

Update on response fit

UHH CMS SUSY Meeting

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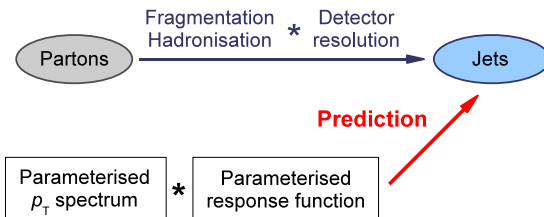


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Concept of the response fit method



- In each event i , probability density of the dijet configuration p_T^1, p_T^2 is

$$\mathcal{P}_i^{1,2} \propto \int_0^\infty dp_T^{\text{true}} f_b(p_T^{\text{true}}) \cdot r_b(p_T^1/p_T^{\text{true}}) \cdot r_b(p_T^2/p_T^{\text{true}})$$

- f_b is the probability density function (pdf) of p_T^{true}
- r_b is the response pdf

- Likelihood $\tilde{\mathcal{L}}(\mathbf{b}) = \prod_{i=0}^{N_{\text{evt}}} \mathcal{P}_i^{1,2}$ maximal for correct parameter values $\mathbf{b}$

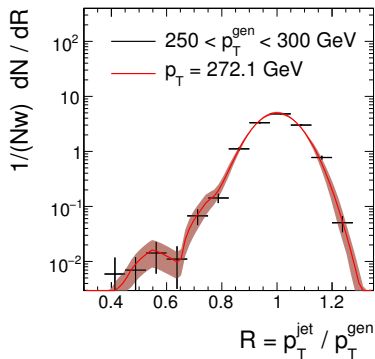
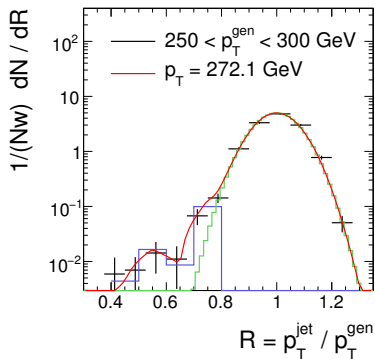
Current studies

- Evaluation of statistical uncertainties of fit
 - ▶ Consideration of correlation $\rightarrow$ lessons
 - ▶ Statistical error on fitted response and spectrum
- Problem with current response parameterisation (Gaussian + step function)
 - ▶ Fixed step function range at left side
 - ▶ Unsufficient over larger p_T range due to asymmetric contributions to Gaussian part
- Improvement of response parameterisation
 - 1 Step function over larger response range
 - 2 Parameterisation with Crystal Ball Function
- New idea for parameterisation of p_T dependence
 - ▶ Fits in different p_T^{gen} bins
 - ▶ Fit dependence of parameters on p_T^{gen}
 - ▶ Parameters $\rightarrow$ Function of p_T

Event selection

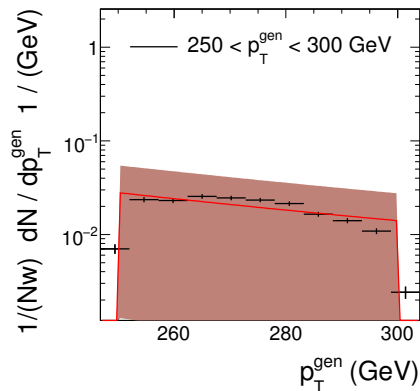
- A few intermediate results shown in the following
- /QCDFlat_Pt15to3000/Summer09-MC_31X_V9_7TeV-v1/
GEN-SIM-RECO
- Weighting $\propto \hat{p}_T^{-4.5}$ for real QCD spectrum
- The usual dijet event selection
- Both jets in central region $|\eta| < 0.8$
- $250 < p_T^{\text{gen}}(1, 2) < 300 \text{ GeV}$

1) Gaussian + step function: fitted response



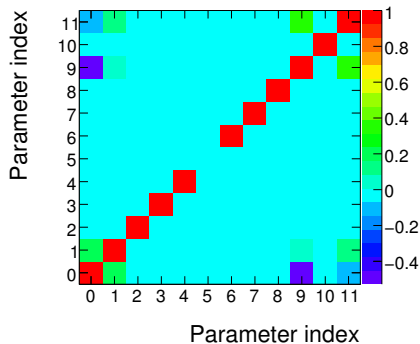
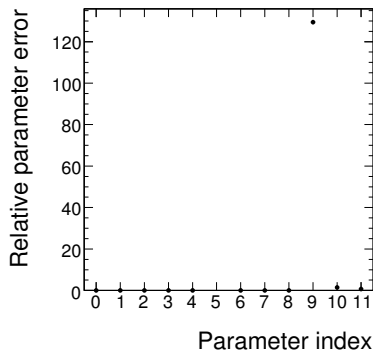
- Step function
 - ▶ 9 bins between $0.4 < R < 1.3$
- Gaussian
 - ▶ Scale fixed at 1.
 - ▶ Width parameterised with one parameter (small p_T range)

1) Gaussian + step function: fitted spectrum



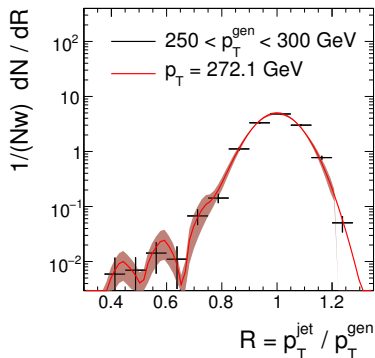
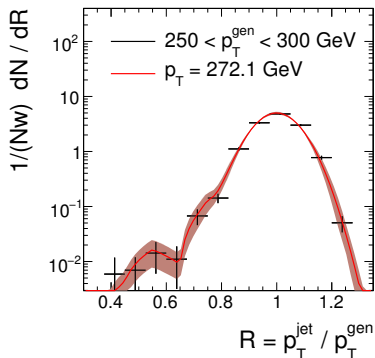
- Spectrum parameterised $\propto (p_T^{\text{gen}})^{-n}$

1) Gaussian + step function: errors



- Large relative errors on
 - ▶ Exponent of spectrum
 - ▶ Step function values underneath Gaussian
- Correlation between
 - ▶ Gaussian width and relative Gaussian contribution (0,1)
 - ▶ Gaussian width and exponent of spectrum (1,11)

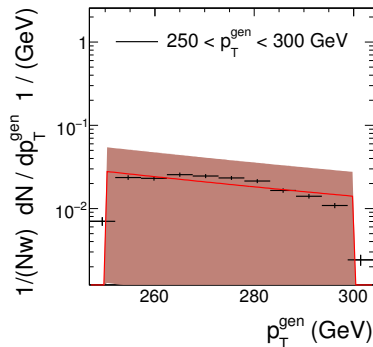
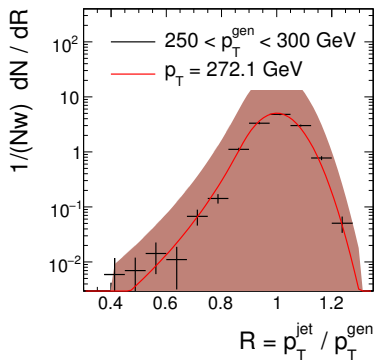
1) Gaussian + step function: systematic errors



• Step function

- ▶ Left: 9 bins between $0.4 < R < 1.3$ (as before)
- ▶ Left: 12 bins between $0.4 < R < 1.3$

2) Crystall Ball Function: response and spectrum

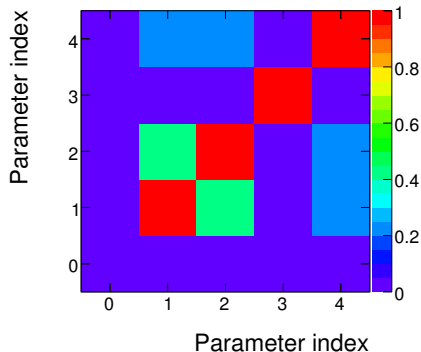
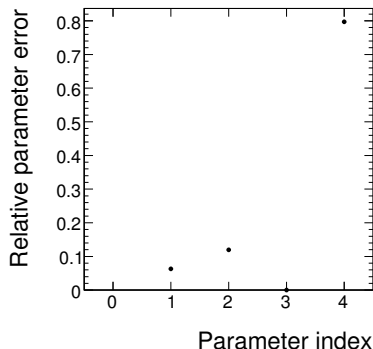


- Response parameterised as

$$f(x; \bar{x}, \sigma, \alpha, n) = N \begin{cases} e^{\frac{1}{2} \left(\frac{x - \bar{x}}{\sigma} \right)^2} & \text{if } \frac{x - \bar{x}}{\sigma} > -\alpha \\ A(\alpha, n) \cdot (B(\alpha, n) - \frac{x - \bar{x}}{\sigma})^{-n} & \text{if } \frac{x - \bar{x}}{\sigma} \leq -\alpha \end{cases}$$

- Spectrum parameterised $\propto (p_T^{\text{gen}})^{-m}$

2) Crystall Ball Function: errors



- Large relative errors on
 - ▶ Exponent of spectrum (4)
 - ▶ Exponent of powerlaw tail (3): $\text{NAN} \rightarrow 0$
- Correlation between
 - ▶ Gaussian width σ (1) and relative Gaussian contribution α (2)
 - ▶ Exponent of spectrum (4) with σ (1) and α (2)