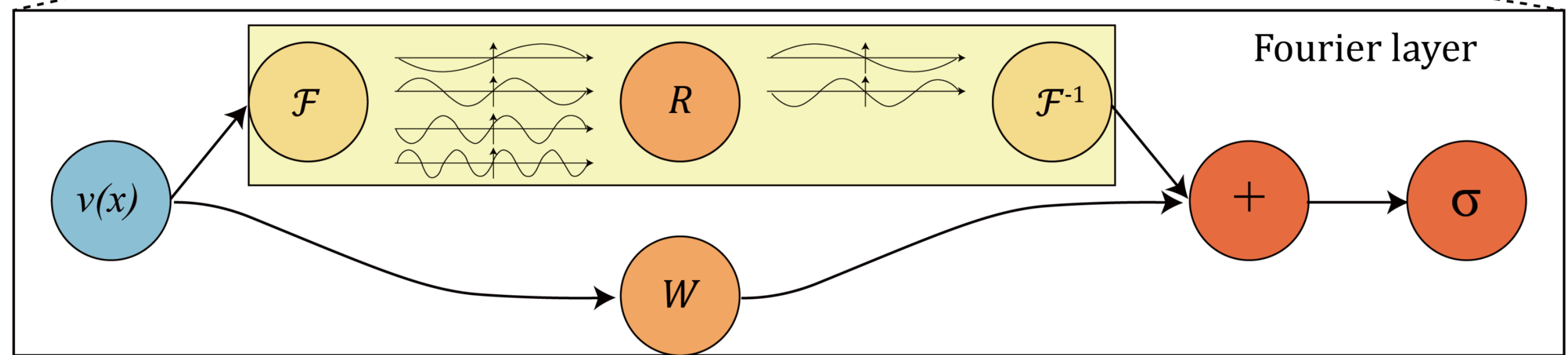
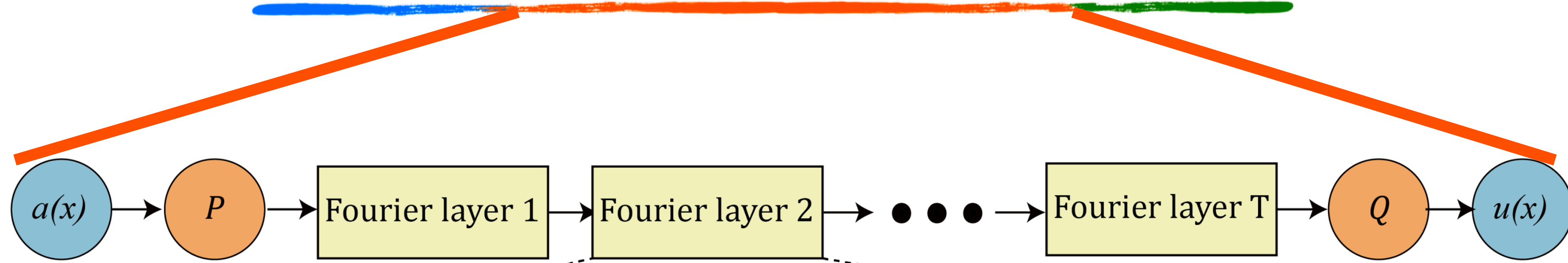
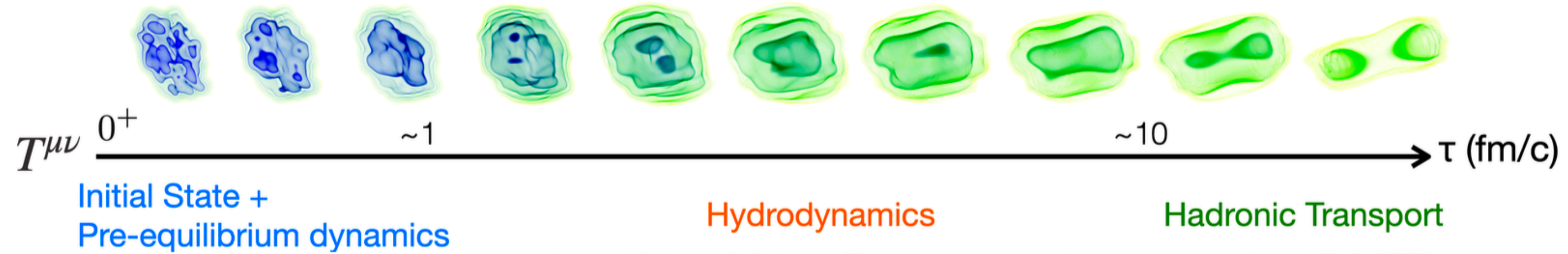


FLASH — Fast Learning-based Approaches for Simulating High- energy nuclear collisions (14C)

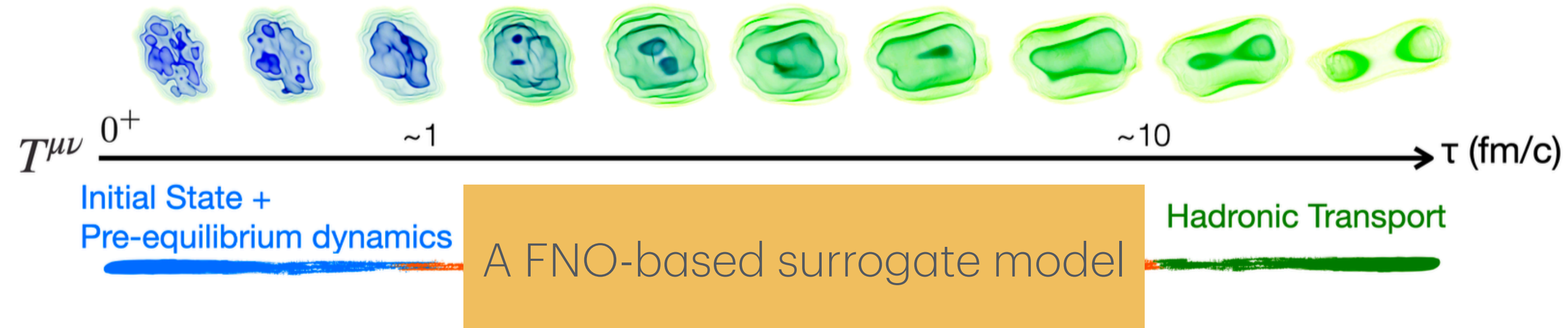
Wayne State (Lead) + BNL (+ Ford AI)

Project Summary



Fourier Neural Operator framework

Project Goals

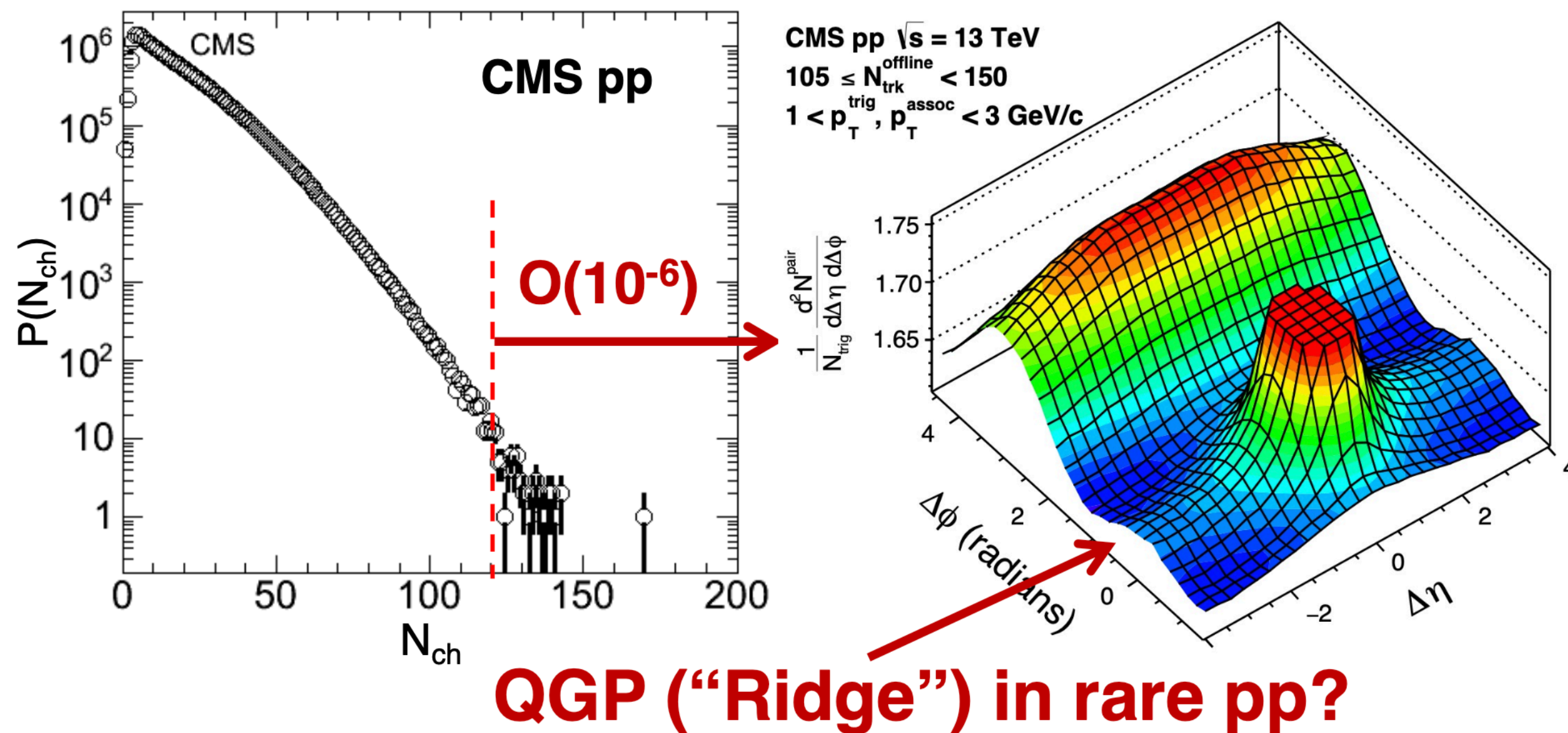


- Speed up (3+1)D hydrodynamic simulations by several orders of magnitude
- Enable phenomenological studies for jet-medium interactions and soft-hard correlations
- Explore transfer learning for fluid dynamics with complex car geometry design (Ford AI)
- Phase 2 (engaging JETSCAPE Collaboration and more industry partners):
 - Coupled the accelerated framework with Bayesian Uncertainty Quantification
 - Extend the ML framework for stochastic hydrodynamics (general SDE)

Generative Foundation Model for Discovery of Rare QCD Emergent Phenomena (14A)

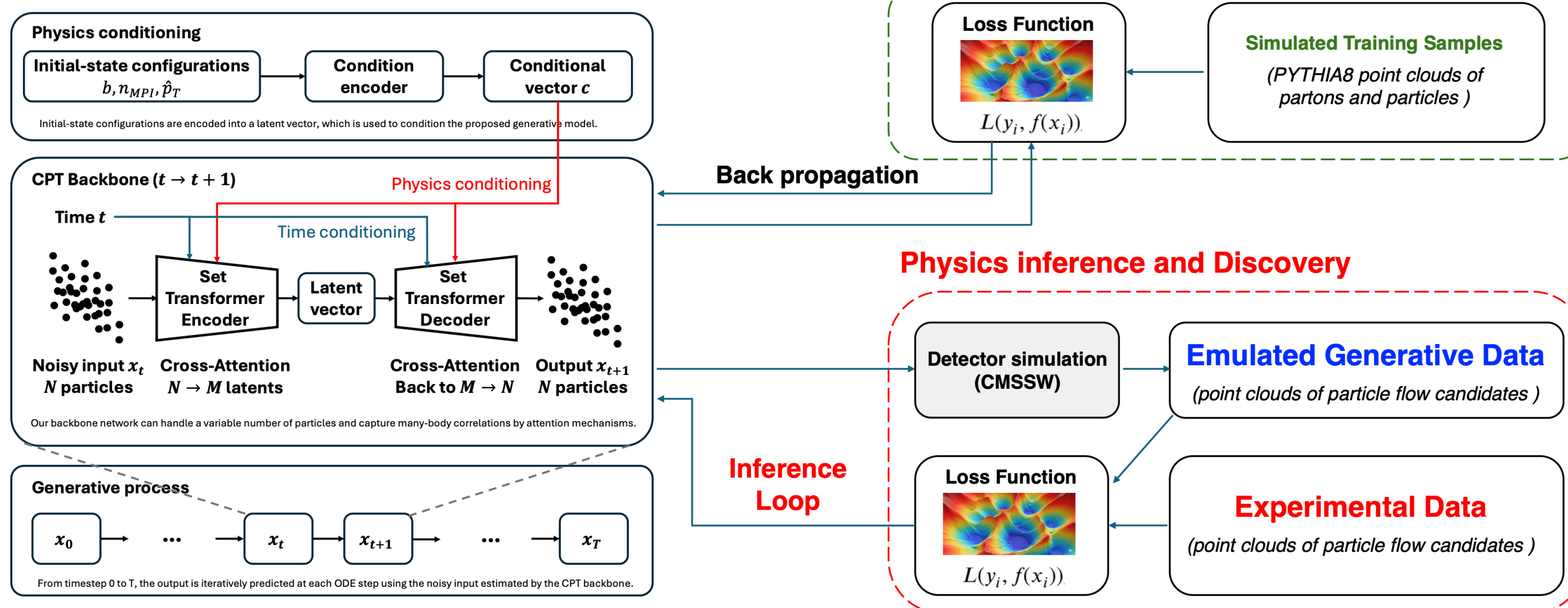
Rice University (Lead) + Wayne State + BNL

Project Summary



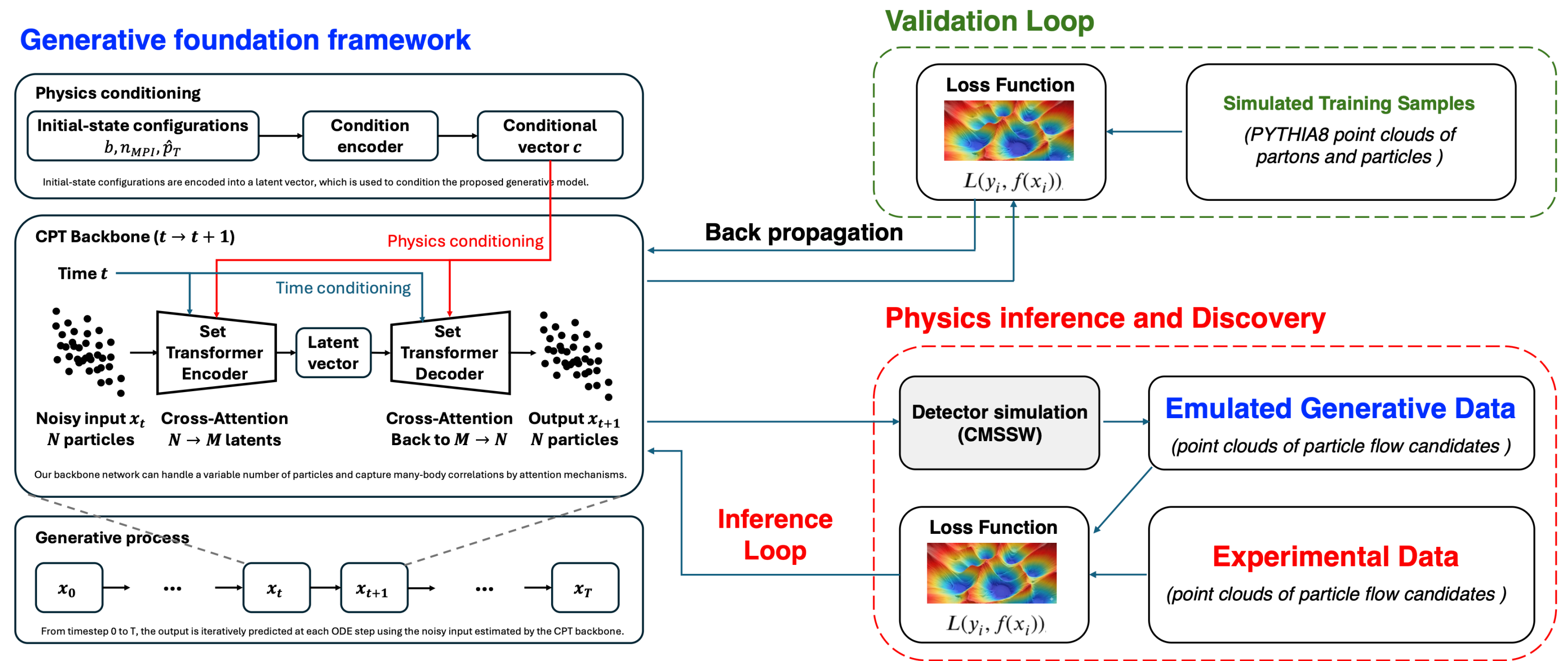
- Triggering the rare high-multiplicity events in p+p collisions requires millions of CPU hours
- Quantitative understanding of emergent phenomena in these rare events is lacking

Generative foundation framework



- Develop a generative framework for high-multiplicity p+p collisions with **many-body correlations** based on a Conditional Particle Transformer (CPT)
- Training data generated from PYTHIA 8

Project Goals



- 1000x speed up for generating rare high-multiplicity p+p collision events
- Develop inference tools at the event level (unbinned) for with and without final-state collectivity in theoretical models
- Phase 2:
 - Extend the ML framework to other rare QCD events (high multiplicity e+A and jets)