LEPTONIC SUSY SEARCH WITH SAME SIGN DIMUONS

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INTRODUCTION OF SUPERSYMMETRY

- Supersymmetry is a generalization of the space-time symmetry of quantum field theory that transforms fermions into bosons and vice versa. It can provide a framework for the unification of particle physics and gravity, which governed by the Plank energy scale, $M_P \approx 10^{19}$GeV. In particular, SUSY will ultimately explain the origin of the large hierarchy of energy scales from the W and Z masses to the Plank scale(gauge hierarchy).

INTRODUCTION OF SUPERSYMMETRY

- If SUSY was an exact symmetry of nature, then particles and their superpartners would be degenerate in mass. Since superpartners have not (yet) been observed, supersymmetry must be a broken symmetry. Nevertheless, the stability of the gauge hierarchy can still be maintain if the breaking is soft, and the corresponding susy-breaking mass parameter are no larger than a few TeV

INTRODUCTION OF SUPERSYMMETRY

- Although there are no unambiguous experitmental result (at present) that require the existence of new physics at the TeV-scale, expectations of the latter are primarily based on three theoretical argument.

1. A nature explanation of the gauge hierarchy demands new physics at the TeV-scale.
2. The unification of the three gauge coupling at the Plank energy scale does not occur in the SM, but it can achieved with the addition of new physics that can modify the way gauge coupling run over the EW scale. Such as MSSM
3. The existence of dark matter cannot be explained within the SM. The lightest susy particlea is a promising candidate for the dark matter.

MSUGRA PARAMETERS AND SPECTRUM

- Five free parameters: m_0,$m_{1/2}$,A_0,tanβ, sign(μ) Then the sparticle spectrum, decay branching ratios and production cross sections can be derived.
- gaugino mass parameters:

$$M_3 \equiv M_{\tilde{g}} \simeq 2.7 m_{1/2}; M_2\left(M_Z\right) \simeq 0.8 m_{1/2}; M_1\left(M_Z\right) \simeq 0.4 m_{1/2}$$

- gluino mass is equal to M_3, neutralinos $\tilde{\chi}_i^0$ (i=1-4) and chargino $\tilde{\chi}_i^{\pm}$ (i=1-2) masses are obtained after diagonalising their mass matrices which are a function of M_1,M_2, μ.
- The sfermions of the first two generations:

$$m_{\tilde{u}_L}^2 \simeq m_0^2 + 5.0 m_{1/2}^2 + 0.35 \cos 2\beta M_Z^2 \qquad m_{\tilde{u}_R}^2 \simeq m_0^2 + 4.5 m_{1/2}^2 + 0.15 \cos 2\beta M_Z^2$$

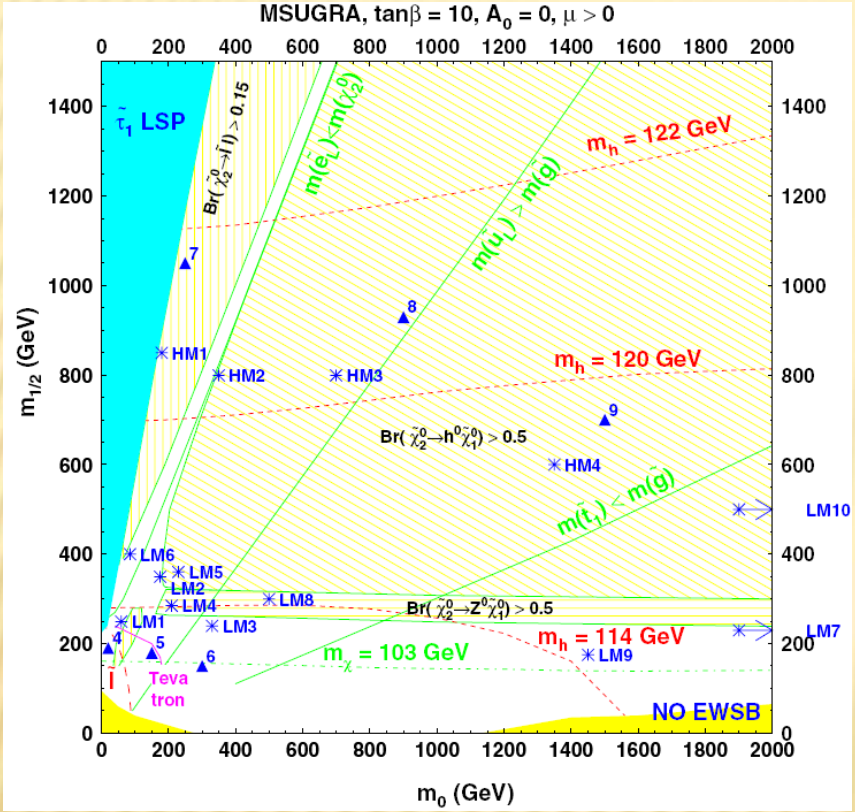
$$m_{\tilde{d}_L}^2 \simeq m_0^2 + 5.0 m_{1/2}^2 - 0.42 \cos 2\beta M_Z^2 \qquad m_{\tilde{d}_R}^2 \simeq m_0^2 + 4.4 m_{1/2}^2 - 0.07 \cos 2\beta M_Z^2$$

$$m_{\tilde{e}_L}^2 \simeq m_0^2 + 0.49 m_{1/2}^2 - 0.27 \cos 2\beta M_Z^2 \qquad m_{\tilde{e}_R}^2 \simeq m_0^2 + 0.15 m_{1/2}^2 - 0.23 \cos 2\beta M_Z^2$$

$$m_{\tilde{\nu}}^2 \simeq m_0^2 + 0.49 m_{1/2}^2 + 0.50 \cos 2\beta M_Z^2$$

- Third family scalars mass are more complicated. *Yukawa couplings ,off-diagonal elements.*

TEST POINT FOR MSUGRA



Point	m_0	$m_{1/2}$	$\tan\beta$	sgn(μ)	A_0
LM1	60	250	10	+	0
LM2	185	350	35	+	0
LM3	330	240	20	+	0
LM4	210	285	10	+	0
LM5	230	360	10	+	0
LM6	85	400	10	+	0
LM7	3000	230	10	+	0
LM8	500	300	10	+	−300
LM9	1450	175	50	+	0
LM10	3000	500	10	+	0
HM1	180	850	10	+	0
HM2	350	800	35	+	0
HM3	700	800	10	+	0
HM4	1350	600	10	+	0

LM0

$$m_0 = 200 \quad M_{1/2} = 160 \quad Tan\beta = 10 \quad Sign(\mu) = + \quad A_0 = -400$$

TEST CMS POINTS ARE INDICATE BY STARS AND THE POINT USED IN THE CMS DAQ TDR BY TRIANGLE

MSUGRA PARAMETER VALUES FOR THE TEST POINTS.MASSED ARE GIVEN IN UNITS OF GEV

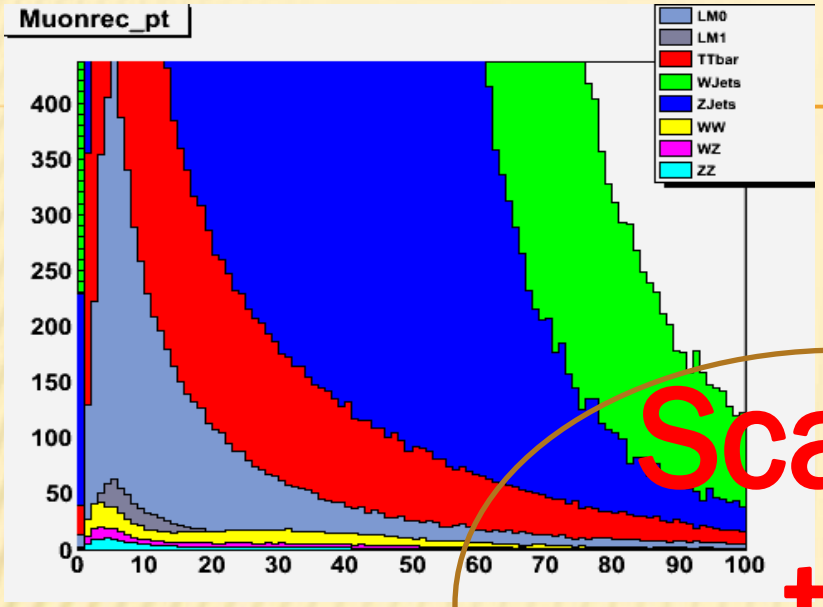
SUSY SEARCH WITH SAME SIGN DIMUON

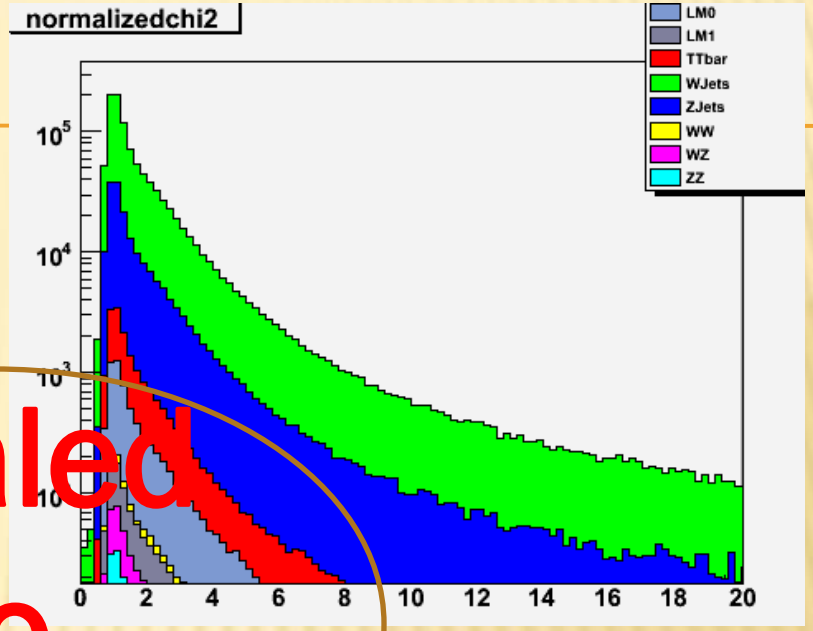
- Official background :

Background provided by office	
TTbar	Considered
W+jets	Considered
Z+jets	Considered
WW+jets	Considered
WZ+Jets	Considered
ZZ+jets	Considered
QCD	Non considered
WWW+jets	Non considered
Z+bbar+jets	Non considered

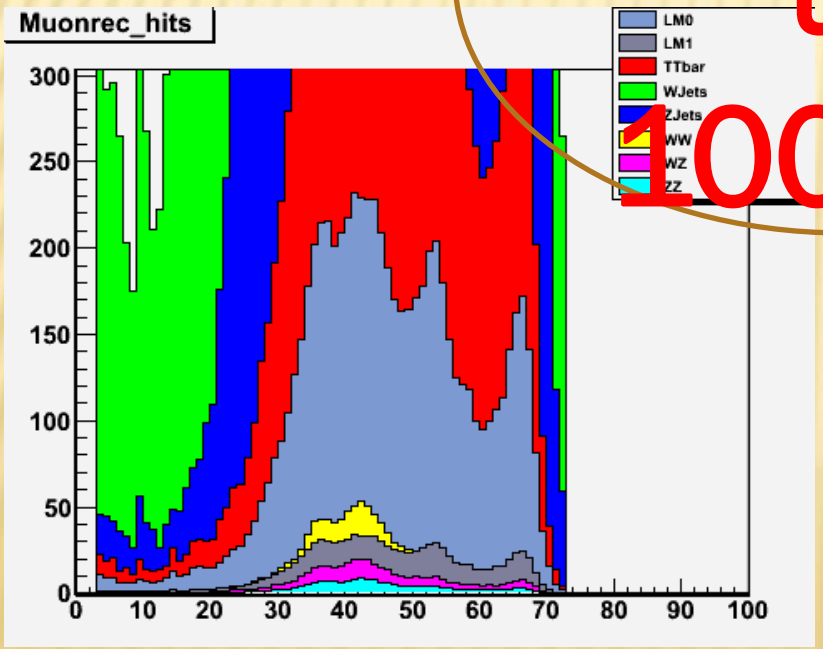
MUON CUTS

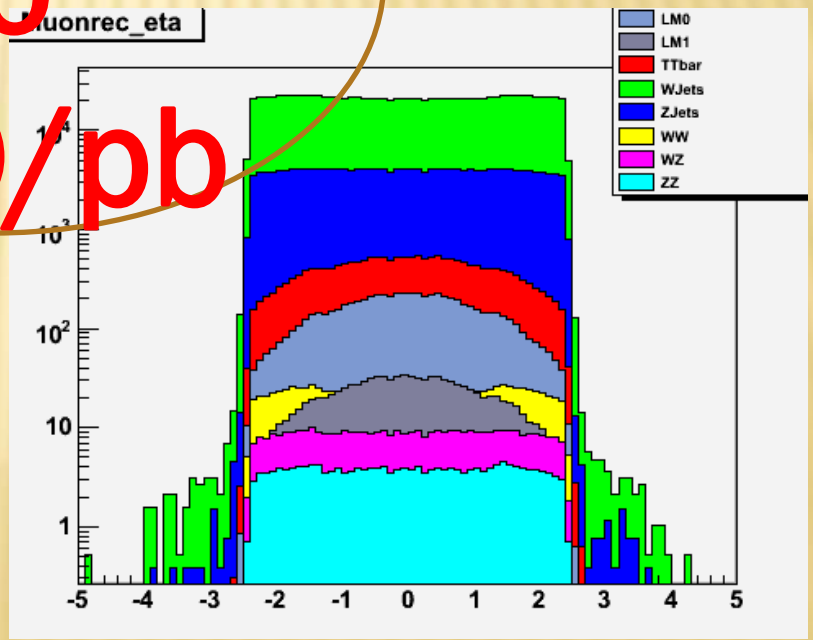
- 2SS global Muons with pt large than 10TeV
- The number of hits more than 11
- Muons' eta less than 2.4
- NormalizedChi2 less than 3
- 2 muons deltaR larger then 0.01





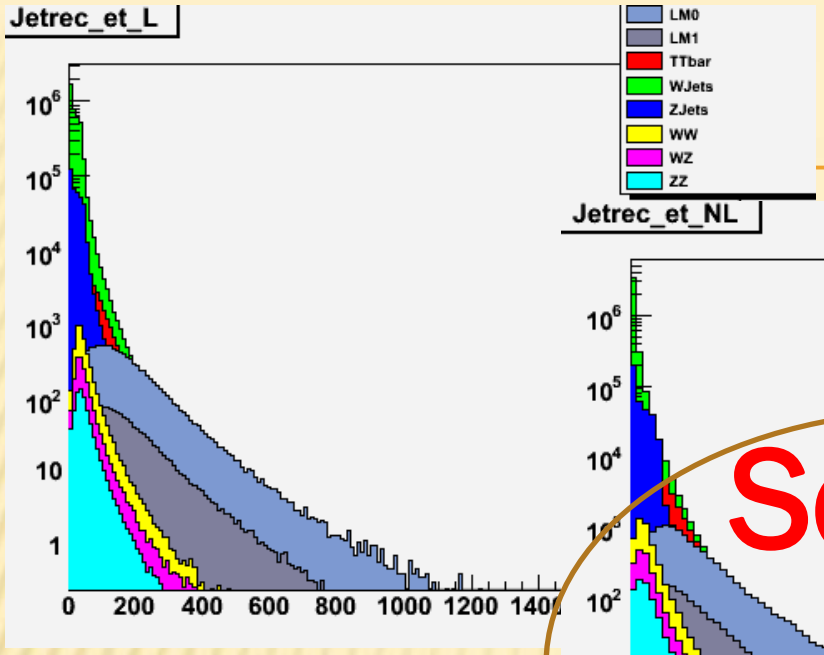
Scaled to 100/pb

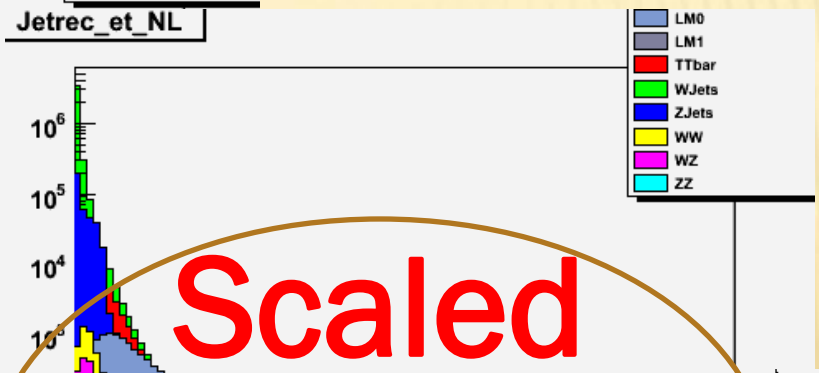




JET CUTS (KT4CALO JET)

- The number of jet more than 3
- The L, NL, NNL Jet Et larger than 175GeV,130GeV, 55GeV





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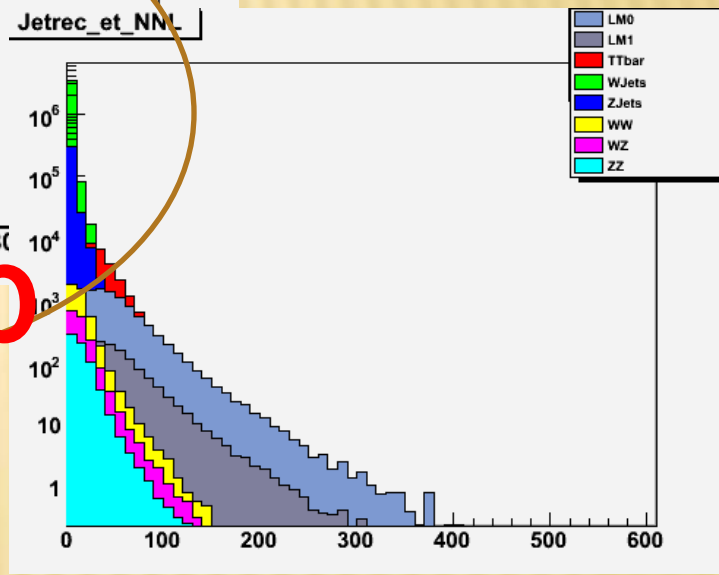
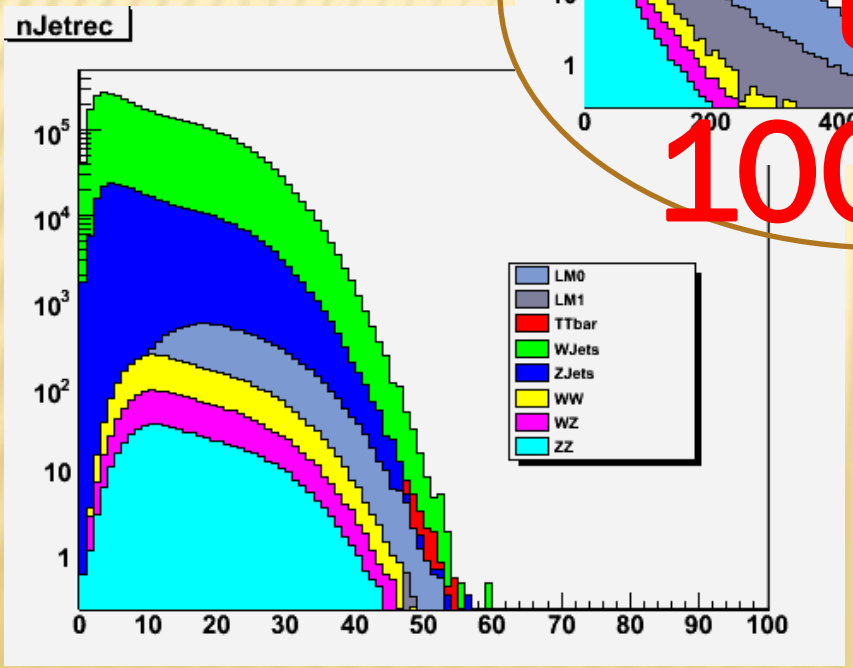
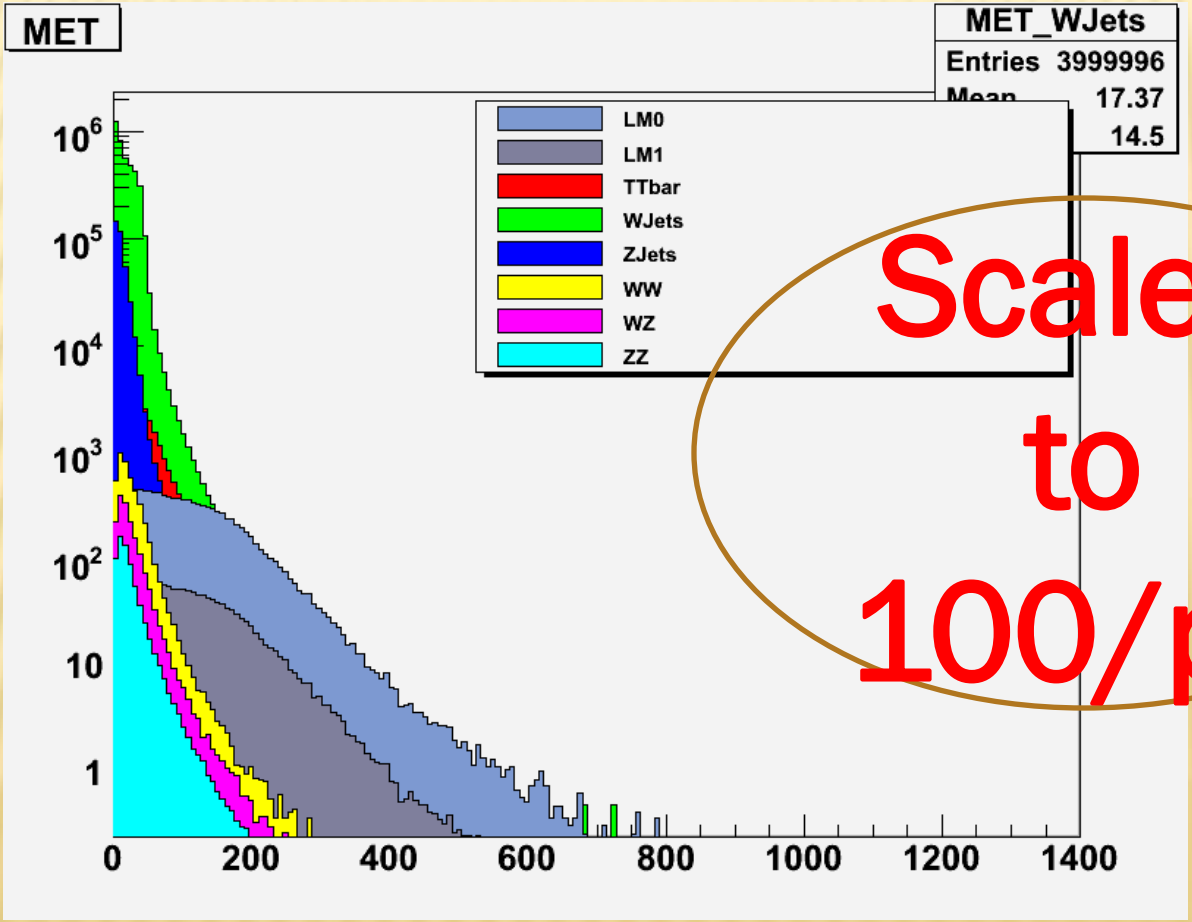




MET CUT

- MET large than 200GeV



MC DATA SAMPLE USED

Sample name on DBS	Total Events	Events (pass all cuts)	σ pb
/SUSY LM0-sftsht/Summer08 V11 -SIM-RECO _ M _IDEAL_ _v1/GEN	195786	123	110
/SUSY_LM1_sftsht/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	98914	72	16
/TTJets-madgraph/Fall08_IDEAL_ 11_redigi_v10/GEN-SIM-RECO	510000	19	317
/WJets-madgraph/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	7636495	0	40000
/ZJets-madgra h/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	974405	0	3700
/WW/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	160000	0	44.8
/WZ_incl/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	216000	0	17.4
/ZZ/Summer08_IDEAL_V11_redigi_v1/GEN-SIM-RECO	190000	0	7.1

REUSLT OF UCSB AND KIT

Process	Num evts in 100/pb		Efficiency(%)		Comments
	UCSB	KIT	UCSB	KIT	
LM0	3.49233	3.256	0.0317485	0.0296	
LM1	0.635566	0.613	0.0395745	0.0382	
LM2	0.103858	0.109	0.0429168	0.0452	
LM3	0.937129	0.902	0.0794851	0.0765	
LM4	0.390348	0.352	0.0582609	0.0525	
LM5	0.093871	0.090	0.0483874	0.0466	
LM6	0.215295	0.213	0.1682	0.1666	
LM7	0.116343	0.144	0.0401183	0.0498	
LM8	0.57416	0.537	0.200756	0.1879	
LM9	0.253765	0.231	0.0219141	0.0199	
wjets	0		0		
zjets	0	0	0	0	
ttbar	0.0402708	0.046	9.7721e-05	14.3e-05	

Process	Num evts in 100/pb	Efficiency(%)
LM0	6.888	0.0562
LM1	1.152	0.0729
TTbar	1.178	0.0037
Wjets	0	0
Zjets	0	0
WW	0	0
WZ	0	0
ZZ	0	0

TO DO LIST

- Check my code, and figure out the problem
- Study the MET calculate algorithm，add the hadronic shower shape