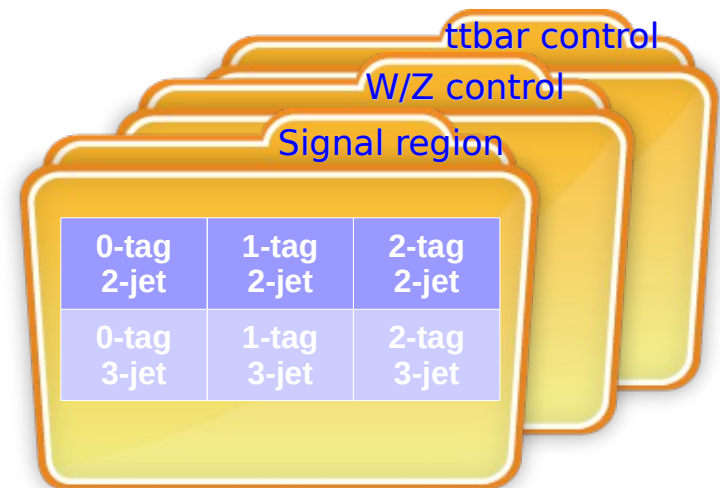


Updates BSM Higgs searches

Xiaohu Sun(IHEP), 25-03-2014

VH analysis

- Searching for $V(jj)H(\text{inv.})$ with final states: $jj+\text{MET}$
 - Cut $\text{MET} > 120 \text{ GeV}$, for the regions below the MET trigger plateau, use the complicated MET SF measurements derived in HSG5
- Do a global fit on pTV distribution over all the possible regions for signal extraction and background control simultaneously
 - SR: 0/1/2 tagged jets, 2/3 jets
 - Wjets: one-lepton regions
 - Zjets: two-lepton regions
 - ttbar: emu control regions

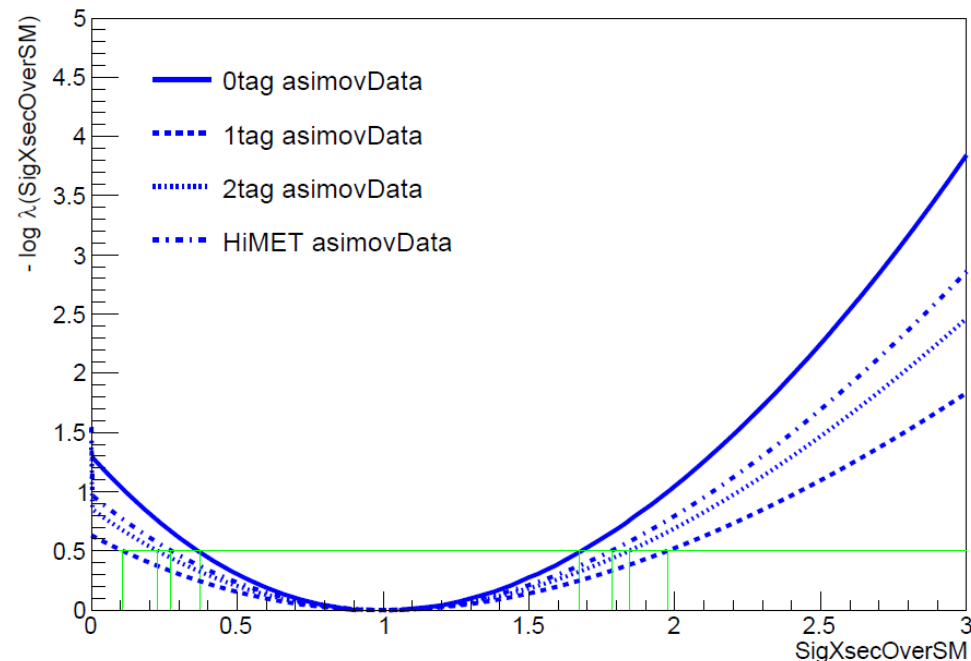


3-jet stands for
3 jets exclusive

Expected sensitivities @ $m_H=125\text{GeV}$

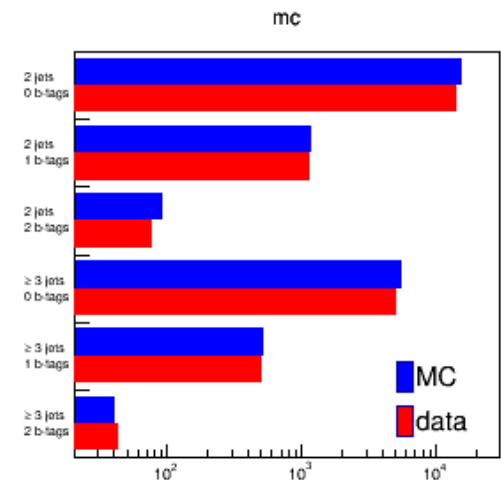
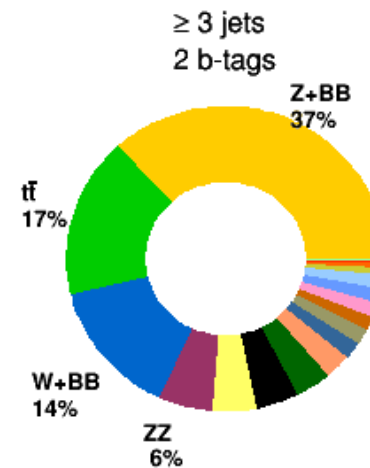
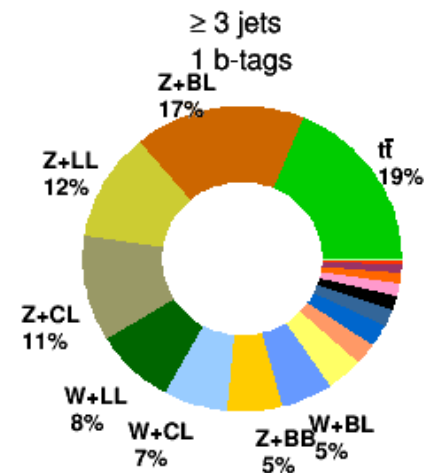
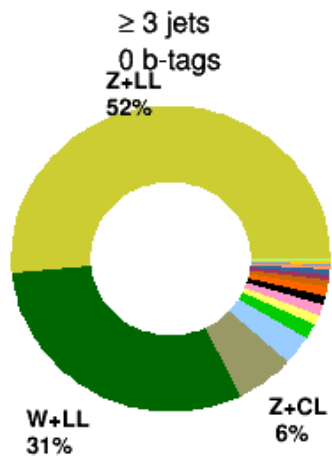
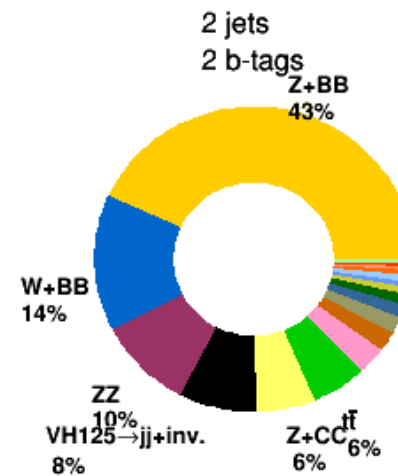
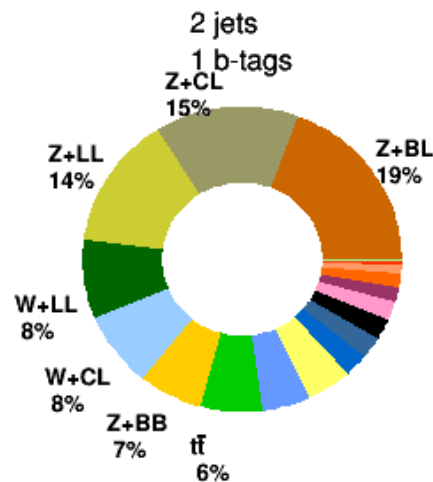
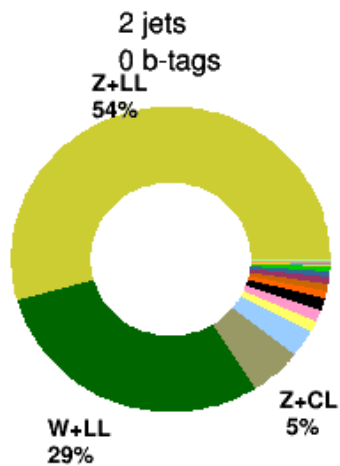
- Test **2-tag, 1-tag, 0-tag** and **Highest MET** regions exclusively
- It is very important to include 0/1-tag regions in the global fit, since they have similar sensitivities that can improve the result only from 2-tag events
- To compare with analysis on Fat-jet based Higgs $\rightarrow$ inv. search, we test on HiMET region ($\text{MET} > 300\text{GeV}$), which shows that its sensitivity is also important in our analysis
 - VH limit ~ 1.6
 - Fat-jet limit ~ 2.2

inclu region	median	+1 σ	-1 σ	+2 σ	-2 σ
2-tag	1.57	2.23	1.13	3.11	0.84
1-tag	1.80	2.55	1.30	3.55	0.96
0-tag	1.31	1.85	0.94	2.54	0.70
HiMET	1.61	2.31	1.17	3.20	0.87



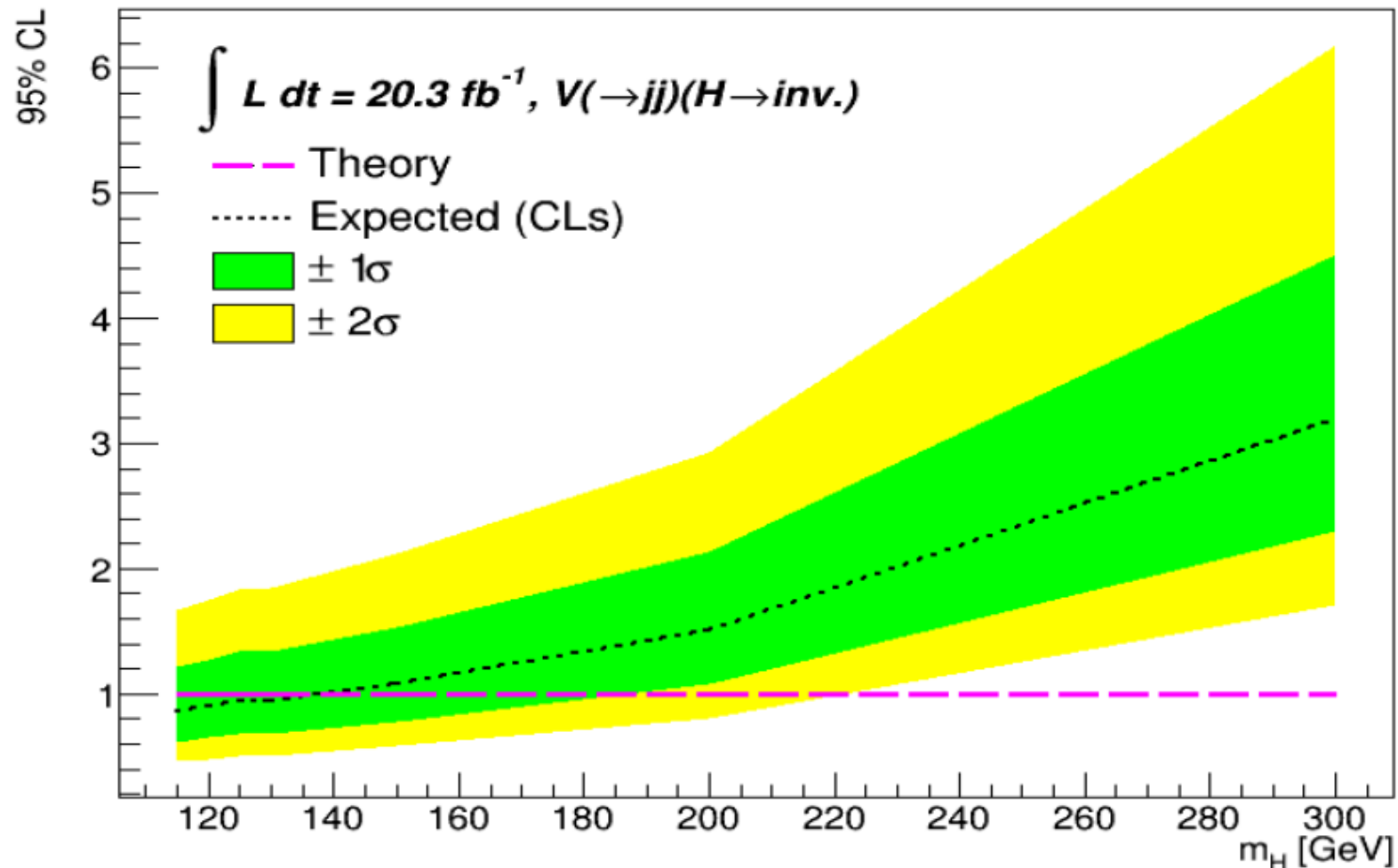
Background components

- For signal region with MET [200,300]
- 2-tag: higher signal purity; 1-tag: too many V+hl; 0-tag: simple bkg composition



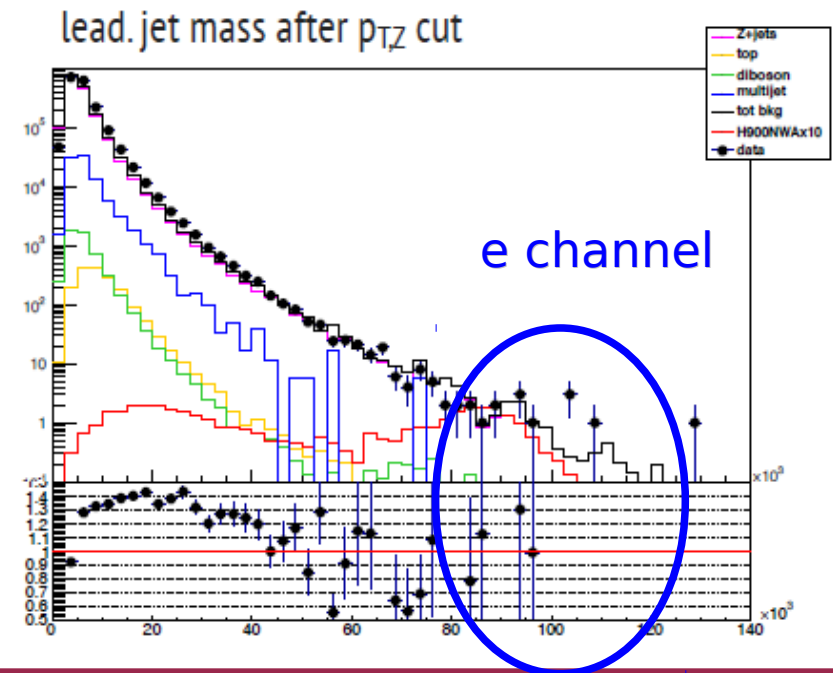
Expected limit

- Including all the tag/jet/MET bins we have, the expected limits are shown as below
- Expected ratio limits ~ 0.95 @ 125 GeV



VH - Summary

- The expected limit has been improved from using 2-tag 2-jet events to using 0/1/2-tag 2/3-jet events, shown from previous talk
 - <https://indico.cern.ch/event/302124/contribution/1/material/slides/0.pdf>
- 0/1-tag events have similar sensitivities, shown separately in this talk
- Next, to be studied
 - Better understanding of the NP behaviors
 - QCD (expected to be very small)
 - Diboson background
 - Binning effects
 - Possibilities in boosted regime
 - Documentation
 - etc.



H $\rightarrow$ hh analysis

- Still using ws provided by bbbb since Feb
- Starting to rebuild ws by crunching the numbers in bbyy notes, the last version was from Feb
 - Yu is building the ws and we are validating together
 - This week, we can have a ws ready for combination
- Private VBF H $\rightarrow$ hh production is close to the end

SM VBF H $\rightarrow$ yy analysis

- Maosen's thesis will focus on this analysis 8TeV $\rightarrow$ 14TeV
- Probably need help from Jin to get information on VBF SM H $\rightarrow$ yy analysis
 - A detailed INT note
 - A machinery on statistical interpretation

Backup slides

- **Follow HSG5 systematics:**

Experimental systematics:

- Jet energy scale (24(18) JES + 1 JER); HSG5 customed b-tagging (10b + 6 c + 1l) $\Rightarrow$ continuous b-tagging (10b + 15 c + 10 l)
- Lepton. smearing/scaling/isolation
- E_T^{miss} . Soft-term scale and resolution
- JVF. μ re-scaling
- triggers.

modeling systematics

for V+jets

- $d\phi$ corrections, p_T^V modeling , 3-jet/2-jet ratio
- m_{jj} shape and m_{bb} shape

for single-top and ttbar

- Dedicated p_T^V , m_{bb} and njets for different single-top/ttbar channels
- 3-jet/2-jet ratio, p_T^V uncertainty in ttbar, m_{bb} shape

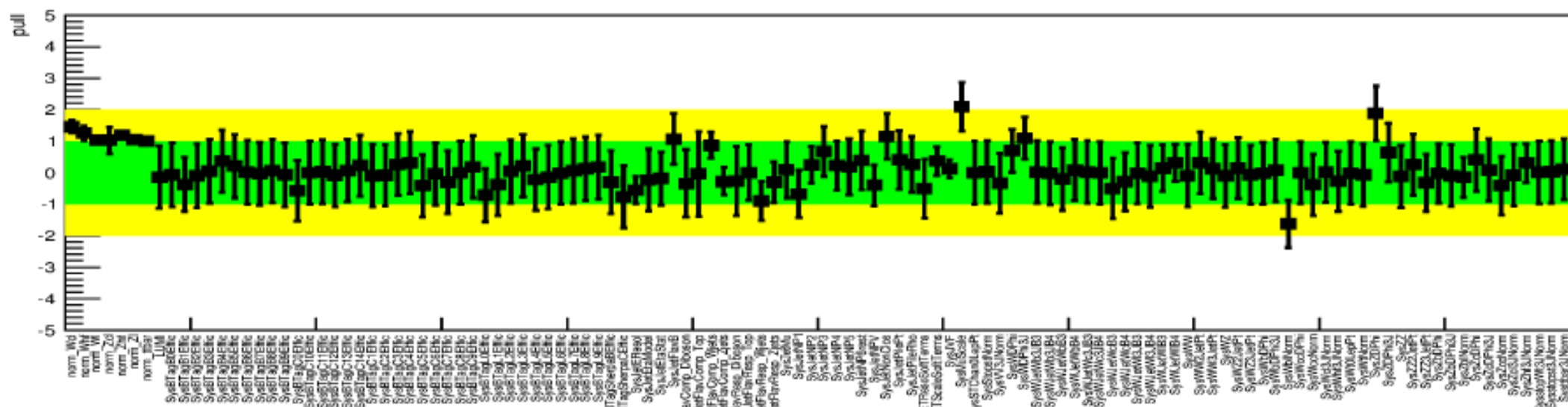
Event selection

Mass windows

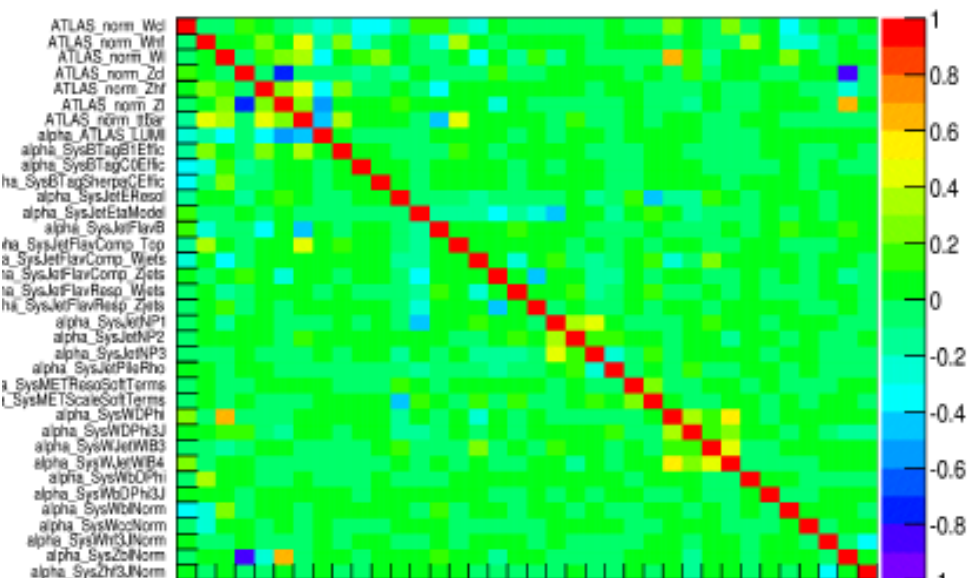
	MET	120-160	160-200	200 -300	> 300
	Min $\Delta\phi$ (MET,jets)	> 1.5	> 1.5	> 1.5	> 1.5
	$\Delta\phi$ (MET,MPT)	< $\text{Pi}/2$	< $\text{Pi}/2$	< $\text{Pi}/2$	< $\text{Pi}/2$
	DPhi(V,H)	> 2.8	> 2.8	> 2.8	> 2.8
	DeltaR(b,b)	> 0.7	> 0.7	-	-
	DeltaR(b,b)	< 2.0	< 1.5	< 1.	< 0.9
0-tag 2-jet		68. , 100.	70. , 98.	72. , 98.	74. , 102.
0-tag 3-jet		46. , 100.	54. , 102.	62. , 100.	72. , 102.
1-tag 2-jet		66. , 98.	68. , 96.	70. , 100.	74. , 102.
1-tag 3-jet		40. , 98	48. , 96.	60. , 98.	72. , 100.
2-tag 2-jet		68. , 100.	72. , 100.	74. , 102.	74. , 102.
2-tag 3-jet		58. , 100	60. , 100.	66. , 98.	72. , 102

Fitting cross-checks

Graph



correlation_matrix



- Running NP-ranking to check the impact of the strange-behaving NPs
- inputs histograms checking
- similar issues here: Zcl lack of constraint, trying put MV1c shape into fitting