

The Game

ISTAPP11, final day

Main Goal

- To let you analyse “data” the way you would analyse data from an actual machine.
- A fun way to practise the concepts you learned in the last couple of days.
- If you did the homeworks, there is nothing to stop you...

Rules

- You will be provided with 3 blackboxes in the form of ROOT files.
- Search for some BSM signal in the boxes. Look for new particles or some sort unusual behaviour.
- You are allowed to work in groups, and free to use whatever sources you like. If you work in groups, each member might be randomly chosen to present the group's results, so be ready.

About the Boxes

- Each of the boxes represent some interesting scenarios we might see at the LHC.
- They have been produced by using PGS4 as the detector simulator, whose output format is the LHCO format we discussed in our lectures.
- The LHCO files were converted to ROOT files using ExRootAnalysis.
- You can ignore the trigger words provided by PGS4 – the trigger for each box will be told to you in advance.

Box 1

- Trigger: High P_T electrons
- This box contains events that were triggered by high-momentum electrons. Analyze them to find out what sort of decay(s) they are coming from. Assuming the events originate from quark-antiquark interactions, draw the possible tree-level Feynman diagrams for the process(es). If you think you have beyond-SM physics, estimate the statistical significance for your discoveries.

Box 2

- Trigger: High- P_T electrons and muons
- Study these events triggered by high-momentum leptons and try to find out the physics processes that lie behind them. Since these events are coming from p-p collisions, what could the tree-level Feynman diagrams look like?

Box 3

- Trigger: High P_T jets
- The events in this box have been triggered by pairs of high-momentum jets. While studying these events, we have also seen that there are relatively high-momentum leptons as well. Find out from the decays of which particle(s) these come from. Draw the relevant tree-level Feynman diagrams.

Bonus Question

- What can you say about the kinds of the particle(s) you discovered in box1?