Study of Mass Composition of Cosmic Rays with IceTop and IceCube

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1. What is this contribution about?

We present three machine-learning approaches aiming for cosmic ray (CR) mass composition.

2. Why is it relevant / interesting?

We combine surface (IceTop) and in-ice (IceCube) signals of CR events and individually introduce new input features (LLHR), a new network architecture (Graph Neural Network - GNN) and an extension to sub-PeV energies.

3. What have we done?

A random forest, a GNN (both high energy, regression) and a boosted decision tree (low energy, classification) are trained on CR Monte-Carlo data and tested.

4. What is the result?

Improved reconstruction methods utilizing state of the art machine learning will provide better mass composition sensitivity than previous publications and the composition analysis energy range will be expanded to a lower energy by including new sensitive variables and techniques.