ESR3: Real time analysis strategies for reconstruction, exotic physics, and market analysis

Leon Bozianu

Under the supervision of
Anna Sfyrla and Steven Schramm
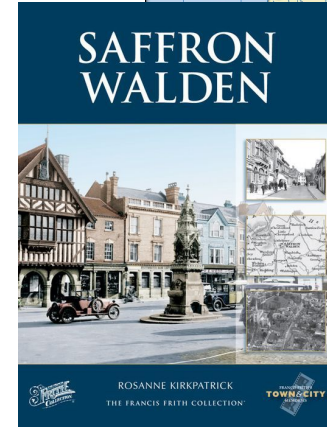
UNIVERSITÉ
DE GENÈVE

SMARTHEP
REAL-TIME ANALYSIS FOR
SCIENCE AND INDUSTRY

Who am I?

Introduction

Born in Wales, but lived in Saffron Walden (near Cambridge) for many years - hence the lack of Welsh accent.

What have I been doing?

So physics?

Pursued undergraduate (bachelors) degree in Natural Sciences (mathematics and physics) at Durham University.

Unsurprisingly, heavy maths content. No python, a little R. Few labs, more theory.

Final dissertation inside mathematics department entitled "Gauge Theory and Lie Algebras".
Finished in lockdown.

So physics?

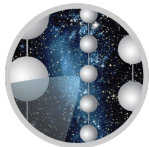Received masters degree in physics from Niels Bohr Institute (NBI) at Københavns Universitet.

Courses in python, statistics, particle physics and machine learning. A lot of python (and Zoom calls).

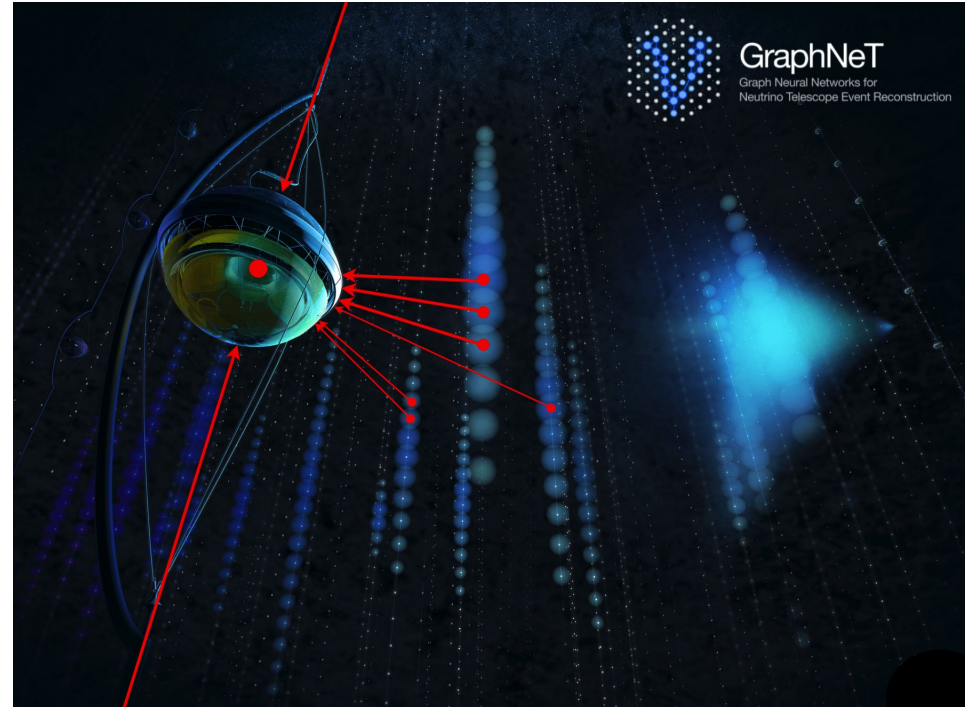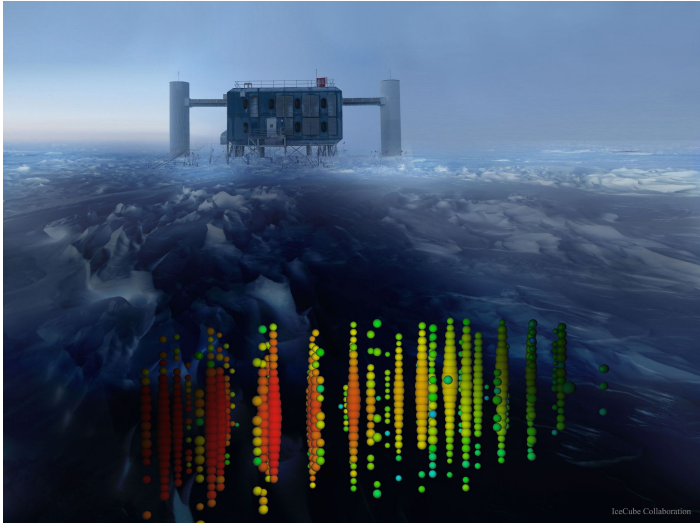Thesis in the IceCube South Pole Experiment group at NBI in "low" energy neutrino reconstruction.

KØBENHAVNS UNIVERSITET

IceCube
Neutrino Observatory

IceCube Work

Thesis titled "Stopped Muon Reconstruction In IceCube DeepCore.

Part of team deploying GNNs in the reco. of neutrinos and muons as they pass through the Antarctic ice sheet.

IceCube Collaboration

arxiv.org/abs/2209.03042

https://icecube.wisc.edu/news/research/2022/11/machine-learning-method-improves-reconstruction-and-classification-of-low-energy-icecube-events/
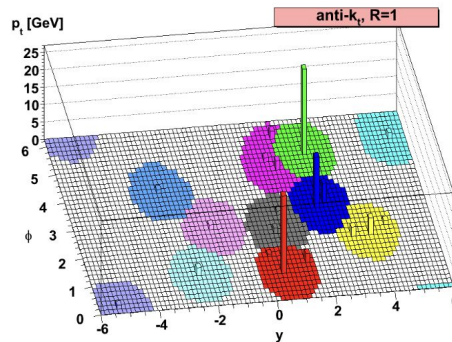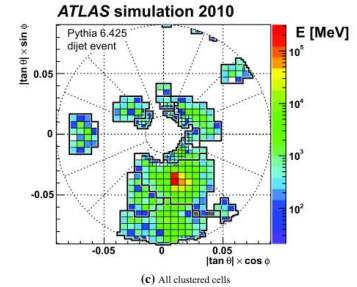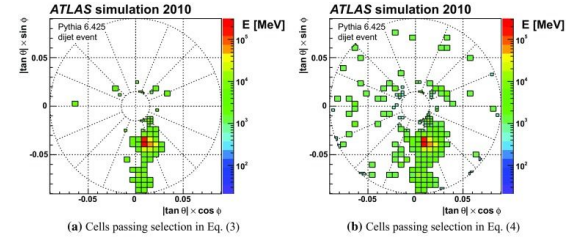
What am I doing now?

Explore ML alternatives to TopoClustering algorithm currently used in trigger.
Similar performance and noise resistance but faster.

Any method must overcome the challenges of the calorimeter - granularity, size and irregular geometry.

A 2-prong proposal: CNN + GNN
Identify RoIs with RPN, then find clusters inside RoIs as node classification task.

(a) Cells passing selection in Eq. (3)
(b) Cells passing selection in Eq. (4)
(c) All clustered cells

What else?

When I'm not doing physics

- Triathlon

- Outdoor swimming

- Camping

- Chess/board games

- Old movies

- Complaining about the weather?