Intrinsic k_T and soft gluons in Monte Carlo generators

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Branching phase space

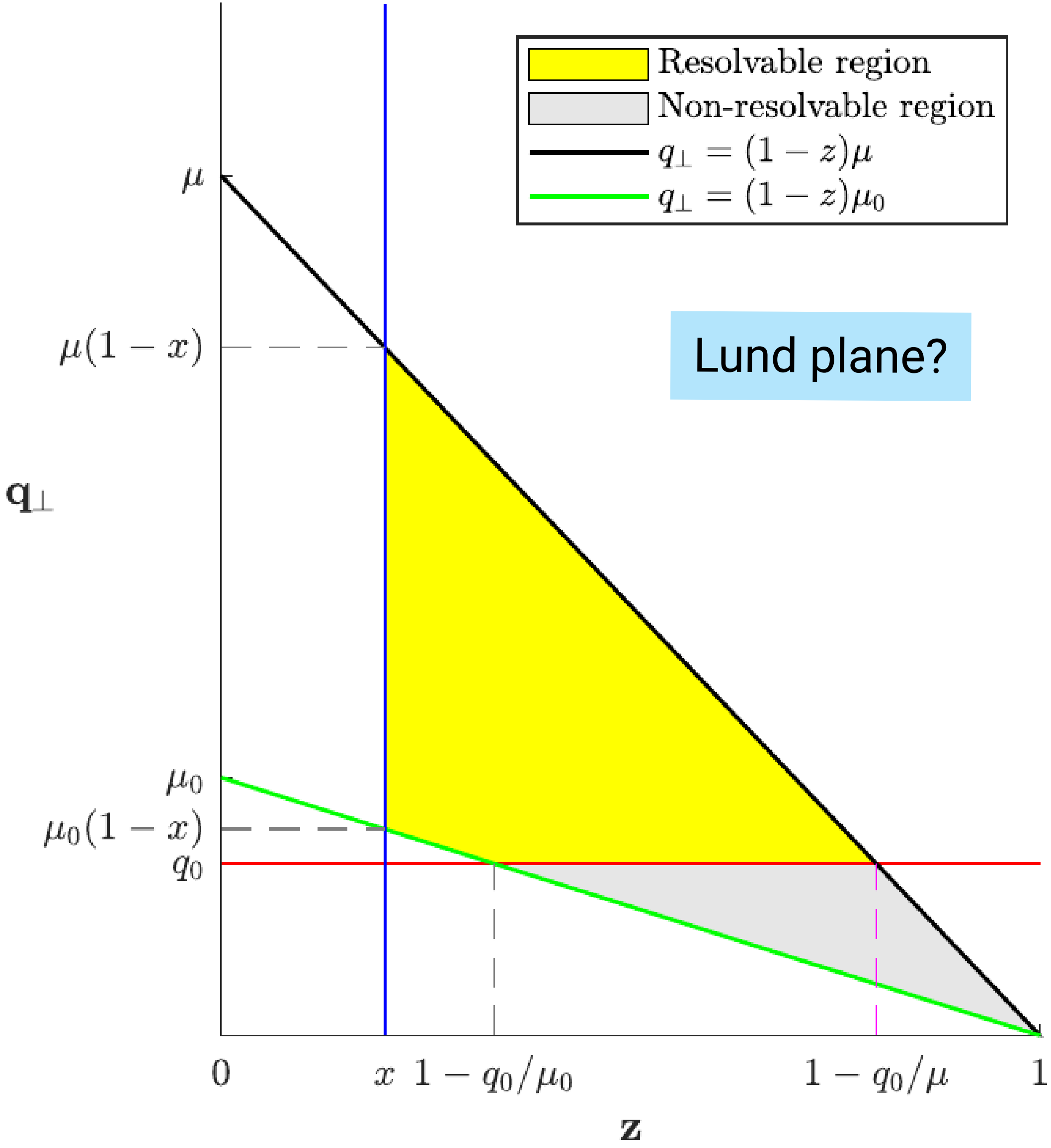
If using the DGLAP scheme with $\alpha_s(\mu')$, every branching is perturbative

With angular ordering, we use

$$\alpha_s(q_T) = \alpha_s(\mu'^2(1 - z)^2)$$

so in some regions of q_T this is may not be perturbative

Question:
Why not using the DGLAP scheme?

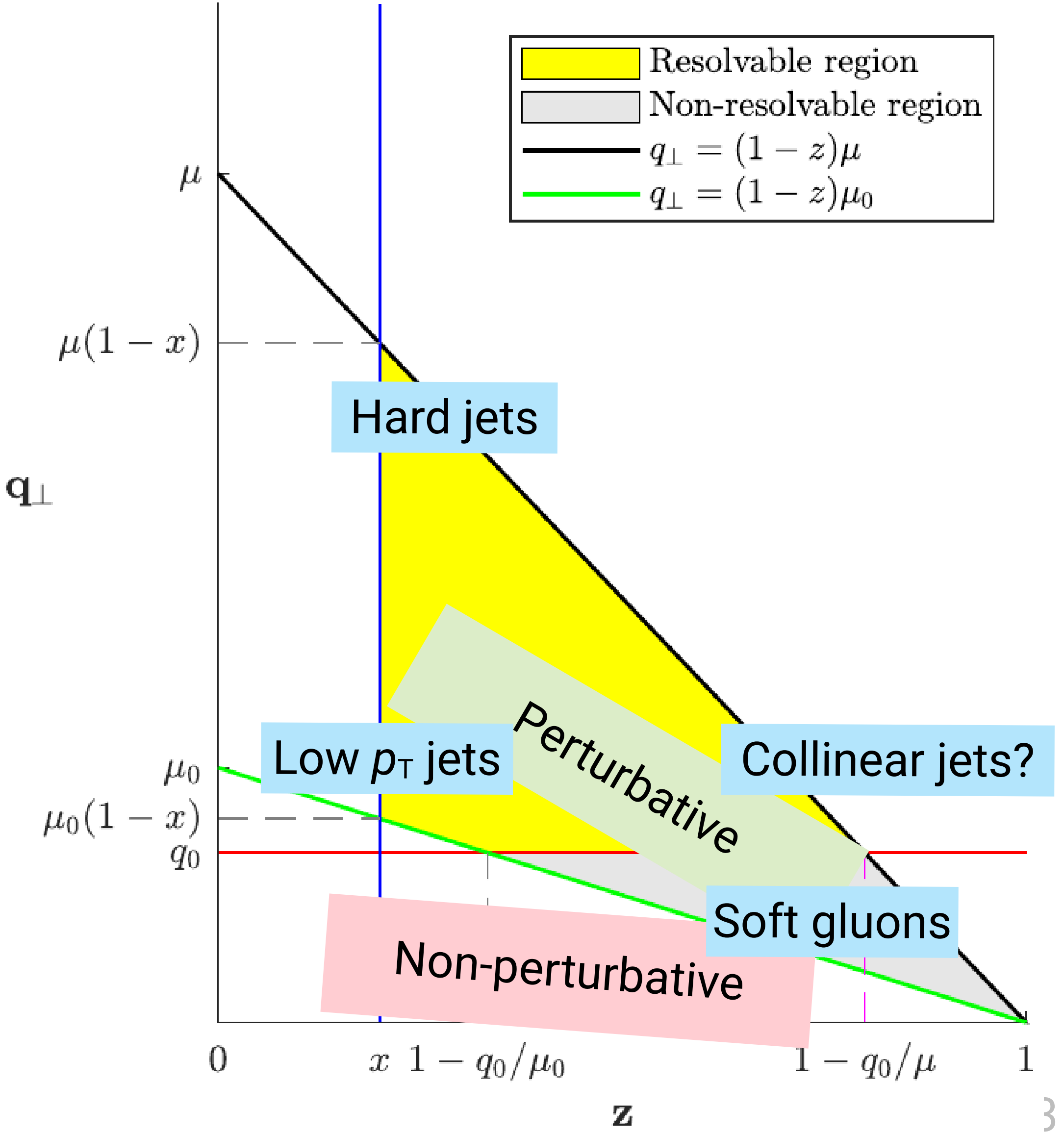


Branching phase space

First things first...
There is a perturbative region defined by μ > 1 GeV (roughly)

Everything perturbative is part of the shower

Everything non-perturbative is free to be parameterized in the TMD (q_s etc)



Traditional z_{max}

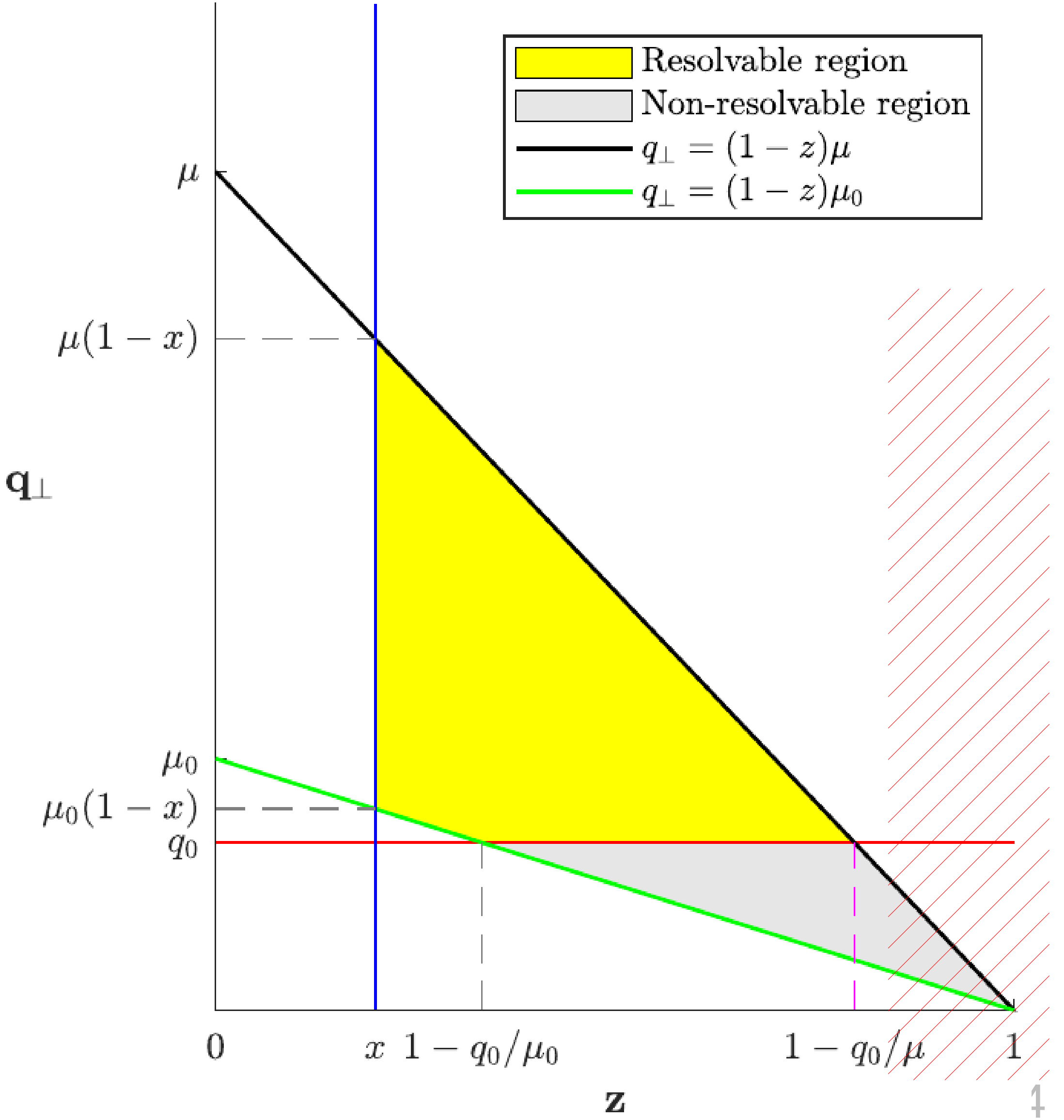
Traditional z_{max} cuts off everything with $1 - z < 10^{-3}$ or so

Questions:

Is this region fully neglected?

Included in a Sudakov?

Parameterized?



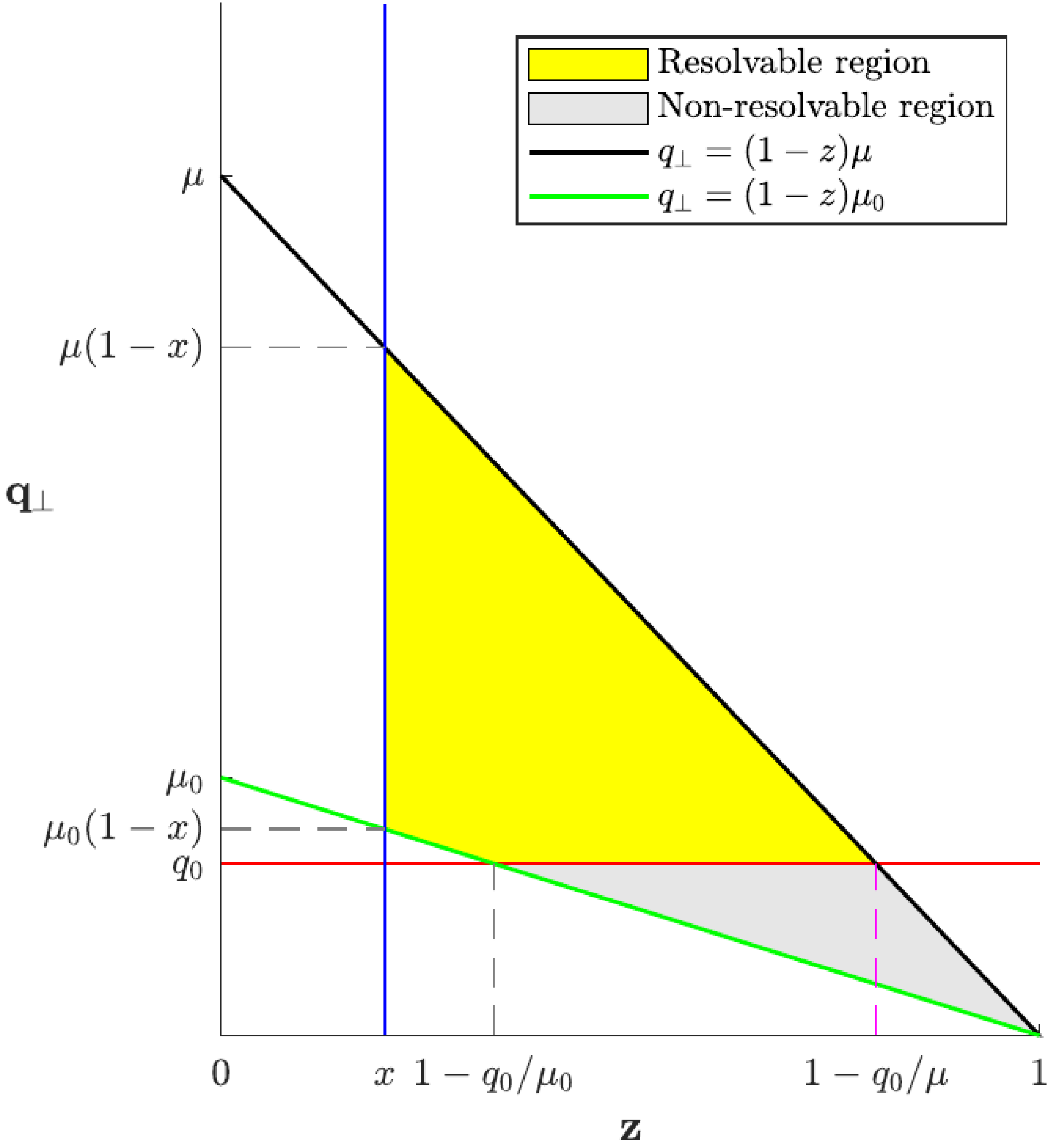
Dynamic z_{max}

Traditional z_{max} cuts off everything with $1 - z < 10^{-3}$ or so

Dynamic z_{max} cuts off the grey area, because:

- $\alpha_s(q_T)$ is getting large
  (can also cap it to $\alpha_s(q_0)$)
- q_T is too small for the gluon to be seen anyway (not resolvable)
  $\simeq$ rapidity factorization in CSS

How do we handle the grey region? Move it to the TMD?



Master formula

Sudakovs

$$A_a(x, \mathbf{k}, \mu^2) = \Delta_a(\mu^2, \mu_0^2) A_a(x, \mathbf{k}, \mu_0^2) + \sum_b \int \frac{\mathrm{d}^2 \boldsymbol{\mu}'}{\pi \mu'^2} \int^{z_{max}} \mathrm{d}z \, \mathcal{E}_{ab}[\Delta; P^{(R)}; \Theta] A_b(x/z, \mathbf{k} + a(z)\boldsymbol{\mu}', \mu'^2)$$

Where else does z_{max} appear?