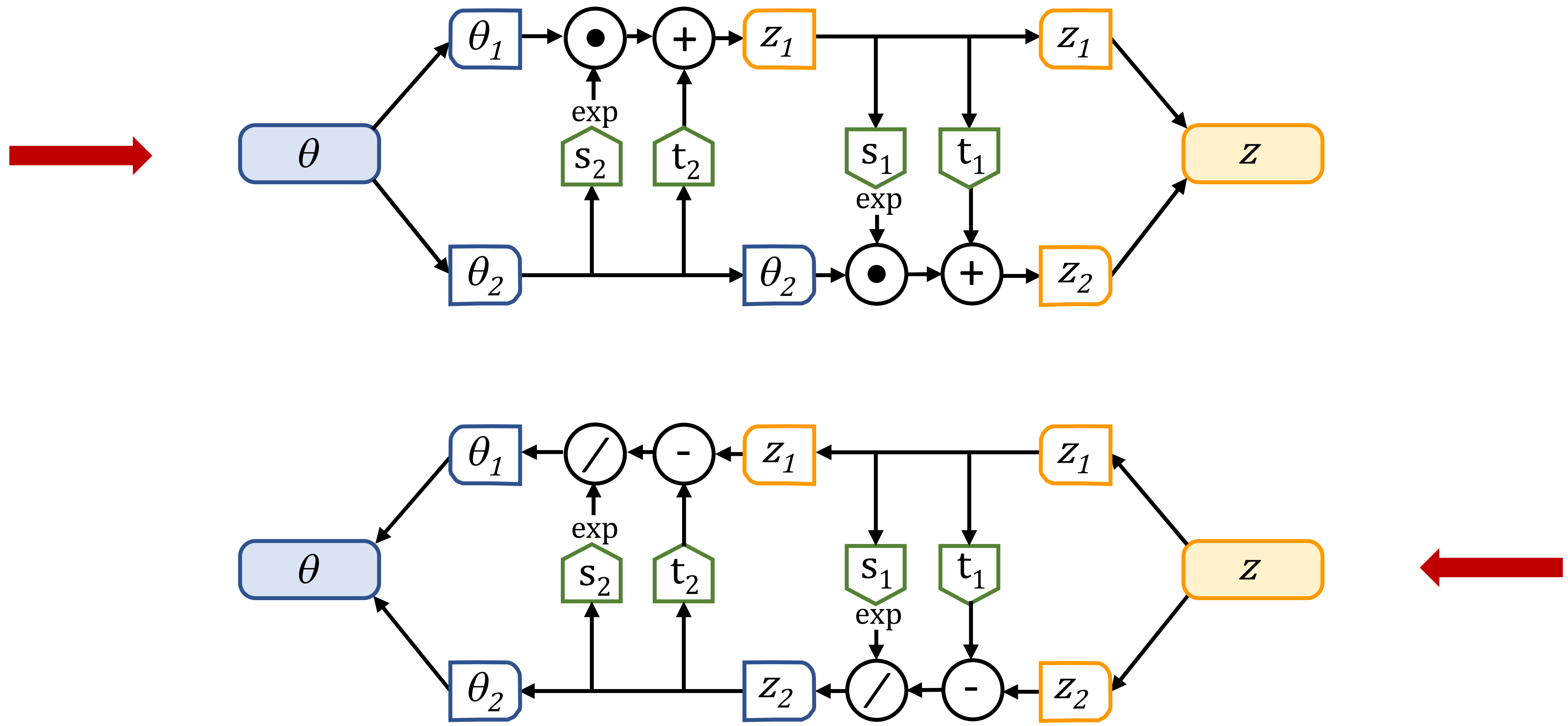


Concept: ***normalizing flow networks***

Conserve probability

Invertible Networks to map probability distributions

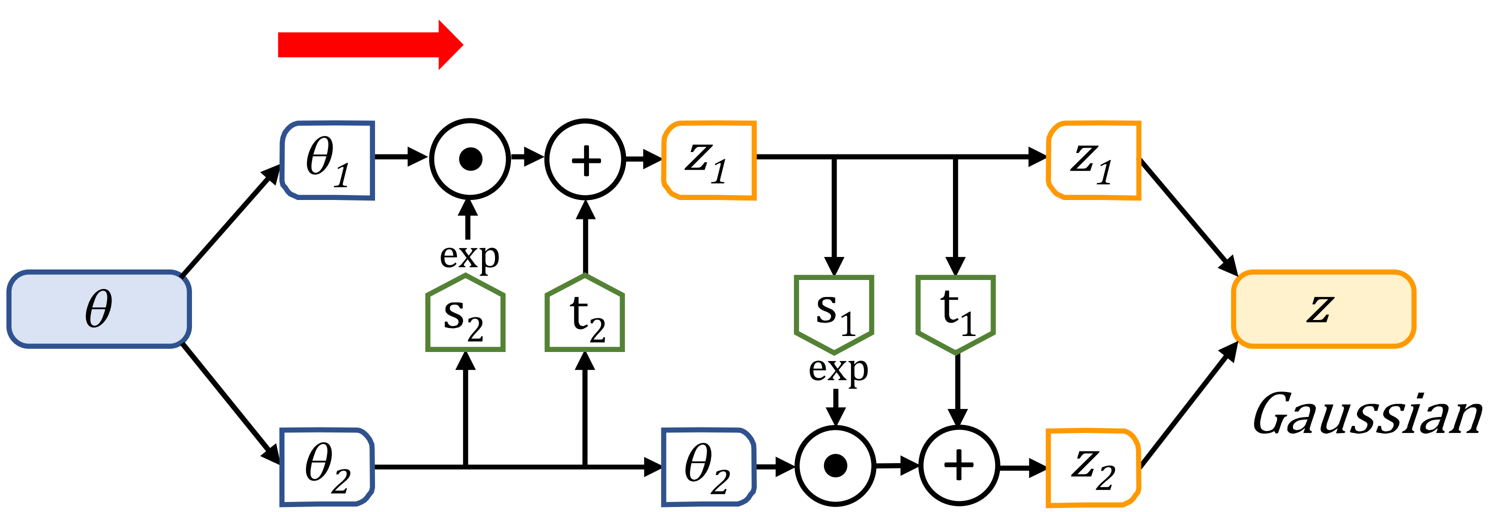
$\theta = (\gamma, R_{\text{cut}})$ **@source**

S. Radev, U. Mertens, A. Voss, L. Ardizzone, U. Köthe, arxiv 2003.06281

M. Bellagente, A. Butter, G. Kasieczka, T. Plehn, A. Rousselot, R. Winterhalder, L. Ardizzone, U. Köthe, SciPost Phys. 9, 074 (2020)

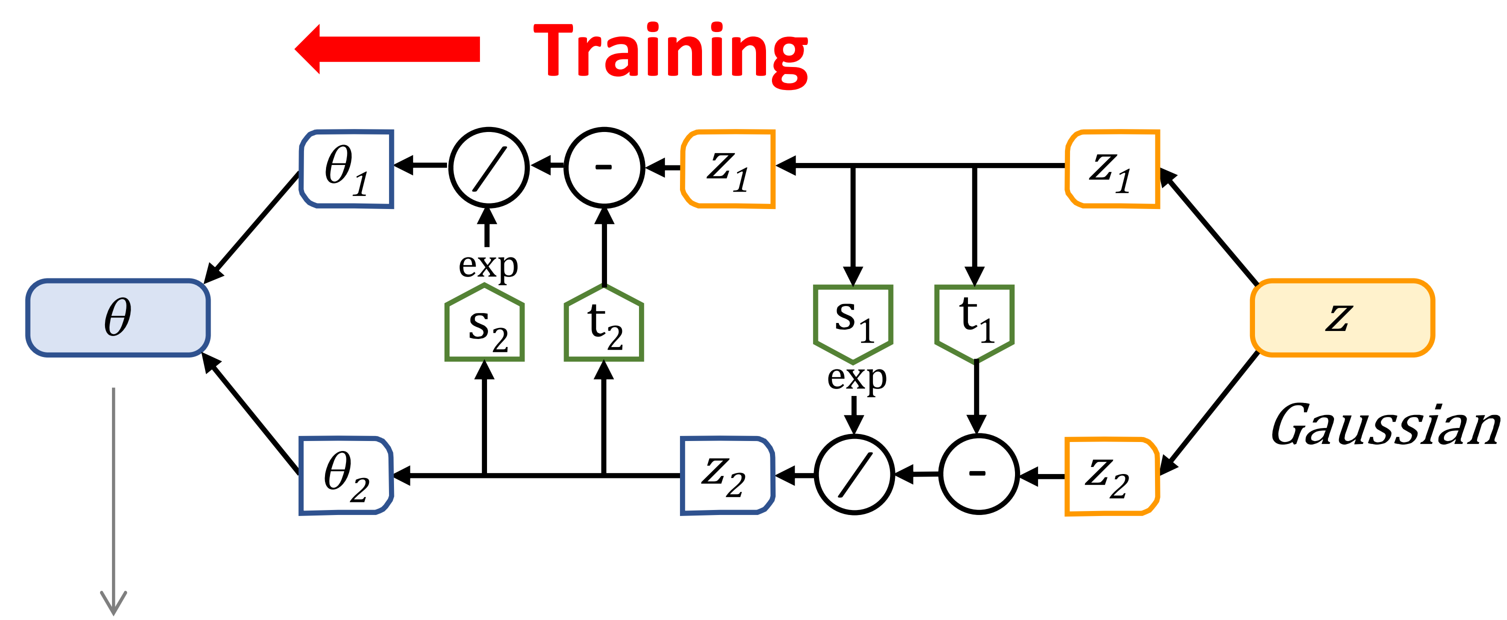
T. Bister, M. Erdmann, U. Köthe, J. Schulte, The European Physical Journal C volume 82 (2022) 171, arXiv:2110.09493

$$J_{\text{inj}}(E) \propto E^{-\gamma} \cdot f_{\text{cut}}(E, Z \cdot R_{\text{cut}})$$



Probability conservation $p_\phi(\theta)\, d\theta = p(z)\, dz$

Training



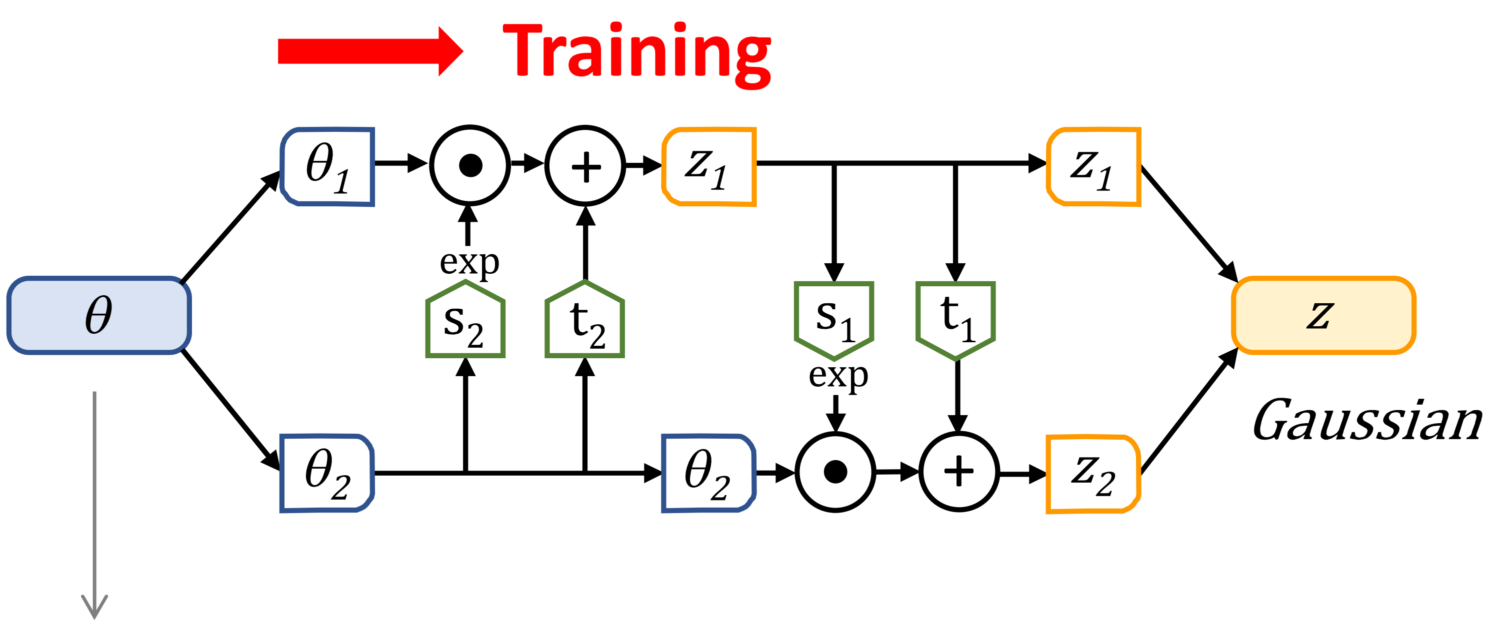
sim.data   network

$$\underset{\boldsymbol{\phi}}{\text{argmin}}\, \mathbb{E}_{p(\boldsymbol{\theta} \mid \boldsymbol{x})} \left[\log p(\boldsymbol{\theta} \mid \boldsymbol{x}) - \log p_{\boldsymbol{\phi}}(\boldsymbol{\theta} \mid \boldsymbol{x})\right]$$

Invertible Networks to map probability distributions

$\theta = (\gamma, R_{\text{cut}})$@**source**

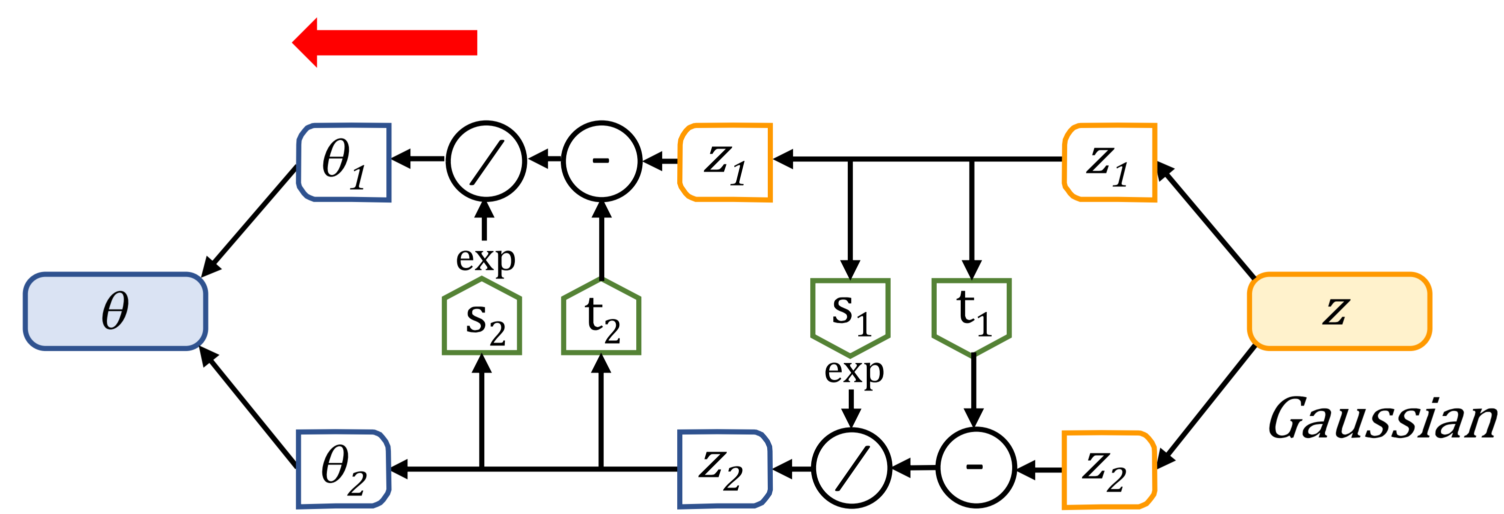
$J_{\text{inj}}(E) \propto E^{-\gamma} \cdot f_{\text{cut}}(E, Z \cdot R_{\text{cut}})$



sim.data network

$$\underset{\phi}{\operatorname{argmin}}\, \mathbb{E}_{p(\boldsymbol{\theta}\,|\,\boldsymbol{x})}\left[\log p(\boldsymbol{\theta}\,|\,\boldsymbol{x}) - \log p_{\phi}(\boldsymbol{\theta}\,|\,\boldsymbol{x})\right]$$

Probability conservation $p_{\phi}(\theta)\, d\theta = p(z)\, dz$

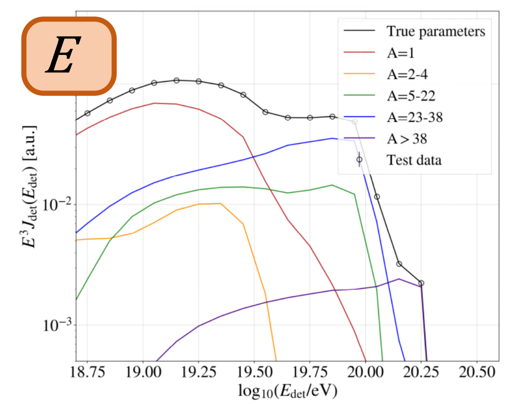


Invertible Networks to unfold observed data

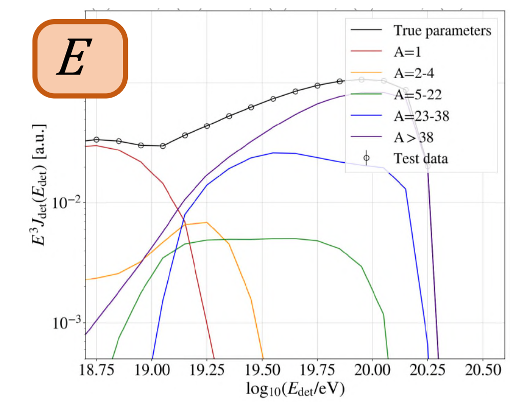
$\theta = (\gamma, R_{\text{cut}})$**@source**

$J_{\text{inj}}(E) \propto E^{-\gamma} \cdot f_{\text{cut}}(E, Z \cdot R_{\text{cut}})$

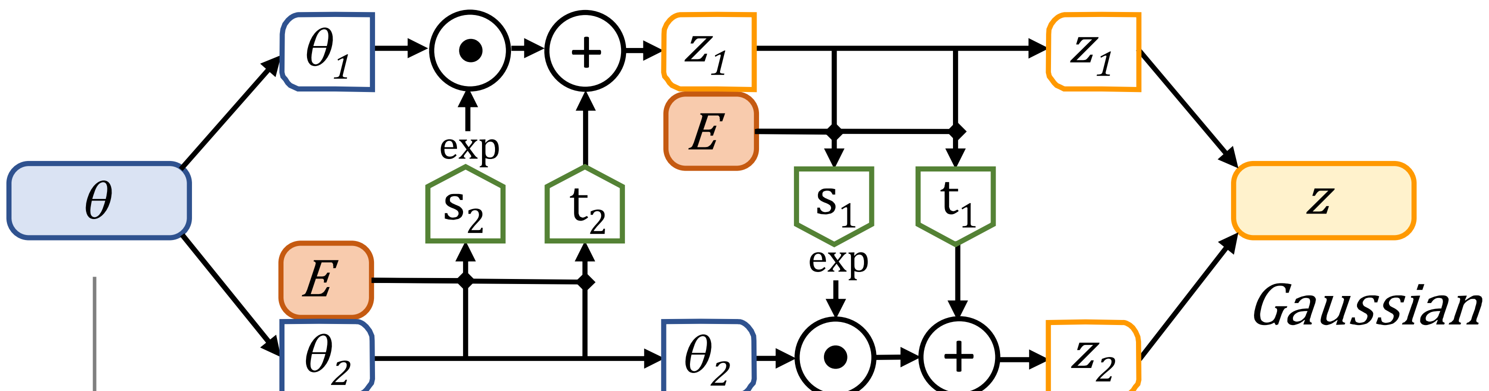
Energy E **@observation**



\`measurement´



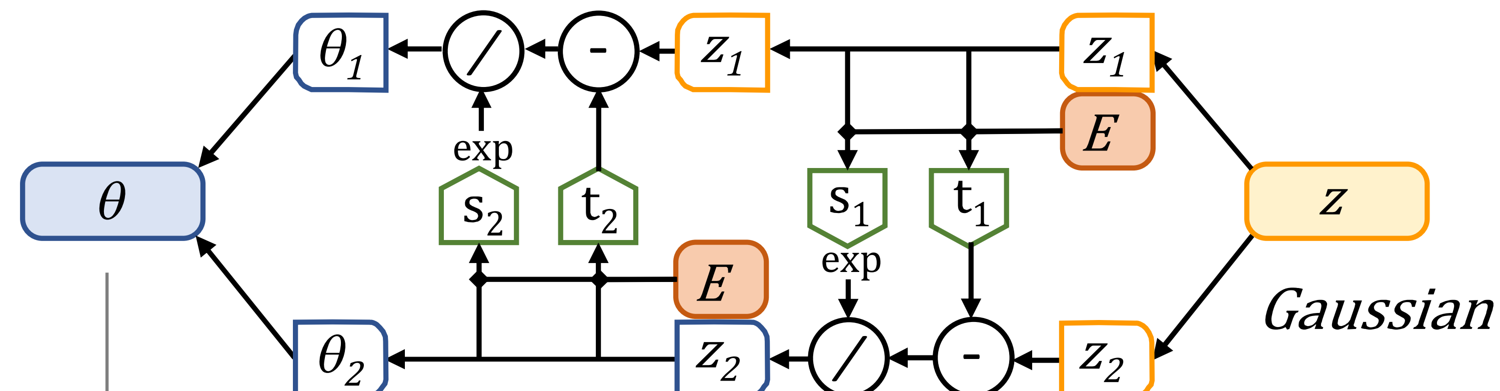
Training

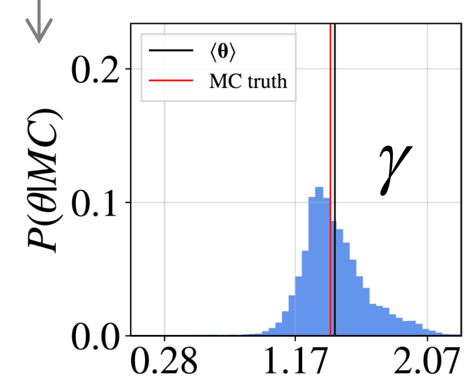


sim.data network

$$\underset{\phi}{\operatorname{argmin}}\ \mathbb{E}_{p(\boldsymbol{\theta} \mid \boldsymbol{x})} \left[\log p(\boldsymbol{\theta} \mid \boldsymbol{x}) - \log p_{\phi}(\boldsymbol{\theta} \mid \boldsymbol{x})\right]$$

Evaluation





Network learns to extract posterior distribution from given data