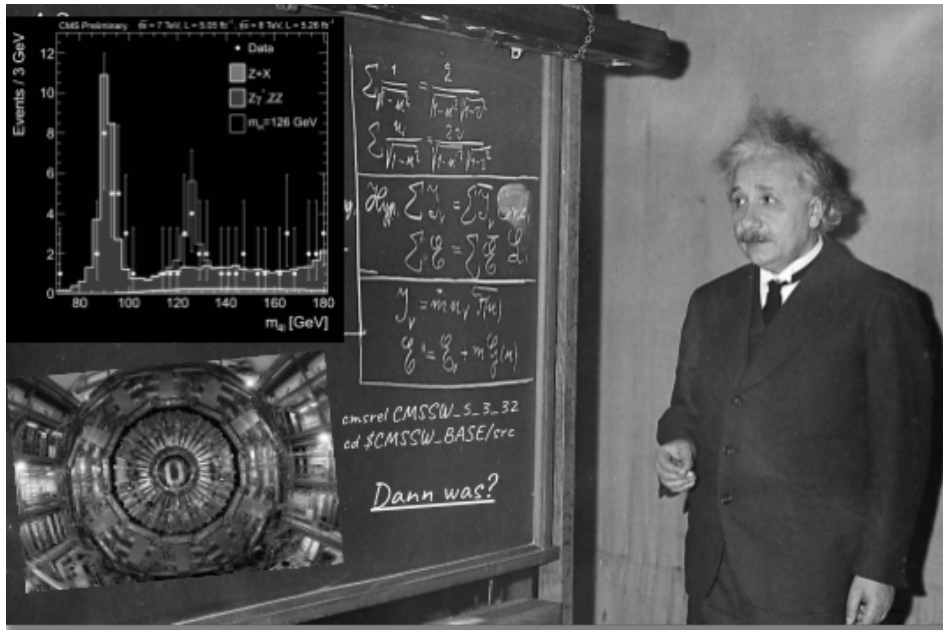


REMOTE CMS Open Data Workshop for Theorists at the LPC



Report of Contributions

Contribution ID: 1

Type: **not specified**

Welcome and orientation

Wednesday 30 September 2020 08:30 (30 minutes)

Contribution ID: 2

Type: **not specified**

Live Presentation: Workshop Introduction

Wednesday 30 September 2020 09:00 (45 minutes)

Presenter: LASSILA-PERINI, Kati (Helsinki Institute of Physics (FI))

Contribution ID: 3

Type: **not specified**

Live Hands-on lesson: Dataset scouting

Wednesday 30 September 2020 10:00 (45 minutes)

This lesson is designed to teach you how to use the command-line to explore the directories where the data is stored. In this way, you can see what triggers were applied when the data was taken and what Monte Carlo samples are available for the run period you are interested in.

You'll also be shown how to do a first-order inspection of some of these datafiles, just to see what is stored in them.

Presenter: BELLIS, Matthew (Cornell University/Siena College (US))

Contribution ID: 4

Type: **not specified**

Live Hands-on lesson: Trigger manipulation

Wednesday 30 September 2020 10:45 (1h 15m)

In this lesson you will:

- learn what the CMS trigger system is
- learn how to select and understand triggers for you analysis
- learn how to obtain trigger prescales and acceptance bits

Presenter: CARRERA JARRIN, Edgar Fernando (Universidad San Francisco de Quito (EC))

Contribution ID: 5

Type: **not specified**

Async Demo: Physics objects

Wednesday 30 September 2020 12:15 (45 minutes)

In this video tutorial we will introduce you to CMS particle flow and physics objects. Later, in the afternoon, you will dive into the code. Enjoy!

A youtube video link is attached as well as the slides presented in it.

Presenter: HOGAN, Julie (Brown University, Bethel University (US))

Contribution ID: 6

Type: **not specified**

Async Hands-on lesson: Physics objects I

Wednesday 30 September 2020 14:30 (1h 30m)

When a physicist approaches an analysis using CMS data, they typically rely on the reconstruction algorithms developed by CMS to interpret detector signals into meaningful physics objects. In code, the result of these reconstruction algorithms takes the form of several C++ classes that will be introduced briefly in this lesson. The content of the C++ class reflects the nature of the physics object it represents.

In this lesson we will study several fundamental particles: muons, electrons, photons, and tau leptons. The first three particles are special in CMS, because they are reconstructed as single “particle-flow candidates”. The Particle Flow algorithm (CITE ME) combines detector signals from multiple CMS subdetector systems to categorize all energy deposits as muons, electrons, photons, neutral hadrons, or charged hadrons. Tau leptons are more complex because they are not stable and have several detector signatures that include muons, electrons, photons, and/or hadrons. In the next lesson we will approach even more complex objects such as jet and missing transverse energy.

After exploring the code elements that are common to all CMS physics objects we will look at muons, electrons, photons, and tau leptons in more detail to understand the options for identifying these particles in your analysis. The final episode (MAYBE IN SELECTION LESSON?) will show how an analyzer can combine different identification elements into selection criteria.

Presenter: HOGAN, Julie (Brown University, Bethel University (US))

Contribution ID: 7

Type: **not specified**

The Future is Open: Adventures with Public Collider Data

Wednesday 30 September 2020 16:00 (1 hour)

Fermilab employees and users can access the Zoom link below (Services login required):

<https://fermipoint.fnal.gov/org/ood/LabLeadership/Shared%20Documents/Zoom%20link%20for%20colloquium.docx?d=wd>

Please note: you will need the passcode to enter the zoom

Anyone else can obtain the Zoom link the day of the colloquium by emailing Barb Kronkow at kronkow@fnal.gov

In November 2014, the CMS experiment at the Large Hadron Collider made the unprecedented move of releasing research-grade particle physics data for unrestricted use. I am a theoretical particle physicist, and for the first time, I had access to real collision data from a cutting-edge experiment, as well as an opportunity to demonstrate the scientific value of public data access. Over the past six years, my research group has carried out a number of innovative analyses using the CMS Open Data. In this colloquium, I highlight some of our research successes as well as some of the challenges we faced using public collider data to explore physics in and beyond the Standard Model.

Presenter: THALER, Jesse (MIT)

Contribution ID: 8

Type: **not specified**

Live Hands-on lesson: Physics objects II - Jets and MET

Thursday 1 October 2020 08:30 (1h 30m)

Jets and missing transverse energy (MET) are critical for CMS physics analyses. They are more complex than most of the objects we discussed in the previous lesson, because they are reconstructed using multiple particle-flow candidates. After all candidates have been built from the tracks and energy deposits in CMS, they can be “clustered” using a variety of algorithms into composite objects called “jets”. Missing transverse energy clusters, in a sense, all candidates in the entire detector: it is the negative vector sum of the momentum of all candidates.

In this lesson we will explore the basic utilities for jets and MET, how to identify jets that arise from interesting original particles such as bottom quarks, and possibly how to correct jets and MET for differences between data and simulation.

Author: HOGAN, Julie (Brown University, Bethel University (US))

Co-authors: SIMPSON, Farrah (Brown University (US)); PERVAN, Nikolas (Brown University (US))

Presenters: SIMPSON, Farrah (Brown University (US)); HOGAN, Julie (Brown University, Bethel University (US)); PERVAN, Nikolas (Brown University (US))

Contribution ID: 9

Type: **not specified**

Live Hands-on lesson: Pre-selection and skimming

Thursday 1 October 2020 10:15 (1 hour)

In this lesson we will review the CMS data flow and summarize the selections that have been made up through the NanoAOD production. We will also go over how to produce your own set of NanoAOD files, though this will not be required to continue with the workshop.

Author: HOGAN, Julie (Brown University, Bethel University (US))

Co-authors: SIMPSON, Farrah (Brown University (US)); PERVAN, Nikolas (Brown University (US))

Presenters: SIMPSON, Farrah (Brown University (US)); HOGAN, Julie (Brown University, Bethel University (US)); PERVAN, Nikolas (Brown University (US))

Contribution ID: **10**

Type: **not specified**

Live Hands-on lesson: Object ID and selection.

Thursday 1 October 2020 11:15 (30 minutes)

With physics object prepared and NanoAOD files created, we are ready to begin thinking about an actual physics analysis!

In the previous exercises, you learned how to access and store object information from an AOD file and convert the AOD file to NanoAOD. The Events tree within the NanoAOD files contains all the derived information required for many searches or measurements. We will study a search for the Higgs boson in the tau tau decay channel –you can go back to the pre-exercises to find the published paper.

Author: HOGAN, Julie (Brown University, Bethel University (US))

Co-authors: SIMPSON, Farrah (Brown University (US)); PERVAN, Nikolas (Brown University (US))

Presenters: SIMPSON, Farrah (Brown University (US)); HOGAN, Julie (Brown University, Bethel University (US)); PERVAN, Nikolas (Brown University (US))

Contribution ID: 11

Type: **not specified**

Live Hands-on lesson: Plotting and interpretation

Thursday 1 October 2020 12:00 (1 hour)

This exercise will walk you through the process of making some basic plots, once you have skimmed some data and produced ROOT files. We'll make these plots using ROOT and calling ROOT from python using the PyROOT module. Note, that you could choose other approaches to making plots, such as using matplotlib, but the ROOT files need to be accessed with ROOT or uproot so we'll stick with ROOT for now.

Once we've made the plots, we'll spend some time examining them and trying to interpret the distributions so that we can develop some intuition for how things look.

Presenter: BELLIS, Matthew (Cornell University/Siena College (US))

Contribution ID: 12

Type: **not specified**

Async Demo: Luminosity and data quality.

Thursday 1 October 2020 14:30 (45 minutes)

Welcome. In this lesson you will:

learn what luminosity is and why it's important

learn how luminosity is measured

learn how to calculate luminosity

Presenter: MCCAULEY, Thomas (University of Notre Dame (US))

Contribution ID: 13

Type: **not specified**

Async Hands-on lesson: Efficiency Studies using the Tag and Probe Method

Thursday 1 October 2020 15:15 (1h 45m)

Presenters: DA SILVA JALES, Allan (Universidade do Estado do Rio de Janeiro (BR)); GAEHTGENS, Thomas

Contribution ID: 14

Type: **not specified**

Live Demo: CMS analysis in the cloud

Friday 2 October 2020 08:30 (2 hours)

Author: LANGE, Clemens (CERN)

Co-author: LINTULUOTO, Adelina Eleonora (University of Helsinki (FI))

Presenters: LINTULUOTO, Adelina Eleonora (University of Helsinki (FI)); LANGE, Clemens (CERN)

Contribution ID: 15

Type: **not specified**

Live Hands-on lesson: CMS analysis in the cloud

Friday 2 October 2020 10:45 (1 hour)

Author: LANGE, Clemens (CERN)

Co-author: LINTULUOTO, Adelina Eleonora (University of Helsinki (FI))

Presenters: LINTULUOTO, Adelina Eleonora (University of Helsinki (FI)); LANGE, Clemens (CERN)

Contribution ID: 16

Type: **not specified**

Live Hands-on lesson: Background estimation - the ABCD method

Friday 2 October 2020 12:00 (1 hour)

Presenter: LAURILA, Santeri (CERN)

Contribution ID: 17

Type: **not specified**

Live Featured Demo: ADL

Friday 2 October 2020 14:30 (30 minutes)

Presenter: SEKMEN, Sezen (Kyungpook National University (KR))

Contribution ID: **18**

Type: **not specified**

Wrap up and time for discussion

Friday 2 October 2020 15:00 (2 hours)