"Advanced deep-learning applications in neutrino physics"
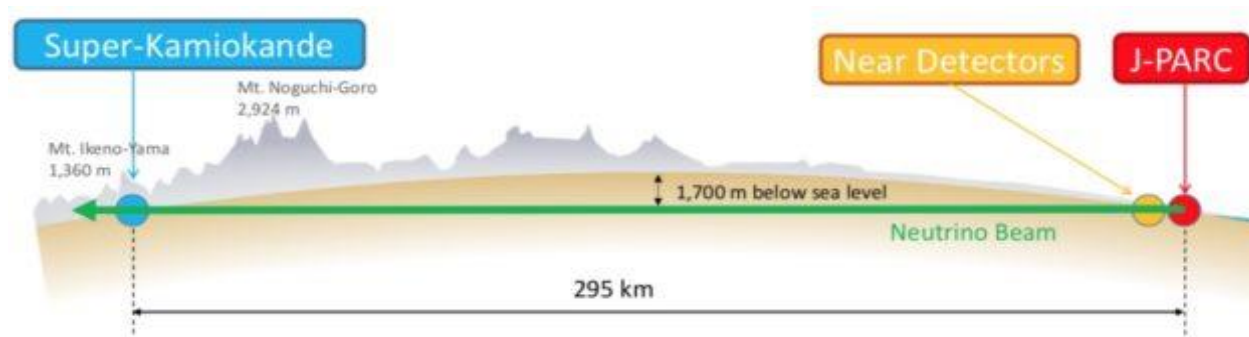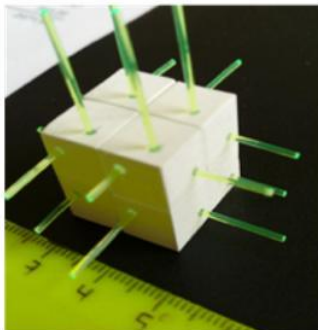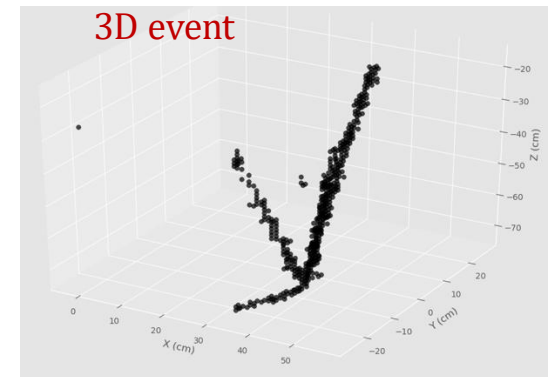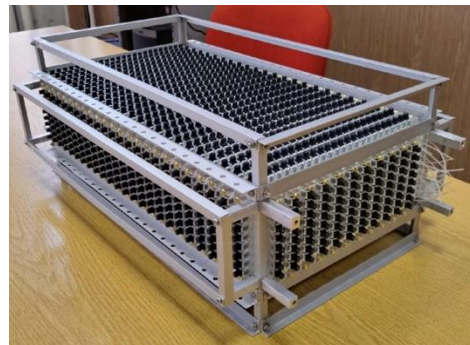
- T2K is an international neutrino oscillation experiment in Japan.

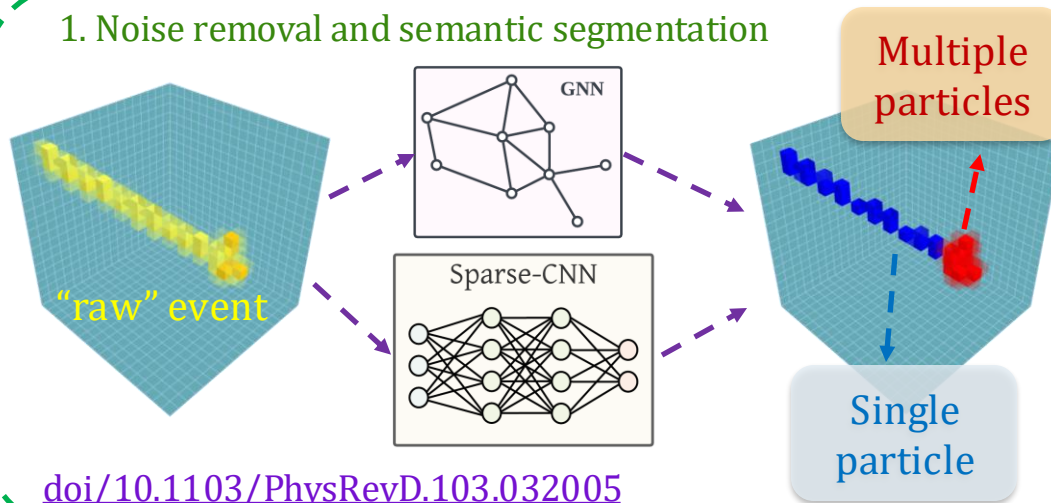- SuperFGD: main upgrade to the near detector.

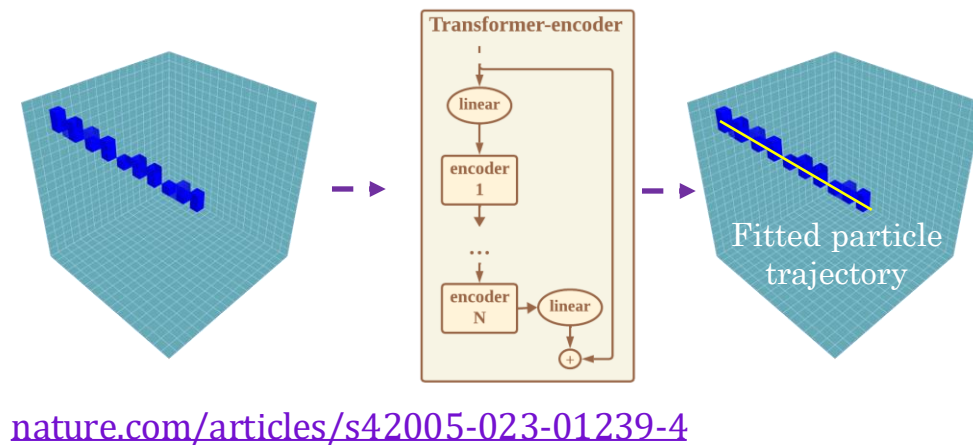
JINST 13 (2018) 02, P02006
NIM A936 (2019) 136-138

3D event

- 2M optically independent cubes, 1 cm^3 per cube.
- Spatial localisation of scintillation light.

Deep learning in the near detector

1. Noise removal and semantic segmentation

GNN

Sparse-CNN

"raw" event

Multiple particles

Single particle

doi/10.1103/PhysRevD.103.032005

2. Single-particle trajectory fitting

Transformer-encoder

linear

encoder 1

⋮

encoder N

linear

Fitted particle trajectory

nature.com/articles/s42005-023-01239-4

3. Multi-particle decomposition

Target event

Reconstructed event

Encoder

Decoder

Decomposing transformer

Decomposed particles

Reconstructed kinematics of each single particle

Generative Adversarial Network

nature.com/articles/s42005-024-01669-8