Higgs WG: theory

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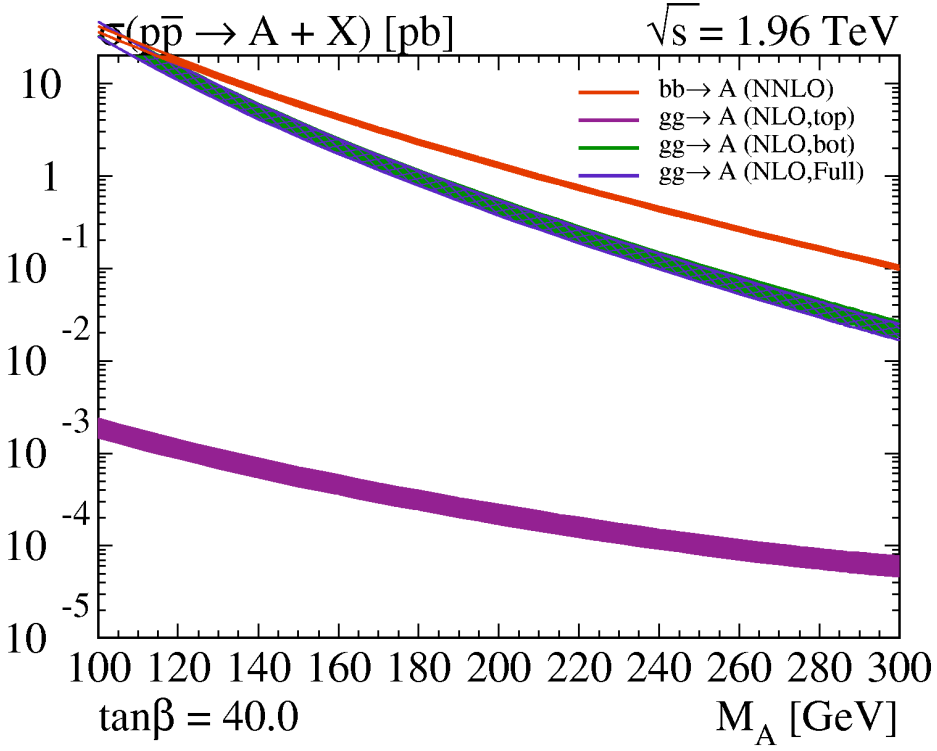
TABLE I: **Possible explanations consistent with LEP Higgs search results.** Ranges of neutral and charged Higgs masses consistent with background only hypotheses as well as one, two or three "signal" hypotheses are listed. The column headed by "Signals" indicates what signals might have appeared for a given model. Qualitative $\tan\beta$ and Higgs coupling ranges for each individual parameter space is given. All ranges should be understood as indicative of the allowed region at the roughly 10% accuracy level: fine scans of the parameter space have not been performed. For Higgs state φ_i the $ZZ\varphi_i$ coupling is $(g_2 M_Z/\cos\theta_W)C_i$, approximate values are given in the table. The column marked ϕ indicates a non-trivial phase $\phi_{\mu A_t}$ is needed. When there is nontrivial phase, m_A is understood as the mass of the neutral Higgs with smallest C_{ZZH_i} coupling. The column μ indicates the presence of a large μ term. The column marked U indicates this scenario is compatible with a unified SUSY breaking scenario such as mSUGRA. We believe all other such scenarios effectively reduce to one of these.

No.	m_h	m_A	m_H	$m_{H^\pm}$	Signals	$\tan\beta$	C_h^2	C_H^2	U	μ	ϕ
1	98	89	115	112-123	98,115,187	6-12	0.2	0.8		Y	Y
2	98	$< m_h$	115	106-127	98,115	4-13	0.2	0.8		Y	Y
3	98	$\approx m_h$	115	121-136	98,115	5-50	0.2	0.8			
4	98	115-130	115	112-124	98,115	10-24	0.2	0.8		Y	
5	70-91	96-116	115	110-140	115,187	10-50	0.0	1.0		Y	
6	98	89	> 115	118-127	98,187	6-10	0.2	0.8		Y	Y
7	82-110	$< m_h$	115	$\sim m_A$	115	7-50	0.0	1.0		Y	Y
8	82-110	$\approx m_h$	115	$\sim m_A$	115[c]	5-50	0.0	1.0	Y		
9	82-110	115-140	115	$\sim m_A$	115	6-24	0.0	1.0		Y	
10	115	$m_A \approx m_H > 115$		$\sim m_A$	115[c]	3-50	1.0	0.0	Y		
11	98	100-130	120-130	$\sim m_A$	98	5-50	0.20	0.80			
12	98	< 98	120-130	106-128	98	4-13	0.20	0.80		Y	Y
13	65-93	94-120	116-125	110-140	187	8-50	0.0	1.0		Y	
14	80-100	25-40	133-154	109-130	None[a]	2-5	0.5-0.8	0.2-0.5		Y	Y
15	111-114.4	$m_A \approx m_H > 114.4$		$\sim m_A$	None[b]	2.1-4	1.0	0.0			
16	70-114.4	90-140	> 114.4	$\sim m_A$	None	4-50	0.0	1.0	Y		
17	> 114.4	$m_A \approx m_H > 114.4$		$\sim m_A$	None[c]	4-50	1.0	0.0	Y		

[a] Dominant decay is CP violating process $H_2 \to H_1 H_1$. This case was studied in Ref. 18.
[b] The "invisible" decay $h \to \tilde{N}_1\tilde{N}_1$ and $h \to b\bar{b}$ decays are comparable (*i.e.* $\mathrm{Br}(h \to \tilde{N}_1\tilde{N}_1)$ ranges from 30 to 60%).
[c] These scenarios were studied in Ref. 15.

Gordon Kane

$\sigma_A(\tan\beta = 40)$ at the Tevatron

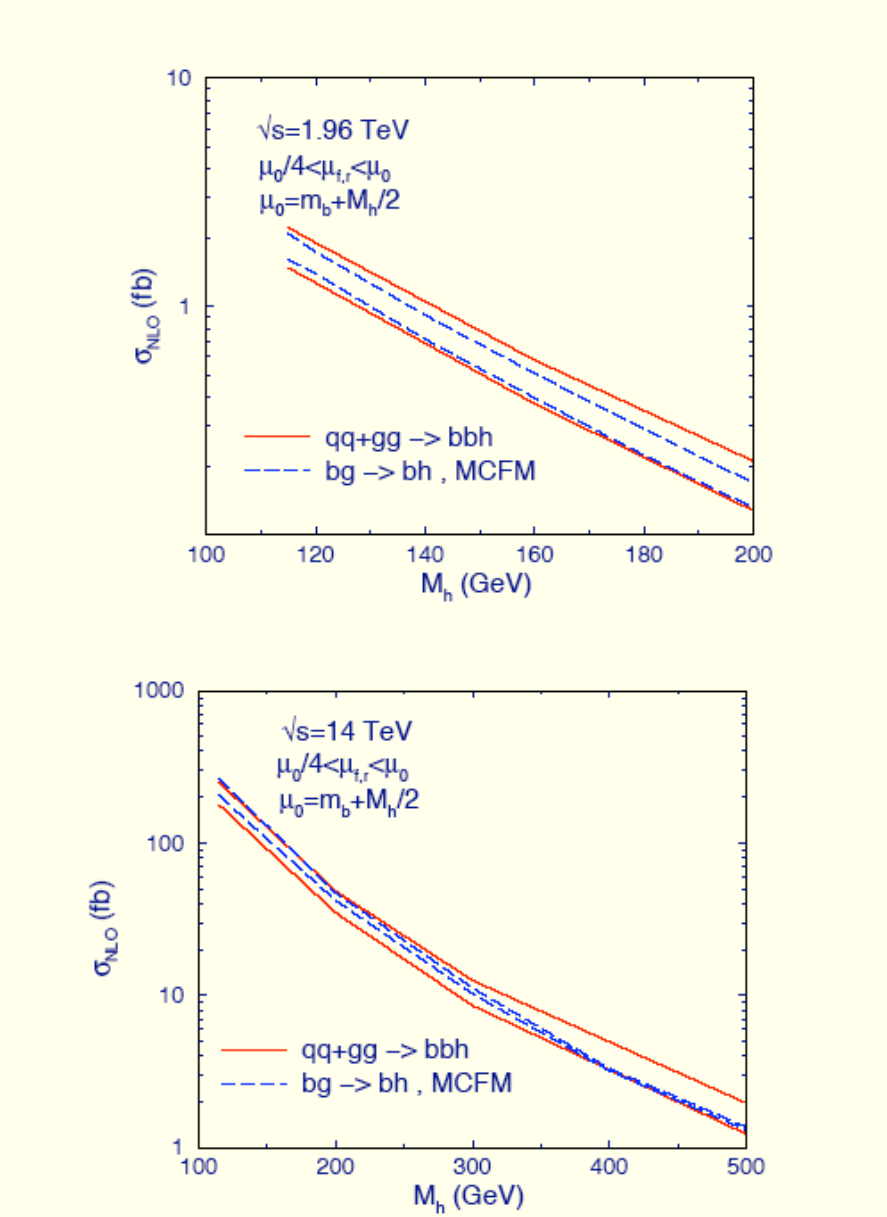


Cross sections (pb) for Z + "inclusive b" production

Process LO	TeV	LHC
qq > Zbb	25.3	170
bb>Z	14.7	735

Very similar to bb>H

Higgs Working Group @ TEV4LHC, September 2004

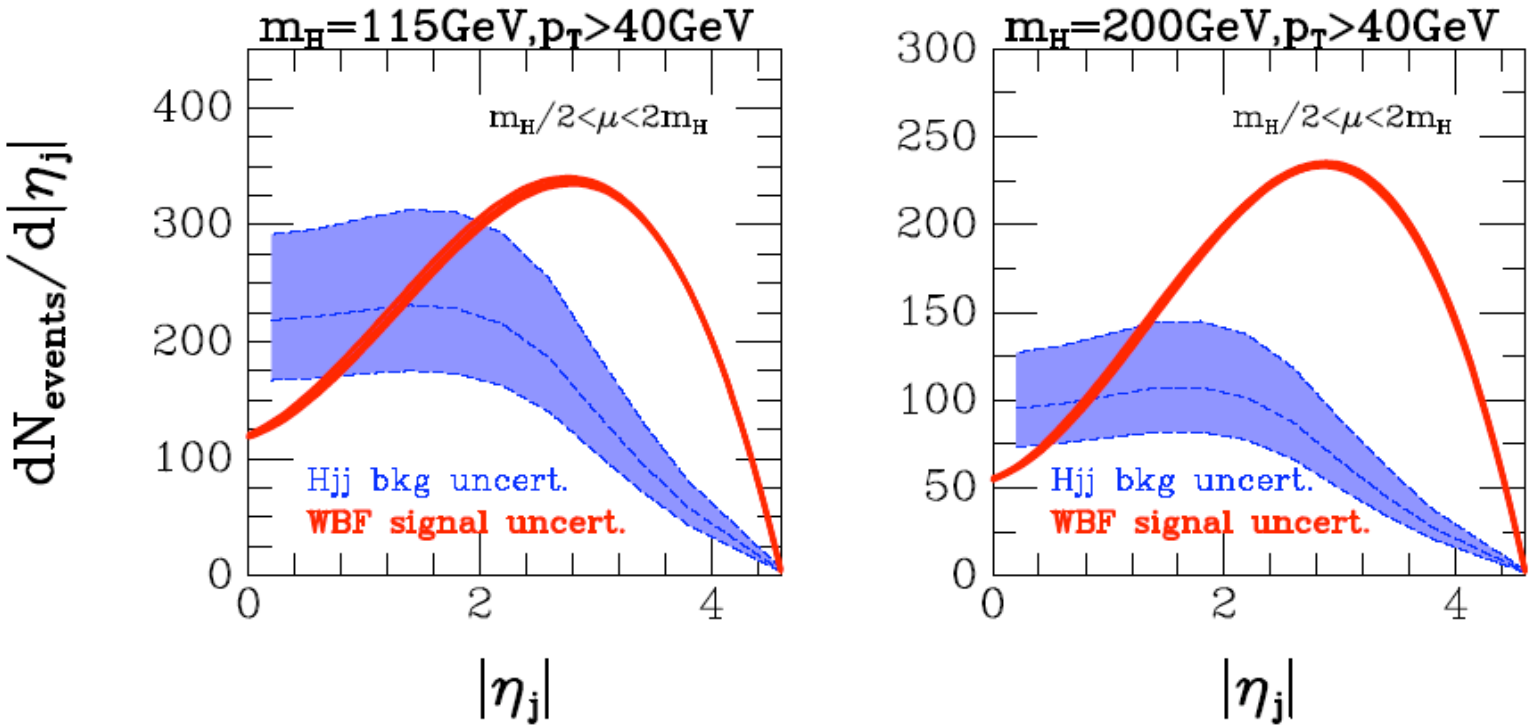


Chris Jackson

$H + 2$ Jet Production – μ dependence

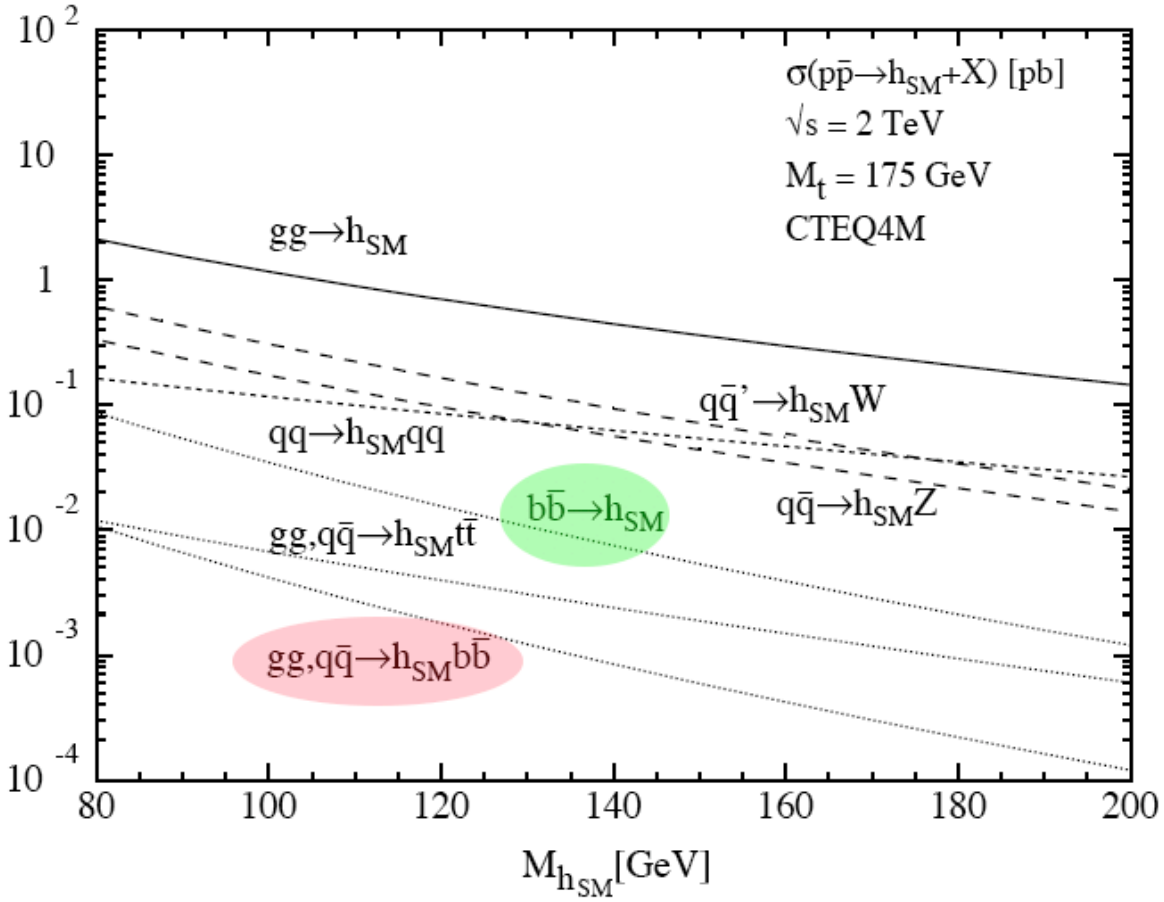
- Higgs boson H production via WW scattering in NLO and via gg QCD processes (LO)

  hard-scale μ variation from $\mu = m_H/2$ to $\mu = 2m_H$:



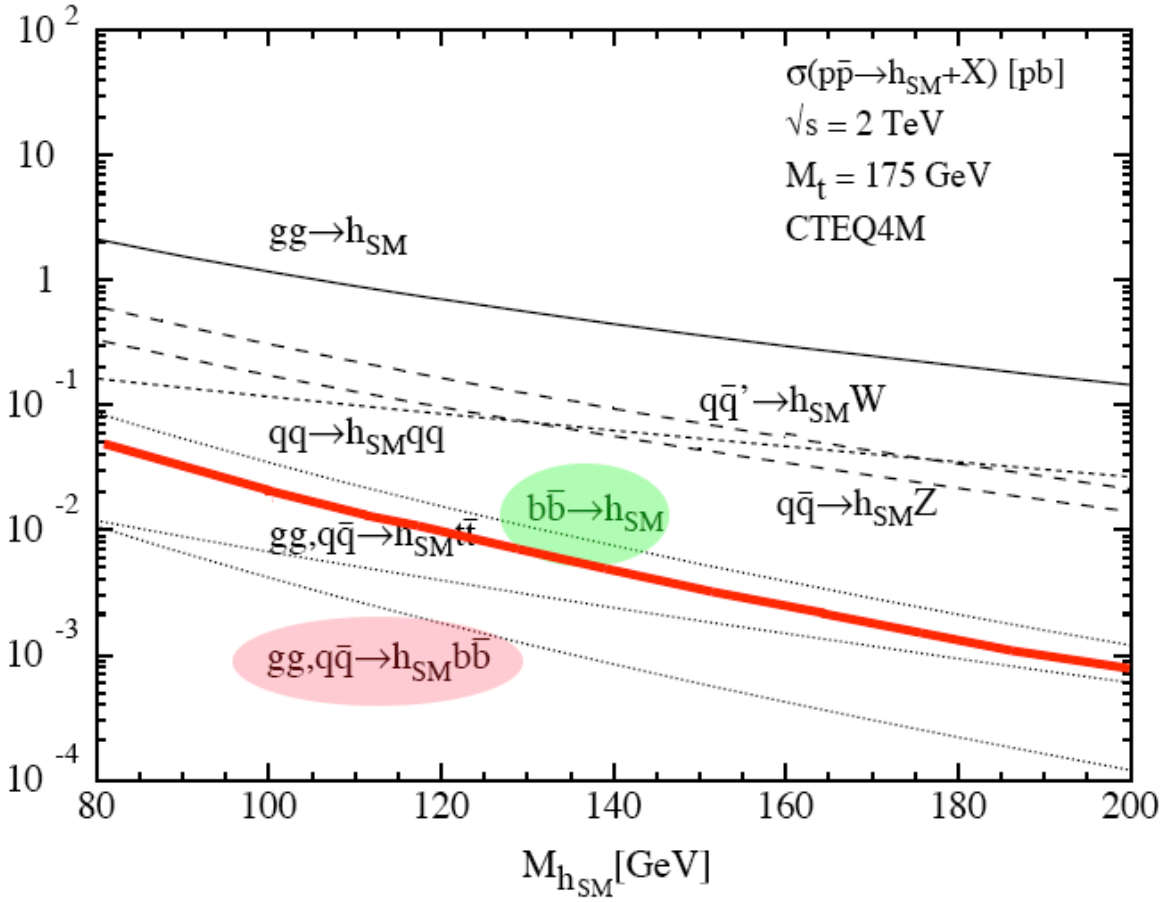
Possible projects

Higgs cross sections



Higgs Tevatron Workshop 1998

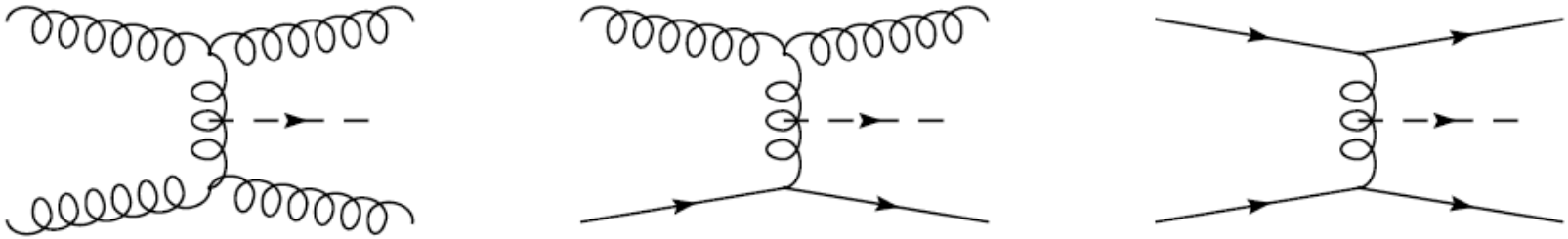
Higgs cross sections



Higgs Tevatron Workshop 1998

$H + 2$ Jet Production – Irreducible Background

- Higgs boson H production via gg scattering. Ex:



- Fully differential NLO calculation of $H + 2$ jet production does not exist; contribution computed at LO Kauffman Desai and Risal, PRD55, 4005 (1997); PRD58, 119901 (1998)

Proposal for the TEV4LHC

Study "inclusive" bottom measurements in W/Z production

Why ?

theory: we can predict cross sections extremely well

experiment: new approach, maybe better sensitivity

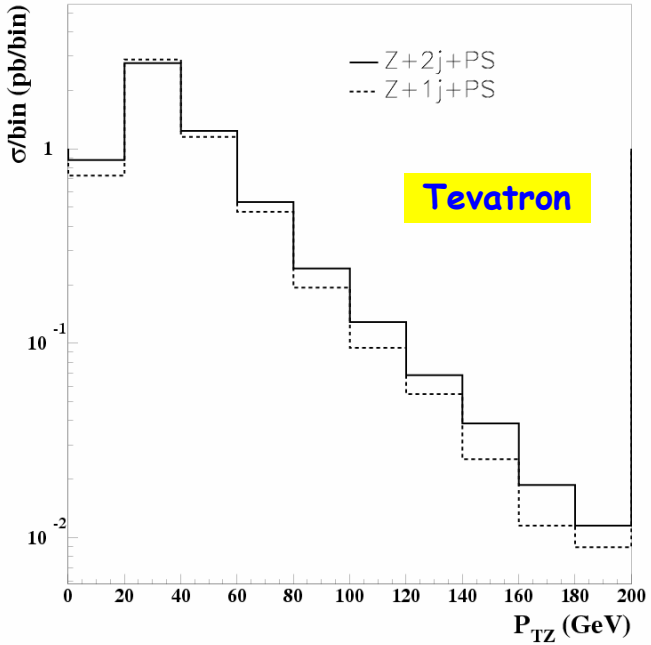
How ?

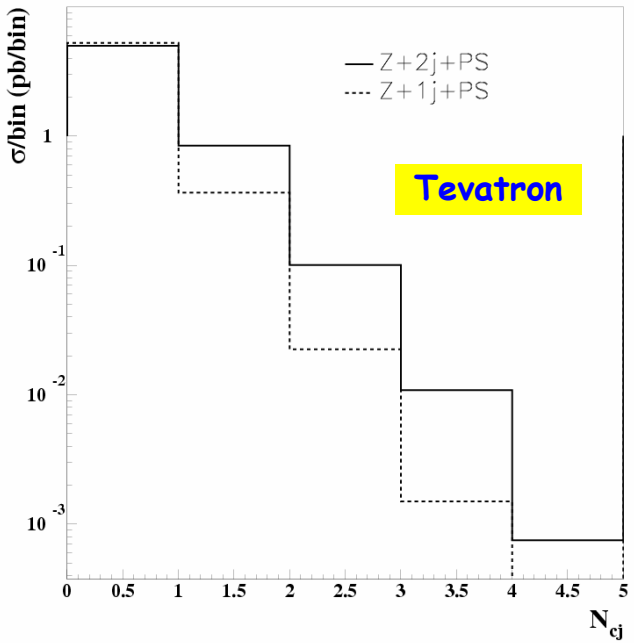
theory : perform the new NLO (and NNLO) calculations for Z and W that are needed

experiment: look at what CMS has done, use CDF and DO data for Wbb and Zbb to test feasibility, find efficiencies, etc...

Higgs Working Group @ TEV4LHC, September 2004

- Require at least one jet with P_T>20 GeV
- To define an extra jet P_T>20 GeV is also required
  - N_{cj} = number of extra jets with $|\eta|<2$





BSM Higgs

- Non-standard Higgs at the Tevatron
- MSSM Higgs and beyond
- ...