Task 1.6

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New physics scenarios and SM properties as trigger benchmarks

Identify BSM scenarios and signatures to be used as benchmarks for the assessment of new-generation triggers performance, aligned with WP2/3, in close collaboration with the experiments

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Indico: https://indico.cern.ch/category/18030/

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Work plan

- Hire of dedicated fellow and formal start of work in 2025
- Preliminary discussions led by **Joe Davighi** and **Matthew McCullough** (TH) with ATLAS and CMS reps
- Target models well-motivated for BSM (not just “simplified models” for the signature), in particular related to
  - Dark Matter
  - Flavour puzzle
  - Neutrino masses

Follow some examples

LLP-derived leptons

- Two or more displaced e/μ (eg from dark mediator $A \to \ell\ell$ with $m_A \gtrsim 2m_\ell$), possibly from distinct decay vertices (as in eg charged LLP pair-production, with $\text{LLP} \to \ell X^0$)
- Prompt + displaced leptons
  - eg $pp \to A \xrightarrow{fast} \ell_1\chi_1 \ (\chi_1 \xrightarrow{slow} \chi_2\ell_2)$, from models with gauged lepton number, possibly lepton-flavour non-universal
  - For explicit relevant models, see eg https://arxiv.org/pdf/2205.04473.pdf and https://arxiv.org/pdf/2105.06918.pdf
- Late-appearing leptons

Soft stuff

- Ultra-slow particles, out-of-time decays with a peaked in-time signal
  - eg heavy mediator A, with $pp \rightarrow A \rightarrow \phi\phi$, $pt(A) \ll m_A$, $m_A \approx 2m_\phi$
  - decay driven by interaction with the oscillating vev of a bkg scalar (see eg https://arxiv.org/abs/2007.03662)

High multiplicity, low-energy, heavy flavour

- See eg https://arxiv.org/pdf/1902.05535.pdf for models' framework
- Typically beyond sensitivity of current triggers
- Large multiplicity of soft b-jets (n>5), eg from multiple associate production of $Z' \rightarrow bb$
- Multiple soft taus , with charge tagging and sensitivity to $\tau^+ \tau^+ \tau^+$ vs $\tau^+ \tau^+ \tau^-$