Hidden Valley Higgs Search

Blessing

Higgs Group

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CDF Note 10315 and 10356 (public)

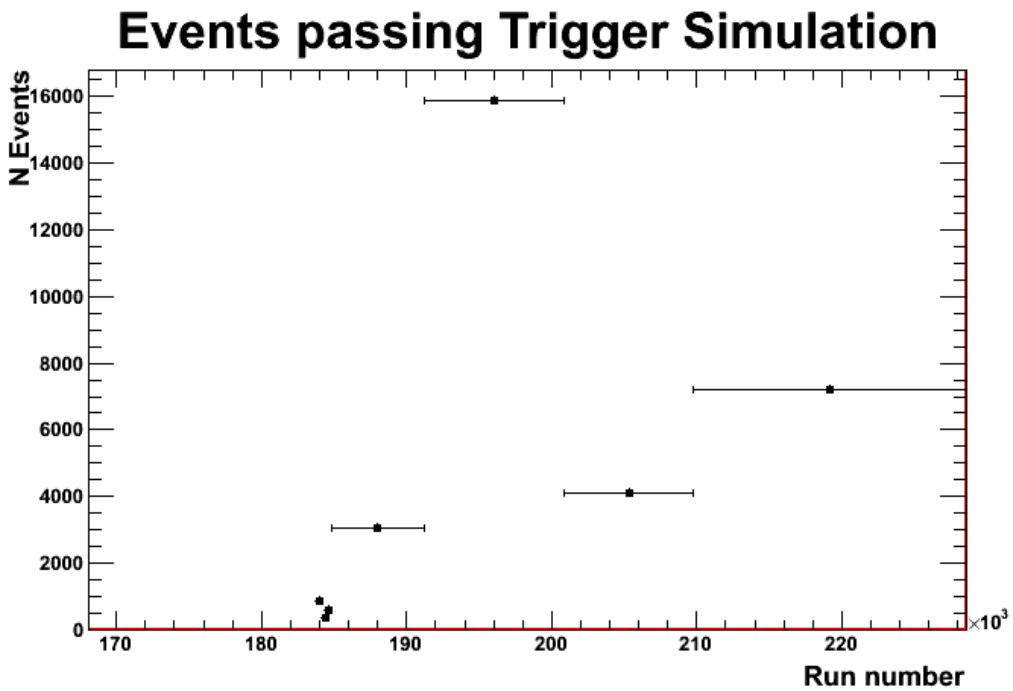
Introduction

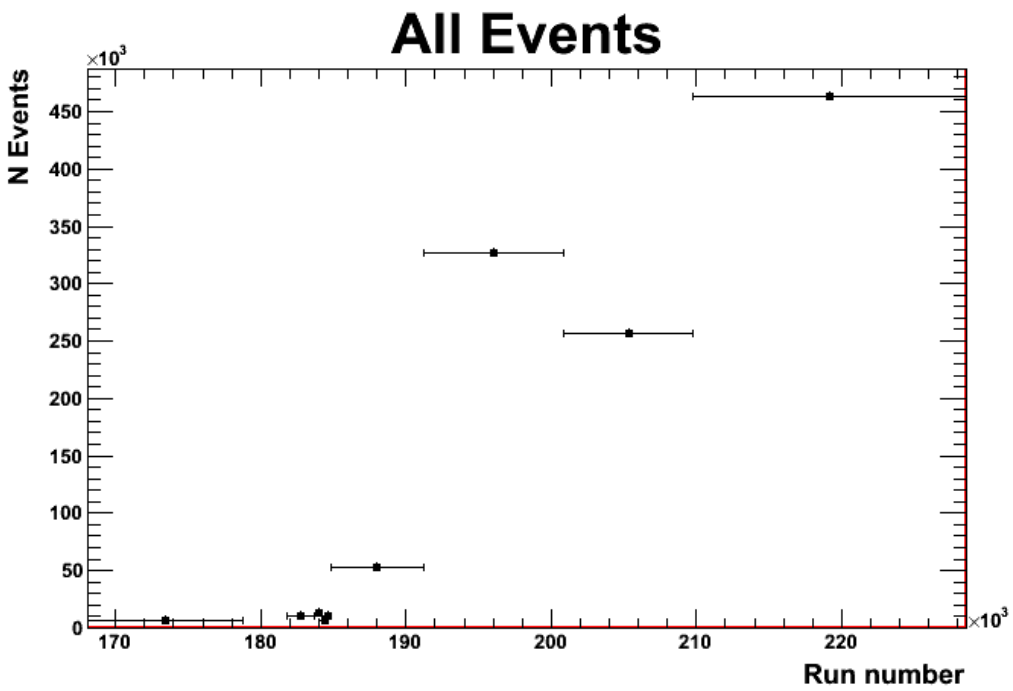
- Blessing (part 1): 2010-12-03
- Preblessing: 2010-10-29
- Full Status: 2010-09-24

- Analysis Note - CDF Note 10315
- Public Note - CDF Note 10356
- Public Web page URL
  - http://www-cdf.fnal.gov/~skwang/DispVtxAna/PubWeb/
  - (At some point this will by copied to the Higgs Public results page)

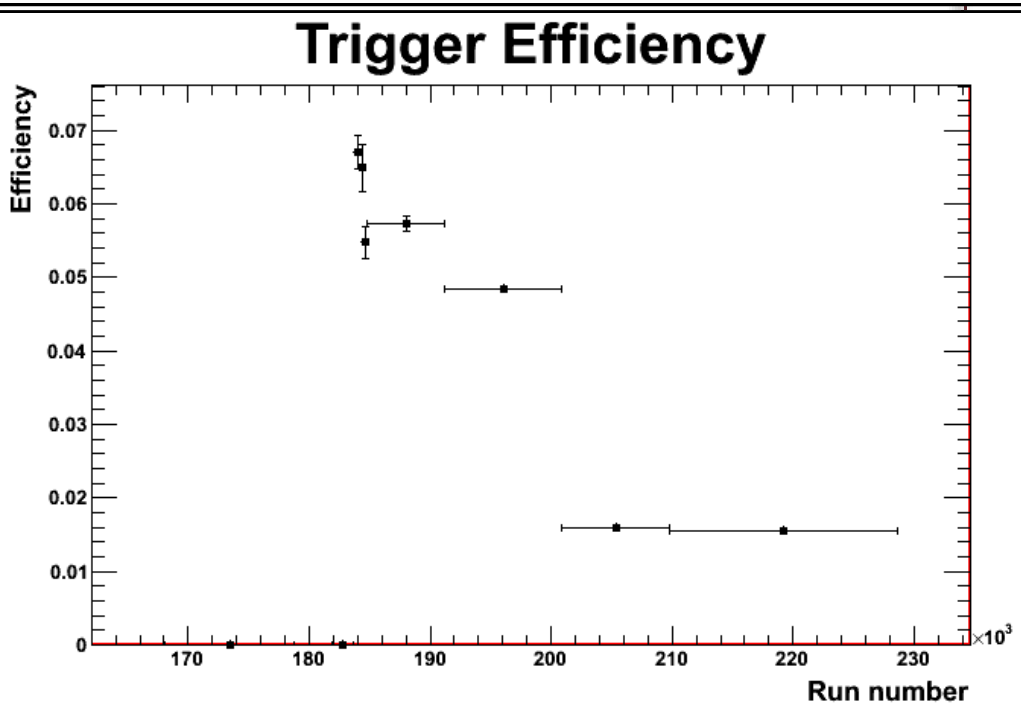
- In this presentation-Blessing Update
  - New signal MC expected events
    - Two new reweightings
  - Changes to systematic uncertainties
  - These lead to new limits

Questions Trigger Eff



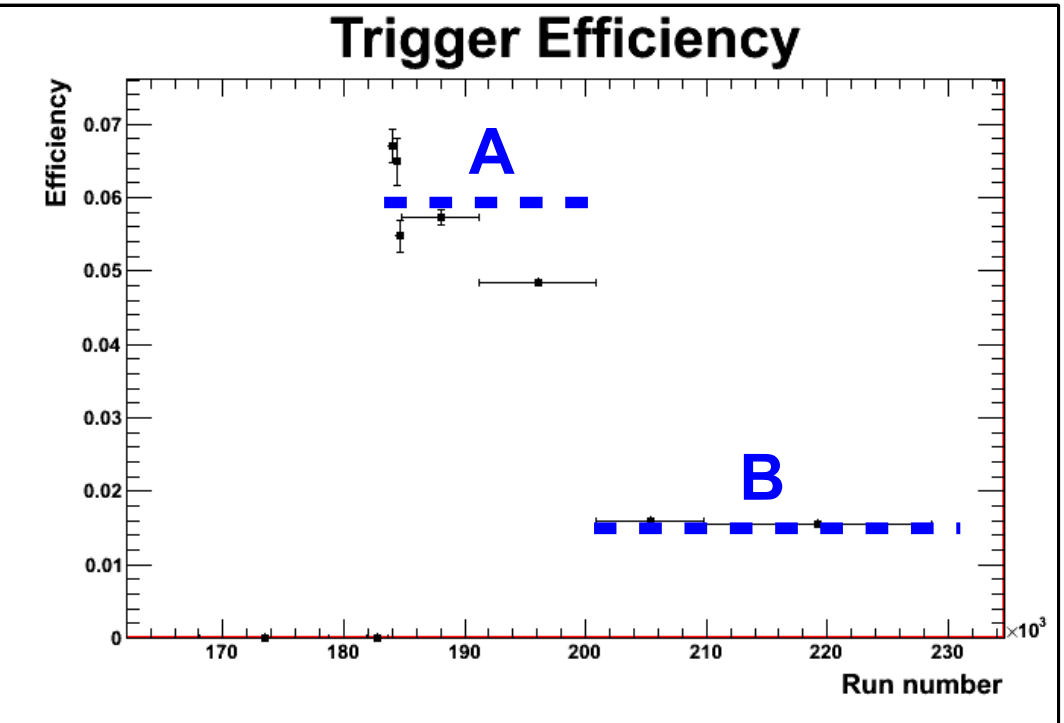


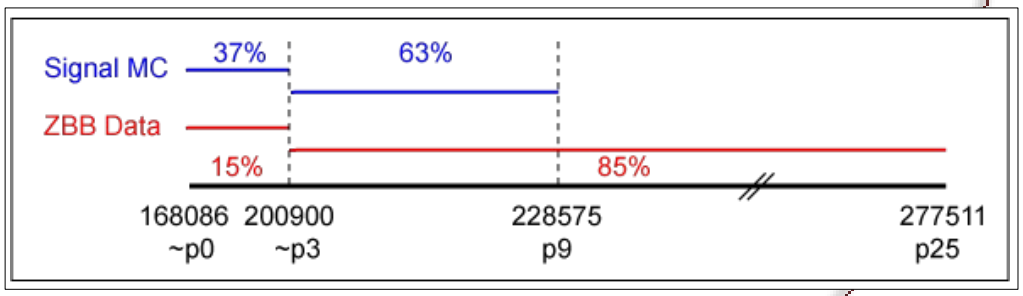
- Each points represents a trigger chunk, where the trigger simulation has a slightly different simulation
- The trigger efficiency vs. time shows that the efficiency is separated into two “periods”.



Trigger Efficiency

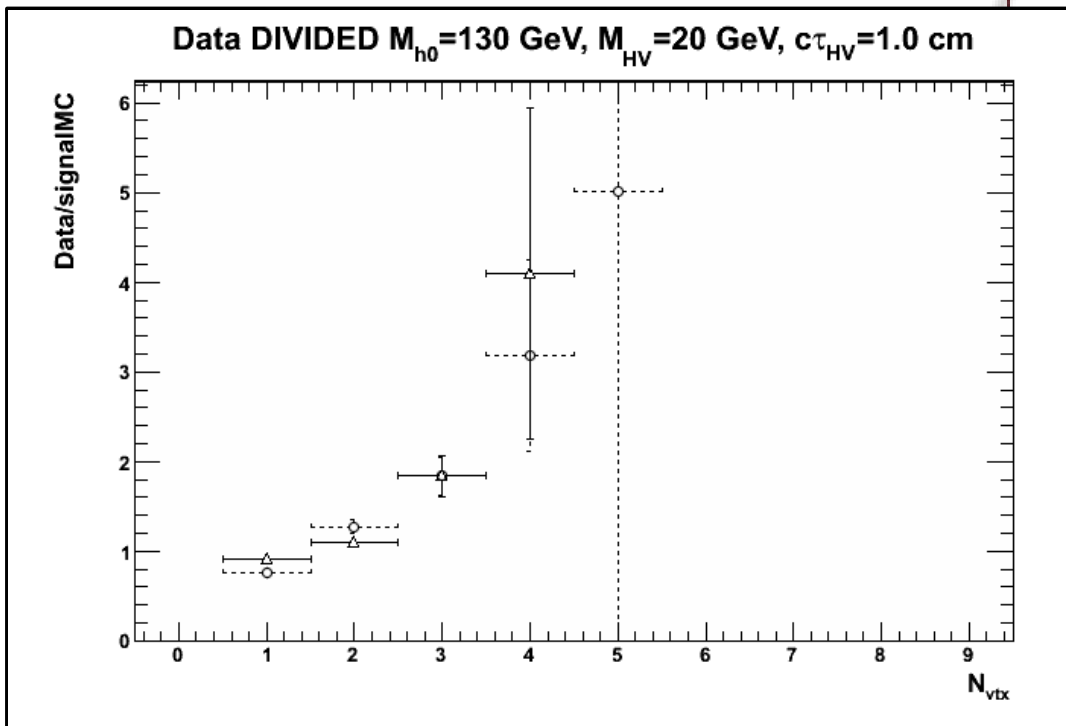
- Let's define the early trigger efficiency period as Period A and the latter as Period B.
  - The barrier is Run 200900.
  - At this point, the L2 SVT requirements changed
  - Period A: and two SVT tracks (which matched jets)
  - Period B: the two SVT tracks have $\Delta\phi$ requirements
    - Same Side (SS): $2^\circ < \Delta\phi < 3^\circ$
    - Opposite Side (OS): $150^\circ < \Delta\phi < 180^\circ$
  - However in the ZBB trigger path, period B represents about 85% of the events collected.





Trigger Efficeincy

- We weight the signal MC events to the data run range
  - $exp.SignalMC = Y_A \frac{\sigma L_A}{N_A} + Y_B \frac{\sigma L_B}{N_B}$
  - Y_i is the yield of signal MC events for a given period
- This also leads to a second weighting, one to account for the differences in the luminosity in the signal MC and ZBB trigger data.
  - Much of the data events come from later dates, which correspond to higher luminosity runs.
  - Weight signal MC events using the number of primary vertices (N_{privtx}) as the variable of interest. Weighting N_{privtx} changes the luminosity profile of the signal MC to match that of the data.
  - Divide N_{privtx} in data by signal MC
  - Use these values as weights for individual events
  - $Y_i = \Sigma w_i$



Questions: Systematic Unc.

- We change the systematic uncertainties associated with the signal MC for this analysis.
- The systematic for the signal MC trigger efficiency should be negligible because of the new weighting scheme previously discussed.
- We take into account a new systematic to account for the effect of the ZBB trigger simulation used on the signal MC
  - This is from Julien and Ken's studies for the Z to bbbar cross-section measurement.
  - They measure a systematic associated with the L2 track portion of the ZBB trigger path of : (1.12 $\pm$ 0.10)

Number Expected Signal MC

- Previous only contains the BTSF of 0.91.
- Reweight 1 is to adjust signal MC to data luminosity (Periods A and B)
- Reweight 2 is to adjust signal MC to data's N_{privtx} distribution
- Final SF includes the trigger SF of 1.12.
- The bottom table shows the percent difference when each change is applied, w.r.t. to “one column to the left.”

M_{h0} (GeV)	M_{HV} (GeV)	$c\tau_{HV}$ (cm)	Previous	Reweight1	Reweight2	Final SF
130	20	1	0.73	0.56	0.55	0.64
170	20	1	0.086	0.063	0.065	0.074
130	40	1	0.38	0.23	0.23	0.26
170	40	1	0.49	0.33	0.33	0.38
170	65	1	0.21	0.13	0.12	0.14
130	40	0.3	0.38	0.21	0.21	0.24
130	40	2.5	0.14	0.086	0.088	0.101
130	40	5	0.049	0.036	0.038	0.043

M_{h0} (GeV)	M_{HV} (GeV)	$c\tau_{HV}$ (cm)	%change →	Reweight1	Reweight2	Final SF
130	20	1		-23.07%	-1.49%	14.5%
170	20	1		-26.97%	2.73%	14.5%
130	40	1		-40.02%	0.83%	14.5%
170	40	1		-33.08%	-0.45%	14.5%
170	65	1		-39.37%	-2.75%	14.5%
130	40	0.3		-45.58%	0.93%	14.5%
130	40	2.5		-38.21%	2.37%	14.5%
130	40	5		-25.68%	4.09%	14.5%

Results

- The resulting changes to the signal MC result a new yield on the number of expected signal MC events for the analysis.
- Also, new systematic uncertainties results.
- Tables of these are presented on the next slides.

- Afterward there are slides showing the new p-values and limit results, followed by new limit graphs.

To be blessed

Higgs Mass (GeV)	HV Mass (GeV)	HV life-time (cm)	Expected Signal MC	Background Estimate	Number Observed
low HV mass search					
130	20	1.0	0.64	0.58	1
170	20	1.0	0.074	0.58	1
high HV mass search					
130	40	1.0	0.26	0.29	1
170	40	1.0	0.38	0.29	1
170	65	1.0	0.14	0.29	1
130	40	0.3	0.24	0.29	1
130	40	2.5	0.10	0.29	1
130	40	5.0	0.043	0.29	1

To be blessed

Uncertainty	Down (%)	Up (%)
Background estimite - low HV mass search		
Data statistics	±0.039	
B-tag prob. statistics	-7.74	3.42
Flavor composition	-0.5	2.75
Background estimate - high HV mass search		
Data statistics	±0.046	
B-tag prob. statistics	±3.92	
Flavor composition	-0.5	8.91
Signal MC		
Jet Energy Scale	-15.6% to -6.3%	4.0% to 25.5%
Trigger Unc.	±8.9	
B-tagging scale factor	±10	
P.d.f.	±2.5	
Luminosity	±6	

Higgs Mass (GeV)	HV Mass (GeV)	HV life-time (cm)	JES Down (%)	JES Up (%)
low HV mass search				
130	20	1.0	12.97	14.32
170	20	1.0	12.5	10.71
high HV mass search				
130	40	1.0	15.58	16.08
170	40	1.0	8.8	7.89
170	65	1.0	6.33	4.0
130	40	0.3	16.49	12.8
130	40	2.5	14.27	21.27
130	40	5.0	13.56	25.52

To be blessed

Higgs Mass (GeV)	HV Mass (GeV)	HV life-time (cm)	p-value
low HV mass search			
130	20	1.0	0.44
170	20	1.0	0.43
high HV mass search			
130	40	1.0	0.27
170	40	1.0	0.26
170	65	1.0	0.26
130	40	0.3	0.27
130	40	2.5	0.27
130	40	5.0	0.27

Higgs Mass (GeV)	HV Mass (GeV)	HV life-time (cm)	Obs. Limit (pb)	Expected Limit (pb)				
				-2 σ	-1 σ	median	+1 σ	+2 σ
low HV mass search								
130	20	1.0	6.2	4.3	4.3	4.3	6.2	8.4
170	20	1.0	22.1	15.2	15.2	15.2	22.1	29.9
high HV mass search								
130	40	1.0	15.9	10.5	10.5	10.5	15.9	21.5
170	40	1.0	4.4	2.9	2.9	2.9	4.4	6.0
170	65	1.0	11.7	7.7	7.7	7.7	11.7	15.7
130	40	0.3	17.8	11.7	11.7	11.7	17.8	24.2
130	40	2.5	40.7	26.8	26.8	26.8	40.7	55.1
130	40	5.0	94.3	62.0	62.0	62.0	94.3	127.9

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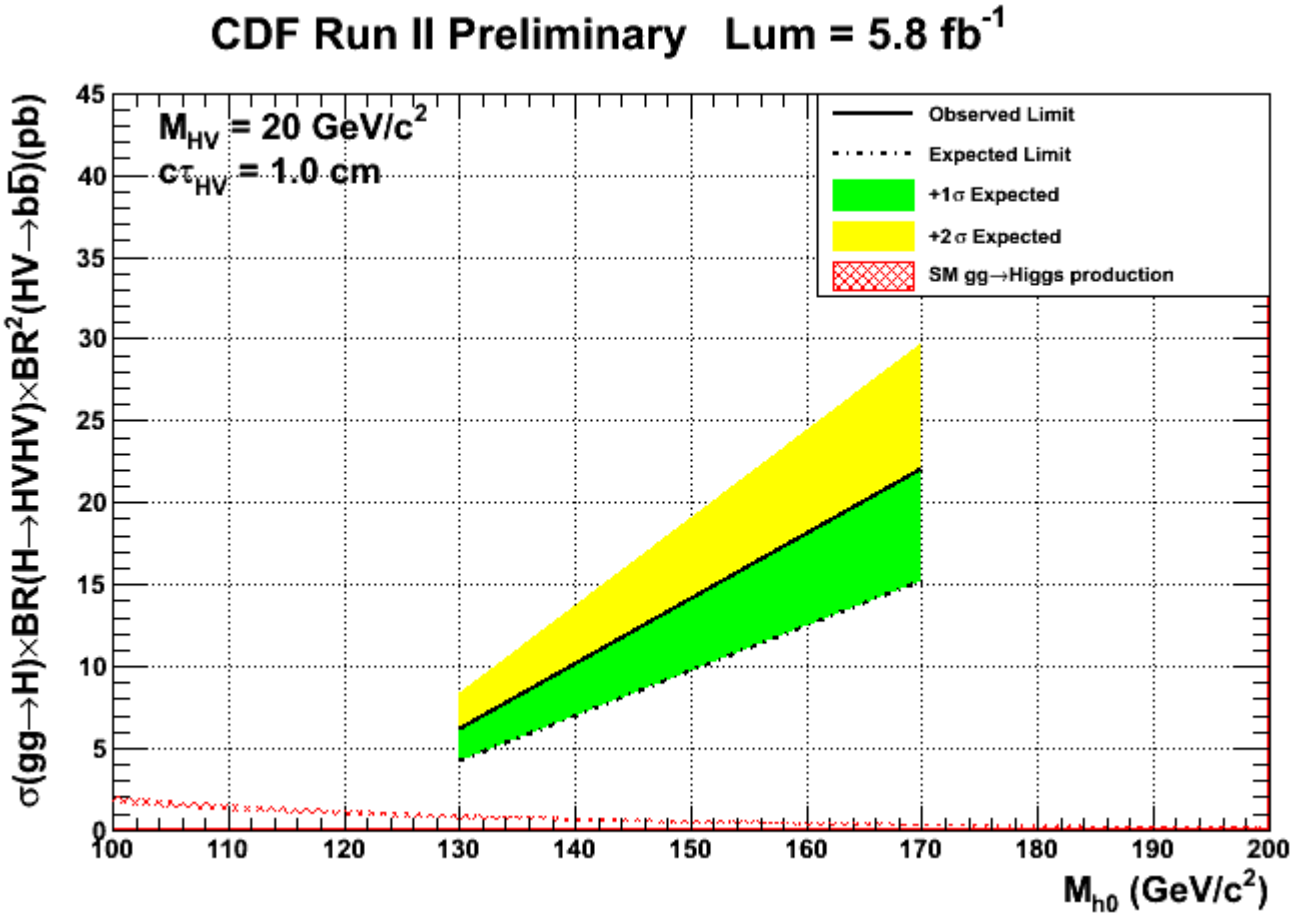

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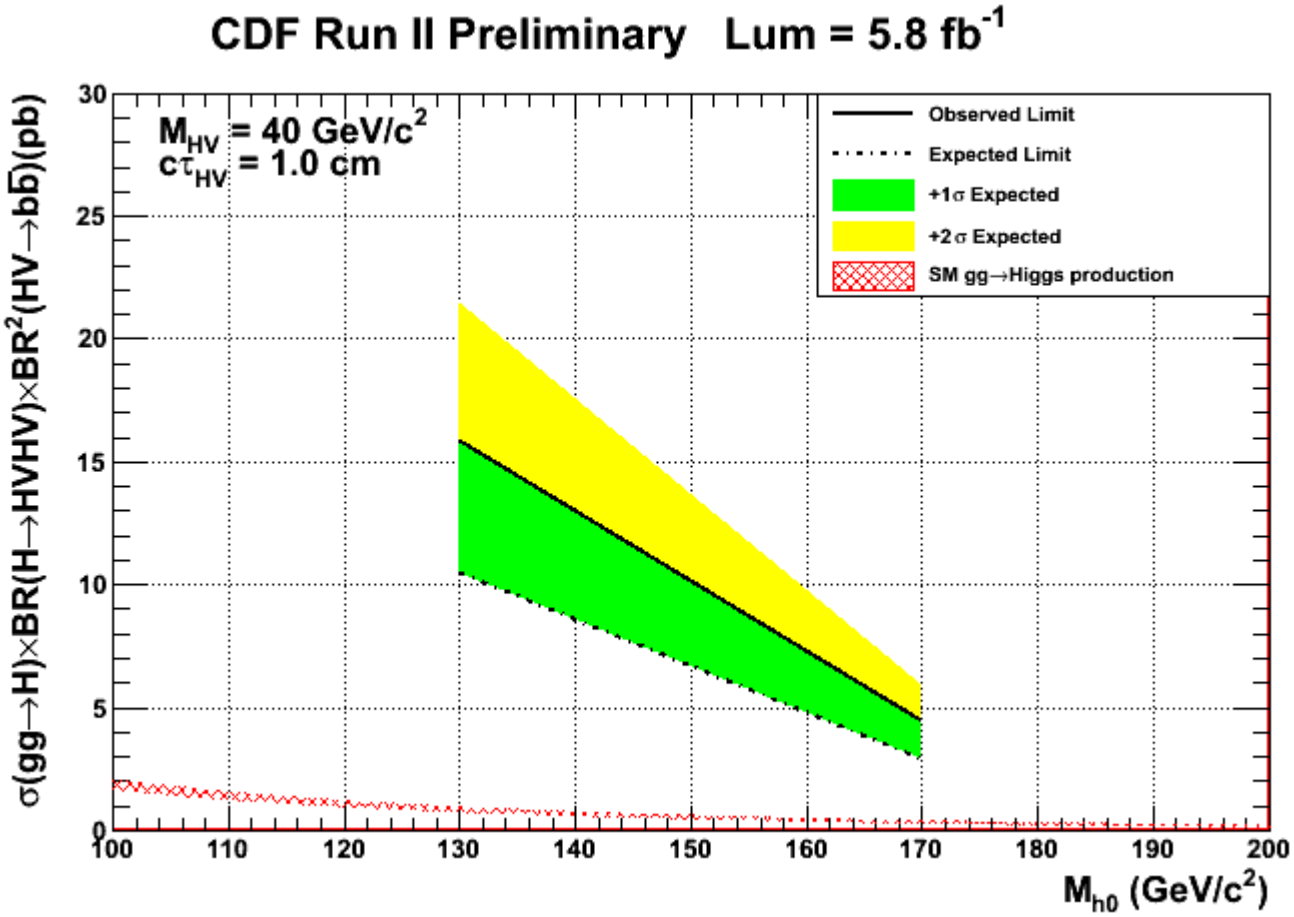

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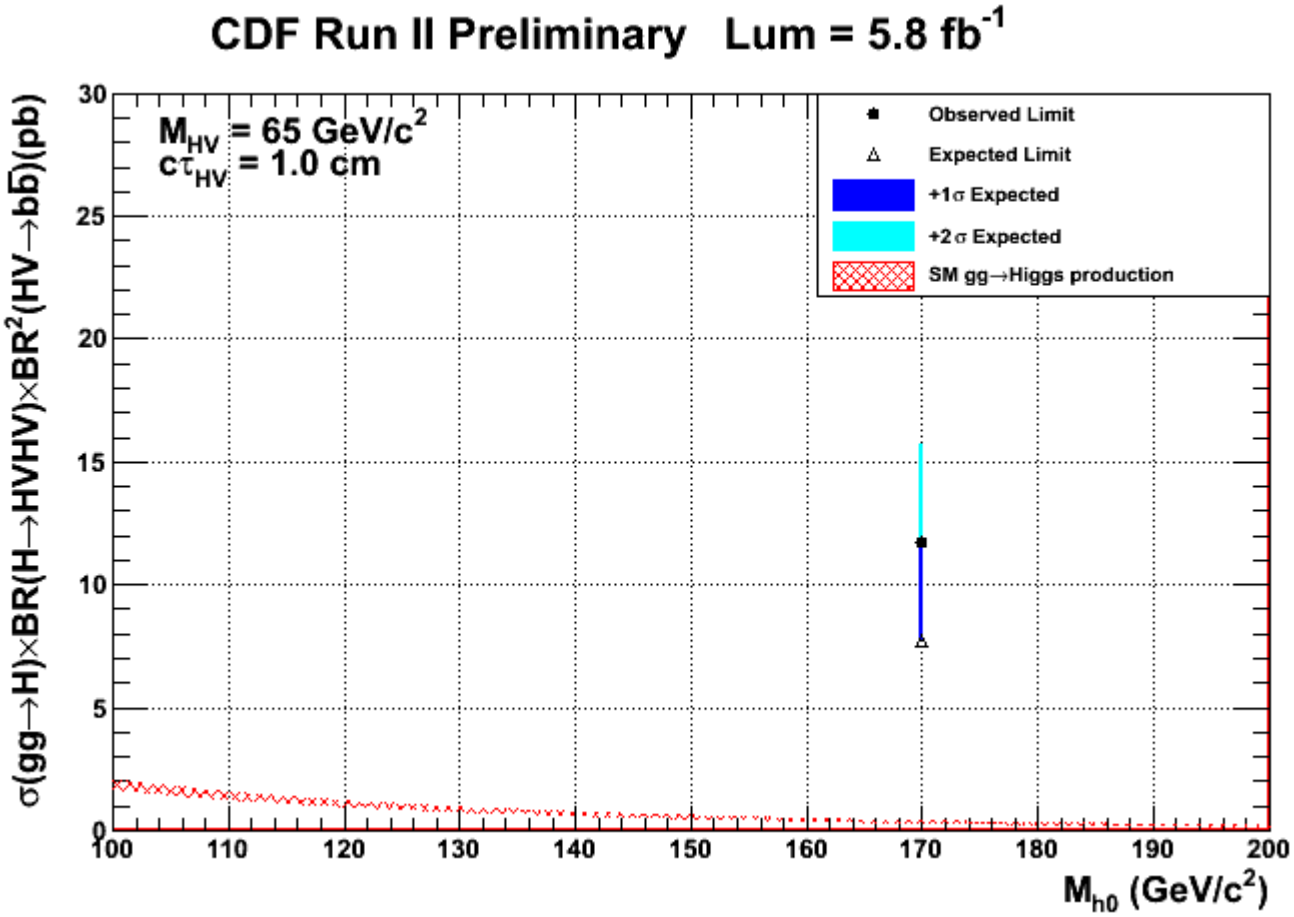

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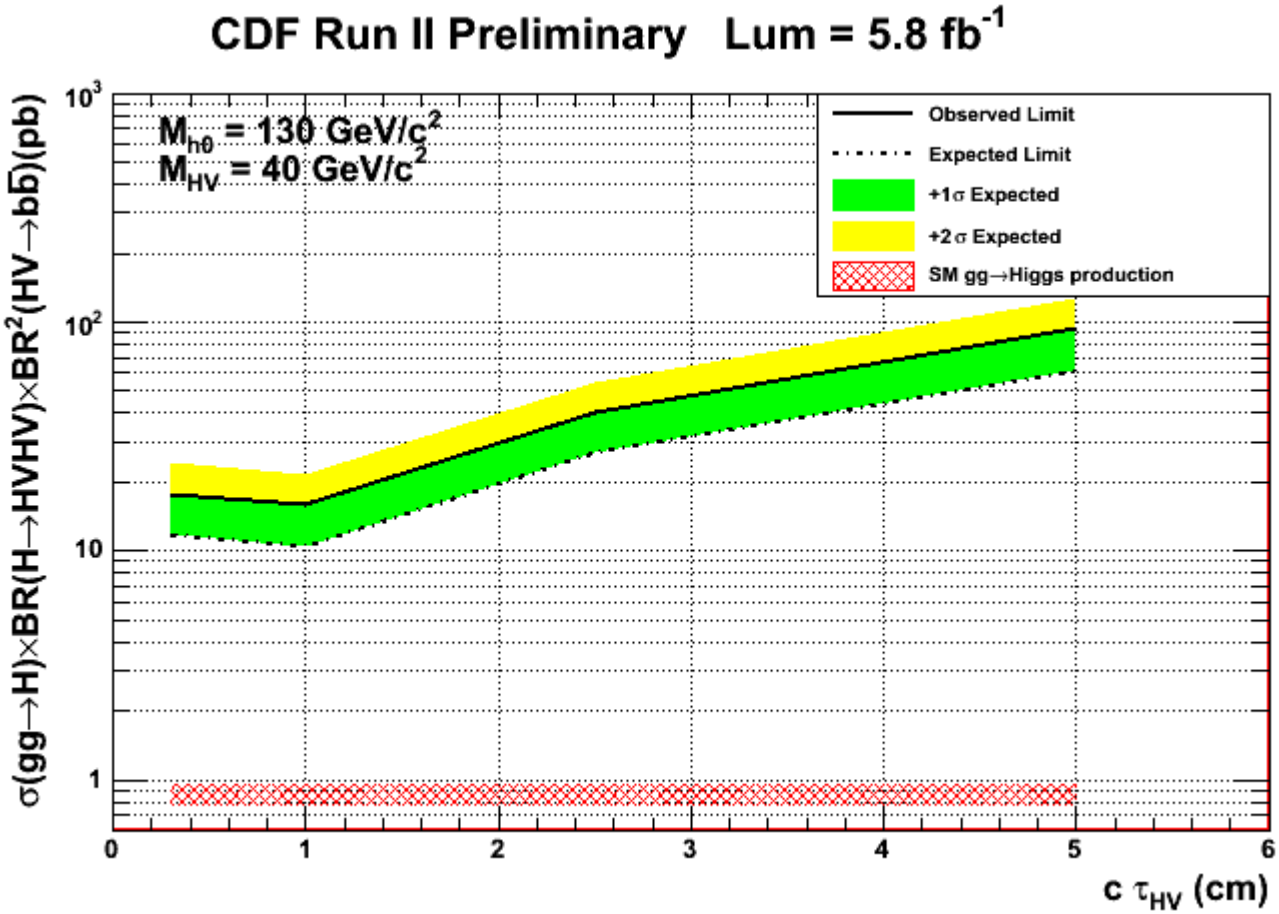


Conclusion

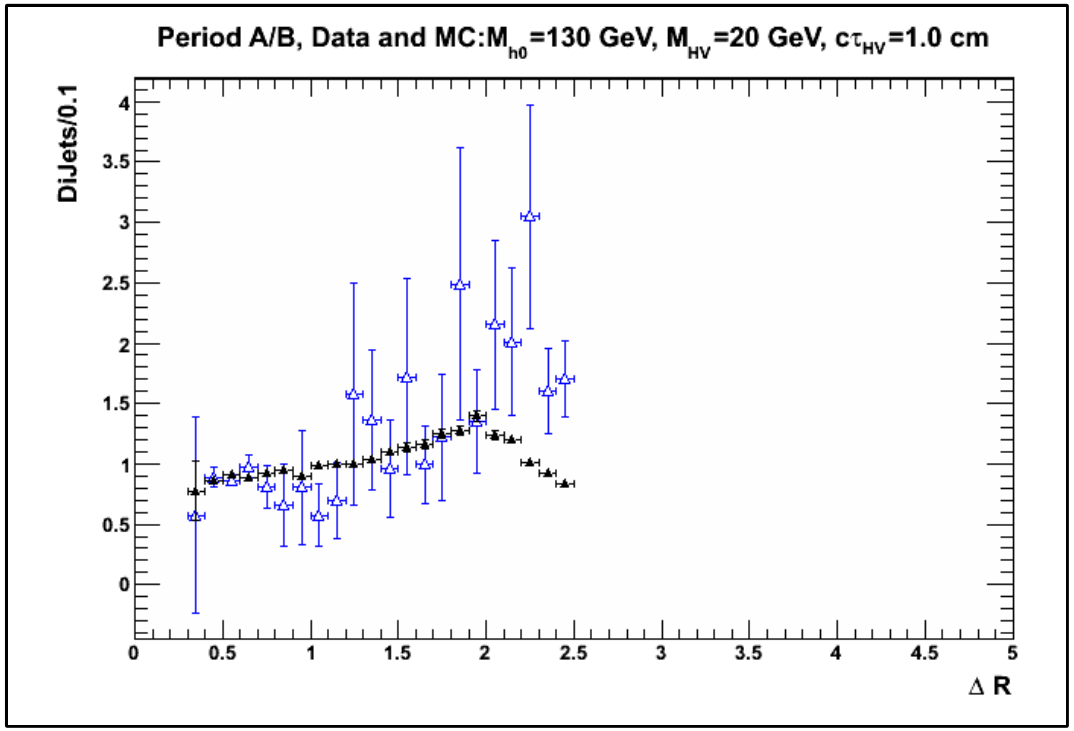
- Presented new results for the Hidden Valley Higgs Search.
- CDF Notes 10315 and 10356 will be updated accordingly with these results.

Backup

- Backup Slides of Delta R

ΔR study

- Plot the difference in ΔR between periods A and B for both signal MC (blue) and data (black).
- Distributions are very similar, i.e. statistical effects.



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