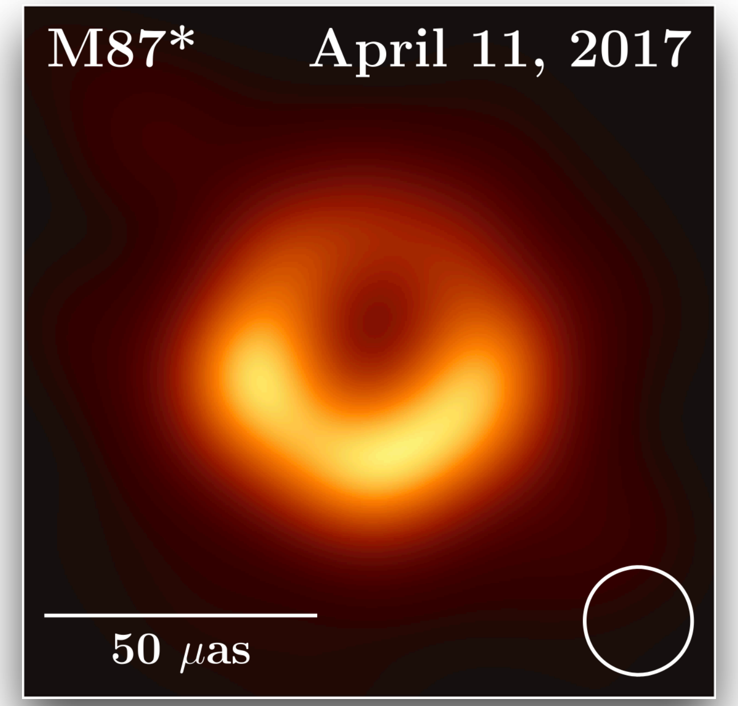
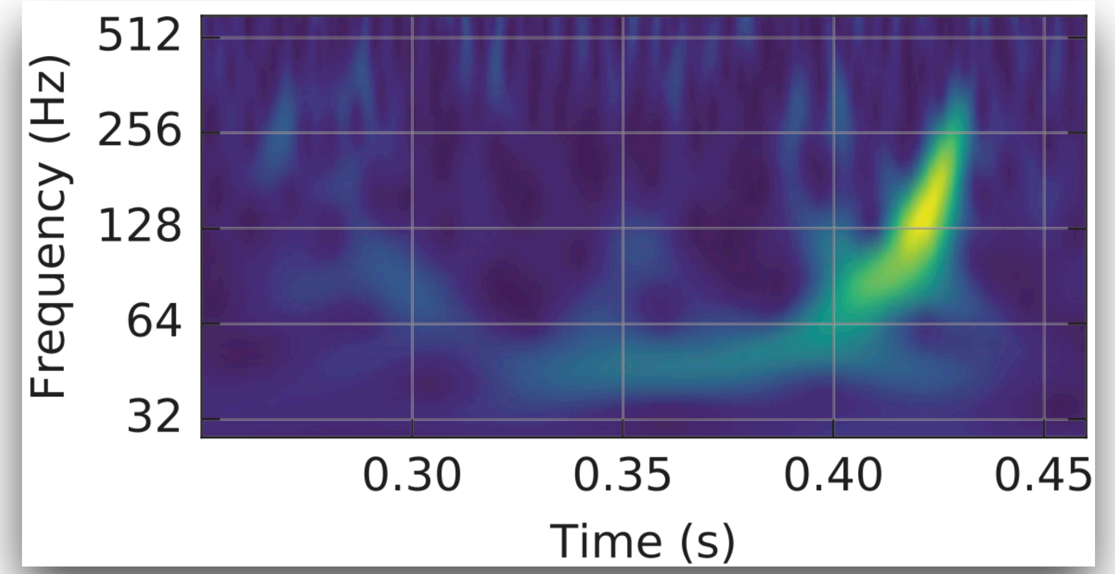
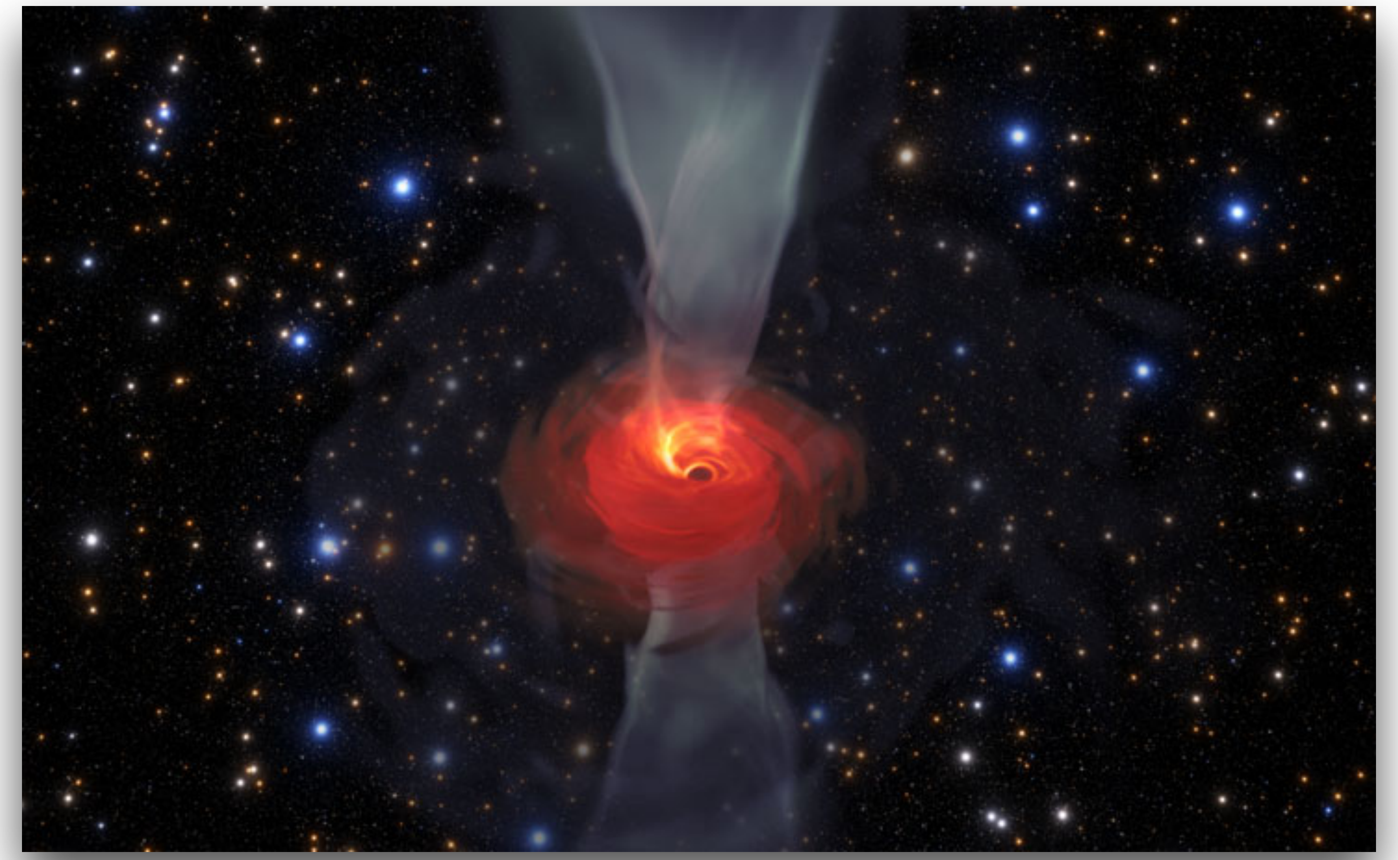
Classification of Radio Sources Through Self-Supervised Representation Learning



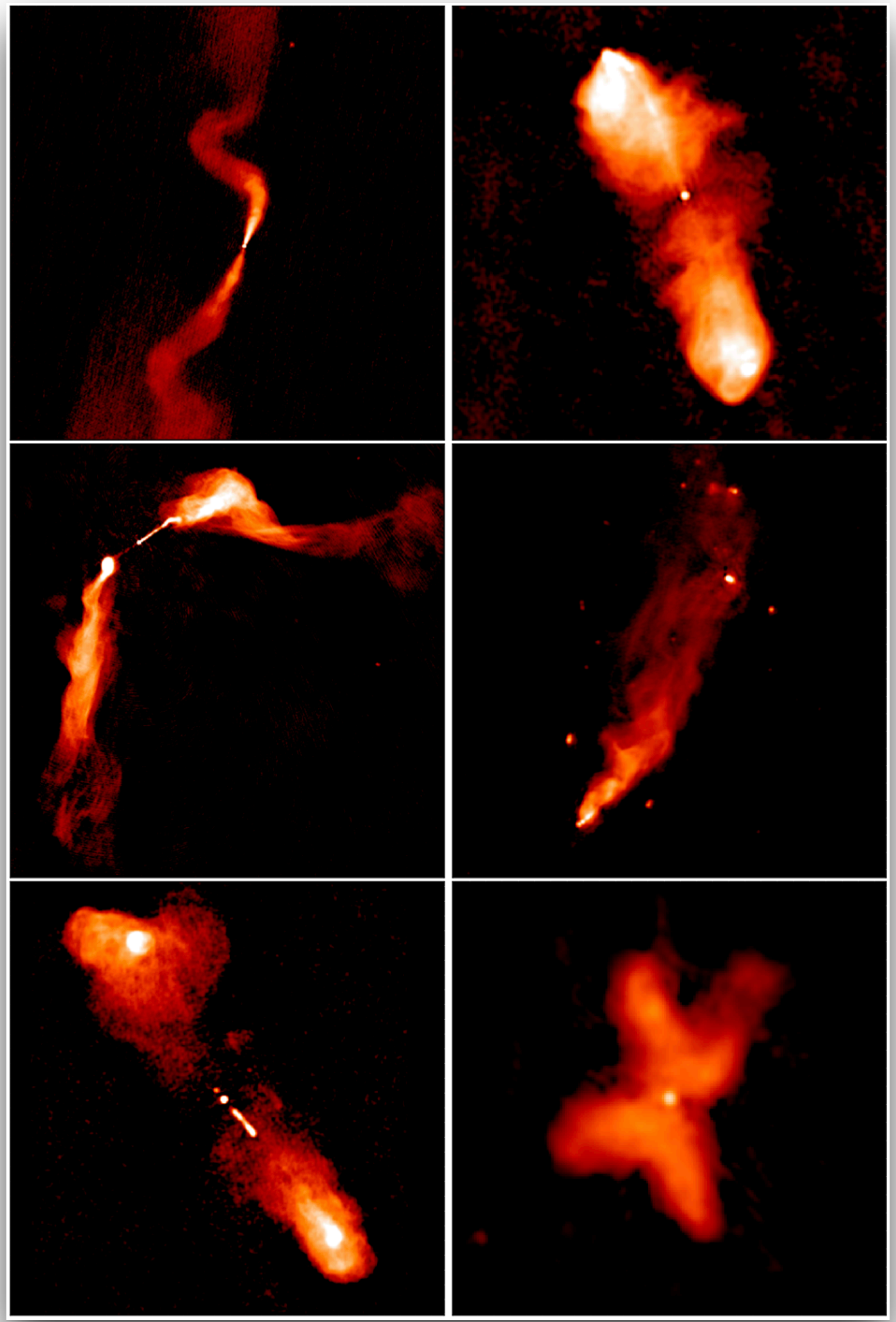
arXiv:1906.11238



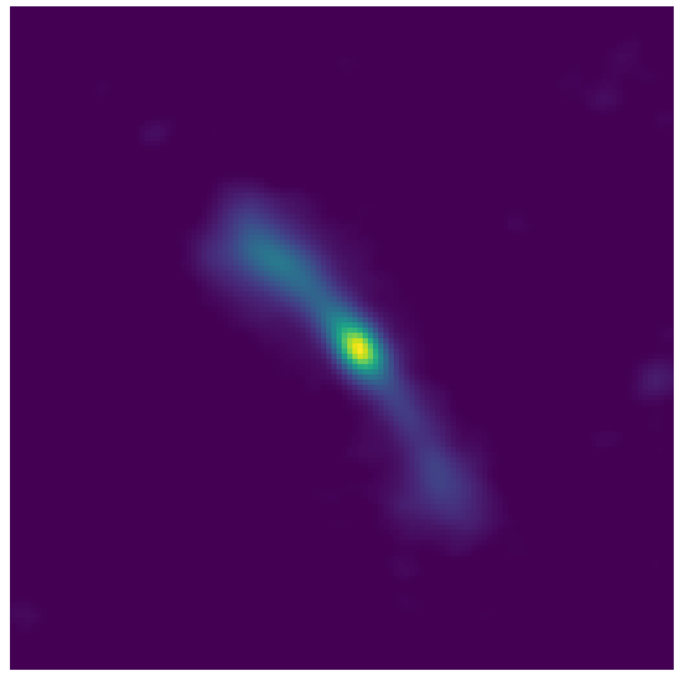
arXiv:1602.03837



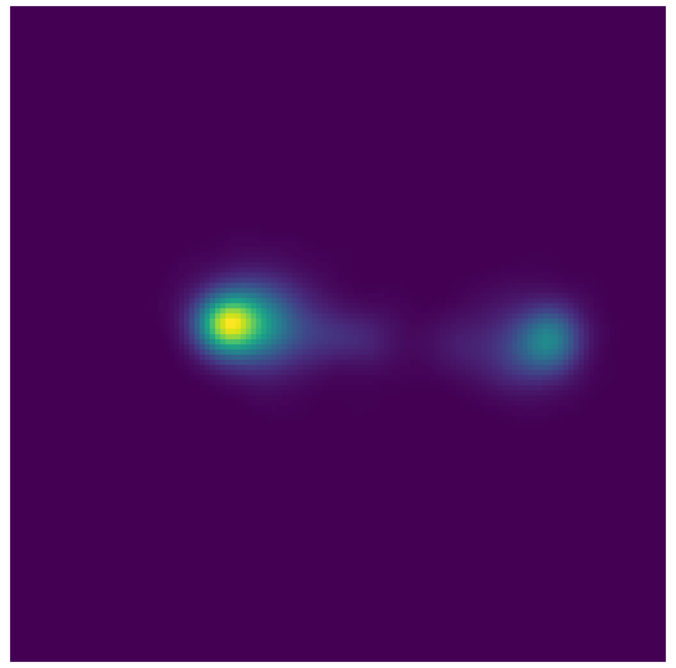
J. Davelaar 2018



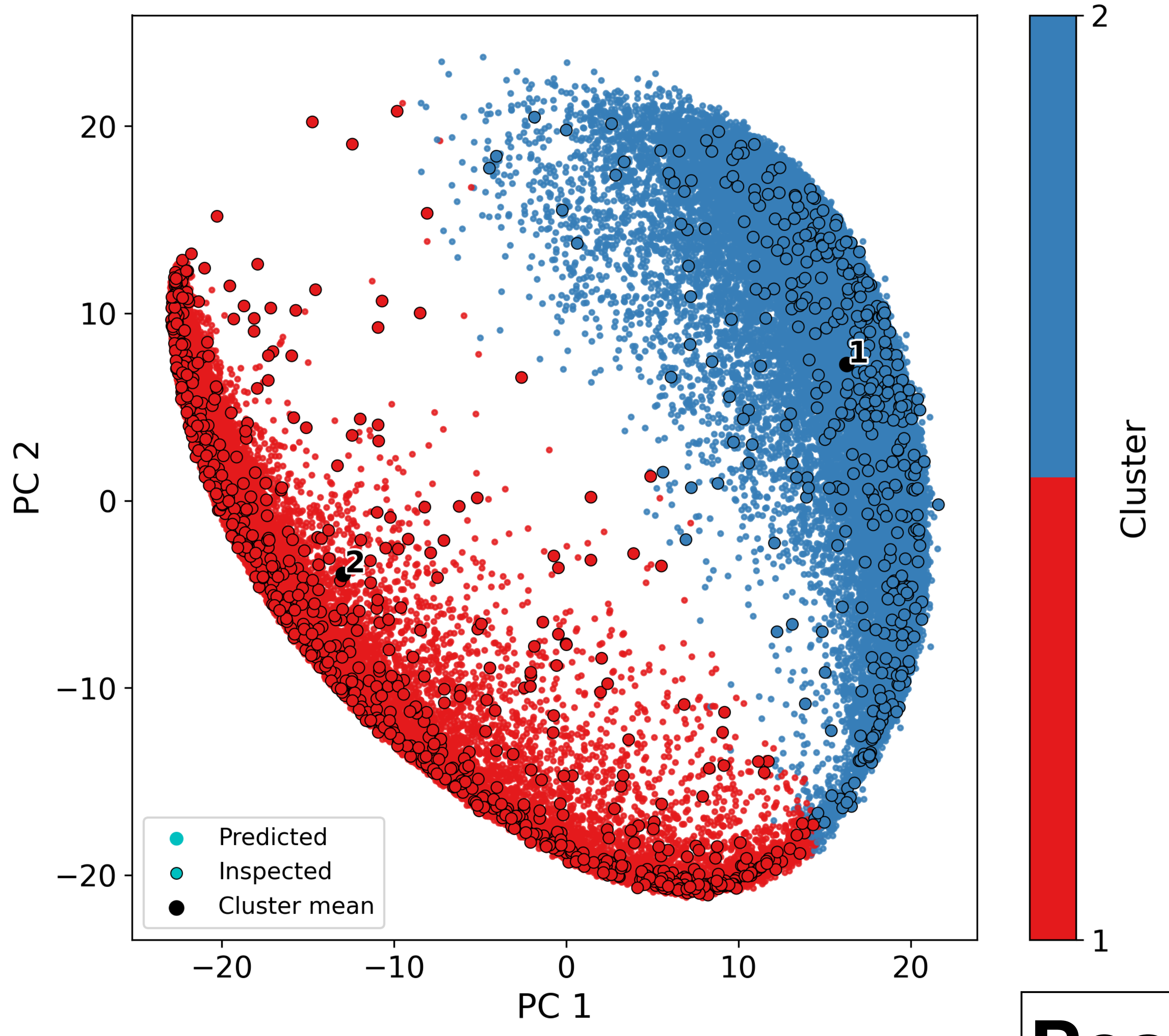
arXiv:2003.06137



FRI



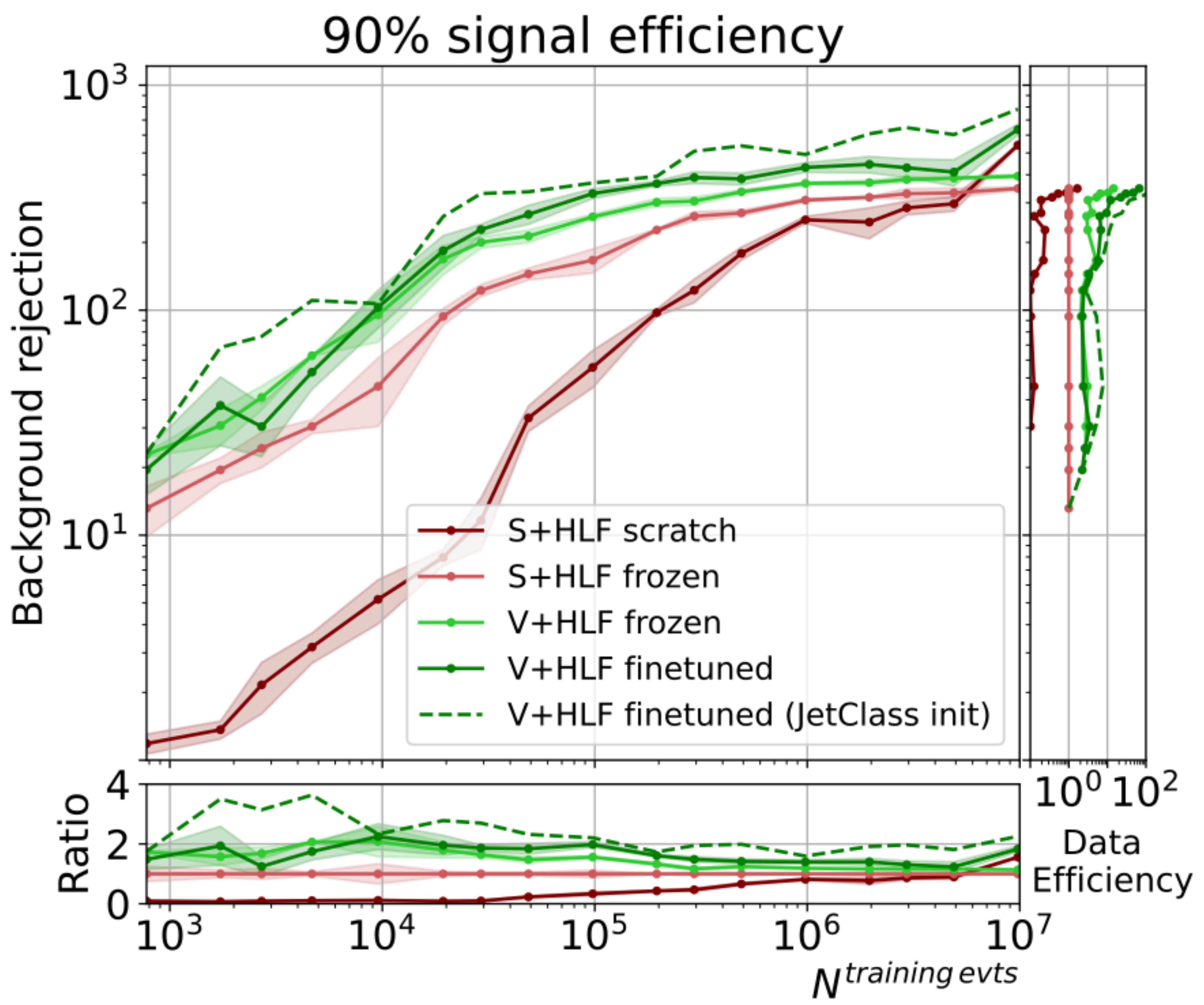
FRII



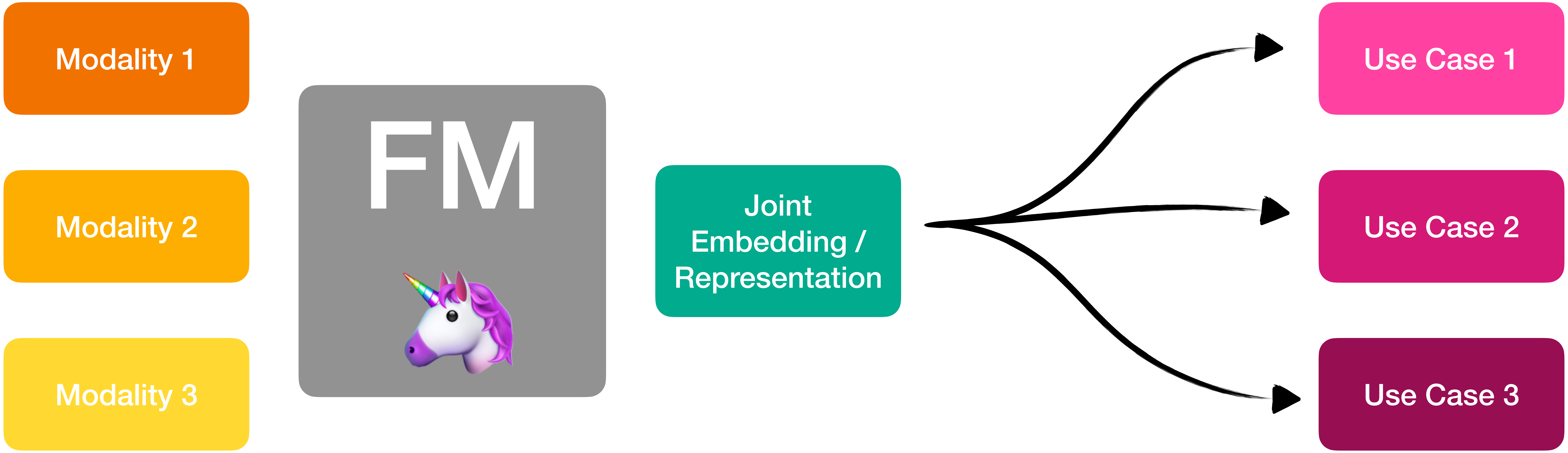
Poster 75

Finetuning Foundation Models

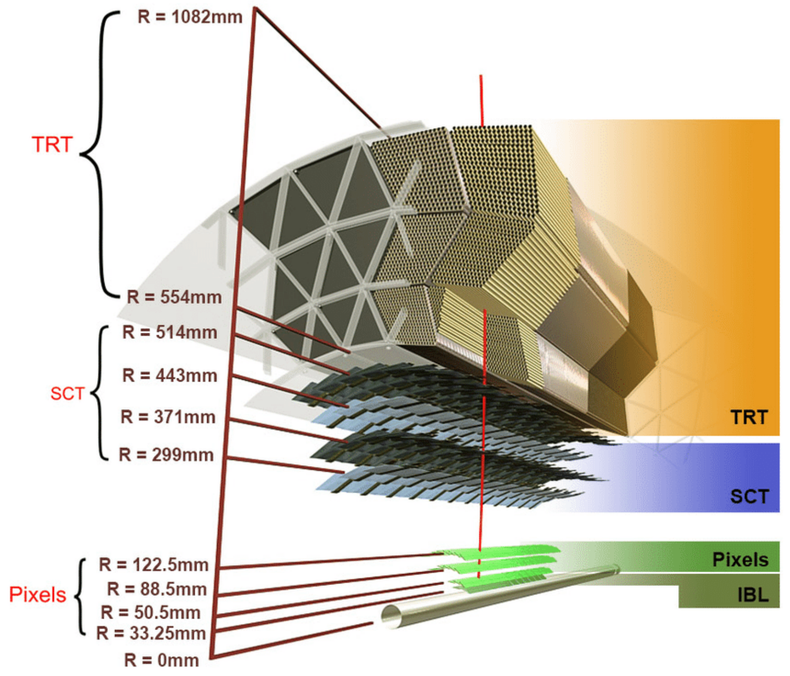
for Joint Analysis Optimization



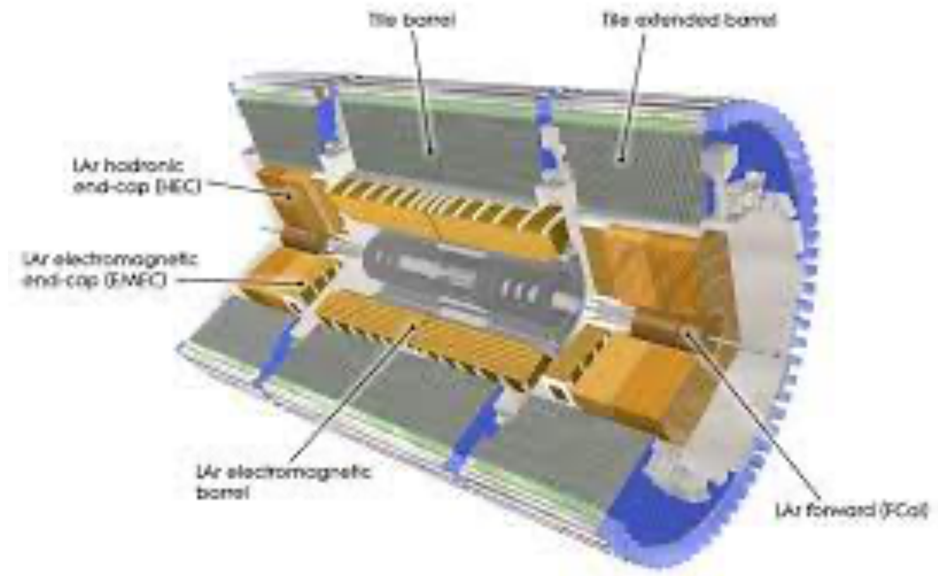
Matthias Vigl, Nicole Hartman, Lukas Heinrich


Modality 1
Modality 2
Modality 3
FM
Joint Embedding / Representation
Use Case 1
Use Case 2
Use Case 3

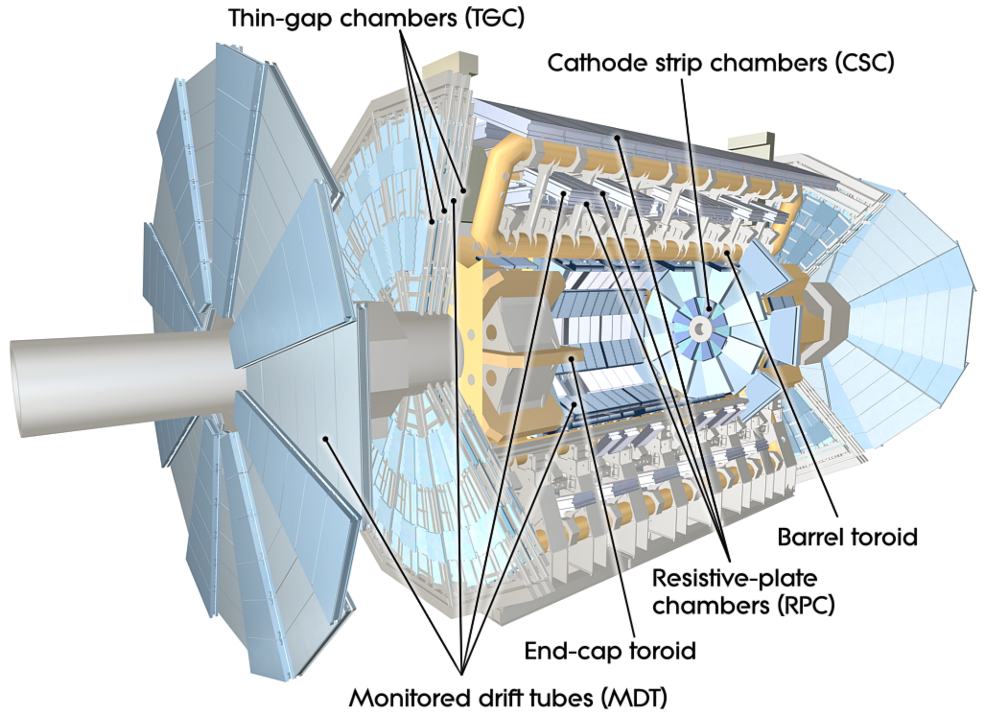
Tracking Data



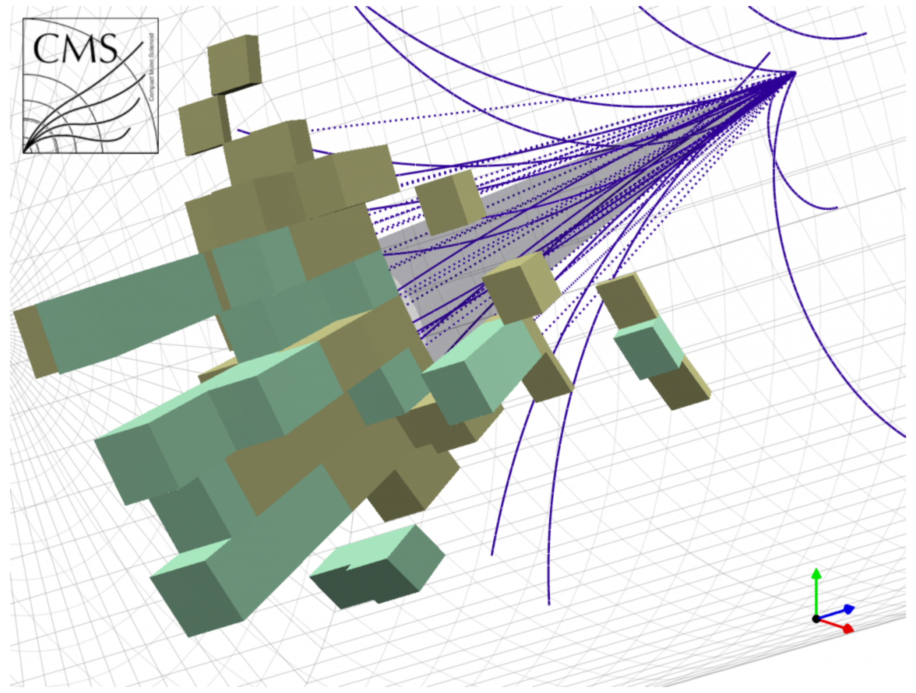
Calorimeter



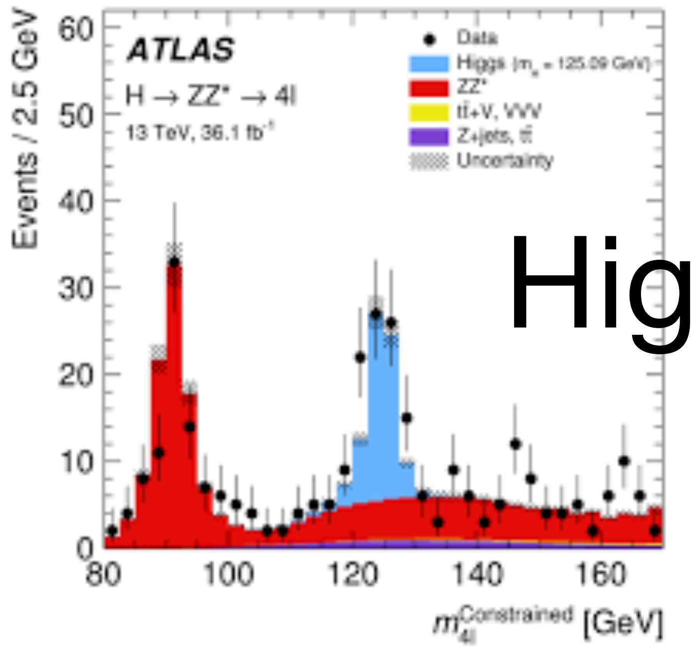
Muon Data



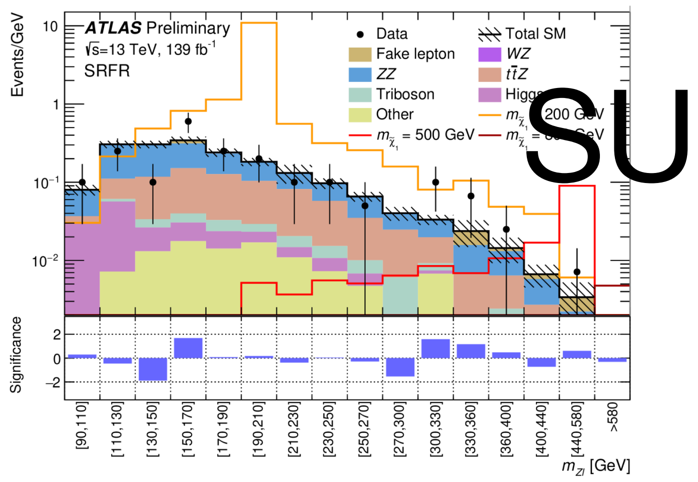
Reco



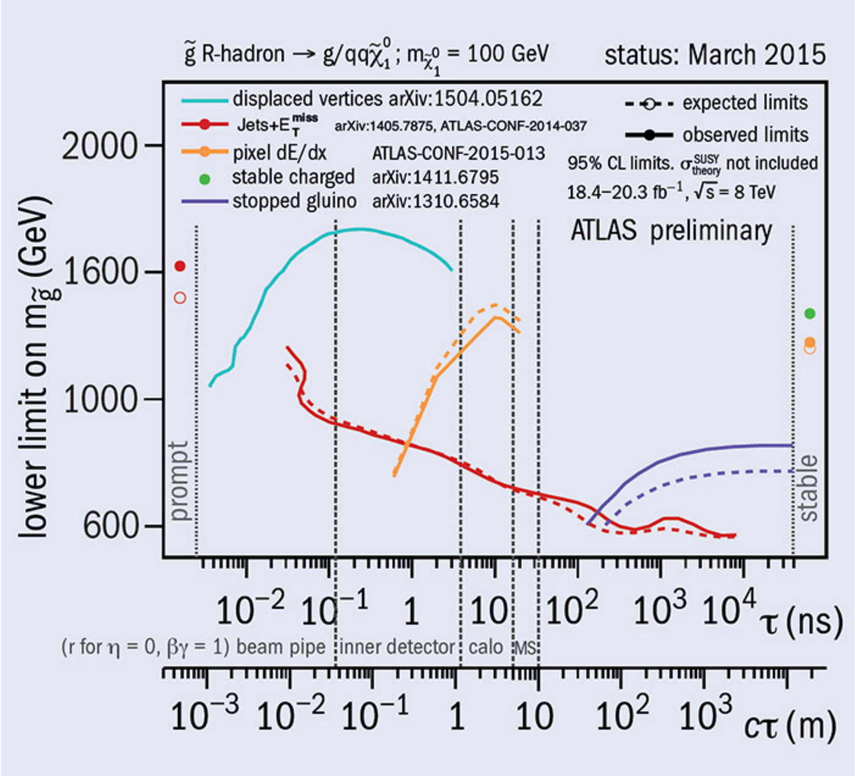
Reconstructed Event



Higgs



SUSY

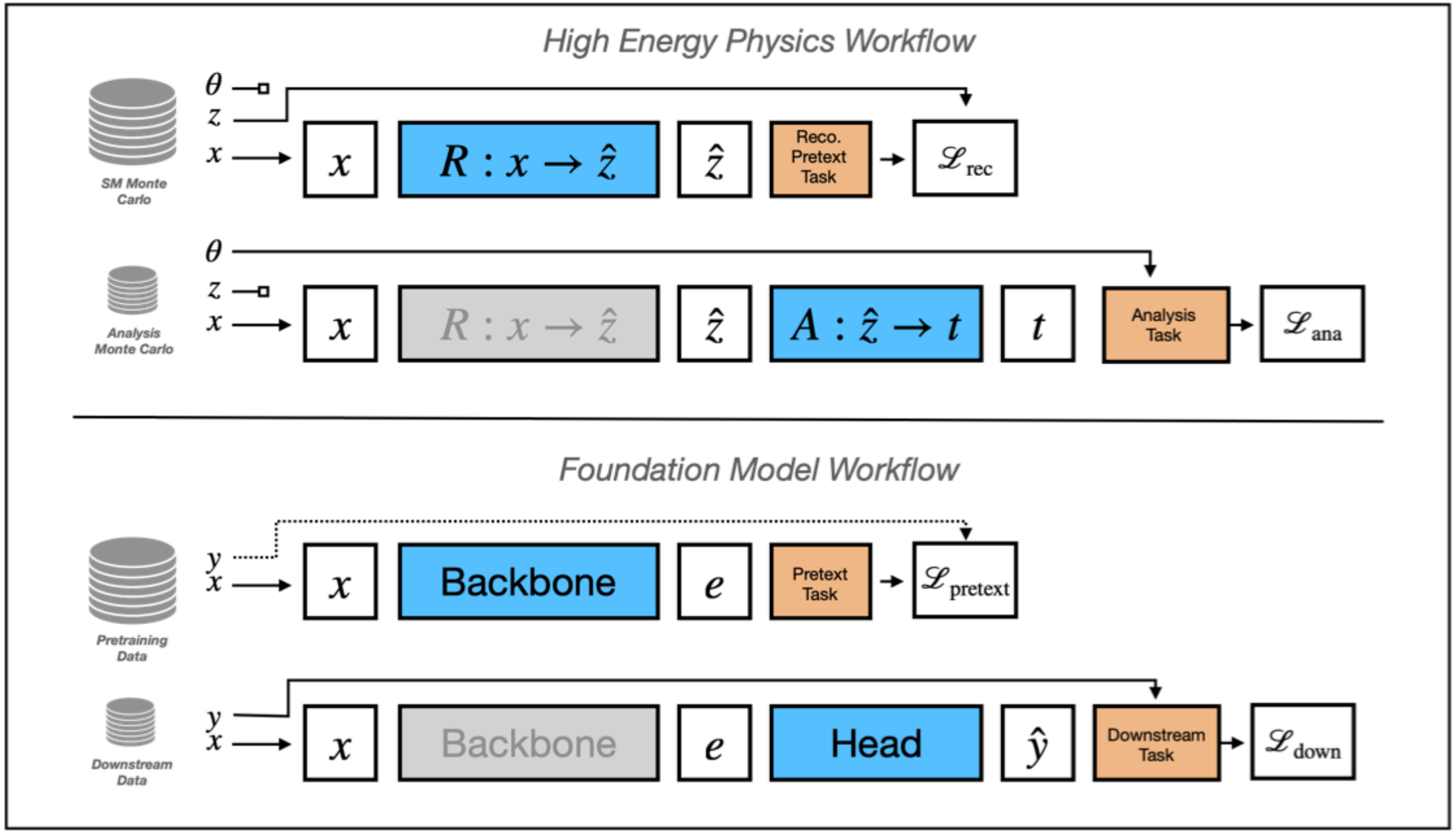


Exotic Particles

In many ways we've always had a foundation model for general purpose experiments..

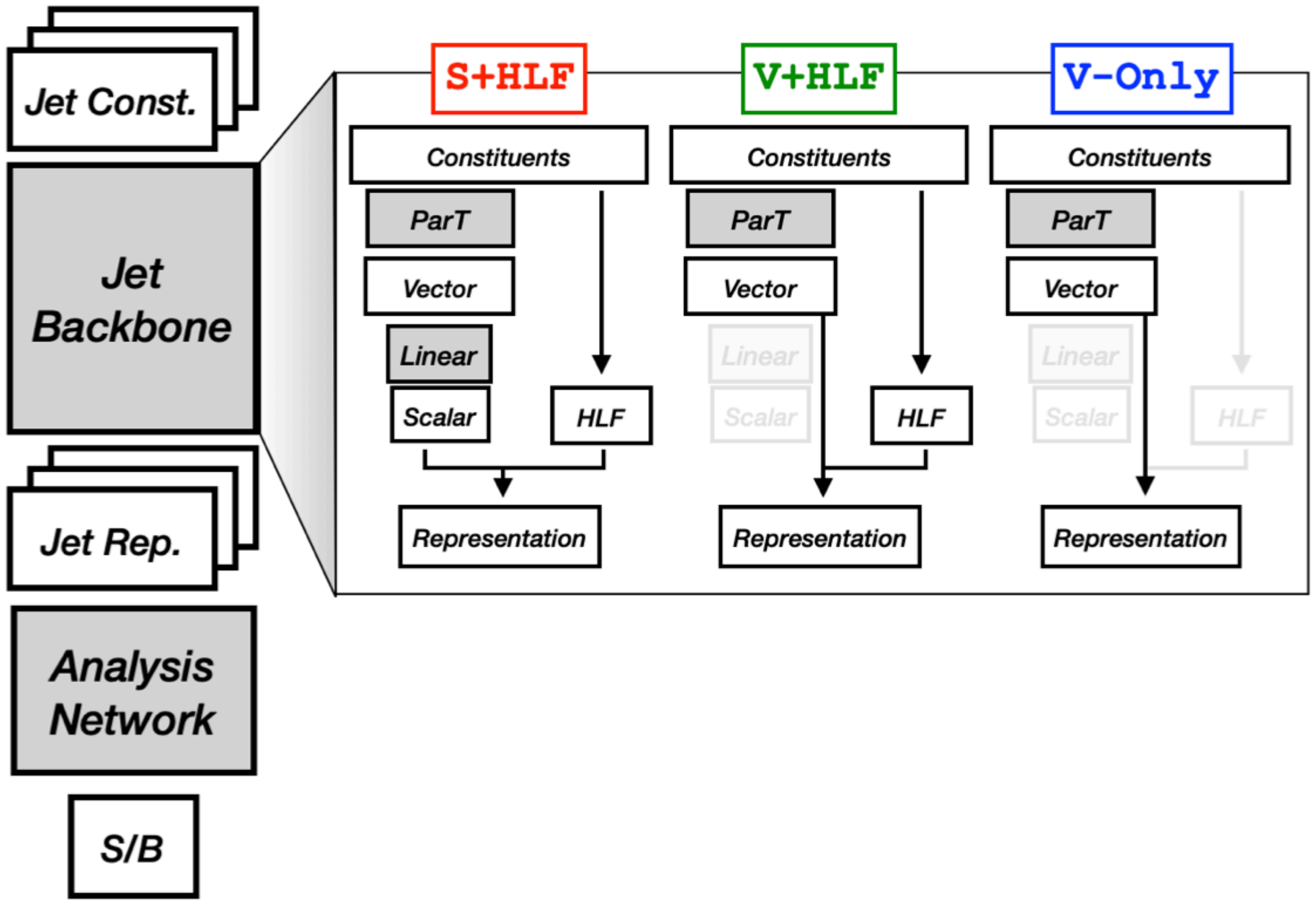
Some more detail here: [Slides]

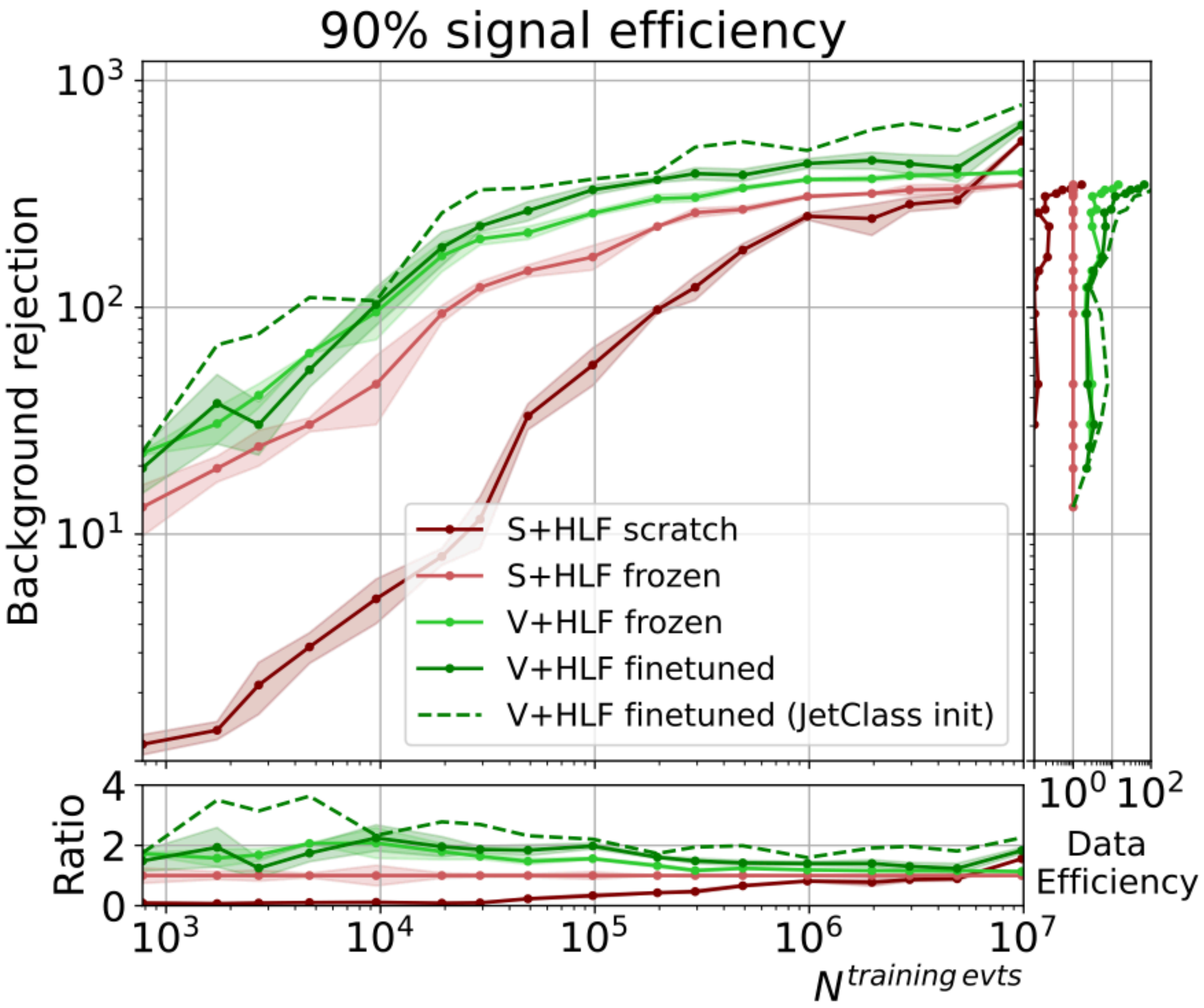
Key Property: Finetuning!



It works!

Finetuning & other workflows from Foundation Model research translate to particle physics and can lead to 100x more data-efficient models





ML Unfolding for error reduction in Lattice QCD observables

EuCAIFCon 2024

1^{st} May 2024

Poster # 77
Thu : 12-15

UNIVERSITÄT BIELEFELD
Faculty of Physics

PUNCH 4NFDI

Simran Singh - *Postdoc @ Bielefeld LGT group*

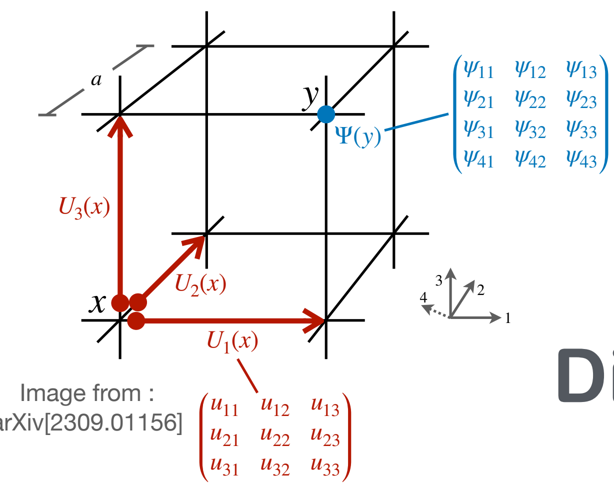


Image from : arXiv[2309.01156]

Lattice QCD - **currently our best probe for understanding low energy QCD**

Discretise space-time and move to Euclidean space

↓

Sample Gauge configurations from a probability distribution

↓

$$Z = \int \mathscr{D}U \det M_f^n e^{-S_G}$$

Compute observables on the generated configurations $\mathcal{O}(\sim(1-10)K)$

$$\langle \mathcal{O} \rangle \sim \frac{\partial \ln Z}{\partial K} \sim Tr\left(M_f^{-1}\frac{\partial M_f}{\partial K}\right)$$

Typical size of Fermion matrices : $N_\sigma^3 \times N_\tau \times N_c \times 4$ **, can go up to** $\sim O(10^7 - 10^9)$

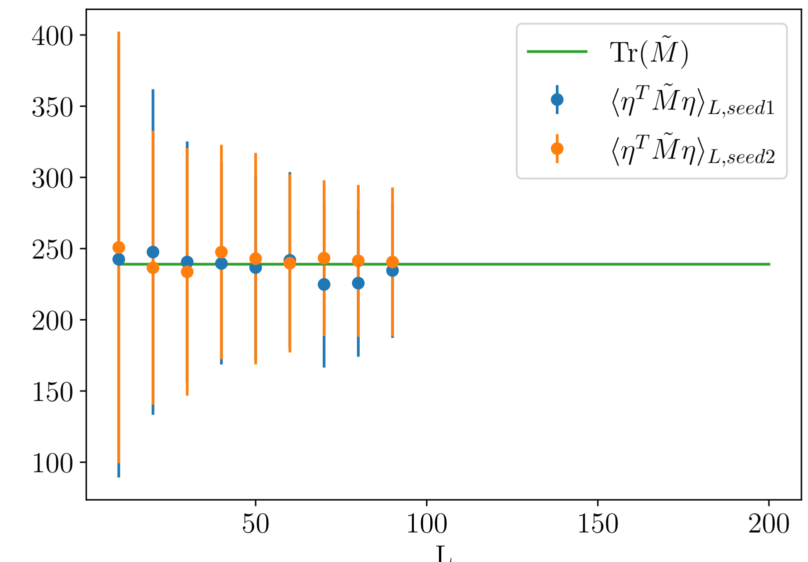
Random Noise Method

No access to individual matrix elements - only matrix vector products !

↓

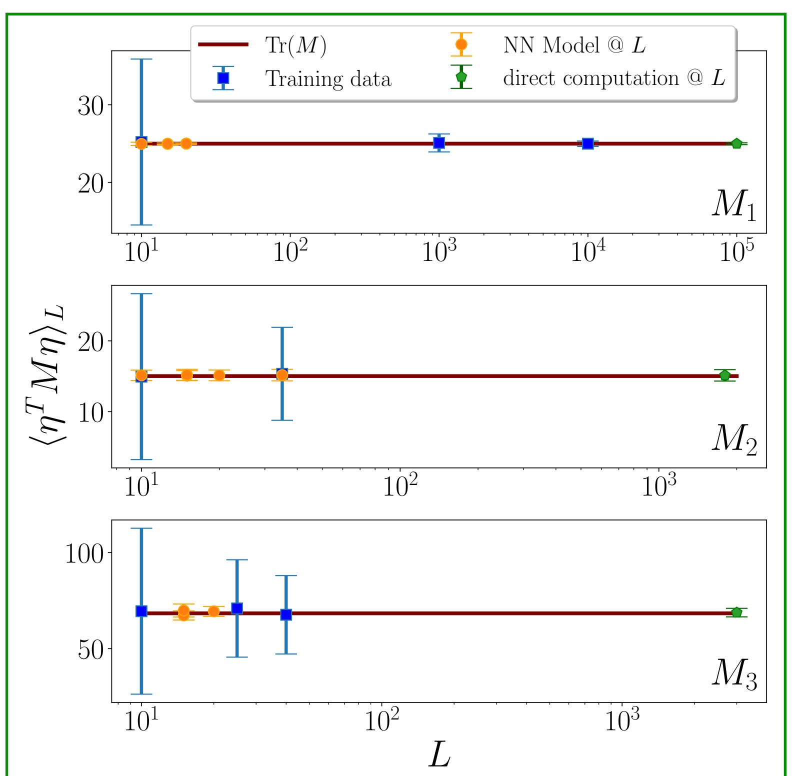
Choose **L** randomly drawn vectors η satisfying certain conditions to get

$$\langle \eta^T M \eta \rangle_L \simeq TrM + \mathcal{O}\left(\frac{f(M)}{\sqrt{L}}\right)$$



Data Unfolding via NN

Question 1 : Can we train a **NN** to learn the systematic effect caused by using only finite such random vectors - given for some observable the **true distribution** with very large L and **measured distribution** with very small L ?



Question 2 : How does this generalise to different Matrices?

Poster # 77 on Thu !