

# SM Higgs for Summer

## p17 publications:

- WV->Inujj, finalizing systematics, cross-checks of background model
- WH->Inubb, systematics, trigger cross-checks
- ZH->nunubb, almost done

## In EB review:

- 2.3/fb ZH->ee/mumu bb, cross-checks, systematics, p17+p20 combination

## Working on for ICHEP (notes to conveners June 18th!):

- 3/fb WH->Inubb, data/MC comparisons, ME+NN
- p17 WH->taunubb, almost ready for review
- 3/fb ZH->nunubb, QCD improvements, MET40, 1tag, isotrack?
- 3/fb H->WW->Inulnu, new NN, new EM-ID, reanalyzed p17
- 2.3/fb H->WW->Inujj, re-weighting issues, sensitivity?
- 3/fb W/Z+H->l+l+, sensitivity?, needs optimization
- p17 ZH->tautaujj(bb), ~10% sensitivity, needs documentation
- p17(+p20?) VBF, study central-jet veto?
- 3/fb ZH->ee/mumu bb, ME+NN, new EM-ID, mu+track (more likely Fall'08)

# Color Flow

Look at energy radiated *between* jets

Gluon->bb vs. H->bb

Should be more energy radiated  
between color-connected objects

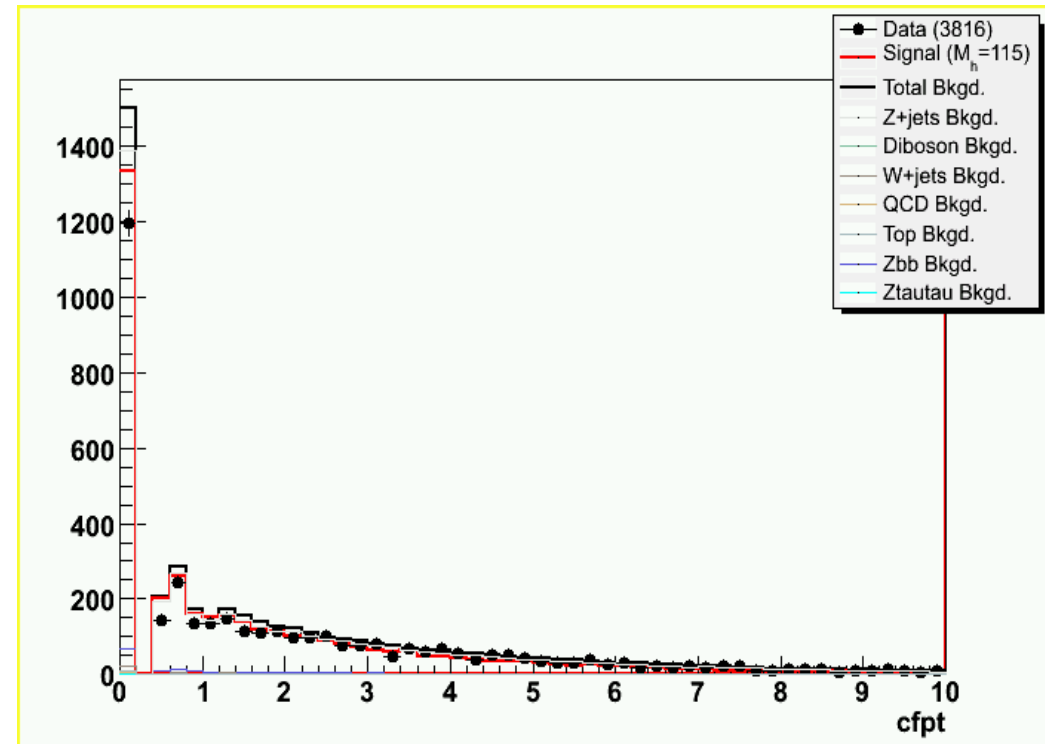
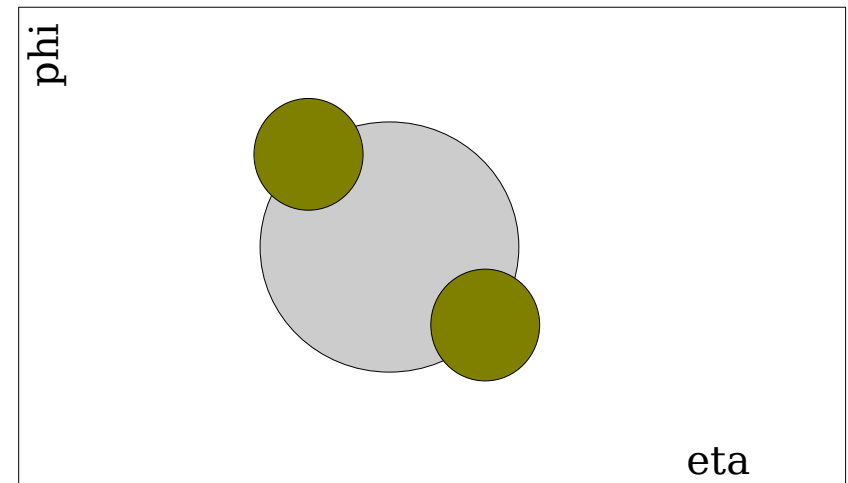
Test with p17 ZH->mumubb data/MC

Start by counting the number of tracks,  
and sum pt of tracks with:

- $p_T > 0.5$  (cafe cutoff)
- $p_T < 8$  (remove Z muons)
- $|\text{Track Z} - \text{PVZ}| < 3\text{cm}$
- not in  $dR < 0.7$  of *any* jets
- within  $dR$  circle defined by the area  
between the leading two jets  
(gray area)

Pretty well-modeled in MC

No major difference between pre-tag  
signal/background

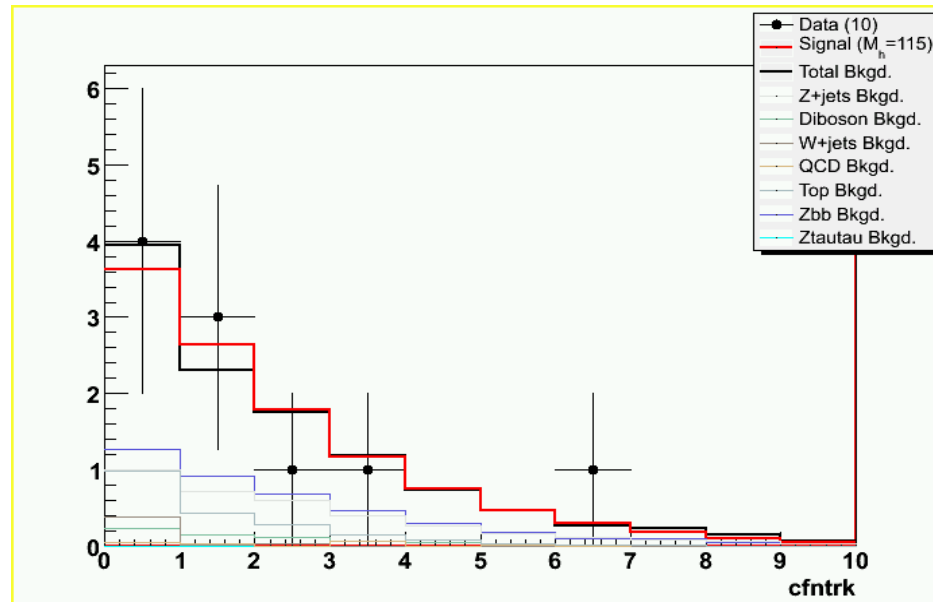
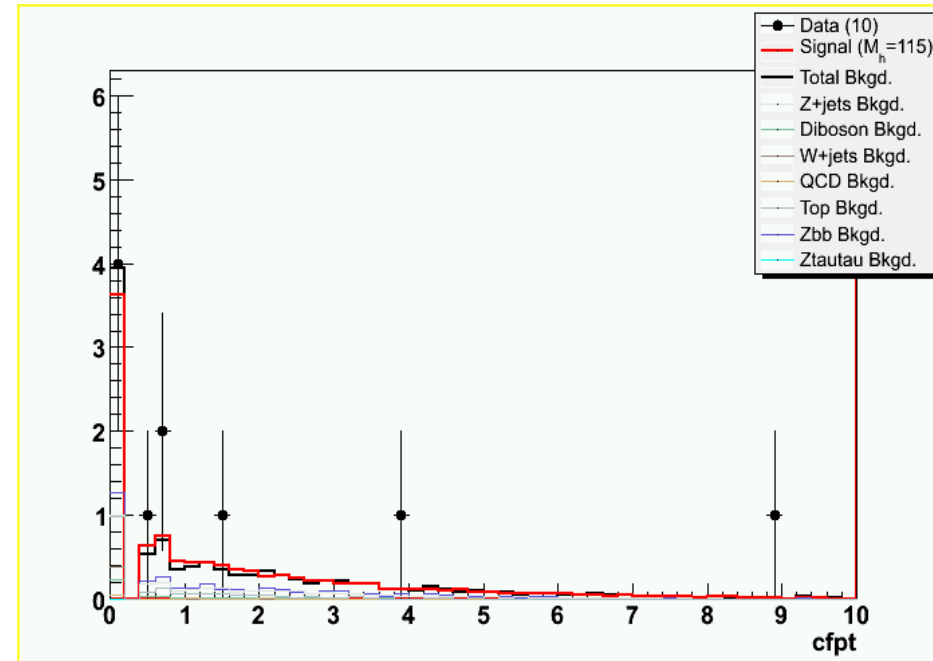


# Color Flow

After b-tagging, and in Mbb mass window of signal, *no separation between signal and background*

Likely that 0.5 pT threshold is too high

Could study in MC at particle level



# H->aa->4mu

Writing up D0Note in spare time

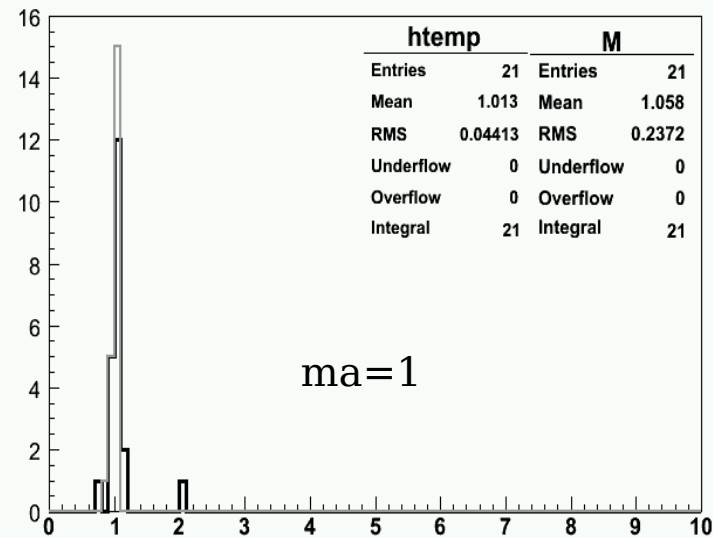
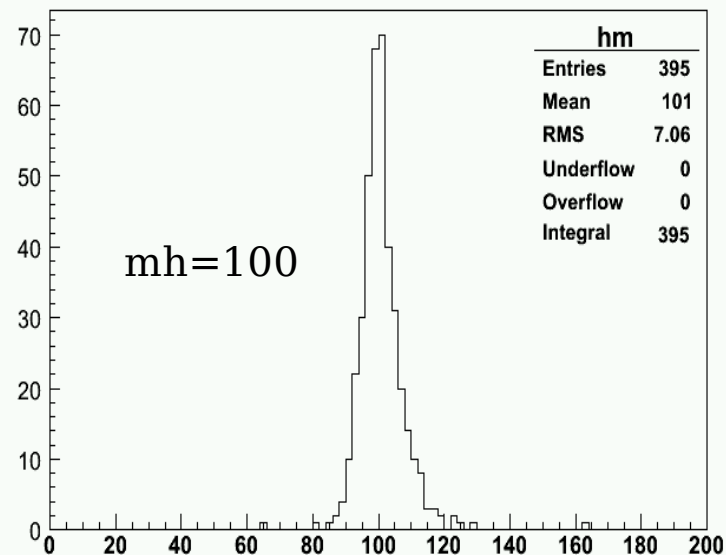
Optimized cuts a bit to reduce QCD background and retain signal acceptance:

- tighten calorimeter isolation cut
- allow more stray tracks in muon iso cone

Now have 20% acceptance and 0.3 background events expected

(Was 20% acceptance and 4.4 background events expected)

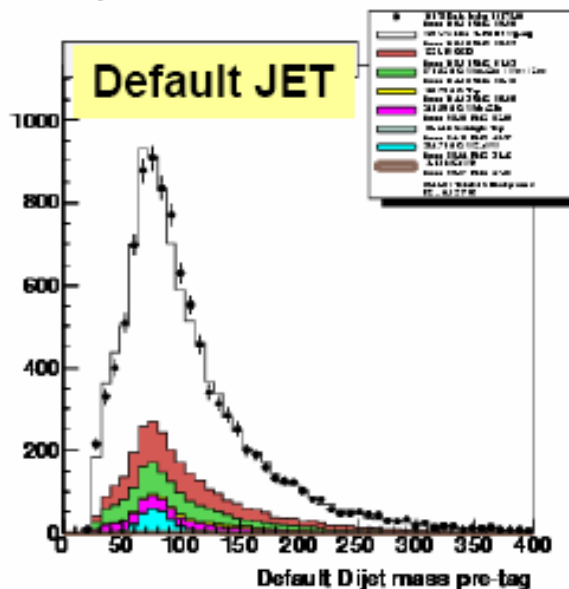
Reconstructing inv. masses of h and a



# Higgs Di-jet Mass Resolution

## Data vs MC in pretag

Yuji Enari



Mean shifts

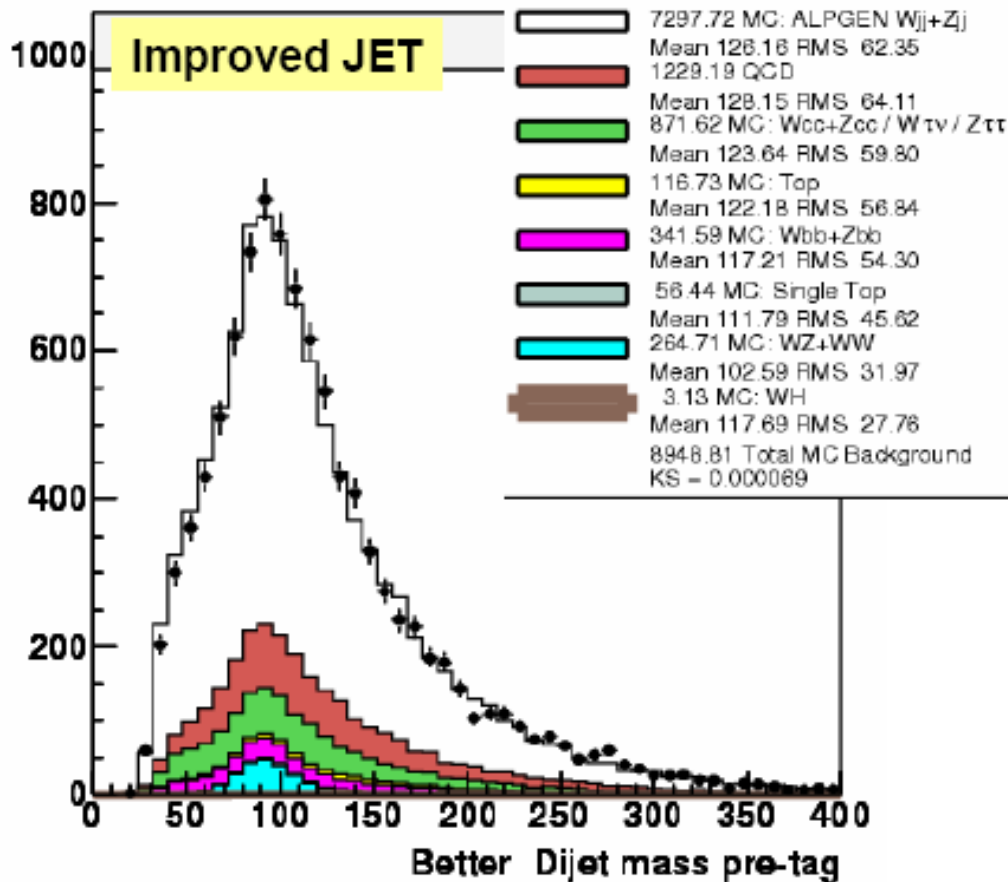
data: 106.81 → 126.02

BG : 106.56 → 126.16

RMS shifts

data: 59.96 → 64.78

BG : 59.82 → 62.35



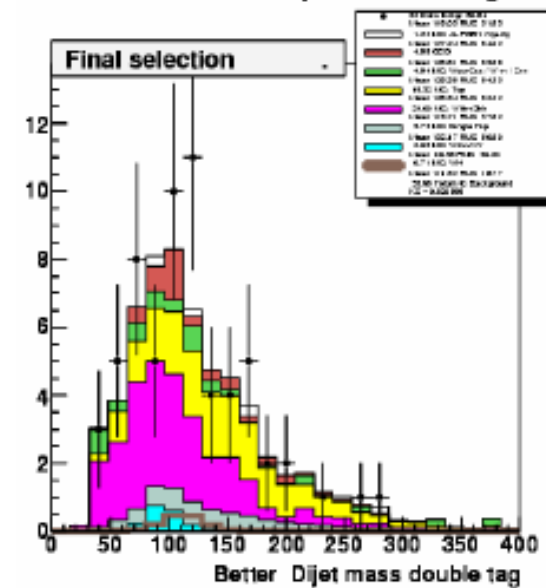
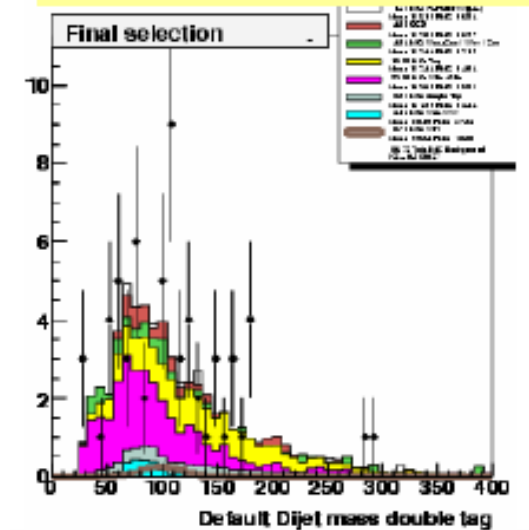
Changes in data well is described by MCs.  
Doesn't distort BG expectation.

## Double tag (OldLoose)

Mean and sigma in double tag:

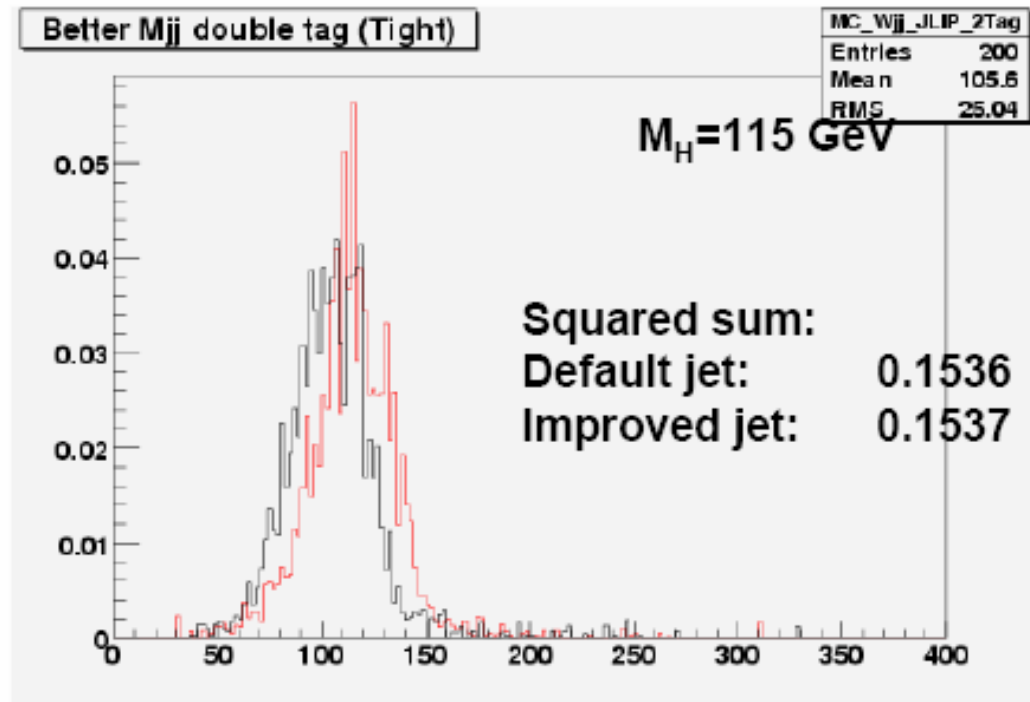
MH = 115 GeV	Mean ( $\mu$ )	Rms	$\mu/\text{rms}$
Default	92.4	17.5	0.19
Improved	104	17.9	0.17

→ Resolution improves ~ 10%.



# Check sensitivity

- $s/\sqrt{s+b}$  each bin.
- Black: default, Red: improved jet  
Mean value is shifted, but squared sum is not change.



## How about is limit?

- Use CLFAST (no systematic)
  - Use dijet mass (single tag, double tag)

**Default jet**

	expected	observed
100	9.139,	9.693
105	10.203,	12.233
110	12.009,	16.915
115	13.751,	22.094
120	16.626,	29.669
125	20.344,	37.553
130	25.606,	46.912
135	34.606,	61.750
140	47.209,	80.608
145		96.025
150	69.707,	108.531

**Improved jet**

	expected	observed
100	9.376,	9.983
105	10.395,	11.982
110	11.926,	15.297
115	14.060,	19.809
120	16.878,	28.749
125	20.703,	37.720
130	25.956,	43.107
135	33.403,	56.734
140	44.511,	71.882
145	50.062,	75.868
150	54.110,	70.512

**Unfortunately, we don't find any improvement at low mass region.**