Performance versus uncertainty in boosted top tagging with the ATLAS detector

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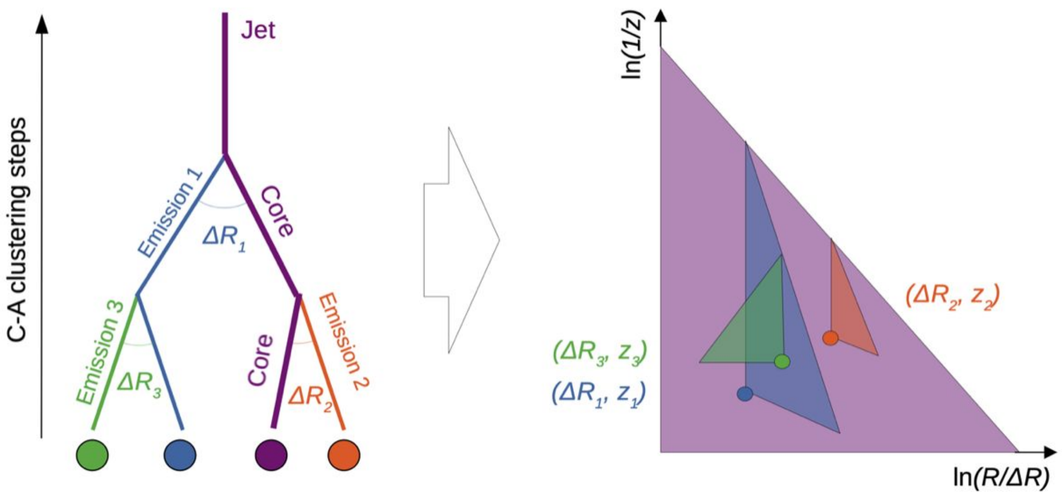
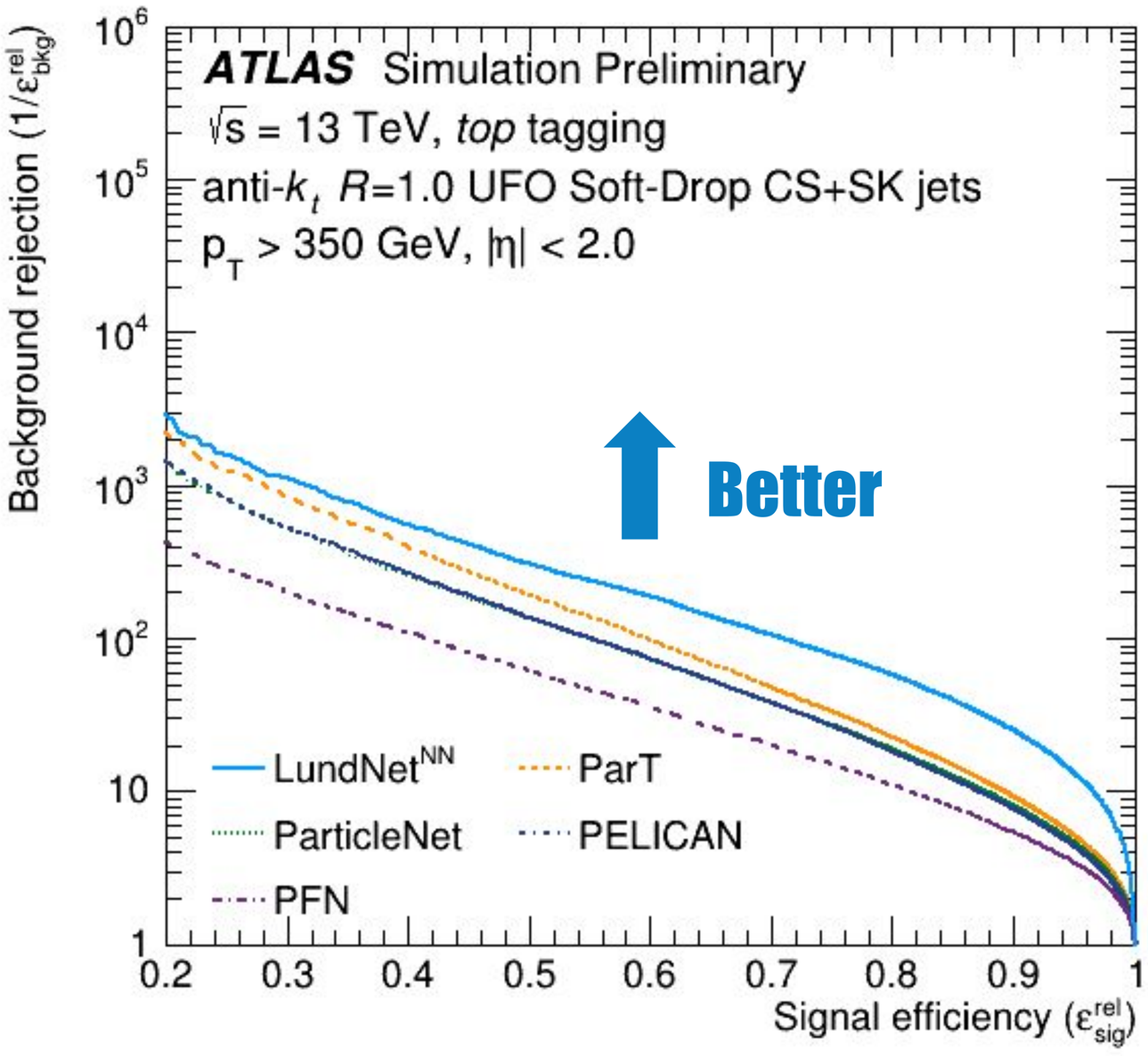
Performance

- What is the most effective machine learning model for tagging boosted top quarks?
- Transformers work great, but the right physics prior [1-2] works even better!



LundNet - Graph neural network, with node connections determined by splittings in Lund jet plane and node features:

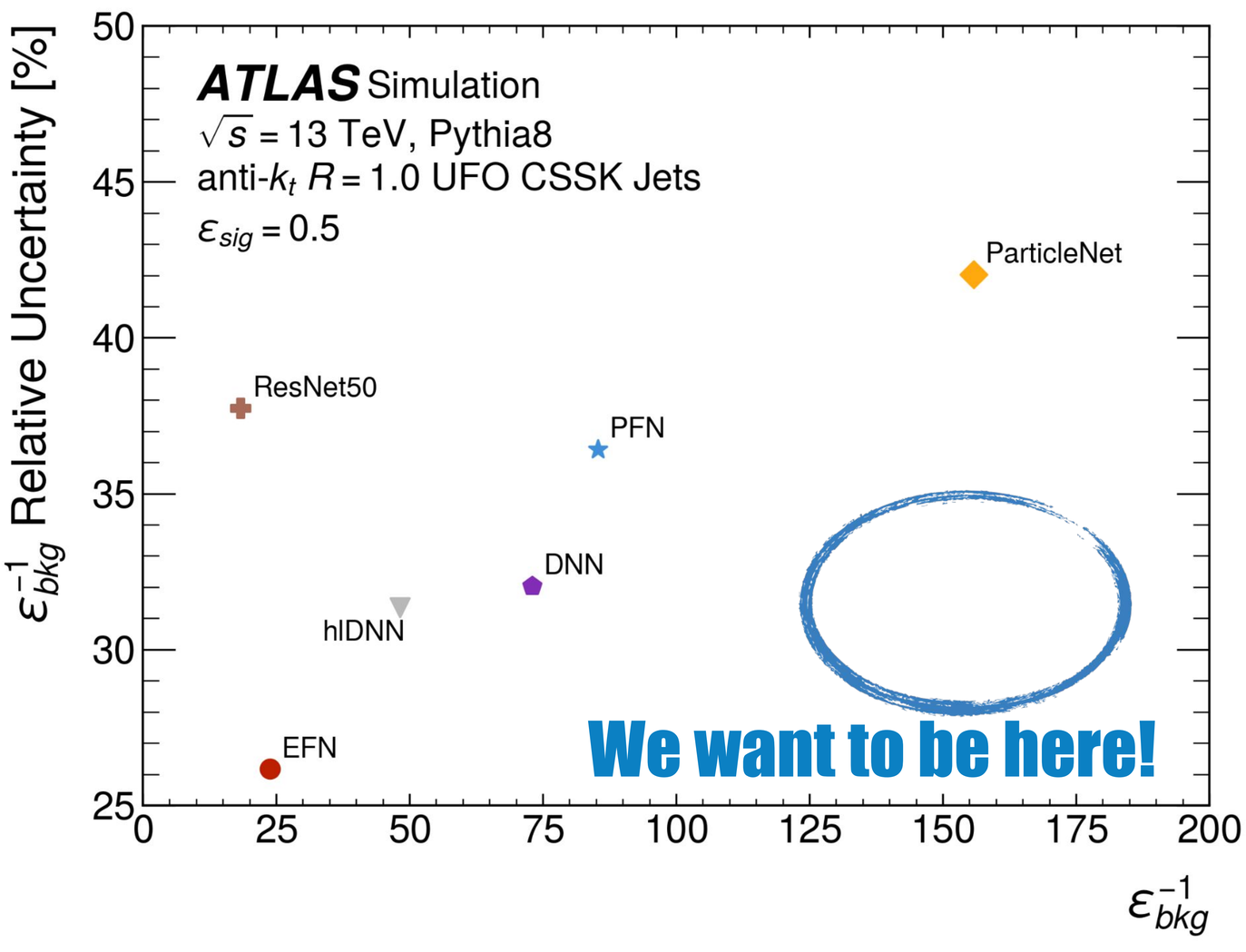
$$\tau^{(i)} = k_t, \Delta, z, m, \psi$$



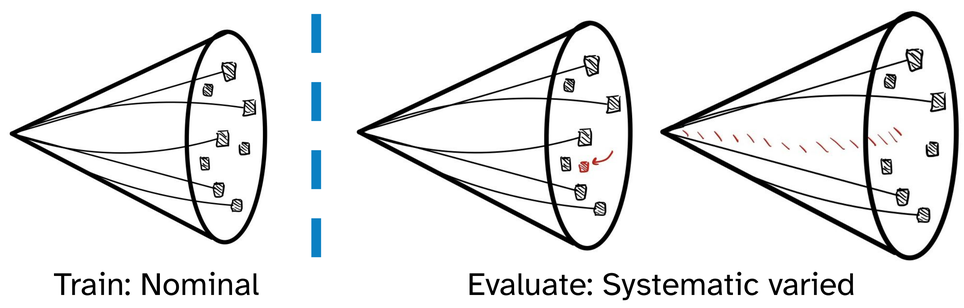
versus

Have an idea for controlling uncertainties? These datasets are public!

Public data:



- Treatment of systematic uncertainties is crucial for interpreting physics results
- Can **approximate** the size of systematic uncertainties associated with each tagger using “bottom-up” approach [3]:



- The most performant taggers produce the largest uncertainties

uncertainty

References: **[1]** F. A. Dreyer and H. Qu, *Jet tagging in the Lund plane with graph networks*, JHEP **03** (2021) 052, arXiv: 2012.08526 [hep-ph] **[2]** ATLAS Collaboration, *Tagging boosted W bosons applying machine learning to the Lund Jet Plane*, ATL-PHYS-PUB-2023-017, 2023 **[3]** CERN preprint: CERN-EP-2024-159