# CMS Physics Object & Data Analysis School (PO&DAS) 2023



# **Report of Contributions**

Registration

#### Contribution ID: 1

Type: not specified

# Registration

Monday 9 October 2023 09:00 (1h 30m)

Tracker

Contribution ID: 2

Type: not specified

#### Tracker

Tuesday 10 October 2023 11:00 (2 hours)

**Presenters:** Dr CARDINI, Andrea (CMS (CMS Fachgruppe HIGGS)); VAGNERINI, Antonio (DESY); PE-TERSEN, Henriette (CMS (CMS Fachgruppe TOP))

Calorimeter

Contribution ID: 3

Type: not specified

#### Calorimeter

*Tuesday 10 October 2023 11:00 (2 hours)* 

**Presenters:** COUDERC, Fabrice; WANG, Long **Session Classification:** DPG exercises

Muon chambers

Contribution ID: 4

Type: not specified

# **Muon chambers**

*Tuesday 10 October 2023 11:00 (2 hours)* 

**Presenters:** SHARMA, Archana (Panjab University, Chandigarh); WANG, Jian **Session Classification:** DPG exercises

Triggers

Contribution ID: 5

Type: not specified

#### Triggers

Tuesday 10 October 2023 11:00 (2 hours)

The trigger exercise will introduce students to calculating trigger efficiencies, using two different methods. Figuring out the trigger efficiency is a necessary step in most analyses, so this exercise will be broadly applicable to every student, regardless of their physics topic. This exercise will make use of CMSSW, nanoAOD, and SWAN.

**Presenters:** LOBANOV, Artur (Universität Hamburg); ALIMENA, Juliette (CMS (CMS Fachgruppe Searches))

CMS Physics Obj  $\ldots \ /$  Report of Contributions

Tracker

Contribution ID: 6

Type: not specified

#### Tracker

Wednesday 11 October 2023 10:45 (2 hours)

Calorimeter

Contribution ID: 7

Type: not specified

# Calorimeter

Wednesday 11 October 2023 10:45 (2 hours)

Muon chambers

Contribution ID: 8

Type: not specified

# Muon chambers

Wednesday 11 October 2023 10:45 (2 hours)

CMS Physics Obj  $\dots \ /$  Report of Contributions

Triggers

Contribution ID: 9

Type: not specified

## Triggers

Wednesday 11 October 2023 10:45 (2 hours)

The trigger exercise will introduce students to calculating trigger efficiencies, using two different methods. Figuring out the trigger efficiency is a necessary step in most analyses, so this exercise will be broadly applicable to every student, regardless of their physics topic. This exercise will make use of CMSSW, nanoAOD, and SWAN.

CMS Physics Obj  $\ldots \ /$  Report of Contributions

Tracker

Contribution ID: 10

Type: not specified

## Tracker

Thursday 12 October 2023 10:30 (2 hours)

Calorimeter

Contribution ID: 11

Type: not specified

# Calorimeter

Thursday 12 October 2023 10:30 (2 hours)

Muon chambers

Contribution ID: 12

Type: not specified

# Muon chambers

Thursday 12 October 2023 10:30 (2 hours)

CMS Physics Obj  $\dots \ /$  Report of Contributions

Triggers

Contribution ID: 13

Type: not specified

### Triggers

Thursday 12 October 2023 10:30 (2 hours)

The trigger exercise will introduce students to calculating trigger efficiencies, using two different methods. Figuring out the trigger efficiency is a necessary step in most analyses, so this exercise will be broadly applicable to every student, regardless of their physics topic. This exercise will make use of CMSSW, nanoAOD, and SWAN.

Tracker

Contribution ID: 14

Type: not specified

#### Tracker

Friday 13 October 2023 10:30 (2 hours)

Calorimeter

Contribution ID: 15

Type: not specified

# Calorimeter

Friday 13 October 2023 10:30 (2 hours)

Muon chambers

Contribution ID: 16

Type: not specified

# Muon chambers

Friday 13 October 2023 10:30 (2 hours)

Triggers

Contribution ID: 17

Type: not specified

# Triggers

Friday 13 October 2023 10:30 (2 hours)

Intro

Contribution ID: 18

Type: not specified

#### Intro

Monday 9 October 2023 10:30 (20 minutes)

Presenter: CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS)

Session Classification: Plenaries

Muon chambers

Contribution ID: 21

Type: not specified

# **Muon chambers**

Session Classification: Plenaries

Anomaly detection

Contribution ID: 29

Type: not specified

# Anomaly detection

Monday 9 October 2023 13:30 (2 hours)

**Presenters:** MOUREAUX, Louis (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); LAM-BRECHT, Luka

SciKit learn

Contribution ID: 30

Type: not specified

#### SciKit learn

Monday 9 October 2023 13:30 (2 hours)

**Presenter:** KOMM, Matthias (CMS (CMS Fachgruppe Searches))

RDataFrame

Contribution ID: 31

Type: not specified

#### RDataFrame

Monday 9 October 2023 13:30 (2 hours)

**Presenter:** CHOWDHURY, Suvankar

Git

Contribution ID: 32

Type: not specified

#### Git

Monday 9 October 2023 13:30 (2 hours)

**Presenters:** EL-MORABIT, Karim (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); STI-ETZ, Lars Olaf (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); BEIN, Samuel (University of Hamburg)

Columnar analysis

Contribution ID: 33

Type: not specified

#### **Columnar analysis**

Monday 9 October 2023 13:30 (2 hours)

This exercise introduces the basics of columnar data analysis in the Python Scientific Ecosystem using the nanoAOD data format used by CMS. Columnar analysis here means processing high energy physics data in a vectorized way, giving potentially large speedups compared to traditional loop-based computing. The students will use the Python packages awkward, uproot and coffea to read and explore a nanoAOD event file, understand its format as well as its documentation, compute high-level variables, select events with simple cuts, as well as fill and plot histograms of the events.

**Presenter:** JEPPE, Laurids (CMS (CMS Fachgruppe TOP))

ROOT

Contribution ID: 34

Type: not specified

#### ROOT

Monday 9 October 2023 13:30 (2 hours)

**Presenter:** VAGNERINI, Antonio (DESY) **Session Classification:** Topical exercises

MC techniques

Contribution ID: 35

Type: not specified

#### **MC techniques**

Tuesday 10 October 2023 14:00 (2 hours)

**Presenters:** MENDIZABAL MORENTIN, Mikel (DESY); GIANNEIOS, Paris; KOSMOGLOU KIOSEOGLOU, Polidamas Georgios

Combine

Contribution ID: 36

Type: not specified

#### Combine

Tuesday 10 October 2023 14:00 (2 hours)

**Presenters:** NIGAMOVA, Aliya (University of Hamburg); KEICHER, Philip Daniel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Columnar analysis

Contribution ID: 37

Type: not specified

#### **Columnar analysis**

Tuesday 10 October 2023 14:00 (2 hours)

**Presenter:** JEPPE, Laurids (CMS (CMS Fachgruppe TOP))

Machine learning with PyTorch

Contribution ID: 38

Type: not specified

#### Machine learning with PyTorch

**Presenters:** STIETZ, Lars Olaf (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); RIEGER, Marcel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Unfolding

Contribution ID: 39

Type: not specified

## Unfolding

Tuesday 10 October 2023 14:00 (2 hours)

**Presenters:** DEFRANCHIS, Matteo (CERN); CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); GUGLIELMI, Valentina (CMS (CMS Fachgruppe QCD))

CMSSW

Contribution ID: 40

Type: not specified

#### **CMSSW**

Tuesday 10 October 2023 14:00 (2 hours)

Presenter: CHOWDHURY, Suvankar

Jets

Contribution ID: 41

Type: not specified

#### Jets

Wednesday 11 October 2023 13:45 (2 hours)

We discuss the clustering algorithms, reconstruction, and calibration of jets. We alternate slides with open questions, exercises in plain C++, and exercises with Jupyter notebooks in Python.

**Presenters:** HINZMANN, Andreas (CMS (CMS Fachgruppe Searches)); GIANNEIOS, Paris; KIOSEOGLOU, Polidamas

 $E/\gamma$ 

#### Contribution ID: 42

Type: not specified

#### $E/\gamma$

Wednesday 11 October 2023 13:45 (2 hours)

Electrons and photons are widely used and play an essential role in the success of CMS. They are indispensable for searches of new physics, including many models of supersymmetry. Knowing the characteristics of electrons and photons in the CMS detector is helpful. This long exercise shows how electrons and photons are reconstructed and how we get their correct energy. The attendees are assumed to have basic knowledge of ROOT, C++, and Python.

**Presenters:** ANUAR, Afiq Aizuddin (CMS (CMS Fachgruppe TOP)); Ms AN, Ying (CMS (CMS Fachgruppe TOP))

Tauon

#### Contribution ID: 43

Type: not specified

#### Tauon

Friday 13 October 2023 13:30 (2 hours)

Tau leptons are excellent probes of electroweak physics, they decay before reaching the inner layers of the CMS tracker and require a dedicated reconstruction algorithm. With this exercise you will see how hadronically decaying tau leptons are identified with respect to jets, muons, and electrons, and measure the efficiency of the tau identification algorithm in order to measure the Z cross section in decays to tau leptons. You will also get familiar with resolution effects in the tau reconstruction process and other properties that need to be corrected to achieve excellent physics results.

**Presenters:** Dr CARDINI, Andrea (CMS (CMS Fachgruppe HIGGS)); PONCET, Océane **Session Classification:** POG exercises

Contribution ID: 44

Muon

Type: not specified

#### Muon

Wednesday 11 October 2023 13:45 (2 hours)

In this session, we will start by introducing some basic concepts about muons: what they are, the sources of muons in CMS, the muon reconstruction algorithm, and the criteria used to select interesting muons for analyses.

After that, you can familiarize yourself with muons in three tasks resembling real analysis tasks: The first exercise will get you familiar on how to handle muons in CMSSW: looking at a Drell-Yan simulated sample, you will learn to recognize the different sources of muons and how to use identification methods to classify them.

In the second exercise, you will study the resolution of the muon reconstruction, using  $Z \rightarrow \mu \mu$  events as a standard candle. Then, using the same sample, you will try different identification methods and decide which one is more appropriate.

In the third exercise, you will learn how to compute the corrections to cover the difference in efficiency between data and simulated events, using the tag and probe method.

Presenters: WINTER, Christian; SIMONE, Federica; TREVISANI, Nicolo
B-tagging and vertexing

Contribution ID: 45

Type: not specified

## **B-tagging and vertexing**

Wednesday 11 October 2023 13:45 (2 hours)

The BTV exercise aims to demonstrate the concept of flavor tagging and its usage in analyses. The first part of this exercise will cover the fundamental principle of b tagging, starting with understanding the discrimination power of the inputs to the tagging algorithm and is continued by evaluating the performance of the trained model.

The second part of this exercise will be dedicated to the calibration of the b-tagger to handle differences between data and simulation. It will introduce one of the currently used methods for calibrating the full shape of the b-tagging discriminant and focus on the derivation of the correction and its application in analysis.

Both exercises are based on a purely pythonic and columnar analysis workflow, in which you will be able to study the inputs and performance of the b-tagging algorithm by evaluating general machine learning performance metrics. In the second workflow, you will examine the agreement between data and simulation before and after the calibration, as well as implement the calibration itself with a special treatment of the jet flavors.

Presenters: WUCHTERL, Sebastian (CERN); DIEKMANN, Svenja

Tracking

Contribution ID: 46

Type: not specified

# Tracking

Thursday 12 October 2023 13:30 (2 hours)

The exercises introduce the basics of track and vertex reconstruction at CMS. The main track reconstruction algorithms are discussed with explanations on how to understand and access the reconstructed quantities. A few implications on the physics analysis are illustrated. The exercises are based on the standard CMSSW workflows with pythonic interface for job configurations.

**Presenter:** SKOVPEN, Kirill (Ghent University) **Session Classification:** POG exercises

Proton

Contribution ID: 47

Type: not specified

#### Proton

The forward proton detectors are new detectors introduced during LHC Run 2 by the CMS collaboration and are used to recontsruct scattered protons that emerge intact from the proton-proton interaction. In this exercise, we will learn about the process of proton reconstruction and its application in analysis, following the latest recommendations provided by the Proton Object Group.

Throughout this exercise, participants will use the nanoAOD data/MC samples with CMSSW, obtain analysis ntuple with proton objects, and make validation plots from the obtained ntuples using Jupiter notebook.

**Presenter:** RIBEIRO LOPES, Beatriz (CMS (CMS Fachgruppe TOP))

Luminosity

Contribution ID: 48

Type: not specified

## Luminosity

Wednesday 11 October 2023 13:45 (2 hours)

The students will be introduced to the luminosity measurement at CMS, perform their own luminosity calibration with 2023 data, and learn how to calculate the integrated luminosity of a data set.

Presenters: KNOLLE, Joscha (Ghent University); VAN DEN BOSSCHE, Niels (Ghent University)

Contribution ID: 49

Type: not specified

#### **Physics Performance & Data sets**

In this exercise you will learn to find the samples you need for an analysis and information about them, for instance their cross section or how they were produced. You will also learn how the CMS simulation chain works and how to run FullSim and FastSim on your own.

**Presenters:** MOUREAUX, Louis (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); CON-NOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); BEIN, Samuel (University of Hamburg)

Generators

Contribution ID: 50

Type: not specified

#### Generators

Wednesday 11 October 2023 13:45 (2 hours)

**Presenters:** STAFFORD, Dominic (CMS (CMS Fachgruppe TOP)); ESTEVEZ BANOS, Luis Ignacio (CMS (CMS Fachgruppe QCD)); AMOROSO, Simone (CMS (CMS Fachgruppe QCD))

Measurement of Z to µµγ branchin...

Contribution ID: 51

Type: not specified

## Measurement of Z to $\mu\mu\gamma$ branching fraction

Saturday 14 October 2023 09:15 (1h 30m)

During the exercise, the students will go through the main steps of dimuon analyses up to the branching fraction extraction, checking at event level the impact of the standard corrections at CMS. In the exercise, ROOT and C++ will be used.

**Presenters:** MEHTA, Ankita (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); MOUREAUX, Louis (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); GIANNEIOS, Paris; CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); Ms AN, Ying (CMS (CMS Fachgruppe TOP))

Jet measurements in Run 2

Contribution ID: 52

Type: not specified

#### Jet measurements in Run 2

Saturday 14 October 2023 09:15 (1h 30m)

This section is focused on jets, which are a powerful tool to constrain the strong coupling constant alphaS, the parton distribution functions (PDFs) and to search for new physics. During the exercise, the students will go through the main steps of jet analyses up to the cross section extraction with a special focus on the trigger, jet energy corrections, pileup, and unfolding procedure. In the exercise, ROOT and C++ will be used.

**Presenters:** CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); KIOSEOGLOU, Polidamas; AMOROSO, Simone (CMS (CMS Fachgruppe QCD)); GUGLIELMI, Valentina (CMS (CMS Fachgruppe QCD))

Top mass measurement in Run 2

Contribution ID: 53

Type: not specified

# Top mass measurement in Run 2

Saturday 14 October 2023 09:15 (1h 30m)

**Presenters:** PETERSEN, Henriette (CMS (CMS Fachgruppe TOP)); PARK, Jiwon (DESY); DEFRAN-CHIS, Matteo (CERN); WUCHTERL, Sebastian (CERN)

Top integrated cross section in Run 3

Contribution ID: 54

Type: not specified

## Top integrated cross section in Run 3

Saturday 14 October 2023 09:15 (1h 30m)

This exercise will perform a measurement of the top quark pair production cross section at a center of mass energy of 13.6 TeV, using data recorded by CMS in 2022. Based on a simplified version of the first CMS publication from LHC Run 3, the measurement will focus on the dilepton decay channels. A modern python-based framework will be used, with some dependence on the scikit-HEP package library (uproot, awkward arrays) and Coffea, highlighting the speed of columnar-based analysis and the CMS NanoAOD data tier. Students will start from a minimal working example and add their own cuts, histograms, and uncertainties to produce a measurement.

**Presenters:** RANKEN, Evan (CMS (CMS Fachgruppe TOP)); JEPPE, Laurids (CMS (CMS Fachgruppe TOP))

Higgs columnar analysis

Contribution ID: 55

Type: not specified

### Higgs columnar analysis

Saturday 14 October 2023 09:15 (1h 30m)

In the search for physics beyond the Standard Model, a detailed understanding of the Higgs boson properties is a crucial component. This exercise aims to give an overview of different analysis aspects in the context of Higgs physics at the CMS experiment. Specifically, we will discuss challenges and requirements needed for the selection of objects in signal and background events as well as the construction of a suitable final observable for selected examples. Additionally, we will show how to accomplish these tasks with modern Python-based tools for vectorized analyses, such as AwkwardArray and columnflow.

**Presenters:** SAVOIU, Daniel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); RIEGER, Marcel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); BONANOMI, Matteo (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); KEICHER, Philip Daniel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Contribution ID: 56

Type: not specified

#### Search for New Physics with Top Tagging and Missing Transverse Momentum

Saturday 14 October 2023 09:15 (1h 30m)

This analysis is a generic search for new physics targeting final states with one or more top quarks. It is motivated by models of R-parity conserving Supersymmetry (SUSY) that assume the existence of additional elementary particles not included in the Standard Model (SM). In the simplest case, there is one supersymmetric partner-particle for each Standard Model SM particle. The existence of these additional particles has many interesting consequences: Most strikingly, they can provide excellent candidates for Dark Matter, the substance that constitutes about 25% of our universe and for which there is no candidate particle in the SM. Moreover, the presence of supersymmetric partner particles in virtual loops can cancel the otherwise large corrections occurring in the renormalisation of e.g. the Higgs-boson mass. As a consequence, the theory becomes less dependent on the exact values of its parameters (becomes more natural) - a feature typically thought desirable. Also, the presence of supersymmetric particles in virtual loops leads to common gauge-coupling strengths when extrapolated to higher scales, which hints to some underlying, unified theory. However, so far, SUSY particles have not been observed, and hence, they must have higher masses than the known SM particles. SUSY particles could be directly produced in the proton-proton collisions at the LHC if they have masses in the TeV range. In many SUSY models the super partners of the quarks and gluons (called squarks and gluinos), are pair produced and can occur with particularly large cross sections compared to other SUSY-production channels. The squarks and gluinos will predominantly decay into coloured SM particles and pairs of stable LSPs (Lightest Supersymmetric Particles). In realistic models, the LSPs are electrically neutral and only weakly interacting such as neutrinos.

**Presenters:** BAXTER, Samuel (CMS (CMS Fachgruppe TOP)); BHATTACHARYA, Soham (CMS (CMS Fachgruppe Searches))

Anomaly detection

Contribution ID: 58

Type: not specified

# Anomaly detection

Monday 9 October 2023 16:00 (2 hours)

**Presenters:** MOUREAUX, Louis (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); LAM-BRECHT, Luka

SciKit Learn

Contribution ID: 59

Type: not specified

# SciKit Learn

Monday 9 October 2023 16:00 (2 hours)

**Presenter:** KOMM, Matthias (CMS (CMS Fachgruppe Searches)) **Session Classification:** Topical exercises

RDataFrame

Contribution ID: 60

Type: not specified

## RDataFrame

Monday 9 October 2023 16:00 (2 hours)

**Presenter:** CHOWDHURY, Suvankar

Git

Contribution ID: 61

Type: not specified

#### Git

Monday 9 October 2023 16:00 (2 hours)

**Presenters:** EL-MORABIT, Karim (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); STI-ETZ, Lars Olaf (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); BEIN, Samuel (University of Hamburg)

Columnar analysis

Contribution ID: 62

Type: not specified

## **Columnar analysis**

Monday 9 October 2023 16:00 (2 hours)

**Presenter:** JEPPE, Laurids (CMS (CMS Fachgruppe TOP))

MC techniques

Contribution ID: 63

Type: not specified

# **MC techniques**

Monday 9 October 2023 16:00 (2 hours)

**Presenters:** MENDIZABAL MORENTIN, Mikel (DESY); GIANNEIOS, Paris; KIOSEOGLOU, Polidamas

CMSSW

Contribution ID: 64

Type: not specified

#### **CMSSW**

Tuesday 10 October 2023 16:30 (2 hours)

Presenter: CHOWDHURY, Suvankar

Combine

Contribution ID: 65

Type: not specified

#### Combine

Tuesday 10 October 2023 16:30 (2 hours)

**Presenters:** NIGAMOVA, Aliya (University of Hamburg); KEICHER, Philip Daniel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Machine learning with Keras

Contribution ID: 66

Type: not specified

# Machine learning with Keras

Tuesday 10 October 2023 16:30 (2 hours)

**Presenters:** EL-MORABIT, Karim (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); BE-NATO, Lisa (Hamburg University)

Machine learning with PyTorch

Contribution ID: 67

Type: not specified

# Machine learning with PyTorch

*Tuesday 10 October 2023 16:30 (2 hours)* 

**Presenters:** STIETZ, Lars Olaf (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); RIEGER, Marcel (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

MC techniques

Contribution ID: 68

Type: not specified

## **MC techniques**

*Tuesday 10 October 2023 16:30 (2 hours)* 

**Presenters:** MENDIZABAL MORENTIN, Mikel (DESY); GIANNEIOS, Paris; KIOSEOGLOU, Polidamas

Unfolding

Contribution ID: 69

Type: not specified

# Unfolding

Tuesday 10 October 2023 16:30 (2 hours)

**Presenters:** DEFRANCHIS, Matteo (CERN); CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); GUGLIELMI, Valentina (CMS (CMS Fachgruppe QCD))

From Analysis to Publication

Contribution ID: 70

Type: not specified

# **From Analysis to Publication**

Wednesday 18 October 2023 13:30 (45 minutes)

**Presenter:** MEYER, Andreas (DESY) **Session Classification:** Plenaries

Closing and award ceremony

Contribution ID: 71

Type: not specified

## Closing and award ceremony

Wednesday 18 October 2023 14:15 (15 minutes)

**Presenters:** GROHSJEAN, Alexander (CMS - University of Hamburg); HINZMANN, Andreas (CMS (CMS Fachgruppe Searches)); KOMM, Matthias (CMS (CMS Fachgruppe Searches)); CONNOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS)

#### Session Classification: Plenaries

Combine

Contribution ID: 72

Type: not specified

### Combine

Monday 9 October 2023 16:00 (2 hours)

**Presenter:** NIGAMOVA, Aliya (University of Hamburg)

Coffee break

Contribution ID: 73

Type: not specified

# **Coffee break**

Lunch break

Contribution ID: 74

Type: not specified

# Lunch break

Poster installation

Contribution ID: 75

Type: not specified

# Poster installation

Monday 9 October 2023 18:00 (30 minutes)

Poster moving

#### Contribution ID: 76

Type: not specified

# Poster moving

Monday 9 October 2023 20:30 (15 minutes)

Coffee break

Contribution ID: 77

Type: not specified

# **Coffee break**

Coffee break

Contribution ID: 78

Type: not specified

# **Coffee break**

Lunch break

Contribution ID: 79

Type: not specified

# Lunch break

Coffee break

Contribution ID: 80

Type: not specified

# **Coffee break**

Lunch break

Contribution ID: 81

Type: not specified

# Lunch break
Contribution ID: 82

Type: not specified

Generators

Contribution ID: 83

Type: not specified

#### Generators

Thursday 12 October 2023 13:30 (2 hours)

**Presenters:** STAFFORD, Dominic (CMS (CMS Fachgruppe TOP)); ESTEVEZ BANOS, Luis Ignacio (CMS (CMS Fachgruppe QCD)); AMOROSO, Simone (CMS (CMS Fachgruppe QCD))

B-tagging & vertexing

Contribution ID: 84

Type: not specified

# **B-tagging & vertexing**

Thursday 12 October 2023 13:30 (2 hours)

Presenters: WUCHTERL, Sebastian (CERN); DIEKMANN, Svenja (RWTH Aachen University)

Contribution ID: 85

Muon

Type: not specified

#### Muon

Thursday 12 October 2023 13:30 (2 hours)

In this session, we will start by introducing some basic concepts about muons: what they are, the sources of muons in CMS, the muon reconstruction algorithm, and the criteria used to select interesting muons for analyses.

After that, you can familiarize yourself with muons in three tasks resembling real analysis tasks: The first exercise will get you familiar on how to handle muons in CMSSW: looking at a Drell-Yan simulated sample, you will learn to recognize the different sources of muons and how to use identification methods to classify them.

In the second exercise, you will study the resolution of the muon reconstruction, using  $Z \rightarrow \mu \mu$  events as a standard candle. Then, using the same sample, you will try different identification methods and decide which one is more appropriate.

In the third exercise, you will learn how to compute the corrections to cover the difference in efficiency between data and simulated events, using the tag and probe method.

**Presenters:** TREVISANI, Nicolo (KIT - Karlsruhe Institute of Technology); TREVISANI, Nicolo (KIT - Karlsruhe Institute of Technology (DE)); TREVISANI, Nicolo (KIT)

Jet

Contribution ID: 86

Type: not specified

### Jet

Thursday 12 October 2023 13:30 (2 hours)

We discuss the clustering algorithms, reconstruction, and calibration of jets. We alternate slides with open questions, exercises in plain C++, and exercises with Jupyter notebooks in Python.

**Presenters:** HINZMANN, Andreas (CMS (CMS Fachgruppe Searches)); GIANNEIOS, Paris; KIOSEOGLOU, Polidamas

Lumi

Contribution ID: 87

Type: not specified

#### Lumi

*Thursday 12 October 2023 13:30 (2 hours)* 

The students will be introduced to the luminosity measurement at CMS, perform their own luminosity calibration with 2023 data, and learn how to calculate the integrated luminosity of a data set.

**Presenter:** KNOLLE, Joscha (Ghent University)

Contribution ID: 88

Type: not specified

Lunch break

Contribution ID: 89

Type: not specified

# Lunch break

Contribution ID: 90

Type: not specified

Contribution ID: 91

Type: not specified

Lunch break

Contribution ID: 92

Type: not specified

# Lunch break

Contribution ID: 93

Type: not specified

Contribution ID: 94

Type: not specified

Physics Performance & Data sets

Contribution ID: 95

Type: not specified

## **Physics Performance & Data sets**

Friday 13 October 2023 13:30 (2 hours)

In this exercise you will learn to find the samples you need for an analysis and information about them, for instance their cross section or how they were produced. You will also learn how the CMS simulation chain works and how to run FullSim and FastSim on your own.

**Presenters:** MOUREAUX, Louis (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); CON-NOR, Patrick (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik) & CDCS); BEIN, Samuel (University of Hamburg)

CMS Physics Obj  $\dots \ /$  Report of Contributions

Tracking

Contribution ID: 96

Type: not specified

## Tracking

Friday 13 October 2023 13:30 (2 hours)

The exercises introduce the basics of track and vertex reconstruction at CMS. The main track reconstruction algorithms are discussed with explanations on how to understand and access the reconstructed quantities. A few implications on the physics analysis are illustrated. The exercises are based on the standard CMSSW workflows with pythonic interface for job configurations.

**Presenter:** SKOVPEN, Kirill (Ghent University) **Session Classification:** POG exercises

Jet

Contribution ID: 97

Type: not specified

#### Jet

*Friday 13 October 2023 13:30 (2 hours)* 

We discuss the clustering algorithms, reconstruction, and calibration of jets. We alternate slides with open questions, exercises in plain C++, and exercises with Jupyter notebooks in Python.

**Presenters:** HINZMANN, Andreas (CMS (CMS Fachgruppe Searches)); GIANNEIOS, Paris; KIOSEOGLOU, Polidamas

E/γ

#### Contribution ID: 98

Type: not specified

#### $E/\gamma$

Friday 13 October 2023 13:30 (2 hours)

Electrons and photons are widely used and play an essential role in the success of CMS. They are indispensable for searches of new physics, including many models of supersymmetry. Knowing the characteristics of electrons and photons in the CMS detector is helpful. This long exercise shows how electrons and photons are reconstructed and how we get their correct energy. The attendees are assumed to have basic knowledge of ROOT, C++, and Python.

**Presenters:** ANUAR, Afiq Aizuddin (CMS (CMS Fachgruppe TOP)); Ms AN, Ying (CMS (CMS Fachgruppe TOP))

SUSY search

Contribution ID: 100

Type: not specified

## SUSY search

Wednesday 18 October 2023 09:00 (20 minutes)

CMS Physics Obj  $\dots \ /$  Report of Contributions

Top cross section

Contribution ID: 101

Type: not specified

# **Top cross section**

Wednesday 18 October 2023 09:30 (20 minutes)

Jet measurements

Contribution ID: 102

Type: not specified

## Jet measurements

Wednesday 18 October 2023 10:00 (20 minutes)

Top mass

Contribution ID: 103

Type: not specified

## **Top mass**

Wednesday 18 October 2023 11:00 (20 minutes)

Vector boson measurement

Contribution ID: 104

Type: not specified

## Vector boson measurement

Wednesday 18 October 2023 11:30 (20 minutes)

Higgs

Contribution ID: 105

Type: not specified

# Higgs

Wednesday 18 October 2023 12:00 (20 minutes)

CMS Physics Obj  $\ldots \ /$  Report of Contributions

Directions

Contribution ID: 106

Type: not specified

## Directions

Thursday 12 October 2023 19:00 (5 minutes)

Session Classification: Session