Inclusive Signatures and Distributions for the "Classic" Blackbox

We present inclusive signatures and distributions for the "classic" blackbox with (updated) $20fb^{-1}$ of data at the LHC. The classic blackbox model has been created by the Michigan group with the data simulated by Stephen Mrenna.

The inclusive signatures and distributions for the 'old' data ($2fb^{-1}$) can be accessed from links in the official LHC Olympics webpage :

http://wwwth.cern.ch/lhcOlympics/lhcolympicsII.html

The old and updated data should not be combined.

$20fb^{-1}$ of data probably requires 2-3 years of LHC running time. The inclusive signatures and distributions posted here are very similar to those that would be presented by experimenters in the first or second conference reporting LHC data. Hence, anyone who wants to interpret an LHC signal of new physics can practice by analyzing and interpreting the inclusive signatures posted here.

Only the simplest inclusive signatures and distributions have been presented here. Readers interested in getting more information about the data as well as inclusive signatures and distributions may contact the blackbox creators,[1] [2] just as they might contact experimenters to ask for information beyond that presented in a talk.

1 Some Information about the Data File

The data file created by Stephen Mrenna uses *Pythia 6.324* for the evolution of short-distance physics to long-distance physics, such as the conversion of quarks and gluons into jets of hadrons, decays of tau leptons, etc. The program used for jet reconstruction, lepton identification and isolation, heavy flavor tagging, etc. is called *PGS* (Pretty Good simulation). Readers interested in details should refer to the *Pythia* and *PGS* websites. Links can also be found through the official LHC Olympics webpage.

2 Triggering

Triggering is done to reduce the staggering amount of data obtainable at a hadron collider to a manageable set which is interesting and worth analyzing. For more information about triggering,

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refer to the Blackbox webpage (accessible from the official LHC Olympics webpage). A simple triggering scheme has been used for the classic blackbox data set as follows:

For any simulated event,

- All electrons and muons with a transverse momentum (p_T) greater than 10 GeV are considered.
- All jets and (hadronically decaying) taus with p_T greater than 100 GeV are considered.
- The event is considered only if the missing transverse energy ($\not{E}_T$) in the event is greater than 50 GeV.
- From the set of objects which pass the above cuts, the following quantity is constructed:

$$ht_{sum} = \sum_{jets} 0.2|(p_T)_{jet}| + \sum_{\tau} 0.4|(p_T)_\tau| + \sum_{e,\mu} 4.0|(p_T)_{e,\mu}| + \not{E}_T \quad (1)$$

The event is considered only if ht_{sum} is greater than 150 GeV.

3 Inclusive Signatures

	0 jets	1 jet	2 jets	3 jets	4 jets	5 jets	$\geq$ 6 jets
0 leptons	1346	20452	35082	25641	10068	2695	562
1 lepton	3099	9322	9240	4481	1340	254	47
Opp. Sign dileptons	221	377	262	76	17	4	1
Same Sign dileptons	221	336	258	89	17	2	0
$\geq$3 leptons	2	2	1	0	0	0	0

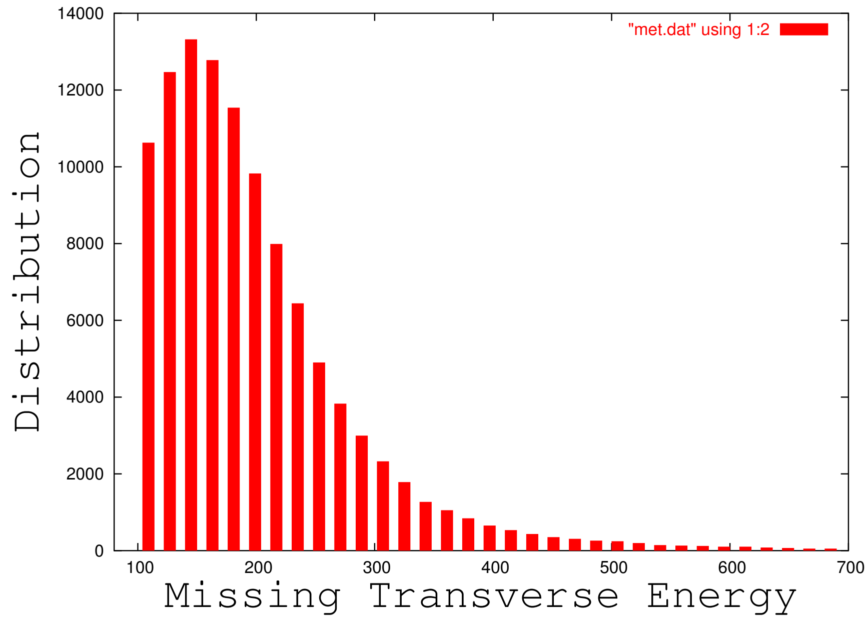
Table 1: Number of events for $20 fb^{-1}$ of data for each of the above signatures. The total number of events simulated is 142187.

4 Distributions

The following three distributions are plotted below :-

a) Distribution of $\not{E}_T$

$\not{E}_T$ is the magnitude of the missing transverse momentum in an event. It is defined as the magnitude of the vector sum of the transverse momenta of all photons, electrons, muons, hadronically decaying taus and jets.

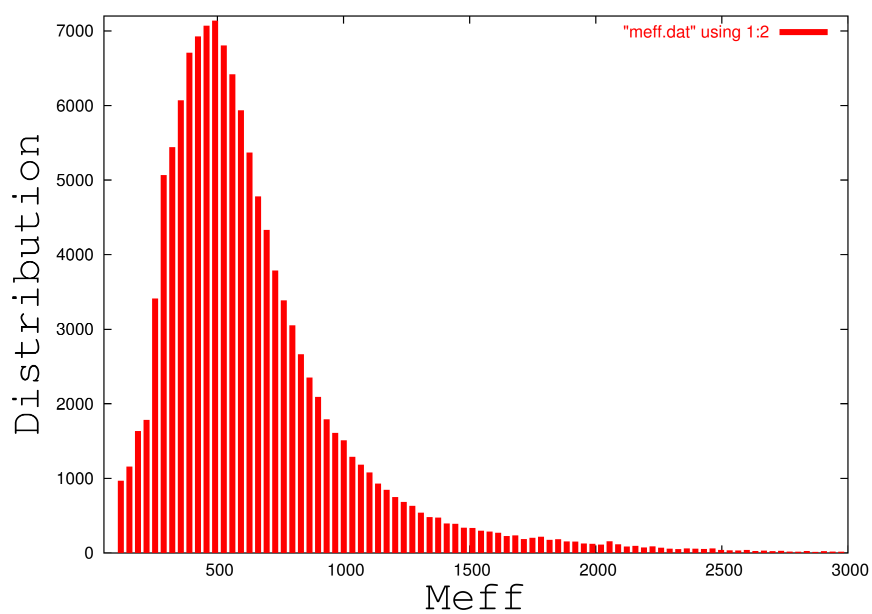


b) Distribution of M_{eff}

M_{eff} is defined as follows :

$$M_{\text{eff}} = (\sum_{1}^{n_{jets}} P_T^{jets}) + \not{E}_T \quad (2)$$

$$P_T^{jet} = \sqrt{(P_x^{jet})^2 + (P_y^{jet})^2} \quad (3)$$



c) Distribution of M_{ll} for 'Opposite Sign dileptons + ≥ 2 jets' signature

M_{ll} is defined as follows :

$$M_{ll} = \sqrt{(P_{l_1} + P_{l_2})^{\mu}(P_{l_1} + P_{l_2})_{\mu}} \tag{4}$$

The distribution (N) for M_{ll} is defined as :

$$N = |N_{e^+e^-} + N_{\mu^+\mu^-} - N_{e^+\mu^-} - N_{e^-\mu^+}| \tag{5}$$