

## Methods for antideuteron identification with the AMS-02 detector

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Cosmic ray (CR) antideuterons, although yet to be detected in space, represent a highly sensitive channel for probing new physics, including models related to Dark Matter. The identification of CR antideuterons poses significant challenges due to their limited abundance, with an expected flux approximately  $10^{-9}$  times lower than that of protons. The AMS-02 experiment, after 11 years of data collection, holds the potential for cosmic-ray antideuterons identification. However, the accurate characterisation and rejection of various backgrounds are crucial to achieve a good isotopic mass separation over a wide range of energies. Machine Learning methods, particularly Boosted Decision Trees, are well suited for this classification task, but their performance relies on the choice of the features needed for their training phase. While physics-driven feature selection methods based on the knowledge of the detector are often used, Machine Learning algorithms for automated feature selection can provide a helpful alternative that optimises the classification method's performance. In the talk, I will review the principal challenges in the search for antideuterons and show how to improve isotope identification with AMS-02 using Machine Learning feature selection algorithms.

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