Diffusion induced radiation/absorption

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Mission

- Including the diffusion induced radiation in the `Lido` framework, and compare with the old Langevin framework (LGV vs. Lido)
- Additional diffusion-induced absorption process, to reach the correct equilibrium temperature

0. Gluon radiation – HT

1. Improved Langevin

$$dp = -\Gamma p \times dt + \sqrt{dt}\kappa\rho + (-dp_{\text{gluon}}) \tag{1}$$

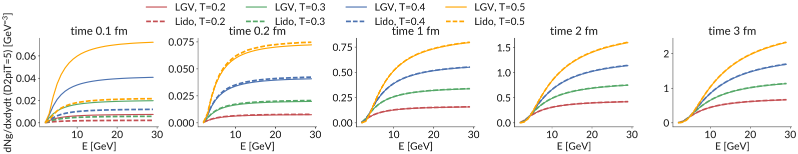
2. Gluon emission probability:

$$\frac{dN_{\text{gluon}}}{dx dk_\perp^2 dt} = \frac{2\alpha_s P(x)}{\pi k_\perp^4} \sin^2\left(\frac{t-t_i}{2\tau_f}\right)\left(\frac{k_\perp^3}{k_\perp^2 + x^2 M^2}\right)^4 \times \hat{q}_{\text{gluon}} \tag{2}$$

3.
   - $x = \omega/E_Q$, $k_\perp$ is gluon transverse momentum
   - splitting function: $P(x) = (2 - 2x + x^2)/x * C_F$
   - gluon formation time $\tau_f = \frac{2xE(1-x)}{k_\perp^2 + x^2 M^2}$, different from **scatttering** component: $\tau_f = \frac{2x(1-x)E}{k_\perp^2 + x^2 M^2 + (1-x) m_D^2/2}, x = \frac{k+k_z}{E+p_z}$
   - additional cutoff: $2E(E-\pi) > M^2$, $k_0 = xE > \mu\pi T$, $\tau_f > 1/(\pi T)$
   - by changing μ, change the final T_{eff}

1. Gluon radition table: LGV vs. `Lido`

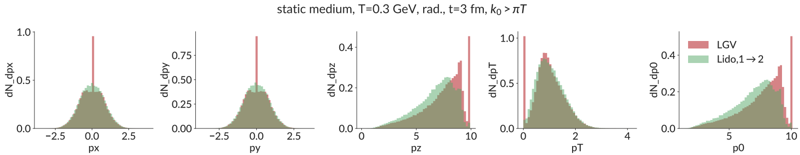
First of all, comparing the effective rate table of $\frac{dN_{\rm gluon}}{dxdk_\perp dt}$ with $D_s 2\pi T = 5$:



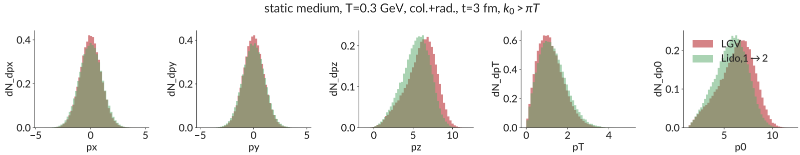
- Comparing at different temperature and time-interval
- Large deviation at small time interval, difference comes from the interpolation
- Fix? smaller grid-size; A better interpolation scheme

2. Static medium: ($E_{\text{init}} = 10$ GeV, t=3 fm/c)

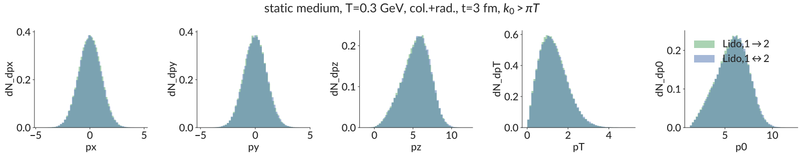
- rad. only



- col. + rad.

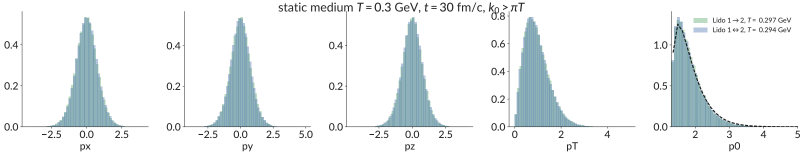


- col. + rad. + abp.

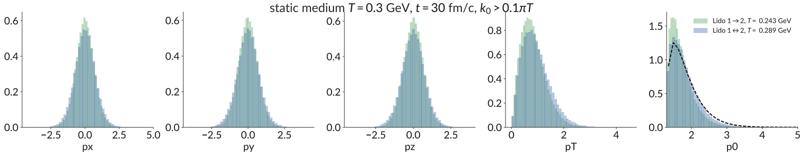


4. Approaching equilibrium:

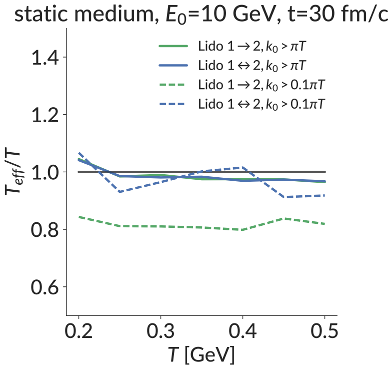
1. cutoff: $\mu = 1 \Rightarrow k_0 < \pi T$
   - w/ $1 \to 2$: $T_{\rm eff}, T$ deviation (1%)
   - w/ $1 \to 2 + 2 \to 1$: $T_{\rm eff}, T$ deviation (2%)



2. cutoff: $\mu = 0.1 \Rightarrow k_0 < 0.1\pi T$
   - w/ $1 \to 2$: $T_{\rm eff}, T$ deviation (19%)
   - w/ $1 \to 2 + 2 \to 1$: $T_{\rm eff}, T$ deviation (3%)



4. Approaching equilibrium:

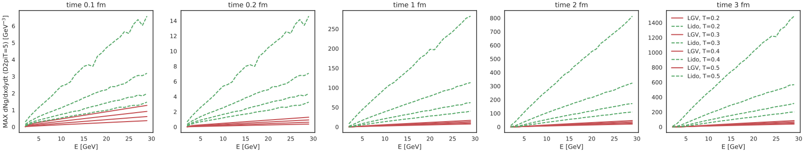


- For $k_0 > \pi T$, T_{eff} very similar to T
- While $k_0 > 0.1\pi T$, gluon absorption process is needed for true equilibrium status.

some extra temperatures

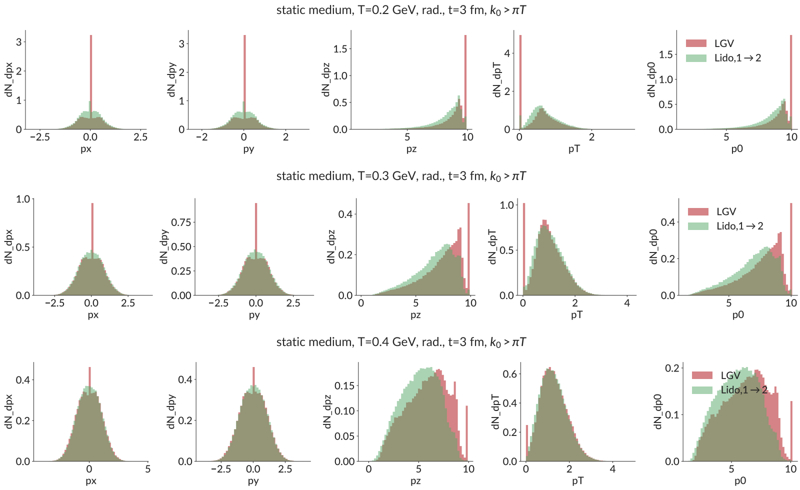
Some more technique issues need to be fixed/improved:

Comparing the **MAX** $\frac{dN_{\rm gluon}}{dx dk_\perp dt}$ with $D_s 2\pi T = 5$:



No wonder we have so many failure during the reject sampling!

2. Static medium: rad. ($E_{\text{init}} = 10$ GeV, t=3 fm/c)



2. Static medium: col.+rad. ($E_{\text{init}} = 10$ GeV, t=3 fm/c)