Fake E_T^{miss} estimator for for QCD background

Robindra Prabhu
(K.Desch, P.Wienemann)
University of Freiburg

SUSY WG Meeting 31.05.06

---

(1) Motivation

(2) Fake E_T^{miss} estimator

(3) Performance (CSC Jn samples)

(4) Summary & Outlook

Motivation

- QCD contributes to E_T^{miss} in two ways:
  - Real: semileptonic decay of b,c quarks
  - Fake: instrumental $\longrightarrow$ host of different causes

- QCD has a huge cross section $\longrightarrow$ difficult to study rare events
  - Require a filtering mechanism at generator level

- Real E_T^{miss} is easy to handle
  - Select events with high-p_T neutrinos

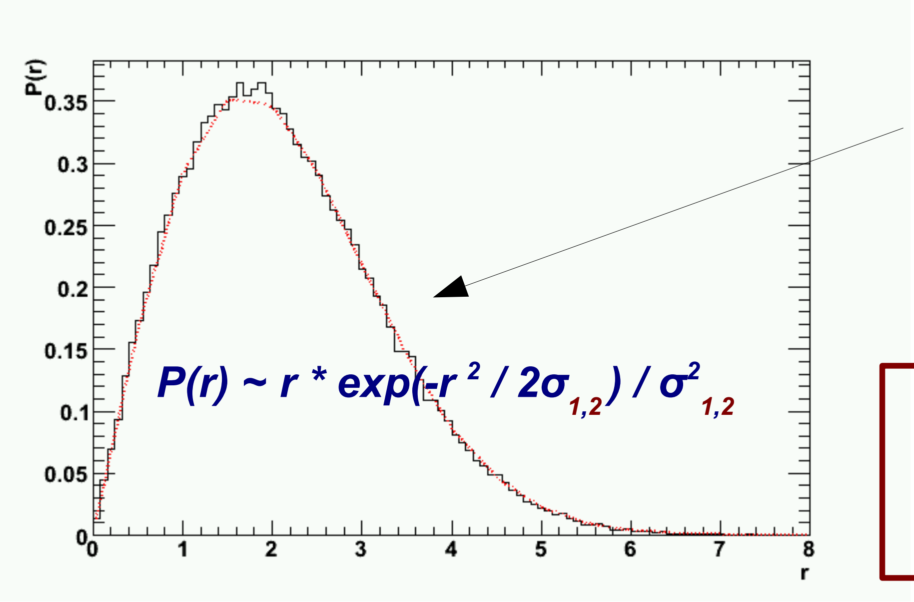
- Fake E_T^{miss} is much harder to predict!
  - Method to estimate expected $\langle$Fake $E_T^{miss}\rangle$ at generator level

Fake E_T^{miss} estimation (I)

- Assume dijet pair is back-to-back in φ
- Consider $\Delta p(1,2) = p_{meas}(1,2) - p_{true}(1,2)$
- Define $Fake\ E_T^{miss} = \Delta p_T(1,2) = sqrt\,(\Delta p_x^{\,2}(1,2) + \Delta p_y^{\,2}(1,2))$
- Assume gaussian spread of p_{meas} about p_{true} :

$$\Delta p_x = \Delta p_x(1) + \Delta p_x(2)$$

Independent gaussians with mean 0, spread σ_1 and σ_2



$P(r) \sim r * exp(-r^2 / 2\sigma_{1,2}) / \sigma^2_{1,2}$

Shape of $\Delta p_T(1,2)$ known analytically

→ Mean value :

$$<Fake\ E_T^{miss}> = \sigma_{1,2} * sqrt\,(\pi / 2)$$

Method easily extendable to N-jet events:

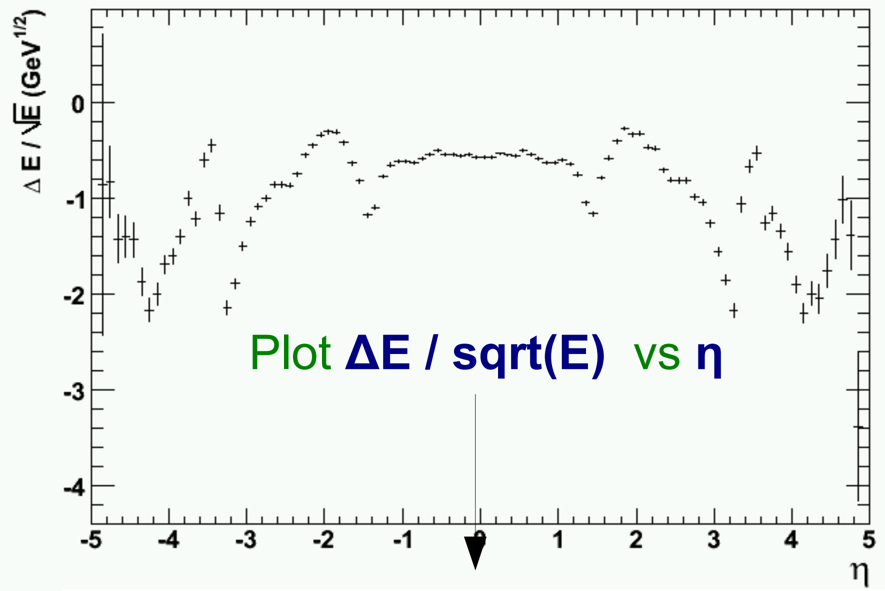
$$<Fake\ E_T^{miss}> = \sigma_N * \sqrt{2}\,\Gamma((N+1)/2) / \Gamma(N/2)$$

Fake E_T^{miss} estimation (II)

Find $\sigma(\eta, E_{jet})$ from

Rome Jn dijet samples

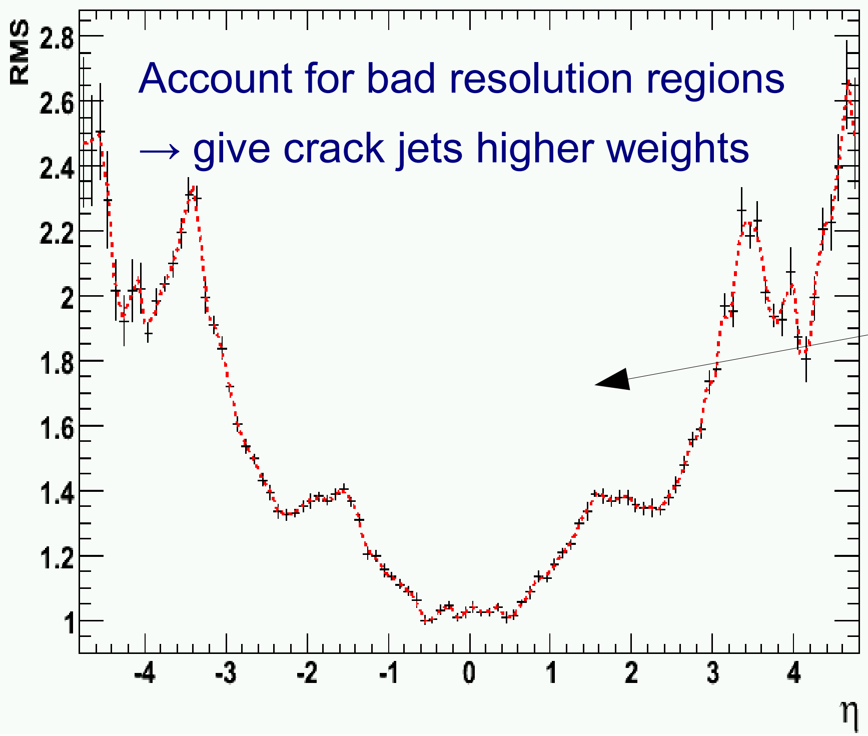
(+ private samples, court. M.Heldmann)



Plot **ΔE / sqrt(E)** vs **η**

Extract **RMS** from each **η**-bin

→ Fit distribution with a **spline**



Account for bad resolution regions

→ give crack jets higher weights

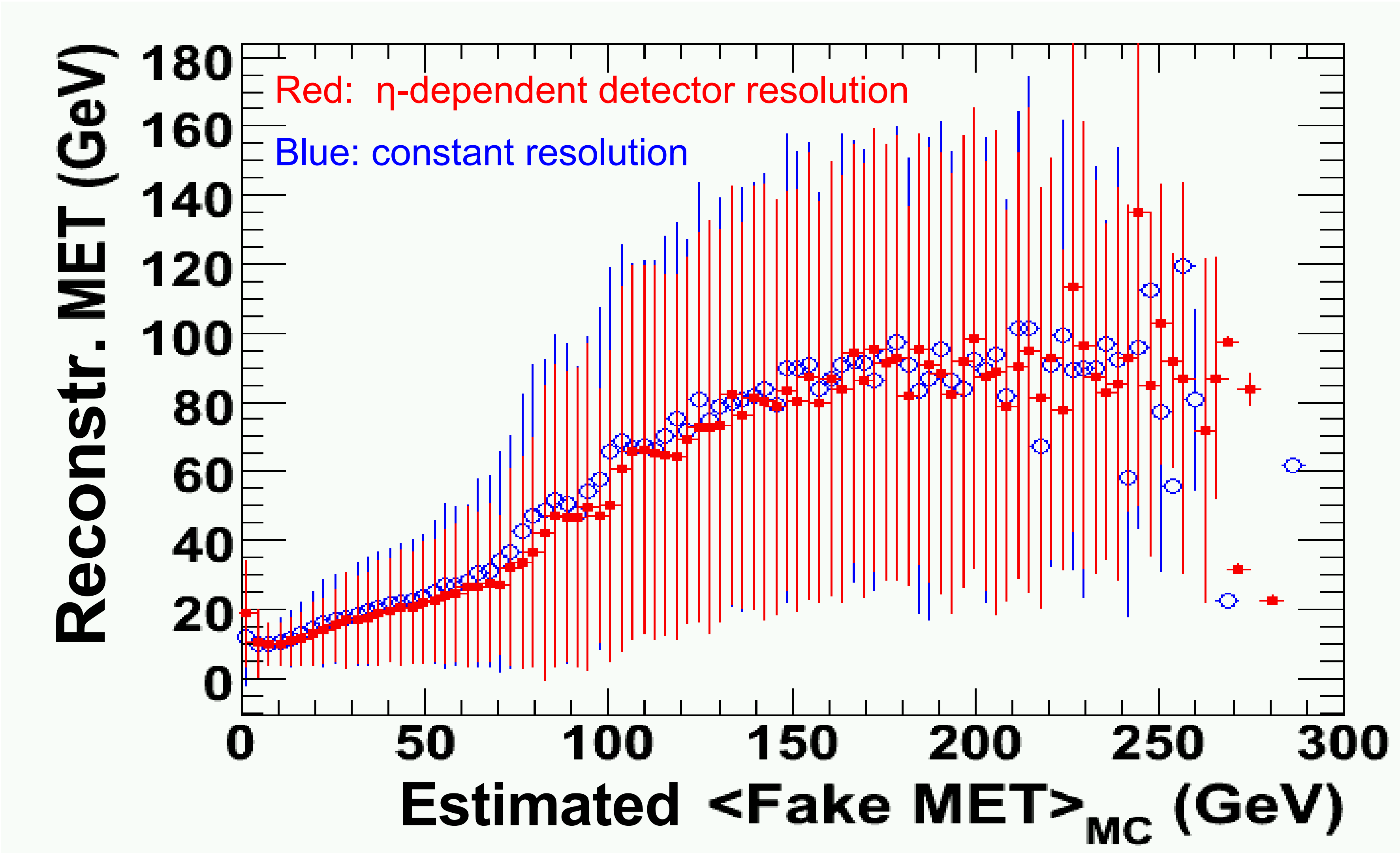
one jet:

$$\sigma\,(\,jet\ i\,) = RMS(\eta) * \sqrt{E} * \sin(\theta)$$

all jets:

$$\sigma_N = sqrt(\,\Sigma\,\sigma_i^{\,2})$$

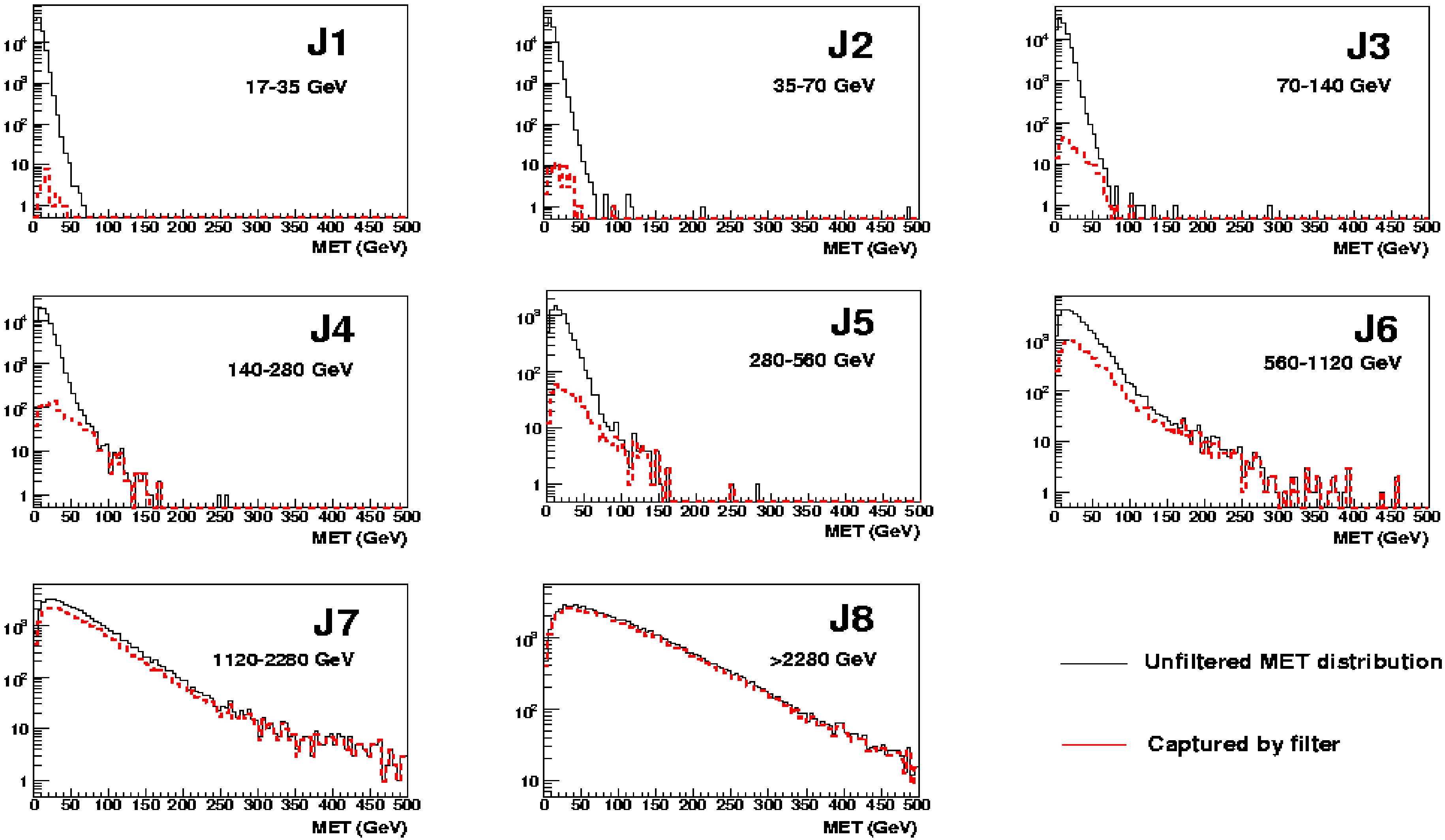
Fake E_T^{miss} estimation (III)



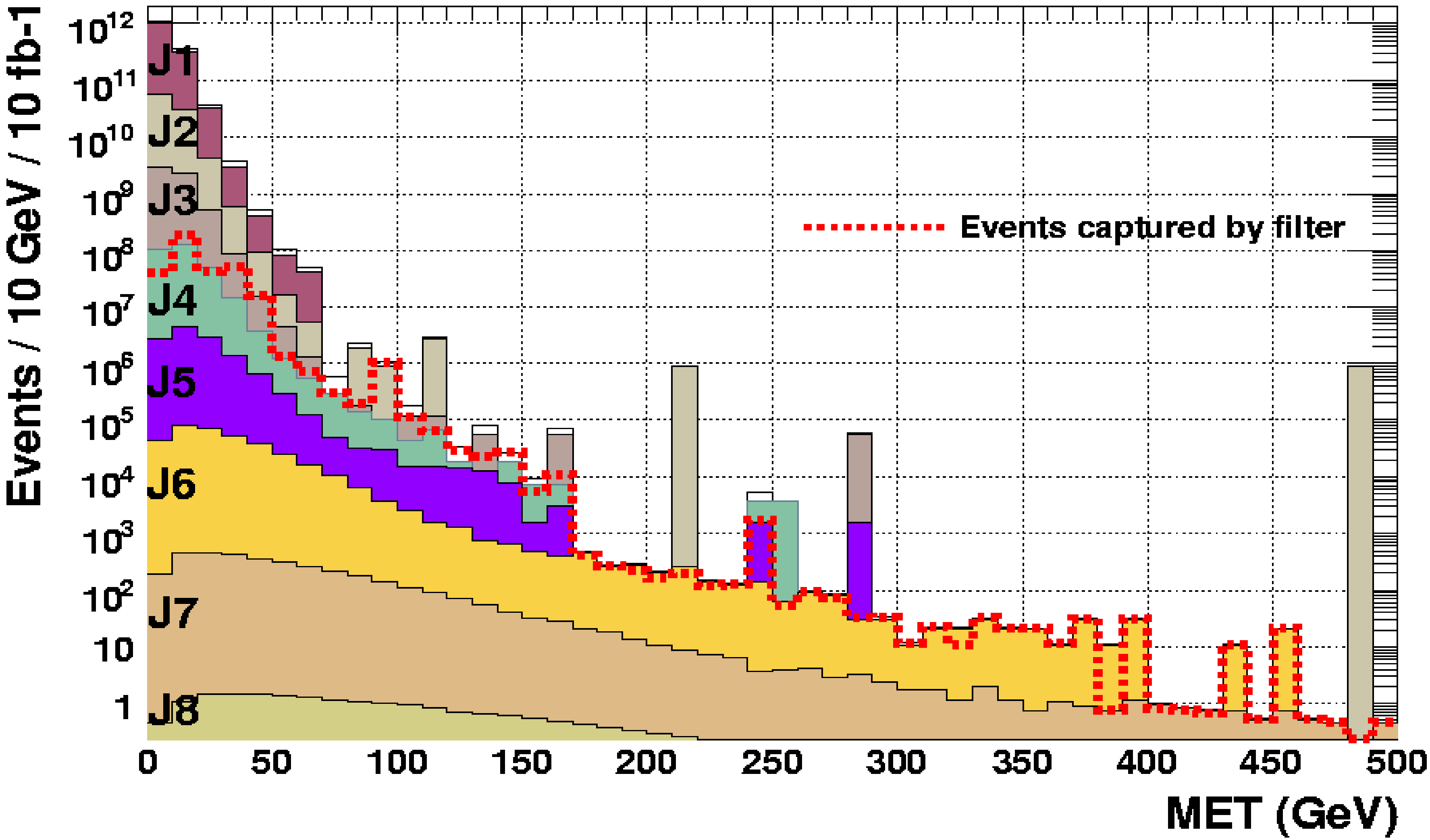
Filter strategy

- Combine <Fake E_T^{miss}> with real E_T^{miss} → total predicted E_T^{miss} :
  - ΣE_T(neutrinos) + $\langle$Fake $E_T^{miss}\rangle_{MC}$ **>** E_T^{cut} (100 GeV)
- (Additionally select high-E_T muons (?))
- Select events with high total *predicted* E_T^{miss}
- Event weighting
  - Low: *predicted* E_T^{miss} < 50 GeV
  - Intermediate: 50 GeV < *predicted* E_T^{miss} < 100 GeV
  - High: *predicted* E_T^{miss} > 100 GeV

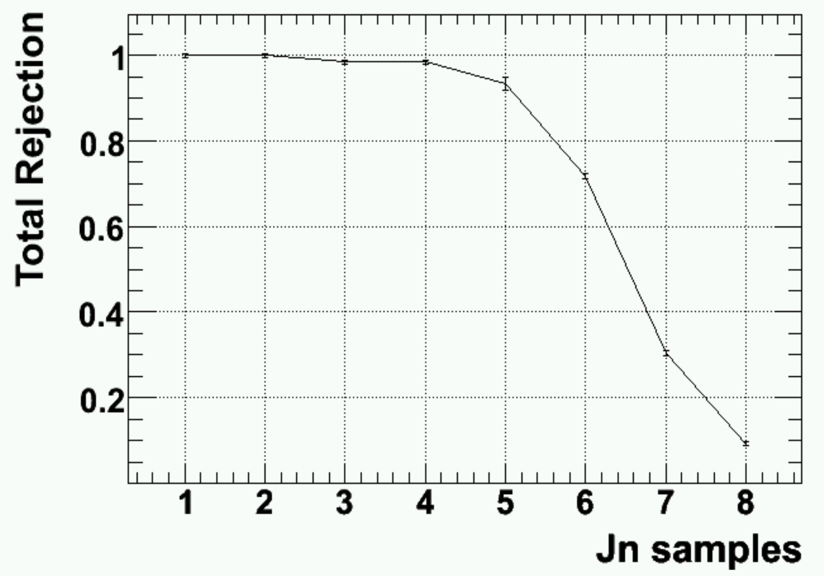
Performance (csc11)

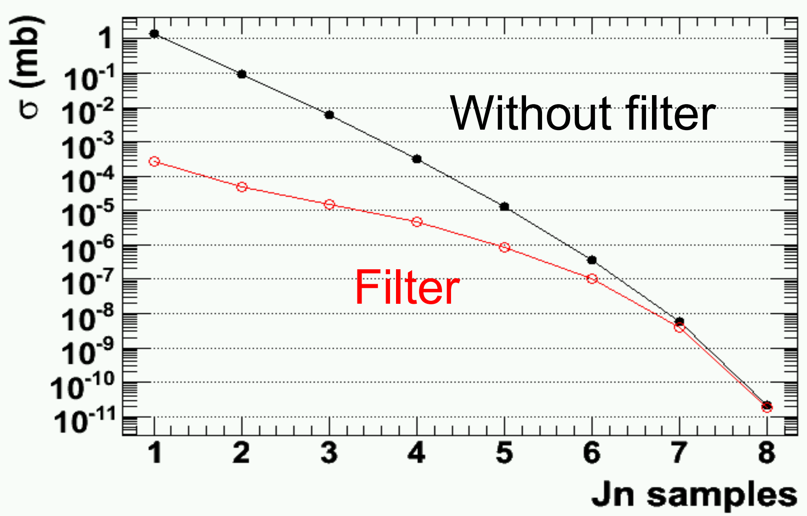


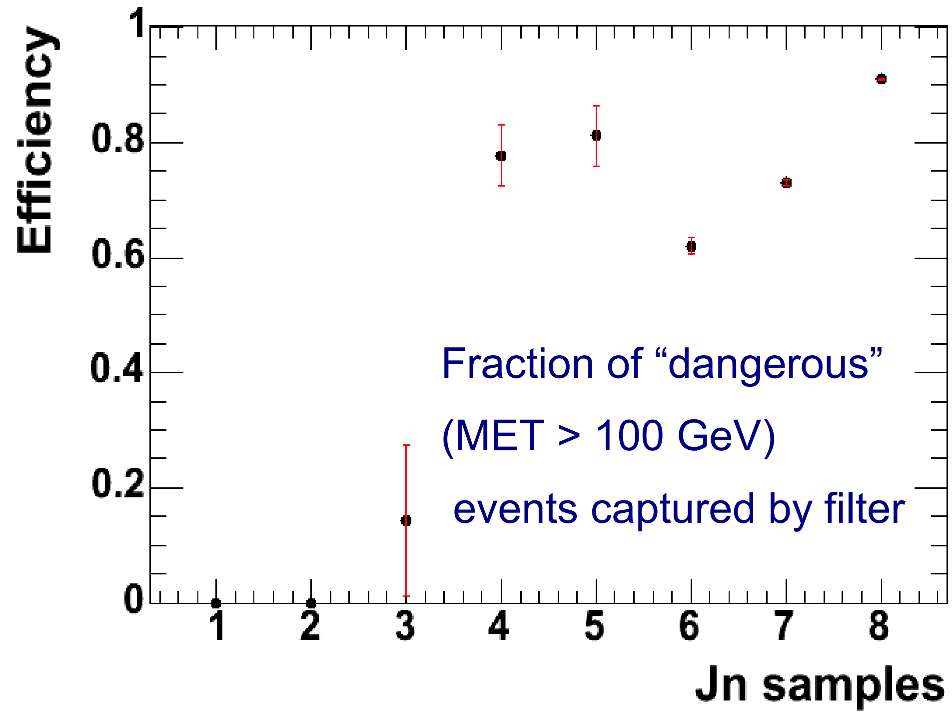
Performance (csc11)



Performance (csc11)







Good overall performance

→ e.g. for J4 :

~98% reduction in # full-sim events

~80% of dangerous events captured

Summary / Outlook

- Mismeasured jets contribute in a large way to *fake* E_T^{miss}
- Constructed a *generator level* variable correlated to reconstructed MET
  → allows for a reasonable estimation of *fake* E_T^{miss} at generator level
- Use *fake* E_T^{miss} *estimator* in combination with real E_T^{miss} to select potentially dangerous high MET events at *generator level*
- CSC Jn samples: Overall rejection good + good MET tail coverage
- Under investigation:
  - impact of additional high-p_T lepton cuts
  - tune cuts
  - improve on simplifying assumptions?
- We could produce enriched large MET QCD samples. Any interest?