PODAS Long exercise: EXO Long Lived

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Introduction

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- Search for LLP with long lifetimes (>1 m) decaying in the muon system
- \circ CSC and DT as sampling calorimeters \rightarrow showers of hits
- \circ New object: clusters of hits \rightarrow zero background, excellent sensitivity
- $\circ \quad \mbox{We'll look at Run3 data}$
- Hard and interesting part: CSC/DT hits available only in RAW data format!
 - RAW typically on TAPE
 - Muon detector shower is a non standard object!

Exercise ideas

Low-level analysis:

- Perform the muon shower hits clustering
 - Avoid running on RAW with CRAB, we will provide smaller ntuples with hits already pre-processed
 - Need to discuss if we want to do it on condor (or at a smaller scale)
- Identify the optimal algorithm (tune the radius for CA, compare to DBSCAN)
- Few ideas for some ML applications (depends on how the analysis goes by October)
- Will probably rely on C++ macros (no CMSSW, TBD)
- More interesting and non-standard but harder to set up, will need some work
- Pre-requisites: ML (if we decide to apply it, TBD)

High-level analysis:

- Inspect features of muon showers
- Build optimal ABCD plane for background prediction
- Extract limits and compare sensitivity of different categories (CSC vs DT)
- Jupyter notebooks
- Simple to set-up but more "standard" methods
- Pre-requisites: combine



Muon system material map



CSC analysis

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CSC analysis

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