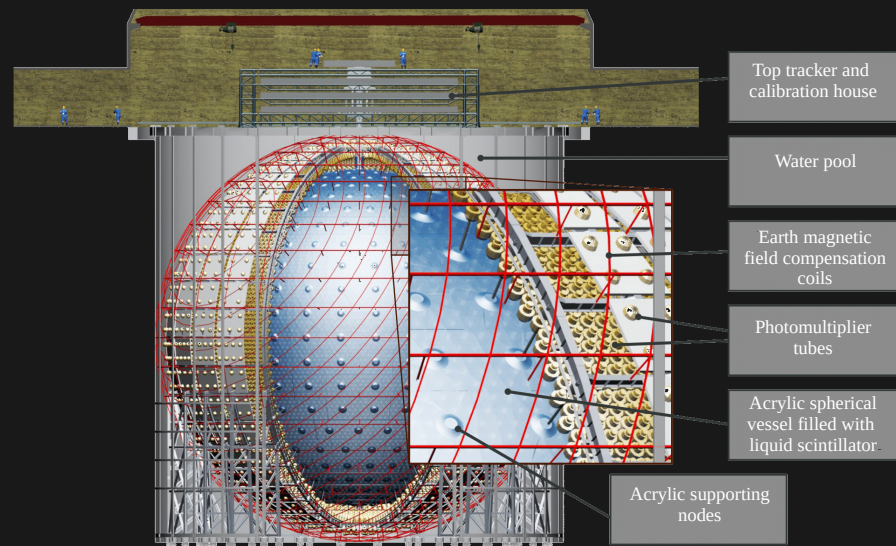# Machine Learning Techniques for Energy Reconstruction in JUNO experiment

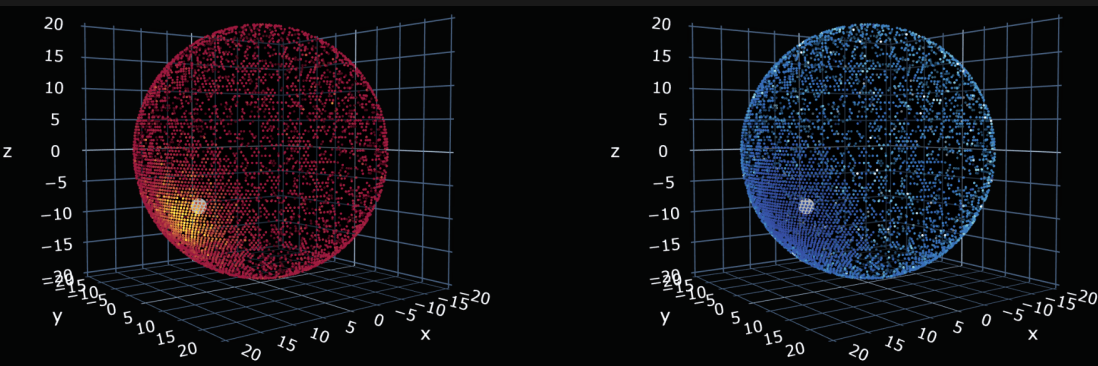Arsenii Gavrikov, Fedor Ratnikov on behalf of the JUNO collaboration

JUNO is a multipurpose experiment located in China with a broad physical program. The primary aims of JUNO are to determine the mass ordering of neutrino and to precisely measure of three oscillation parameters.

In this work, we present machine learning methods for neutrino energy reconstruction in JUNO. We consider following methods: Boosted Decision Trees (BDT) and Fully Connected Deep Neural Network (FCDNN), trained on aggregated features, calculated using information from the whole array of large PMTs.

Top tracker and calibration house

Water pool

Earth magnetic field compensation coils

Photomultiplier tubes

Acrylic spherical vessel filled with liquid scintillator

Acrylic supporting nodes

Avaliable information:

- Charge at each PMT;
- First Hit Time (FHT) at each PMT;
- PMT position.

We want to provide:

- Deposited energy Edep with a high energy resolution: 3% @ 1 MeV.

Summary:

- Designed a large set of aggregated features;
- Investigated their informational importance;
- Selected a subsets providing the same performance as the full set;
- Achieved required for the physics goals effective resolution: $\tilde{a} < 3\%$;
- The models have great computation speed;
- In addition, we considered three calibration sources for the future evaluation of the models on the real data.