Flow Annealed Importance Sampling Bootstrap Meets Differentiable Particle Physics

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Paper

Code

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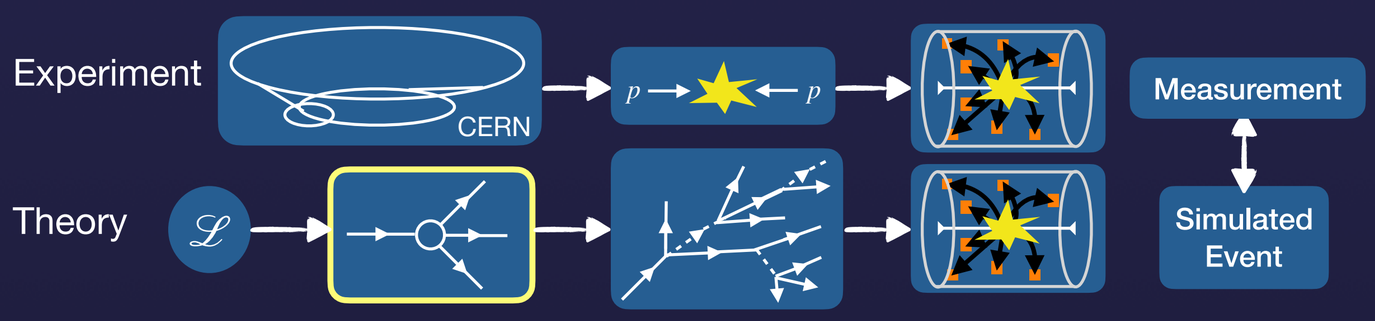
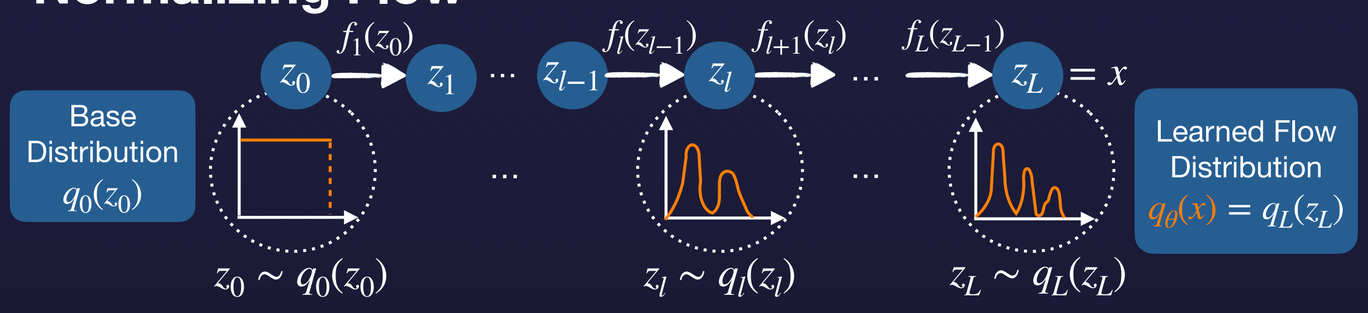
Generation of Data in Particle Physics



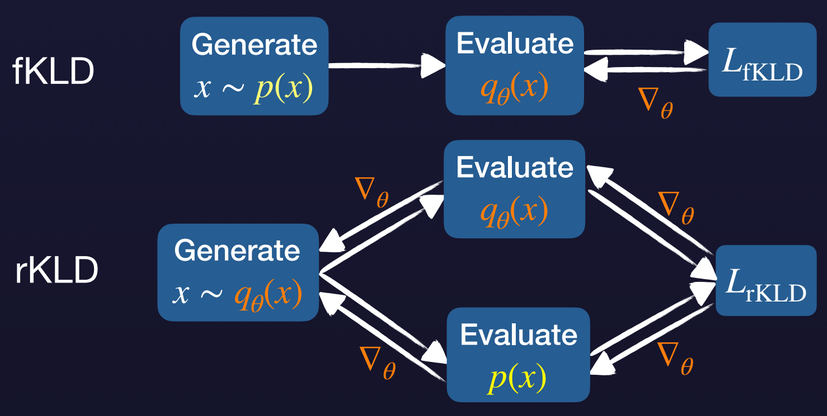
Goal: Use generative models to emulate simulators and speed up critical sampling procedures

Normalizing Flow

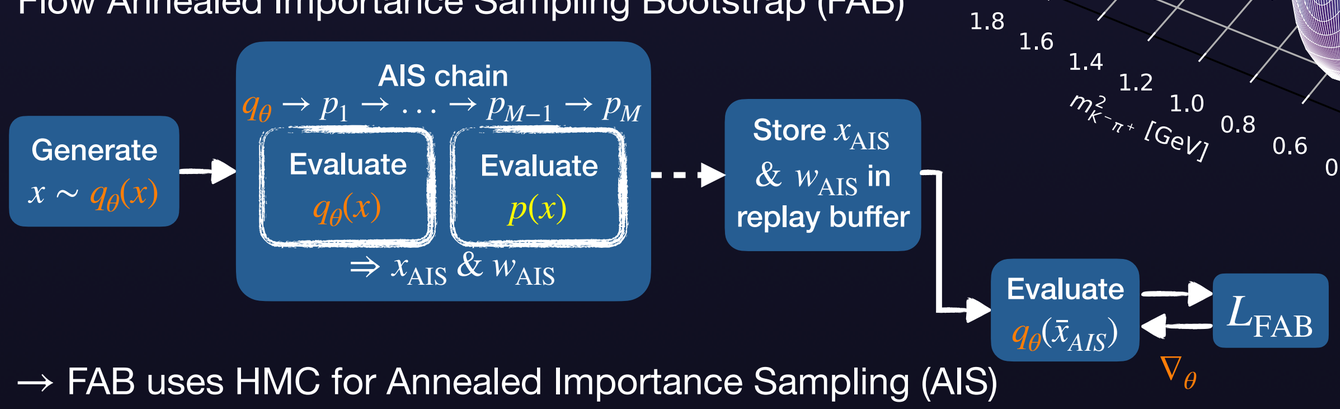


→ Generate samples x and evaluate density $q_\theta(x)$

Training Approaches

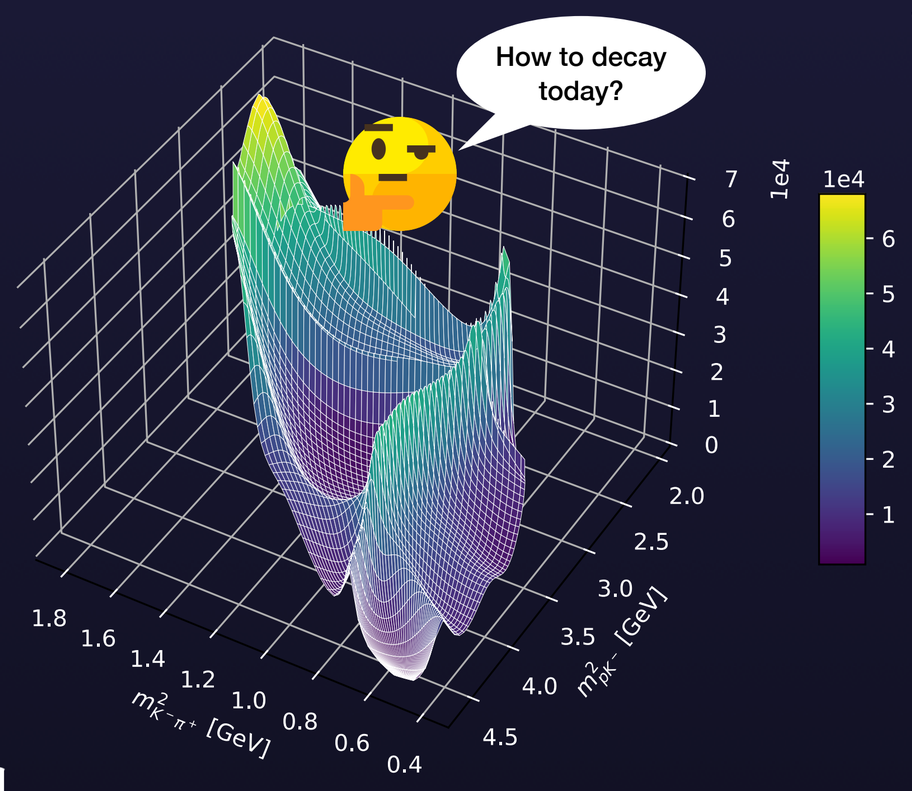


Flow Annealed Importance Sampling Bootstrap (FAB)

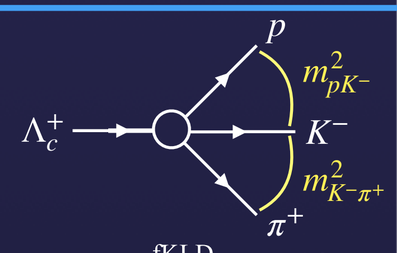


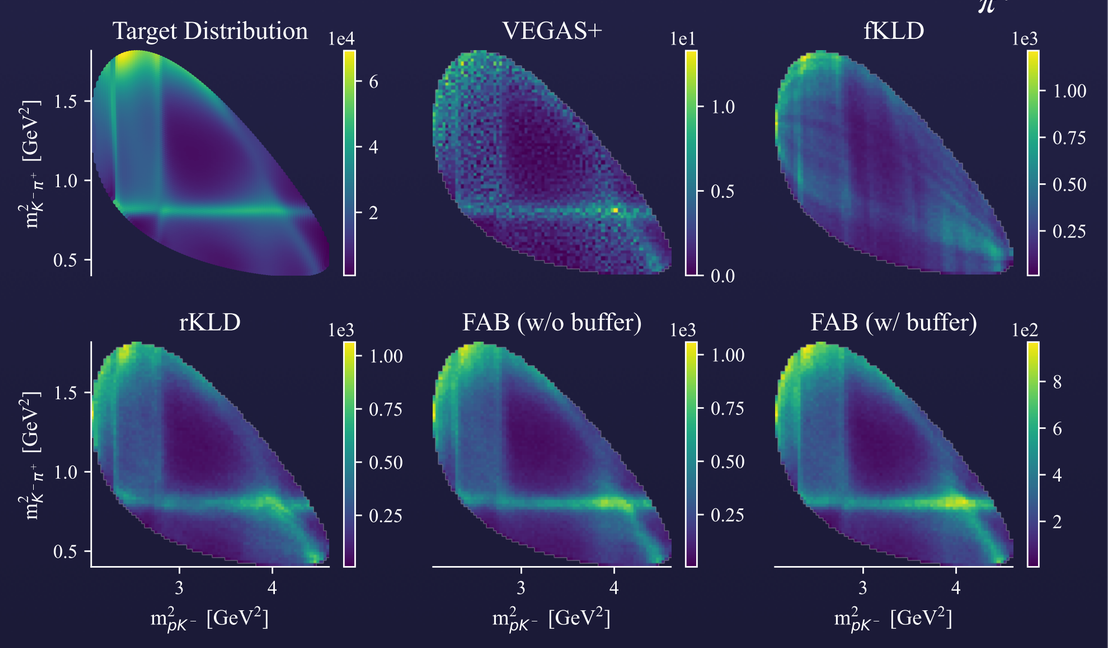
→ FAB uses HMC for Annealed Importance Sampling (AIS)

→ Differentiable target distribution $p(x)$ required for rKLD and FAB



Distribution $\Lambda_c^+ \to pK^-\pi^+$



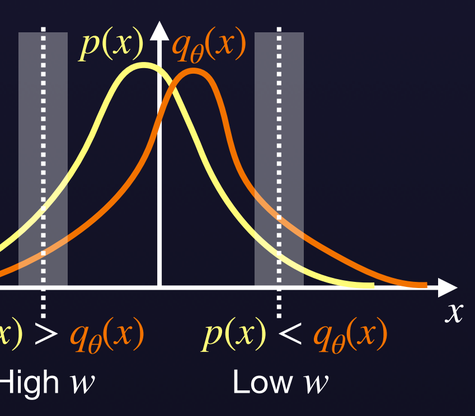


Sampling Efficiency ϵ

$$\epsilon = \frac{1}{N} \frac{\left(\sum_i w_i\right)^2}{\sum_i w_i^2} \in [0,1]$$

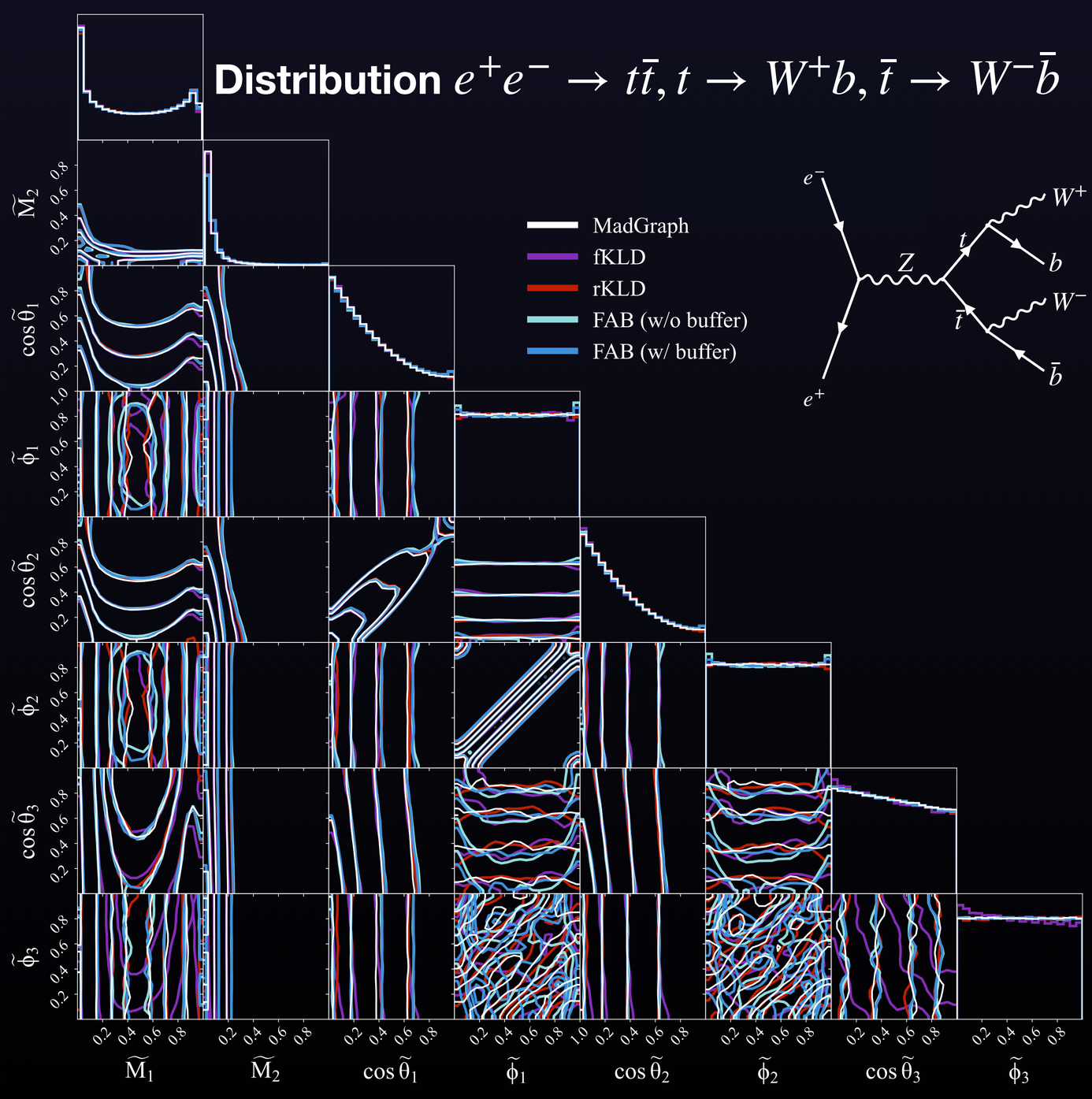
with importance weight

$$w_i = \frac{p(x_i)}{q_\theta(x_i)}$$



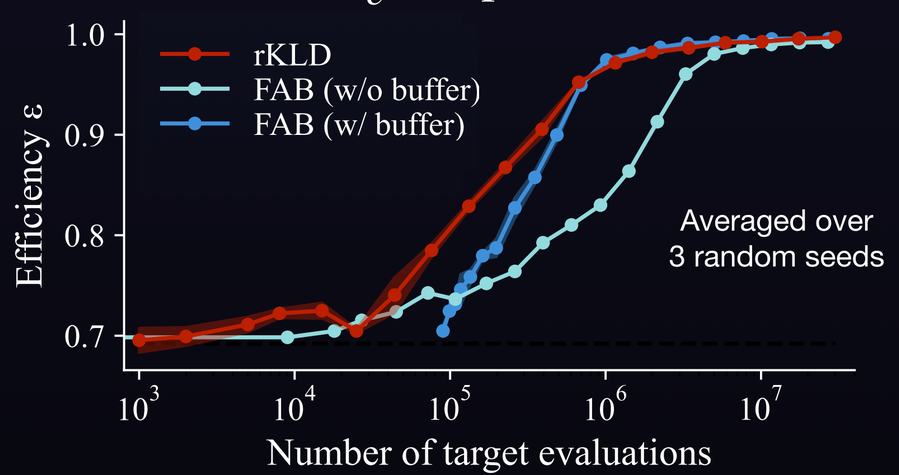
$q_\theta(x) \neq p(x) \to \text{Var}[w_i]$ is large $\to \epsilon \ll 1$

Distribution $e^+e^- \to t\bar{t}, t \to W^+b, \bar{t} \to W^-\bar{b}$



Efficiency with more target evaluations

$$\Lambda_c^+ \to pK^-\pi^+$$



$$e^+e^- \to t\bar{t}, t \to W^+b, \bar{t} \to W^-\bar{b}$$