

Exploring perturbative QCD splittings in heavy-ion collisions

Adam Takacs

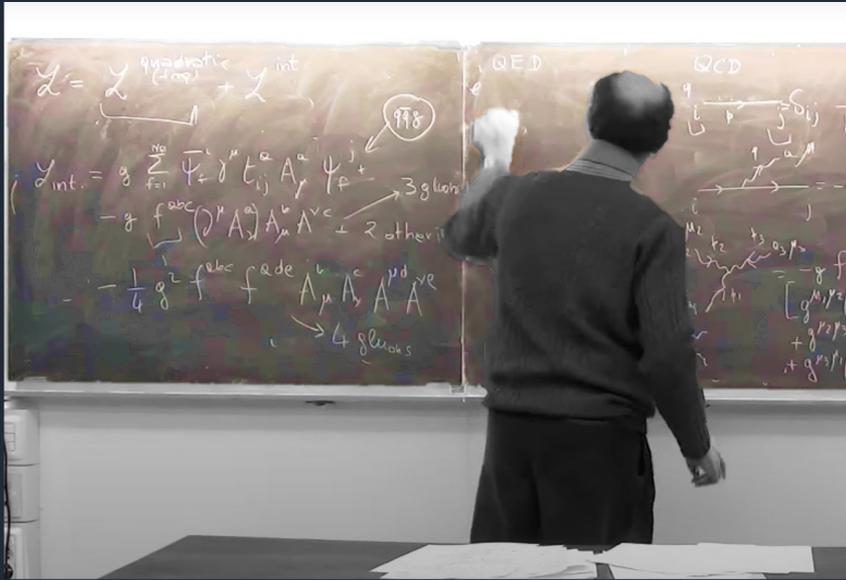
with: Leticia Cunqueiro Mendez, Daniel Pablos,
Alba Soto Ontoso, Martin Spousta, Marta Verweij



UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386

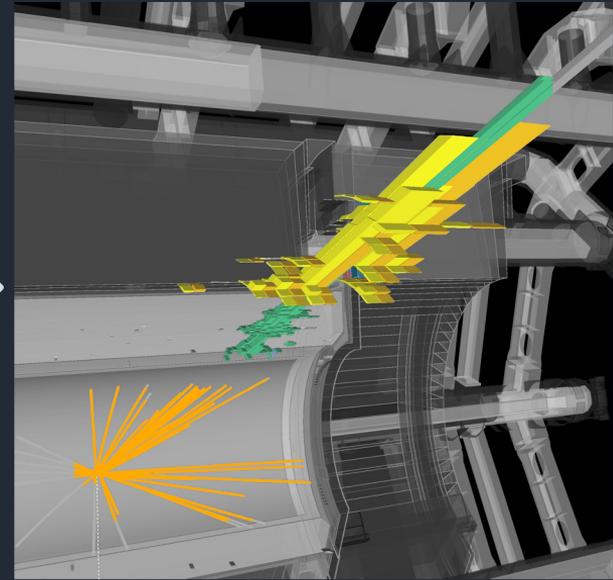
Introduction

theory



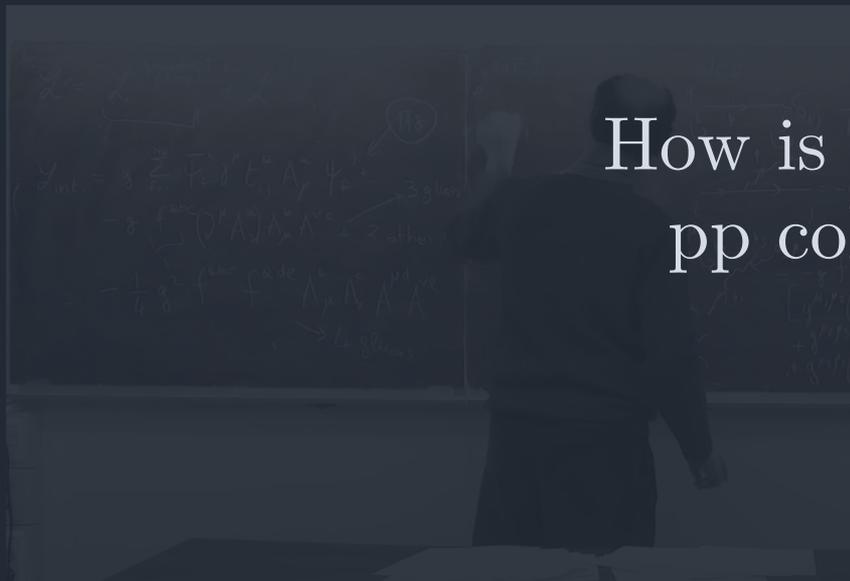
[S, Catani's lectures on yt]

observation

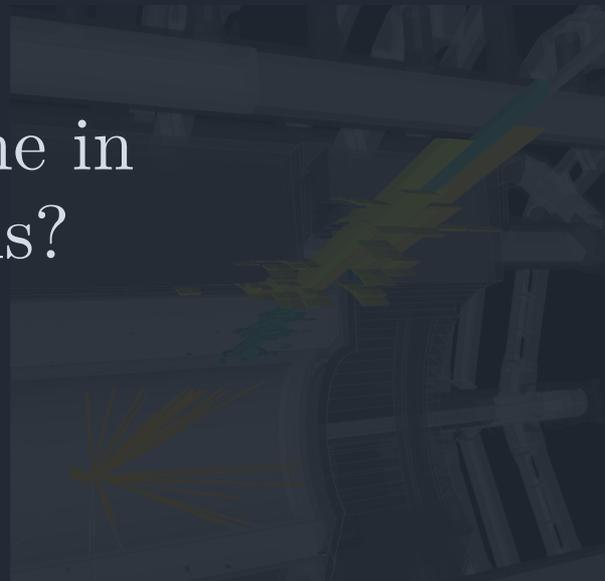


Introduction

theory



observation



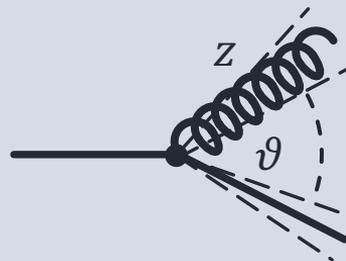
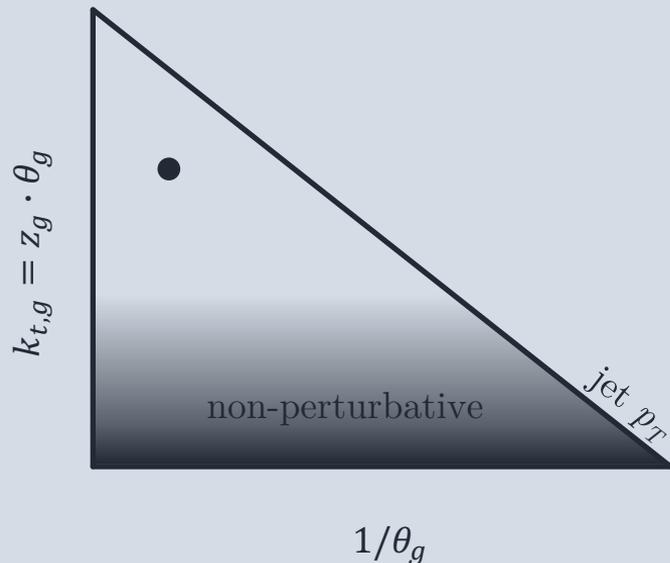
How is it done in
pp collisions?



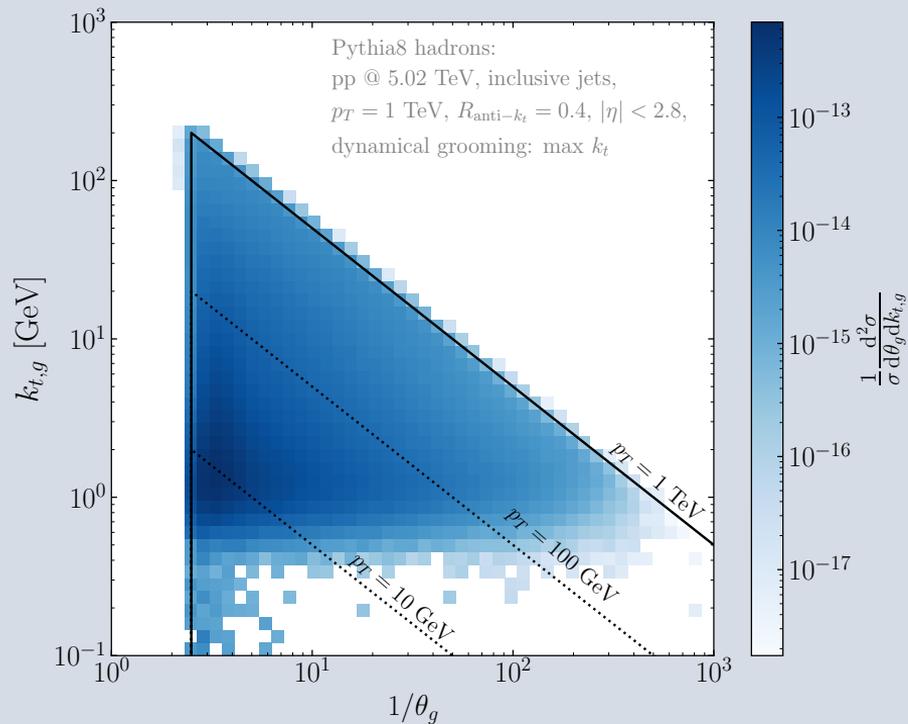
Hardest splitting in jets

[Mehtar-Tani, Soto-Ontoso, Tywoniuk]
[Caucal, Soto-Ontoso, Takacs]
[ALICE, JHEP 05 (2023) 244]
[ATLAS, PRC 107 (2023) 054909]

1. Find a jet
2. Recluster with C/A
3. Find branching with hardest k_t

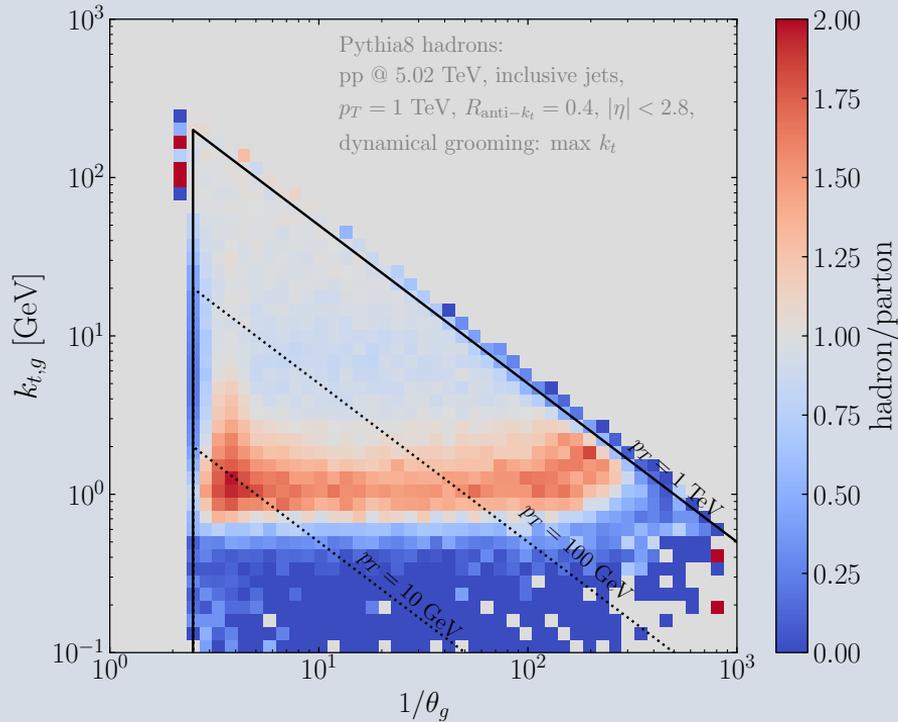


Hardest splitting in jets



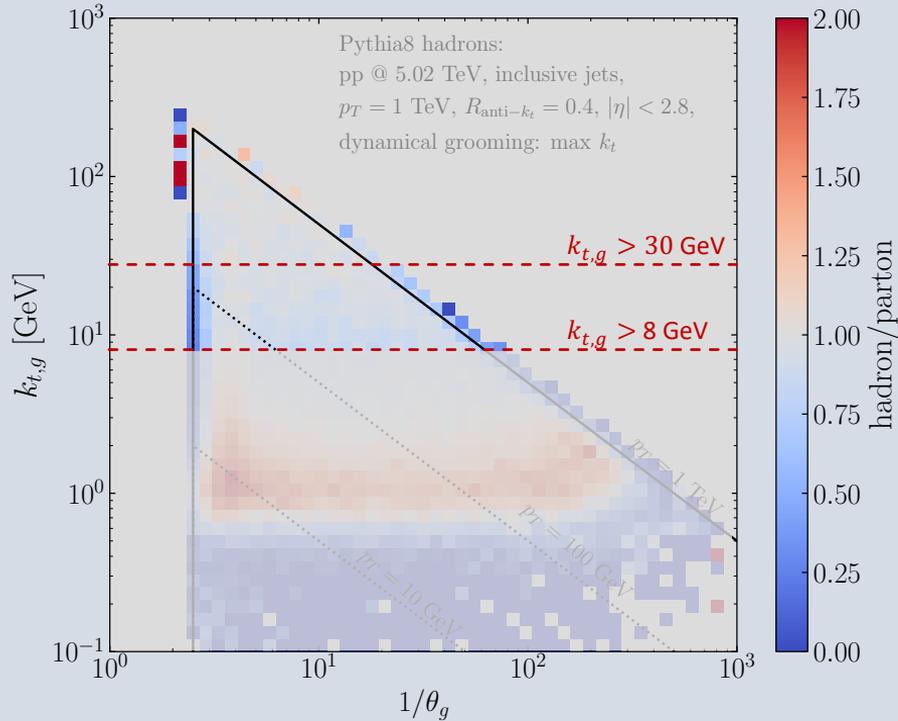
- Higher energy = more perturbative

Hardest splitting in jets



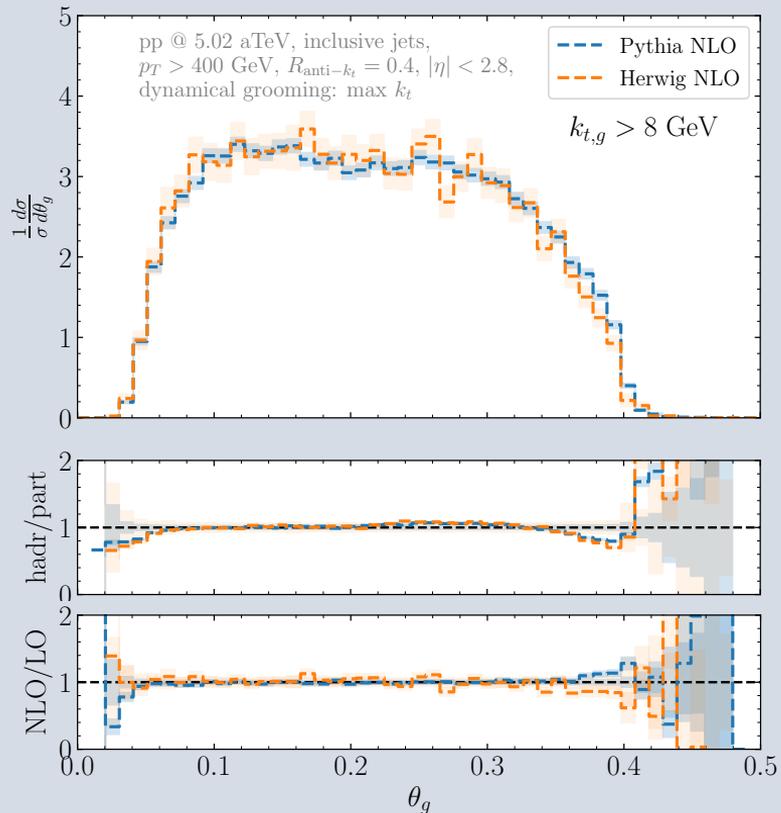
- Higher energy = more perturbative
- Low k_t = non-pert. corrections

Hardest splitting in jets



- Higher energy = more perturbative
- Low k_t = non-pert. corrections
- Cut on k_t to reduce corrections

Hardest splitting in jets



- Higher energy = more perturbative
- Low k_t = non-pert. corrections
- Cut on k_t to reduce corrections
- ($p_T > 400$ GeV to enhance stat.)
- **Controlled pp baseline!**

Introduction

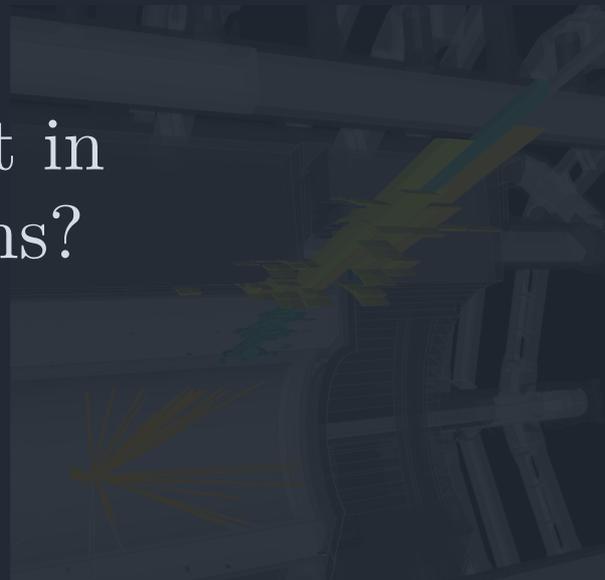
theory



How to do it in
AA collisions?

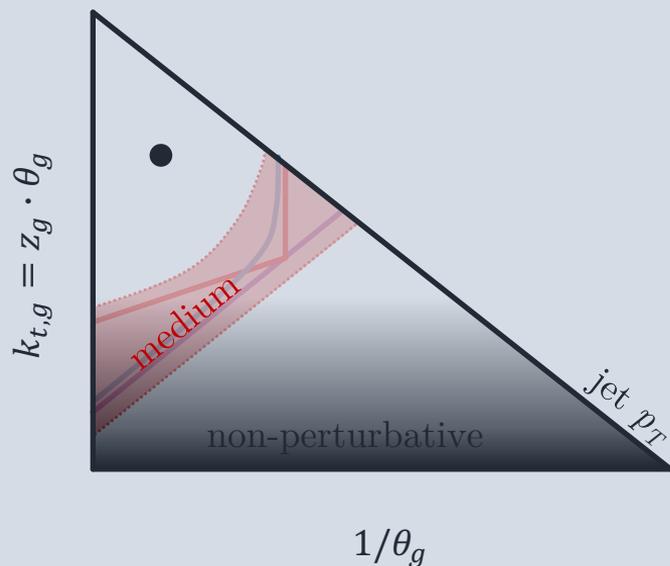


observation



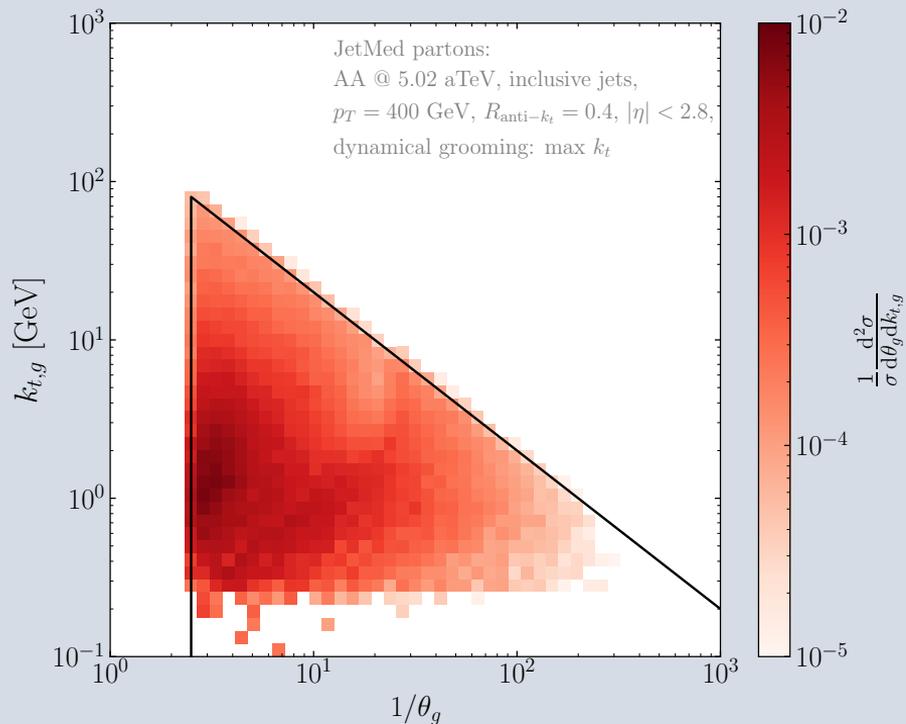
Hardest splitting in quenched jets

[HI Jet Workshop 2017]
[Caucal, Soto-Ontoso, Takacs]
[ATLAS, PRC107(2023)054909]
[Hangal: Tue]
[H.Bossi: Tue]



- Medium scales

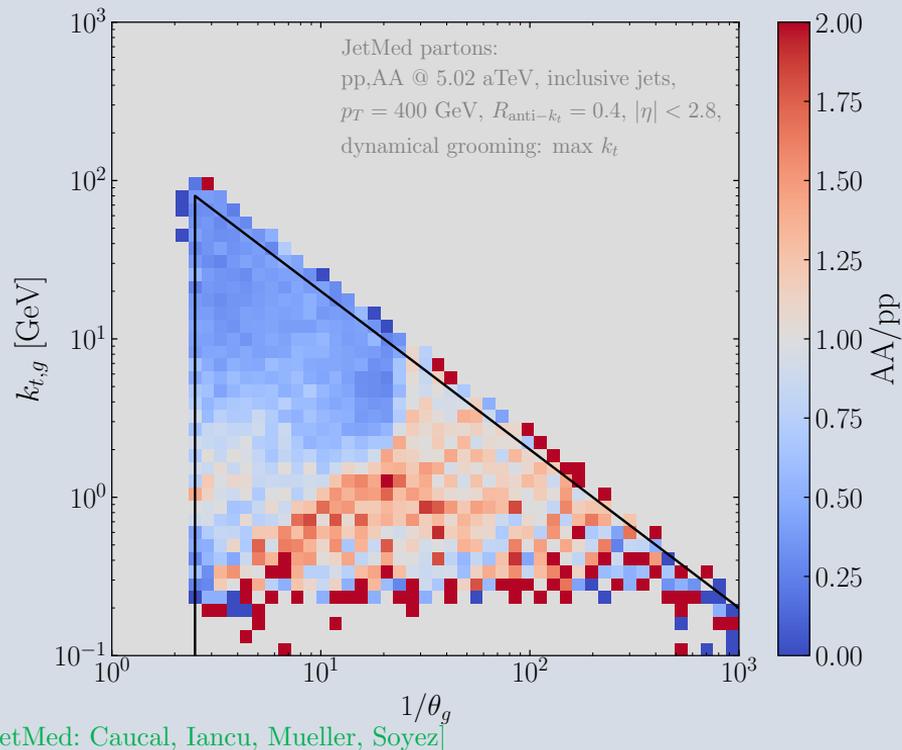
Hardest splitting in quenched jets



[JetMed: Caucal, Iancu, Mueller, Soyez]

- Medium scales
- $k_{t,\text{cut}}$ for very hard emissions
- **very early emissions!**

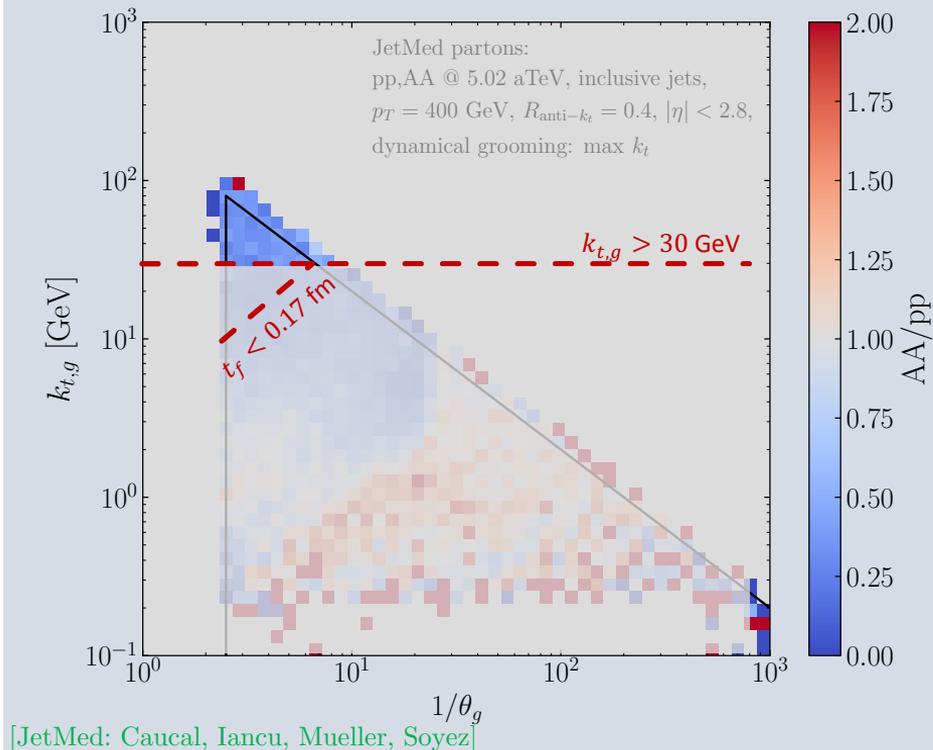
Hardest splitting in quenched jets



- Medium scales

[JetMed: Caucal, Iancu, Mueller, Soyez]

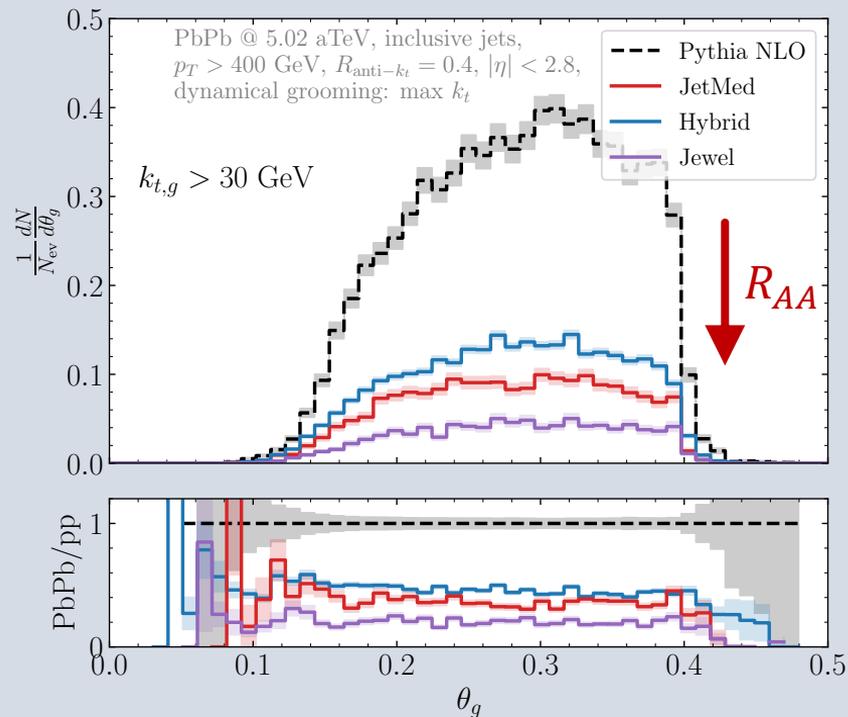
Hardest splitting in quenched jets



- Medium scales
- $k_{t,\text{cut}}$ for very hard emissions
- very early emissions!

Hardest splitting in quenched jets

- less jets = R_{AA}
- flat ratio = no modification!



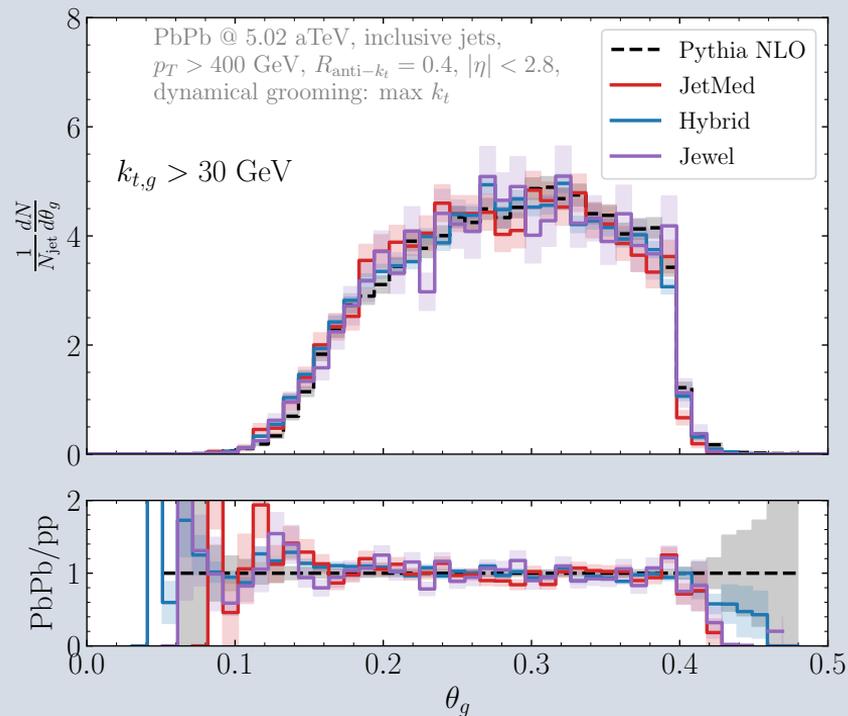
[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderrey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann,]

Hardest splitting in quenched jets

- less jets = R_{AA}
- flat ratio = no modification!



[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderrey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann,]

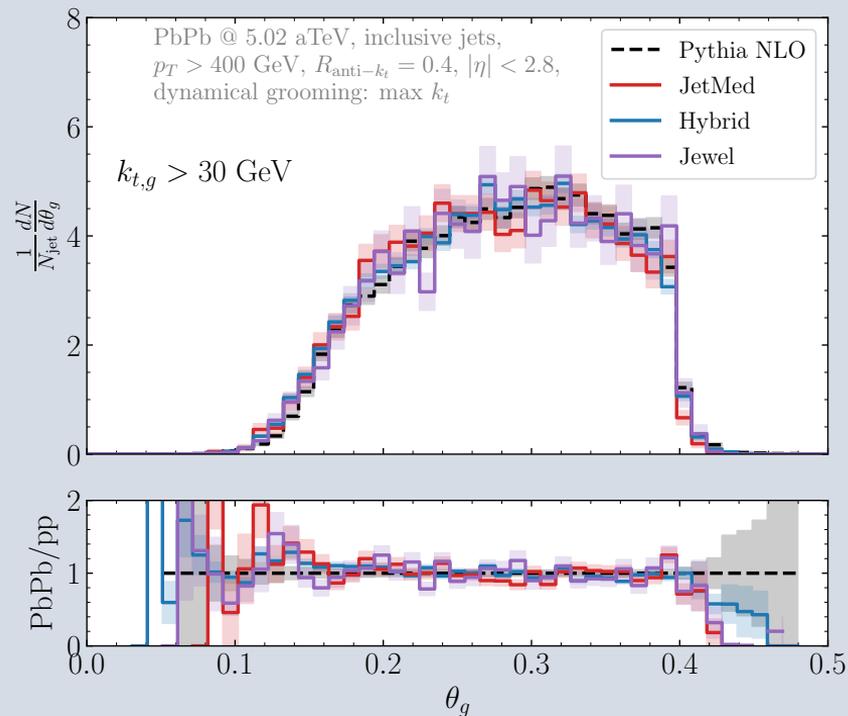
Hardest splitting in quenched jets

- less jets = R_{AA}
- flat ratio = no modification!
- testing mode separation
- new baseline in AA!

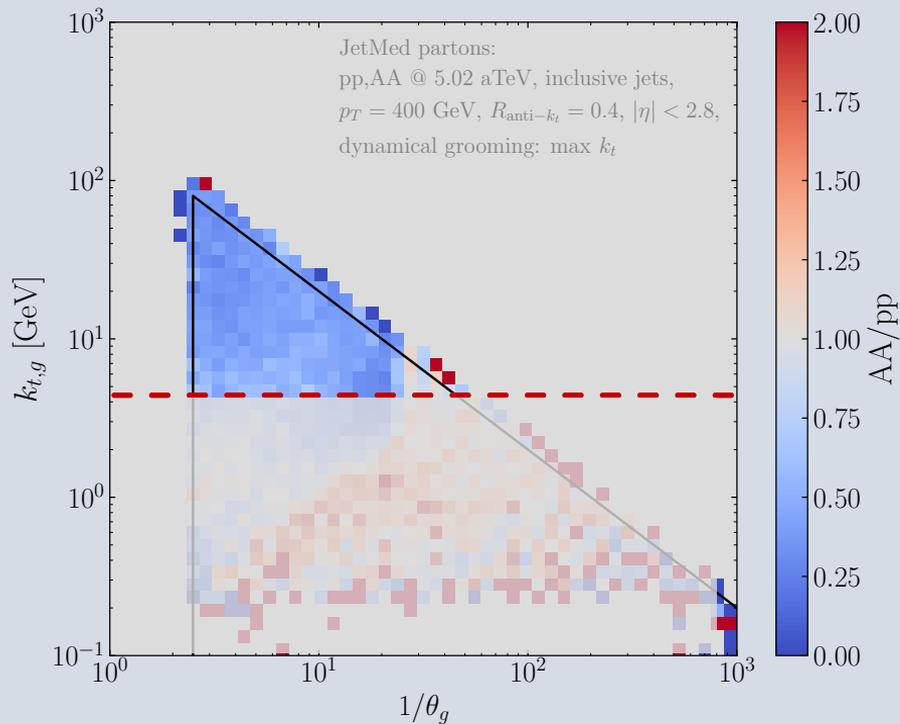
[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderrey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann,]



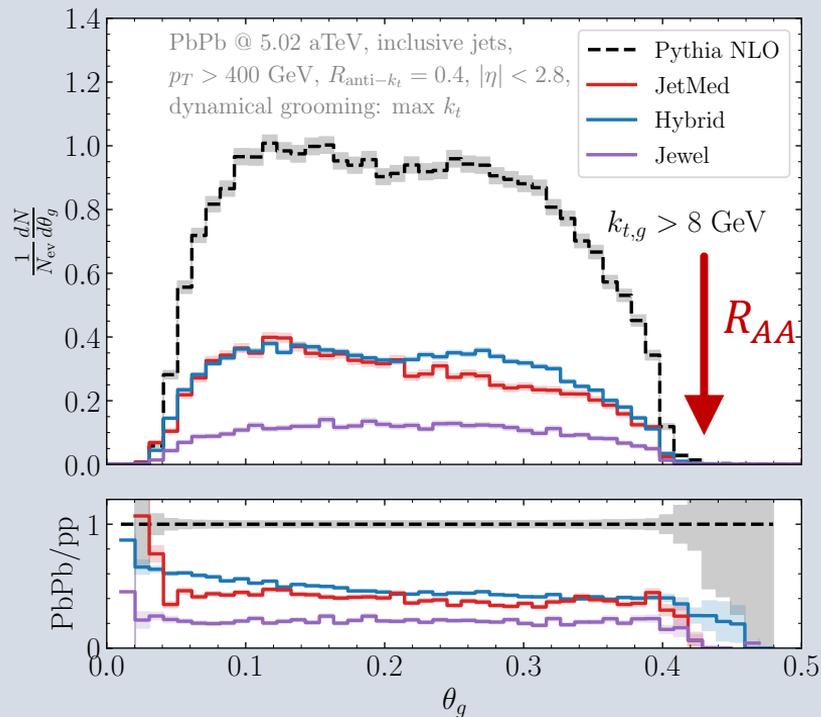
Hardest splitting in quenched jets



- Medium scales
- $k_{t,\text{cut}}$ for perturbative emissions
- not so early emissions!

Hardest splitting in quenched jets

- less jets = R_{AA}
- modification in shape!



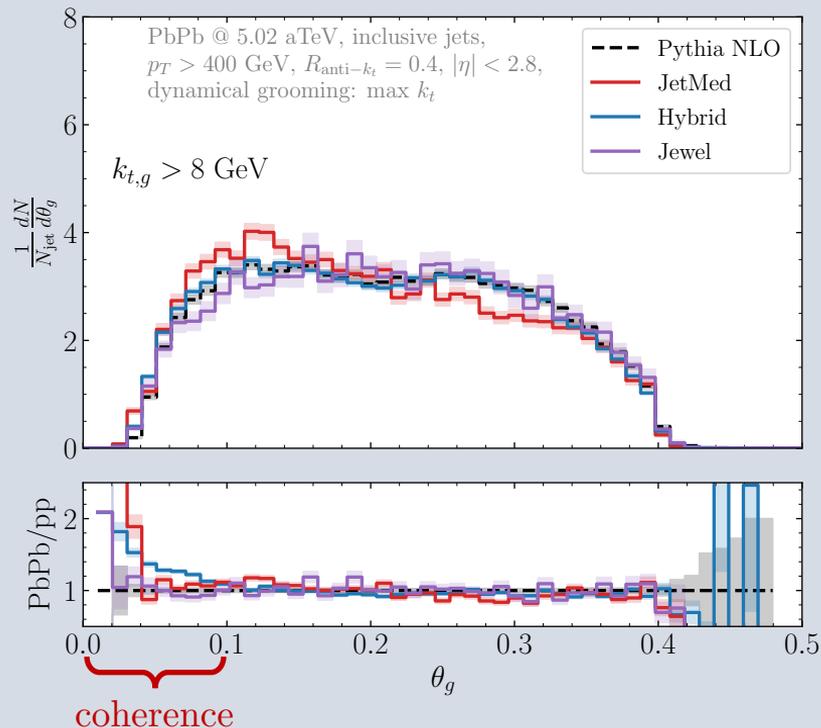
[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderrey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann]

Hardest splitting in quenched jets

- less jets = R_{AA}
- modification in shape!
- testing color resolution



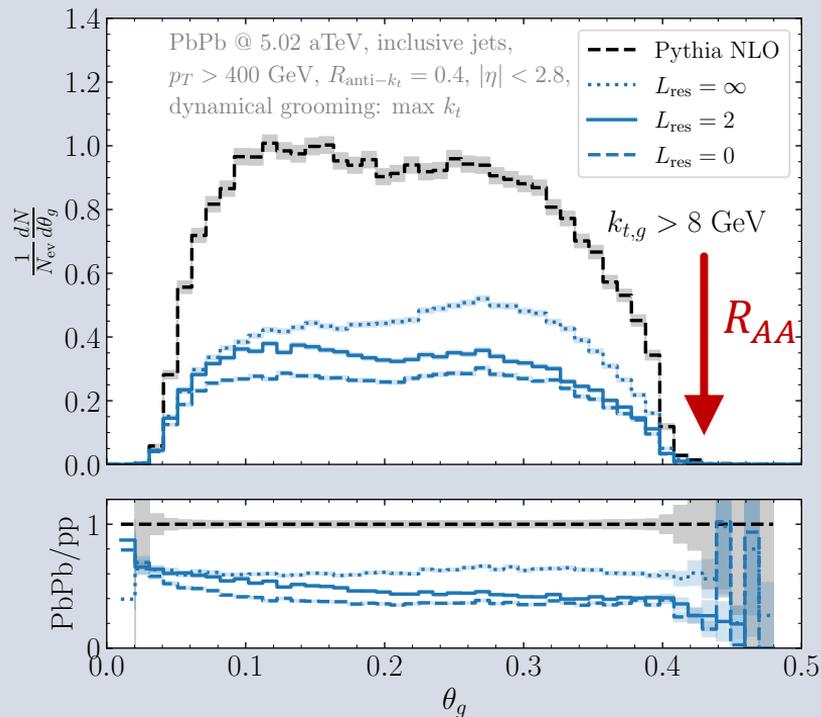
[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casallerrey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann]

Hardest splitting in quenched jets

- less jets = R_{AA}
- modification in shape!
- testing color resolution
- baseline for the future!



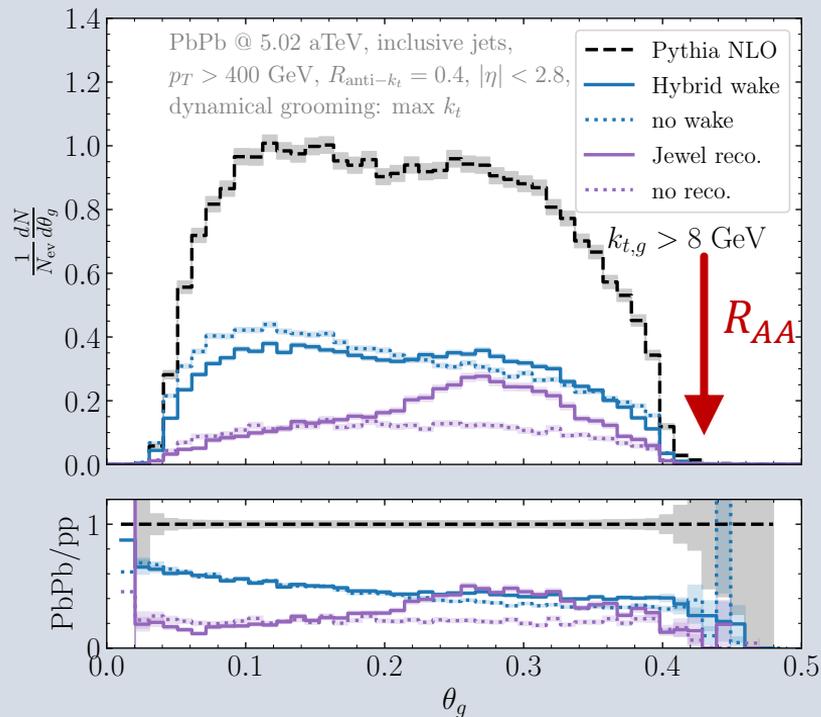
[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann]

Hardest splitting in quenched jets

- less jets = R_{AA}
- modification in shape!
- testing medium response
and thermalization



[JetMed: Caucal, Iancu, Mueller, Soyez]

[Hybrid: Casalderey-Solana, Gulhan, Milhano, Pablos, Rajagopal]

[Jewel: Zapp, Stachel, Wiedemann]

Summary: perturbative splittings in AA

1. high kt :

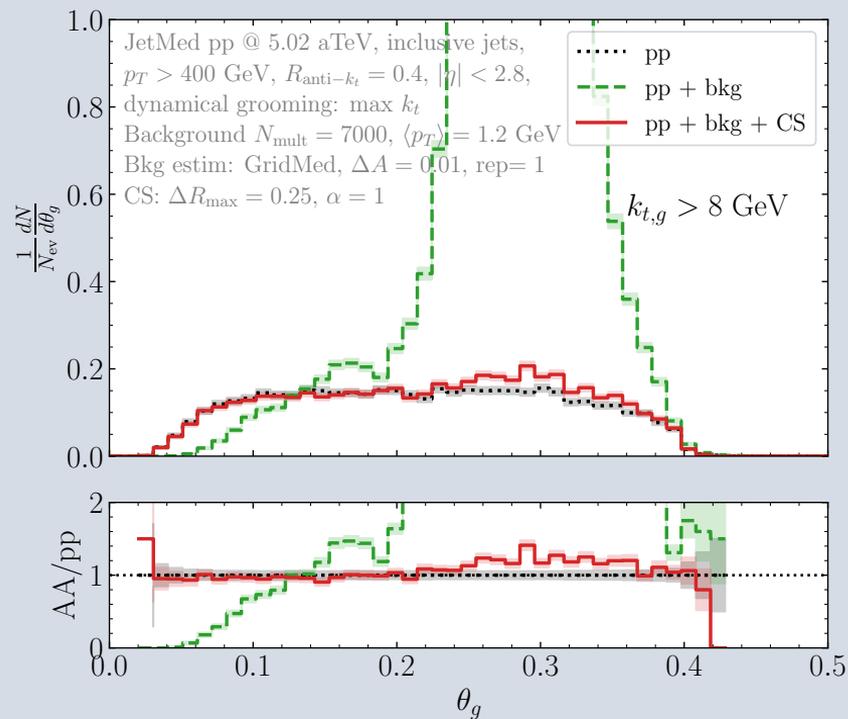
- test of mode separation
- vacuum-like baseline in AA collisions

2. moderate kt :

- test of color resolution
- test of jet thermalization
- new baseline for AA collisions

Hardest splitting in quenched jets

- Expected luminosity $\sim 10 \text{ nb}^{-1}$
- Unfolding is stable for $k_t > 8 \text{ GeV}$



[Berta, Spousta, Miller, Leitner]