Fake and Jet Rate Tests

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Aim

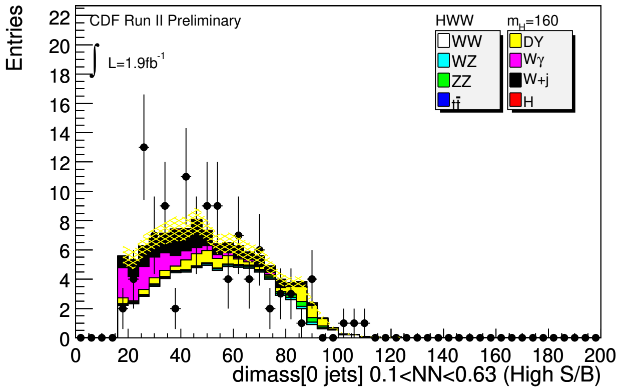
- Study the Jet rates and Fake rates
- Examine the Control region: $0.1 < NN < 80\%$
  - Dominated by WW in High S/B
  - Mixture of WW, W+jet and Wγ in equal parts in Low S/B
- Examine the DY Control region for jet rates: similar ISR structure as WW
- Examine the Base Same Sign region for W+jet and W$+\gamma$ contributions

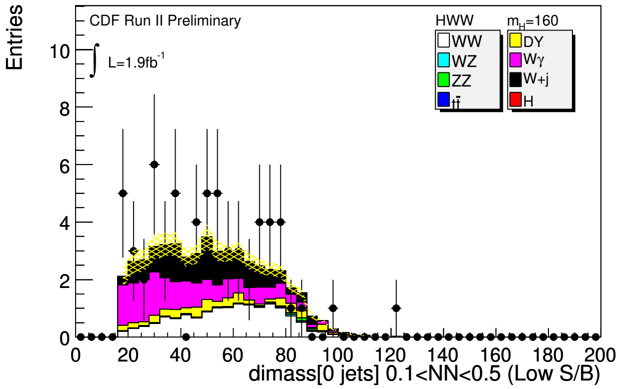
Counting events

Control Region	0 Jet Hi S/B	0 Jet Lo S/B	1 Jet Hi S/B	1 Jet Lo S/B
$0.1 < NN < 80\%$	0.97 ± 0.09	1.24 ± 0.14	0.87 ± 0.15	0.94 ± 0.24
DY	1.0	0.96	0.85	0.80

- 0 and 1 jet consistent between DY and NN control region in High S/B: The WW and DY radiation are modelled to similar accuracy. DY is Pythia, WW is MC@NLO.
- The Low S/B has less statistics with some slight indication of disagreement in the 0 jet.

0 Jets, DiMass: 0.1 $<$ NN $<$ 80%



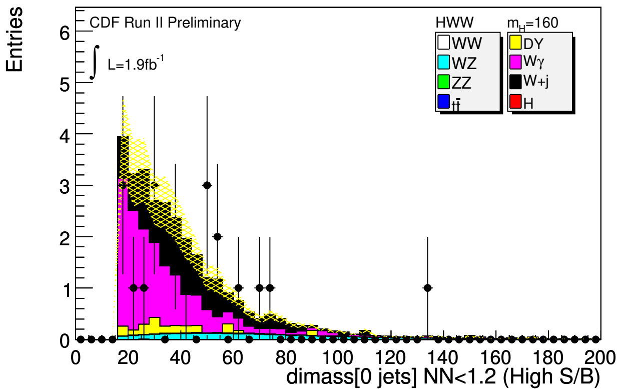


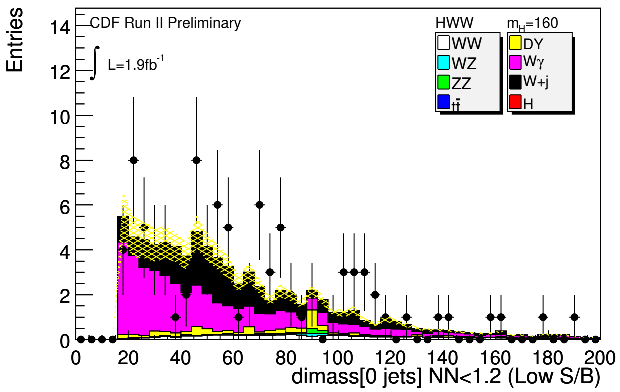
- High S/B OK
- Low S/B:

WW	14
Wγ	15
W+jet	15
Rest	5.7
Total	50
Data	62 ± 7

- Agree within statistics

0 Jets, DiMass: BaseSameSign



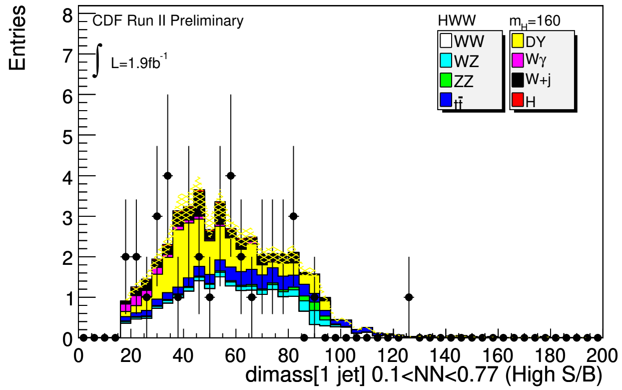


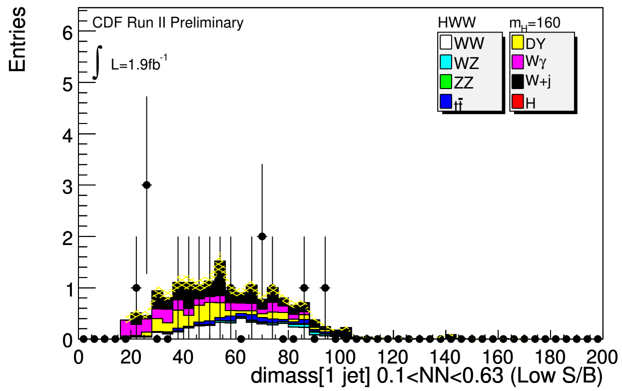
- High S/B OK
- Low S/B:

WW	5.5
Wγ	37
W+jet	29
Rest	6.8
Total	78
Data	93±9

- Again, agree within statistics.

1 Jet, DiMass: 0.1 $<$ NN $<$ 80%



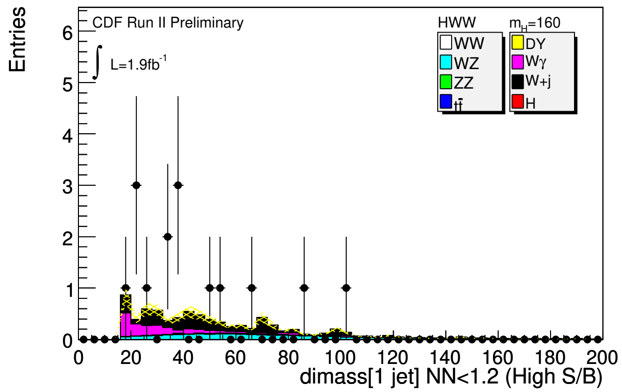


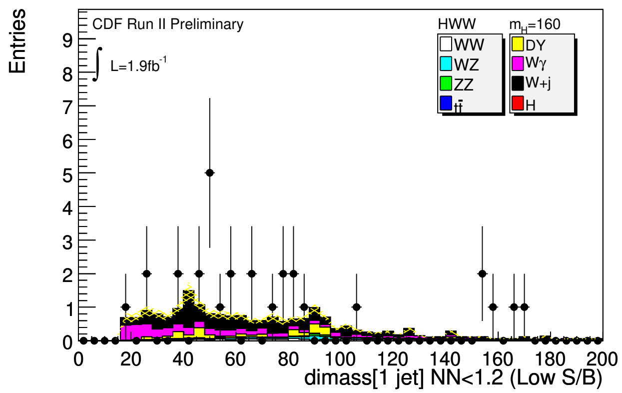
- High S/B ok
- Low S/B:

WW	4.2
Wγ	3.0
W+jet	5.2
Rest	4.7
Total	17
Data	16

- Agree within statistics

1 Jets, DiMass: BaseSameSign





	Hi S/B	Low S/B
WW	0	1.4
Wγ	1.9	5.2
W+jet	3.6	9.5
Rest	2.6	3.9
Total	8	20
Data	15	29

- Statistics too low.

How to Apply

- The rate difference can be due to a jet energy scale (JES) difference
- The jets are used to convert the lepton 4 vectors in the lab to the CM where the ME LR is computed, or as part of the NN information (specifically the MET).
- An incorrect JES implies an incorrect boost. The $\Delta R_{\ell\ell}$ is a strongly ranking variable that will be changed since the boost is transverse (R translates in value for longitudinal boosts). But this change is to both the Signal and Backgrounds so the issue is whether the discrimination is the same.
- This leads potentially to a shape error since the NN score may be different than was thought. This was studied in

CDF8700 where the NN score was computed with variations upwards and downwards in the JES. It is an entirely negligible systematic.

- The JES systematic is 2% to 3%. A fit of a power law to the MC and data gives 4.9 ± 0.1 for the power in both data and MC for High S/B. For Low S/B, the MC gives 6.0 ± 0.2 while the Data give 5.3 ± 0.2. A 15% shift is a 2.8% JES change. This is a bit on the high end but is really negligible in impact.

Summary and Conclusions

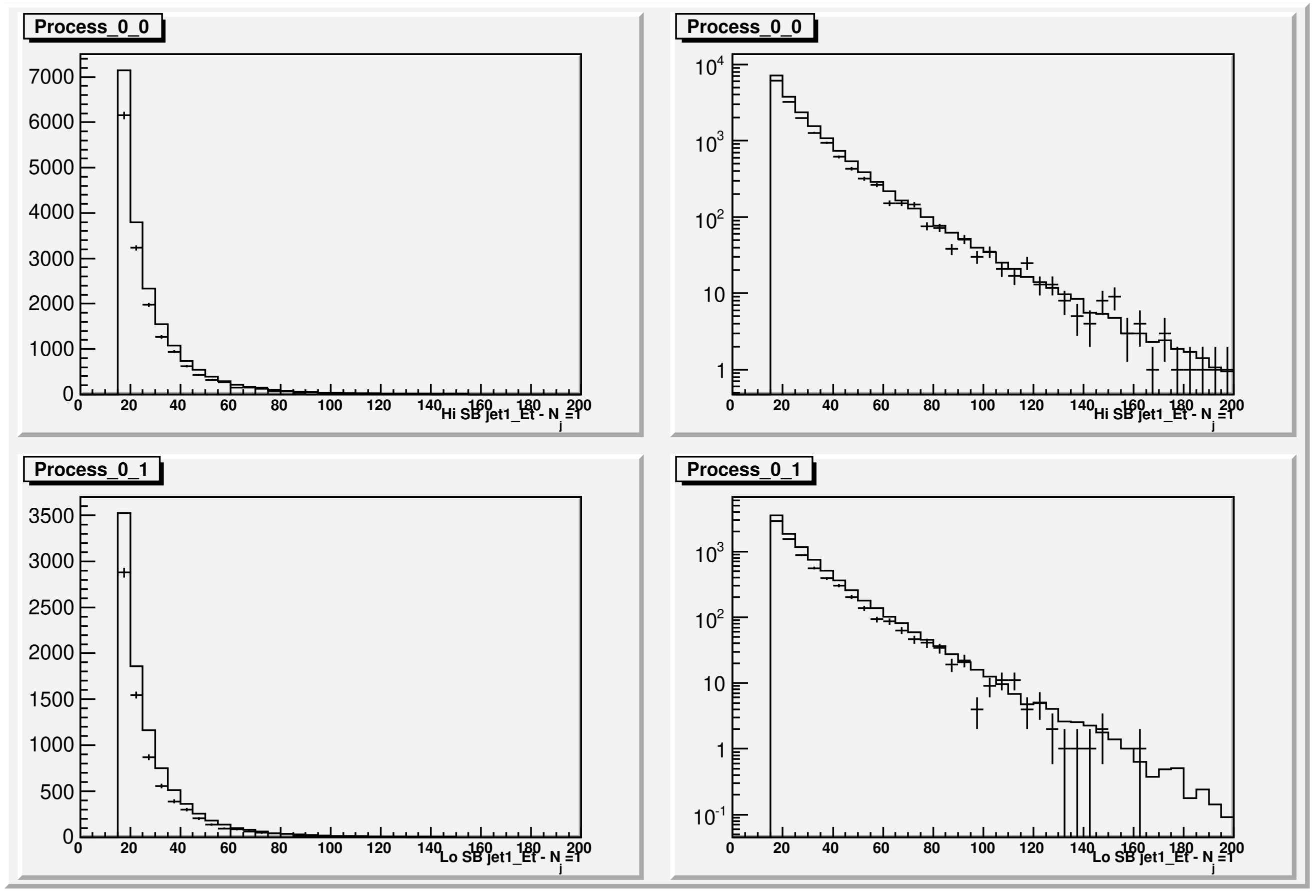
- Three control regions were examined. DY is used to interrogate the jet structure. The High S/B region is rich in WW events and that is compared to the DY. Consistency is found. The DY factor for scaling 1 jet events is 0.85.
- This rate error can be translated to a JES scale error and that has been shown in the past to be negligible. A check that the 15% change is consistent with the JES uncertianty was done.
- Two control regions rich in $W\gamma$ and W+Jets were examined: Model consistent with data but with low statistical power (10%) which is smaller than the usual 20-30% error.

A thought on Fakes

What is the fake rate once one already has a jet? Could it be different? Statistics too low to say.

Backup

Jet Et


Process_0_0
Hi SB jet1_Et - N_j =1
Process_0_0
Hi SB jet1_Et - N_j =1
Process_0_1
Lo SB jet1_Et - N_j =1
Process_0_1
Lo SB jet1_Et - N_j =1

Jet Et Fitting

- A fit of a power law to the MC and data gives 4.9 +- 0.1 for the power in both data and MC for High S/B.
- For Low S/B, the MC gives 6.0 +- 0.2 while the Data give 5.3 +-0.2.

Jet Et Fit

The top row contains result for High S/B and the bottom row for Low S/B. The first histogram is Monte Carlo, the second is data and this is repeated on a logarithmic scale.