

## **Analyses together strong: Optimal combination of LHC new physics searches.**

The statistical combination of LHC results enables a greater understanding of what the observed data tell us about physics Beyond the Standard Model (BSM). In practice, it would allow us to derive stronger limits on BSM theories, to search for dispersed signals, as well as performing more comprehensive probes for deviations from the Standard Model. However, the combination of LHC analyses requires an exact knowledge of their correlation, which is certainly not straightforward to obtain. Nonetheless, we can determine if signal regions (SRs) from different analyses are approximately independent from each other by estimating the corresponding degrees of overlapping events; hence, can be trivially combined. Here, we present a novel stochastic method to determine such overlaps between SRs of different LHC new-physics searches. Also, we introduce a graph theory based method to efficiently find the optimal combination of approximately orthogonal SRs to constrain a given BSM theory. The benefits of the approach are demonstrated by deriving stronger limits on several new physics models of increasing complexity.

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