PhD Open Days

Search for Unexpected New Phenomena at the ATLAS/LHC experiment

PhD Technological Physics Engineering

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As ATLAS data grows in volume and complexity, **machine learning** offers powerful tools to learn what normal **operation** and normal **physics** look like and to flag what doesn't fit. This idea is applied to **model-independent physics searches** and **automated detector monitoring.**

ANOMALY DETECTION IN ATLAS ANALYSIS

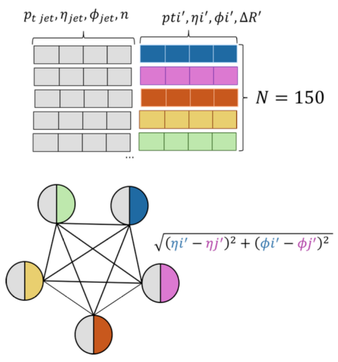
Exploring Anomaly Detection across different angles

? **Can signal-agnostic AD compete with signal-specific supervision?**

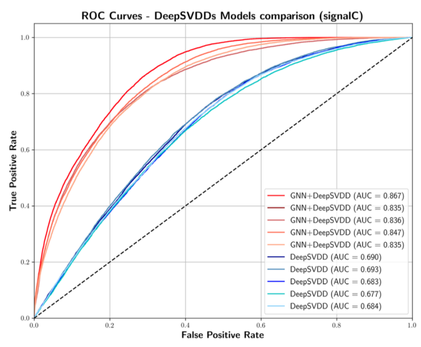
? **How does input representations shape performance?**

? **How do blind model choices affect sensitivity – and the test statistics**

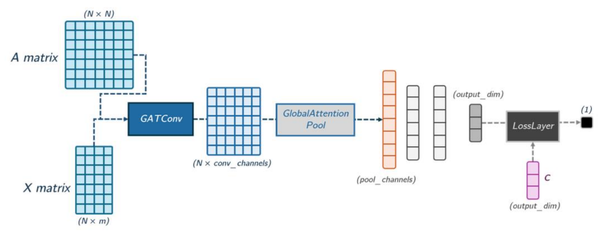
Jet as a graph: constituents are nodes, connected by pairwise ΔR distance (edges)



GNN-based embedding consistently beats the flat Deep SVDD baseline



GAT layer learns relevance of constituent information
Pooled into a single **jet-level embedding**

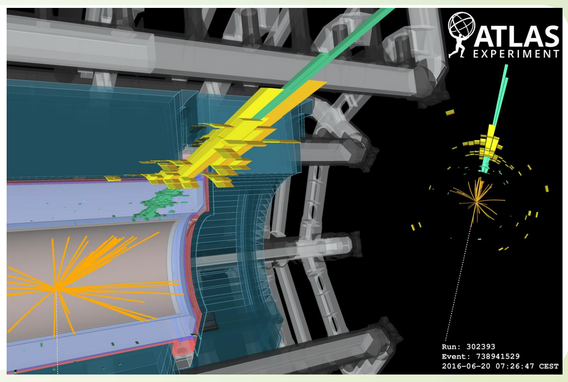


Goal: Turn this into the methodology of an **ATLAS analysis**

Monojet Run 3 analysis

Signature:
1 Large energetic jet + **Missing Transverse Energy, fully hadronic decay**
Searches for New Physics using AD methods

Benchmark signals : Model-independent analysis: set of signals from different theoretical models: Heavy Vector Triplet (**HVT**), 2 Higgs Doublets models (**2HDM**), Supersymmetry Models (**SUSY**), Dark Matter simplified Model



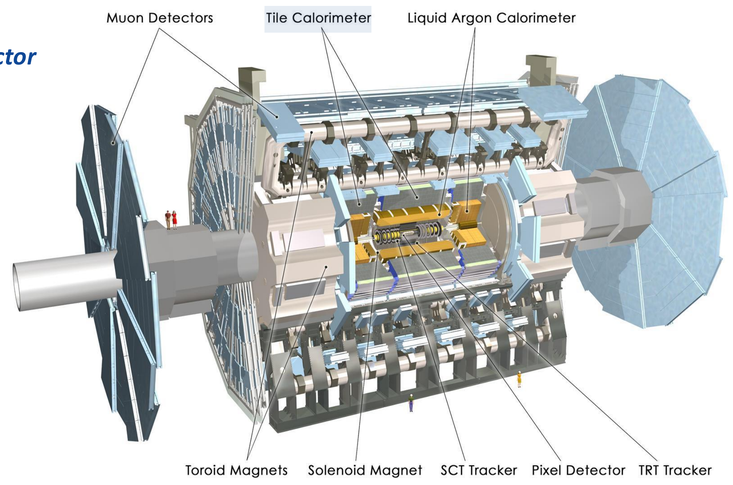
AUTOMATED DATA QUALITY TILECAL

Goal

Automate data quality tasks

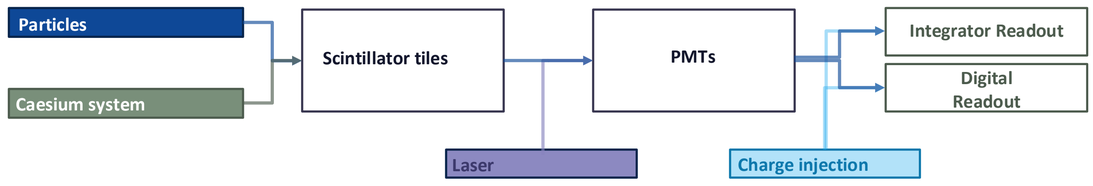
ML-based score as additional tool for DQ shifters

ATLAS Detector



Information used

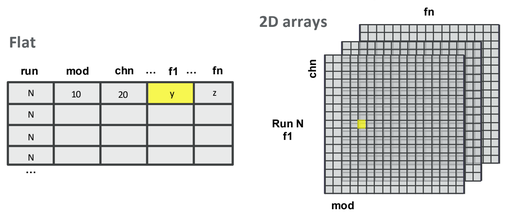
- Physics runs information
- Laser standalone calibration runs
- Pulse shape information

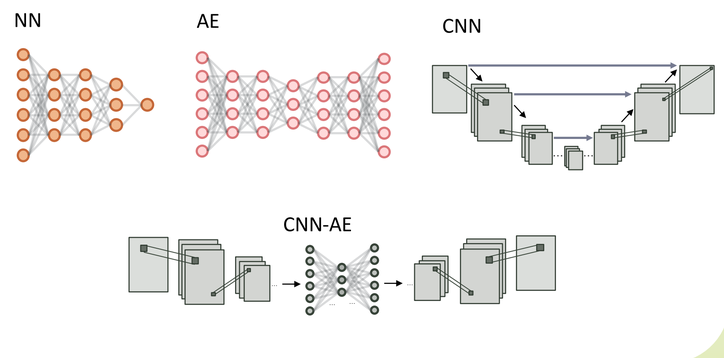


Models Developed

Supervised (NN, CNN) and semi-supervised models (AE, CNN-AE)

Based on flat and 2D arrays inputs





Supervisors: Rute Pedro, Nuno Castro, Henric Wilkens

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