

# Workshop on Machine Learning for Analysis of High-Energy Cosmic Particles



UNIVERSITY OF DELAWARE  
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Contribution ID: 28

Type: **Talk**

## Evaluation of energy reconstruction performance of the Telescope Array surface detector using a deep neural network and hybrid data (Remote)

*Wednesday, 29 January 2025 09:30 (30 minutes)*

Accurate reconstruction of Ultra-High-Energy Cosmic Ray (UHECR) properties is crucial for studying their origins and composition. In this work, we introduce a Deep Neural Network (DNN) model based on the AixNet architecture to reconstruct UHECR parameters using data from the Telescope Array surface detector (SD). The DNN predicts key parameters, such as energy, arrival direction, core position,  $X_{\max}$ , and primary mass, by analyzing both time traces and spatial correlations in the data. Monte Carlo simulations for four mass groups (proton, helium, CNO, and iron) indicate that the DNN enhances the resolution of energy, direction, and core position compared to standard methods. This improvement is expected to hold even with relaxed data quality criteria, potentially increasing the number of usable events. We present resolution estimates, systematic studies based on simulations, and validate the DNN's performance with hybrid data.

### Type of Contribution

talk

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**Session Classification:** Talks