# Transverse momentum distributions and the nuclear modification factors of charged-particles in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV

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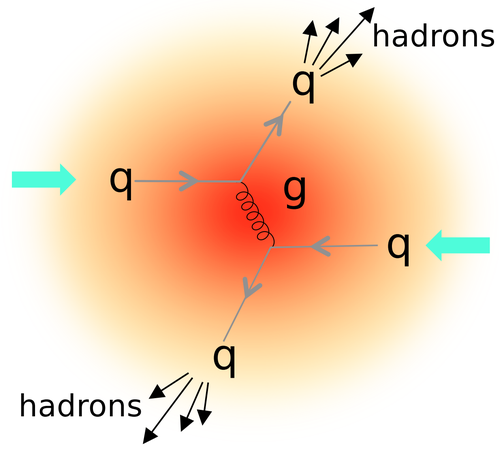
## Motivation

Heavy-ion collisions at high energies allow to study the properties of deconfined matter. Partons originating from initial hard processes lose energy in the medium, leading to a suppression of high-$p_T$ jets. Previous measurements by RHIC at $\sqrt{s_{NN}} = 200$ GeV show that the high $p_T$-yield in central collisions is only ~20% of the expected. Following measurements at the LHC at $\sqrt{s_{NN}} = 2.76$ TeV have shown that this suppression is even stronger at higher collision energies, indicating a hotter and denser medium. Also the suppression remains substantial up to very high $p_T$ and is also observed in jet measurements.




Partons originating from an initial hard collision lose energy in the created medium before forming hadrons.

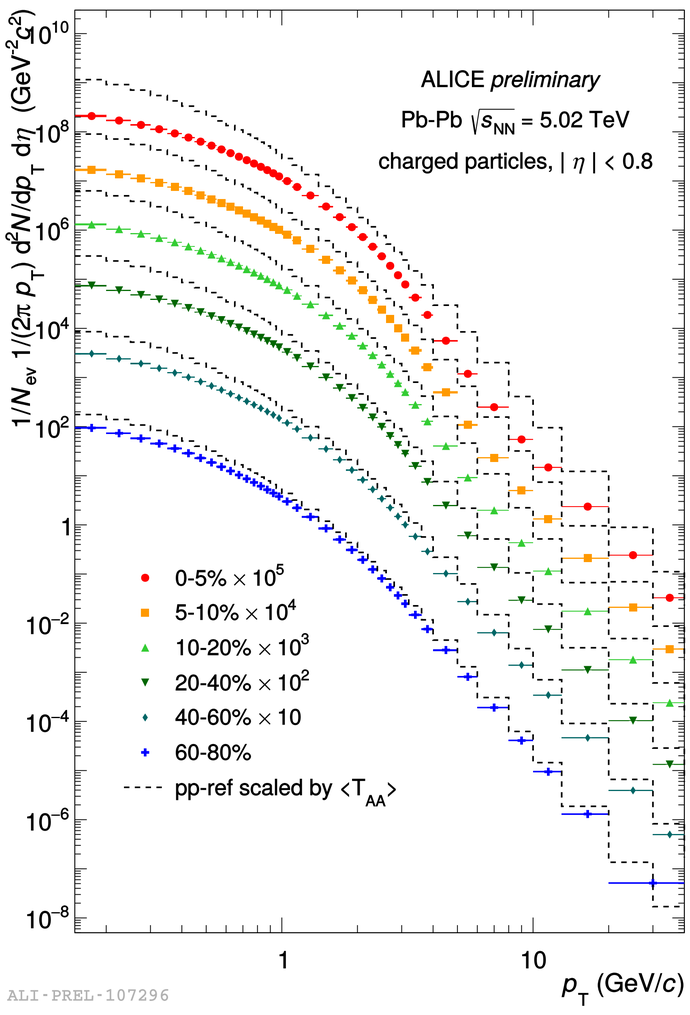
Typically the suppression of particle yields is characterised by the nuclear modification factor ($R_{AA}$) which is defined as:

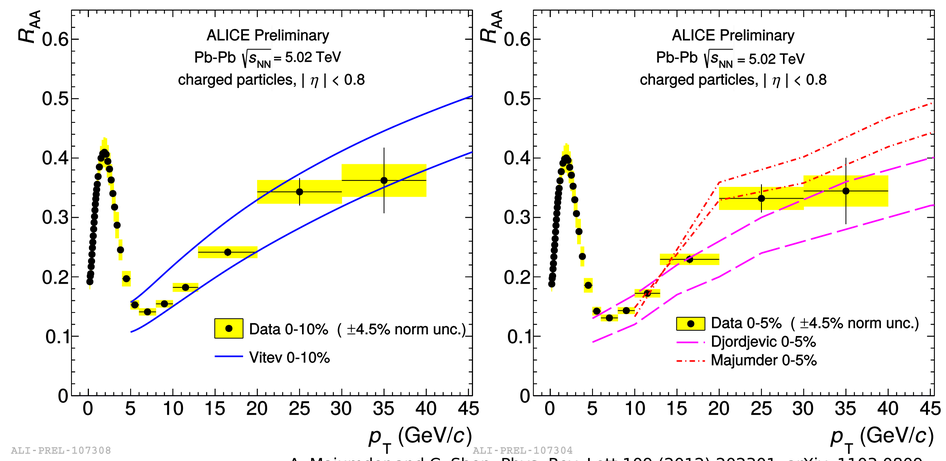
$$R_{AA}(p_T) = \frac{1}{T_{AA}} \frac{dN_{AA}/dp_T}{d\sigma_{pp}/dp_T}.$$

The $R_{AA}$ is a direct comparison of pp and Pb-Pb collisions. Particle yields are strongly dependent on the centrality of the heavy-ion collision, as the number of binary collisions (parton-parton) changes. This is addressed by the nuclear-overlap function ($T_{AA}$) which is determined by Glauber Monte-Carlo calculations.

## Results

The transverse-momentum distributions of charged particles, measured in the range $0.15 < p_T < 40$ GeV/$c$ and the corresponding nuclear modification factors are shown below.




A. Majumder and C. Shen, Phys. Rev. Lett 109 (2012) 202301, arXiv: 1103.0809
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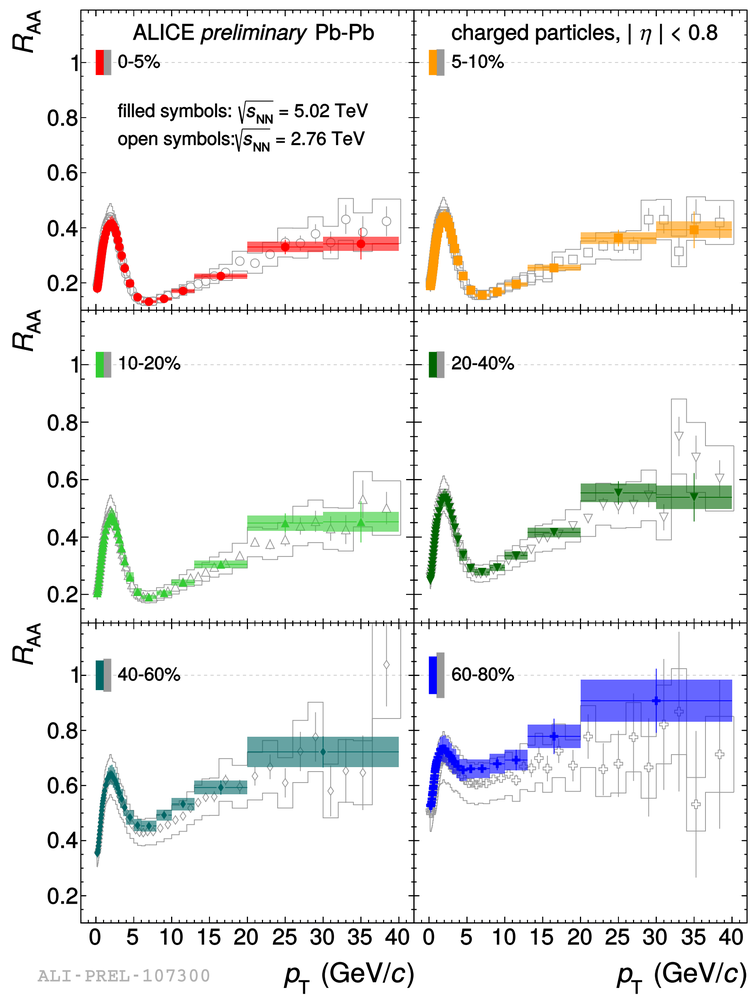
M. Djordjevic et al, arXiv: 1601.07852

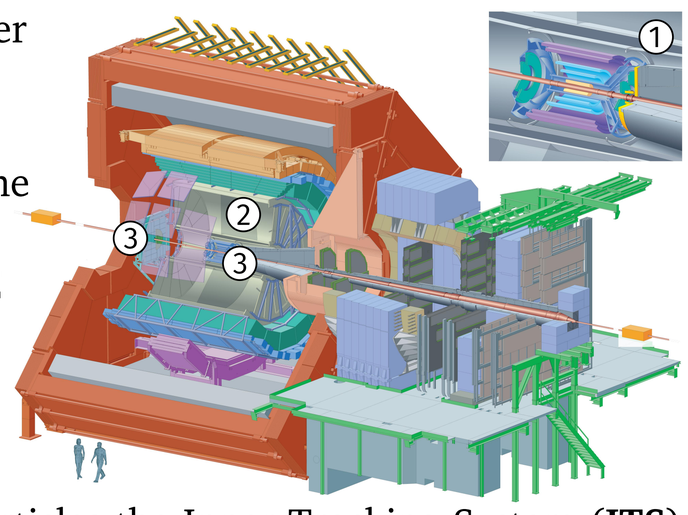
### Conclusions

The $R_{AA}$ measured at 5.02 TeV is similar to the measurement at 2.76 TeV. Having in mind that spectra harden for higher center-of-mass energies this result hints towards a denser and hotter medium.

All models studied in this work succeed in describing the high-$p_T$ rise of the $R_{AA}$.




**ALICE** (A Large Ion Collider Experiment) is a general-purpose detector primarily designed for the study of the Quark Gluon Plasma in heavy-ion collisions. ALICE offers excellent particle identification and tracking capabilities.




For tracking of charged particles the Inner Tracking System (**ITS**) and the Time Projection Chamber (**TPC**) are used.

The **ITS** (1) surrounds the interaction region and is a six layer structure providing a high accuracy in determining the minimal distance of the track to the reconstructed vertex as well as improving the momentum resolution.

The **TPC** (2) is the main Particle IDentification (**PID**) and tracking detector of the central barrel.

The **V0** detectors (3) are mainly used as a trigger detector. They also provide information used for beam-gas event rejection as well as event multiplicity (p-Pb) and centrality (Pb-Pb) classification.

### Event Selection

About 3.3 million minimum-bias (V0A && V0C) events of low interaction rate data taking were analysed.

Events are required to have a valid reconstructed vertex within a range of $|z| < 10$ cm with respect to the beam crossing.

### Track Selection

Tracks are reconstructed using the combined information from the TPC and ITS detectors.

A track is required to reach a minimum length in the active volume of the TPC.

High-purity selection of primary charged particles is achieved with a $p_T$-dependent cut on the distance of closest approach in the transverse plane between the track and the primary vertex.

### Particle composition

The relative abundances of particle species is not correctly reproduced by the used MC generators. We reweight the particle species dependent efficiencies by the relative abundances derived from data at 2.76 TeV (7 TeV for pp).

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