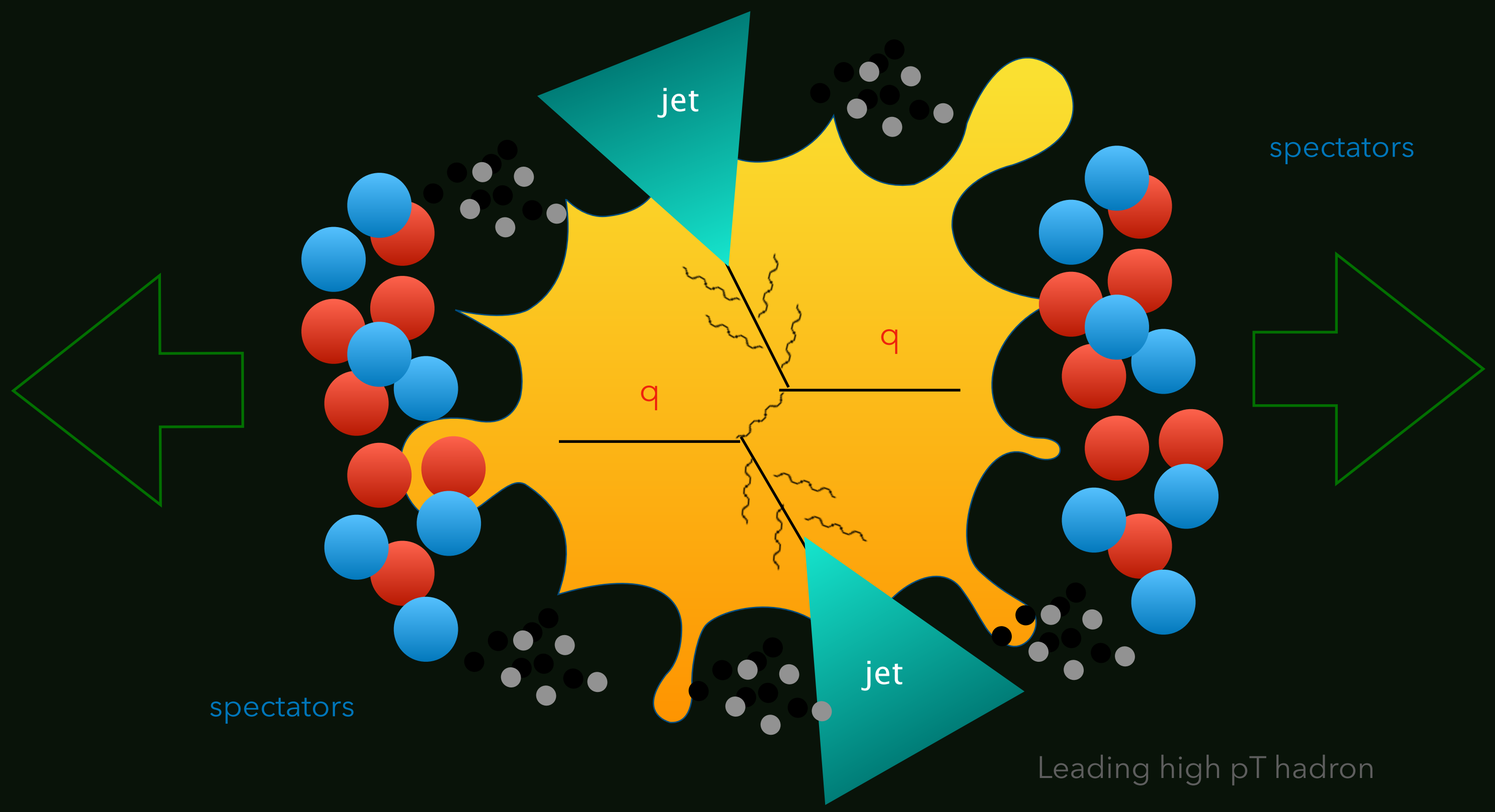


How to study the quenching features of quark and gluon initiated parton cascades in expanding media ?

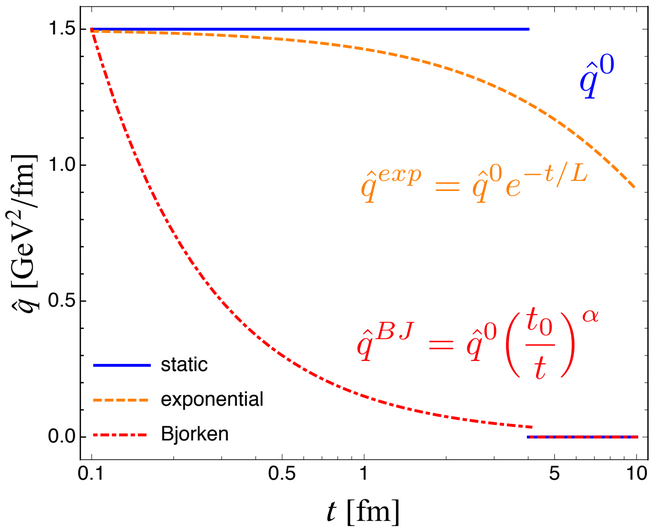
Souvik Priyam Adhya, C. Salgado, M. Spousta & K. Tywoniuk*

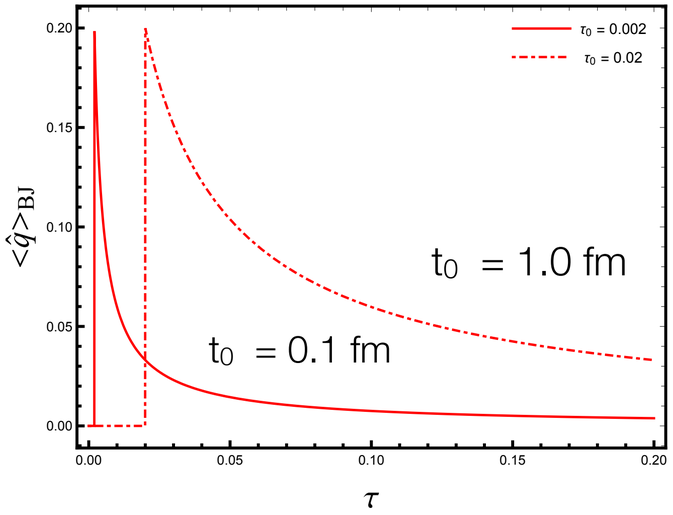
* Institute of Particle and Nuclear physics, Prague

* *presenter*

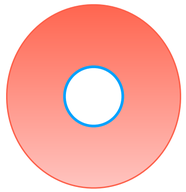
Medium profiles and calculation workflow :

Quenching parameter



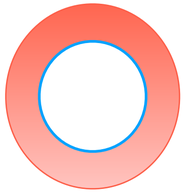


Early quenching



t_0 = 0.1 fm

Late quenching



t_0 = 1.0 fm

Bjorken initial conditions

Evolution equations =>

$$\frac{\partial}{\partial\tau}D_g(x,\tau) = \int_0^1 dz K_{gg}\left[\sqrt{\frac{z}{x}}D_g\left(\frac{x}{z}\right) - \frac{z}{\sqrt{x}}D_g(x)\right] - \int_0^1 zK_{qg}(z)\frac{z}{\sqrt{x}}D_g(x) + \int_0^1 zK_{gq}(z)\sqrt{\frac{z}{x}}D_S\left(\frac{x}{z}\right)$$

Calculation flowchart

$$\frac{\partial}{\partial\tau}D_S(x,\tau) = \int_0^1 dz\, K_{qq}(z)\left[\sqrt{\frac{z}{x}}D_S\left(\frac{x}{z}\right) - \frac{1}{\sqrt{x}}D_S(x)\right] + \int_0^1 dz\, K_{qg}(z)\sqrt{\frac{z}{x}}D_g\left(\frac{x}{z}\right)$$

D_S = q singlet spectra
D_g = gluon spectra
K = splitting rate
τ = evolution variable

S. S and Y. M-T ; JHEP 09 (2018) 144.

Single parton emission spectra (D) in BDMPS-Z formalism for static, exponential and Bjorken expanding media

Splitting rates in static, exponential and Bjorken expanding media

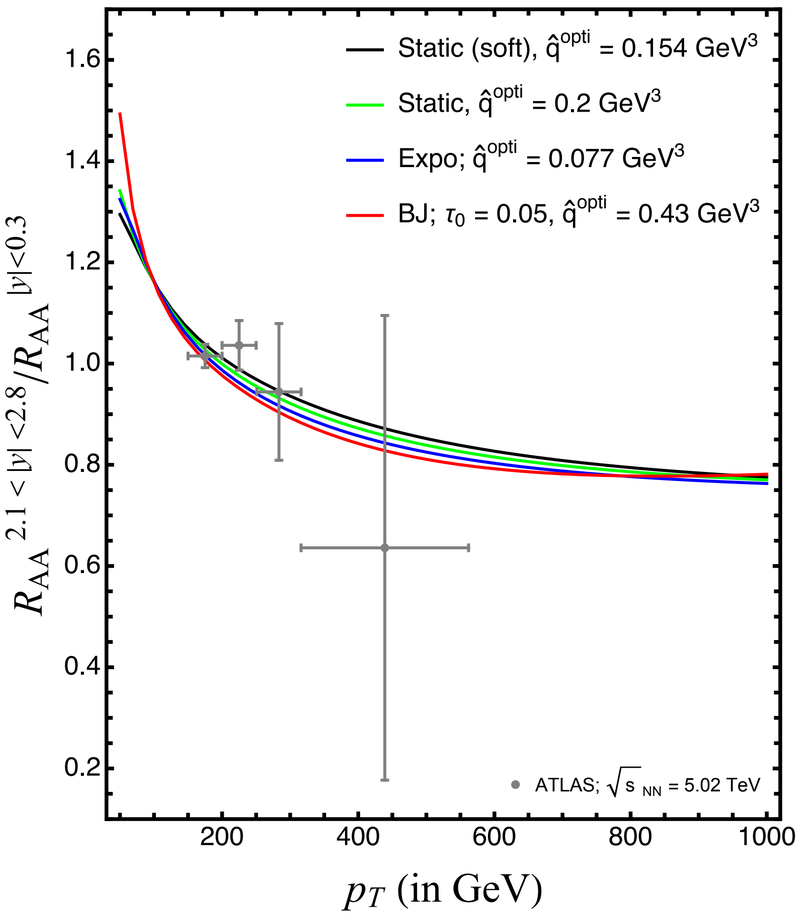
Kinematic rate equation taking into account all the possible splittings for quark & gluon initiated jets

Optimisation in the Quenching factor for jets with combined q and g fractions through modified power law

Study of rapidity dependence and estimation of elliptic flow

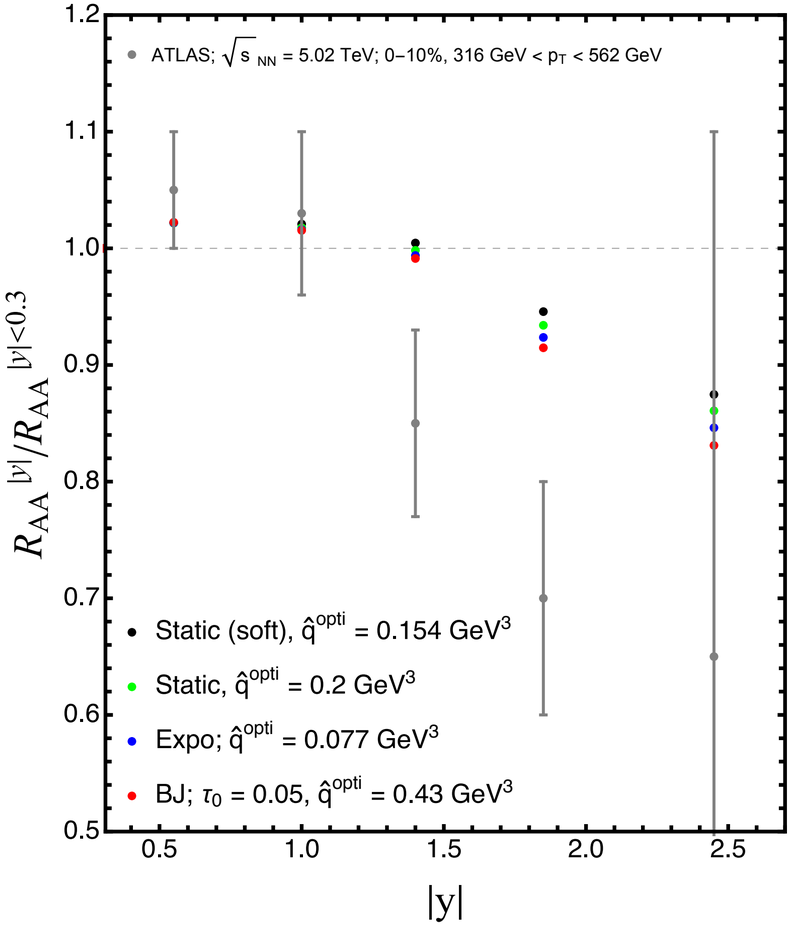
Does the media behave differently as a function of rapidity ?

Yes and no



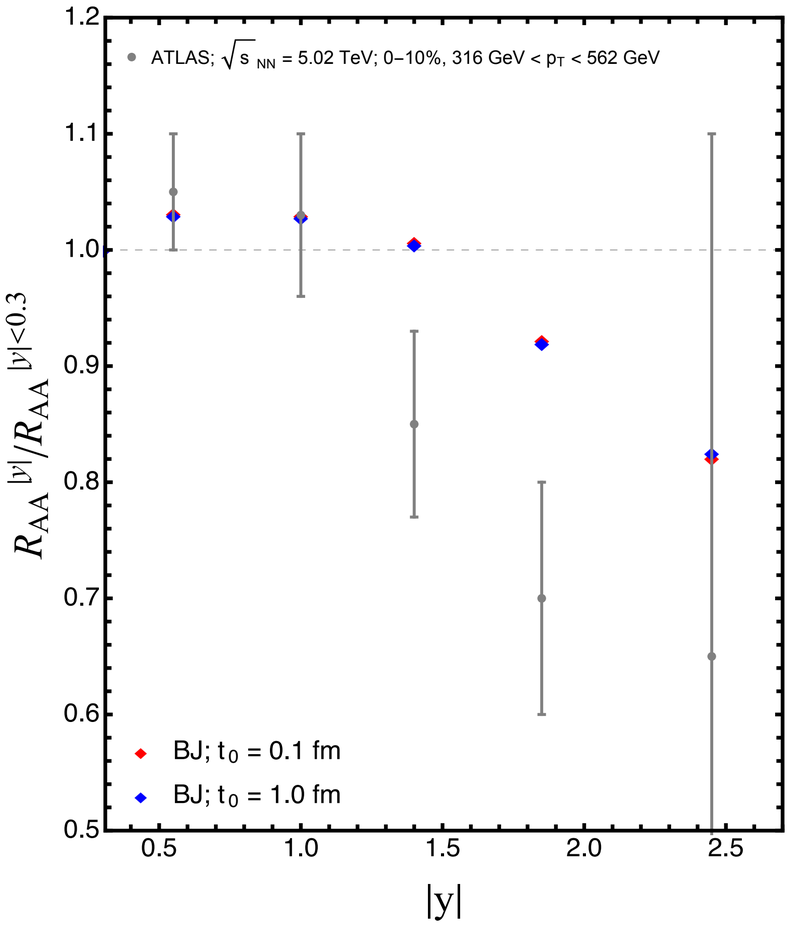
Rapidity ratio for different medium profiles wrt pT

No



Rapidity ratio for different medium profiles wrt |y|

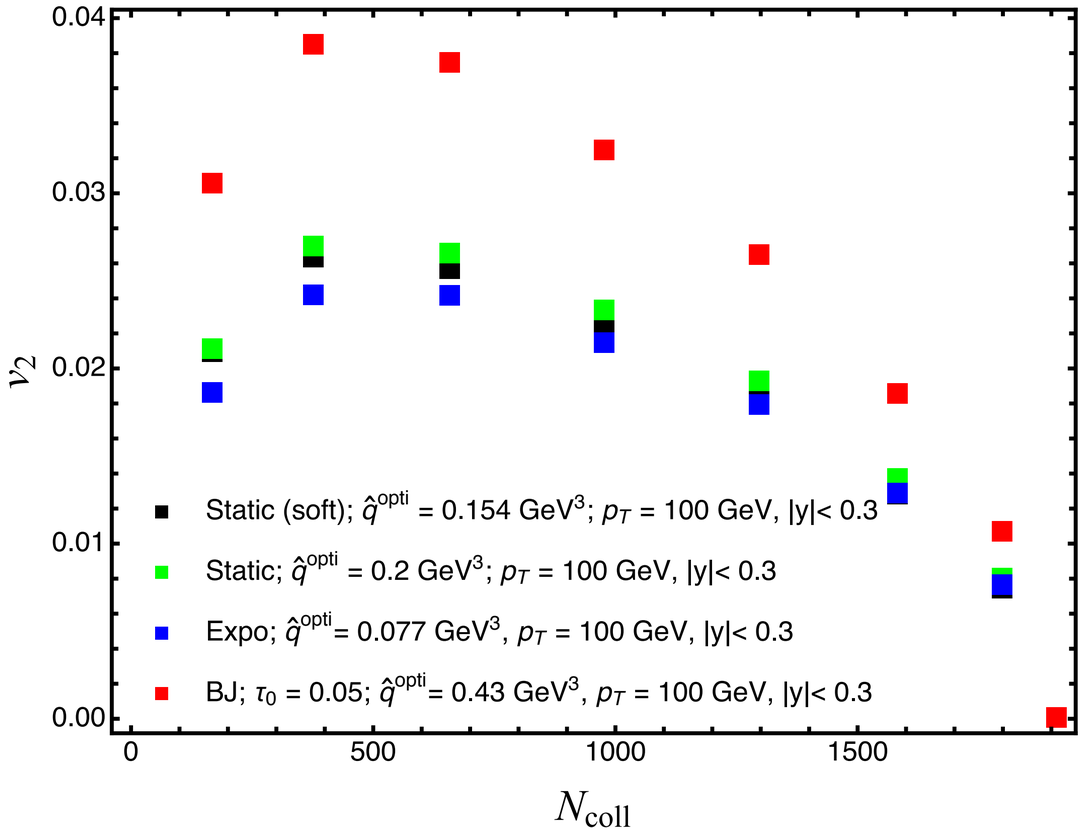
No



Rapidity ratio for different start of quenching time for the Bjorken

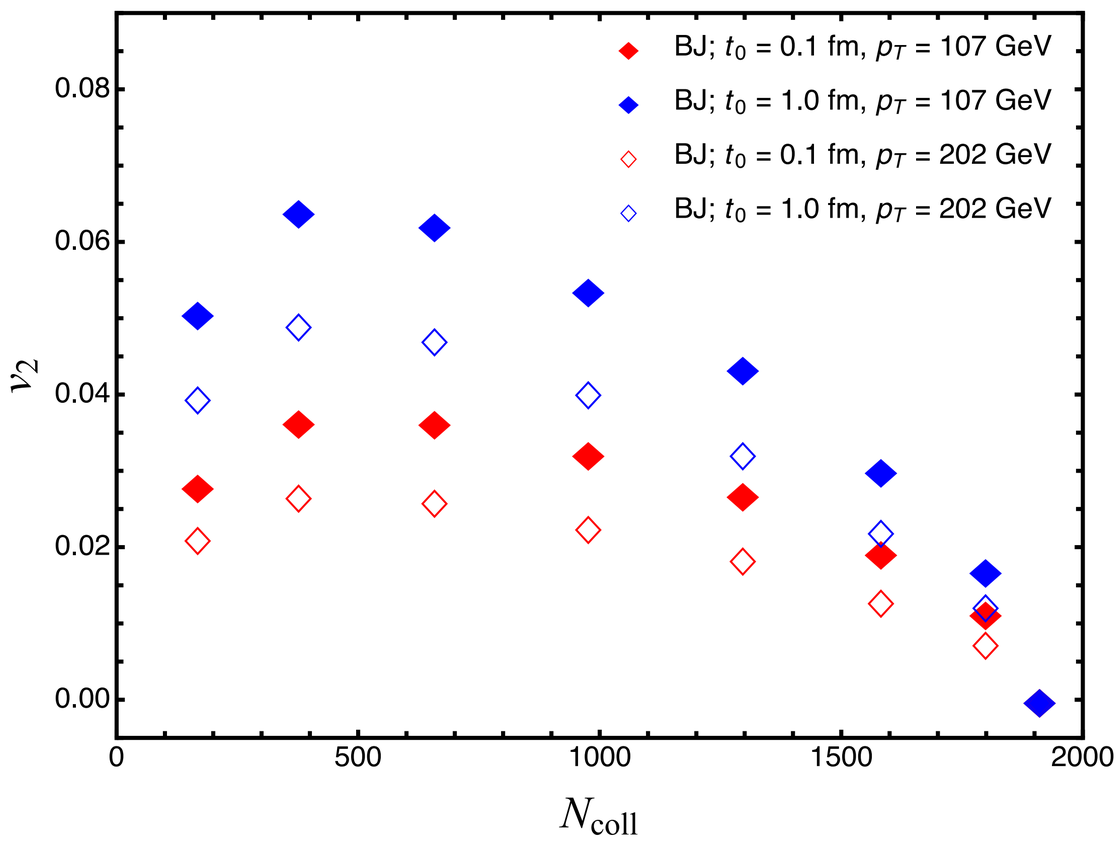
Does the media behave differently with respect to v_2?

Yes and no



Elliptic flow v_2 as a function of N_{coll} for different media

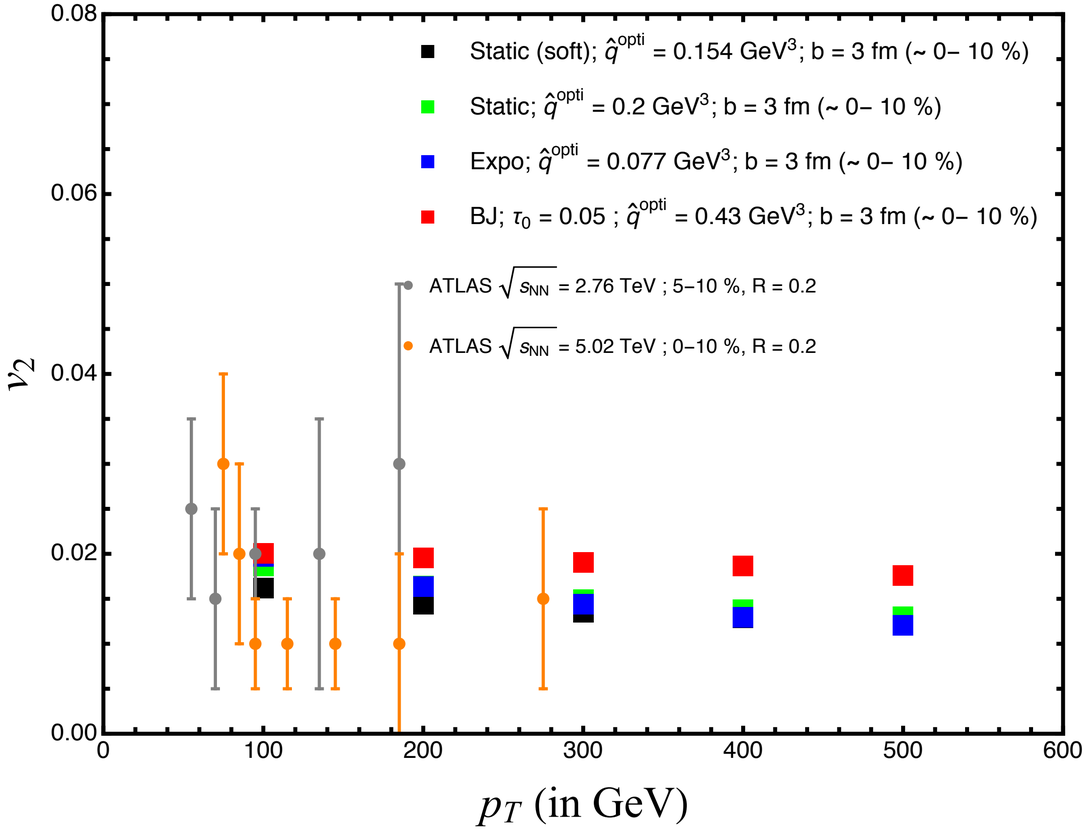
Yes



Elliptic flow v_2 as a function of N_{coll} for Bjorken initial conditions

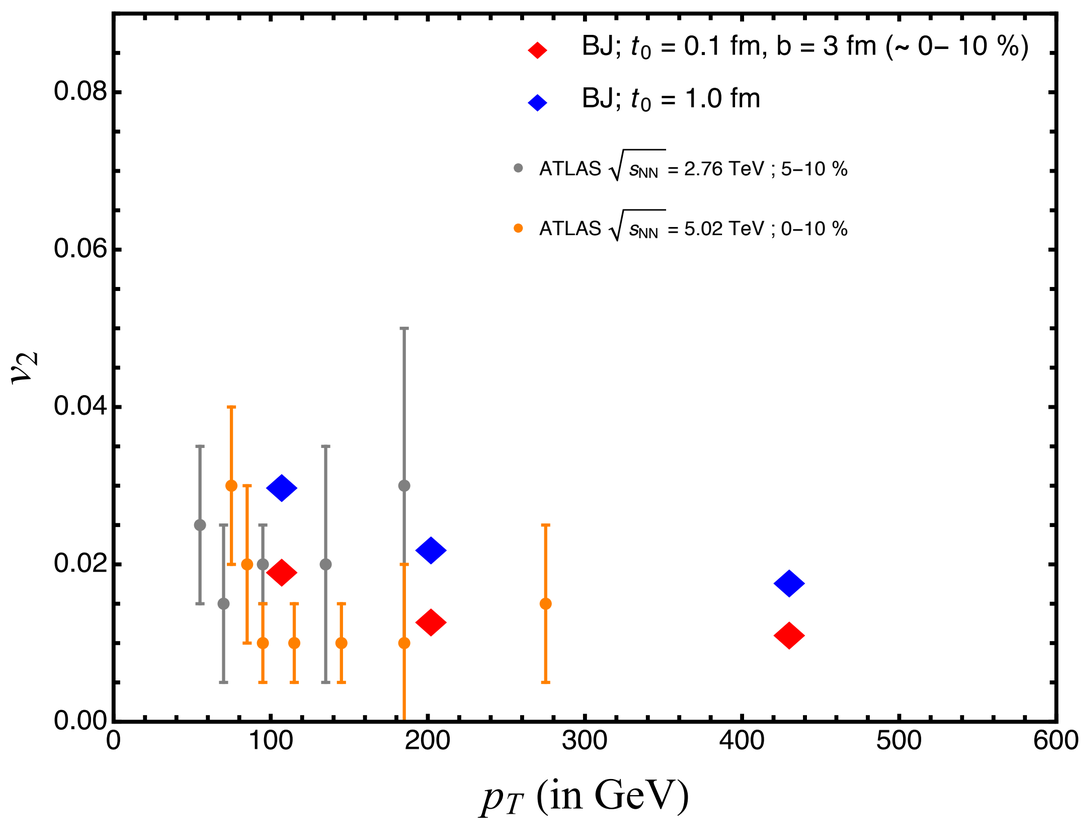
Does the media behave differently with respect to v_2 ?

Yes and no



Elliptic flow v_2 as a function of p_T for different media

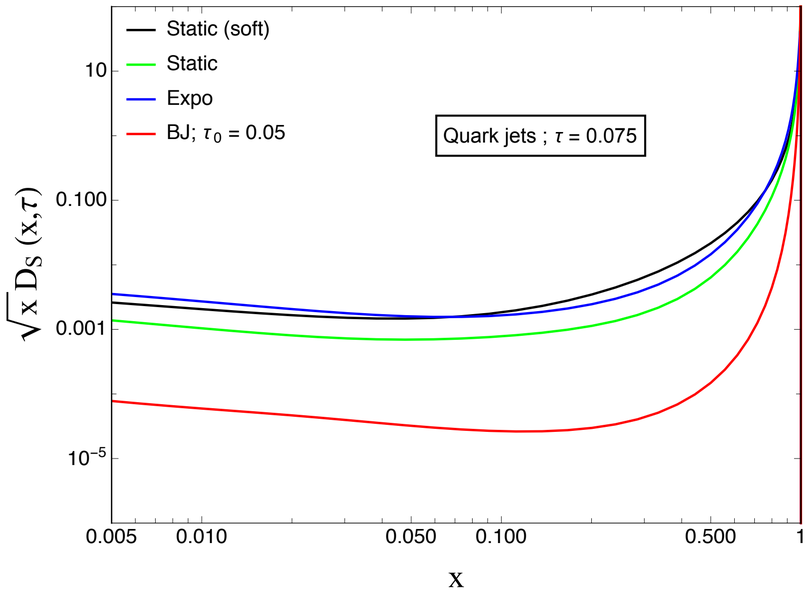
Yes

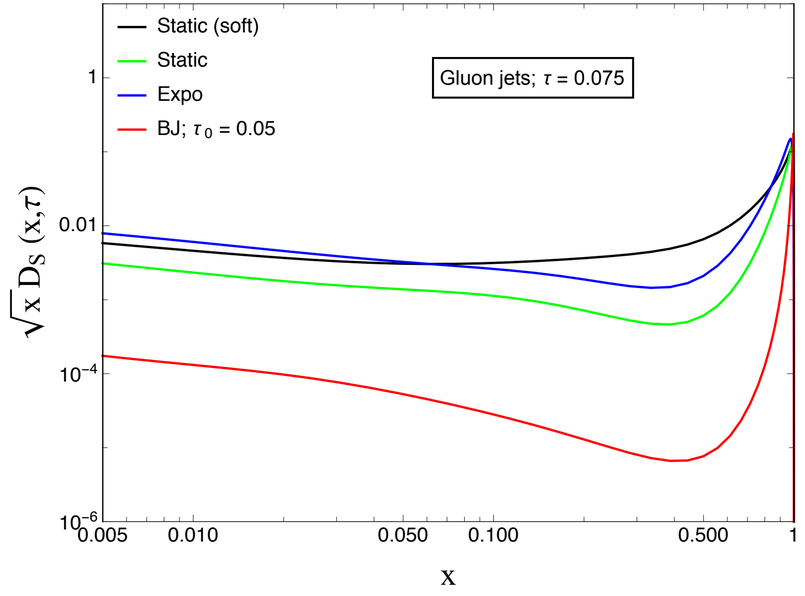


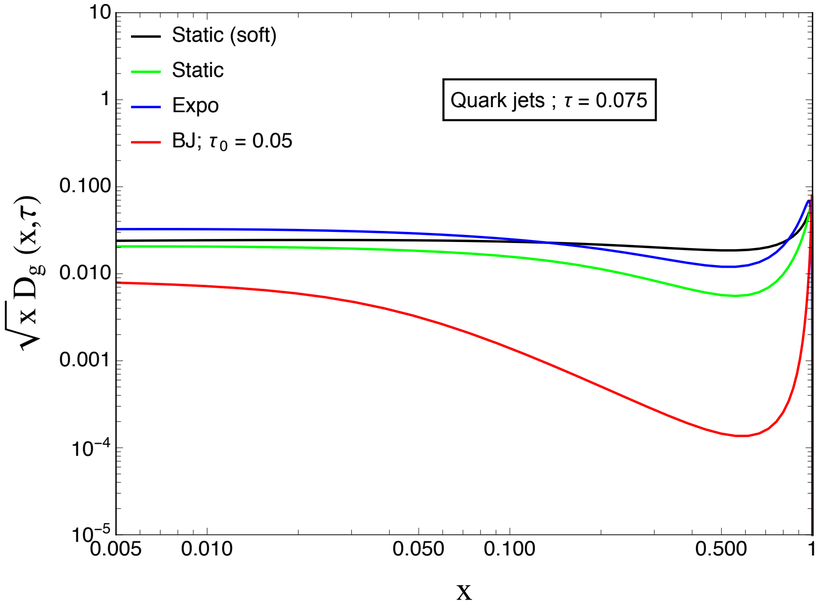
Elliptic flow v_2 as a function of p_T for Bjorken initial conditions

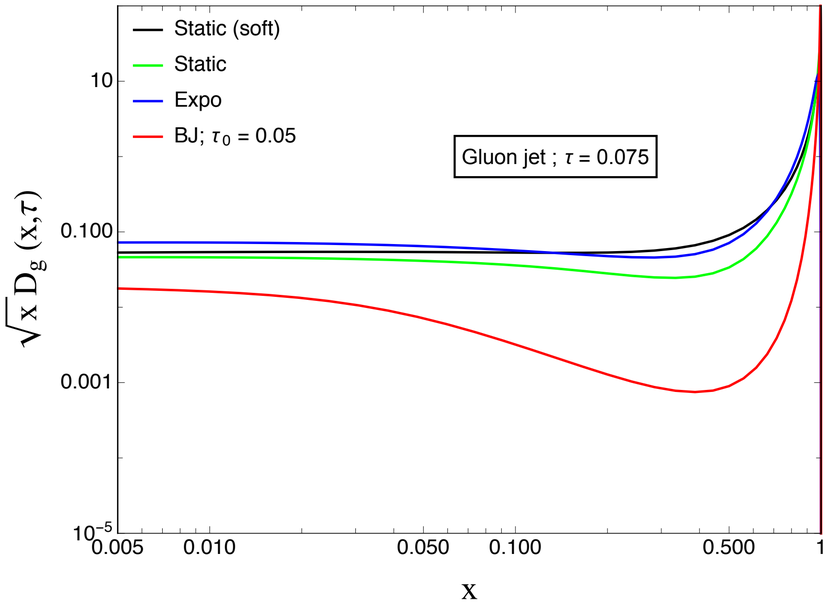
Thanks !

Backup 1 : Medium evolved parton spectra



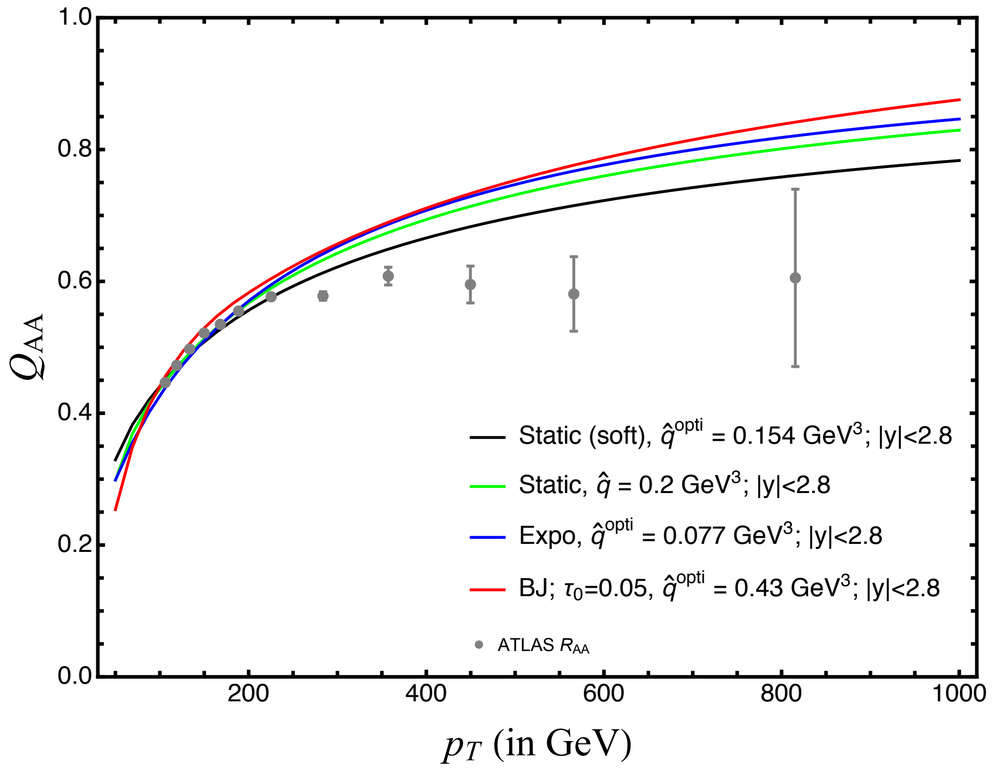


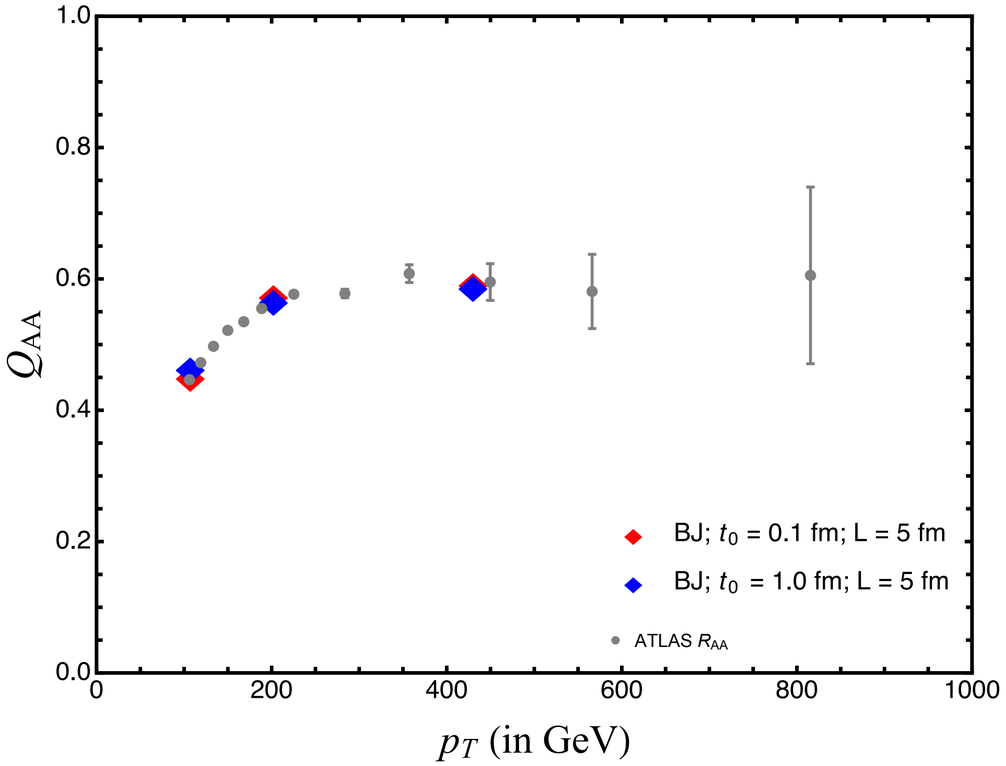




Medium evolved quark and gluon spectra for different medium profiles obtained numerically by solving the kinematic rate equation

Backup 2 : Jet Q_{AA} optimised with ATLAS data





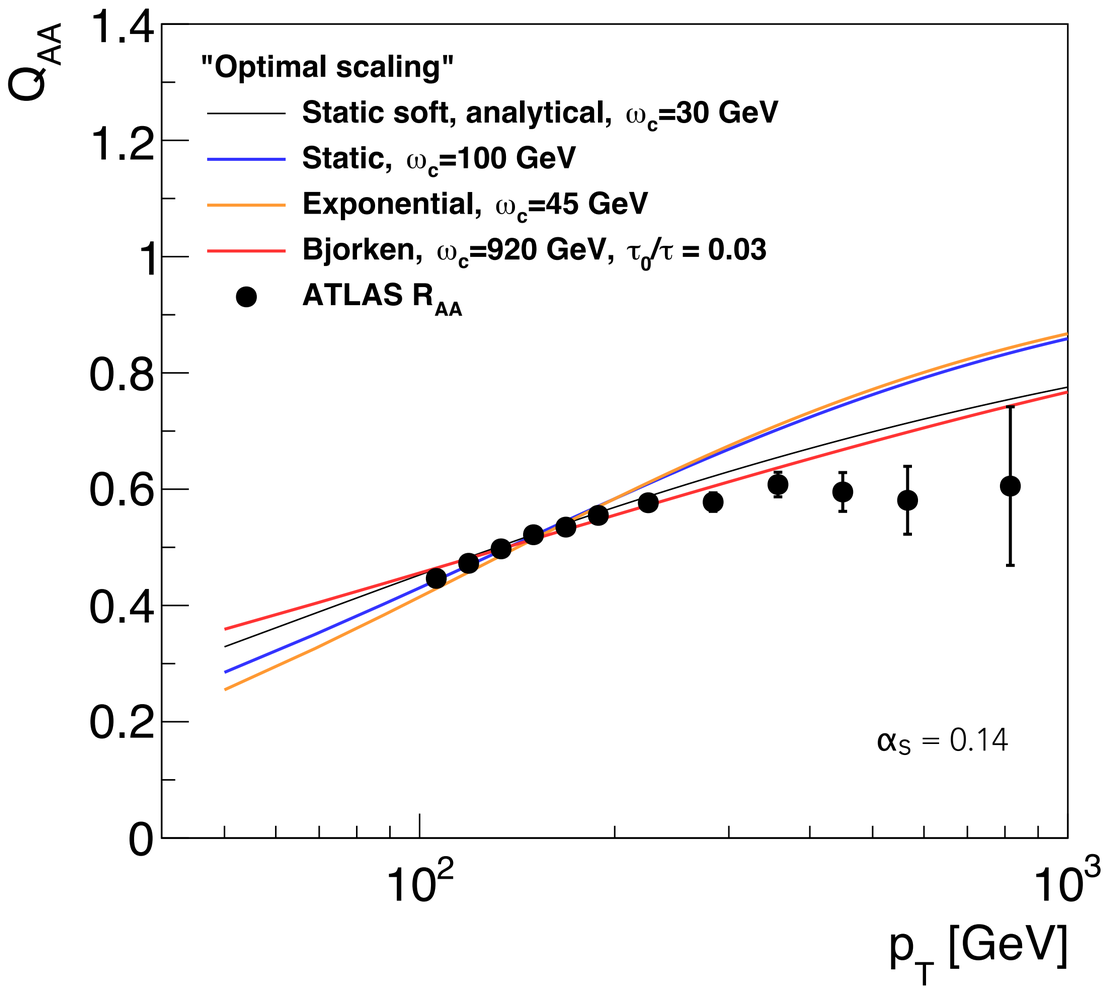
The quenching factor of jets calculated with the modified power law :

parameters	n_g	n_q	β_g	β_q	γ_g	γ_q	δ_g	δ_q	$f_{q,0}$
$\|y\| < 0.3$	3.21	2.52	0.99	0.93	0	0	0	0	0.16
$\|y\| < 2.8$	3.63	3.14	1.00	0.92	0	0	0	0	0.27
$2.1 < \|y\| < 2.8$	5.63	5.00	0.35	0.30	$-1.49 \cdot 10^{-10}$	-0.19	0.24	0.27	0.42

$$Q_{AA}(p_T) = f_q(p_T)(Q_{AA}(p_T)^{S;q_{ini}} + Q_{AA}(p_T)^{g;q_{ini}}) + (1 - f_q(p_T))(Q_{AA}(p_T)^{S;g_{ini}} + Q_{AA}(p_T)^{g;g_{ini}}$$

Spousta and Cole; EPJC 76 (2016) 050.

Backup 3 : Q_{AA} for re-scaled profiles (a short recap of previous work)



- Good, but not perfect scaling is achieved by optimisation.
- Scaling for expo medium ~ average scaling.

The Bjorken profile depends on additional choice of (τ_0/τ) : No universal scaling

- Sizable differences among the values of the quenching parameter for different types of medium and kinematical ranges point to the importance of precise modelling of the jet quenching phenomenon.

BUT WE DID ONLY FOR GLUONIC CASCADES !

Based on the recent work : Medium-induced cascade in expanding media; S. P. Adhya, C. A. Salgado, M. Spousta, K. Tywoniuk; JHEP 07 (2020) 150.