NNCuts on LRHWW, Mll and MetSig

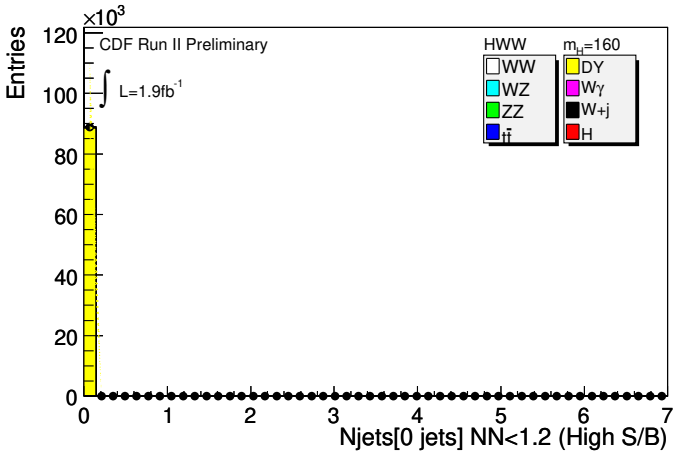
Richard St. Denis University of Glasgow/CDF

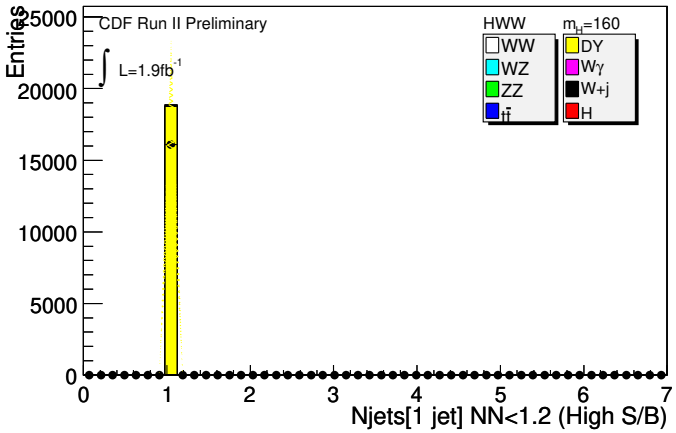
17 December 2007

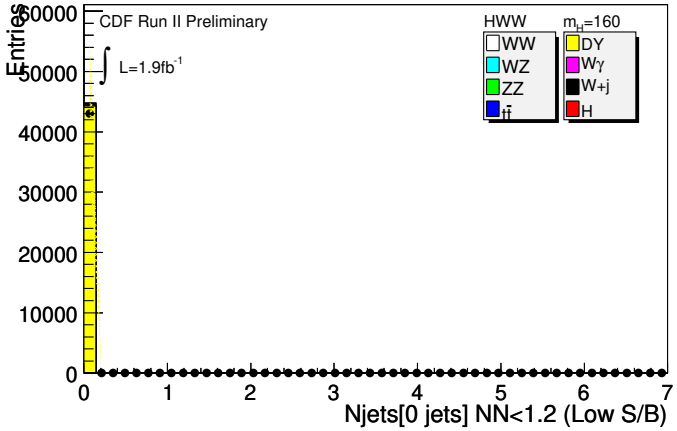
Outline

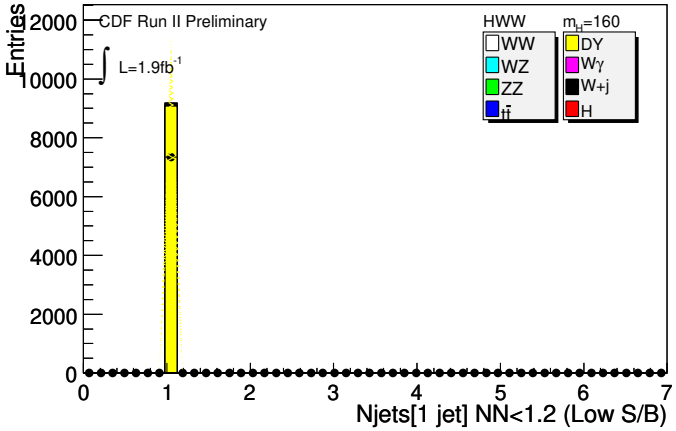
- MetSig, Met and SumEtLeptonsJets by jet and Hi/Lo S/B
- MetSig vs Met
- BaseSameSign

Njet



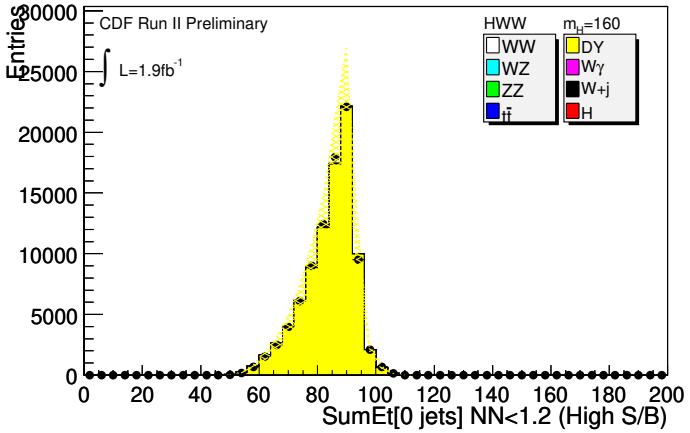


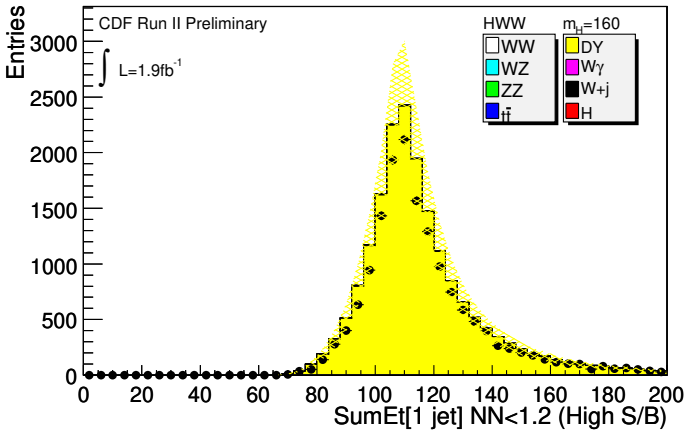


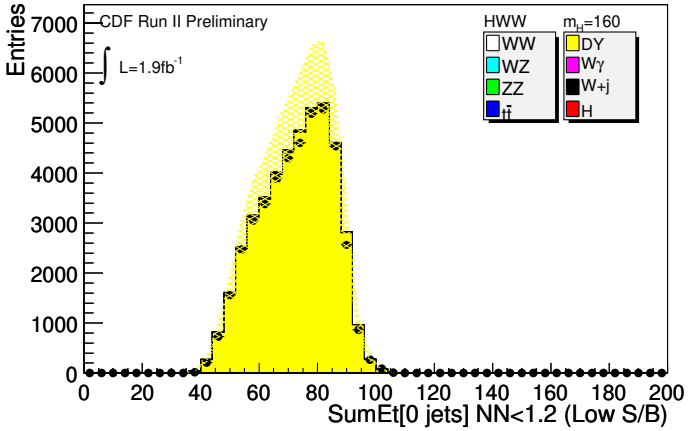


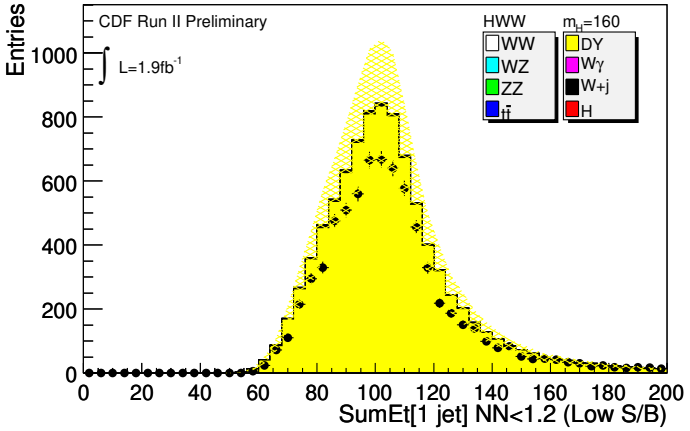
Jet normalization: k factor: This is PYTHIA: MCNLO?

SumEtLeptonsJets

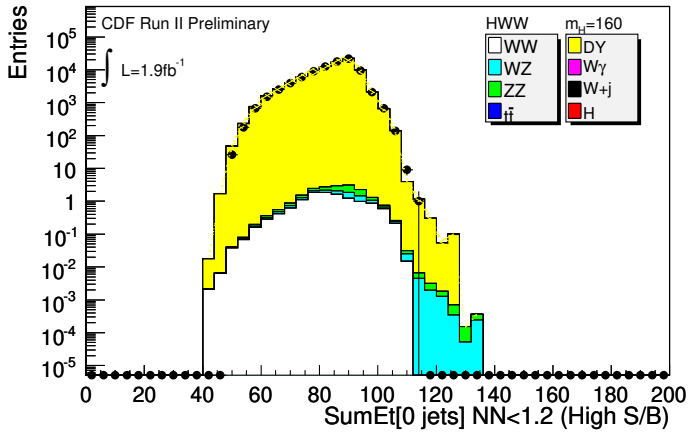


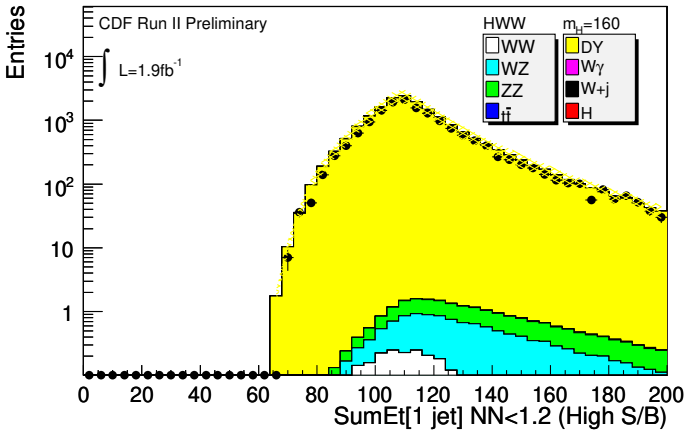


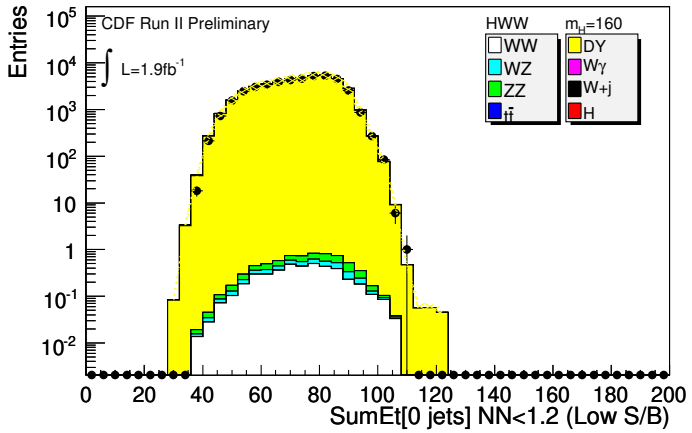


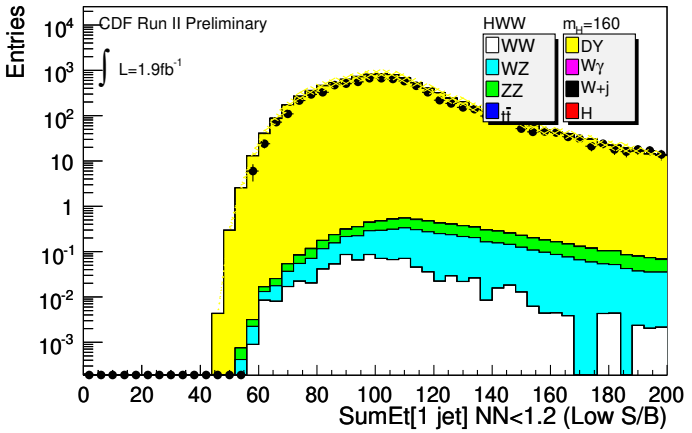


SumEtLeptonsJets

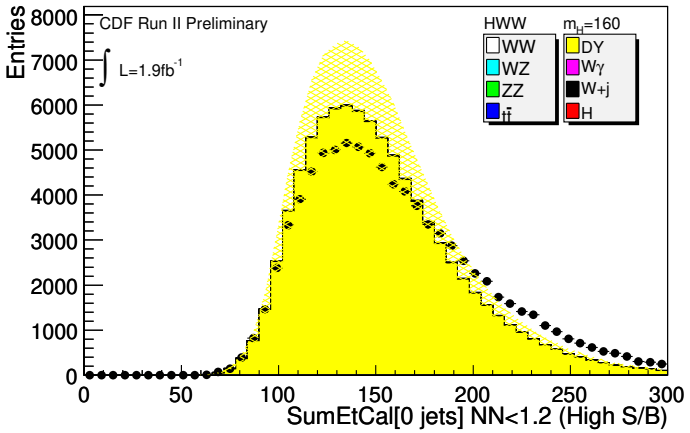


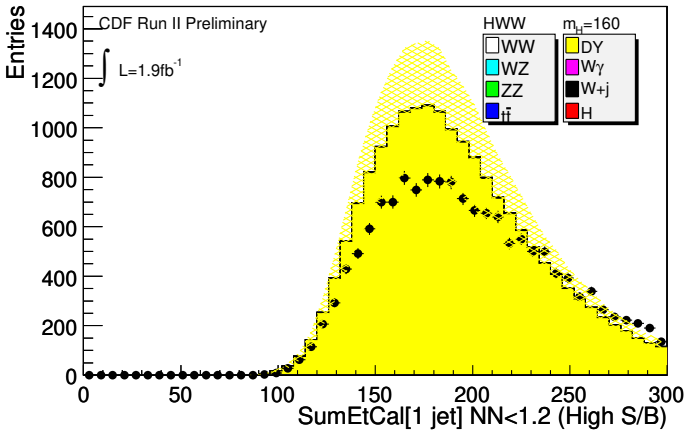






SumEtCal


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
SumEtCal[0 jets] NN<1.2 (High S/B)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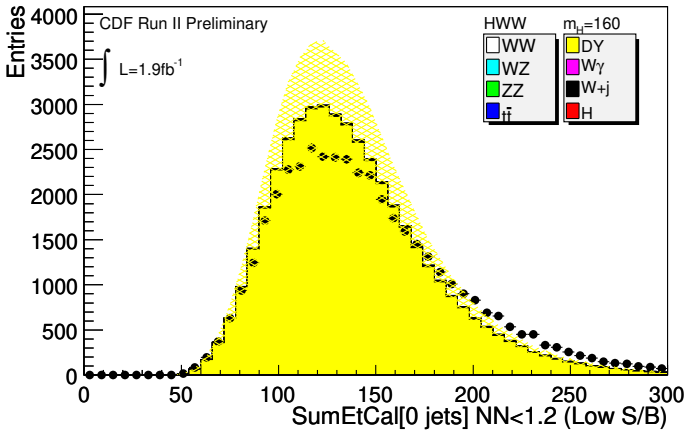
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Wγ
W+j
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∫ L=1.9fb^{-1}
Entries
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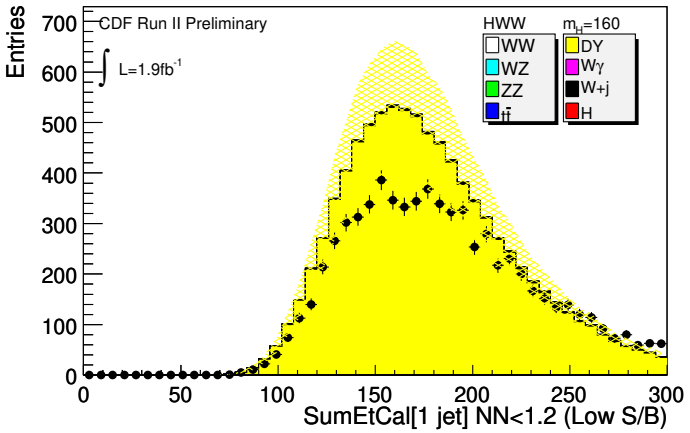
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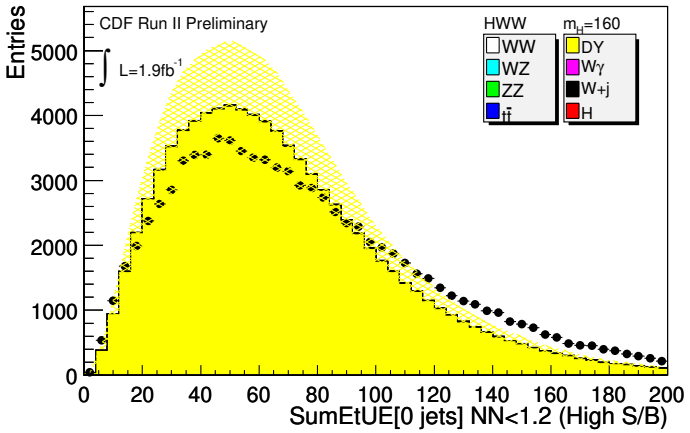
SumEtCal[1 jet] NN<1.2 (Low S/B)

SumEtUE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W+j
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∫ L=1.9fb^{-1}
Entries
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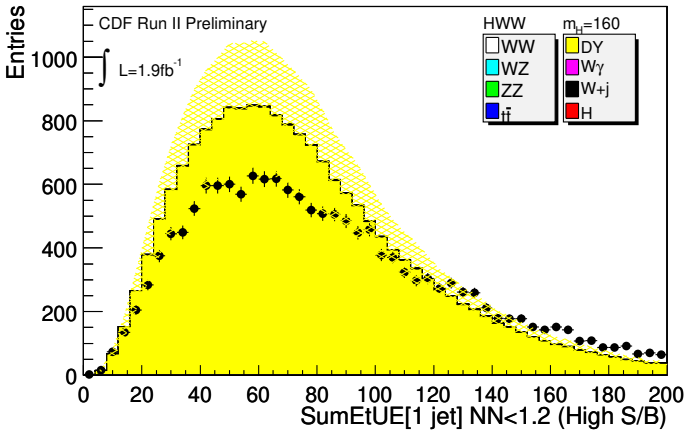
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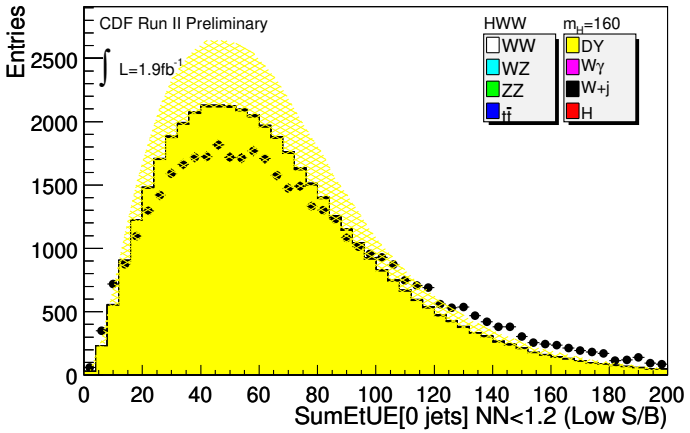
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HWW
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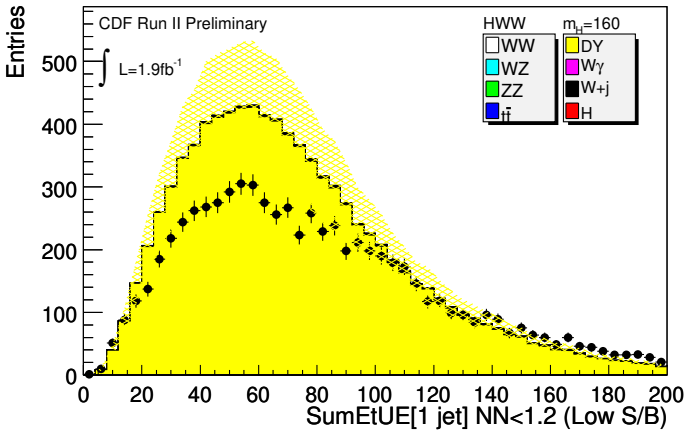
∫ L=1.9fb^{-1}
Entries
SumEtUE[0 jets] NN<1.2 (Low S/B)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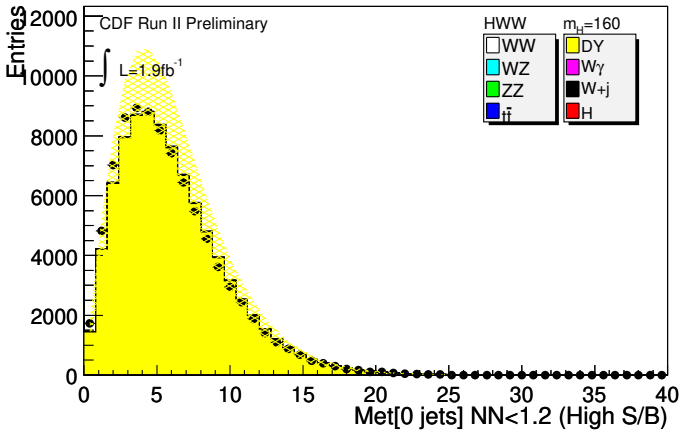
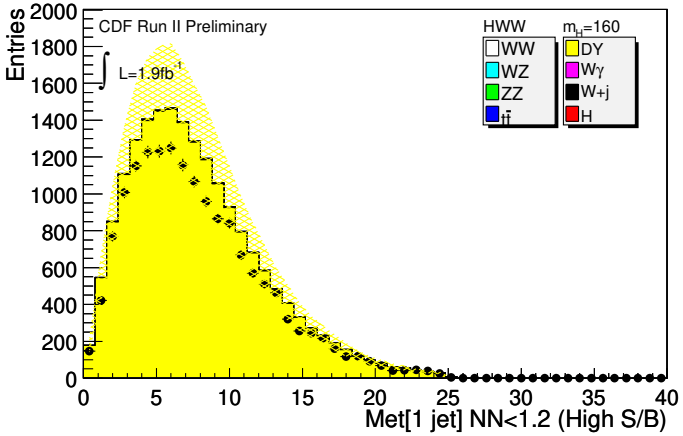
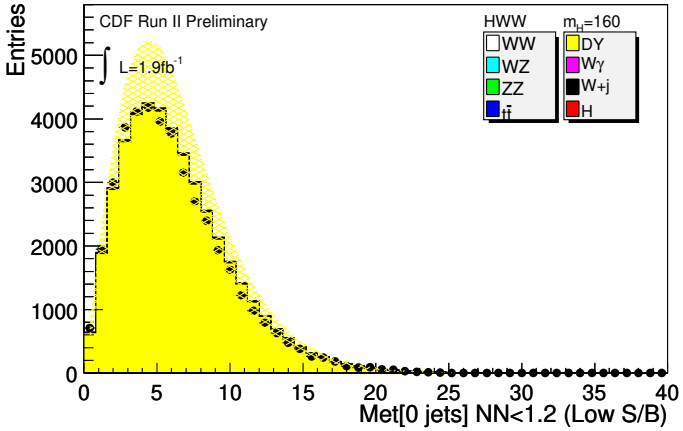
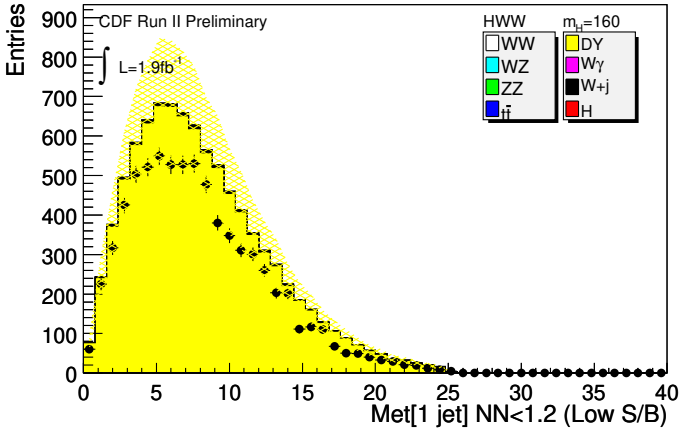
∫ L=1.9fb^{-1}
Entries
SumEtUE[1 jet] NN<1.2 (Low S/B)

Met



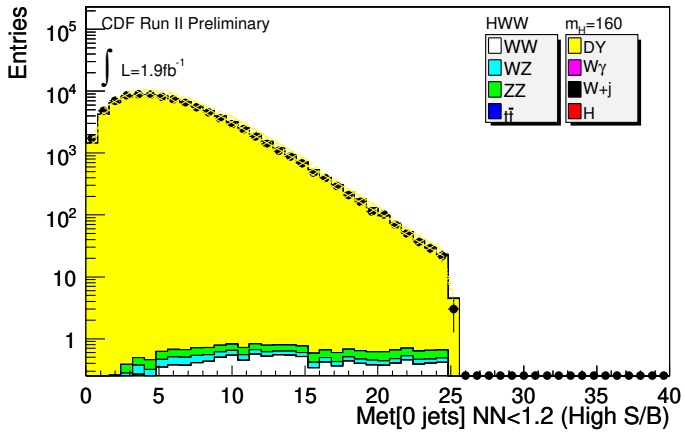






Evident shift in scale

Met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Entries
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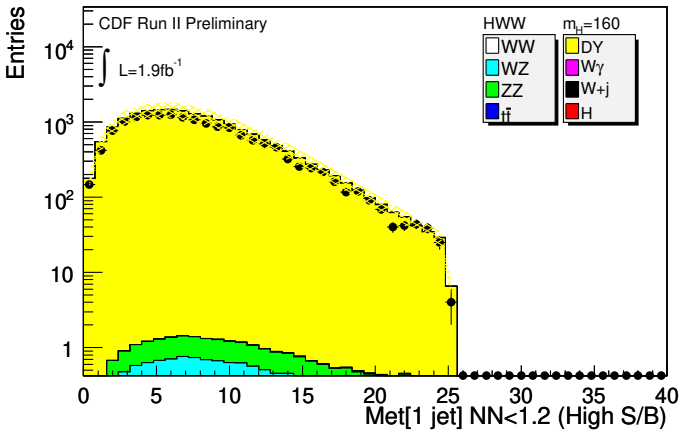
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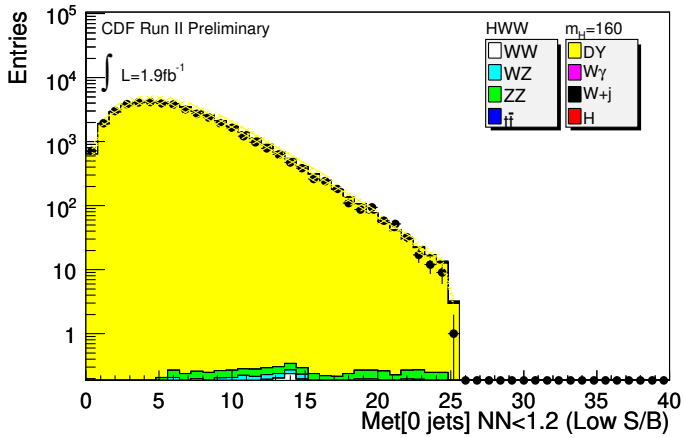
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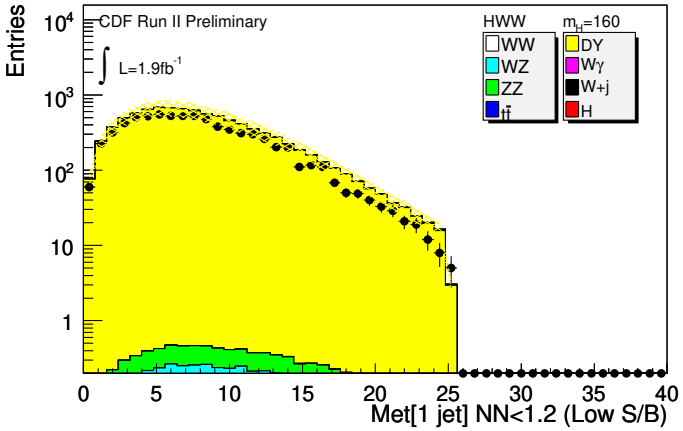
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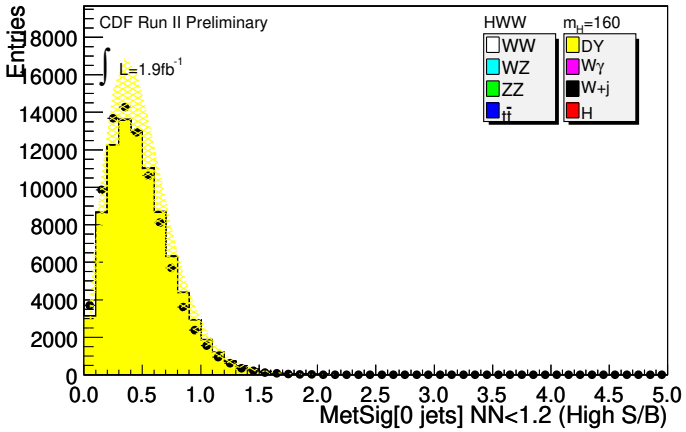
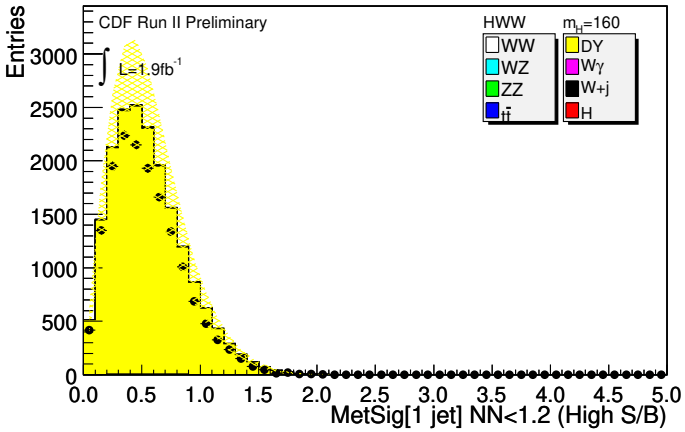
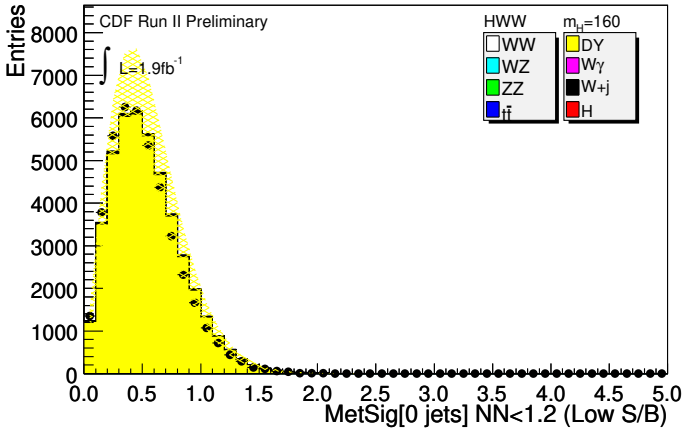
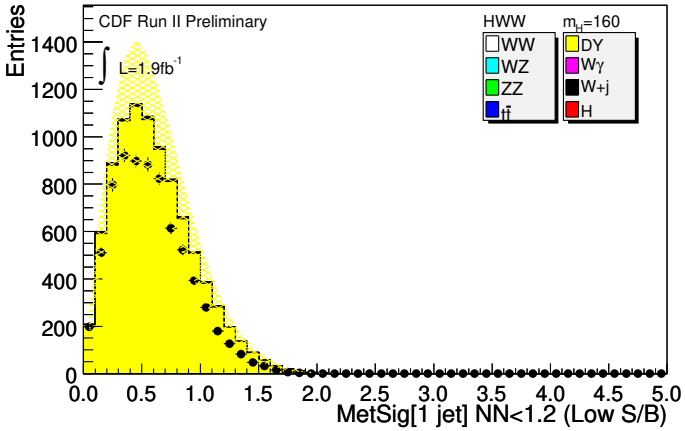
Entries
Met[1 jet] NN<1.2 (Low S/B)

MetSig



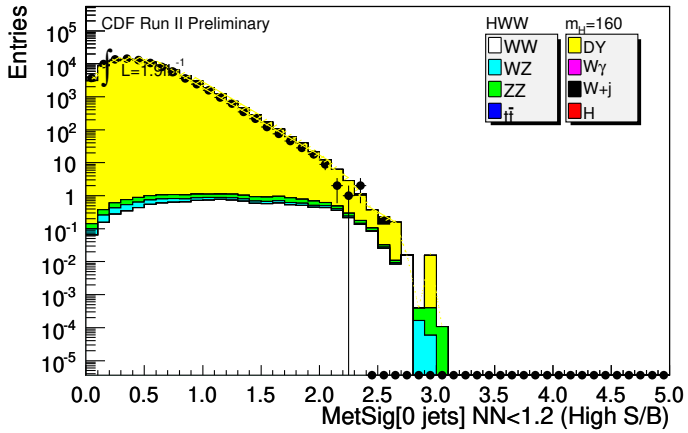






Shift in scale

MetSig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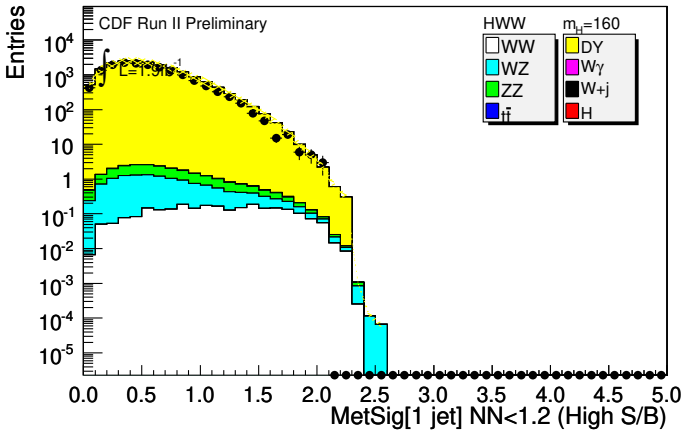
MetSig[0 jets] NN<1.2 (High S/B)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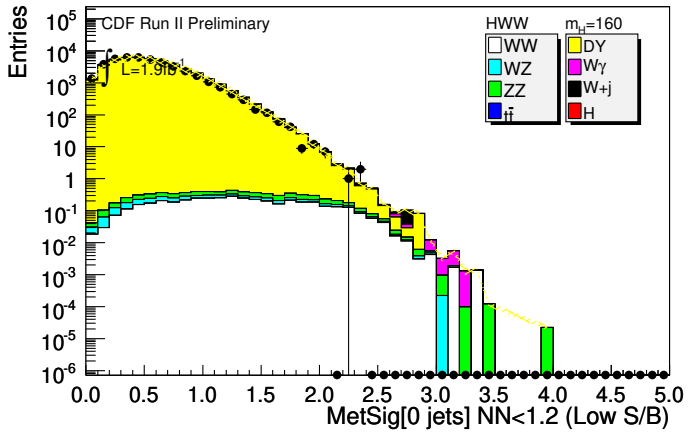
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Entries
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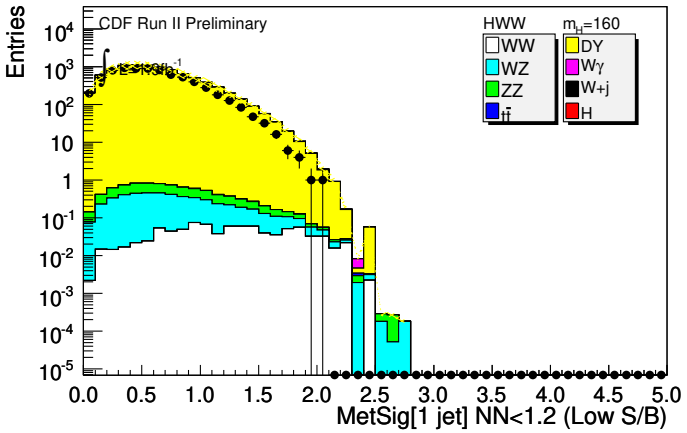
CDF Run II Preliminary
HWW m_H=160
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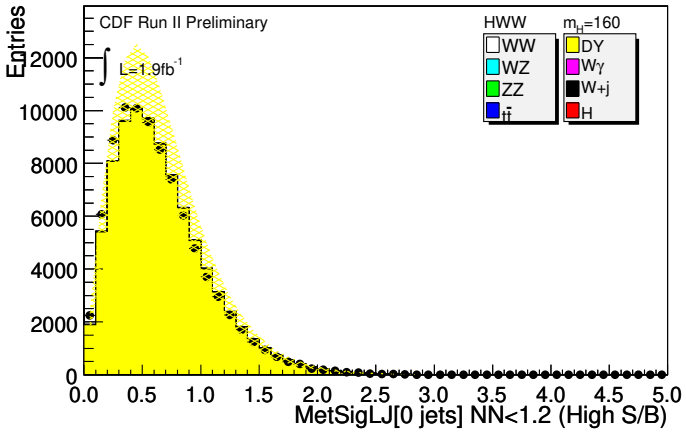
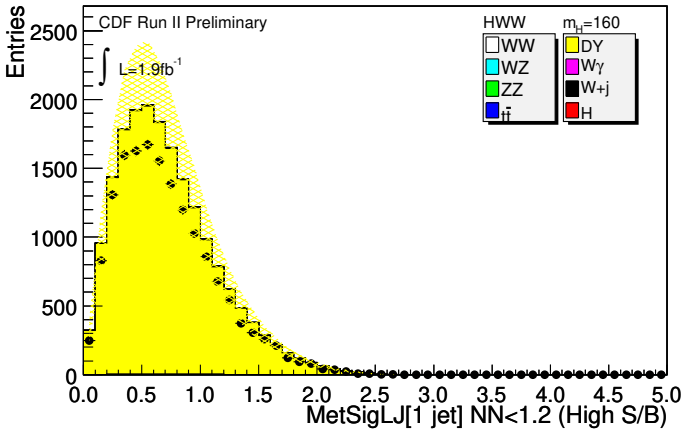
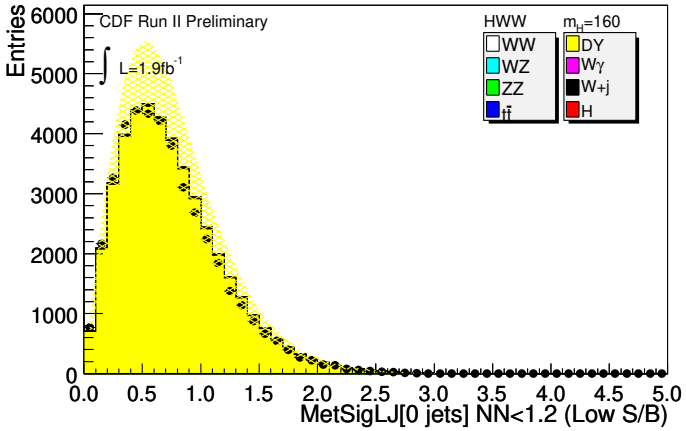
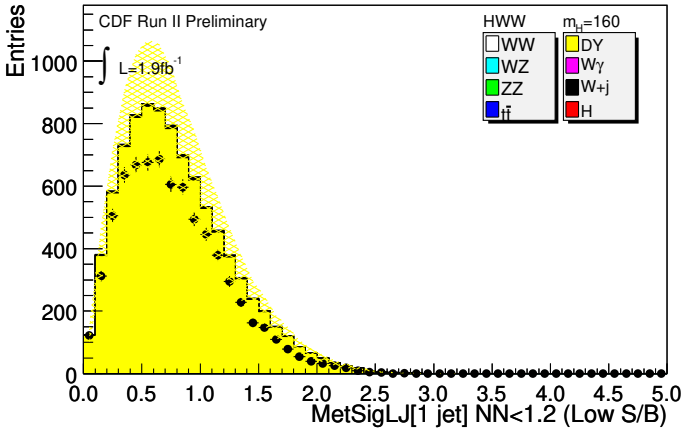
DY
Wγ
W+j
H
Entries
MetSig[1 jet] NN<1.2 (Low S/B)

MetSigLJ



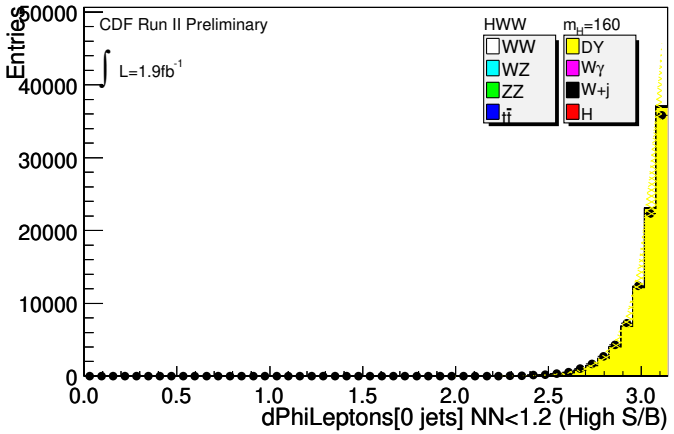


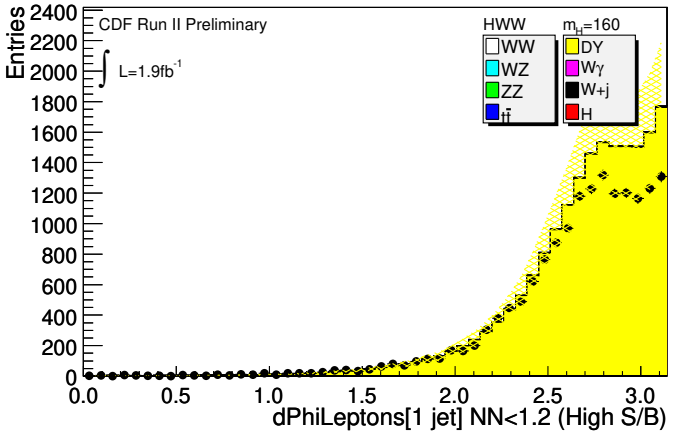


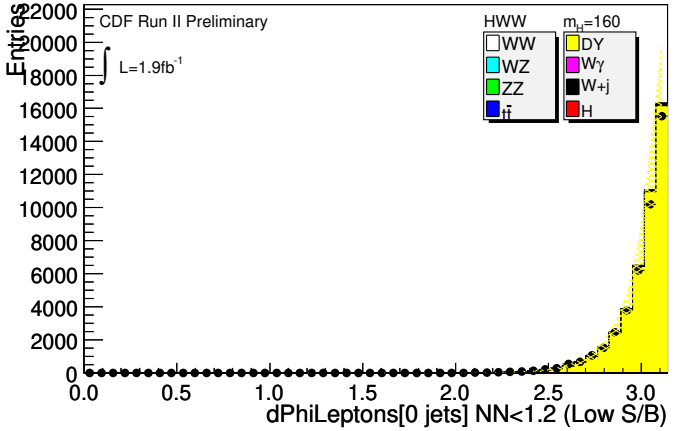


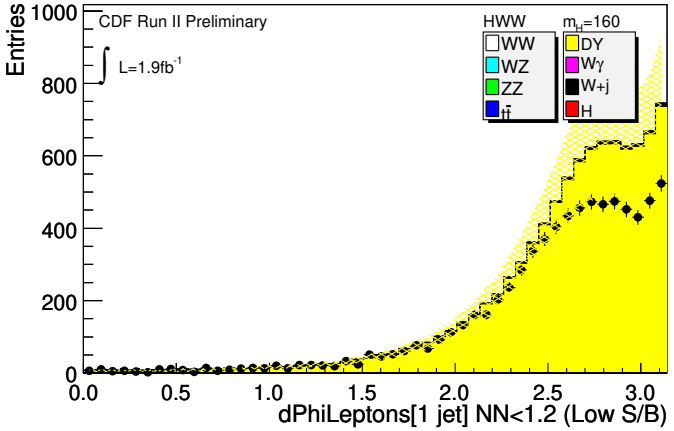
Shift in scale

dPhiLeptons



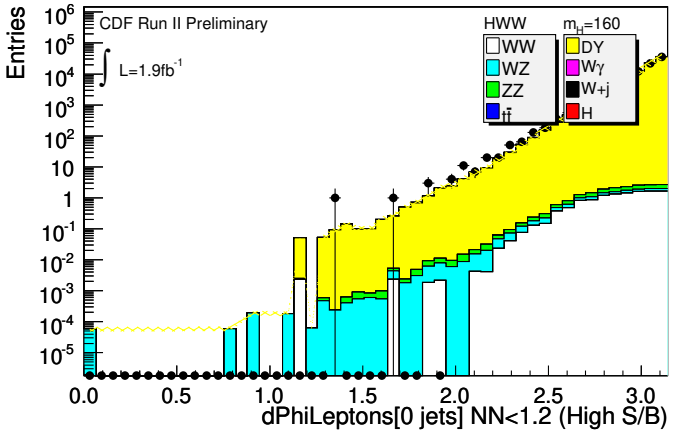


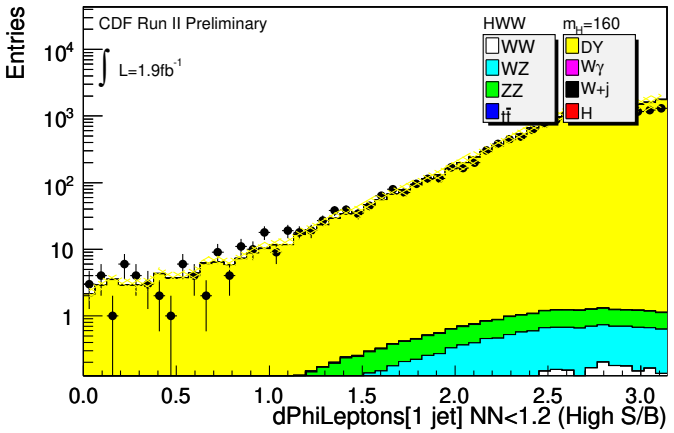


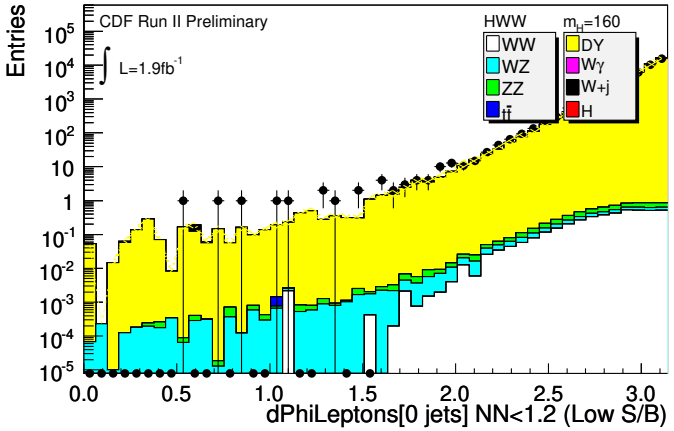


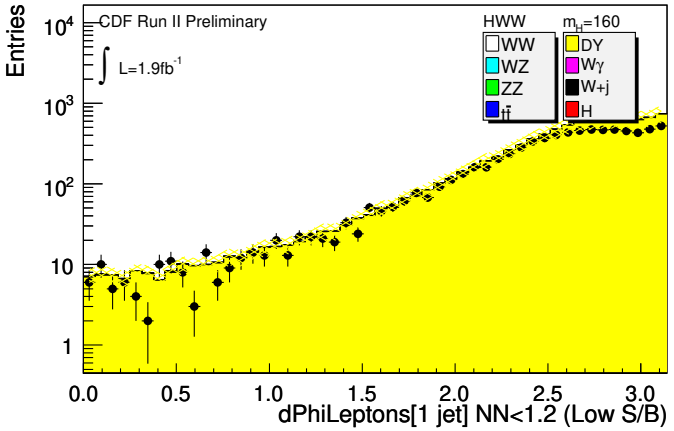
1 Jet Bad: UE + nonUE ?

dPhiLeptons

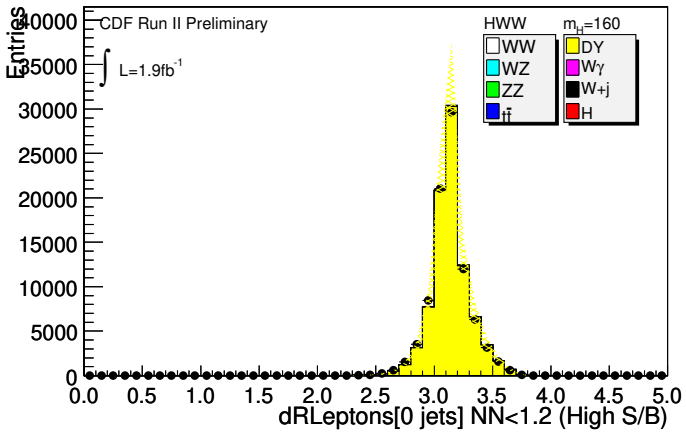


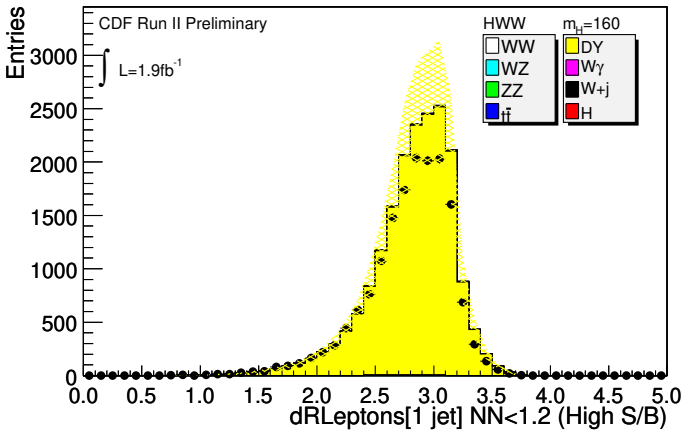


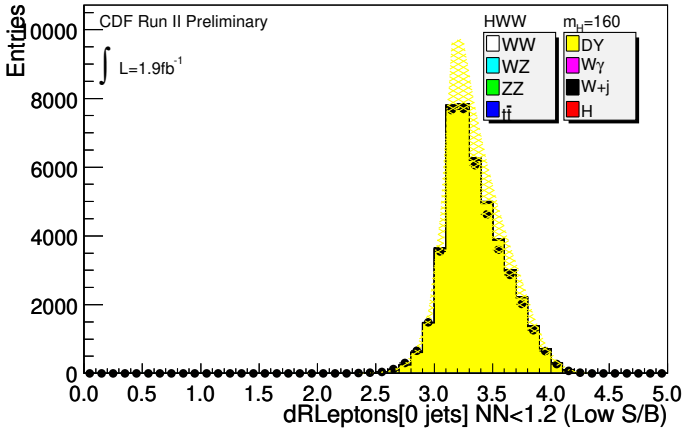


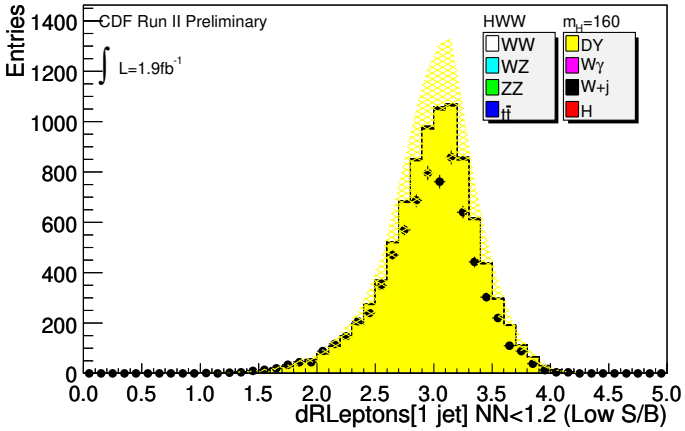


dRLeptons:1 jet also bad

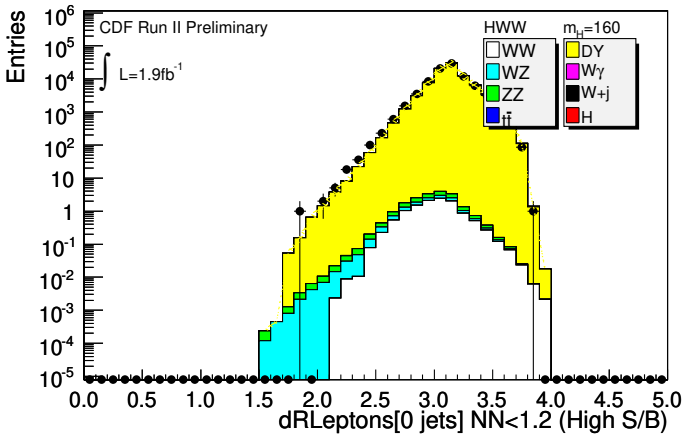


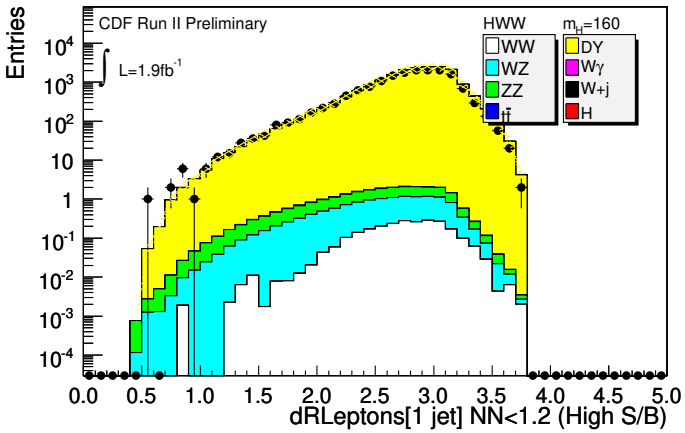






dRLeptons


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dRLeptons[0 jets] NN<1.2 (High S/B)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HWW
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WW
WZ
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$t\bar{t}$
DY
Wγ
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Entries
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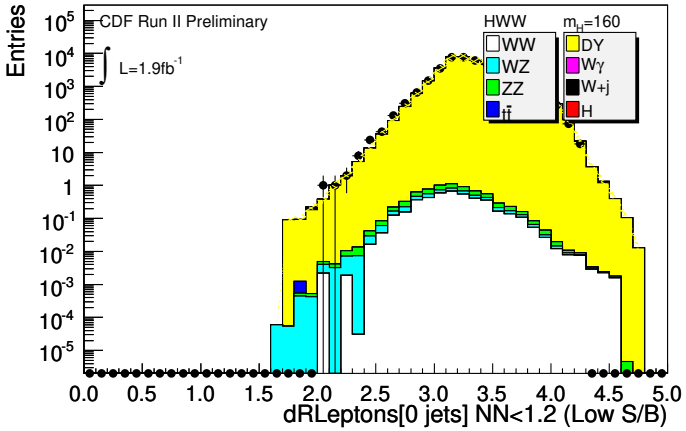
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Wγ
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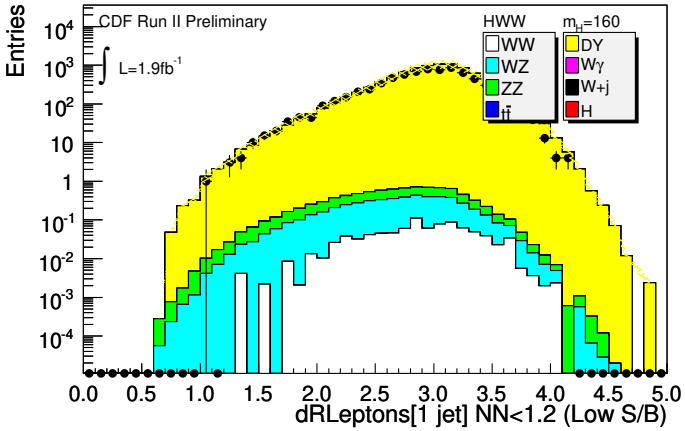
∫ L=1.9fb^{-1}
Entries
dRLeptons[0 jets] NN<1.2 (Low S/B)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HWW
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$t\bar{t}$
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Entries
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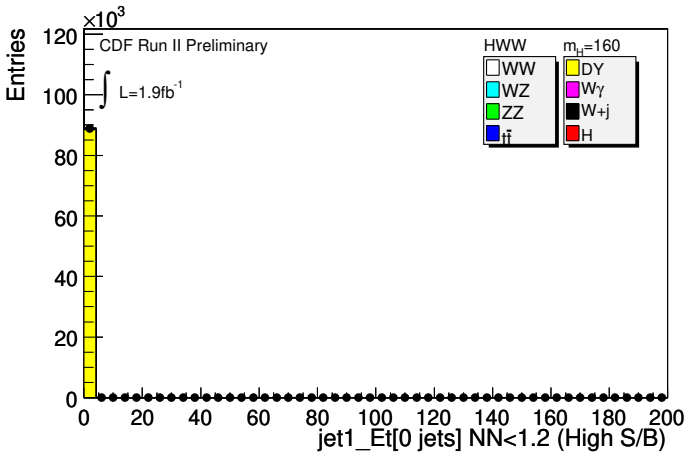
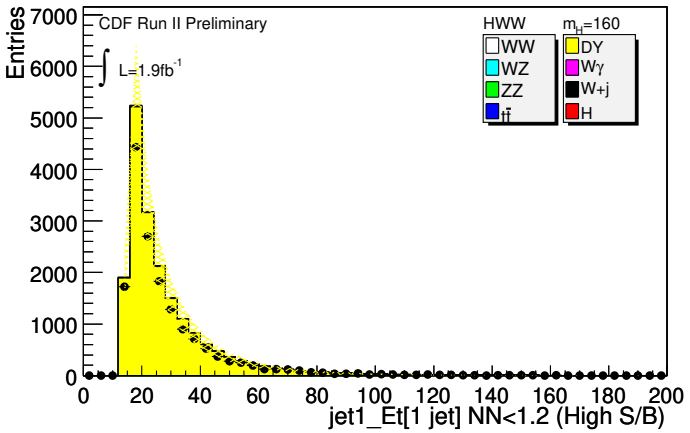
jet1 Et


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
L=1.9fb^{-1}
Entries
×10^3
jet1_Et[0 jets] NN<1.2 (High S/B)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HWW
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WW
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$t\bar{t}$
DY
Wγ
W+j
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L=1.9fb^{-1}
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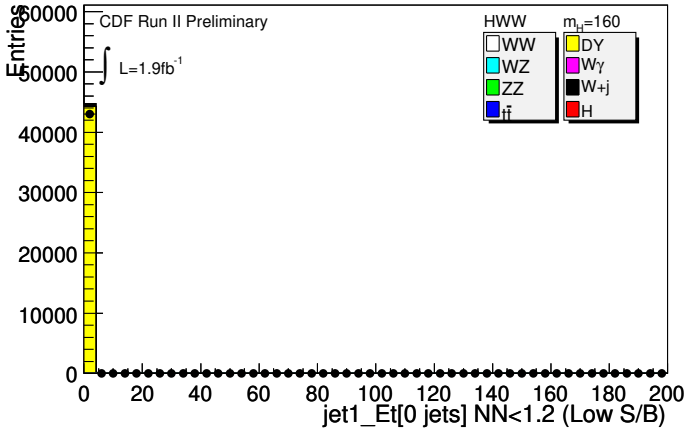
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DY
Wγ
W+j
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L=1.9fb^{-1}
Entries
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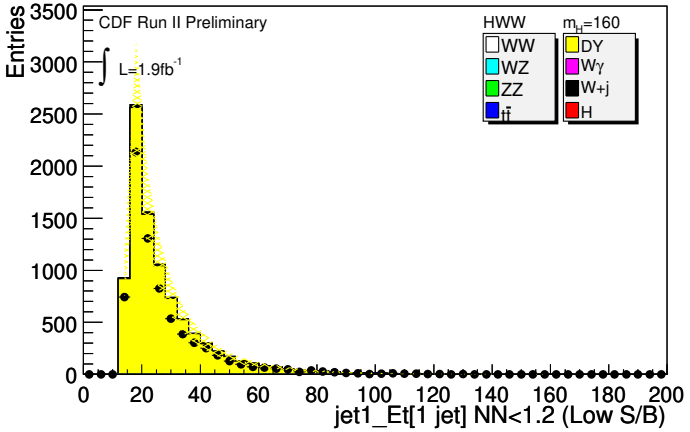
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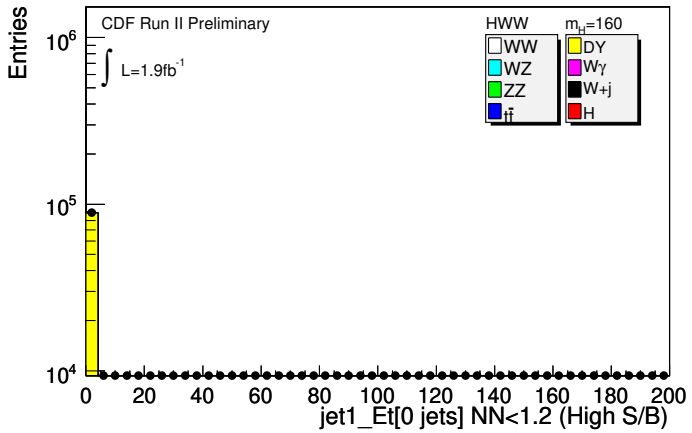
jet1 Et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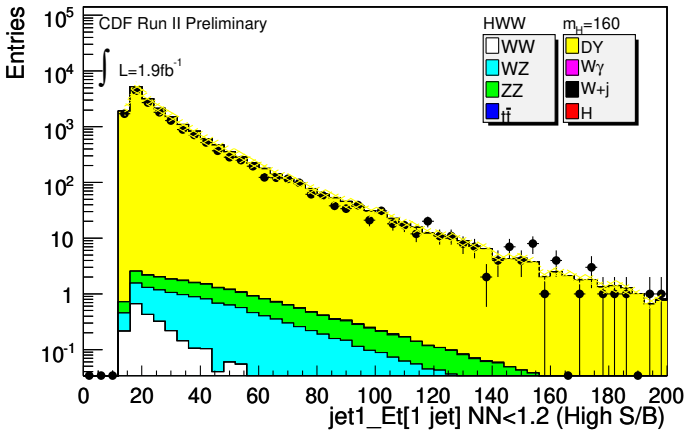
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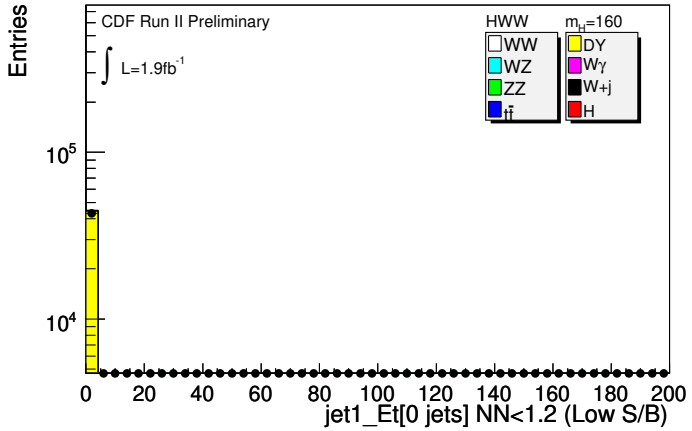
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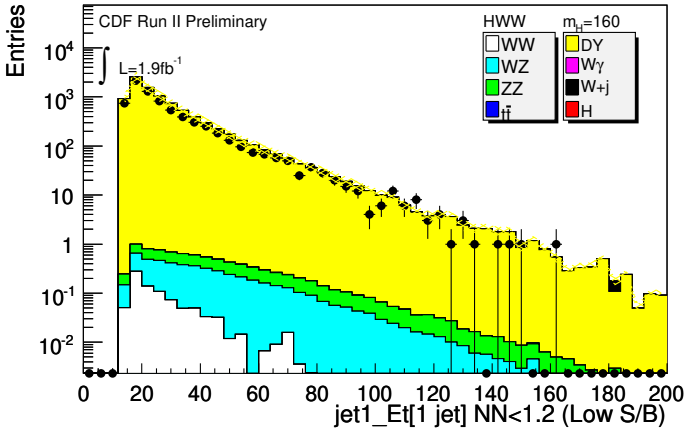
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DY
Wγ
W+j
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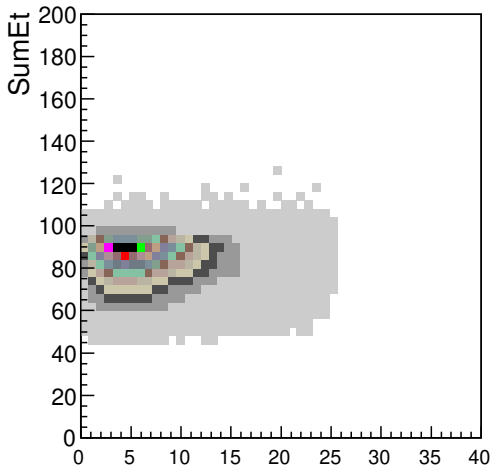
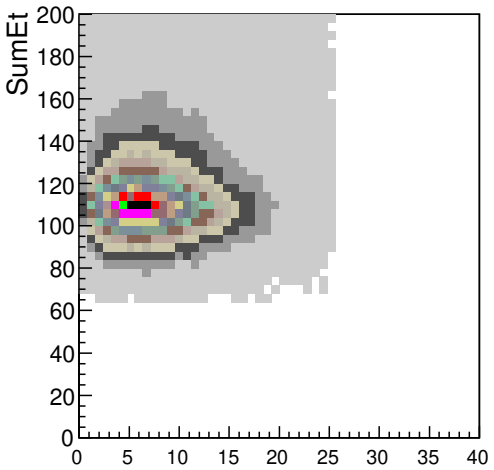
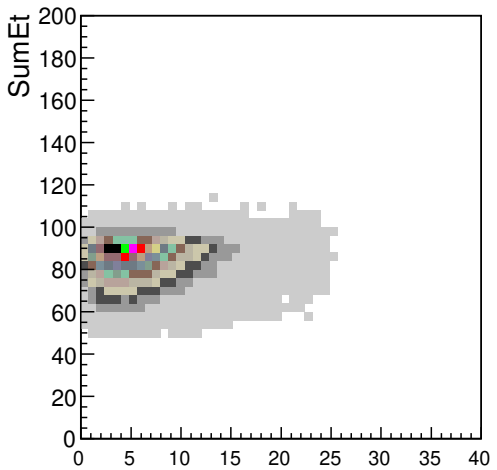
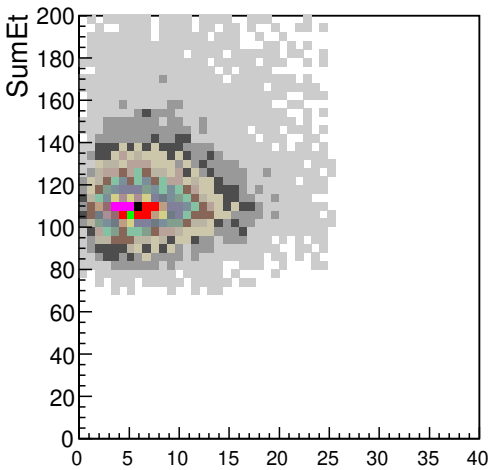
∫ L=1.9fb^{-1}
Entries
jet1_Et[1 jet] NN<1.2 (Low S/B)

SumEtLeptonsJets vs Met: HiSB, ee, Jet=0,1

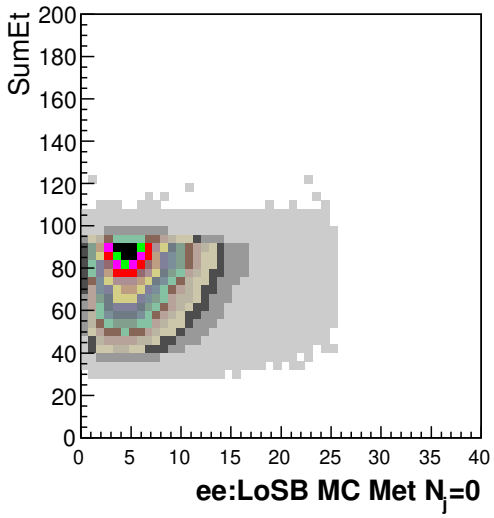


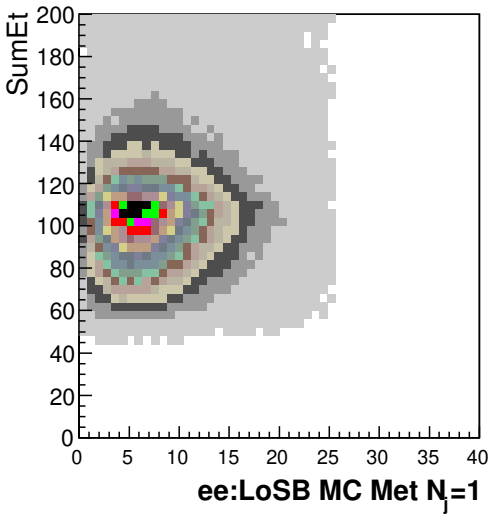


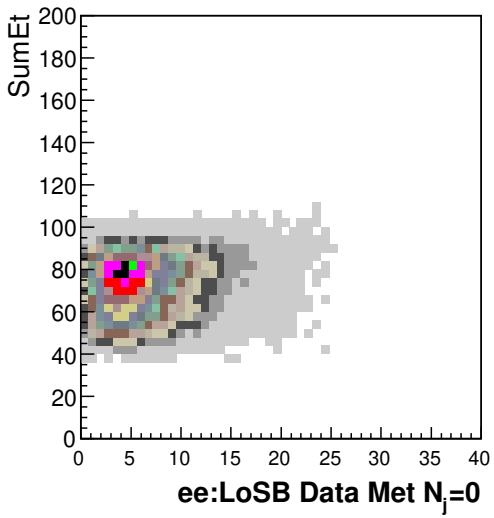


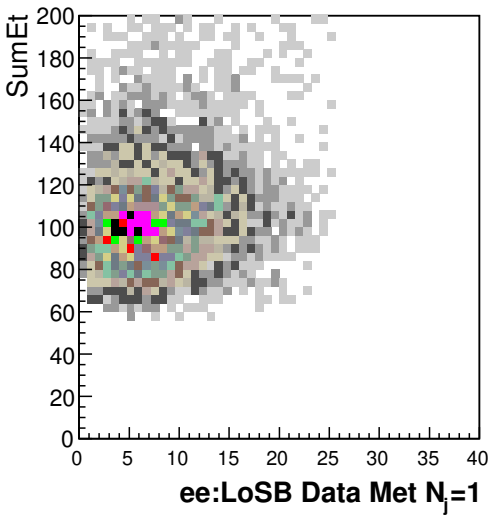


SumEtLeptonsJets vs Met: LoSB, ee, Jet=0,1

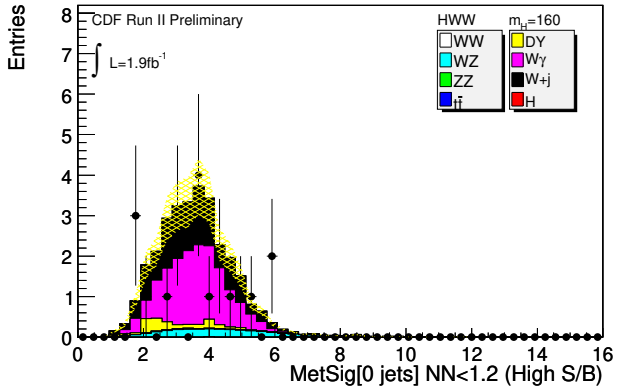


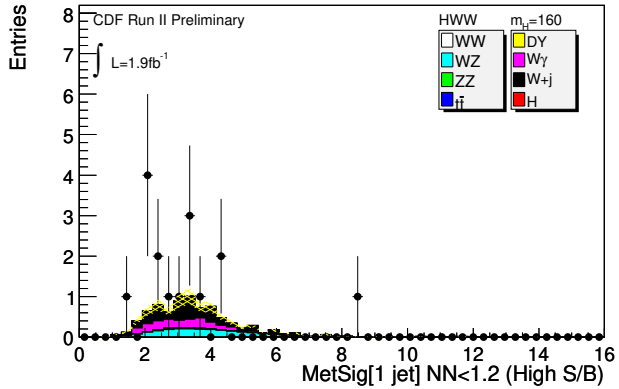


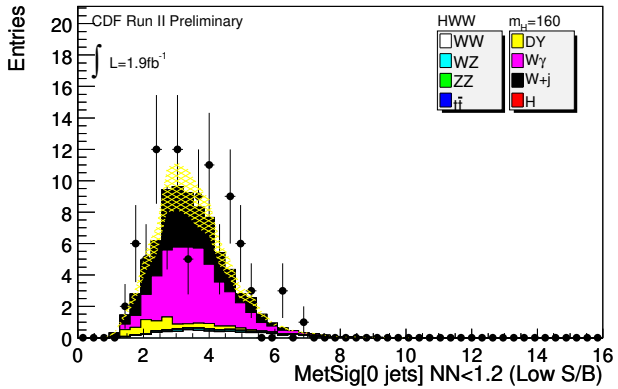


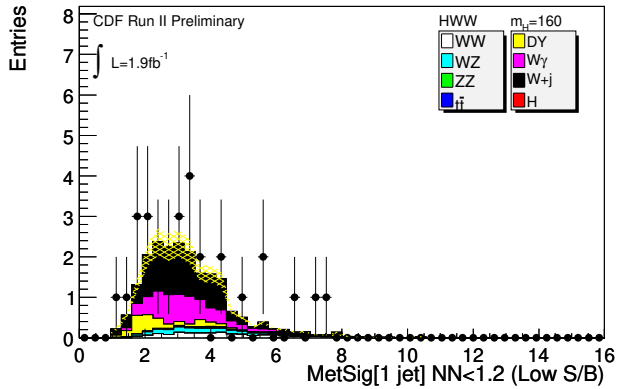


Base SameSign: Similar Pattern as Mll



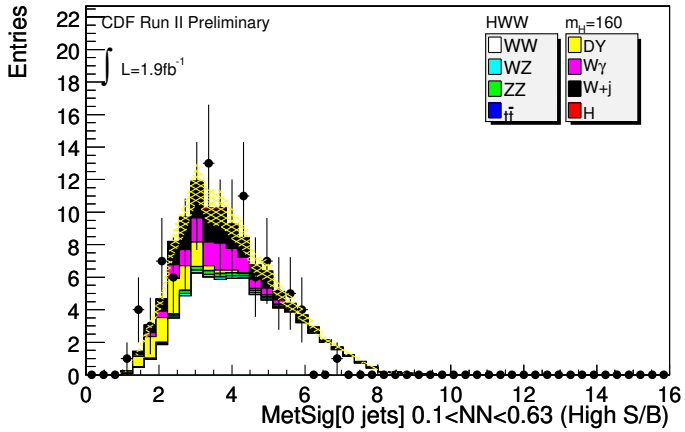


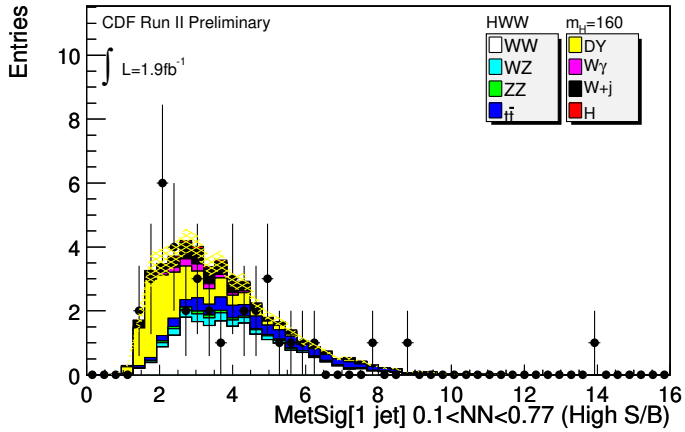




Clearly Wγ and fakes, Look back at MetSig and Mll

Base


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] 0.1<NN<0.63 (High S/B)


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
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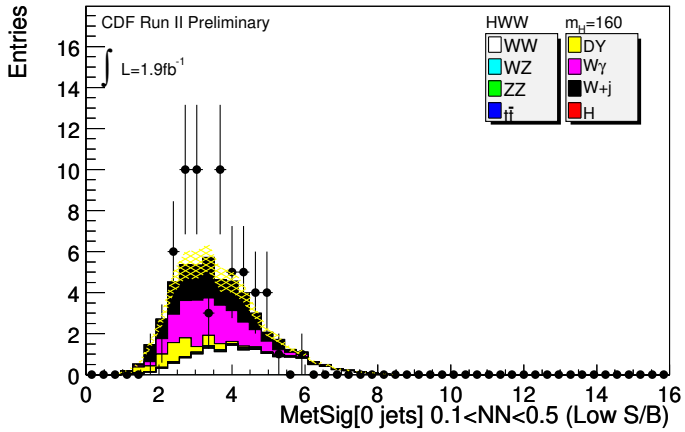
CDF Run II Preliminary
HWW m_H=160
WW
WZ
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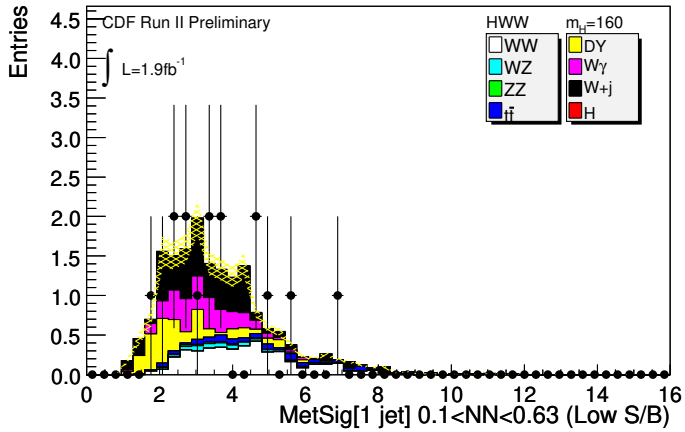
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] 0.1<NN<0.5 (Low S/B)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HWW m_H=160
WW
WZ
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$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
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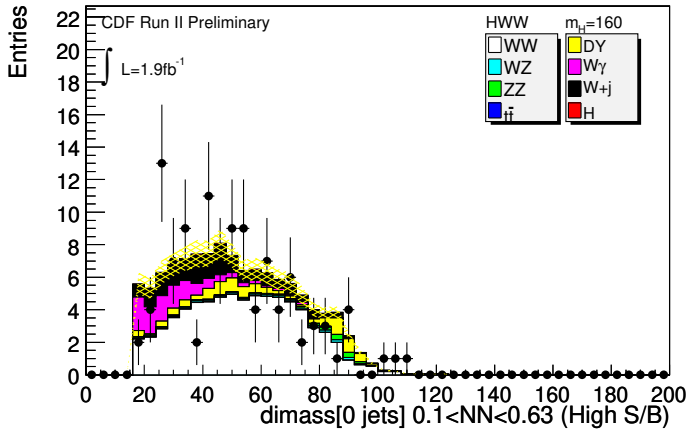
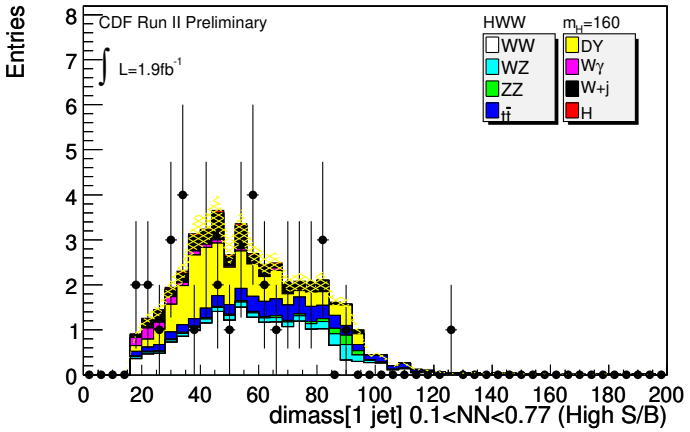
MetSig[1 jet] 0.1<NN<0.63 (Low S/B)

Base


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] 0.1<NN<0.63 (High S/B)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HWW
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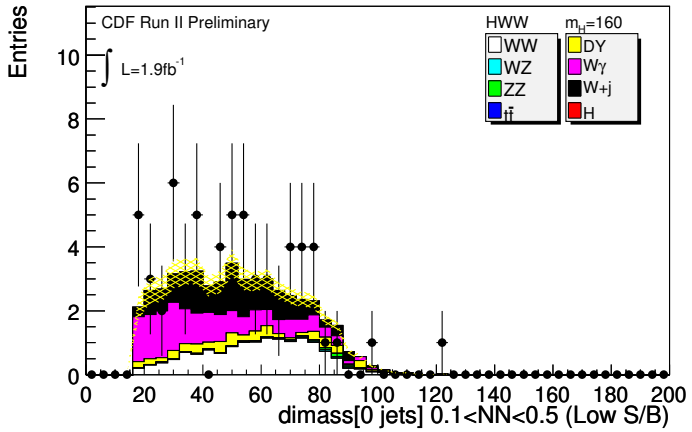
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HWW
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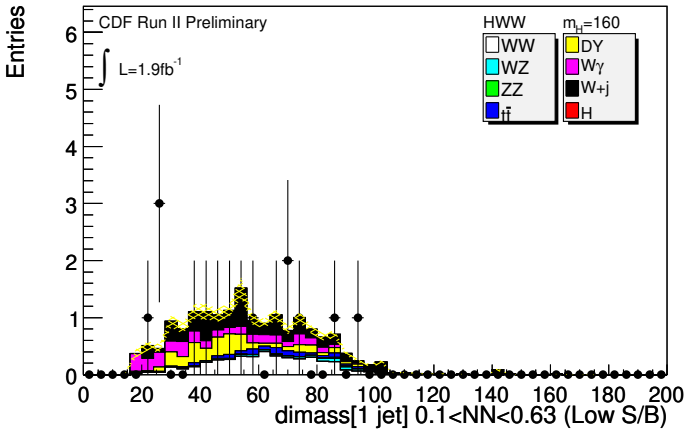
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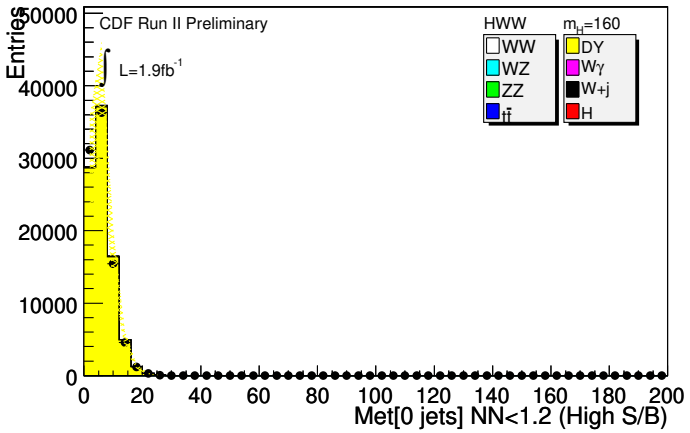
Entries
dimass[1 jet] 0.1<NN<0.63 (Low S/B)

Summary and Next Steps

- Njet=1 normalization off
- Poor agreement with SumEtCal
- Stems from UE modelling
- Good agreement in SumEtLeptonJets
- Can remove MetSig
- BUT: Dphi and DR poor in 1 jet. We don't remove these?!
- Fakes consistent with control using NN
- Examine the control regions
- Need to compute a rescaling on Njet=1
- Need to understand impact of boosts from NonJet

Backup

Met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HWW m_H=160
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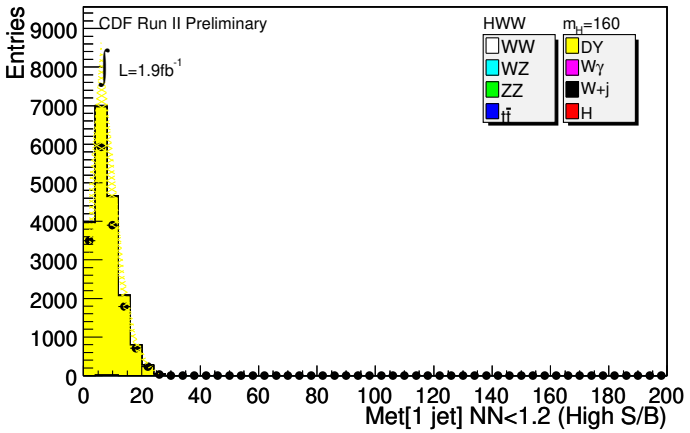
Entries
Met[0 jets] NN<1.2 (High S/B)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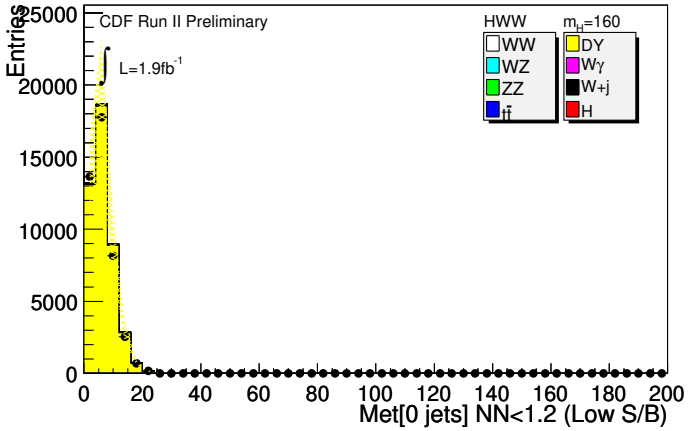
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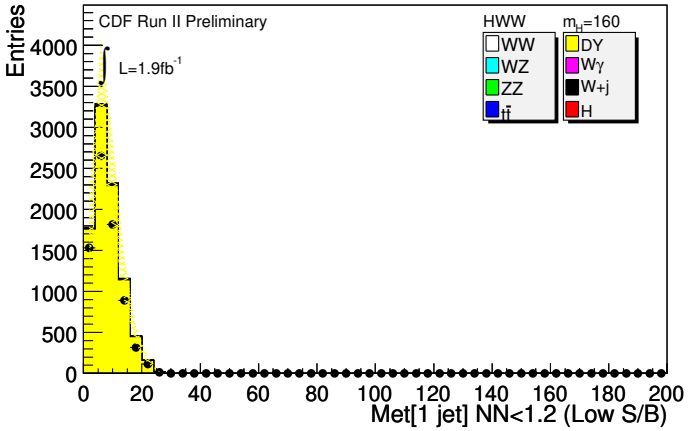
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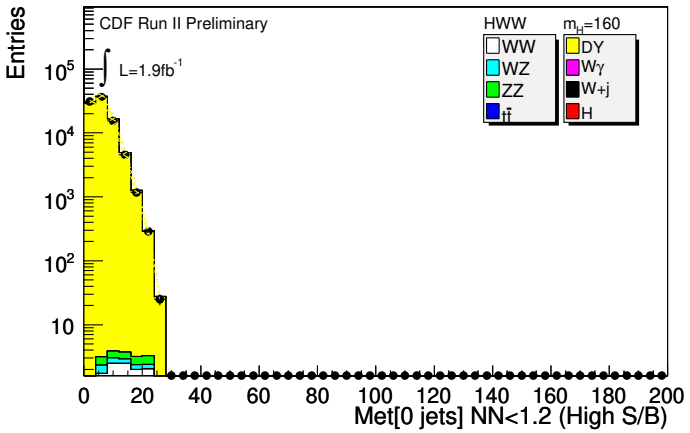
Met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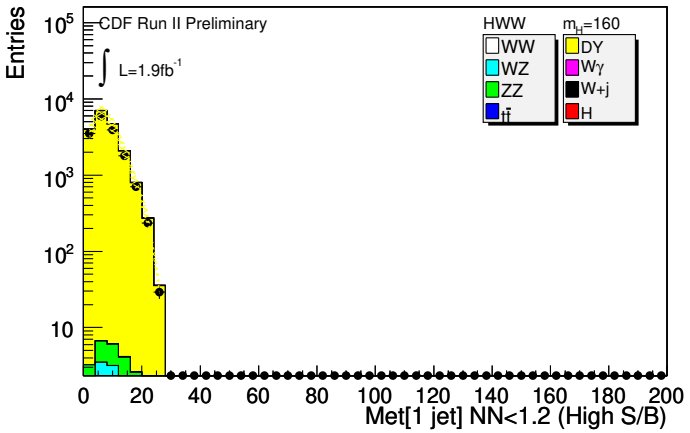
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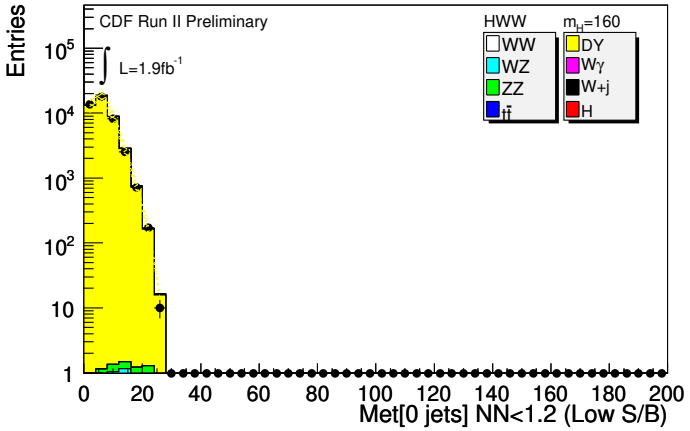
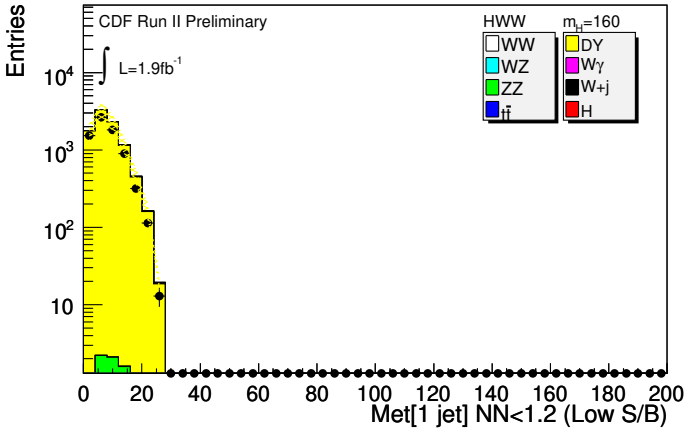
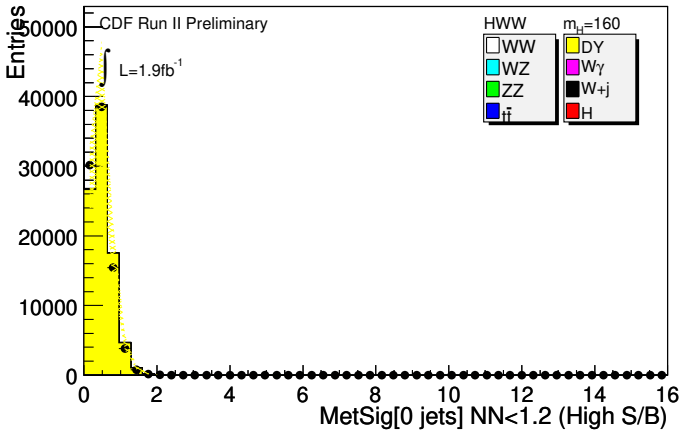
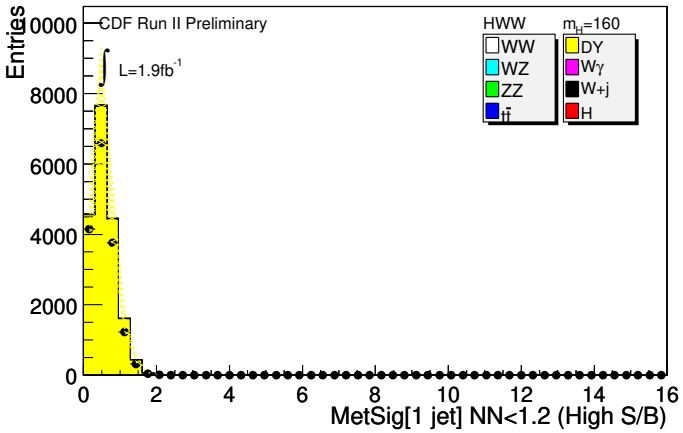
Entries
Met[1 jet] NN<1.2 (High S/B)

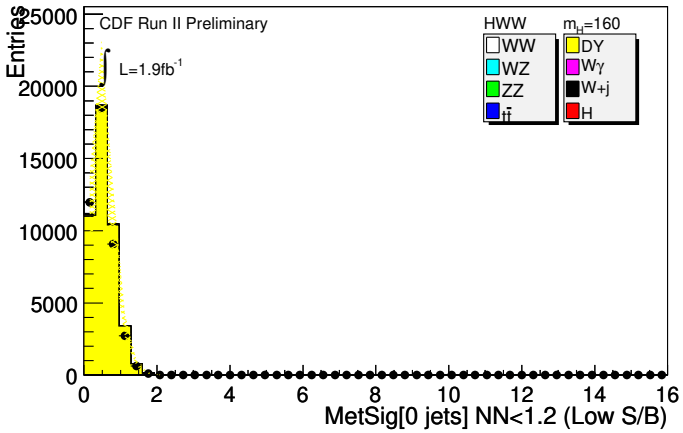

CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
Met[0 jets] NN<1.2 (Low S/B)

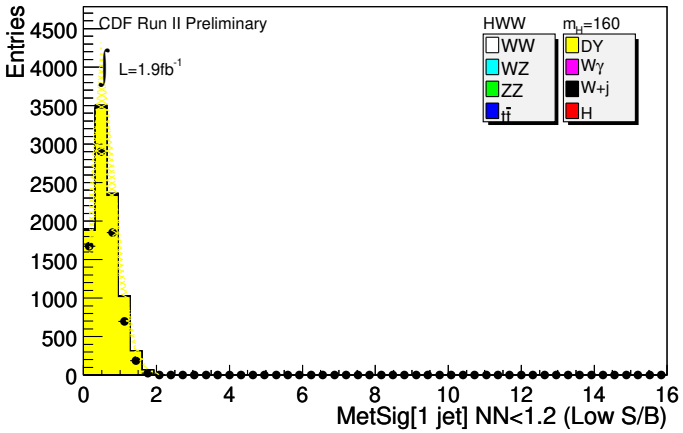

CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
Met[1 jet] NN<1.2 (Low S/B)

MetSig


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[1 jet] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] NN<1.2 (Low S/B)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HWW
m_H=160
WW
WZ
ZZ
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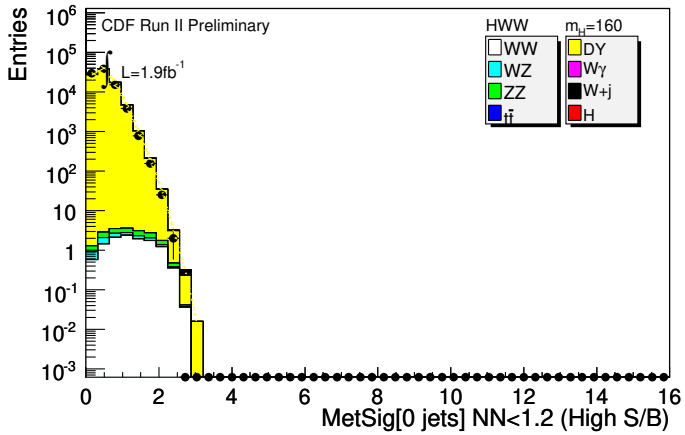
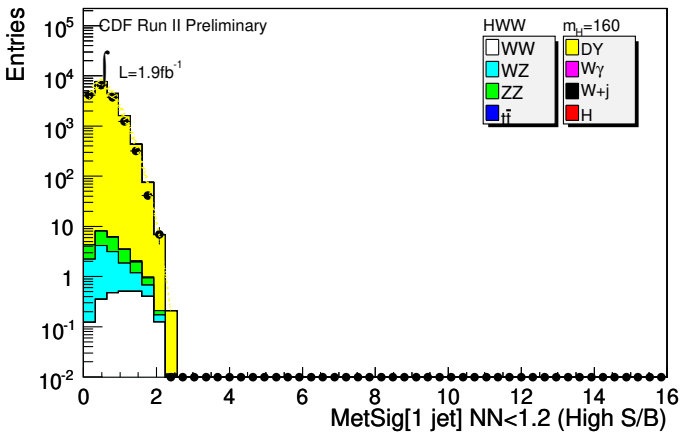
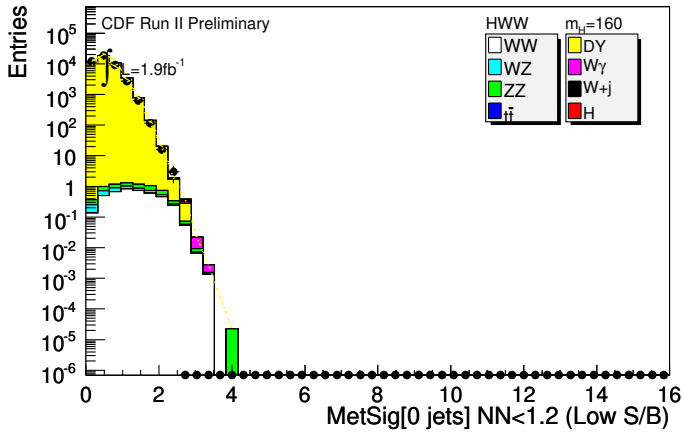
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[1 jet] NN<1.2 (Low S/B)

MetSig


CDF Run II Preliminary
L=1.9fb^{-1}
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
Entries
MetSig[0 jets] NN<1.2 (High S/B)


CDF Run II Preliminary
L=1.9fb^{-1}
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
Entries
MetSig[1 jet] NN<1.2 (High S/B)


CDF Run II Preliminary
L=1.9fb^{-1}
HWW
m_H=160
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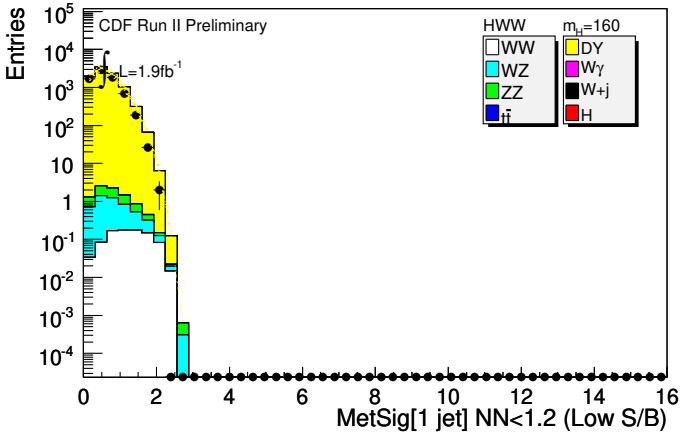
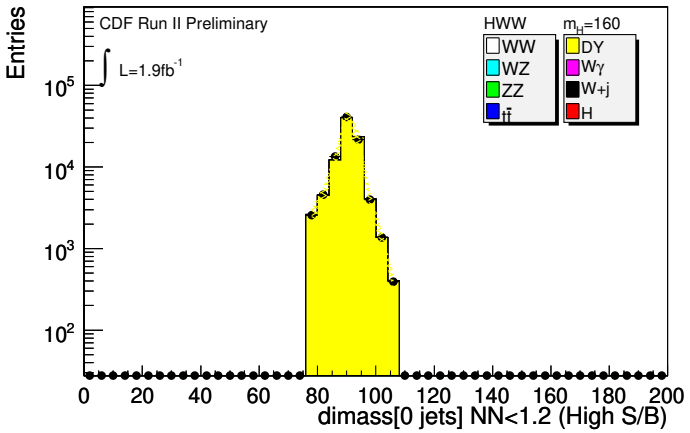
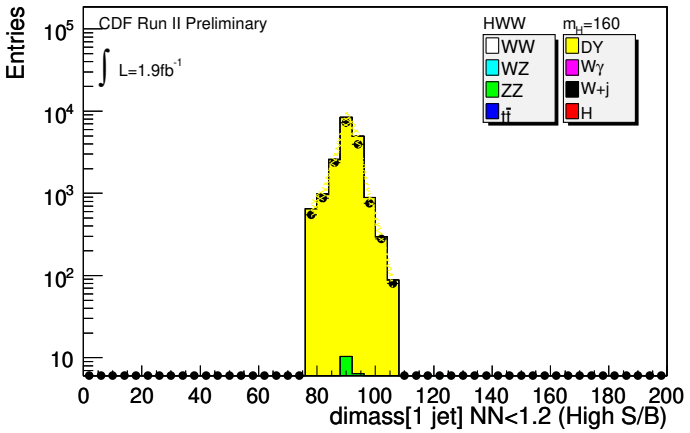
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
Entries
MetSig[0 jets] NN<1.2 (Low S/B)


CDF Run II Preliminary
L=1.9fb^{-1}
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
Entries
MetSig[1 jet] NN<1.2 (Low S/B)

DiMass


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW m_H=160
WW
WZ
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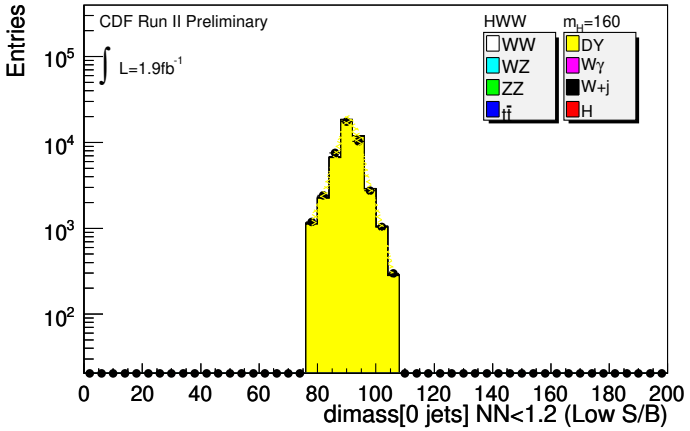
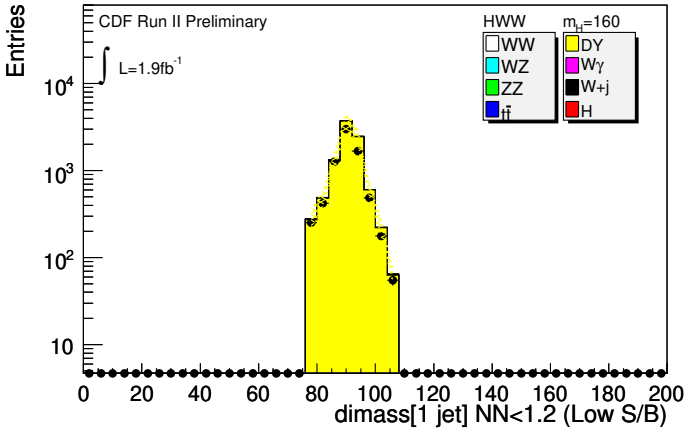
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[1 jet] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] NN<1.2 (Low S/B)


CDF Run II Preliminary
HWW m_H=160
WW
WZ
ZZ
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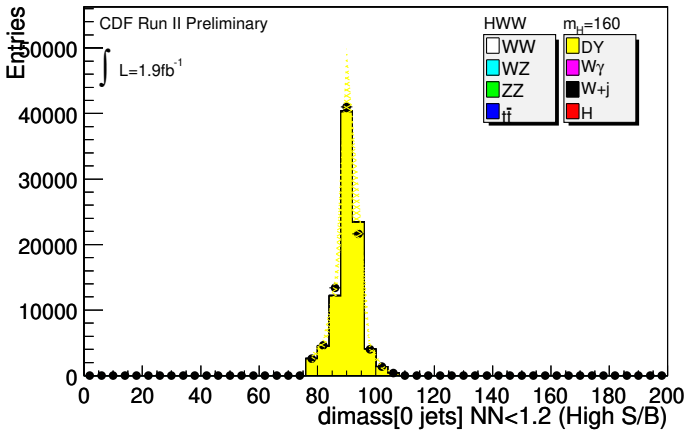
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[1 jet] NN<1.2 (Low S/B)

DiMass


CDF Run II Preliminary
HWW
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WW
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DY
Wγ
W+j
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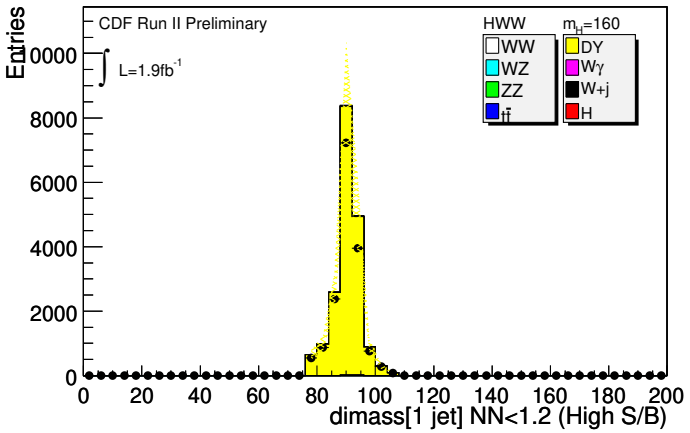
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW
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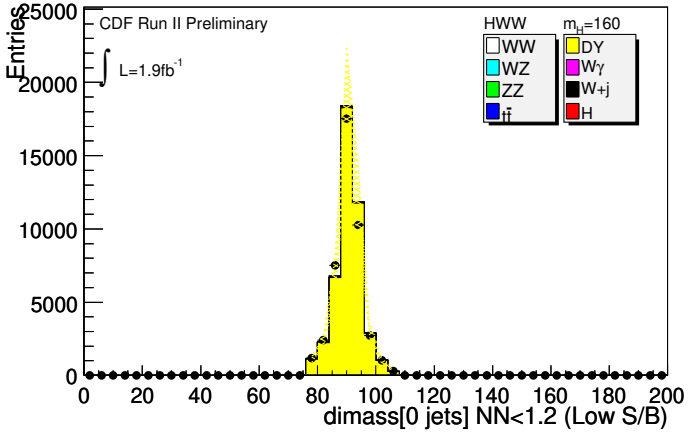
∫ L=1.9fb^{-1}
Entries
dimass[1 jet] NN<1.2 (High S/B)


CDF Run II Preliminary
HWW
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WZ
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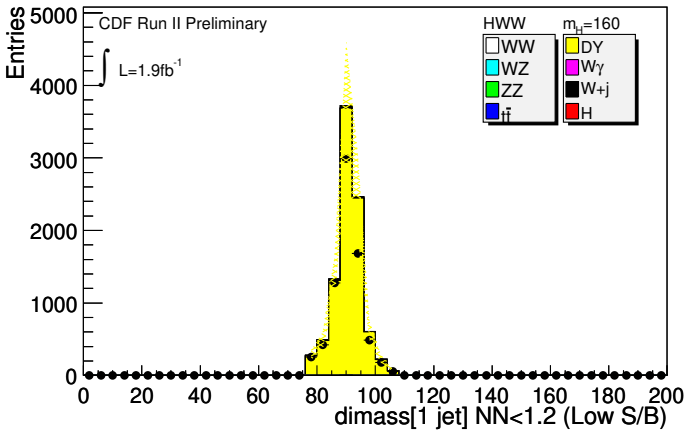
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] NN<1.2 (Low S/B)


CDF Run II Preliminary
HWW
m_H=160
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WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
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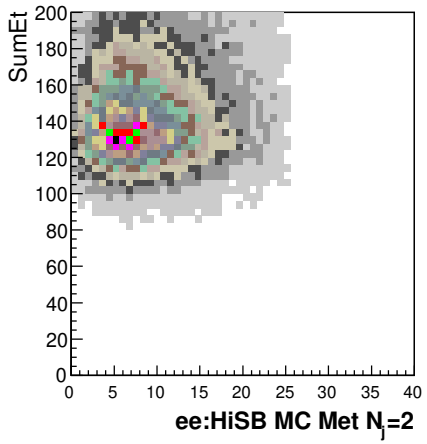
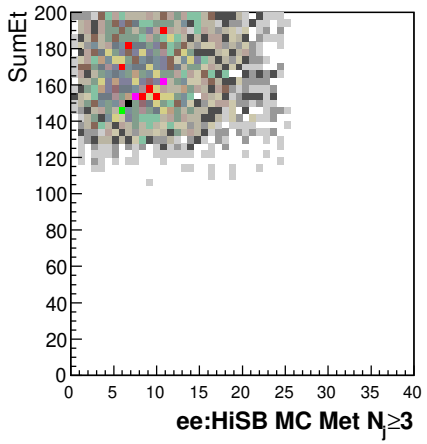
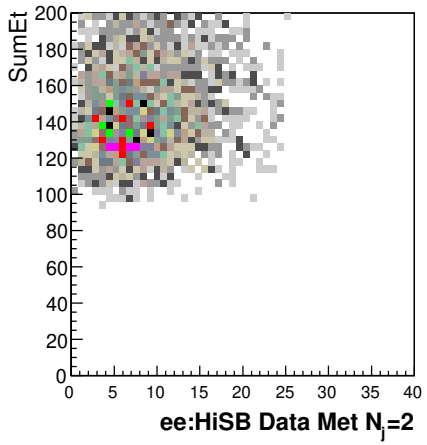
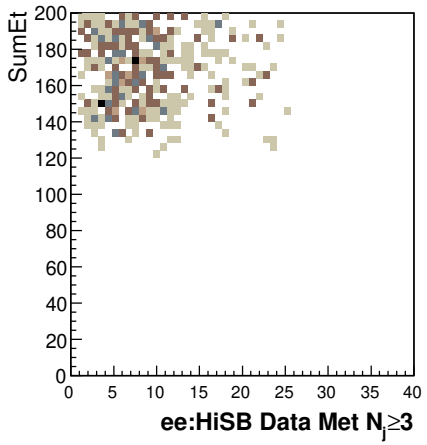
∫ L=1.9fb^{-1}
Entries
dimass[1 jet] NN<1.2 (Low S/B)

SumEtLeptonsJets vs Met: HiSB, ee, Jets=2 ≥ 3

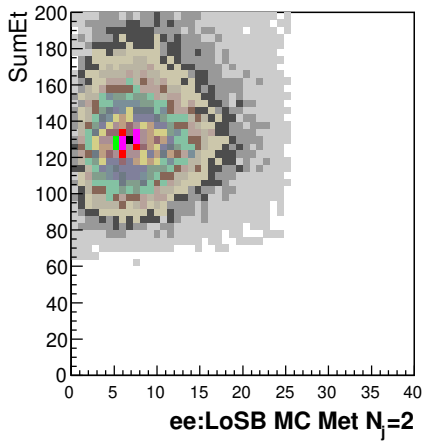


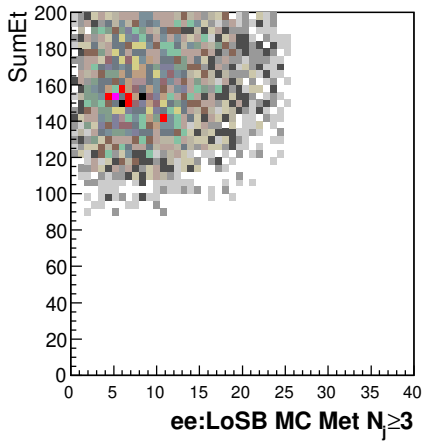


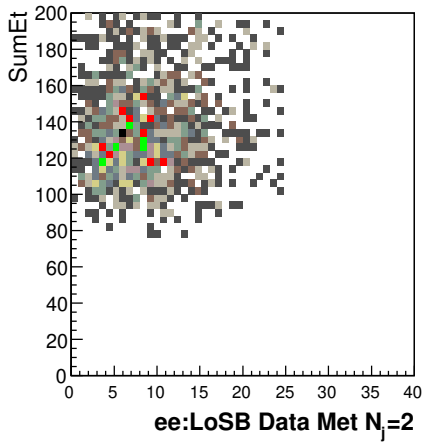


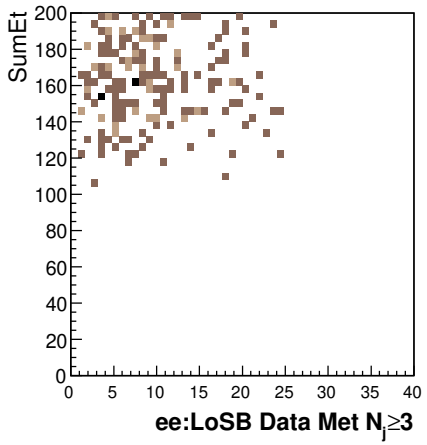


SumEtLeptonsJets vs Met: LoSB, ee, Jets=2, ≥ 3

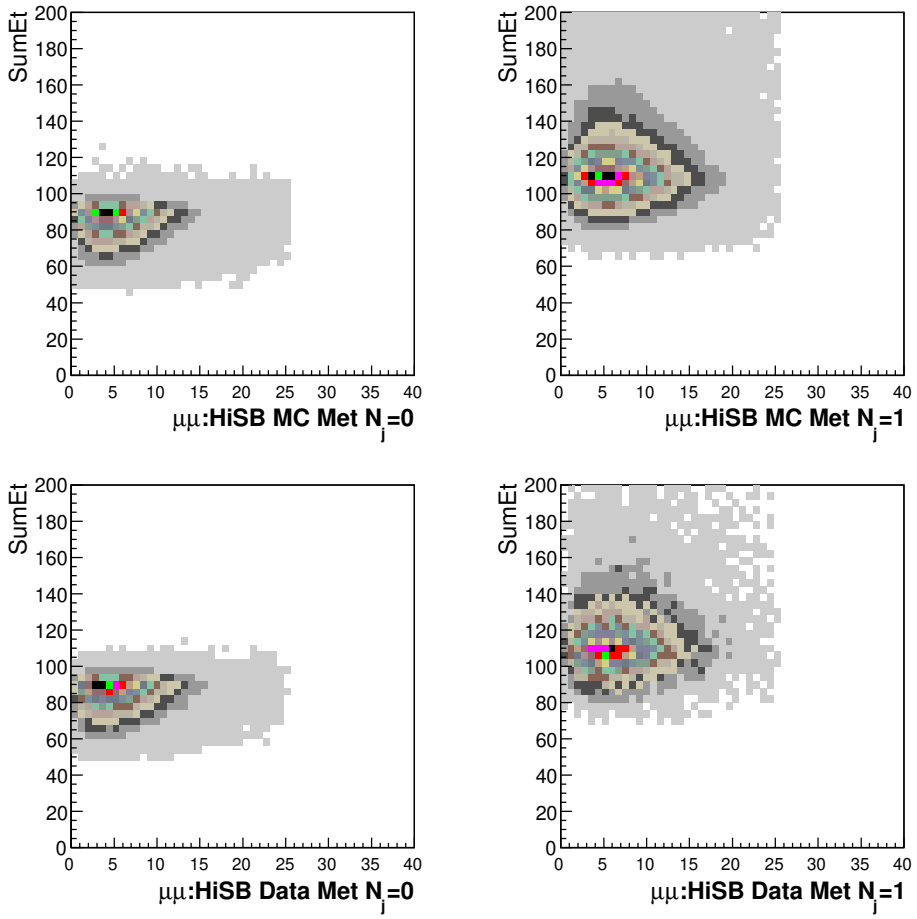




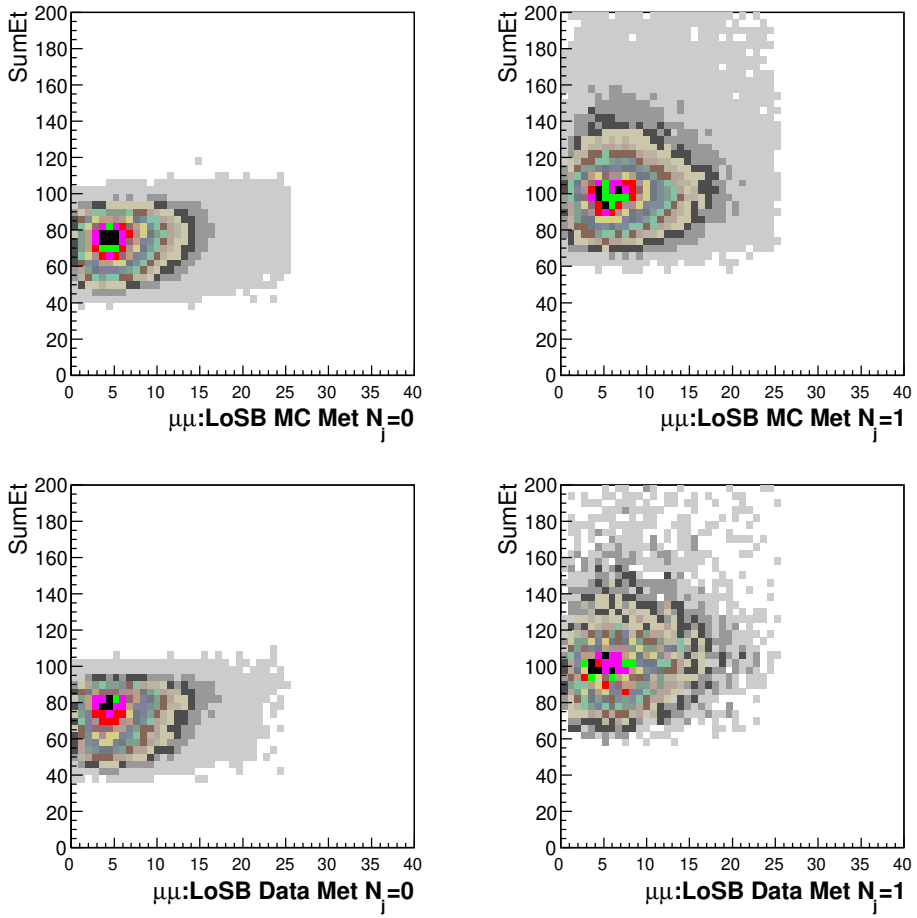




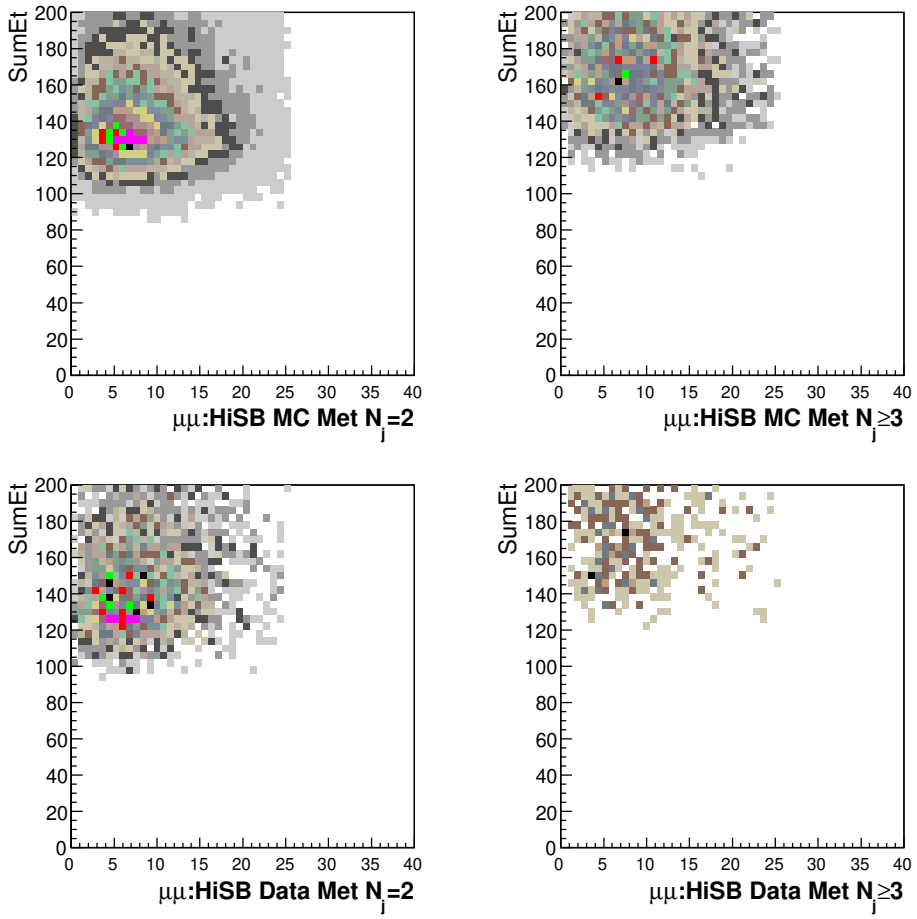
SumEtLeptonsJets vs Met: HiSB, mumu, Jets=1,2



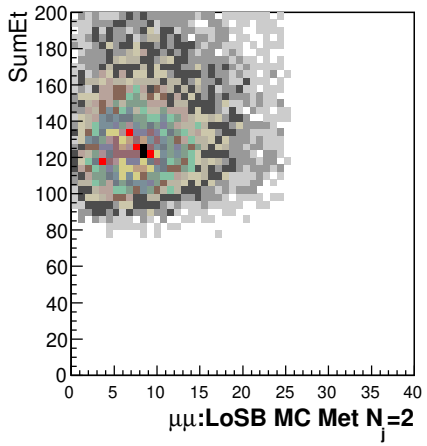
SumEtLeptonsJets vs Met: LoSB, mumu, Jets=1,2

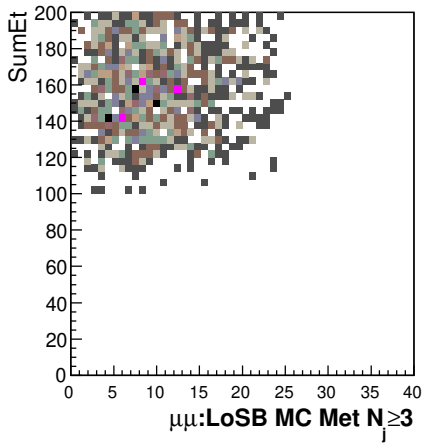


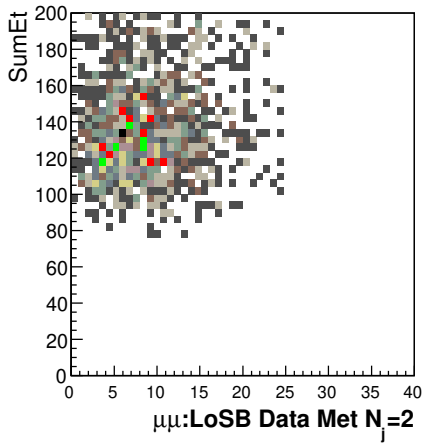
SumEtLeptonsJets vs Met: HiSB, mumu, Jets=2,≥ 3

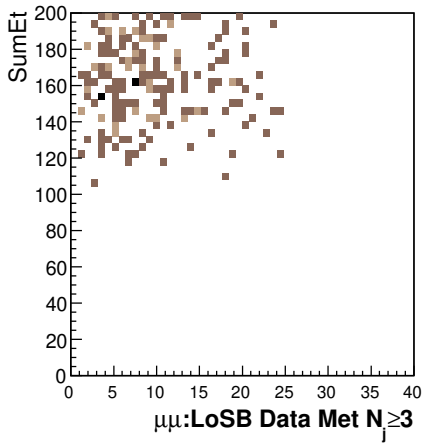


SumEtLeptonsJets vs Met: LoSB, mumu, Jets=2, ≥ 3

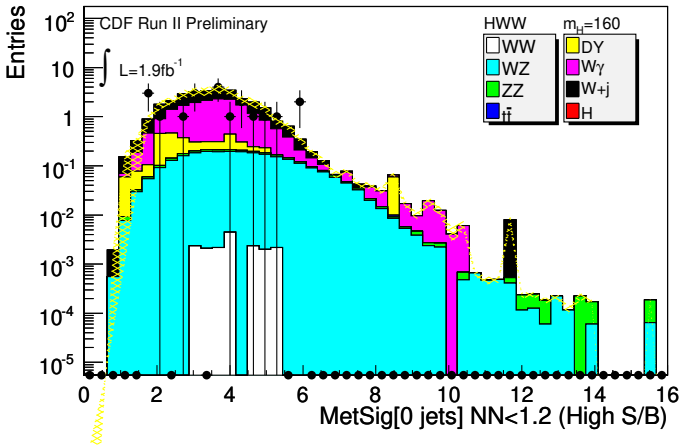


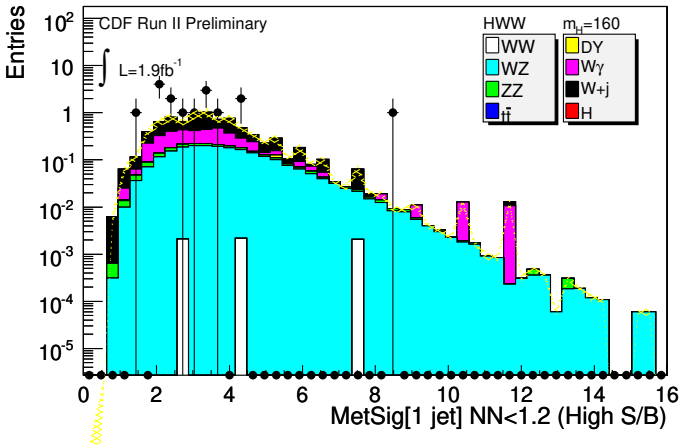


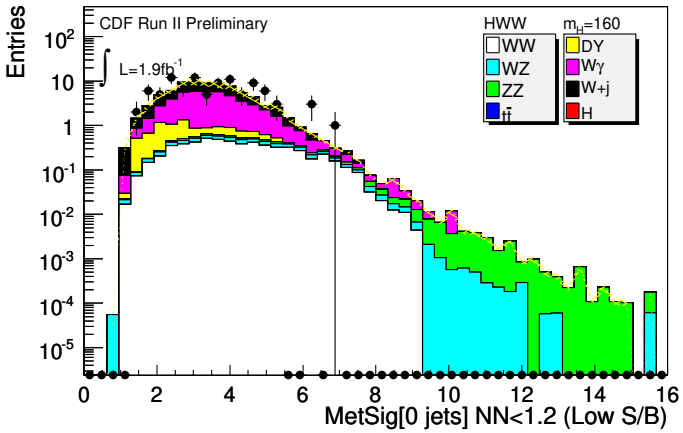


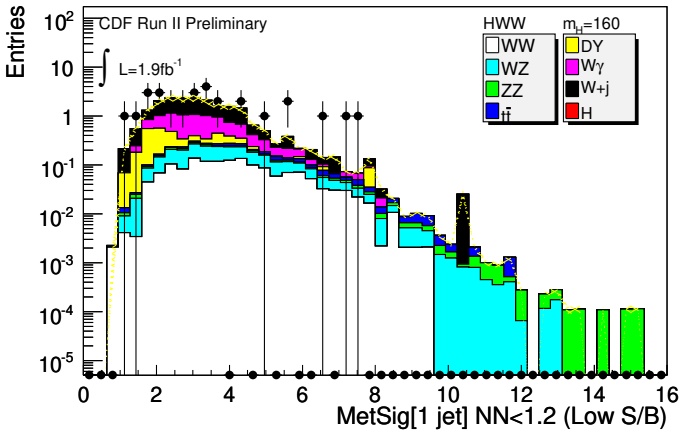


Base SameSign

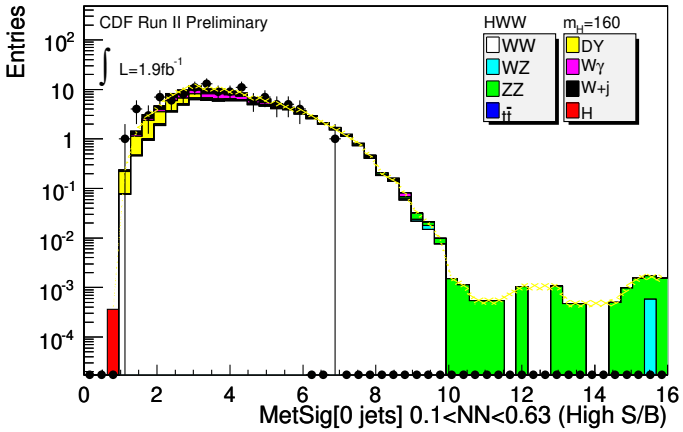


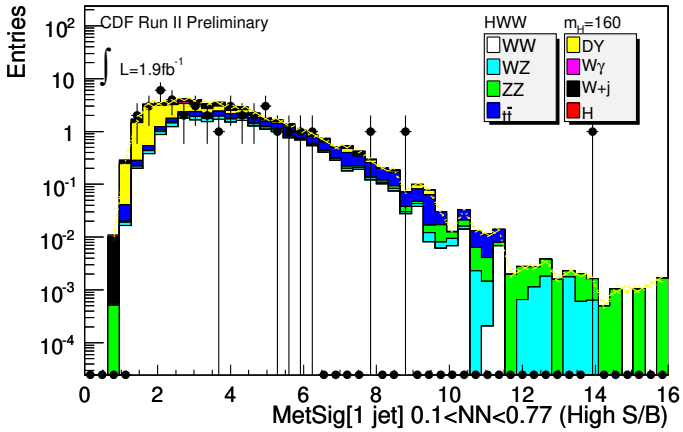






Base


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] 0.1<NN<0.63 (High S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
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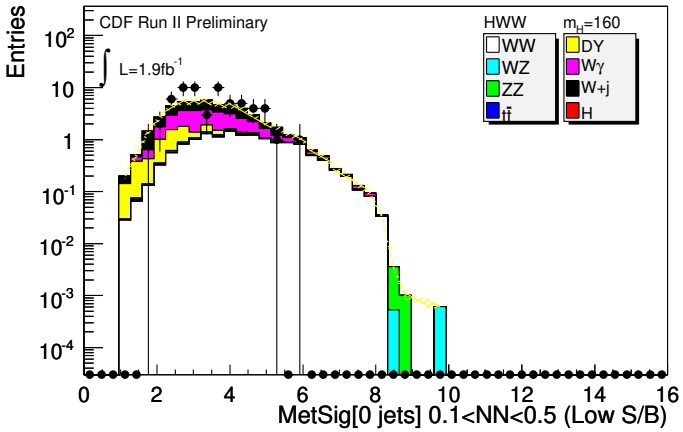
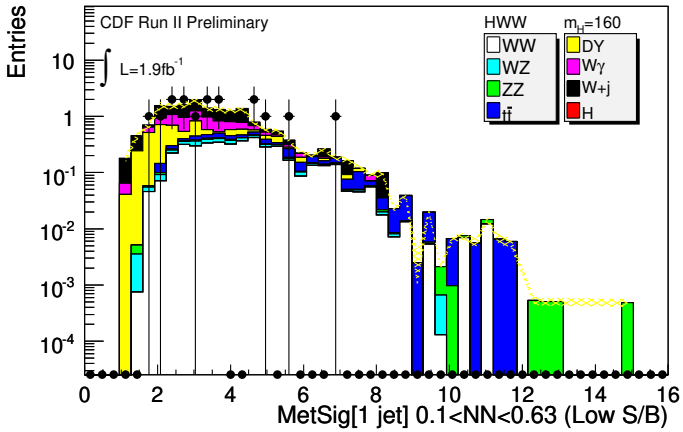
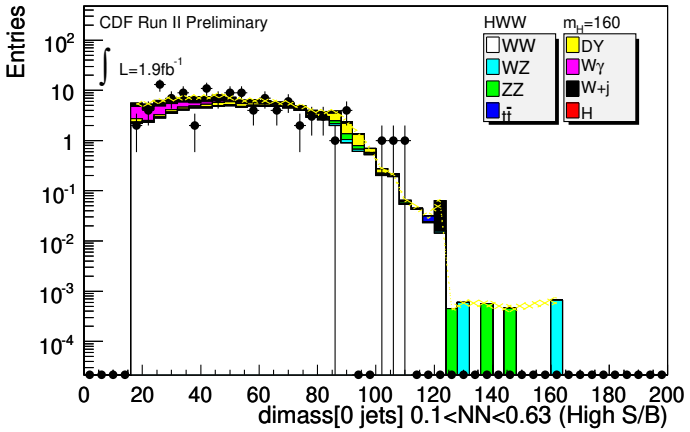
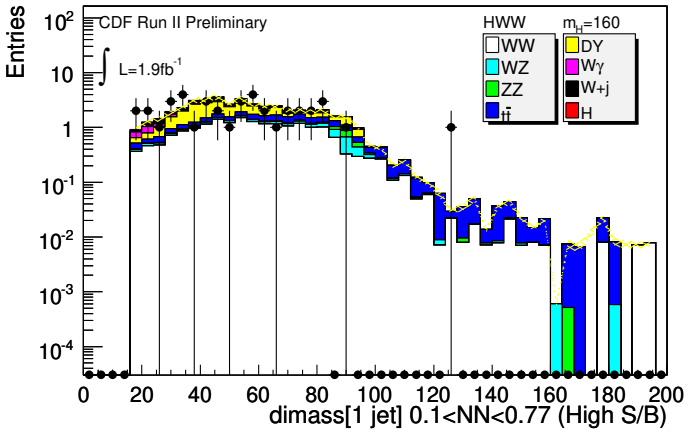

CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[0 jets] 0.1<NN<0.5 (Low S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
MetSig[1 jet] 0.1<NN<0.63 (Low S/B)

Base


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] 0.1<NN<0.63 (High S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
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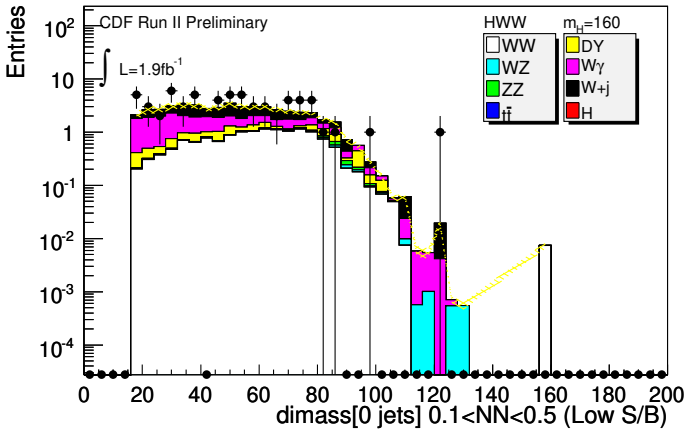
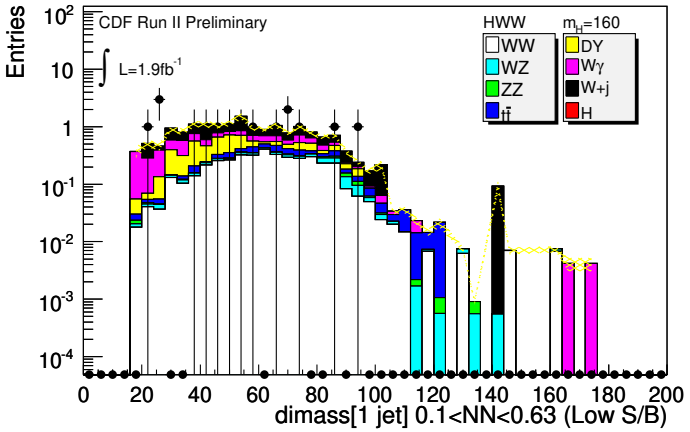
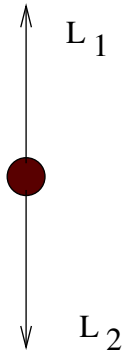

CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[0 jets] 0.1<NN<0.5 (Low S/B)


CDF Run II Preliminary
HWW
m_H=160
WW
WZ
ZZ
$t\bar{t}$
DY
Wγ
W+j
H
∫ L=1.9fb^{-1}
Entries
dimass[1 jet] 0.1<NN<0.63 (Low S/B)

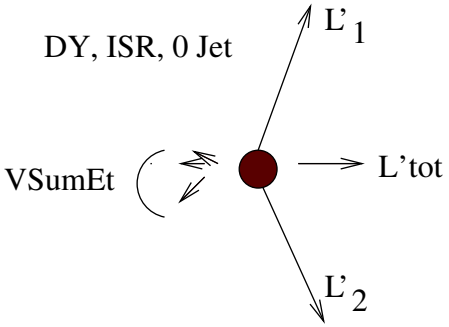
Calibrating SumEt

DY, No ISR



Met=0

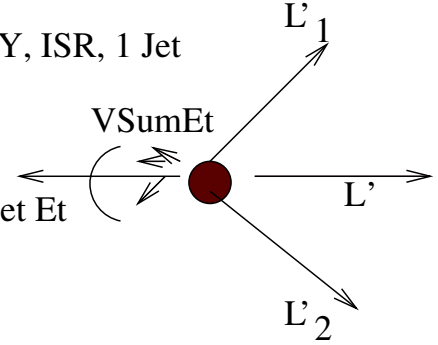
DY, ISR, 0 Jet



L'tot = VSumEt

Met=–(L'tot + VSumEt)=0

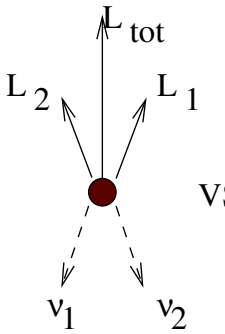
DY, ISR, 1 Jet



Ltot'= VSumEt + JetEt

Met=–(Ltot' + VSumEt + JetEt)=0

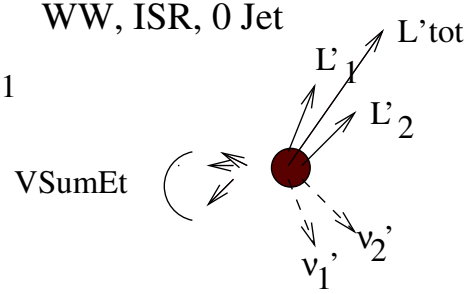
WW, No ISR



$L_{tot} = L_1 + L_2 = -(\nu_1 + \nu_2)$

$= -MET$

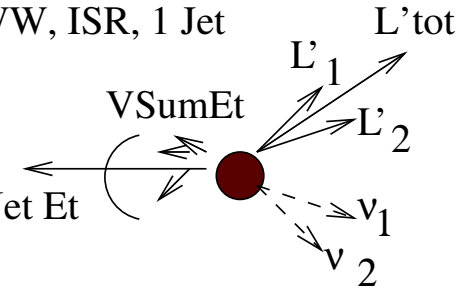
WW, ISR, 0 Jet



L'tot = VSumEt + Ltot

Met=–(L'tot + VSumEt)

WW, ISR, 1 Jet



L'tot= SumEt + JetEt + Ltot

Calibrating SumEt: DY

- DY: for CM or No ISR and no jet:

$$L_1 + L_1 = 0$$

- DY: for ISR and no jet

$$L'_1 + L'_2 = L_{tot}$$

- DY: for ISR and 1 jet

$$L'_1 + L'_2 = L_{tot} = \sum E_T + E_t^{jet}$$

This estabilishes the relationship between observed $\sum E_T$ and the vector to add to the CM vector. If a jet is present, then the table of Jet and $\sum E_T$ needs to be applied. The quantities are $\sum {E_T}^{DY0}$ and $(\sum {E_T}^{DY1}, E_t^{jet1})$.

Applying SumEt Calibration:WW

- WW: for CM or No ISR and no jet:

$$L_1 + L_2 = L_{tot} = \not\!\!E_T = \not\!\!E_{T\,obs} = -(\nu_1 + \nu_2)$$

Here, $L_{tot} \equiv L_{CM}$

- WW: for ISR and no jet

$$L'_1 + L'_2 = L'_{tot} = \sum {E_T}^{WW} + L_{tot}$$

Hence

$$L_{tot} = L'_{tot} - \sum {E_T}^{WW}$$

We assume now that $\sum {E_T}^{WW} = \sum {E_T}^{DY}$ For a given $\sum {E_T}^{WW}$ and substitute in the corresponding calibration for $\sum {E_T}^{DY}$.

- WW: for ISR and 1 jet

$$L_1' + L_2' = L_{tot}' = \sum {E_T}^{WW} + E_t^{jet} + L_{tot}$$

Hence

$$L_{tot} = L_{tot}' - \sum {E_T}^{WW} - E_t^{jet}$$

We assume now that for $(E_t^{jet})^{WW}$ $(\sum {E_T}^{WW})_{1\,jet} = (\sum {E_T}^{DY})_{1\,jet}$
For a given $(SumEt^{WW})_{1\,jet}$ and $(E_t^{jet})^{WW}$ substitute in the corresponding calibration for $(\sum {E_T}^{DY})_{1\,jet}$ and $(E_t^{jet})^{DY}$