

# Principles of Foundation Models for Particle & Nuclear Physics

## Genesis Mission Phase I Project

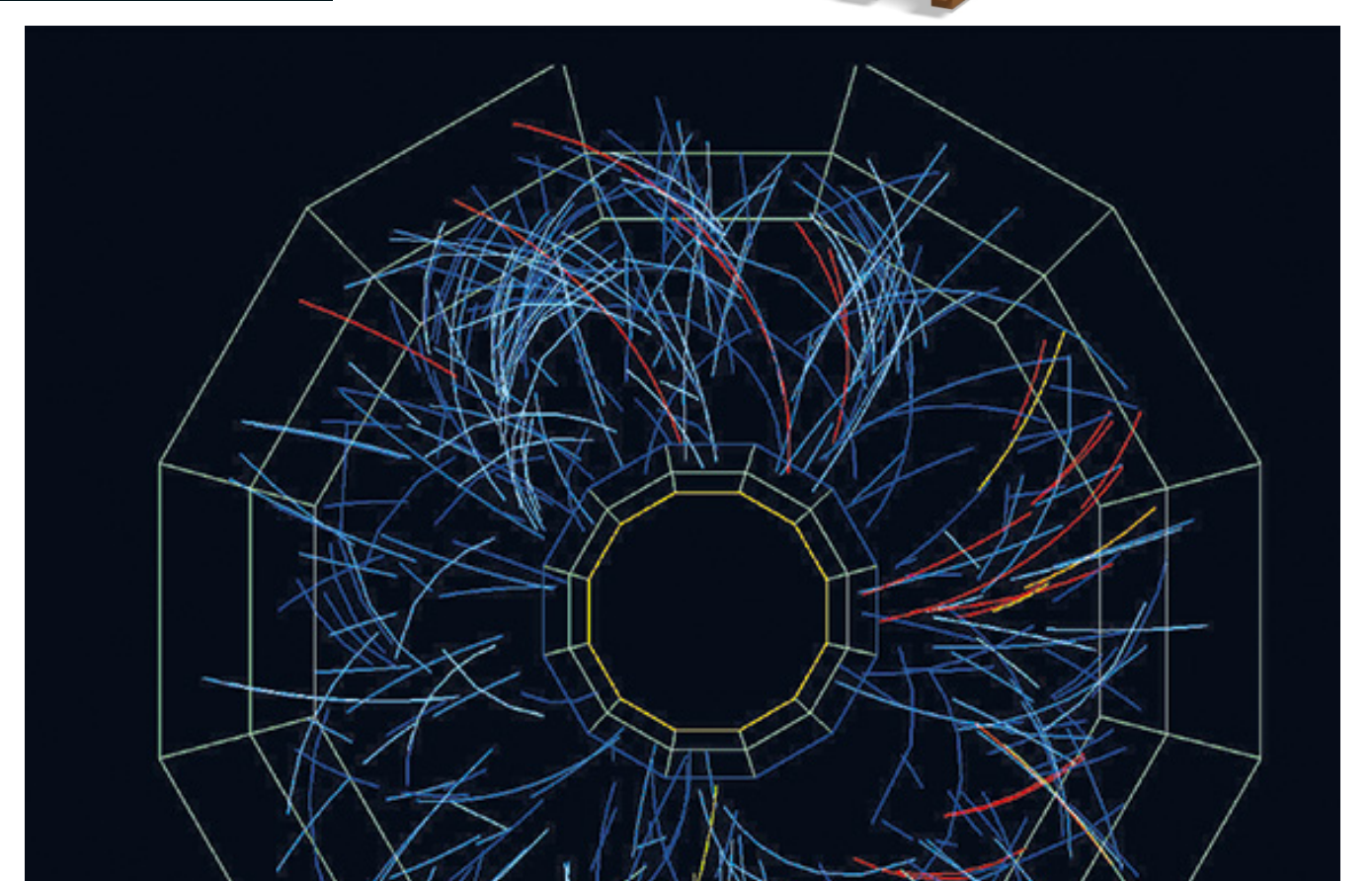
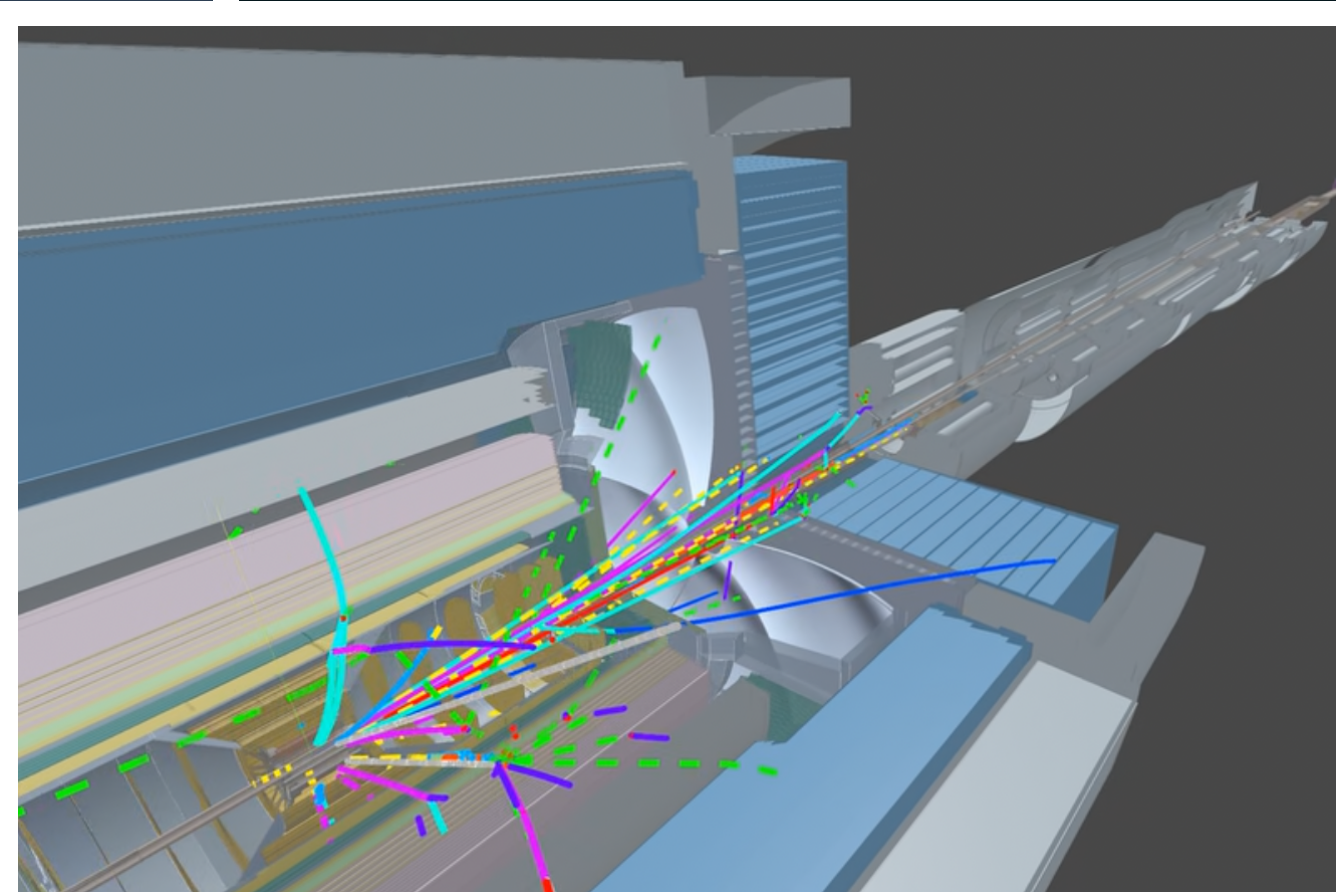
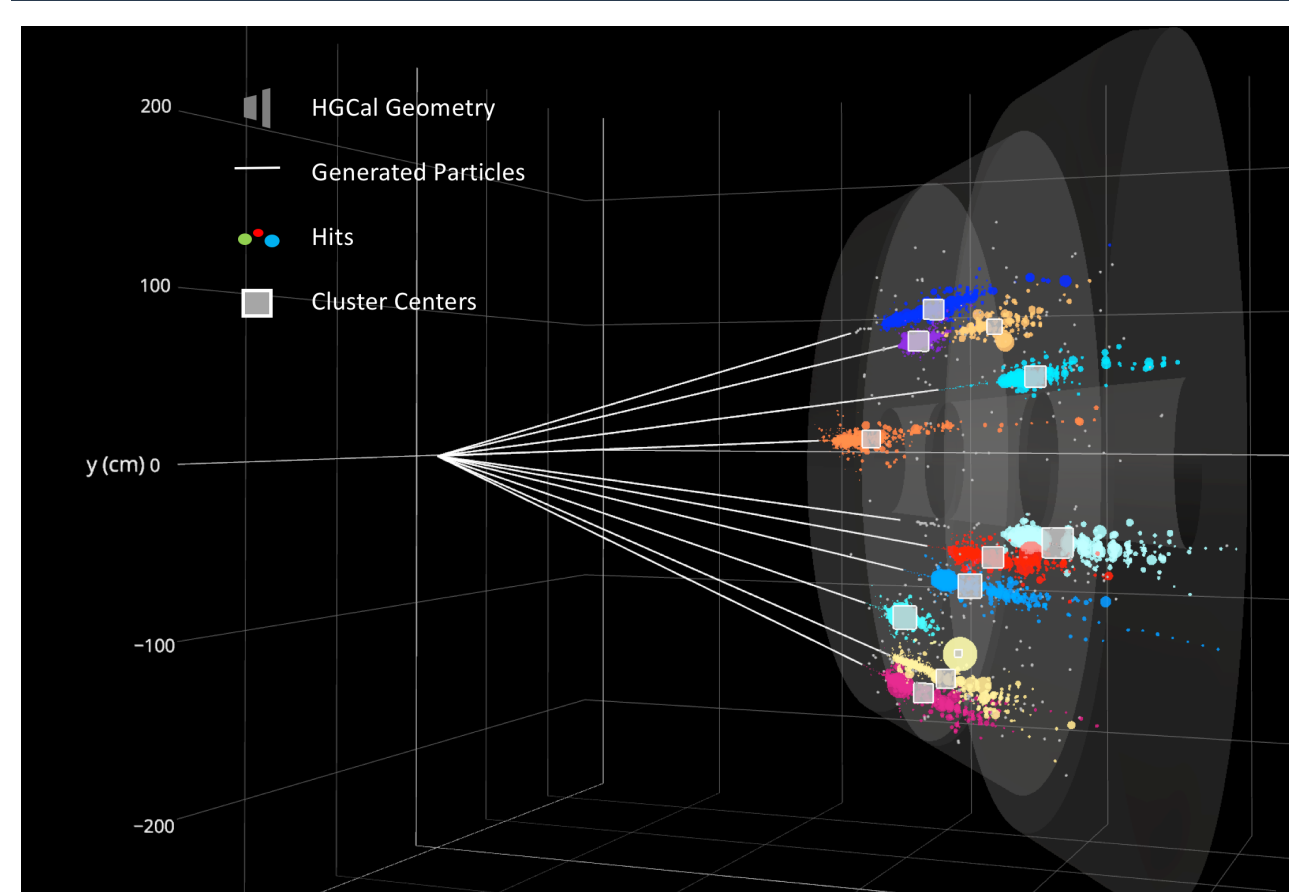
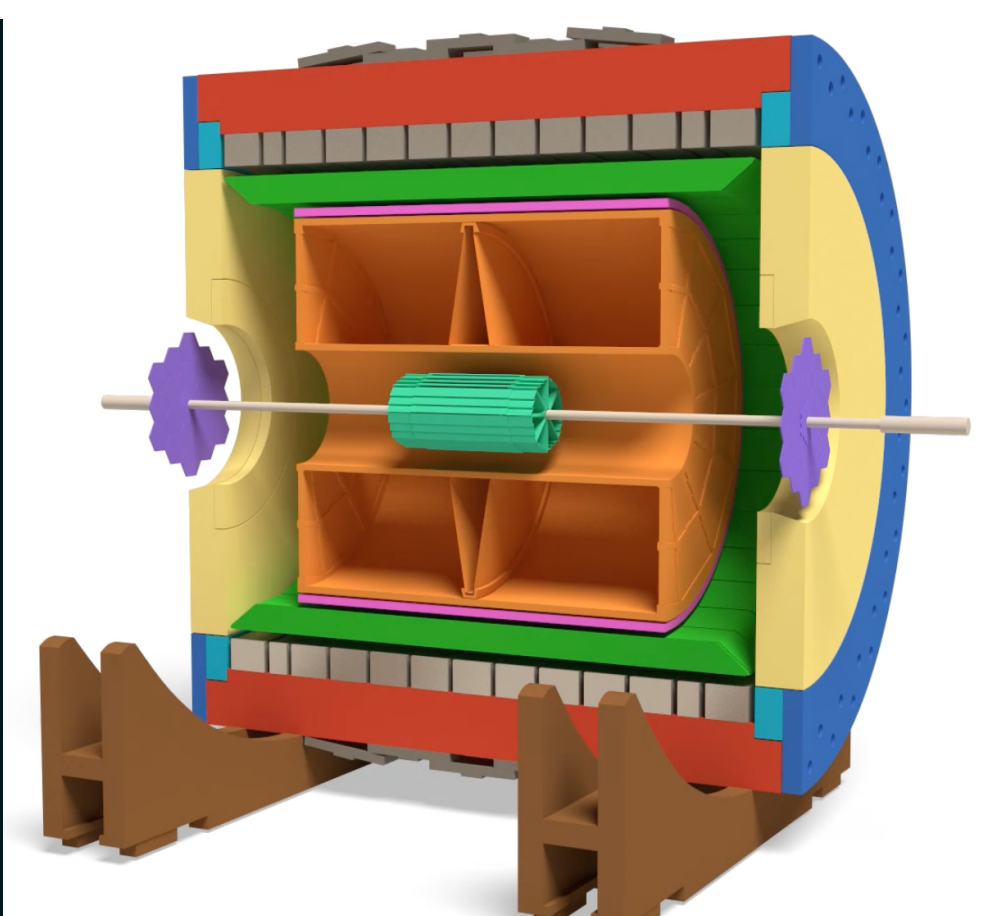
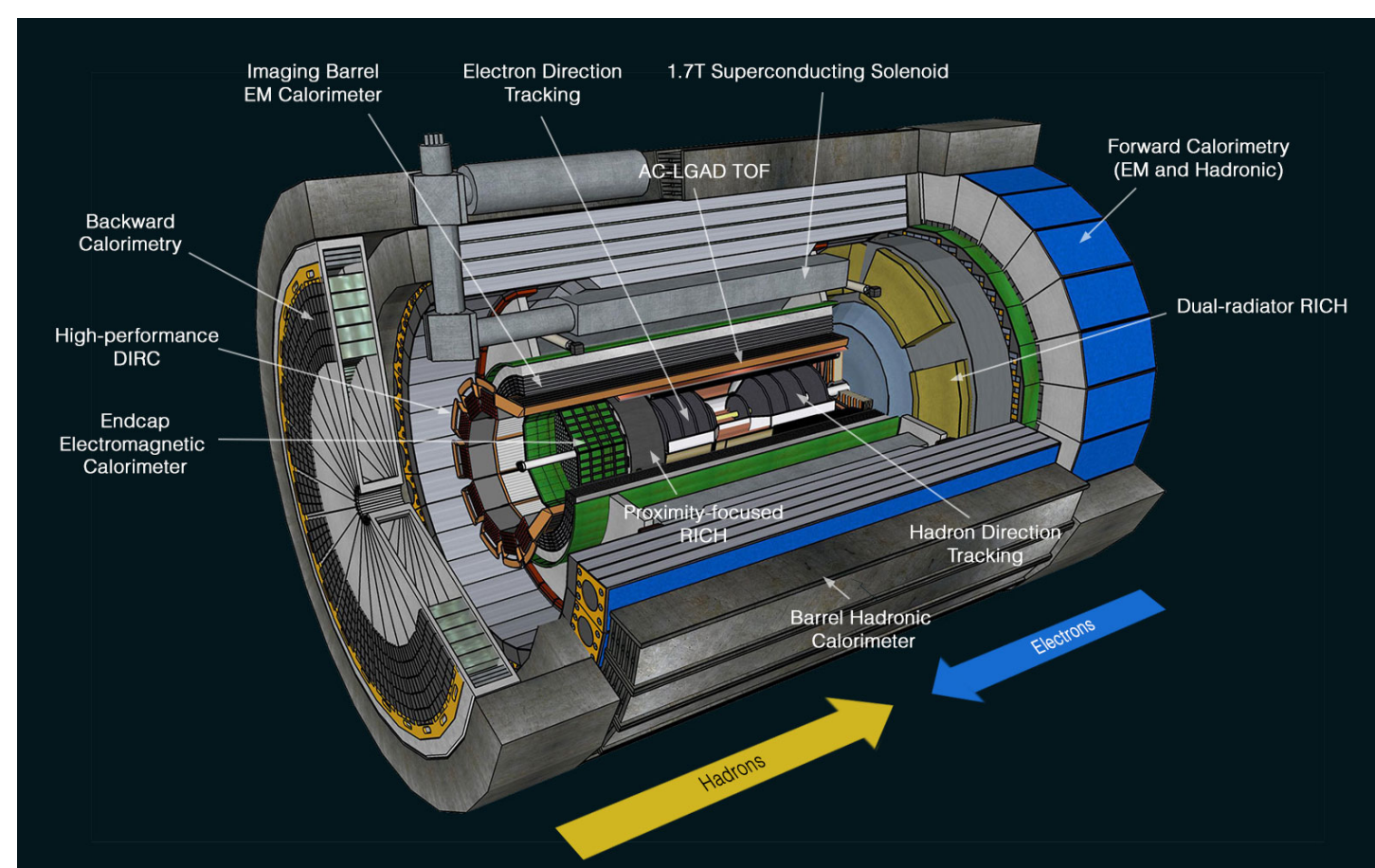
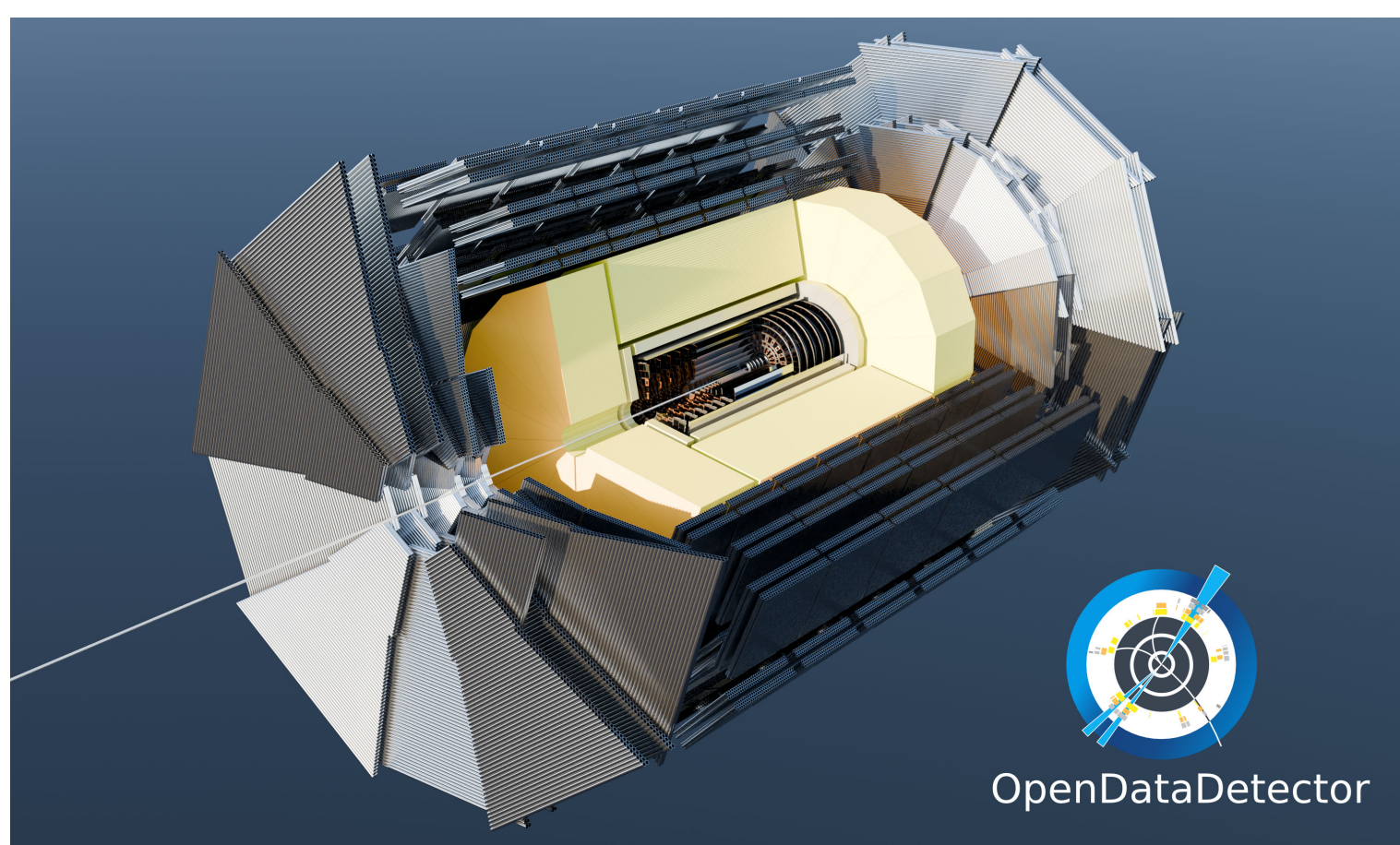
University of Wisconsin-Madison • Argonne National Laboratory • Carnegie Mellon University • University of Kentucky

*Mariel Pettee (PI)*

*Sylvester Joosten  
Maria Żurek  
Nesar Ramachandra*

*Matteo Cremonesi  
Manfred Paulini*

*Renee Fatemi  
Wolfgang Korsch*



### 1 Should HEP and NP use similar representation learning strategies for their detector data?

We will systematically compare the performance of a variety of self-supervised learning (SSL) strategies across these fields to test how similarly these datasets respond to each strategy as a function of scale.

### 2 Is jointly training on HEP and NP datasets beneficial? If so, under what conditions?

Drawing inspiration from industry foundation models that feature significant semantic diversity, we will investigate whether and how integrating data across energy regimes improves learned representations.