JEWEL Model for Jet Quenching

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The MC model of Jet Quenching

The model for Jet Quenching takes into account different types of phenomena:

- Parton showers;
- Elastic scattering with the medium;

Parton showers

The parton showers is treated by making use of factorization in such a way that, given that the parton has gone through *n* branching processes, the differential cross-section of emitting an extra radiation is given by:

$$\mathrm{d}\sigma_{n+1} = \sigma_n \frac{\mathrm{d}t\mathrm{d}z}{t} \frac{\alpha_{\mathrm{s}}(\mu^2)}{2\pi} \hat{P}_{ba}(z)$$

Parton showers

The scale at wich the coupling constant is evaluated is given by the virtuality of the parton *t.* The pole can is avoided by inserting a *infra-red cutoff* t_c. This also set minimal and maximum values for *z* wich avoid the poles on the kernel *P(z).*

Parton showers

The angular ordering of emissions can be applied through the requirement that:

$$t_0 > t_1 > t_2 > \ldots > t_c$$

Elastic Scattering with The Medium

The medium on JEWEL is chacacterized as a collection of scattering centers with a Debye mass μ_D=3T, where T is the temperature of the medium. This identification yields a cross-section on the form:

$$\sigma_i(E,T) = \int\limits_0^{|\hat{t}|_{\max}(E,T)} \mathrm{d}|\hat{t}| \int\limits_{x_{\min}(|\hat{t}|)}^{x_{\max}(|\hat{t}|)} \mathrm{d}x \sum_{j\in\{\mathrm{q},\bar{\mathrm{q}},\mathrm{g}\}} f_j^i(x,\hat{t}) \frac{\mathrm{d}\hat{\sigma}_j}{\mathrm{d}\hat{t}}(x\hat{s},|\hat{t}|)$$

The PDFs are calculated through integration of DGLAP equation.

Elastic Scattering with the Medium

The differential part of the cross-section will be given by:

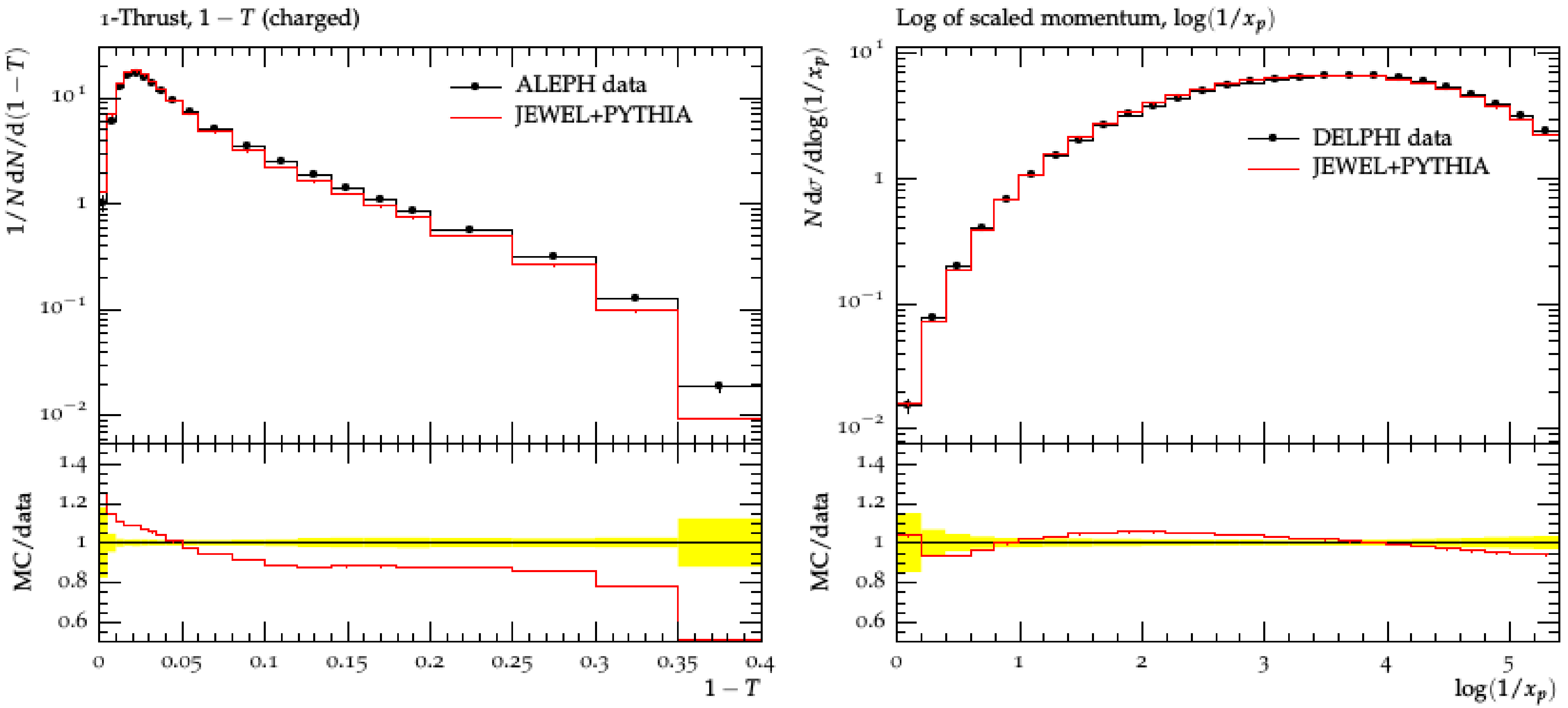
$$\frac{\mathrm{d}\hat{\sigma}}{\mathrm{d}\hat{t}}(\hat{s},|\hat{t}|) = C_{\mathrm{R}}\frac{\pi}{\hat{s}^2}\alpha_{\mathrm{s}}^2(|\hat{t}|+\mu_{\mathrm{D}}^2)\frac{\hat{s}^2+(\hat{s}-|\hat{t}|)^2}{(|\hat{t}|+\mu_{\mathrm{D}}^2)^2} \longrightarrow C_{\mathrm{R}}2\pi\alpha_{\mathrm{s}}^2(|\hat{t}|+\mu_{\mathrm{D}}^2)\frac{1}{(|\hat{t}|+\mu_{\mathrm{D}}^2)^2}$$

Thus, the medium is completely chacarterized by a density of scattering centers and its temperature profile. It is worth remarking that the inclusion of mass effects will only alter the virtuality calculations.

JEWEL validation

On the absence of medium, the JEWEL reduces to PYTHIA, and the data is validated against data from LEP and *p+p* collisions at LHC.

JEWEL validation



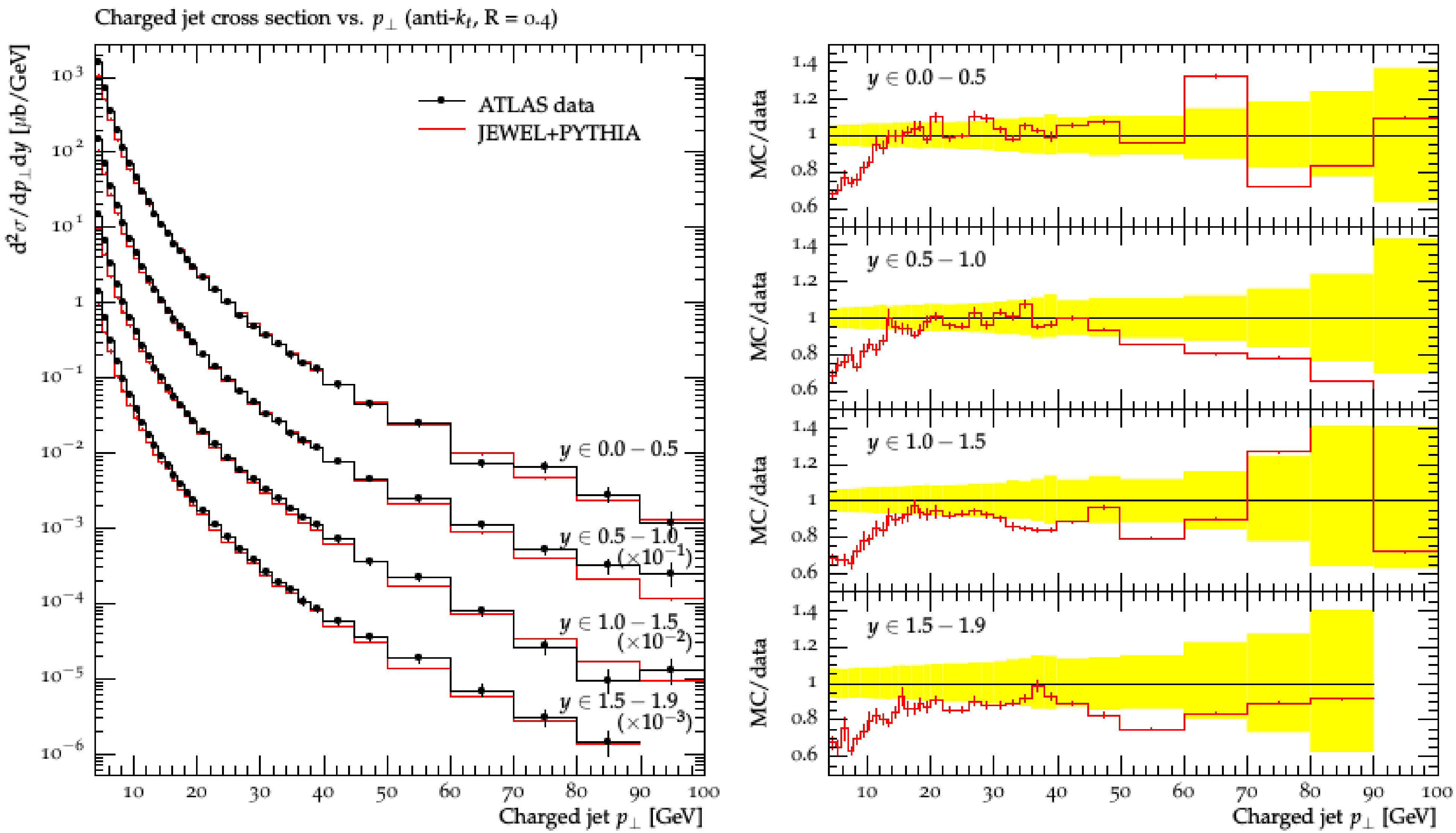
JEWEL validation

The variable thrust is defined as:

$$T \equiv \max_{\boldsymbol{n}_T} \frac{\sum_i |\boldsymbol{p}_i \cdot \boldsymbol{n}_T|}{\sum_i |\boldsymbol{p}_i|}$$

The value *T=.5* is equivalent to a spherical distribution.

JEWEL validation



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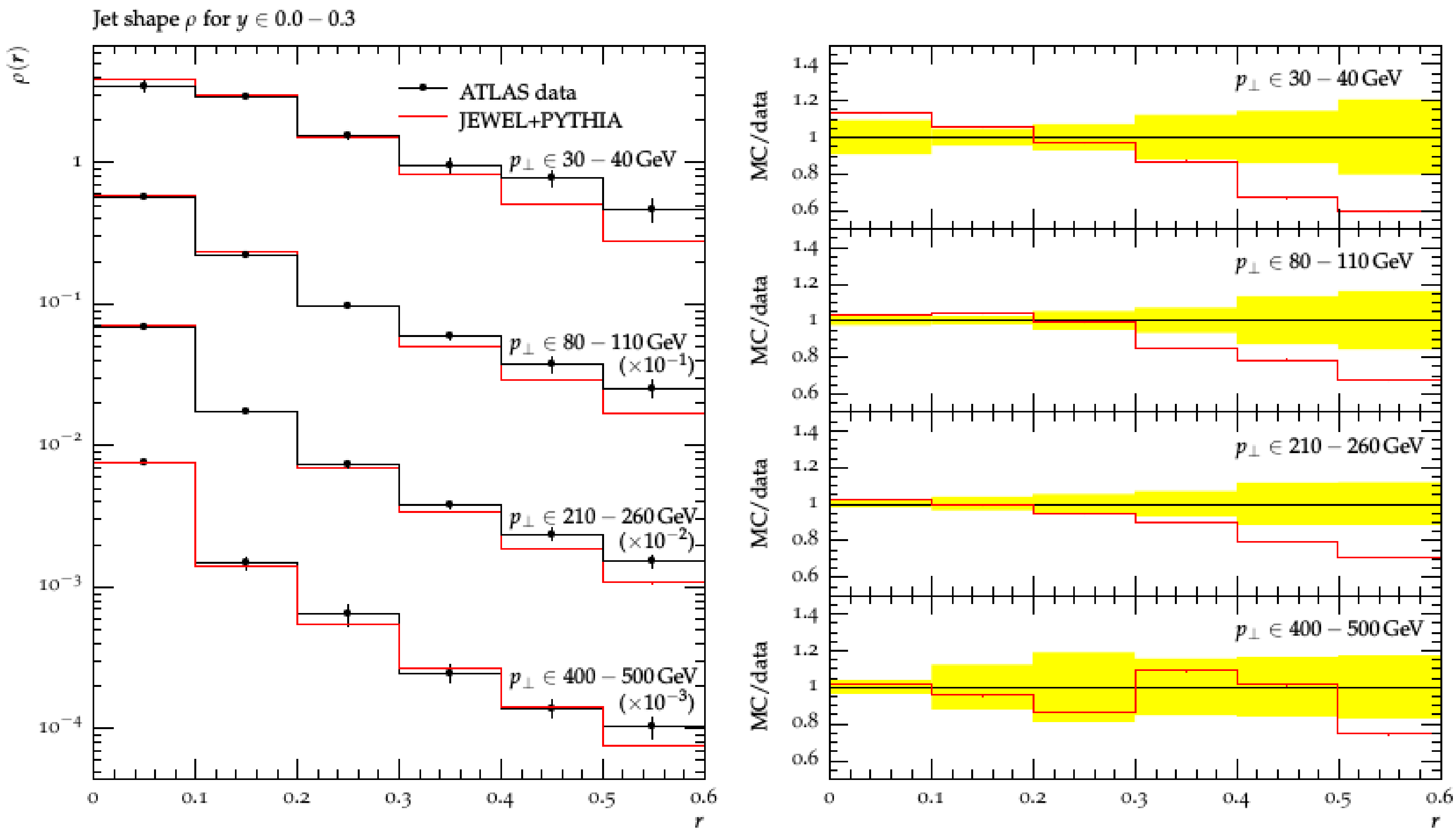
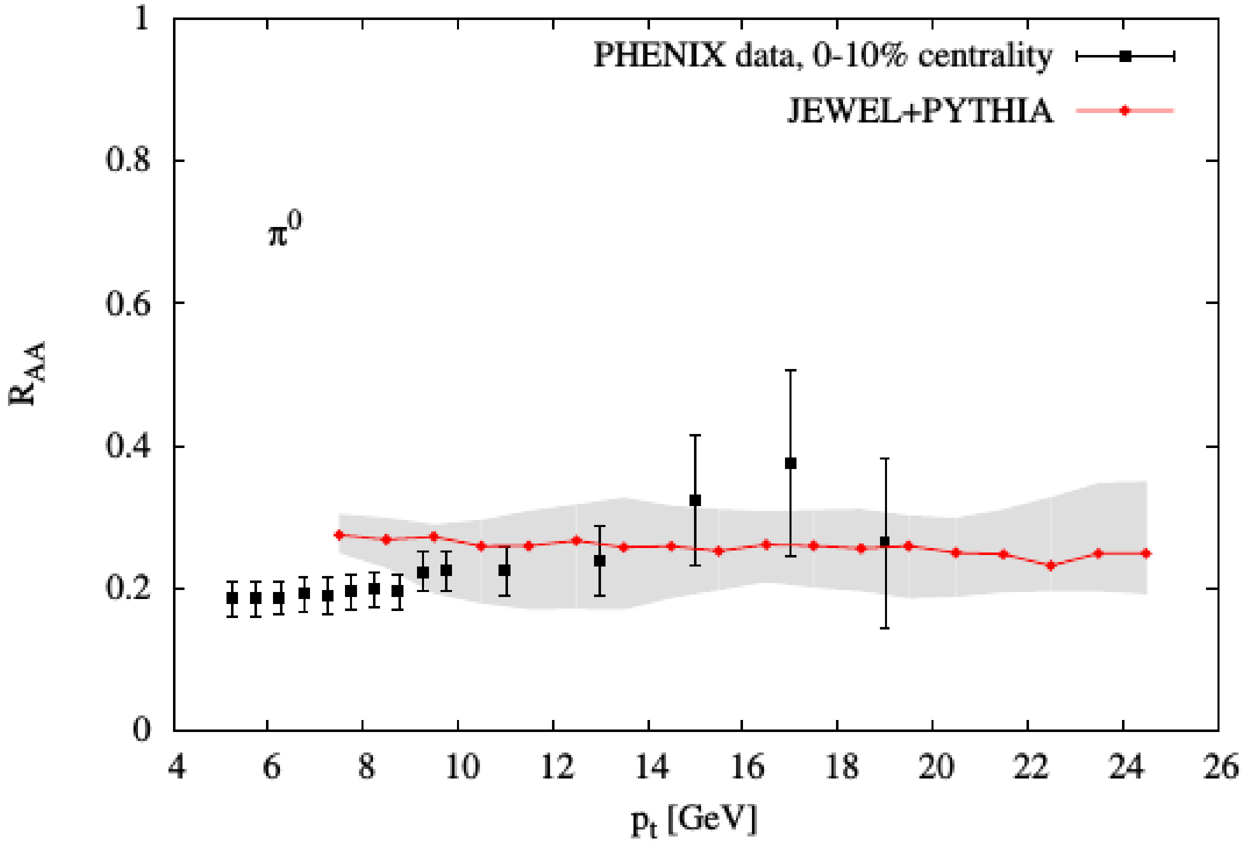


JEWEL validation



JEWEL validation