Dynamically groomed jet radius in heavy-ion collisions

Adam Takacs[*] (University of Bergen),

Paul Caucal (Brookheaven National Laboratory)

Alba Soto-Ontoso (Universite Paris-Saclay)

Based on: arXiv:2103.06566 vacuum baseline
arXiv:2111.14768 resolving the medium phase space

Recording of the presentation is available:
https://youtu.be/pvXHsg6cmK0 YouTube

[*]adam.takacs@uib.no

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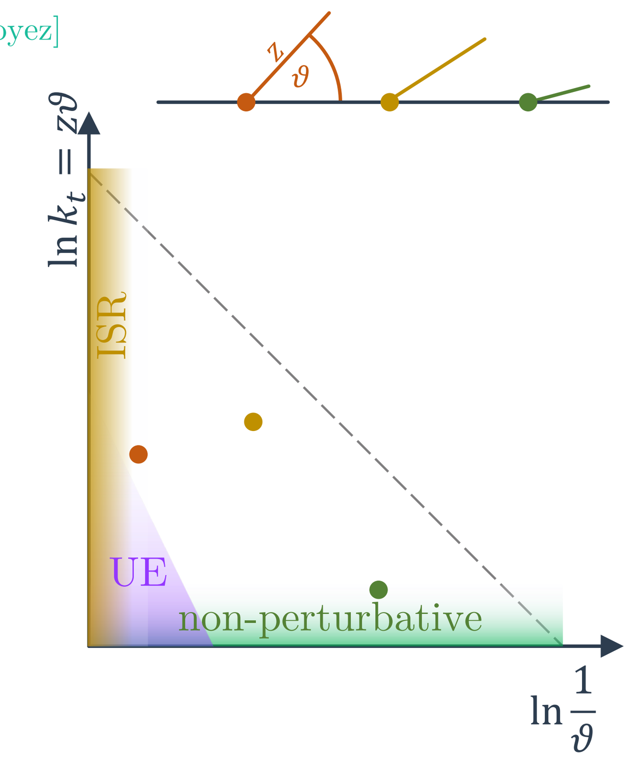
Grooming splittings in jets

The Lund plane: phase space of emissions [Dreyer,Salam,Soyez]
1. Find a jet
2. Recluster with C/A (widest angle first)
3. Follow the hardest branch ($z_i > 1/2$)

Soft Drop grooming [Larkovski, Marzani, Soyez, Thaler]:
4. Stop if $z_i > z_{cut}\vartheta_i^{\beta}$ (with the widest angle)
   - Free parameters z_{cut} and β.

Dynamically grooming [Mehtar-Tani, Soto-Ontoso, Tywoniuk]:
4. Find the hardest $\max_i(z_i \vartheta_i^a)$
   - No cuts, autogenerated jet-by-jet
   - Clear physical meaning: hardest k_t ($a = 1$), or biggest m^2 ($a = 2$)

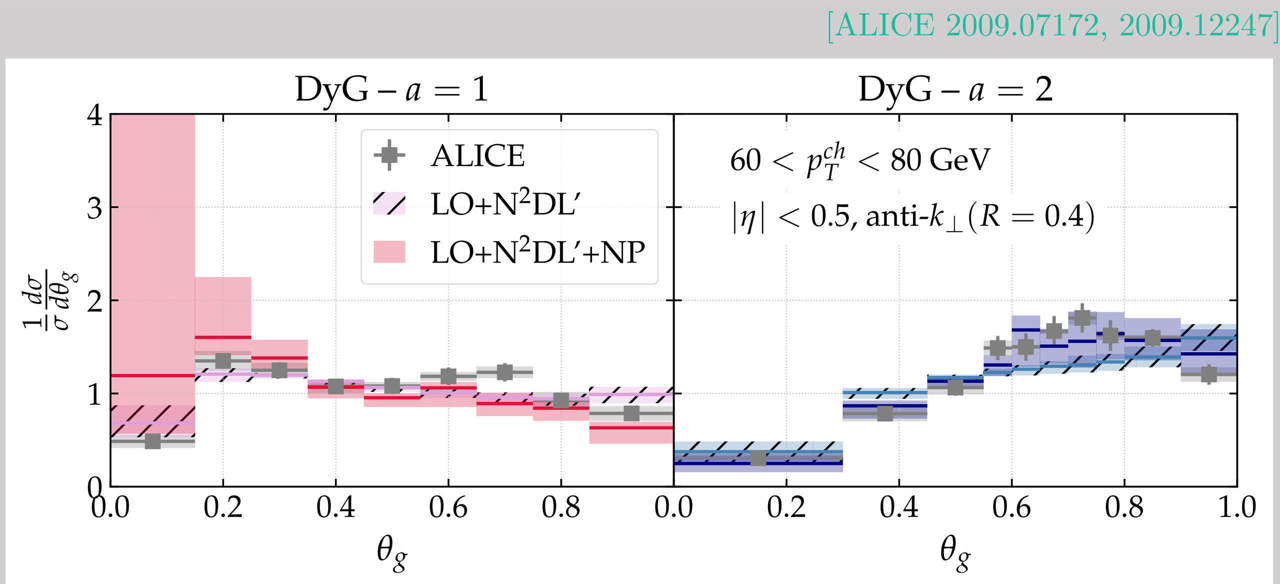


UE is similar for heavy-ions, see in [Heavy-Ion Jet Workshop 1808.03689]

pp - baseline

Targeted high accuracy is LO+N²DL:
- Splittings and coupling at 2-loops
- Matching to NLO MadGraph5
- Non-perturbative corrections
- Non-global contrib. (large-N_c, small-R)
  - There is no clustering log
  - Boundary logs present

[ALICE 2009.07172, 2009.12247]



In-medium emissions

In-medium Lund plane regions: [Caucal, Iancu, Soyez, Mehtar-Tani, Tywoniuk]
- $t_f > L$: Out of the medium vacuum emissions
- $t_f < t_{med}$: Inside and resolved vacuum+medium emissions energy loss

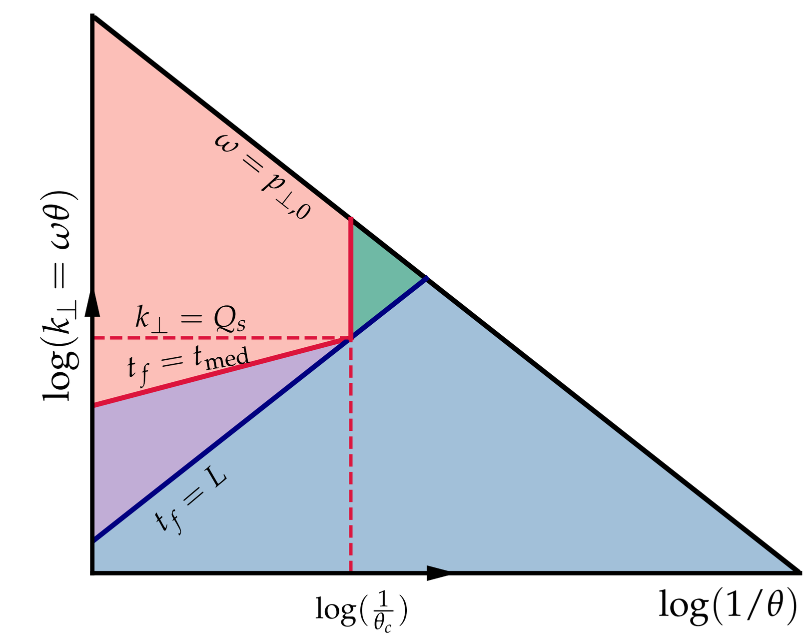
Vacuum-like emissions:

$$\frac{d^2\mathcal{P}_i^{vle}(z,\vartheta|a)}{d\vartheta dz} = P_i(z,\vartheta)\theta_{\notin veto}\Delta_i^{vle}(\kappa^{(a)})$$

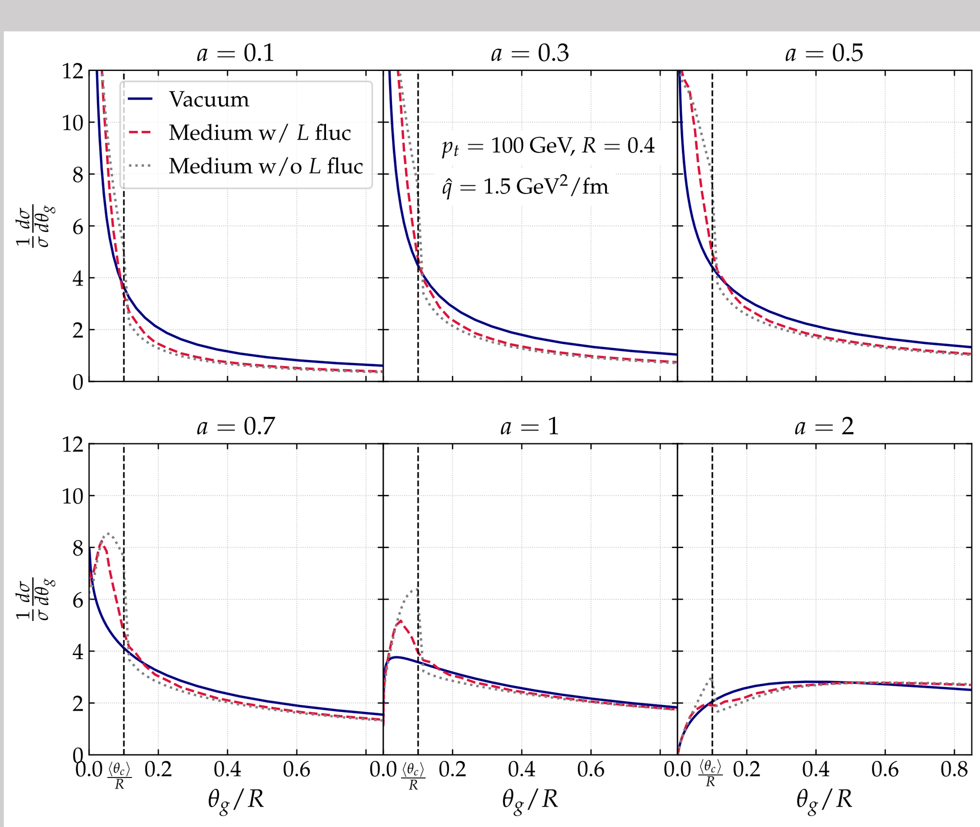
Medium induced emissions: [BDMPS-Z]

$$\frac{d^2\mathcal{P}_i^{mie}(z,\vartheta|a)}{d\vartheta dz} = P_i(z,\vartheta)\Delta_i^{mie}(\kappa^{(a)})$$

Energy-loss with quenching weights: [BDMS]



Our analytic Toy Model



Huge jump around ϑ_c!

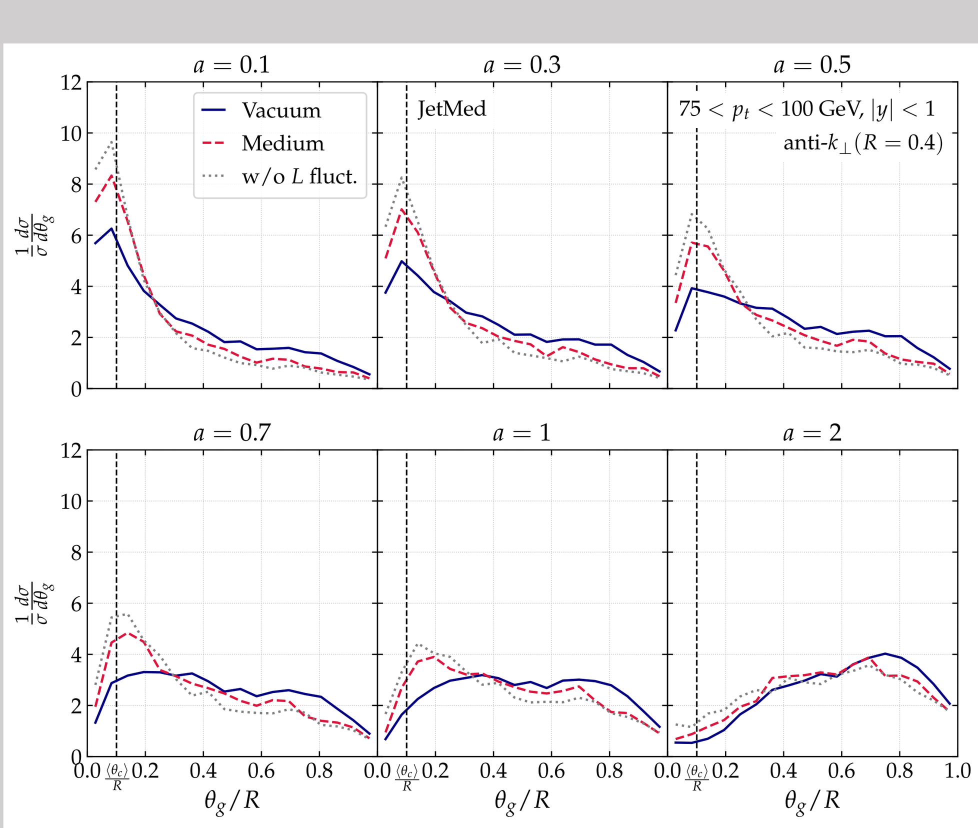
Is ϑ_c measurable?

Which grooming is the best?

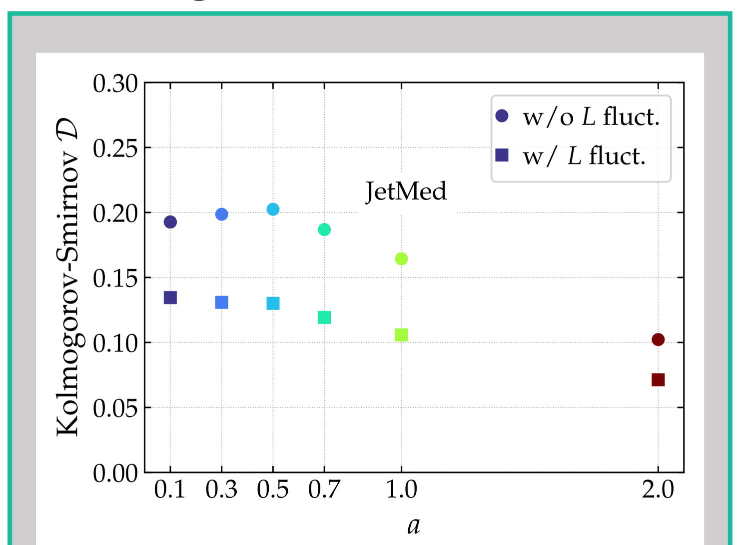
Is ϑ_c really measurable?

- HI Event generator study:
  JetMed [Caucal, Iancu, Soyez]
  Jewel [Zapp, Krauss, Wiedemann]
  Hybrid [Casalderrey-Solana, Milhano, Pablos, Rajagopal]
- Different energy-loss models
- Fluctuations: geometry, path length
- Embedded hydro/kinetic theory
- Medium response
- Hadronization
- Statistical tool: Kolmogorov-Smirnov Distance

JetMed simulation



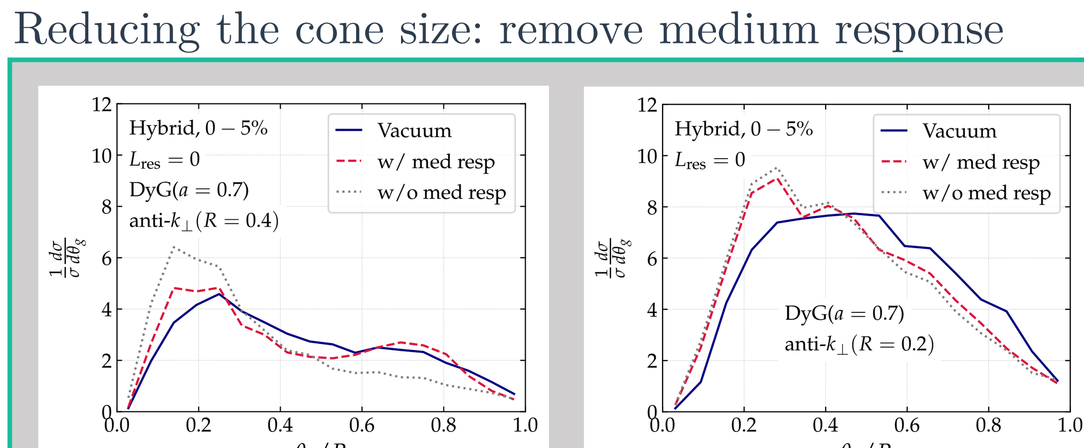
Kolmogorov-Smirnov Distance



best grooming parameter!

Reduce further medium-response

Reducing the cone size: remove medium response



Summary:
- good pp-base line at N²DL
- analytical understanding of enhancement around ϑ_c
- MCs to test ϑ_c and the phase space: JetMed, Jewel, Hybrid
- statistical analysis for measuring ϑ_c
- studied: energy-loss, fluctuations, medium response, hadronization
- best parameter: $0.5 < a < 1$ and $R \sim 0.2$ to resolve the difference btw MCs