

# Multi-partonic medium induced cascades in expanding media

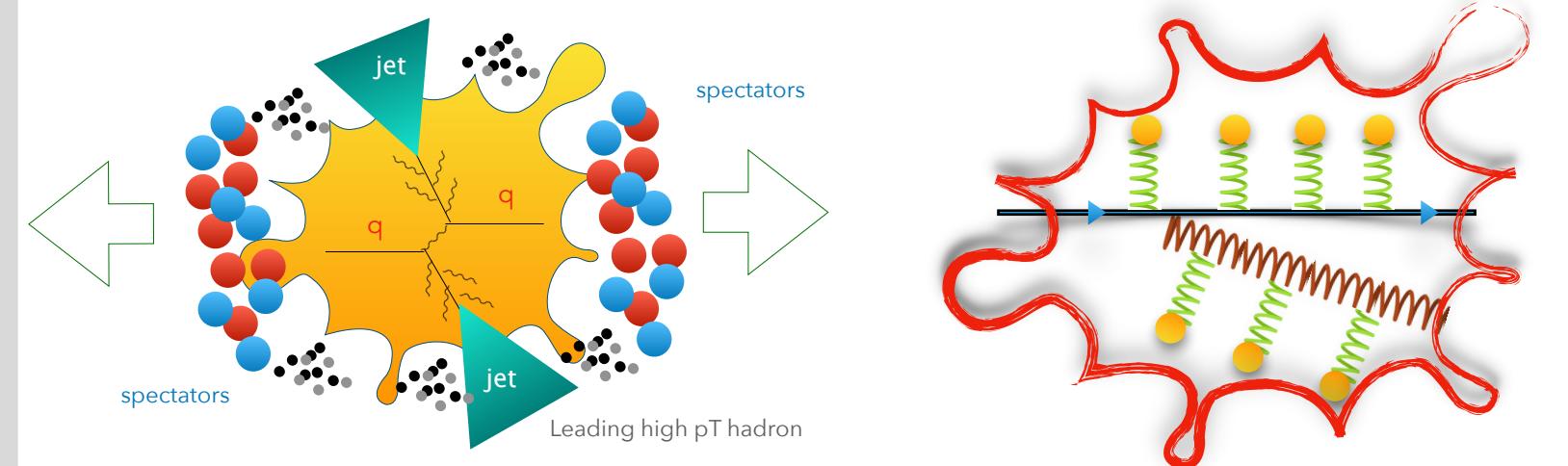
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Based on : JHEP 07 (2020) 150;  
arXiv: 2106.02592 (2021)

## Jets and medium induced emission



- High energy partons, resulting from an initial hard scattering, will create a high energy collimated spray of particles → JETS
- Partons traveling through a dense color medium are expected to lose energy via **medium induced gluon radiation**, "jet quenching". We have used the **BDMPS-Z** (Baier, Dokshitzer, Mueller, Peigné, Schiff; Zakharov) formalism (*multiple soft scattering in medium*).

## Coupled evolution equations

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

$$z = \xi/x \quad zx = \xi \quad \text{Gain} + z = x/\xi \quad z\xi = x \quad \text{Loss}$$

$$x \rightarrow \xi \quad (1-z)x = x - \xi \quad (1-z)\xi = \xi - x$$

$$\star \quad \frac{\partial}{\partial \tau} D_g(x, \tau) = \int dz \mathcal{K}(z, \tau|p) \left[ \sqrt{\frac{z}{x}} D_g\left(\frac{x}{z}, \tau\right) - \frac{z}{\sqrt{x}} D_g(x, \tau) \right] - \int_0^1 z K_{gg}(z) \frac{z}{\sqrt{x}} D_g(x) + \int_0^1 z K_{gq}(z) \sqrt{\frac{z}{x}} D_S\left(\frac{x}{z}\right)$$

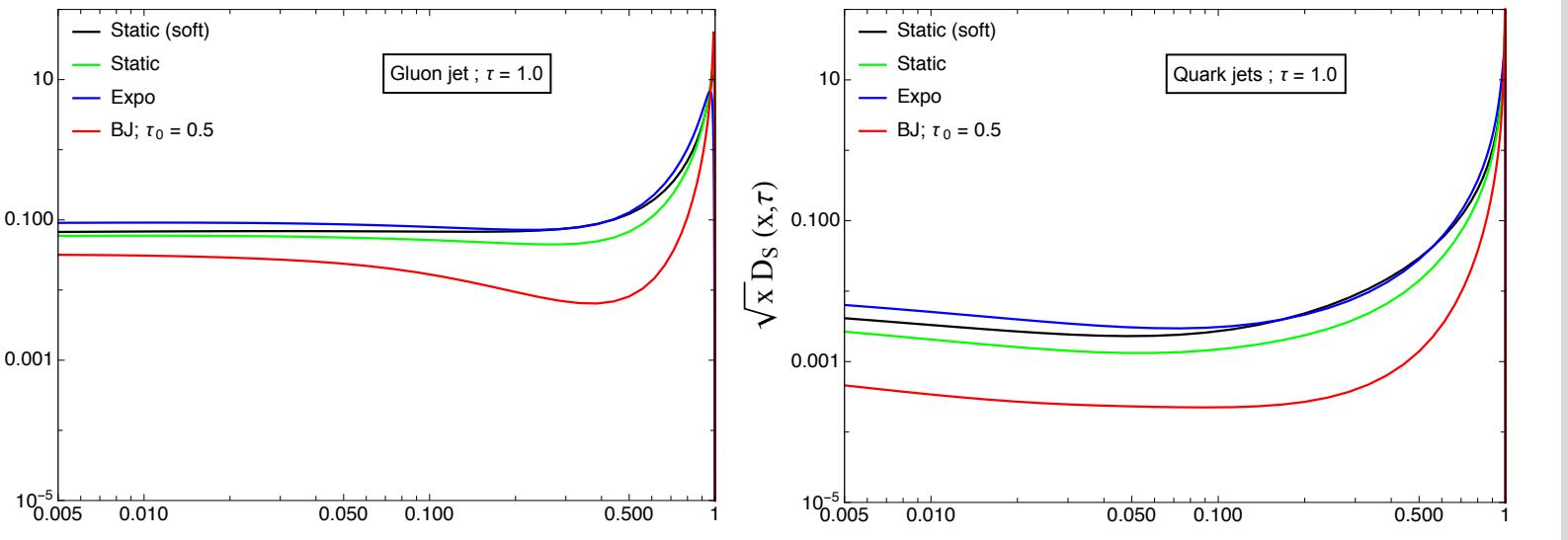
[ Gluonic cascades only ]

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

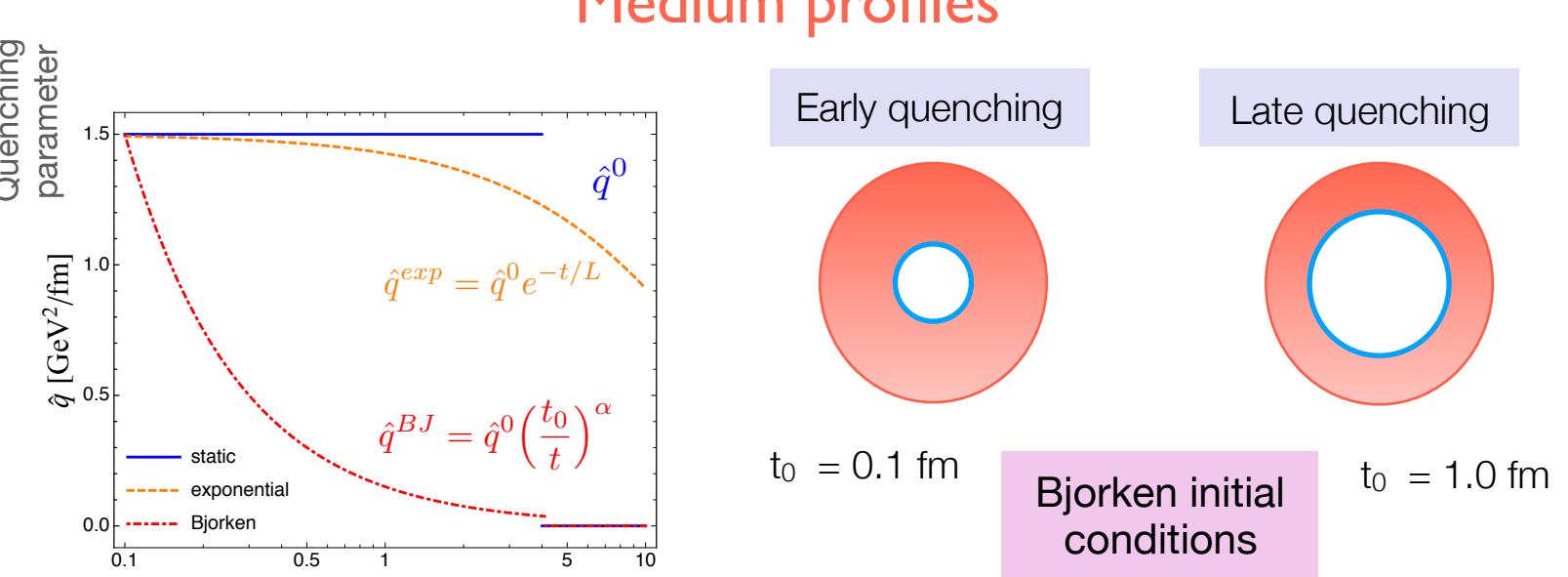
$K_{gg}$        $K_{gq}$        $K_{gq}; K_{qq}$

$D_S = q$  singlet spectra  
 $D_g = \text{gluon spectra}$   
 $K_{ii} = \text{splitting rate}$   
 $T = \text{evolution variable}$

## The medium evolved spectra



## Medium profiles



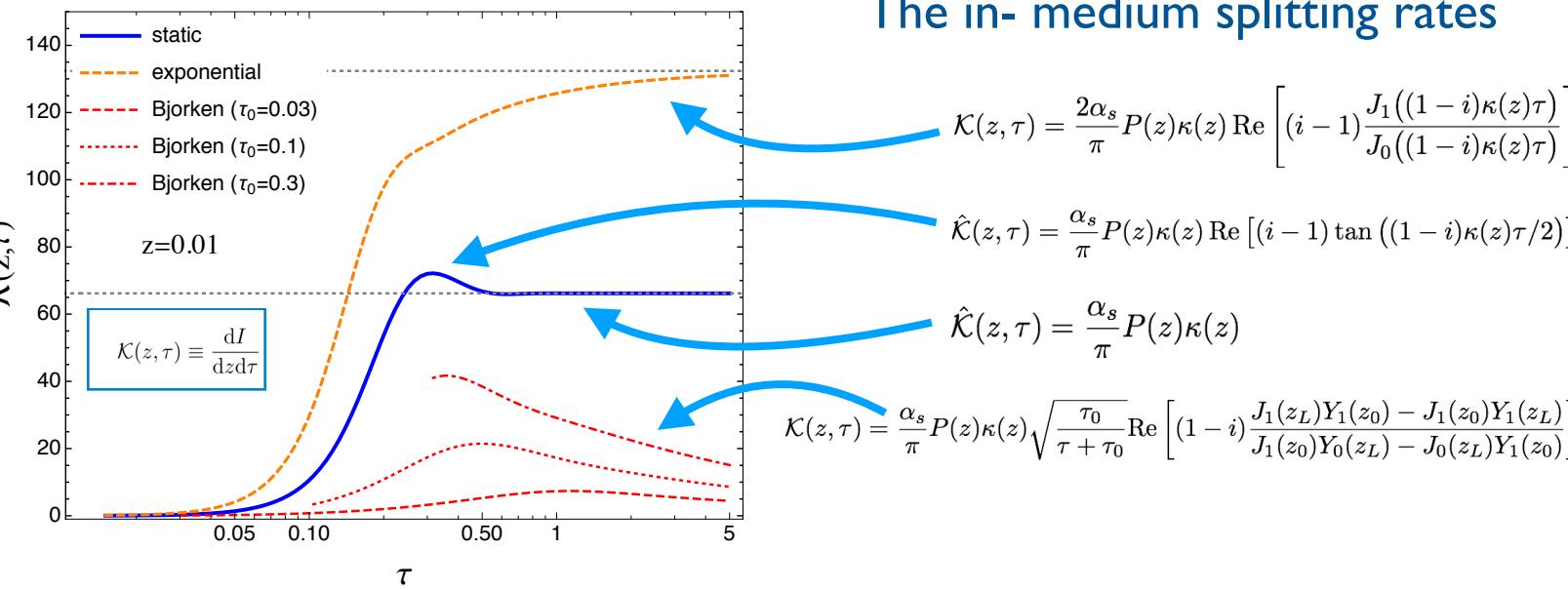
Early quenching

Late quenching

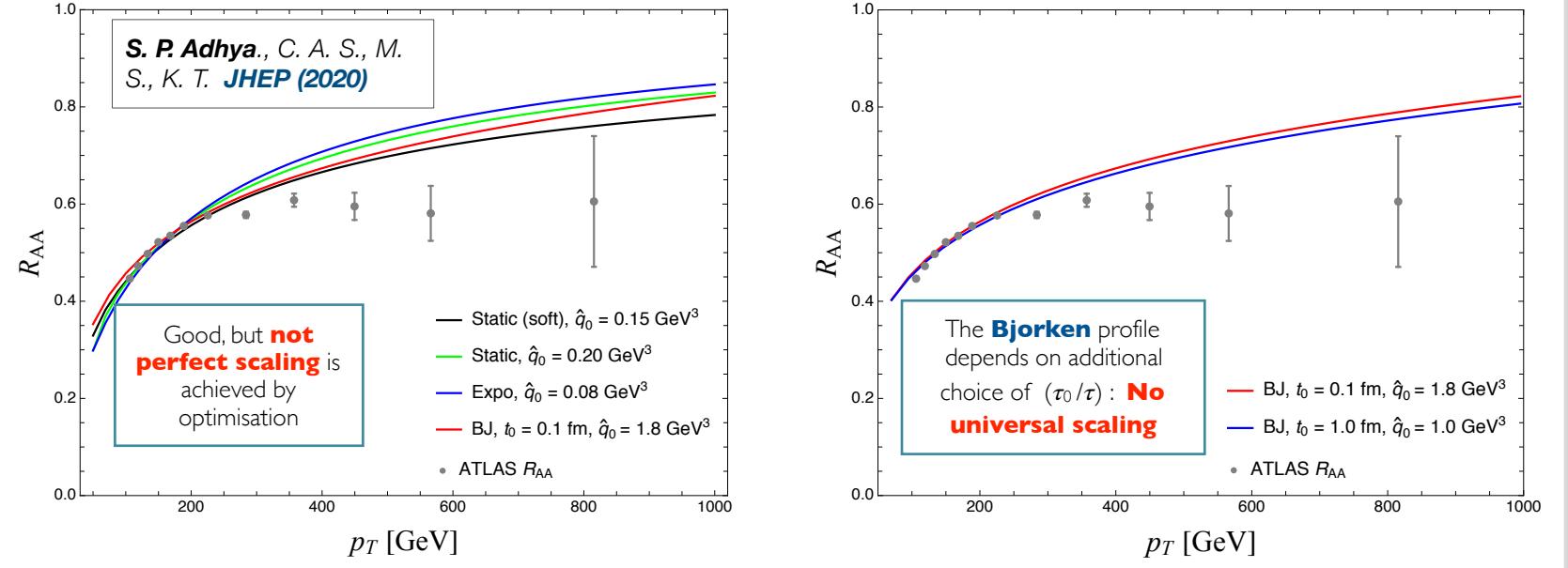
$t_0 = 0.1 \text{ fm}$        $t_0 = 1.0 \text{ fm}$

Bjorken initial conditions

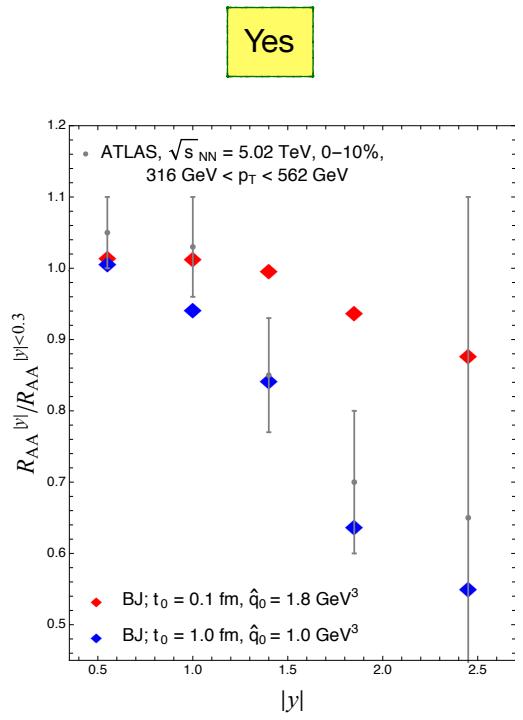
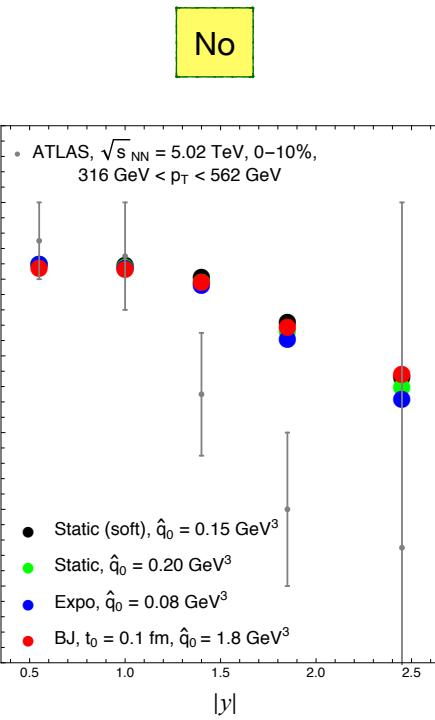
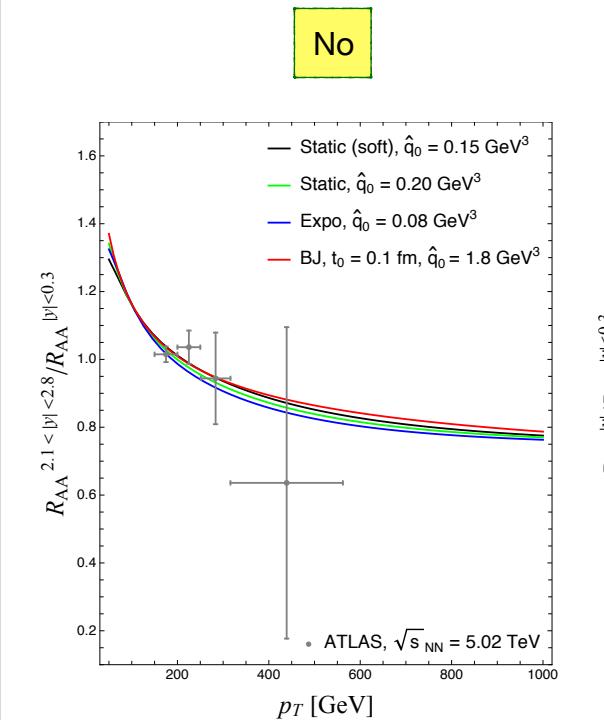
## The in- medium splitting rates



## Is it possible to re-scale $Q_{AA}$ for different medium?

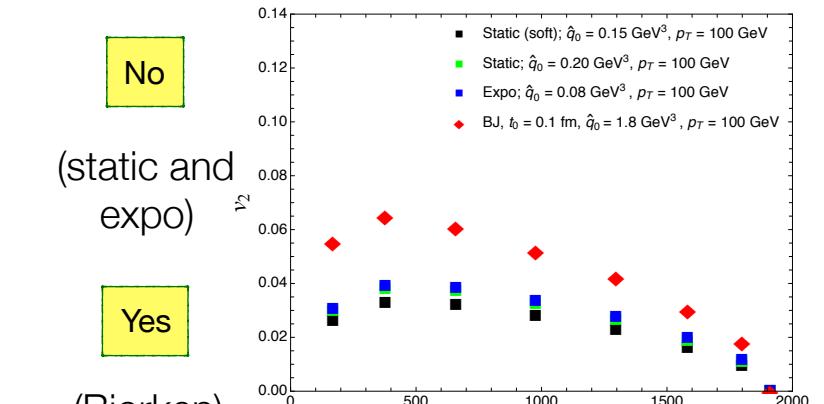


## Does the media behave differently as a function of rapidity ?

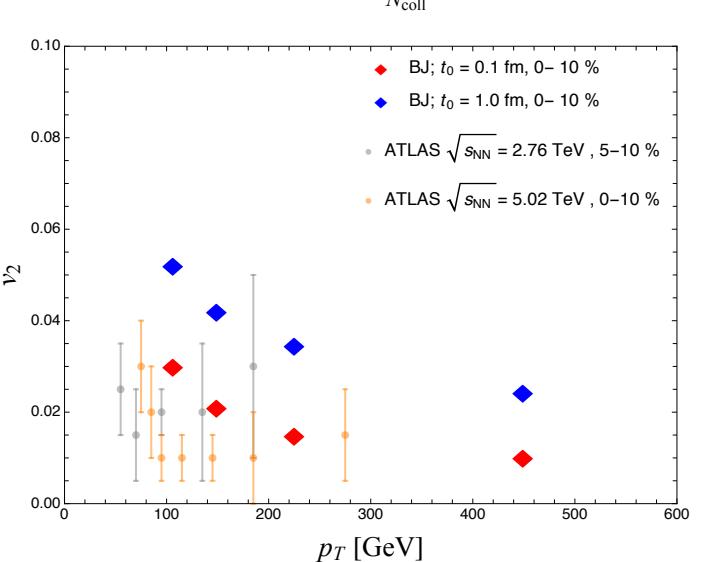
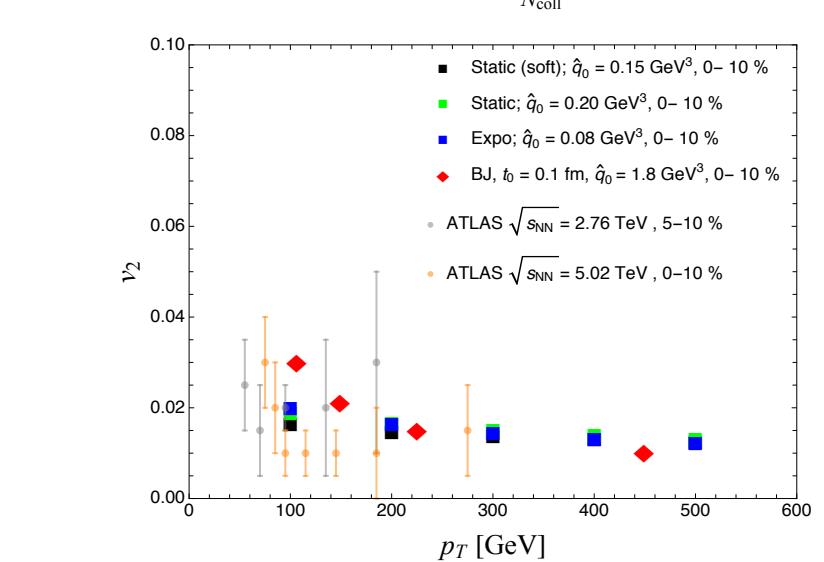
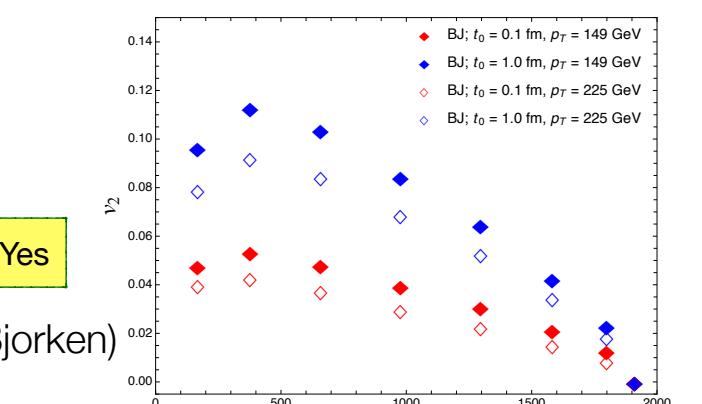


S. P. Adhya., C. A. S., M. S., K. T. arXiv:2106.02592 (2021)

## Does the media behave differently with respect to $v_2$ ?



Yes  
(Bjorken)



- The impact of the medium expansion cannot be scaled out by a suitable choice of  $\hat{q}$  for all kinematical domain [Adhya et. al., JHEP 07 150 (2020)].
- The jet  $v_2$  and  $R_{AA}$  ratio is sensitive to choice of  $t_0$  [Adhya et. al., arXiv: 2106.02592 (2021)].