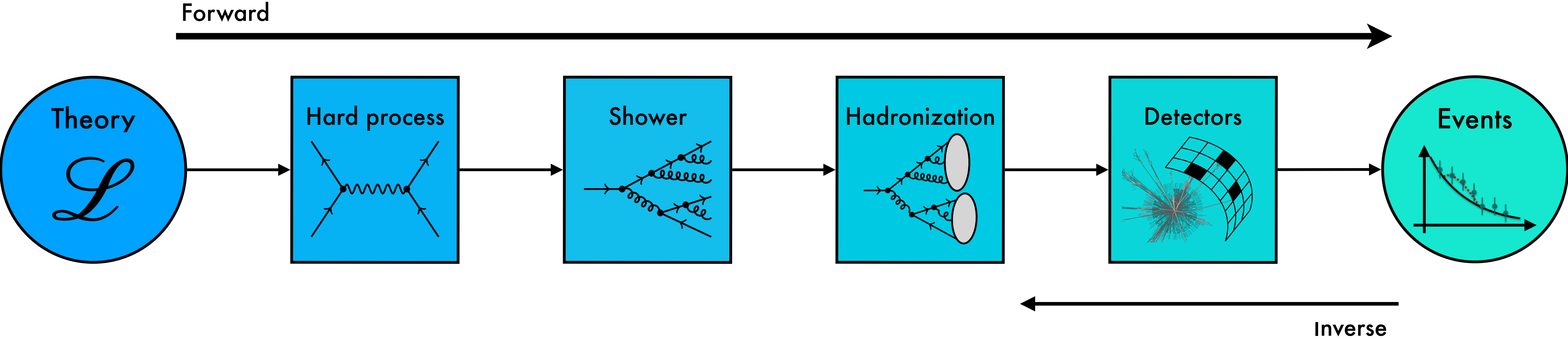# The Landscape of Unfolding with Machine Learning

N. Huetsch, J. Mariño Villadamigo, A. Shmakov, S. Diefenbacher,
V. Mikuni, T. Heimel, M. Fenton, K. Greif, B. Nachman, D. Whiteson, A. Butter, T. Plehn

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Inverting the LHC Simulation Chain

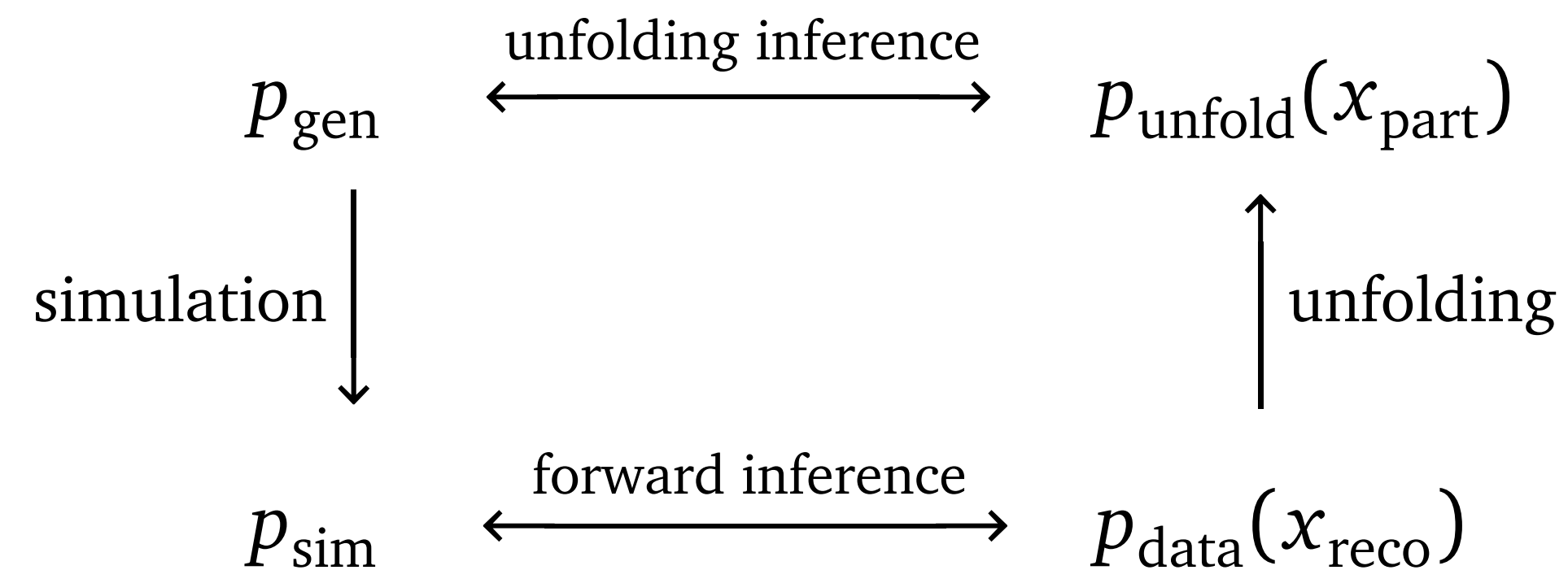**Machine learning methods allow for unbinned, high-dimensional unfolding**

ML-based Unfolding

Reweighting based: Omnifold

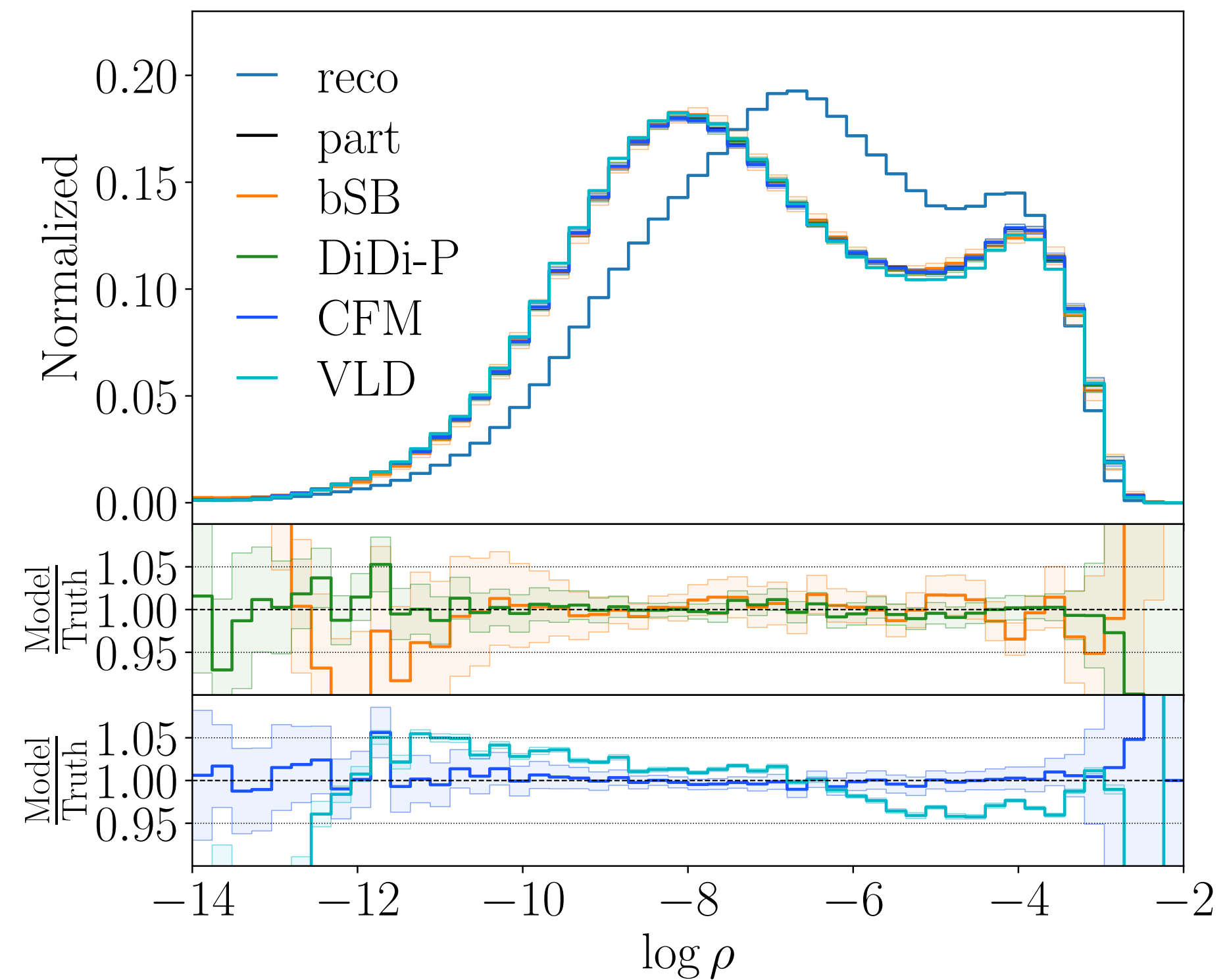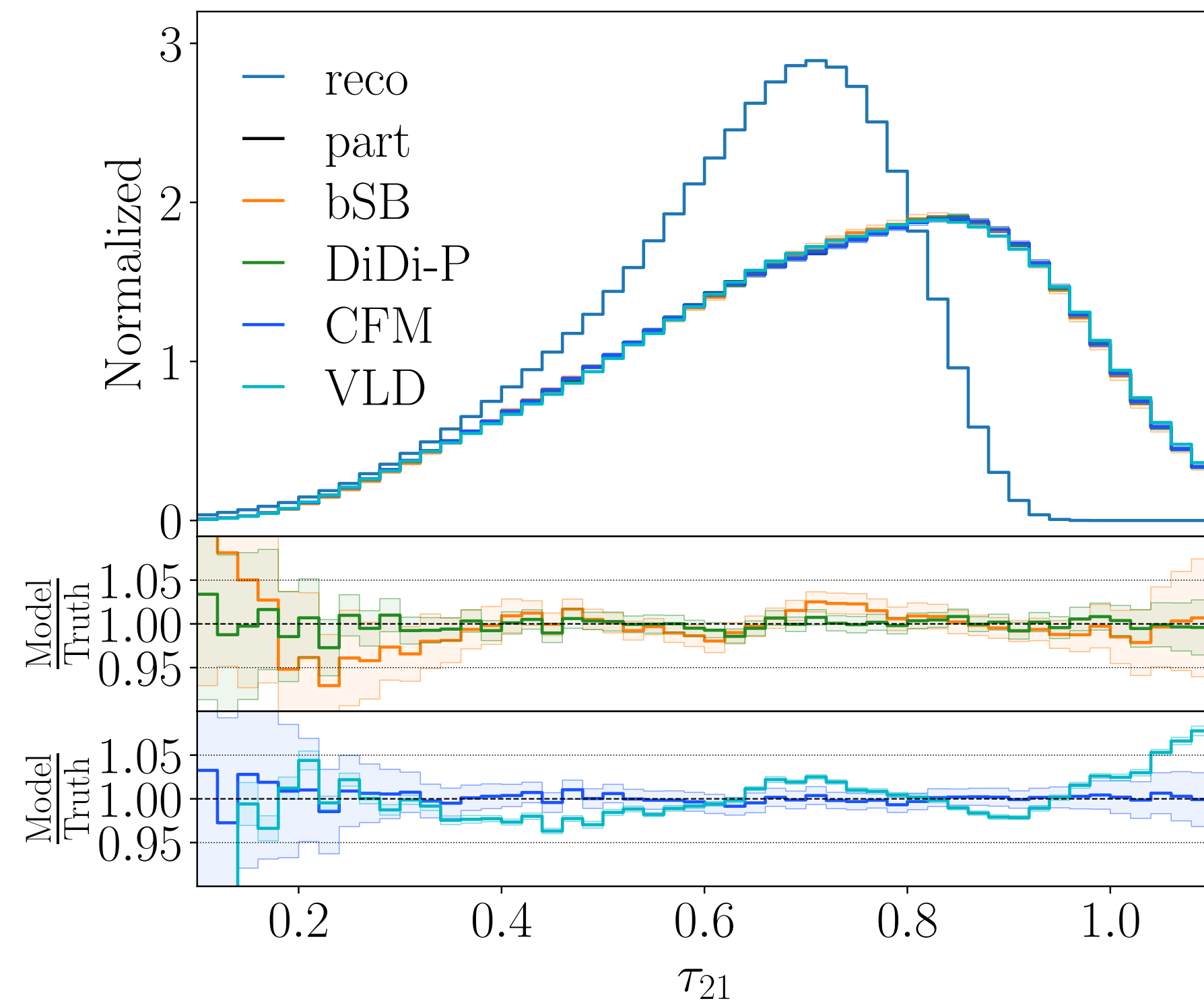$$p_{gen} \rightarrow p_{unfold}$$

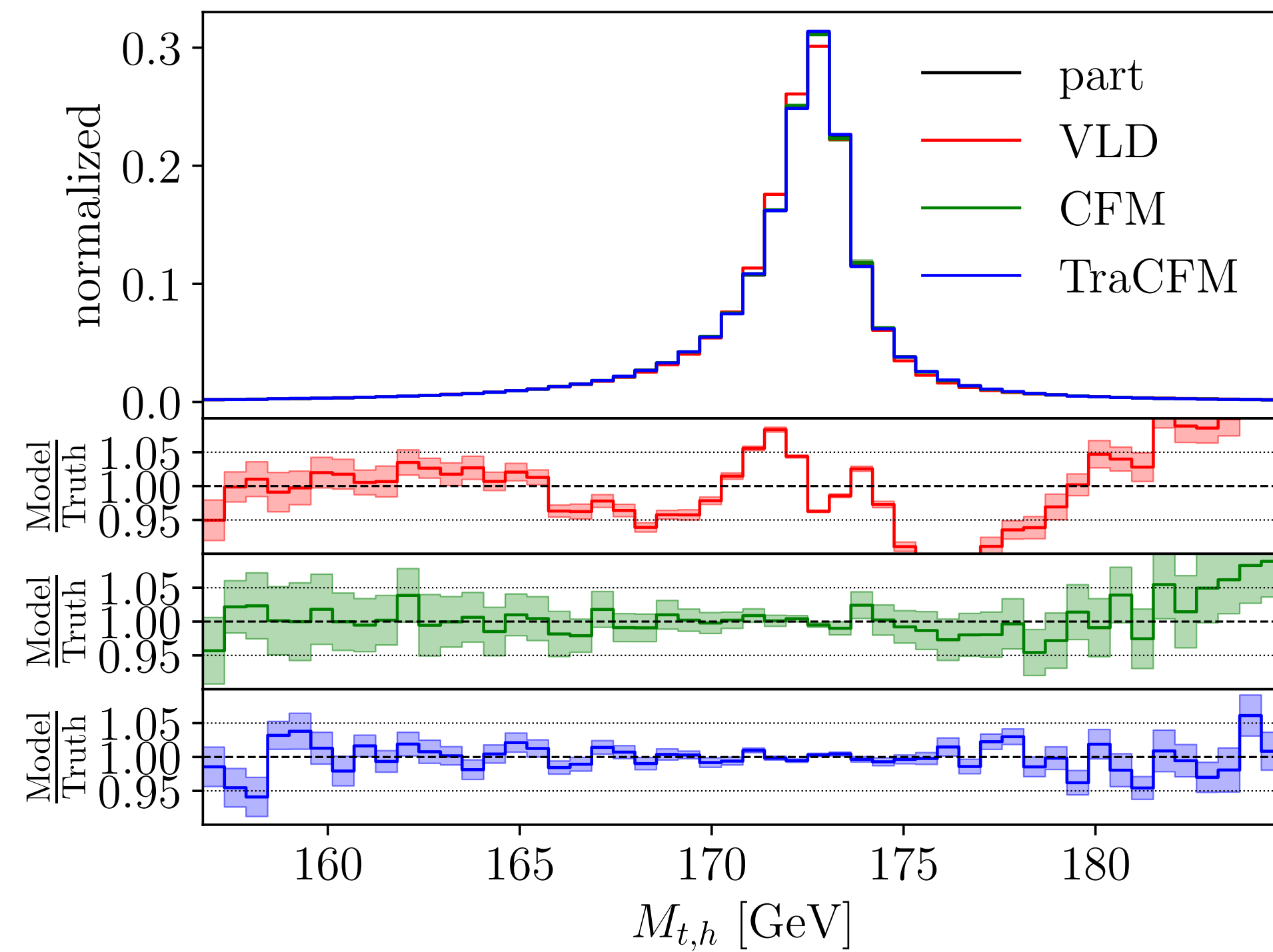Distribution Mapping

$$p_{data} \rightarrow p_{unfold}$$

$$
\begin{array}{ccc}
p_{\text{gen}} & \xleftrightarrow{\text{unfolding inference}} & p_{\text{unfold}}(x_{\text{part}}) \\
\Big\downarrow \text{simulation} & & \Big\uparrow \text{unfolding} \\
p_{\text{sim}} & \xleftrightarrow{\text{forward inference}} & p_{\text{data}}(x_{\text{reco}})
\end{array}
$$

Conditional Generative Unfolding

$$p(x_{part} | x_{reco})$$

Unfolding Delphes ✅

Unfolding Pythia ✅