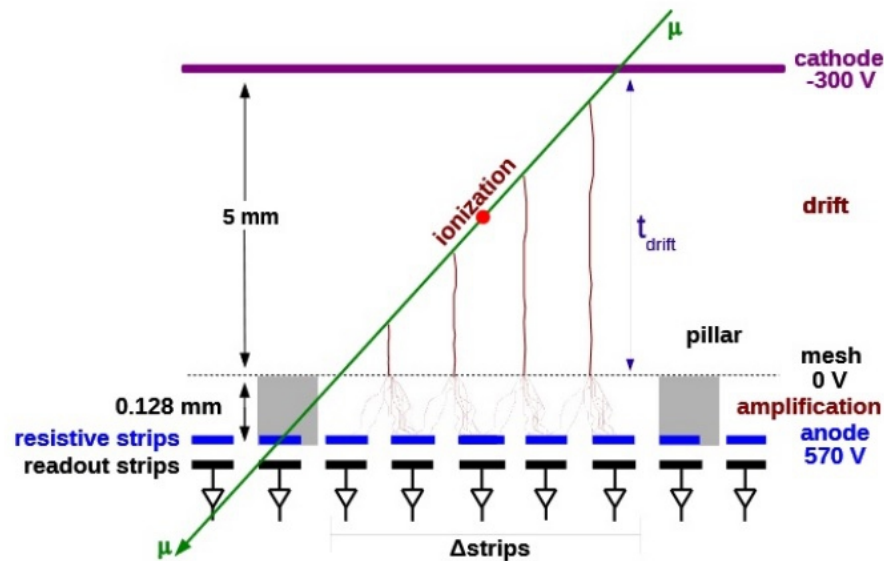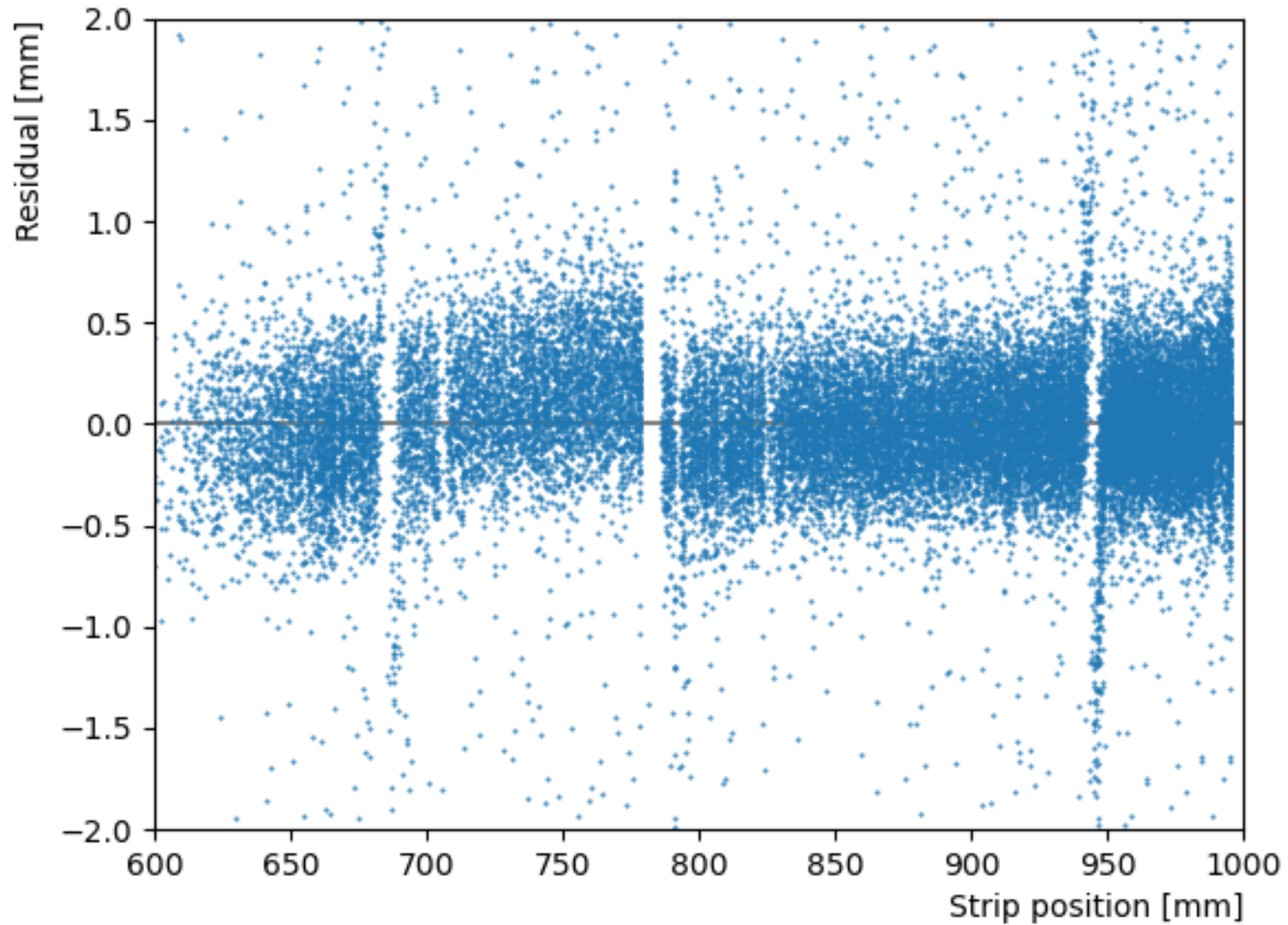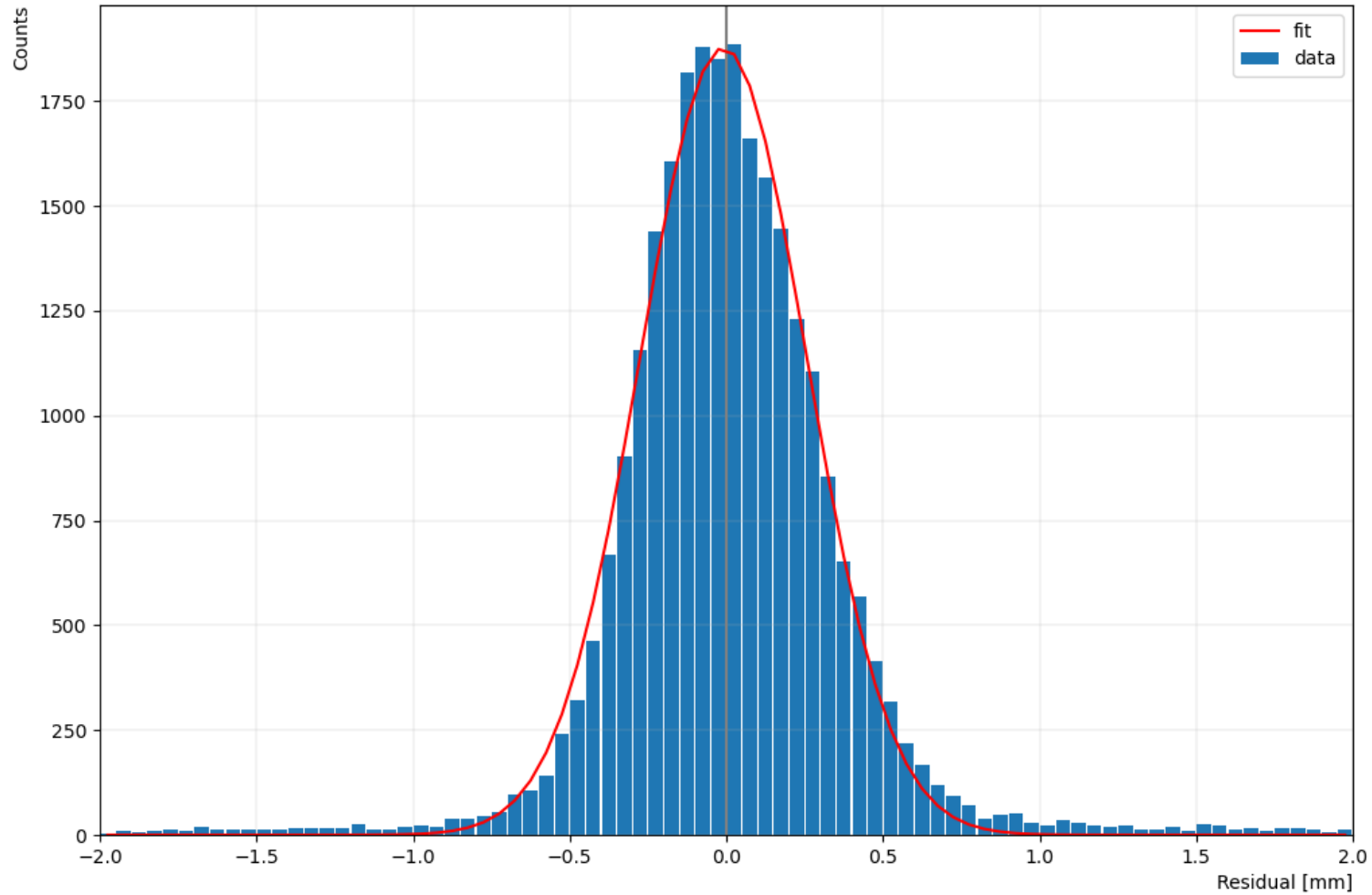# Particle track analysis with ML

Schematic of a resistive strip micromegas detector (taken from [Lösel, 2017]).

Train a neural network to reconstruct from a signal

Reconstruction for 29 degrees

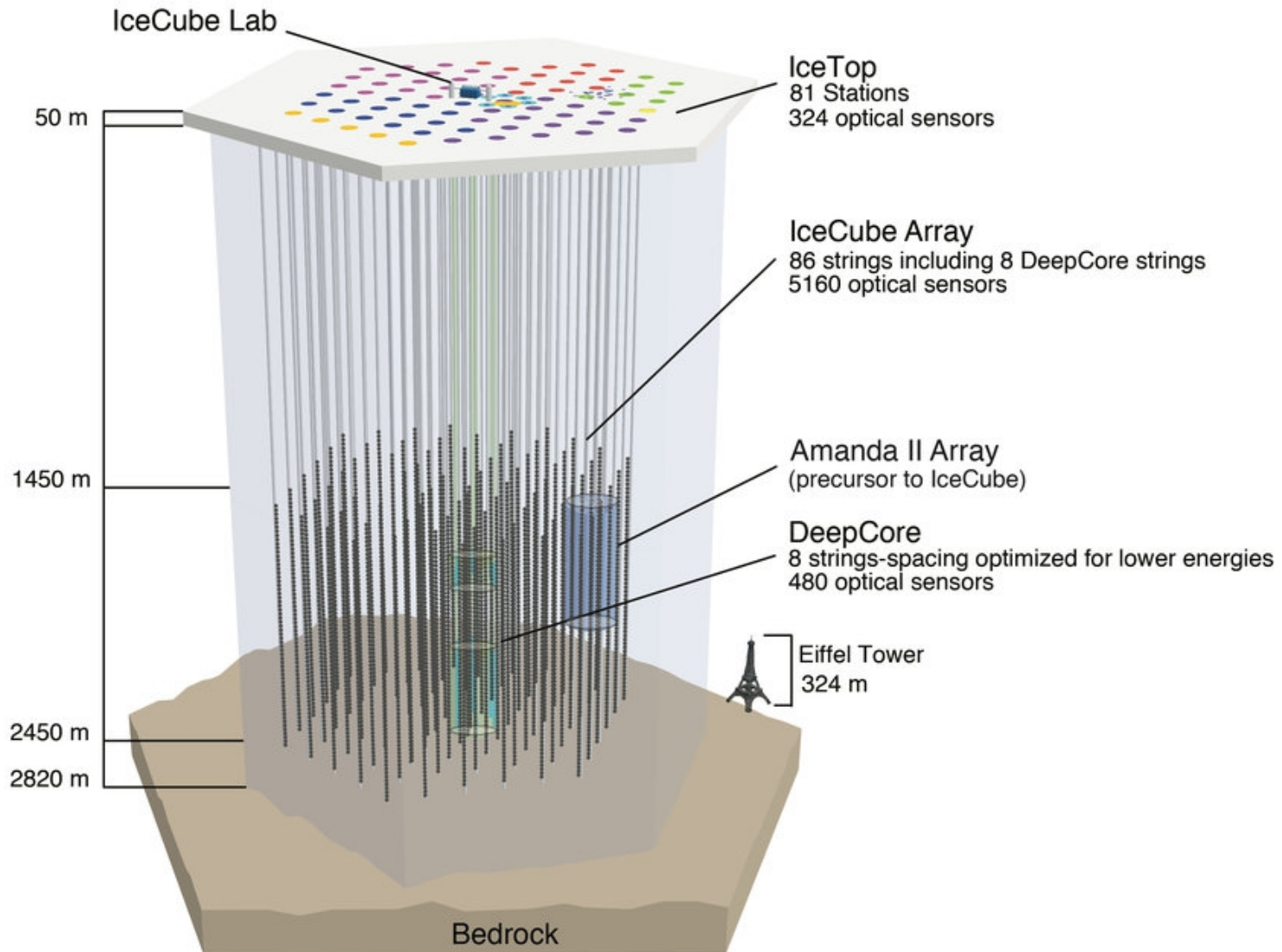# Reconstruction for 29 degrees

FWHM = 840 microns
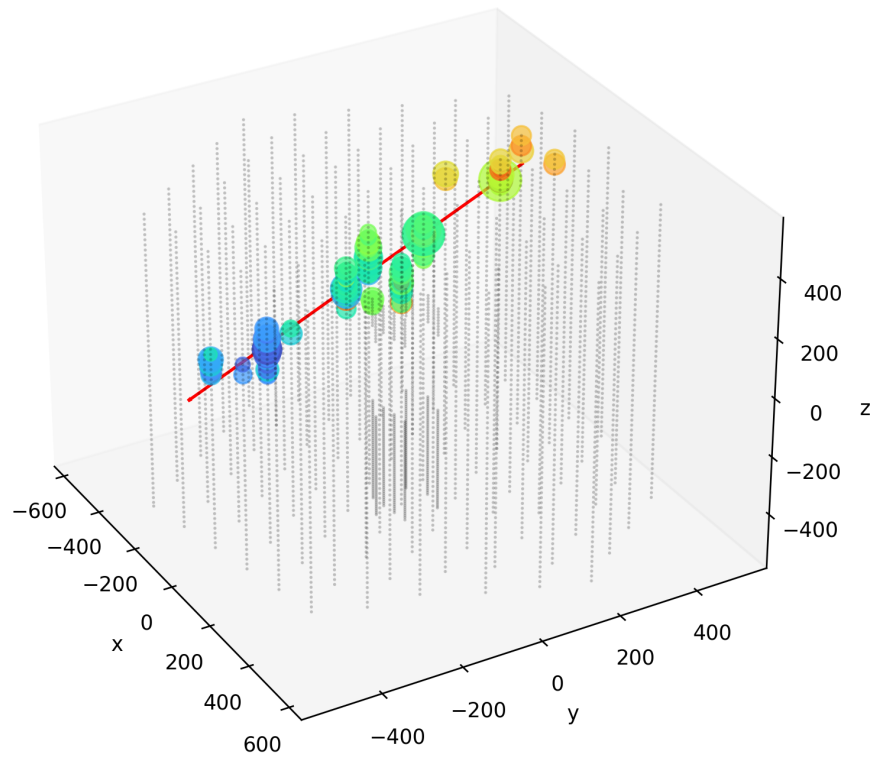
IceCube Neutrino Observatory
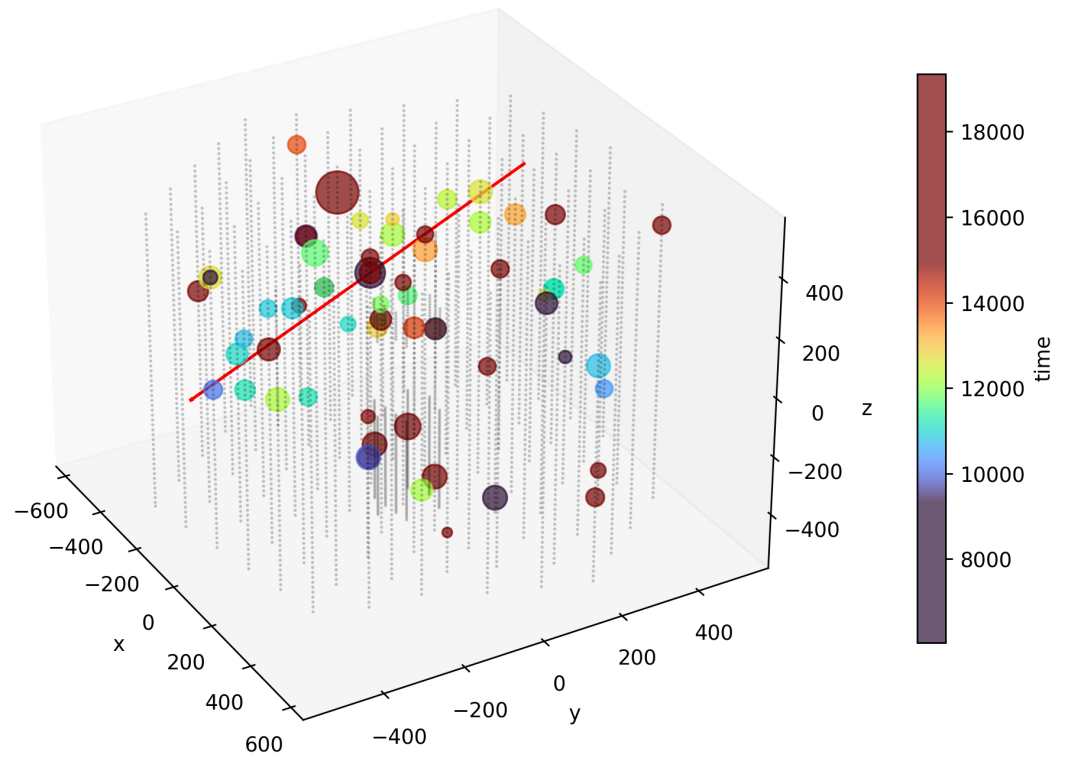
IceCube Neutrino Observatory

Event example

Example event from the dataset:
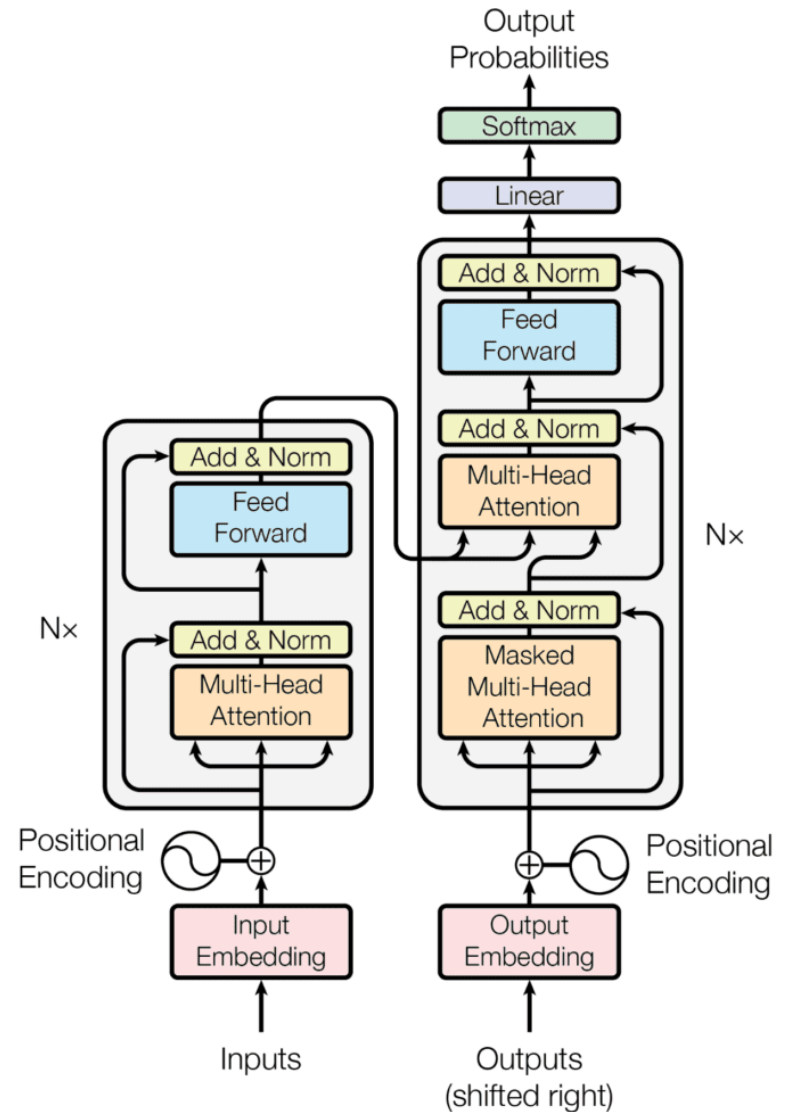(azimuth = 4.86 rad, zenith = 1.96 rad)

Kaggle deep learning tournament

- 6,437 Entrants
- 901 Participants
- 812 Teams
- 11,206 Submissions

- 3 months
- Total prize : $50,000

Best solutions use transformers

Transformer network
with attention
mechanism

Resolution 20% better
than with simple NN

Sources :

- https://en.wikipedia.org/wiki/IceCube_Neutrino_Observatory

- https://www.kaggle.com/competitions/icecube-neutrinos-in-deep-ice

- Paper on competition : https://arxiv.org/abs/2307.15289

- Paper on top 3 solutions : https://arxiv.org/abs/2310.15674

- Attention is all you need (2017) : https://arxiv.org/abs/1706.03762