Timing: Requirements On Precise Timing Measurements

BSM

Timing in the BMS group - thoughts

- Neutral long-lived particles:
  - A heavy neutral decaying in the muon detector (or at the end of calorimeter). Timing in the muon detector will be useful to gain rejection wrt e.g. cosmics and to determine signal existence from matching mass with momentum and time-of flight
- Charged long-lived heavy particles:
  - 15 ns time-of-flight of a muon to muon detector (assuming it is 5m away from vertex) a heavy particle would take longer, depending on momentum
  - Example: GMSB slepton NLSP (https://arxiv.org/abs/hep-ph/0010081) or exotic Higgs decays
  - To think about:
    - Is there any BSM relevant for FCC which could produce such signature
      - Limits obtained at the LHC: e.g. arXiv:1211.1597, can one concoct a model with this signature which escapes LHC limits?
    - Is there any gain wrt measure of ionisation in the inner detector?

Timing in the BMS group - in the practical sense

- Timing is a great tool to reject background in long-lived particle searches
  - In the case of FCC less so against PU, but still useful
- Technical issues to study:
  - Timing window of sensitivity of detector

- The natural case to profit from timing information within the BSM group → The LLP group
  - Already discussed in the context of ALPs studies
  - We want to test timing as a tool to identify photons from ALP decays:
    - Later arrival times at the calorimeter than those expected for a photon produced promptly at the PV
  - Timing in displaced jets? → could be used for exotic Higgs decays