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Cluster Scanning

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We propose a new model-independent method for new physics searches called Cluster Scanning. It uses the k-means algorithm to perform clustering in the space of low-level event or jet observables, and separates potentially anomalous clusters to construct a signal-enriched region. The spectra of a selected observable (e.g. invariant mass) in these two regions are then used to determine whether a resonant signal is present. A pseudo-analysis on the LHC Olympics dataset with a Z′ resonance shows that Cluster Scanning outperforms the widely used 4-parameter functional background fitting procedures, reducing the number of signal events needed to reach a 3σ significant access by a factor of 0.61. Emphasis is placed on the speed of the method, which allows the test statistic to be calibrated on synthetic data.

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