Many beyond the Standard Model (BSM) scenarios postulate the existence of new long-lived particles, leading to interesting experimental signatures such as, e.g., highly displaced decays. Examples of such portals appear both at the renormalizable and non-renormalizable levels and are often assumed, for simplicity, to have minimal content of new physics species required to study their phenomenology. Going beyond such most simplified models, however, is typically more theoretically appealing and can lead to other interesting effects. In particular, large couplings in the dark sector can induce efficient interactions, in which new particles can scatter and change their identity in front of the detector. This leads to an interplay between short and long-lifetime regimes. We illustrate the prospects of such searches in representative CERN-based experiments FASER, SHiP and MATHUSLA for their identity in front of the detector. This leads to an interplay between short and long-lifetime regimes.