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Emerging Triggers: Creating a Safe Space for Dark Matter (G)*

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Our current knowledge of particle physics is best described by the standard model (SM). Despite this, astronomical observations of dark matter made over the past few decades mean that the SM must be incomplete. New models are now motivating the possibility of dark matter being governed by the an extended $SU(3)$ gauge theory resembling Quantum Chromodynamics (QCD) for the strong force. This model includes a stable dark baryon, similar to the proton, as a possible dark matter candidate. If these dark hadrons are accessible at the LHC the dark analogue to the quark will produce a parton shower throughout the detector volume, eventually fragmenting into jets of invisible (dark) colour singlet hadrons. When the unstable particles eventually decay into visible quarks/leptons, a novel jet structure will be seen displaced from the proton-proton collision vertex, termed an 'emerging jet'. With the experiments at CERN producing enormous amounts of data per collision, triggers are implemented for reducing the data by means of vetoing events that deviate from a set of pre-defined criteria. These triggers could potentially throw away an interesting signal if not properly optimized. We use existing triggers, alone and in combination, in obtaining the maximum detected efficiency of an emerging jets signal. The same tools that are familiar for QCD are used to simulate these processes under identical conditions at the ATLAS & CMS experiments. Alongside simulating highly energetic, simple 'toy' processes, interactions with added particle radiation give a better gauge to the complicated dynamics of the theory. The extracted efficiencies corresponding to various triggers will be presented. Finally, new methods of signal discrimination will be discussed for a variety of models.

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