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Diagnosing Hidden Sectors with MATHUSLA and HL-LHC

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MATHUSLA is a proposed dedicated large-volume LLP detector, to be located on the surface above an LHC interaction point. Existing work suggests that in many circumstances MATHUSLA can determine the velocity of any detected LLPs with sufficient resolution to identify the bunch crossings at the main detector from which they originated. Under the assumption that MATHUSLA can identify the LLP production event, we study the possibility of combining MATHUSLA and main detector information to extract information about the LLP production topology and estimate BSM particle parameters. Using only a few simple, event-level variables, we show that in most circumstances the LLP production model can be correctly categorized into one of a few simplified topologies with high probability, with $O(100)$ detected LLPs.

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