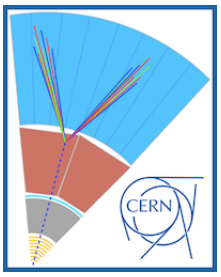

Contribution ID: **6** Type: **not specified**

Identifying the Origin of Long-Lived Particles with MATHUSLA and CMS (12'+3')

Thursday 19 November 2020 17:40 (15 minutes)

MATHUSLA is a proposed large-volume displaced vertex (DV) detector, situated on the surface above CMS and designed to search for long-lived particles (LLPs) produced at the HL-LHC. We show that a discovery of LLPs at MATHUSLA would not only prove the existence of BSM physics, it would also uncover the theoretical origin of the LLPs, despite the fact that MATHUSLA gathers no energy or momentum information on the LLP decay products. Our analysis is simple and robust, making it easily generalizable to include more complex LLP scenarios, and our methods are applicable to LLP decays discovered in ATLAS, CMS, LHCb, or other external detectors. In the event of an LLP detection, MATHUSLA can act as a Level-1 trigger for the main detector, guaranteeing that the LLP production event is read out at CMS. We perform an LLP simplified model analysis to show that combining information from the MATHUSLA and CMS detectors would allow the LLP production mode topology to be determined with as few as ~100 observed LLP decays. Underlying theory parameters, like the LLP and parent particle masses, can also be measured with ⊠10% precision. Together with information on the LLP decay mode from the geometric properties of the observed DV, it is clear that MATHUSLA and CMS together will be able to characterize any newly discovered physics in great detail.

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