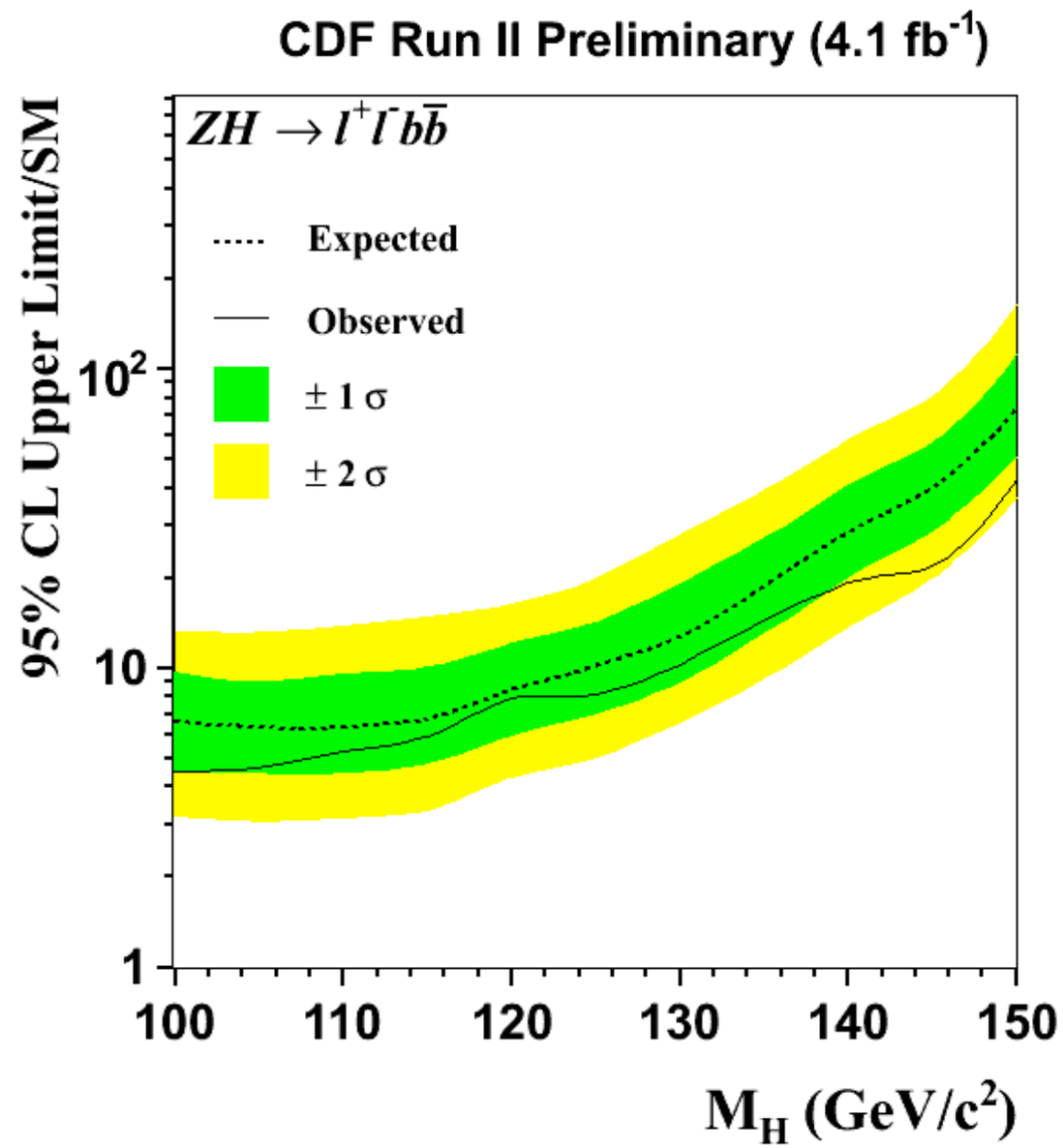
Systematic uncertainties

systematic uncertainty		Samples affected
Tevatron Luminosity	0.05	All MC
CDF Luminosity	0.04	All MC
Z+h.f cross-section	0.40	$Z + bb$, $Z + cc$
$t\bar{t}$ cross-section	0.20	$t\bar{t}$
Diboson cross-sections	0.115	ZZ, ZW, WW
Mistag errors	NN Output Shape & Acceptance	Mistags
Lepton ID	0.01	All MC
B-tag scale factor	0.04	All single tag MC
	0.08	All double SecVtx tag MC
	0.11	All Loose + JP tag MC
Fakes	0.50	Fake ee, $\mu\mu$
JES	NN Output Shape & Acceptance	All MC
ISR & FSR	NN Output Shape & Acceptance	Signal MC
ZH cross-section	0.05	ZH MC
EM energy scale	0.015	All MC

Step 4: Results

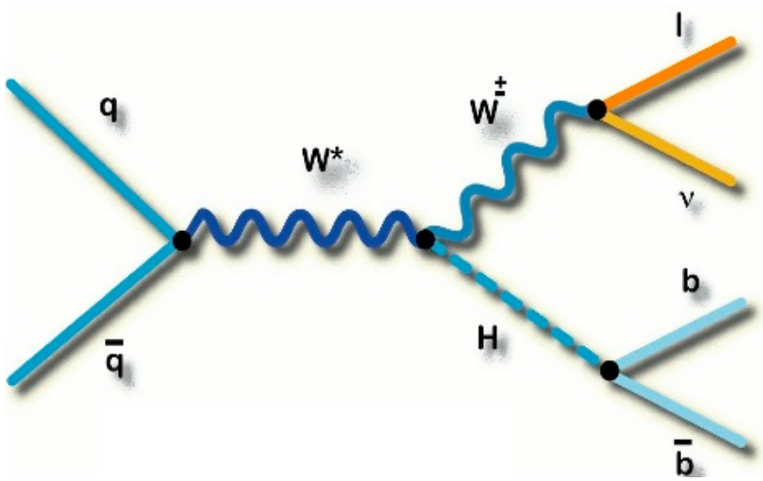
Expected and Observed 95% CL Upper Limits for Individual Channels @ $M_H = 115\,\mathrm{GeV}/c^2$

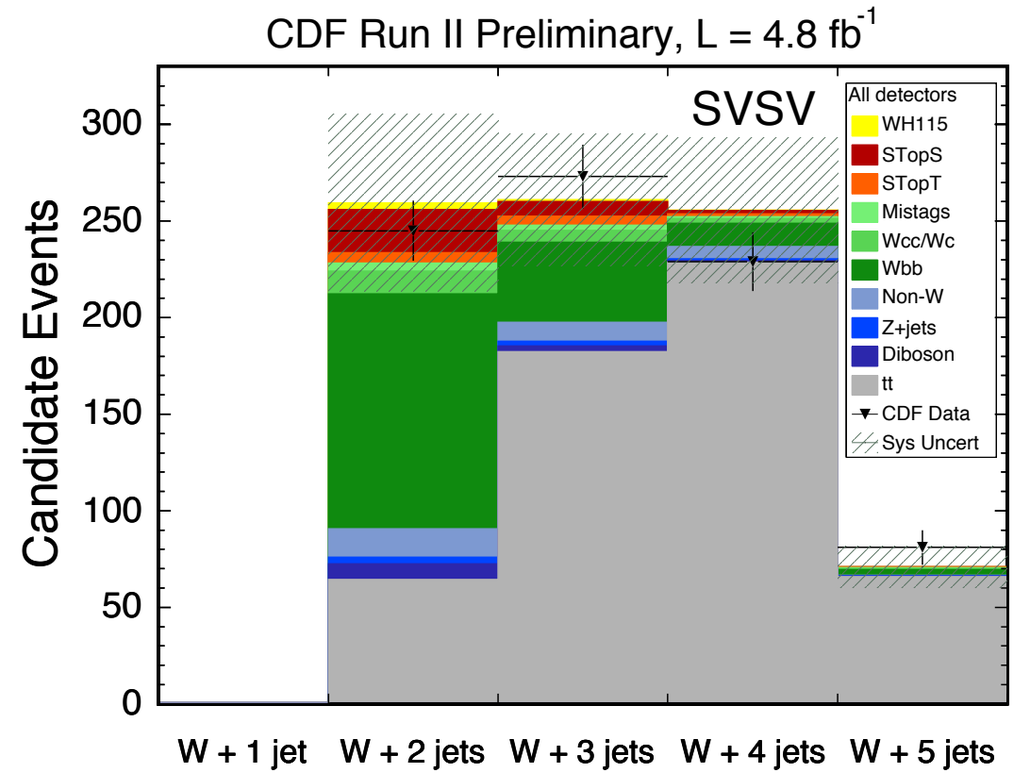
Channel	Data	Background	$S/\sqrt{B}$	Expected$^{+1\sigma}_{-1\sigma}$	Observed
Double Tag High S/B	23	29.3 ± 7.0	0.13	$12.1\ ^{+5.7}_{-5.5}$	11.3
L+JP Tag High S/B	56	52.8 ± 10.5	0.09	$15.98\ ^{+6.95}_{-7.6}$	10.6
Single Tag High S/B	406	366.1 ± 55.9	0.09	$15.5\ ^{+7.1}_{-7.98}$	16.9
Double Tag Low S/B	12	8.7 ± 1.7	0.04	$49.2\ ^{+18.95}_{-19.9}$	58.2
L+JP Tag Low S/B	14	14.3 ± 2.4	0.03	$50.6\ ^{+21.6}_{-21.99}$	71.1
Single Tag Low S/B	116	116.8 ± 17.0	0.02	$41.6\ ^{+19.99}_{-20.04}$	38.5
Combined				$6.8\ ^{+3.22}_{-2.04}$	5.91



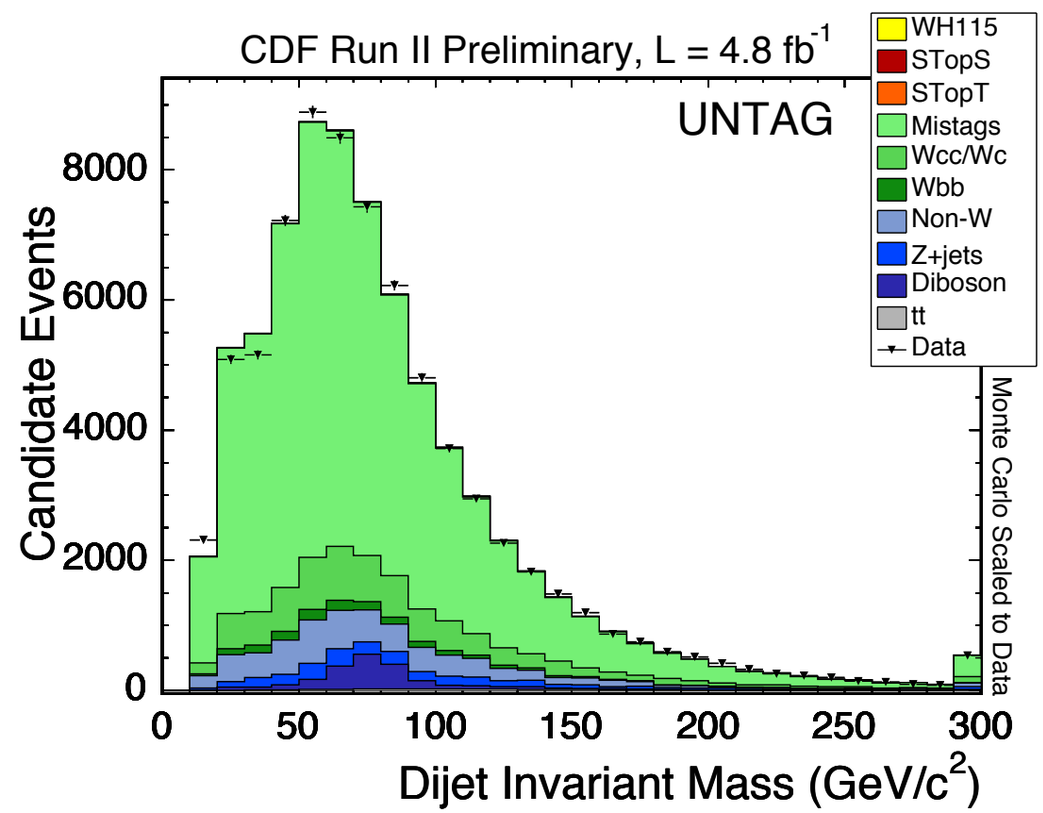
- All samples consistent with background
- Set combined limits for m_H [100,150]GeV
  - Observe (expect) 5.9 (6.8)×σ_{SM} @95% CL for m_H=115 GeV

$WH \rightarrow l\nu b\bar{b}$

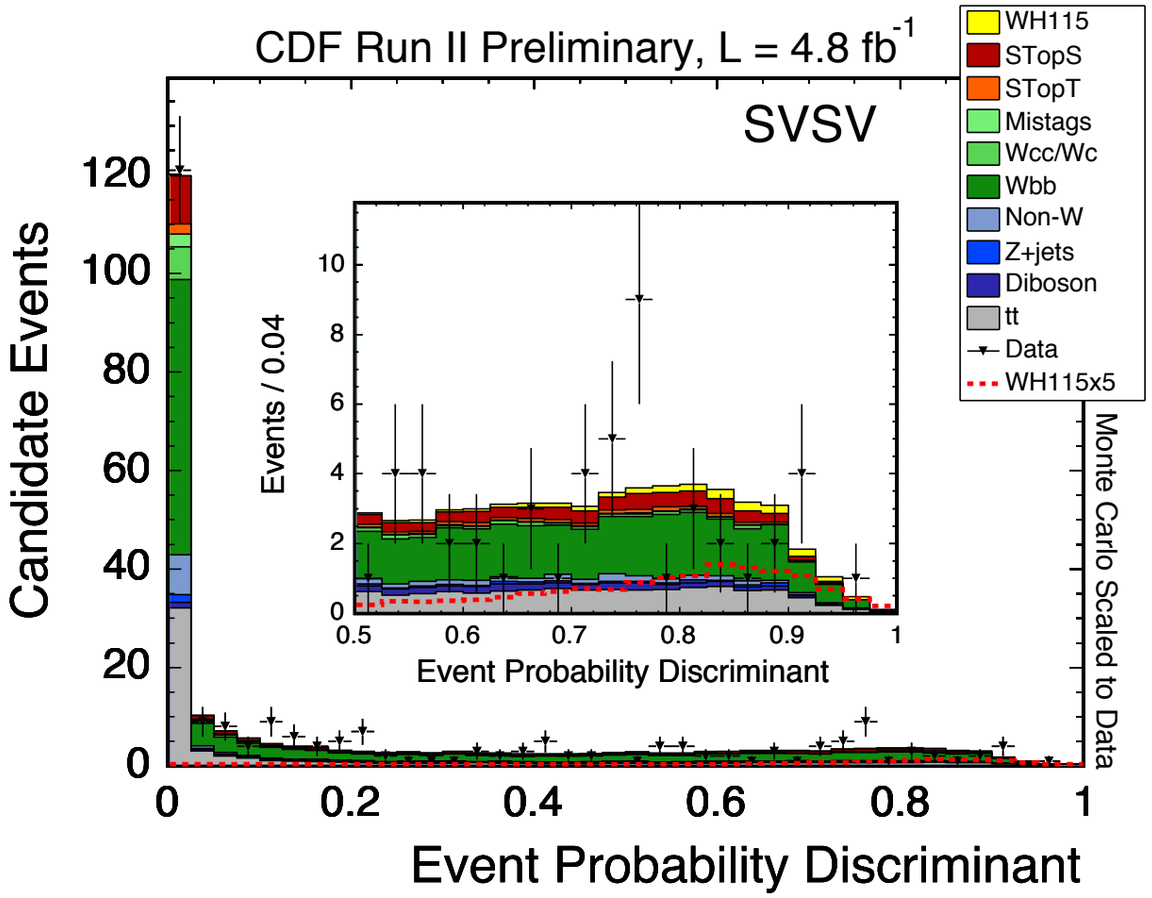


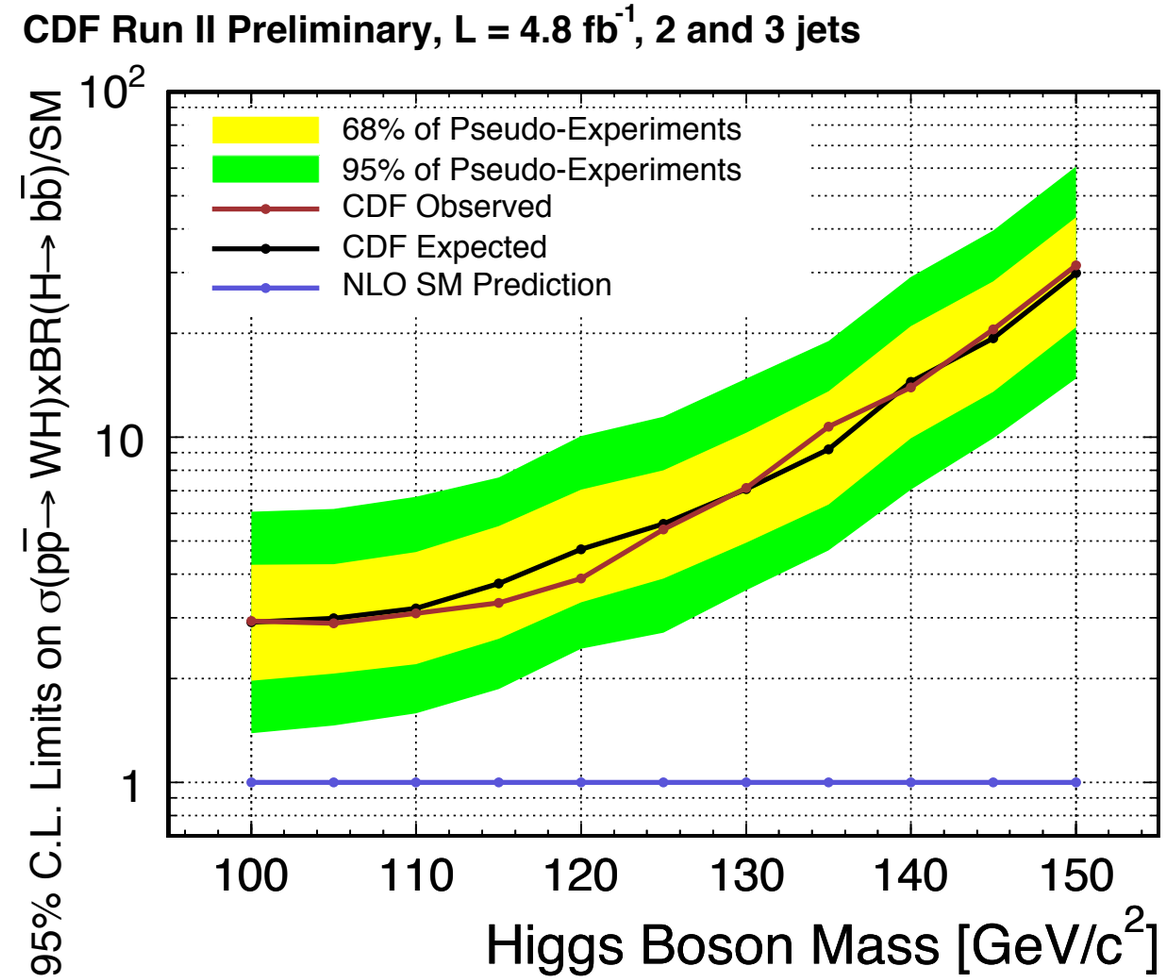


- Largest cross section of *VH* states with identified lepton
- Select events with high-p_T electron or muon, 2 or 3 jets at least one with a *b*-tag, and large missing E_T
- As with *ZH*, can use NN to improve dijet mass resolution
- Dominant backgrounds are W+jets, QCD multijet and top
- Split sample up according to number of jets and tags



$WH \rightarrow l\nu bb$ results

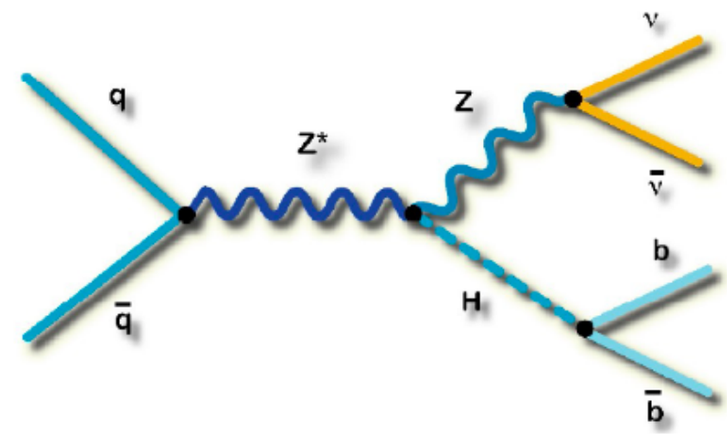


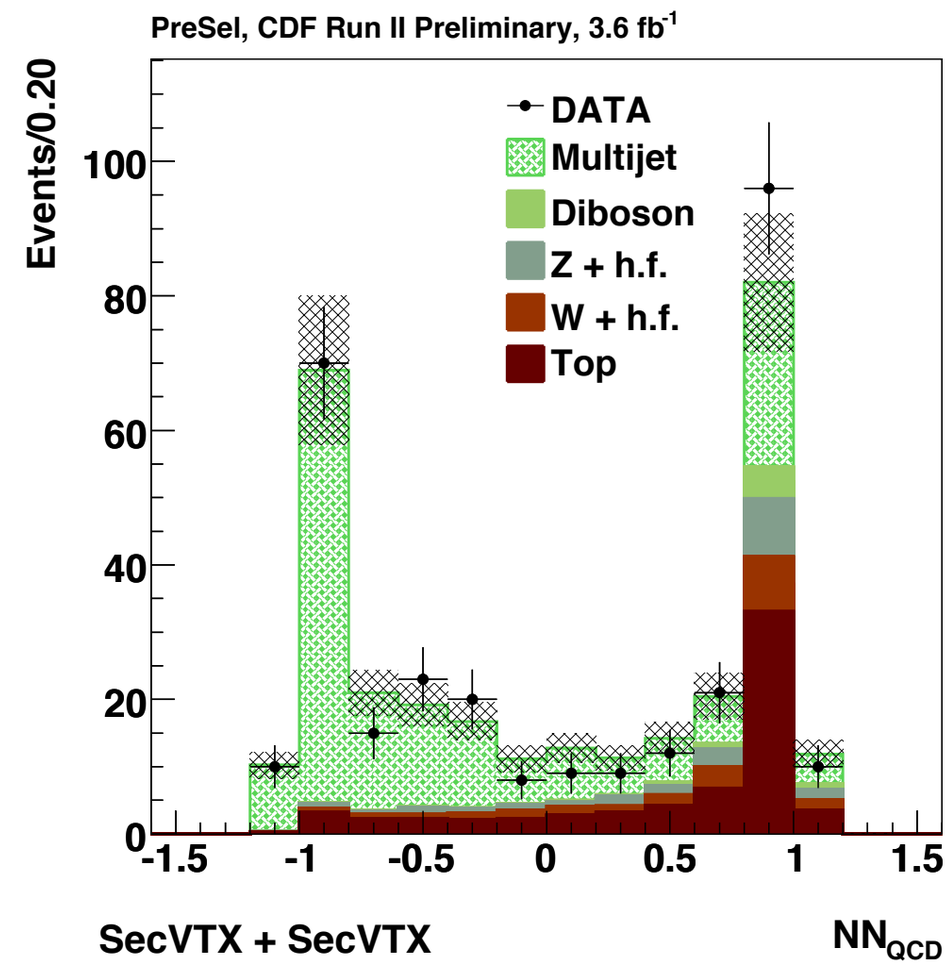


- Use a ME probability calculation ("EPD") for signal enhancement
- 4.8 fb^{-1} Observe (expect) 3.3 (3.8)$\times\sigma_{SM}$ @95% CL for m_H=115 GeV
  - Brand new result: not included in latest combination

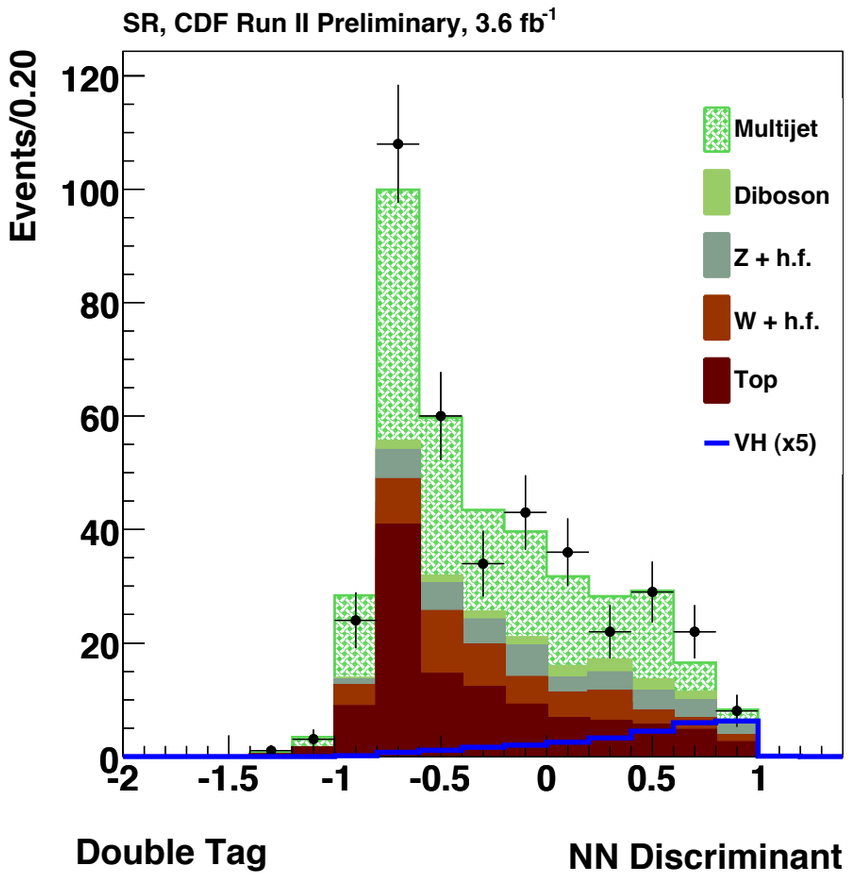
$VH \rightarrow b\bar{b} + \not{E}_T$

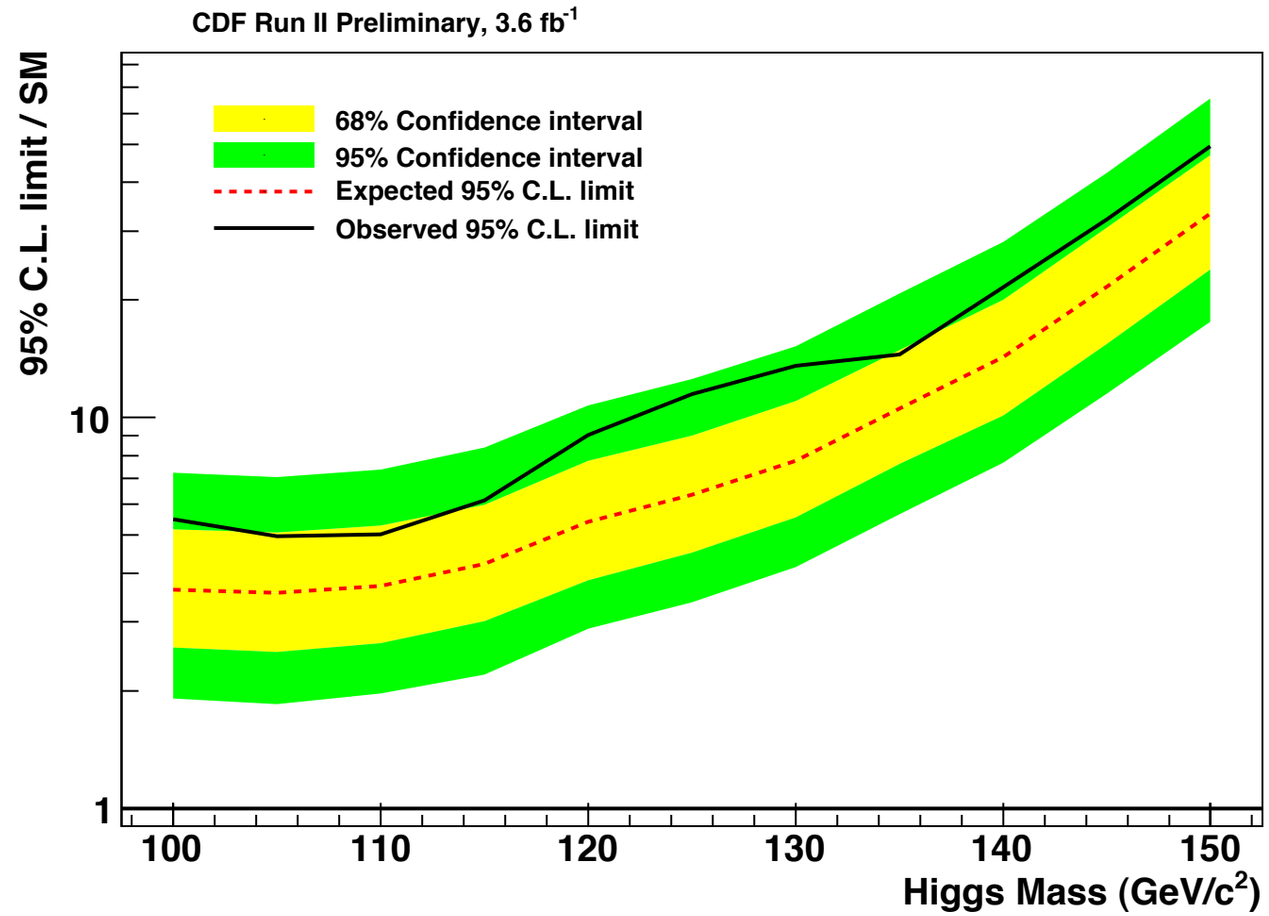
- Includes contributions from
  - $WH \rightarrow (l)\nu b\bar{b}$
  - $ZH \rightarrow \nu\nu b\bar{b}$
- Select events with large missing E_T and jets with at least 1 *b*-tag
- Exclude identified leptons
  - Ensures independent channel from other *VH* searches
- Backgrounds by source of missing E_T
  - Instrumental: QCD multijet
  - Real: W/Z+jets, top, diboson
- Large QCD background drives analysis design
  - Model using data
  - Use NN to separate QCD background





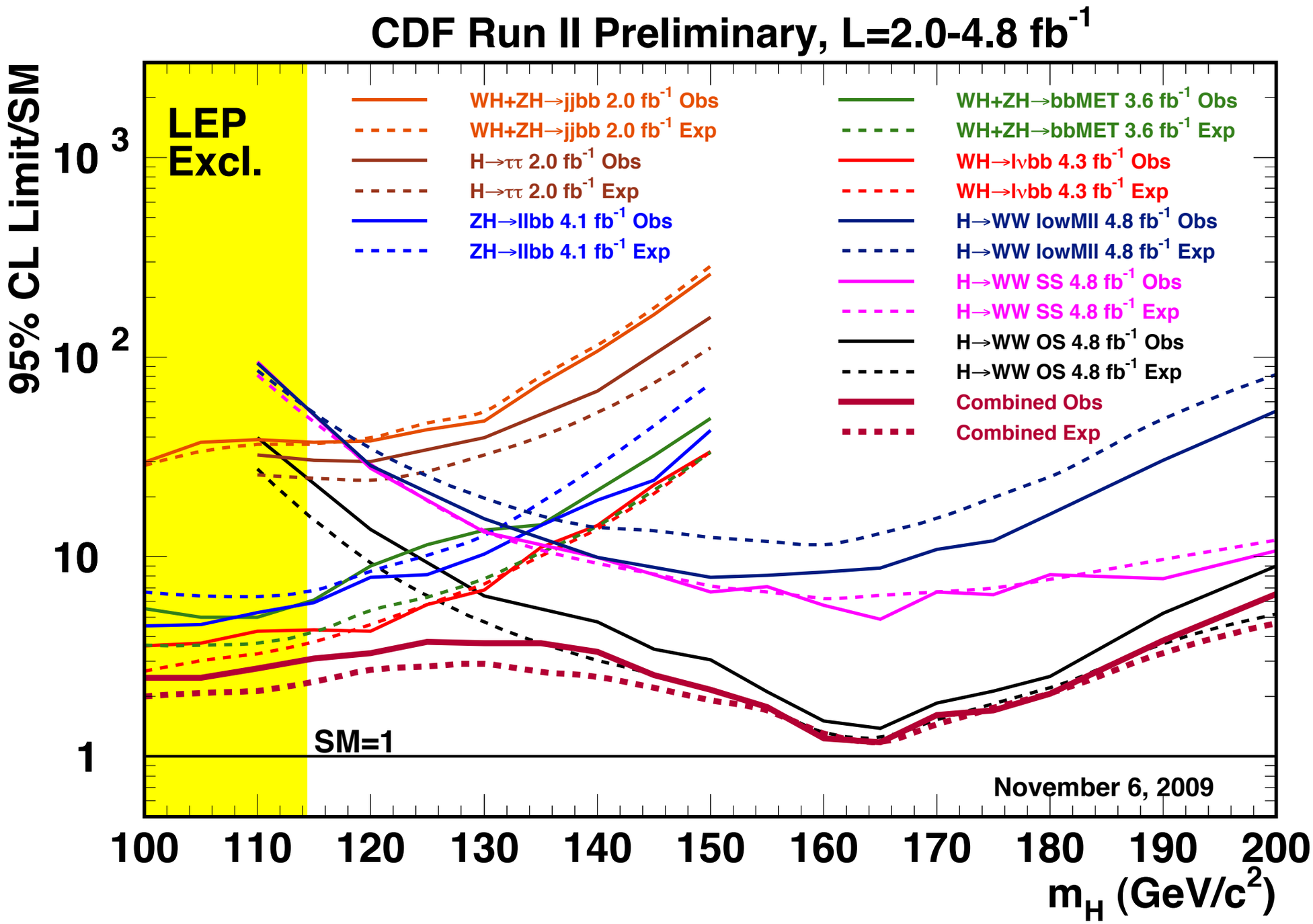
$VH \rightarrow b\bar{b} + \not{E}_T$ results





- Use a NN discriminant for signal enhancement
- 3.6 fb^{-1} Observe (expect) 6.1 (4.2)$\times\sigma_{SM}$ @95% CL for m_H=115 GeV

All channels



Now double the dataset

arXiv:0911.3930

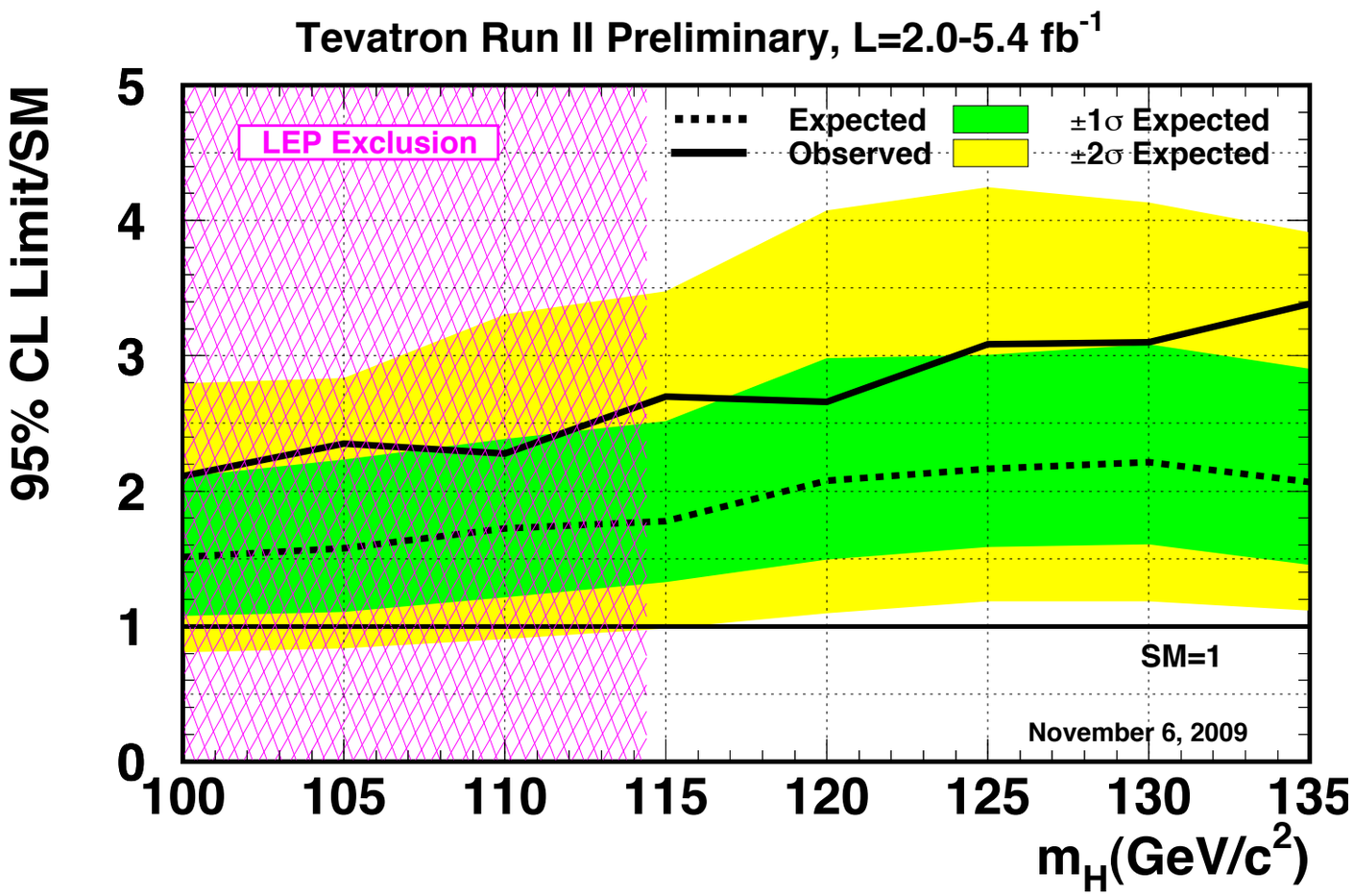
TABLE II: Luminosity, explored mass range and references for the different processes and final state ($\ell = e, \mu$) for the CDF analyses

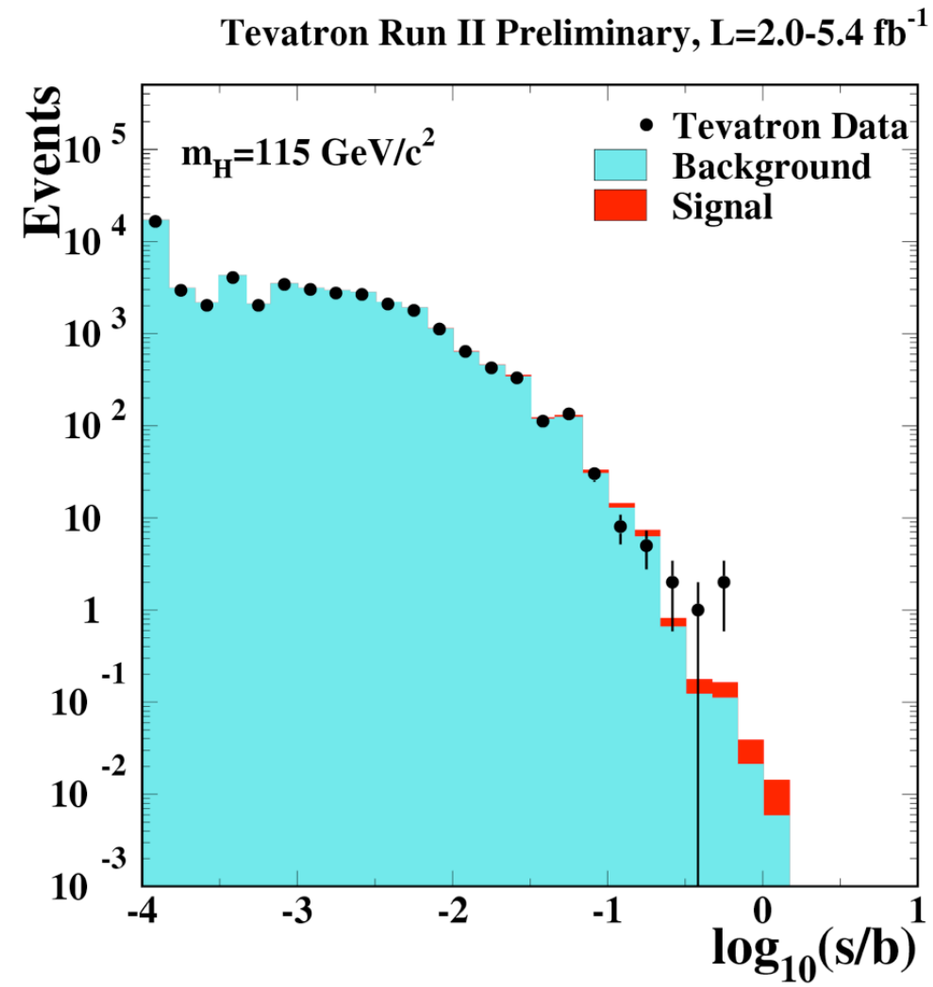
Channel	Luminosity (fb^{-1})	m_H range (GeV/c^2)	Reference
$WH \to \ell\nu b\bar{b}$ 2-jet channels 3×(TDT,LDT,ST,LDTX)	4.3	100-150	[4]
$WH \to \ell\nu b\bar{b}$ 3-jet channels 2×(TDT,LDT,ST)	4.3	100-150	[5]
$ZH \to \nu\bar{\nu}b\bar{b}$ (TDT,LDT,ST)	3.6	105-150	[6]
$ZH \to \ell^+\ell^- b\bar{b}$ (low,high s/b)×(TDT,LDT,ST)	4.1	100-150	[7]
$H \to W^+W^-$ (low,high s/b)×(0,1 jets)+(2+ jets)+Low-$m_{\ell\ell}$	4.8	110-200	[8]
$WH \to WW^+W^- \to \ell^\pm\nu\ell^\pm\nu$	4.8	110-200	[8]
$H + X \to \tau^+\tau^- + 2$ jets	2.0	110-150	[9]
$WH + ZH \to jjb\bar{b}$	2.0	100-150	[10]

TABLE III: Luminosity, explored mass range and references for the different processes and final state ($\ell = e, \mu$) for the D0 analyses

Channel	Luminosity (fb^{-1})	m_H range (GeV/c^2)	Reference
$WH \to \ell\nu b\bar{b}$ 2×(ST,DT)	5.0	100-150	[11]
$VH \to \tau\tau b\bar{b}/q\bar{q}\tau\tau$	4.9	105-145	[12, 13]
$ZH \to \nu\bar{\nu}b\bar{b}$ (ST,TLDT)	5.2	100-150	[14]
$ZH \to \ell^+\ell^- b\bar{b}$ 2×(ST,DT)	4.2	100-150	[15]
$WH \to WW^+W^- \to \ell^\pm\nu\ell^\pm\nu$	3.6	120-200	[16, 17]
$H \to W^+W^- \to \ell^\pm\nu\ell^\mp\nu$	5.4	115-200	[18]
$H \to \gamma\gamma$	4.2	100-150	[19]
$t\bar{t}H \to t\bar{t}b\bar{b}$ 2×(ST,DT,TT)	2.1	105-155	[20]

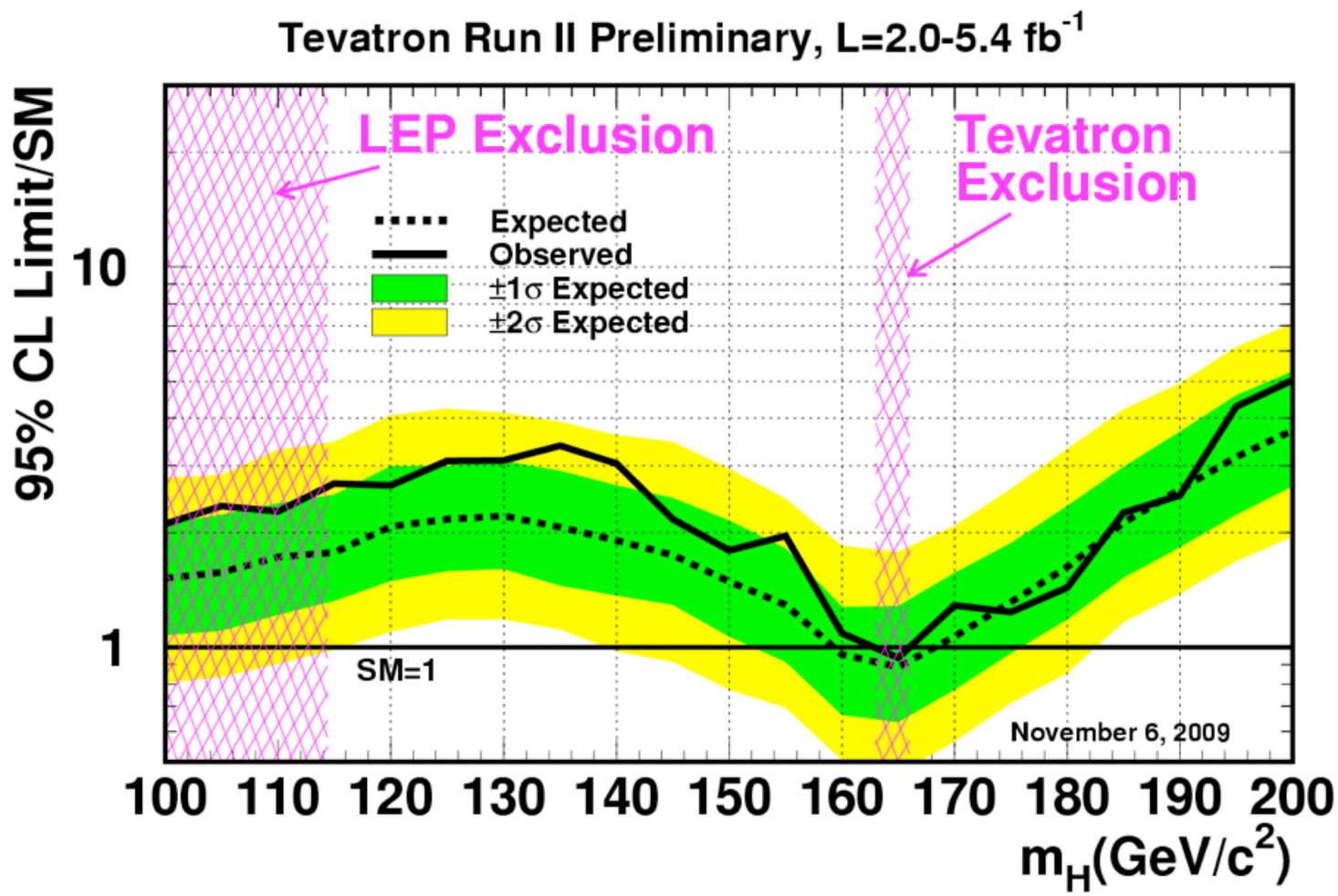
Low mass combination

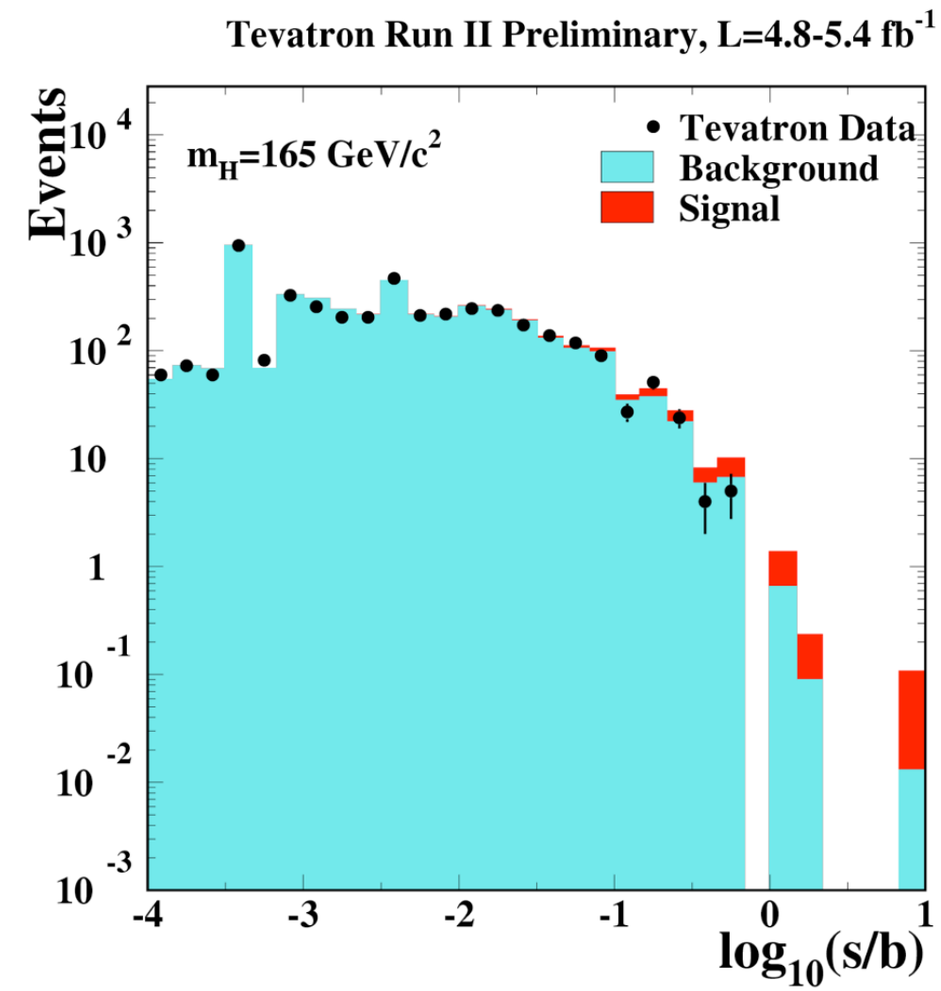




- Two independent methods (Bayesian, modified Frequentist)
- Combined CDF+DØ sensitivity at m_H=115 GeV is now $1.78\times\sigma_{SM}$
  - Observed limit of $2.70\times\sigma_{SM}$ at m_H=115 GeV

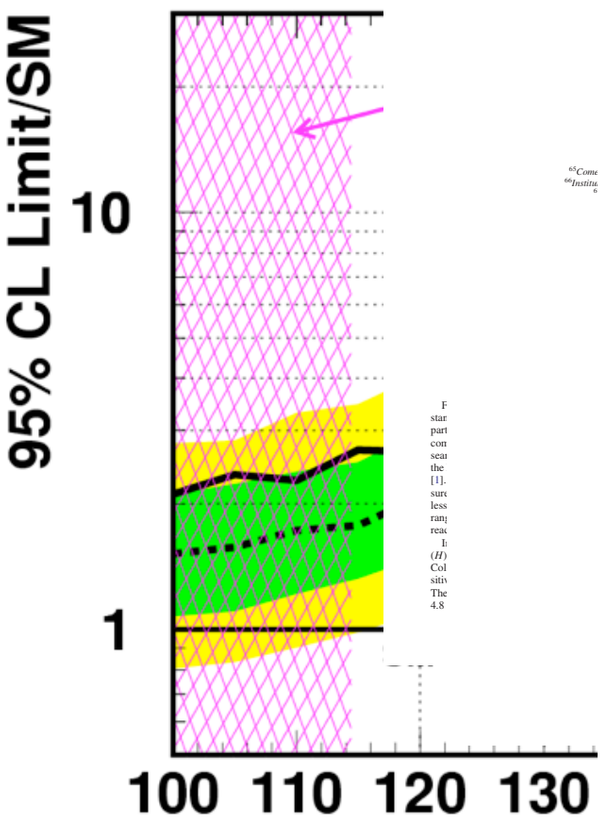
High mass combination

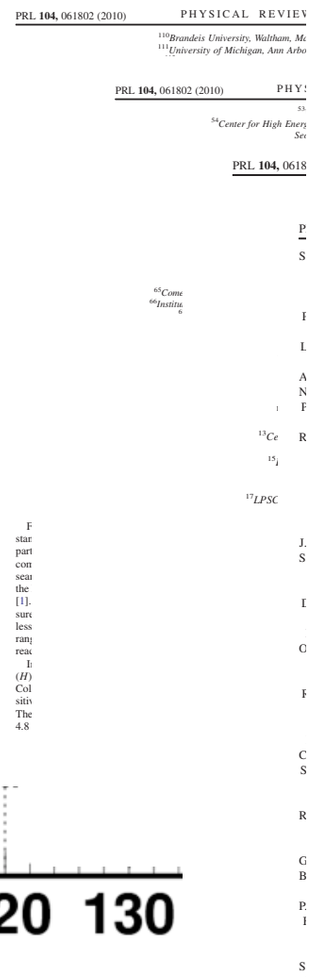




- SM Higgs **excluded** @95% CL for m_H=163-166 GeV/c^2
  - First Higgs exclusion since LEP

High mass combination





Selected for a Viewpoint in *Physics*
PRL **104,** 061802 (2010) PHYSICAL REVIEW LETTERS week ending 12 FEBRUARY 2010

Combination of Tevatron Searches for the Standard Model Higgs Boson in the W^+W^- Decay Mode

T. Aaltonen,[15,*] V. M. Abazov,[60,†] B. Abbott,[128,†] M. Abolins,[113,†] B. S. Acharya,[35,†] M. Adams,[91,†] T. Adams,[87,†] J. Adelman,[90,*] E. Aguilo,[7,†] G. D. Alexeev,[60,†] G. Alkhazov,[64,†] A. Alton,[111,†,gg] B. Álvarez González,[68,*,y] G. Alverson,[106,†] G. A. Alves,[2,†] S. Amerio,[41,40,*] D. Amidei,[111,*] A. Anastassov,[93,*] L. S. Ancu,[59,†] A. Annovi,[39,*] J. Antos,[65,*] M. Aoki,[89,†] G. Apollinari,[89,*] J. Appel,[89,*] A. Apresyan,[98,*] T. Arisawa,[53,*] Y. Arnoud,[17,†] M. Arov,[102,†] A. Artikov,[60,*] J. Asaadi,[135,*] W. Ashmanskas,[89,*] A. Askew,[87,†] B. Åsman,[69,†] O. Atramentov,[116,†] A. Attal,[66,*] A. Aurisano,[135,*] C. Avila,[10,†] F. Azfar,[77,*] J. BackusMayes,[140,†] F. Badaud,[16,†] W. Badgett,[89,*] L. Bagby,[89,†] B. Baldin,[89,†] D. V. Bandurin,[101,†] S. Banerjee,[35,†] A. Barbaro-Galtieri,[79,*] E. Barberis,[106,†] A.-F. Barfuss,[18,†] P. Baringer,[100,†] V. E. Barnes,[98,*] B. A. Barnett,[103,*] J. Barreto,[2,†] P. Barria,[44,42,*] J. F. Bartlett,[89,†] P. Bartos,[65,*] U. Bassler,[21,†] D. Bauer,[74,†] G. Bauer,[108,*] S. Beale,[7,†] A. Bean,[100,†] P.-H. Beauchemin,[6,*] F. Bedeschi,[42,*] D. Beecher,[75,*] M. Begalli,[3,†] M. Begel,[124,†] S. Behari,[103,*] C. Belanger-Champagne,[69,†] L. Bellantoni,[89,†] G. Bellettini,[43,42,*] J. Bellinger,[141,*] J. A. Benitez,[113,†] D. Benjamin,[125,*] A. Beretvas,[89,*] S. B. Beri,[33,†] G. Bernardi,[20,†] R. Bernhard,[26,†] I. Bertram,[72,†] M. Besançon,[21,†] R. Beuselinck,[74,†] V. A. Bezzubov,[63,†] P. C. Bhat,[89,†] V. Bhatnagar,[33,†] A. Bhatti,[121,*] M. Binkley,[89,*,a] D. Bisello,[41,40,*] I. Bizjak,[75,*,ff] R. E. Blair,[88,*] G. Blazey,[92,†] S. Blessing,[87,†] C. Blocker,[110,*] K. Bloom,[115,†] B. Blumenfeld,[103,*] A. Bocci,[125,*] A. Bodek,[122,*] A. Boehnlein,[89,†] V. Boisvert,[122,*] D. Boline,[105,†] T. A. Bolton,[101,†] E. E. Boos,[62,†] G. Borissov,[72,†] D. Bortoletto,[98,*] T. Bose,[105,†] J. Boudreau,[132,*] A. Boveia,[84,*] A. Brandt,[134,†] B. Brau,[84,*,b] A. Bridgeman,[94,*] L. Brigliadori,[38,37,*] R. Brock,[113,†] C. Bromberg,[113,*] G. Brooijmans,[120,†] A. Bross,[89,†] D. Brown,[22,†] E. Brubaker,[90,*] X. B. Bu,[8,†] D. Buchholz,[93,†] J. Budagov,[60,*] H. S. Budd,[122,*] S. Budd,[94,*] M. Buehler,[139,†] V. Buescher,[29,†] V. Bunichev,[62,†] S. Burdin,[72,†,hh] K. Burkett,[89,*] T. H. Burnett,[140,†] G. Busetto,[41,40,*] P. Bussey,[71,*] C. P. Buszello,[74,†] A. Buzatu,[6,*] K. L. Byrum,[88,*] S. Cabrera,[125,*,aa] C. Calancha,[67,*] P. Calfayan,[30,†] B. Calpas,[18,†] S. Calvet,[19,†] E. Camacho-Pérez,[57,†] S. Camarda,[66,*] J. Cammin,[122,†] M. Campanelli,[75,*] M. Campbell,[111,*] F. Canelli,[89,90,*] A. Canepa,[130,*] B. Carls,[94,*] D. Carlsmith,[141,*] R. Carosi,[42,*] M. A. Carrasco-Lizarraga,[57,†] E. Carrera,[87,†] S. Carrillo,[86,*,o] S. Carron,[89,*] B. Casal,[68,*] M. Casarsa,[89,*] B. C. K. Casey,[89,†] H. Castilla-Valdez,[57,†] A. Castro,[38,37,*] P. Catastini,[44,42,*] D. Cauz,[48,*] V. Cavaliere,[44,42,*] M. Cavalli-Sforza,[66,*] A. Cerri,[79,*] L. Cerrito,[75,*,s] S. Chakrabarti,[123,†] D. Chakraborty,[92,†] K. M. Chan,[97,†] A. Chandra,[95,†] S. H. Chang,[54,*] Y. C. Chen,[9,*] M. Chertok,[80,*] E. Cheu,[78,†] S. Chevalier-Théry,[21,†] G. Chiarelli,[42,*] G. Chlachidze,[89,*] F. Chlebana,[89,*] K. Cho,[54,*] D. K. Cho,[105,†] S. W. Cho,[55,†] S. Choi,[56,†] D. Chokheli,[60,*] J. P. Chou,[107,*] B. Choudhary,[34,†] T. Christoudias,[74,†] K. Chung,[89,*,p] W. H. Chung,[141,*] Y. S. Chung,[122,*] T. Chwalek,[28,*] S. Cihangir,[89,†] C. I. Ciobanu,[20,*] M. A. Ciocci,[44,42,*] D. Claes,[115,†] A. Clark,[70,*] D. Clark,[110,*] J. Clutter,[100,†] G. Compostella,[40,*] M. E. Convery,[89,*] J. Conway,[80,*] M. Cooke,[89,†] W. E. Cooper,[89,†] M. Corbo,[20,*] M. Corcoran,[137,†] M. Cordelli,[39,*] F. Couderc,[21,†] M.-C. Cousinou,[18,†] C. A. Cox,[80,*] D. J. Cox,[80,*] F. Crescioli,[43,42,*] C. Cuenca Almenar,[85,*] J. Cuevas,[68,*,y] R. Culbertson,[89,*] J. C. Cully,[111,*] D. Cutts,[133,†] M. Ćwiok,[36,†] D. Dagenhart,[89,*] N. d'Ascenzo,[20,*,x] A. Das,[78,†] M. Datta,[89,*] G. Davies,[74,†] T. Davies,[71,*] K. De,[134,†] P. de Barbaro,[122,*] S. De Cecco,[46,*] A. Deisher,[79,*] S. J. de Jong,[59,†] E. De La Cruz-Burelo,[57,†] F. Déliot,[21,†] M. Dell'Orso,[43,42,*] G. De Lorenzo,[66,*] C. Deluca,[66,*] M. Demarteau,[89,†] R. Demina,[122,†] L. Demortier,[121,*] J. Deng,[125,*,g] M. Deninno,[37,*] D. Denisov,[89,†] S. P. Denisov,[63,†] M. d'Errico,[41,40,*] S. Desai,[89,†] K. DeVaughan,[115,†] A. Di Canto,[43,42,*] H. T. Diehl,[89,†] M. Diesburg,[89,†] B. Di Ruzza,[42,*] J. R. Dittmann,[138,*] A. Dominguez,[115,†] S. Donati,[43,42,*] P. Dong,[89,*] M. D'Onofrio,[66,*] T. Dorigo,[40,*] T. Dorland,[140,†] S. Dube,[116,*] A. Dubey,[34,†] L. V. Dudko,[62,†] L. Duflot,[19,†] D. Duggan,[116,†] A. Duperrin,[18,†] S. Dutt,[33,†] A. Dyshkant,[92,†] M. Eads,[115,†] K. Ebina,[53,*] D. Edmunds,[113,†] A. Elagin,[135,*] J. Ellison,[83,†] V. D. Elvira,[89,†] Y. Enari,[20,†] S. Eno,[104,†] R. Erbacher,[80,*] D. Errede,[94,*] S. Errede,[94,*] N. Ershaidat,[20,*,ee] R. Eusebi,[135,*] H. Evans,[95,†] A. Evdokimov,[124,†] V. N. Evdokimov,[63,†] G. Facini,[106,†] H. C. Fang,[79,*] S. Farrington,[77,*] W. T. Fedorko,[90,*] R. G. Feild,[85,*] M. Feindt,[28,*] A. V. Ferapontov,[133,†] T. Ferbel,[104,122,†] J. P. Fernandez,[67,*] C. Ferrazza,[45,42,*] F. Fiedler,[29,†] R. Field,[86,*] F. Filthaut,[59,†] W. Fisher,[113,†] H. E. Fisk,[89,†] G. Flanagan,[98,*,u] R. Forrest,[80,*] M. Fortner,[92,†] H. Fox,[72,†] M. J. Frank,[138,*] M. Franklin,[107,*] J. C. Freeman,[89,*] S. Fuess,[89,†] I. Furic,[86,*] T. Gadfort,[124,†] C. F. Galea,[59,†] M. Gallinaro,[121,*] J. Galyardt,[131,*] F. Garberson,[84,*] J. E. Garcia,[70,*] A. Garcia-Bellido,[122,†] A. F. Garfinkel,[98,*] P. Garosi,[44,42,*] V. Gavrilov,[61,†] P. Gay,[16,†] W. Geist,[22,†] W. Geng,[18,113,†] D. Gerbaudo,[117,†] C. E. Gerber,[91,†] H. Gerberich,[94,*] D. 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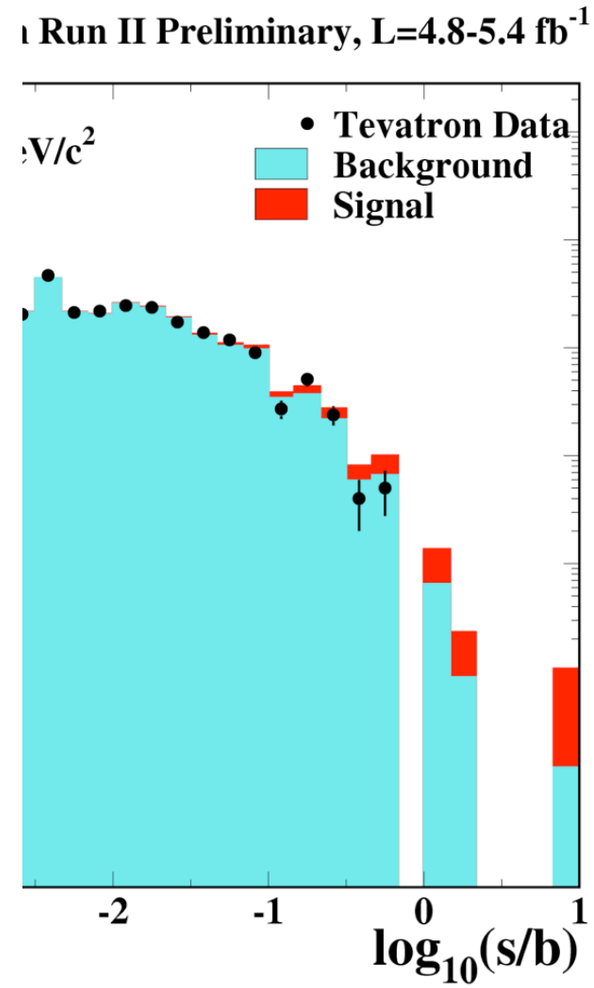
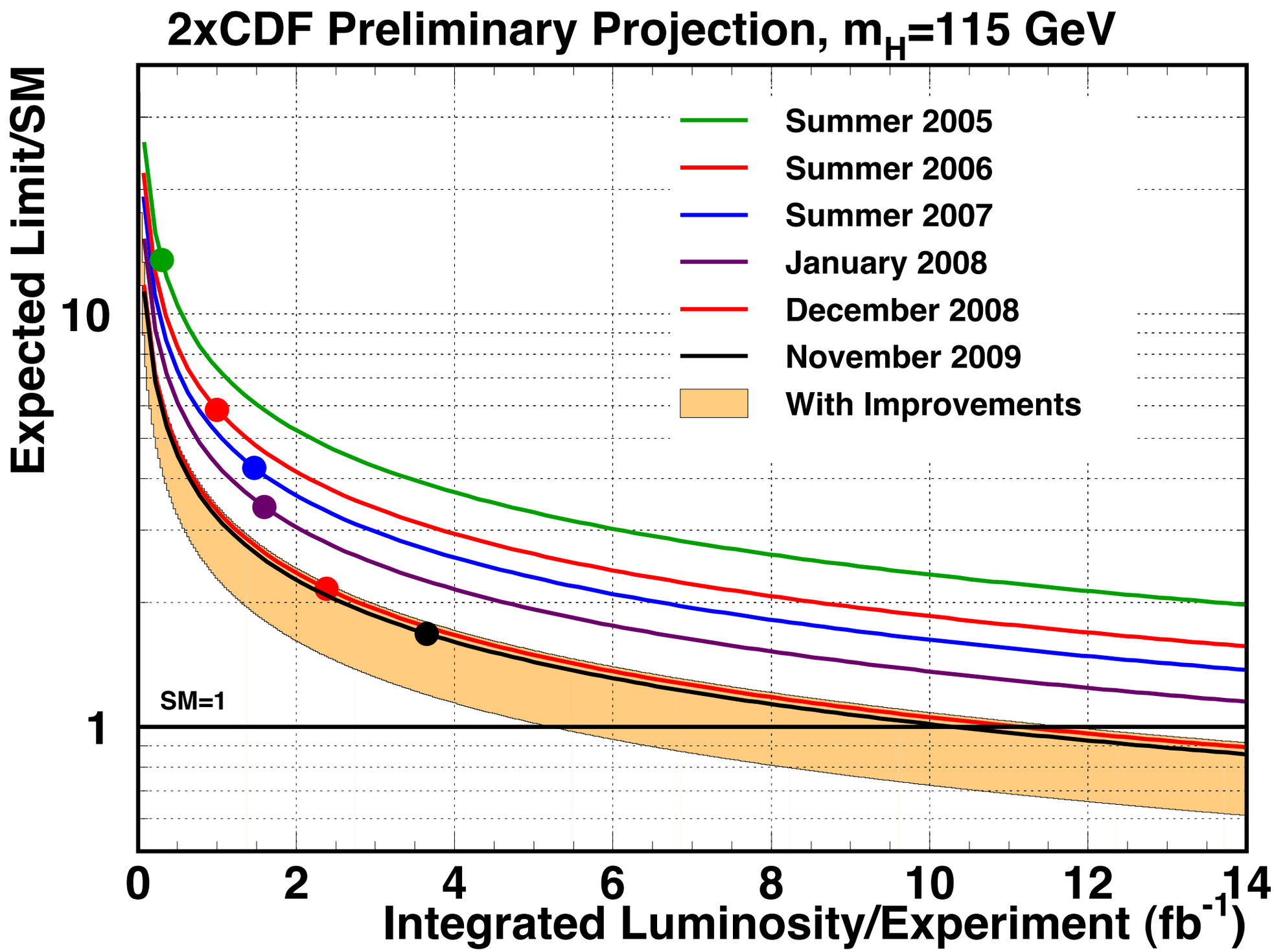


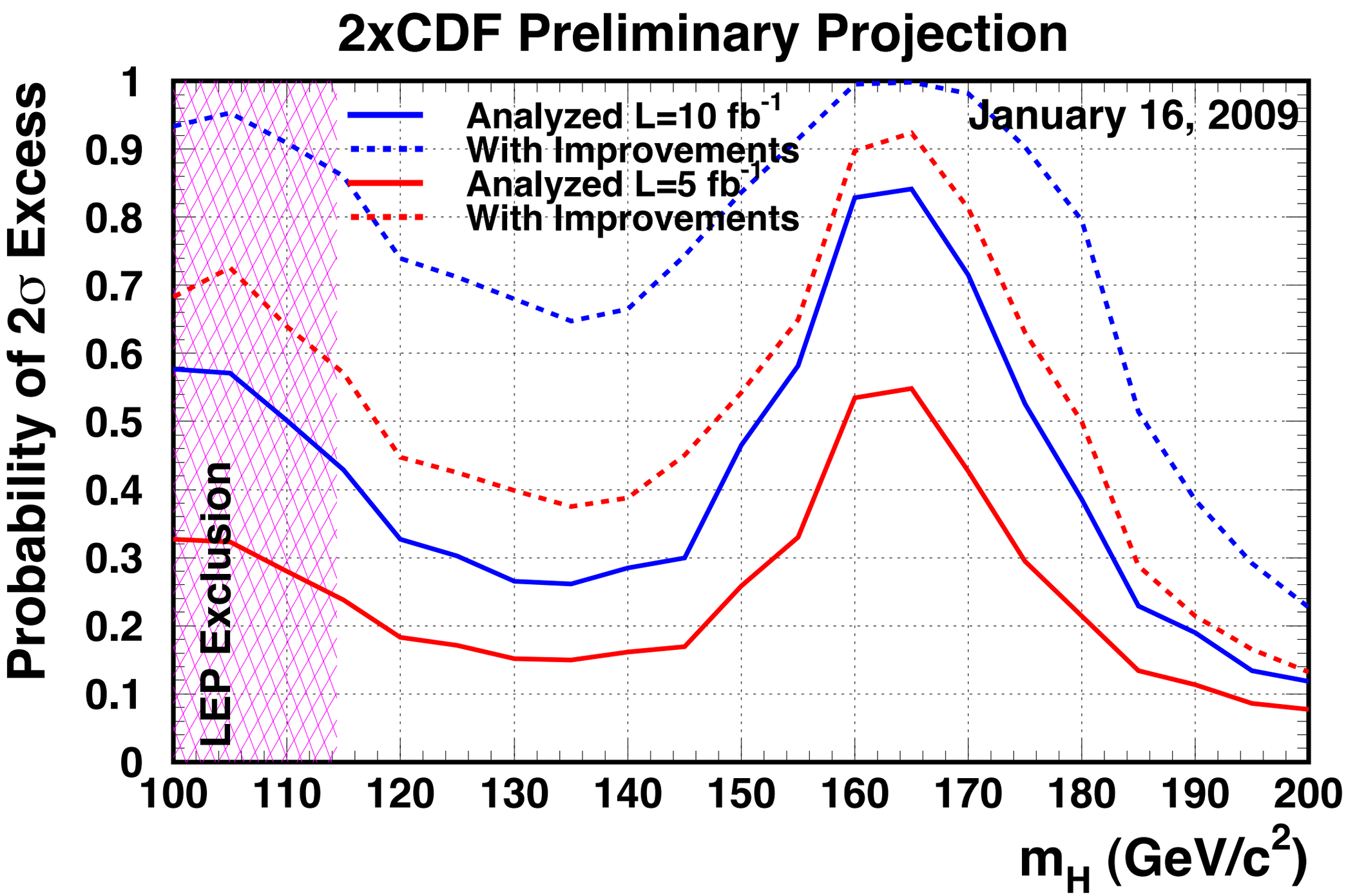
- SM Higgs **excluded**
  - First Higgs exclu

PRL **104**,061802 (2010)
First CDF+DØ
publication in Run II

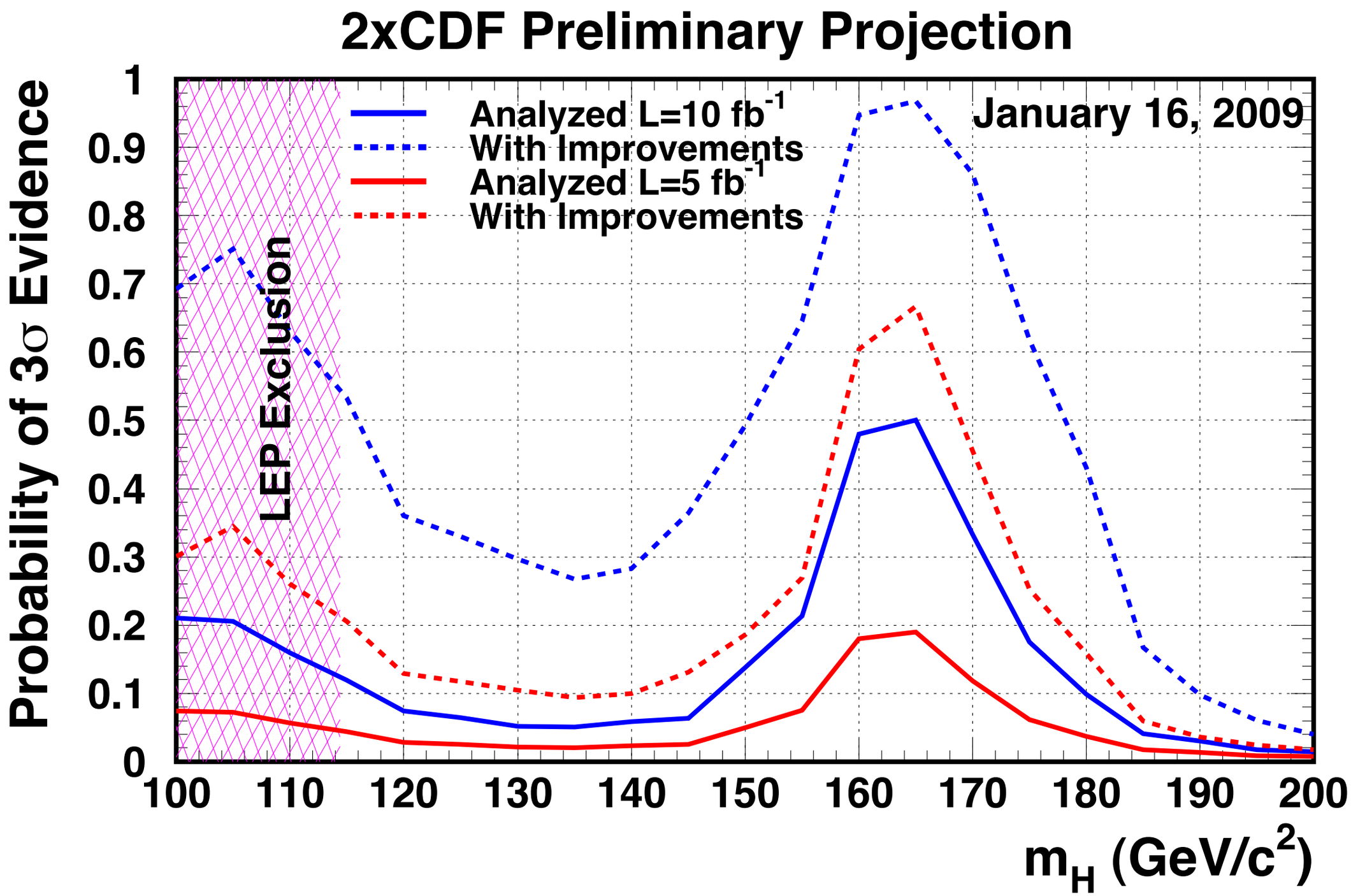
Outlook: m_H=115 GeV



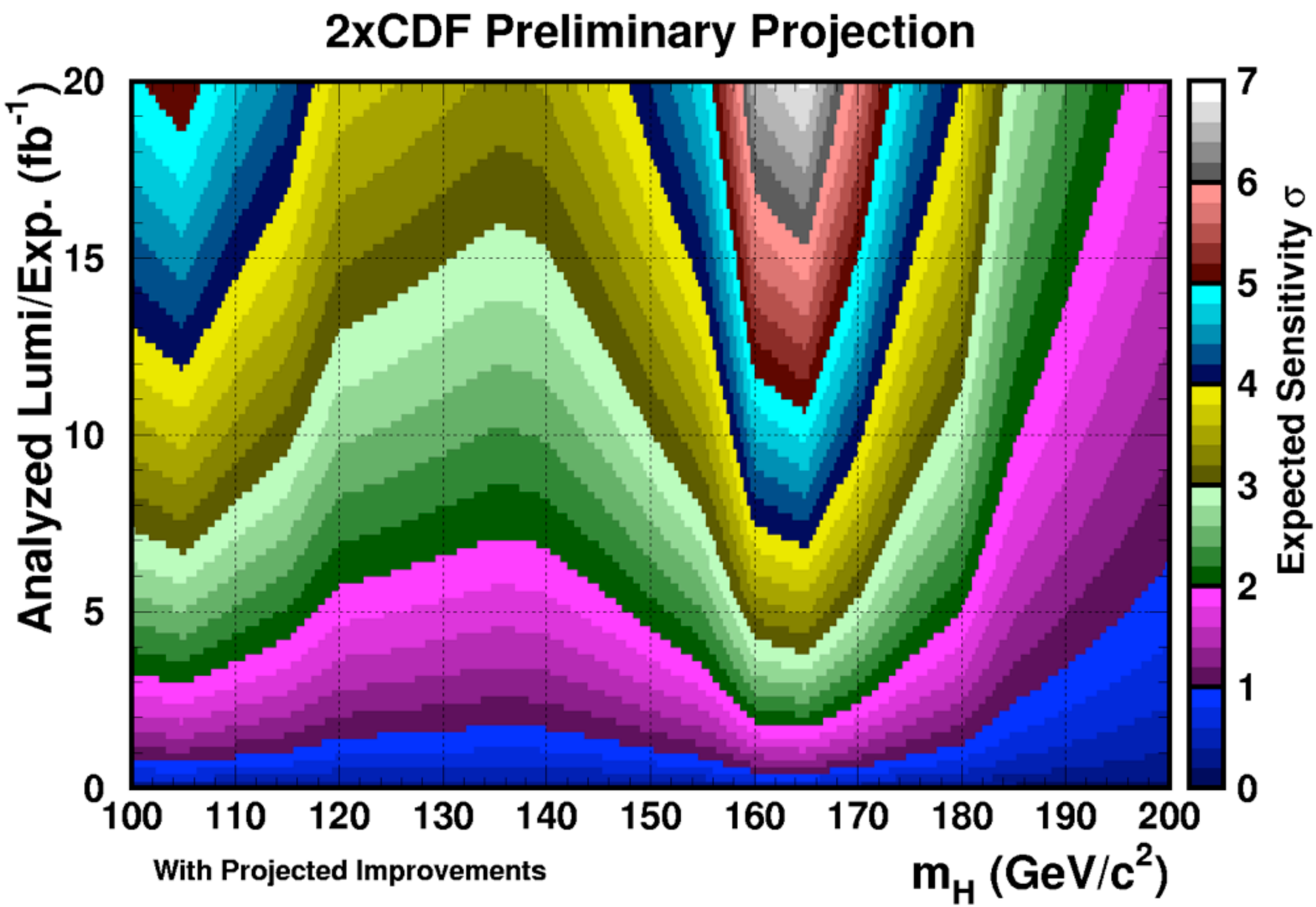
Outlook: can we see an excess?



Outlook: can we see an excess?



Running the Tevatron until 2014?



Conclusion

- Datasets at Tevatron continue to grow
  - Expect ~10 fb^{-1}/experiment analyzed by 2011
- SM Higgs excluded @95% CL for m_H=[163,166] GeV
- Continued effort in improving low mass Higgs searches
- Combined CDF+DØ sensitivity at m_H=115 GeV is now $1.78\times\sigma_{SM}$
  - Observed limit of $2.70\times\sigma_{SM}$ at m_H=115 GeV
- An exclusion over entire search range possible by end of Run II
  - Or better yet, see hints of a signal?