



Nome

COSTANZA CARRIVALE

ATTIVITÀ SCIENTIFICA

- Descrizione dell'attività

My work within the CMS Collaboration is primarily focused on phenomenological studies of multiboson and vector boson scattering (VBS) processes within the Standard Model Effective Field Theory (SMEFT) framework. I am particularly interested in the development of theoretical tools and frameworks to support experimental analyses, while also contributing directly to data analyses within CMS.

Since my master thesis, I have investigated unitarity violation in EFTs applied to VBS, studying the impact of unitarity bounds on the experimental sensitivity to Warsaw-basis operators through LHE-level analyses.

In this context, I gained expertise with tools such as Mathematica, in particular for the calculation of scattering amplitudes through dedicated packages.

This activity evolved into the development of an automated framework to extract theoretical bounds on Wilson coefficients in multiboson processes after the unitarization procedure. I am currently extending this framework to dimension-8 operator bases (including CP-violating structures) and to multi-dimensional limit extractions, with additional work exploring SMEFT models that allow combined dim-6 and dim-8 studies.

I have gained experience with Monte Carlo event generators, which I consolidated while serving as Monte Carlo contact for CMS since 2023. This expertise led me to be directly involved in dedicated generator studies, in particular contributing to a publication on polarization observables comparing different Monte Carlo tools.

Within CMS analyses, I have been involved in EFT interpretations of VBS processes, focusing on opposite-sign WW and WZ fully leptonic final states, and I contributed to the development of the global EFT combination in the electroweak sector with full Run2 data within CMS, where these analyses are included as inputs.

POSIZIONI E GRANT

- Date (da – a)
- Luogo di svolgimento
- Tipo di impiego
- Descrizione dell'attività

June 2024

Laboratoire Leprince-Ringuet, Palaiseau (France)

Grant with COMETA Cost Action - Short Term Mission at Laboratoire Leprince-Ringuet

Development of a general and user-friendly framework (based on arXiv:2205.15959 [hep-ph]) to extract limits on Effective Field Theory parameters with the inclusion of unitarity bounds, enabling fast generator-level sensitivity estimates of multiboson processes to various EFT operators; validation on final states with two or more bosons.

- Date (da – a)
- Luogo di svolgimento
- Tipo di impiego
- Descrizione dell'attività

March-September 2022

Università degli Studi di Perugia, Perugia (Italy)

Postgraduate scholarship: Study of unitarity constraints for Vector Boson Scattering processes at LHC

Participation in the analysis activities of the Vector Boson Scattering same-sign W processes with hadronic tau of CMS carried out by the Perugia group as theoretical support and coordinator of the MC production of the signal samples. Extension of the analysis proposed in the master's thesis to new operators and study of the impact of interference between operators on unitarity constraints.

ISTRUZIONE E FORMAZIONE

- Date (da – a)
- Nome e tipo di istituto di istruzione o formazione
- Qualifica conseguita
- Principali materie / abilità professionali oggetto dello studio
- Descrizione attività

2022-2026

Università degli Studi di Perugia, Perugia (Italy)

Ph.D. in Physics of Fundamental Interactions

Standard Model Effective Field Theory interpretation of Vector Boson Scattering global combination with CMS

Vector Boson Scattering (VBS) processes provide an ideal field for studying possible deviations from Standard Model (SM) given their close link with the electroweak symmetry breaking (EWSB) mechanism. Global fits are a powerful tool to enhance sensitivity to New Physics (NP) effects parametrized by Effective Field Theories (EFTs) and loosen assumptions: given the high interdependence between channels, it becomes essential to set up a combination of different final states to better constrain EFT parameters that affect VBS processes. My project aims to provide global constraints on Wilson coefficients in a combined fit of measurements of VBS channels at the Compact Muon Solenoid (CMS) experiment using full Run2 data. My contribution, beyond the participation in the development of the combination tools, comes from the EFT interpretation of two VBS analyses (WZ and opposite-sign WW in the fully leptonic final state), both included in the combined fit.

• Date (da – a)

2018-2022

- Nome e tipo di istituto di istruzione o formazione
- Qualifica conseguita
- Valutazione finale
- Principali materie / abilità professionali oggetto dello studio
- Descrizione attività

Università degli Studi di Perugia, Perugia (Italy)

Master Degree in Theoretical Physics – LM17

110/110

Study of the impact of unitarity bounds on VBS same-sign W analyses at LHC

In my master thesis, a phenomenological study on the same-sign W VBS processes within the SMEFT framework was performed. The research highlighted how dimension-6 operators can lead to violations of the scattering matrix unitarity. I investigated the range of validity of EFT approach and applied unitarity bounds for several EFT contributions, providing a comprehensive evaluation of the impact of unitarity constraints on theoretical limits on the EFT parameters.

• Date (da – a)

2014-2018

- Nome e tipo di istituto di istruzione o formazione
- Qualifica conseguita
- Valutazione finale
- Principali materie / abilità professionali oggetto dello studio
- Descrizione attività

Università degli Studi di Perugia, Perugia (Italy)

Bachelor Degree in Physics - L30

104/110

Nucleosynthesis from neutron capture: r-processes in the landscape of the new frontiers of astrophysics

The bachelor thesis work aimed to illustrate the nucleosynthesis processes that lead to the chemical enrichment of the interstellar medium and, in particular, to the creation of abundances of elements heavier than iron. There was therefore a particular focus on neutron capture processes (s and r processes) and on the explosive environments in which these are triggered.

• Date (da – a)

2009-2014

- Nome e tipo di istituto di istruzione o formazione
- Qualifica conseguita
- Valutazione finale

Liceo Classico A. Mariotti, Perugia (Italy)

High School Diploma in Classical Studies

84/100

RUOLI NELLA COLLABORAZIONE CMS

- Date (da – a)
 - Ruolo
- Descrizione attività

2024-ongoing
DAQ shifter
Participation in CMS DAQ online shifts at P5.

- Date (da – a)
 - Ruolo
- Descrizione attività

2024-ongoing
Silicon tracker modules assembly
Participation in CMS silicon tracker modules assembly at University of Perugia.

- Date (da – a)
 - Ruolo
- Descrizione attività

2023-ongoing
SMP-VV Monte Carlo contact
Served as Monte Carlo contact for the SMP-VV sub-group (Standard Model Physics), managing sample production requests from CMS collaboration analyzers, with a relevant contribution to the production of fully leptonic VBS samples for Run 3, including providing the required gridpacks.

- Date (da – a)
 - Ruolo
- Descrizione attività

2023-ongoing
DQM Offline Shifter
Participation in CMS Data Quality Monitoring activity in the role of offline shifter.

ESPERIENZA LAVORATIVA

- Date (da – a)
- Nome e indirizzo del datore di lavoro
- Tipo di impiego
- Principali mansioni e responsabilità

SEPTEMBER 2018
Istituto San Francesco, Piazza Partigiani n. 9, 06121 Perugia (Italy)

Physics and Mathematics teacher for high school classes.
Lessons to classes of 5-10 students from third, fourth or fifth year of high school.

- Date (da – a)
- Nome e indirizzo del datore di lavoro
- Tipo di impiego
- Principali mansioni e responsabilità

SEPTEMBER 2018
Centro perugino di Cultura contemporanea, Via Luigi Rizzo, 06128 Perugia (Italy)

Physics and Mathematics teacher for high school students
Private lessons with 1-2 students, mainly for remedial purposes.

TUTORATO E DIVULGAZIONE

- Date (da – a)
- Luogo o Istituto di svolgimento
 - Evento
- Descrizione attività

2023-2025
Perugia (Italy)
INFN "Masterclass – hands on particle physics"
Participation as a tutor carrying out support activities for students during the event at the Physics Department of Perugia.

- Date (da – a)
- Luogo o Istituto di svolgimento
 - Evento
- Descrizione attività

SEPTEMBER 2024
Perugia (Italy)
European Researcher's Night - Sharper
Participation in the project "HEPscape! - The High Energy Physics Escape Room" in collaboration with the Physics Department of Perugia.

- Date (da – a)
- Luogo o Istituto di svolgimento
 - Evento

MAY 2024
Senigallia (Italy)
Fosforo – La Festa della Scienza

• Descrizione attività	Participation in the project "HEPscape! - The High Energy Physics Escape Room" with the INFN Perugia.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	NOVEMBER 2023 Milano (Italy) Focus Live Festival Participation in the project "HEPscape! - The High Energy Physics Escape Room" with the INFN Perugia.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	MAY 2023 Torino (Italy) Salone del Libro Participation in the project "HEPscape! - The High Energy Physics Escape Room" with the INFN Perugia.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	MARCH 2023 Perugia (Italy) INFN "Masterclass – hands on particle physics" Participation in the project "HEPscape! - The High Energy Physics Escape Room" in the context of the CMS Masterclasses at the Physics Department of Perugia.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	FEBRUARY-MARCH 2023 Perugia (Italy) Piano Lauree Scientifiche Participation as science communicator for laboratory activities within the Physics department of Perugia aimed at upper secondary school students.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	NOVEMBER 2022 Roma (Italy) Festival delle Scienze Participation in the project "HEPscape! - The High Energy Physics Escape Room" with the INFN Roma.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	2018-2020 Perugia (Italy) Progetto AggiornaMenti Participation as science communicator for educational laboratory activities aimed at lower secondary school teachers and classes of schools that have joined the project.
• Date (da – a) • Luogo o Istituto di svolgimento • Evento • Descrizione attività	SEPTEMBER 2017 Perugia (Italy) European Researchers' Night Collaboration in the extemporaneous exhibition "Physics and Comics" organized by the University of Perugia.

SCUOLE, WORKSHOP E CONFERENZE

- Date (da – a)
- **Luogo o Istituto di svolgimento**
- **Evento**

- MARCH 2025**
Paris (France)
COMETA workshop on EFT in HH and VBS

- Tipo di evento
 - Eventuali contributi
-
- Date (da – a)
 - Luogo o Istituto di svolgimento
 - Evento
 - Tipo di evento
 - Eventuali contributi
-
- Date (da – a)
 - Luogo o Istituto di svolgimento
 - Evento
 - Tipo di evento
 - Eventuali contributi
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 - Eventuali contributi
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- Date (da – a)
 - Luogo o Istituto di svolgimento
 - Evento
 - Tipo di evento
 - Eventuali contributi
-
- Date (da – a)
 - Luogo o Istituto di svolgimento
 - Evento
 - Tipo di evento
 - Eventuali contributi

Workshop

Invited talk: "Review of VBS EFT MC modelling in ATLAS and CMS".

DECEMBER 2024

CERN (Switzerland)

LHC EFT WG - 8th General Meeting

General Meeting

Invited talk: "Dim-6 and dim-8 EFT studies with VBS at CMS".

OCTOBER 2024

Freiburg (Germany)

QCD@LHC 2024

Conference

Parallel talk: "Vector-boson fusion/scattering measurements".

MAY 2024

Paestum (Italy)

INFN School of Statistics

School

-

APRIL 2024

Grenoble (France)

31st International Workshop on Deep Inelastic Scattering

Workshop

Parallel talk: "Vector Boson Scattering results in CMS".

SEPTEMBER 2023

Salerno (Italy)

SIF 109° National Congress

Conference

Parallel talk: "Study of the impact of unitarity bounds on analysis of Vector Boson Scattering with same-sign W processes at LHC".

Talk selected for publication as proceedings in Nuovo Cimento C.

JULY 2023

Goettingen (Germany)

Goettingen HASCO Summer School

School

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JUNE 2023

CERN (Switzerland)

CMS Data Analysis School 2023

School

Special mention for the analysis.

JUNE 2022

Otranto (Italy)

XXXIII International Seminar of Nuclear and Subnuclear Physics "Francesco Romano"

School

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PUBBLICAZIONI

- | | |
|--|---|
| • Titolo | Precise Standard-Model predictions for polarised Z-boson pair production and decay at the LHC |
| • Autori | C. Carrivale et al. |
| • Anno di pubblicazione | 2025 |
| • Riferimento o rivista | arXiv:2505.09686 [hep-ph] - Submitted to European Physics Journal C (ID: EPJC-25-05-246) |
| • Titolo | Vector boson scattering results in CMS |
| • Autori | C. Carrivale |
| • Anno di pubblicazione | 2025 |
| • Riferimento o rivista | PoS DIS2024 (2025) 127, DOI: 10.22323/1.469.0127 |
| • Titolo | Study of the impact of unitarity bounds on analysis of Vector Boson Scattering with same-sign W processes at LHC |
| • Autori | C. Carrivale, S. Ajmal, L. Fanò, O. Panella, M. Presilla |
| • Anno di pubblicazione | 2024 |
| • Riferimento o rivista | Il Nuovo Cimento C, 47 (5), Article 280, DOI: 10.1393/ncc/i/2024-24280-y |
| List of relevant selection of publications as CMS author (2023-ongoing), full list available on InspireHEP:
https://inspirehep.net/authors/2763684?ui-citation-summary=true | |
| • Titolo | Probing the flavour structure of dimension-6 EFT operators in multilepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV |
| • Autori | CMS Collaboration |
| • Anno di pubblicazione | 2025 |
| • Riferimento o rivista | e-Print: 2507.17498 [hep-ex] |
| • Titolo | Combined effective field theory interpretation of Higgs boson, electroweak vector boson, top quark, and multi-jet measurements |
| • Autori | CMS Collaboration |
| • Anno di pubblicazione | 2025 |
| • Riferimento o rivista | e-Print: 2504.02958 [hep-ex] |
| • Titolo | Constraints on standard model effective field theory for a Higgs boson produced in association with W or Z bosons in the $H \rightarrow b\bar{b}$ decay channel in proton-proton collisions at $\sqrt{s} = 13$ TeV |
| • Autori | CMS Collaboration |
| • Anno di pubblicazione | 2024 |
| • Riferimento o rivista | e-Print: 2411.16907 [hep-ex] |

CAPACITÀ E COMPETENZE

PERSONALI

Acquisite nel corso della vita e della carriera ma non necessariamente riconosciute da certificati e diplomi ufficiali.

MADRELINGUA

Italian

ALTRE LINGUE

Pagina 6 - Curriculum vitae di
[CARRIVALE, Costanza]

Per ulteriori informazioni:
www.cedefop.eu.int/transparency
www.europa.eu.int/comm/education/index_it.html
www.eurescv-search.com

- Capacità di lettura
- Capacità di scrittura
- Capacità di espressione orale

- Capacità di lettura
- Capacità di scrittura
- Capacità di espressione orale

CAPACITÀ E COMPETENZE RELAZIONALI

Vivere e lavorare con altre persone, in ambiente multiculturale, occupando posti in cui la comunicazione è importante e in situazioni in cui è essenziale lavorare in squadra (ad es. cultura e sport), ecc.

CAPACITÀ E COMPETENZE ORGANIZZATIVE

Ad es. coordinamento e amministrazione di persone, progetti, bilanci; sul posto di lavoro, in attività di volontariato (ad es. cultura e sport), a casa, ecc.

CAPACITÀ E COMPETENZE TECNICHE

Con computer, attrezzature specifiche, macchinari, ecc.

English

Excellent
Excellent
Excellent

German

Good
Elementary
Elementary

Teamwork: Good in collaboration within diverse team environments.

Communication: Skilled in the clear and effective communication of scientific concepts to diverse audiences.

Adaptability: Highly adaptable to various team dynamics and readily open to embracing new tasks and challenges.

Teaching

Proficient educator with a strong track record of enhancing student understanding and engagement in scientific subjects.

Accustomed to planning work efficiently, meeting strict deadlines, and managing different tasks in parallel. Experienced in organising teaching and outreach activities, as well as contributing to structured workflows in collaborative environments.

Advanced expertise in **C++**, **Python**, **Mathematica**, **ROOT**, and **LaTeX**, developed through extensive use in research and data analysis within the CMS Collaboration. Confident working across operating systems, including **Windows**, **Linux (Ubuntu)**, and **MacOS**. Highly skilled in data processing and document preparation tools such as **Microsoft Excel**, **Word**, **PowerPoint**, and **Apple Keynote**. Experienced with collaborative platforms and version-control systems, including **GitHub**, **GitLab**, and **Overleaf**, for both code development and scientific writing.

Perugia, 5 Maggio 2026