# Event-by-Event Simulations of Jet Modification Using the MATTER Event Generator

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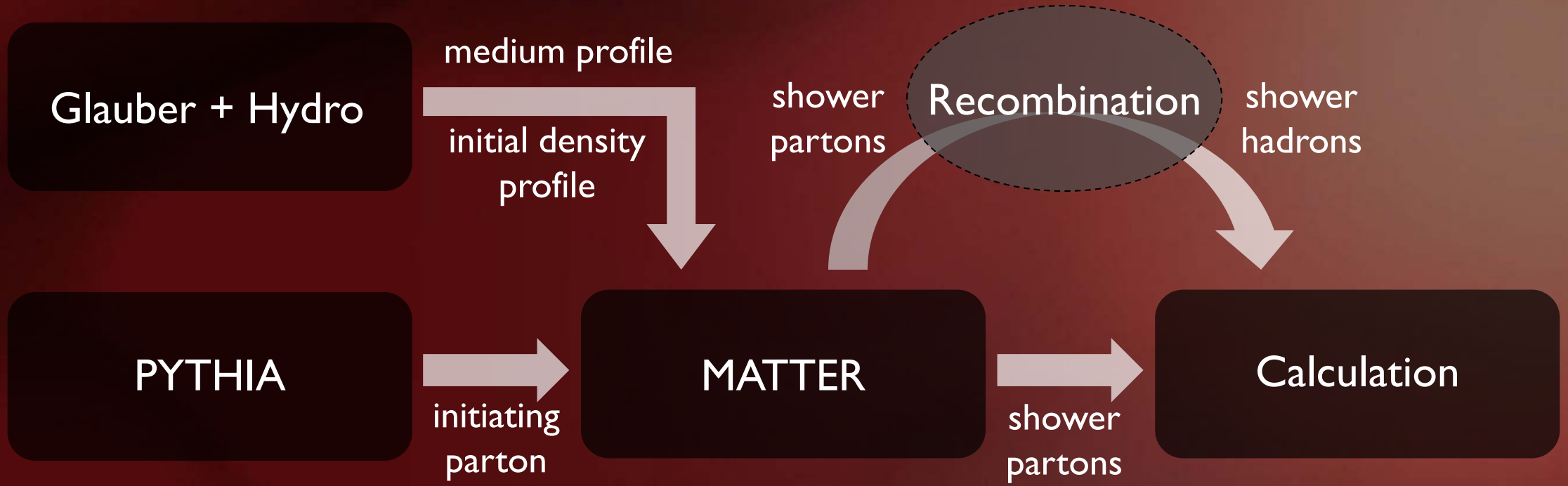
# Code Flowchart

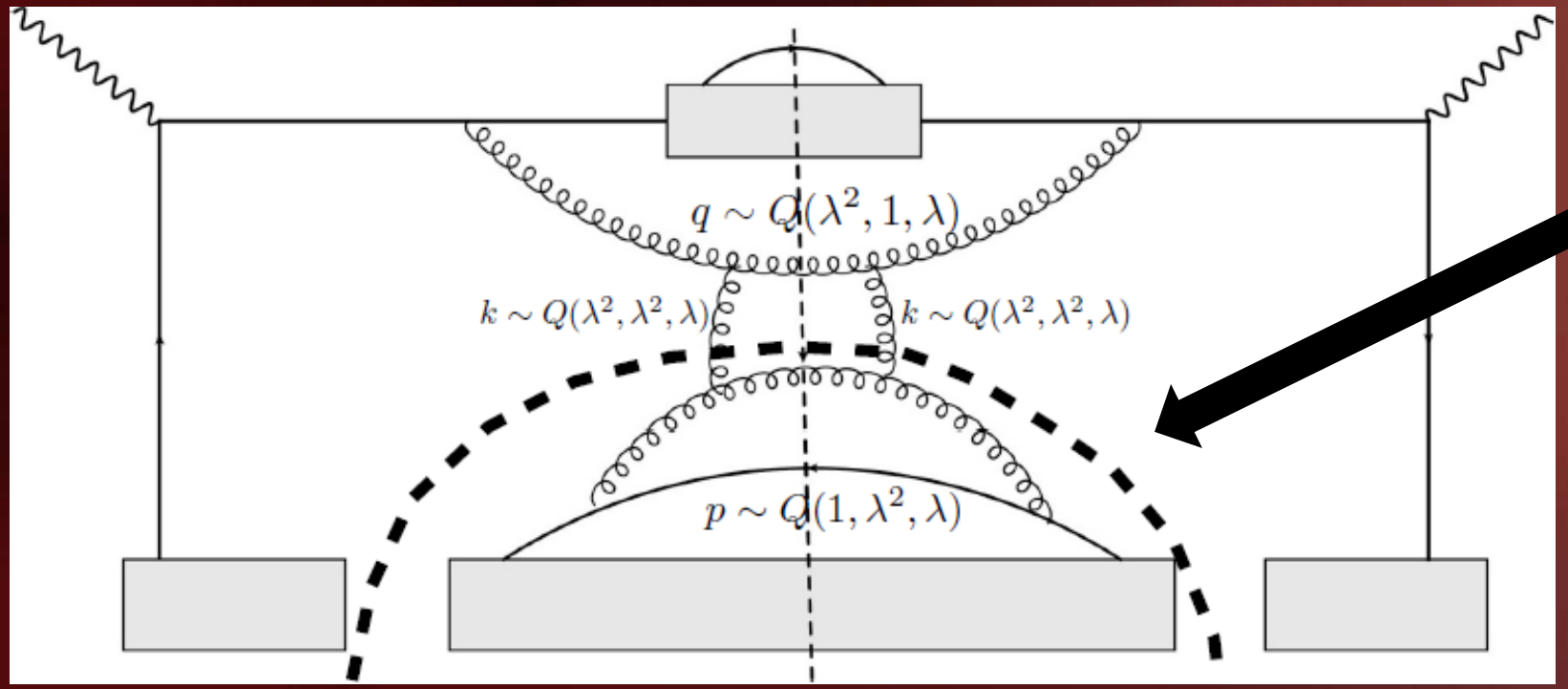


# MATTER

- **M**odular **A**ll **T**wist **T**ransverse **E**lastic scattering and **R**adiation

# MATTER details

Few scatterings per emission limit

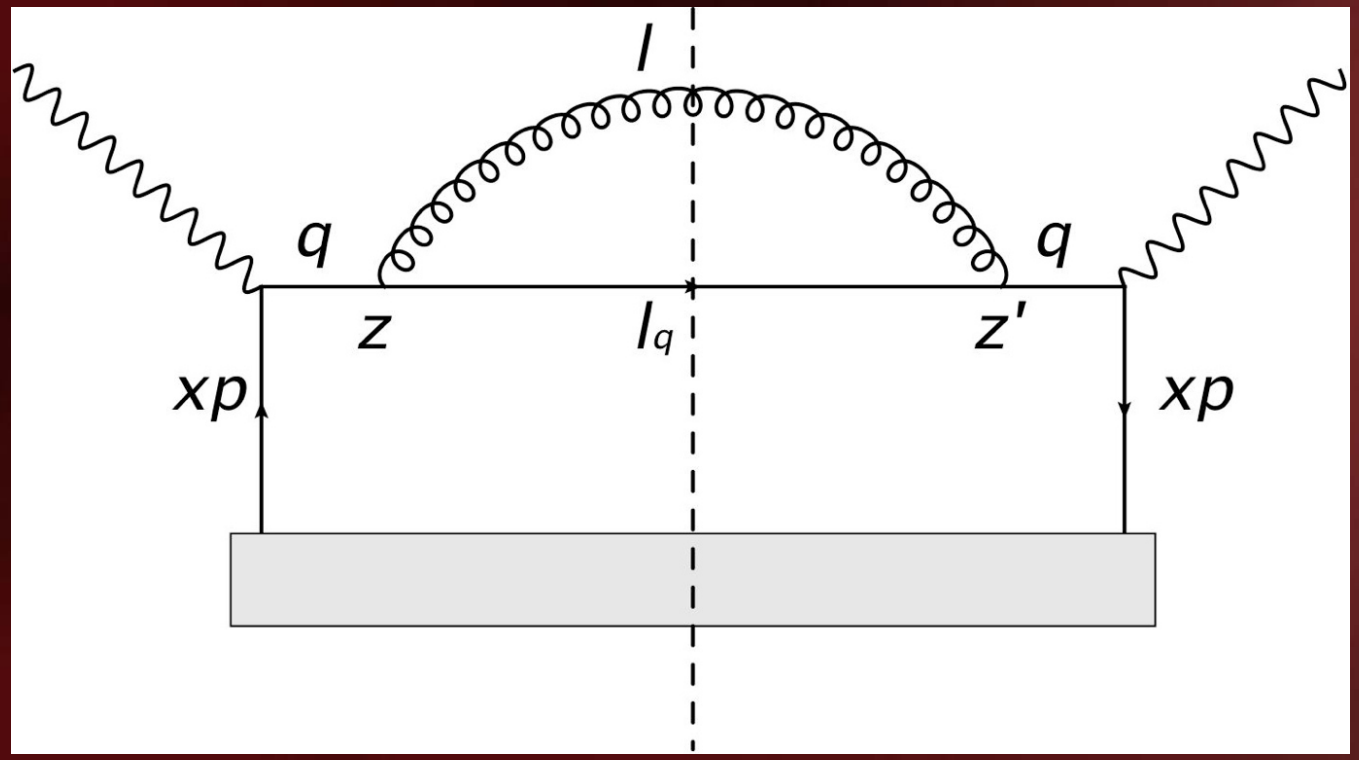



All of this evolution is hiding within $\hat{q}$.

Light quark modification is sensitive to the high $Q^2$, low-x part of the in-medium gluon distribution.

Abhijit Majumder, Quark Matter 2014

# MATTER details II




$\bar{z} = z+z' / 2 \qquad \partial z = z - z'$

$$\int_0^\infty d^4\,\bar{z}\,\exp[i(\partial q)\bar{z}]$$

$$\int d^4\,\partial z\,\exp[i\partial z\bar{q}]$$

$\partial q$ is the uncertainty in q

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# MATTER details III

A reasonable uncertainty is: $\partial q \ll q$

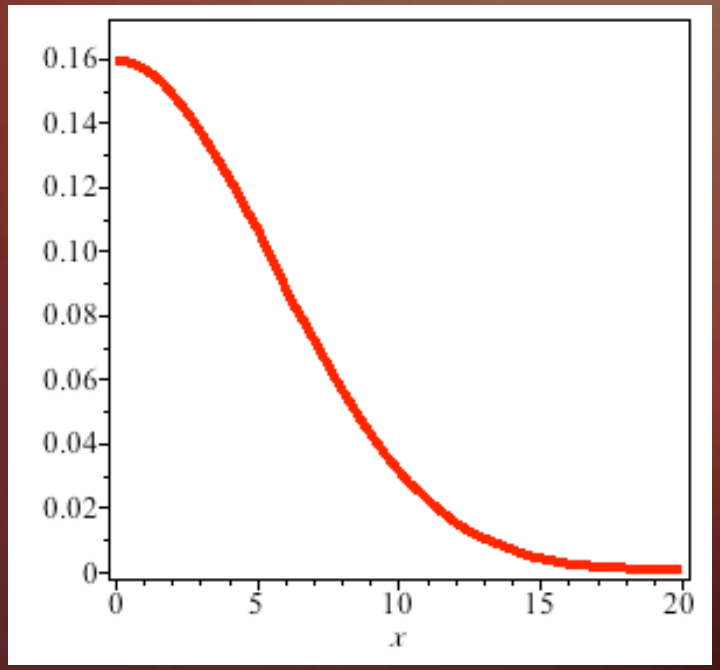
Assume a Gaussian distribution around q+

Set functional form for the width by imposing:
$\langle \tau \rangle = 2q^{--} / Q^2$

To get $z^-$ distribution, only need to assume $\partial q^+$ distribution

Sample the in medium modified Sudakov form factor to get virtuality at each step

$$\rho(\delta q^+) = \frac{\exp[-\frac{(\delta q^+)^2}{2[2(q^+)^2/\pi]}]}{\sqrt{2\pi[2(q^+)^2/\pi]}}$$

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# MATTER details IV

The Sudakov form factor:

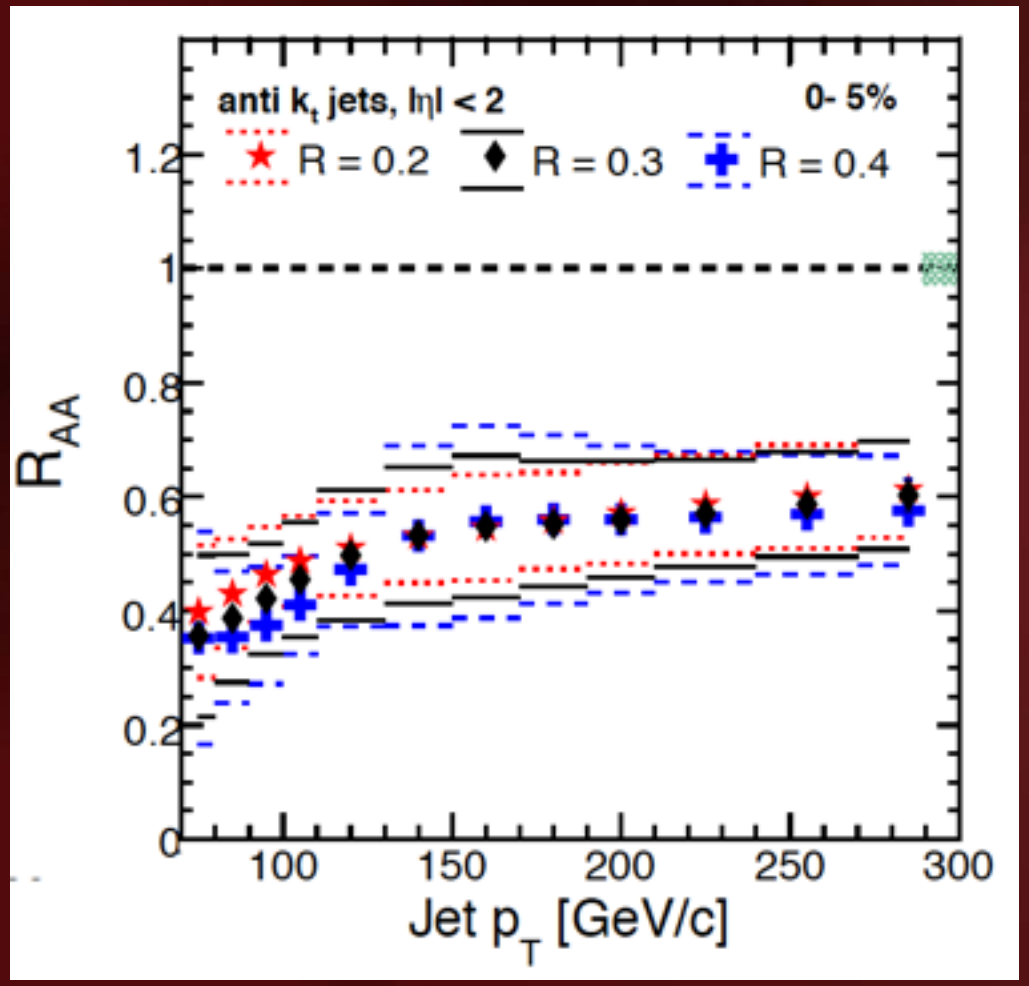
$$S_\zeta(Q_0^2, Q^2) = \exp[-\int_{2Q_0^2}^{Q^2} \frac{d\mu^2}{\mu^2}\frac{\alpha_S(\mu^2)}{2\pi} * \int_{Q_0/Q}^{1-Q_0/Q} dy P_{qg}(y)\{1 + \int_{\zeta_i^-}^{\zeta_i^- + \tau^-} d\zeta K_{p^-,\mu^2}\}]$$

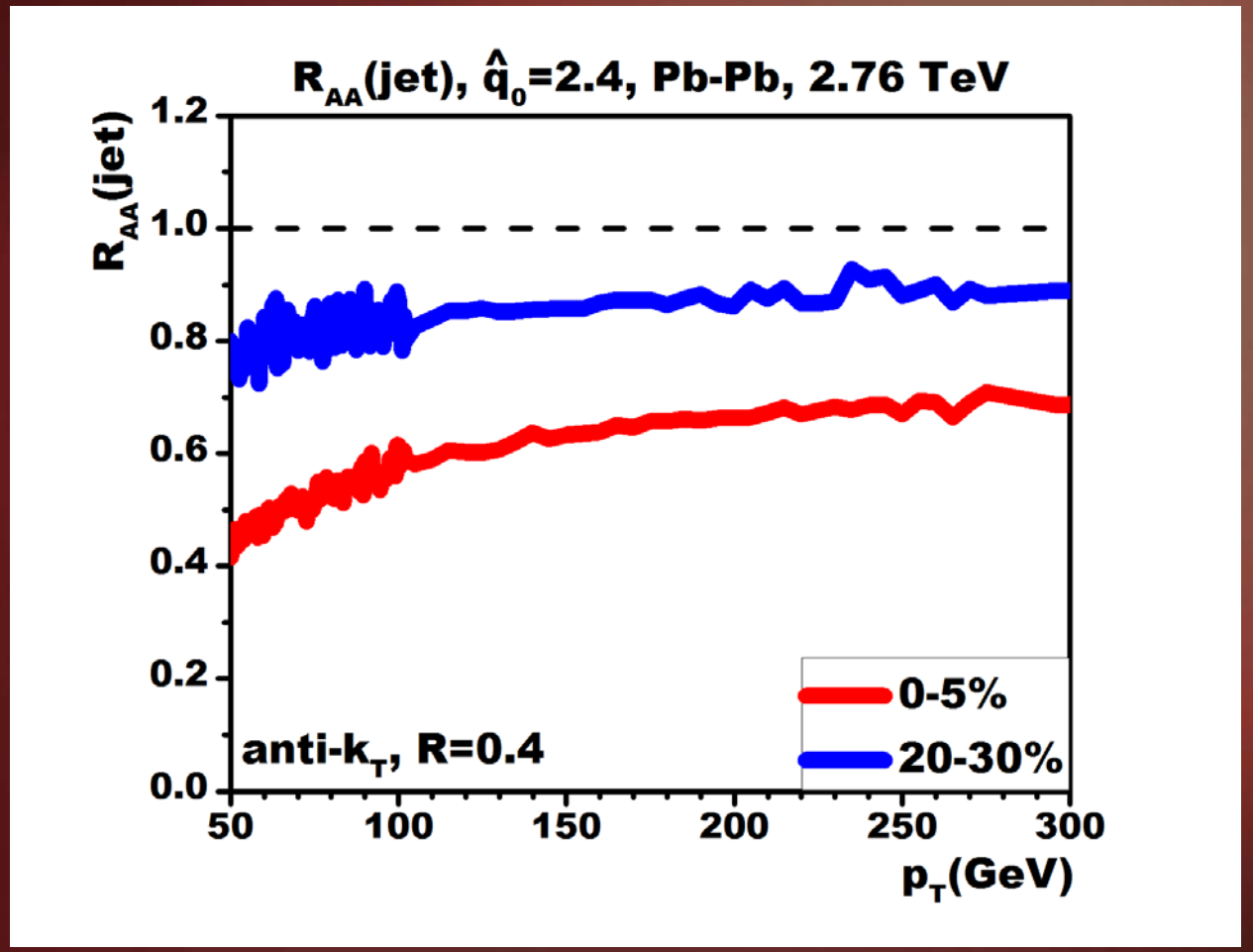
$$K_{p^-,\mu^2}(y,\zeta) = \frac{2\hat{q}}{\mu^2}[2 - 2\cos\left\{\frac{\mu^2(\zeta - \zeta_i)}{2p^- y(1-y)}\right\}]$$

Which is valid while $A\frac{\hat{q}\tau}{\mu^2} \lesssim 1$.

Abhijit Majumder, Quark Matter 2014

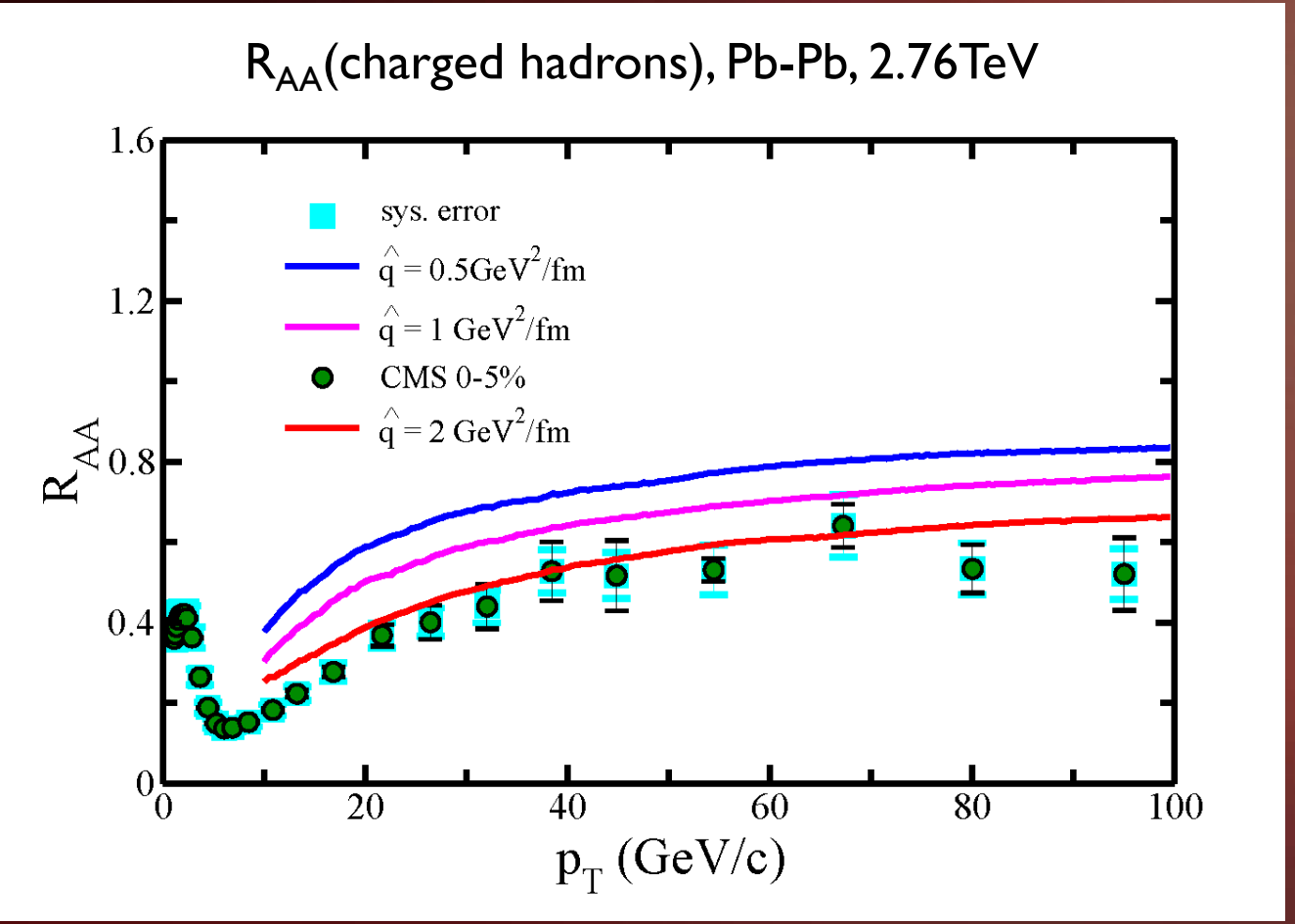
# $R_{AA}$ for jets compared to CMS




Doga Gulhan – Report from CMS; HP2016

# $R_{AA}$ for LHC for varying $\hat{q}_0$ compared to CMS



# Fin.

Questions?