

1st COMETA General Meeting

Report of Contributions

Contribution ID: 2

Type: **not specified**

Triboson production in the SMEFT

Thursday, 29 February 2024 18:24 (10 minutes)

The processes of triboson production in high-energy proton–proton collisions provide a unique mean to probe the quartic interactions between EW gauge bosons and to perform indirect searches for physics beyond the Standard Model. Despite their small cross-sections, the production of $\gamma\gamma\gamma$, $\gamma\gamma Z$, $\gamma Z Z$ ($Z = \gamma$ or Z) at centre-of-mass energy of 13 TeV at the LHC has recently been observed by the ATLAS and CMS experiments. In this talk we present a SMEFT analysis based on total rates and differential distributions of triboson processes and show that NLO QCD corrections have striking effects on the sensitivity to dimension-6 operators. We finally present constraints on SMEFT operators from a global EW fit including electroweak precision observables (EWPOs), diboson (LEP & LHC) and triboson processes focussing on the impact of triboson measurements.

Primary author: CELADA, Eugenia**Co-authors:** VRYONIDOU, Eleni; DURIEUX, Gauthier; MIMASU, Ken**Presenter:** CELADA, Eugenia**Session Classification:** Short Talks Session

Contribution ID: 4

Type: **not specified**

Quantum Collider probes of the fermionic Higgs Portal

Thursday, 29 February 2024 19:00 (10 minutes)

Solutions to the dark matter puzzle and the hierarchy problem can include a BSM fermion ψ that is a SM singlet and couples to the visible sector via a Higgs portal interaction: $\mathcal{L}_{H\psi} = c_\psi/f |H|^2 \bar{\psi}\psi$. Despite its potential of solving these tensions with the SM being well-established, the study of $\mathcal{L}_{H\psi}$ at hadron colliders remains challenging as the Higgs boson is the only portal between the ψ -particles and the SM sector. We study the interaction $\mathcal{L}_{H\psi}$ with several off-shell Higgs probes, namely the contribution of ψ to the Higgs self-energy in $pp \rightarrow ZZ \rightarrow 4\ell$ production, Di-Higgs production, and the direct production of ψ -pairs in off-shell Higgs decays. Finally, we present the combination of these three analyses providing complementary results and give an outlook on the collider reach of HL-LHC and other beyond-LHC pp -colliders in constraining the $\mathcal{L}_{H\psi}$ interaction.

Primary author: SCHMID, Konstantin (University and INFN Padova)

Presenter: SCHMID, Konstantin (University and INFN Padova)

Session Classification: Short Talks Session

Contribution ID: 5

Type: **not specified**

NLO EW corrections to polarised $W^+ W^-$ production and decay at the LHC

Thursday, 29 February 2024 18:00 (10 minutes)

With the help of the pole approximation, observables with polarised intermediate resonances can be calculated. Gauge-boson-pair production represents a particularly interesting class of processes to study polarisation. So far the computation of the NLO EW corrections was only possible for uncharged polarised resonances, since processes with charged resonances have additional infrared divergences from soft photon emission of the resonant propagators. In our calculation we canceled these infrared singularities with additional local counterterms.

This was used to compute the NLO EW corrections to polarised W^+W^- pair production in the double-pole approximation. On my poster I will present details of our calculation. It will be shown how the polarisation of the W bosons affects the shape of the differential distributions.

Primary authors: DENNER, Ansgar; HAITZ, Christoph; PELLICCIOLI, Giovanni (Max-Planck-Institut für Physik)

Presenter: HAITZ, Christoph

Session Classification: Short Talks Session

Contribution ID: 6

Type: **not specified**

An Anomaly Detection strategy for new physics searches at the LHC

Thursday, 29 February 2024 19:12 (10 minutes)

We introduce a strategy based on unsupervised learning to identify new physics contributions in Vector Boson Scattering events at the LHC.

New physics contributions are modeled within the Standard Model Effective Field Theory (SMEFT) framework. Our anomaly detection strategy relies on Variational AutoEncoders (VAEs), which operate a dimensionality reduction and then map the lower dimensional representation back to the input space. The model is trained on a SM process, thereby learning to accurately reproduce its features. However, notable deviations in the output of the model are observed for instances generated through SMEFT. The reconstruction loss can thus be used to identify an anomaly-enriched region. As the model is solely trained on known physics, the strategy is independent of the specific nature of the chosen new physics process.

We demonstrate this strategy using parton-level generations of same-sign WW scattering events at the LHC, assuming an integrated luminosity of 350/fb.

Primary authors: Mr BOLDRINI, Giacomo (Universita & INFN, Milano-Bicocca (IT)); LAVIZZARI, Giulia (Università degli Studi e INFN Milano (IT)); GOVONI, Pietro (Universita & INFN, Milano-Bicocca (IT)); GENNAI, Simone (Universita & INFN, Milano-Bicocca (IT))

Presenter: LAVIZZARI, Giulia (Università degli Studi e INFN Milano (IT))

Session Classification: Short Talks Session

Contribution ID: 7

Type: **not specified**

Polarised cross sections for vector boson production with SHERPA

Thursday, 29 February 2024 18:12 (10 minutes)

Measurements of vector boson (VB) polarisation in VB production processes offer a powerful probe of the electroweak symmetry breaking mechanism, scrutinising the Standard Model and new physics scenarios alike. Since massive VBs can only be observed as intermediate particles, polarised cross section templates from simulation are necessary to extract their polarisation from measurable unpolarised distributions. In this work we present an extension of the SHERPA Monte-Carlo event generator, allowing the simulation of polarised cross sections for VB production processes. Based on the narrow-width approximation, polarised cross sections of all possible polarisation combinations including the interference between different intermediate polarisation states for an arbitrary number of intermediate VBs can be simulated in a single simulation run. Besides polarised cross sections at fixed LO and LO+PS accuracy as well as in multi-jet merged calculations, we also present parton-shower-matched polarised cross sections with approximate NLO QCD corrections in the VB production processes.

Primary author: HOPPE, Diana Mareen (Technische Universitaet Dresden (DE))

Co-authors: SIEGERT, Frank (Technische Universitaet Dresden (DE)); SCHOENHERR, Marek (University of Durham)

Presenter: HOPPE, Diana Mareen (Technische Universitaet Dresden (DE))

Session Classification: Short Talks Session

Contribution ID: 8

Type: **not specified**

A parton-level study on dimension-6 EFT operators in electroweak boson scattering processes at the LHC

Thursday, 29 February 2024 18:36 (10 minutes)

A sensitivity study to new physics parametrized in the context of dimension-6 CP-even operators of the Standard Model Effective Field Theory (SMEFT) is obtained by combining several analyses performed at the parton-level. These include the production of opposite charged W boson ($W^\pm W^\mp$) and various flavours of VBS signatures ($W^\pm W^\pm, W^\pm W^\mp, ZZ, WZ$) in leptonic or semi-leptonic final states. The effect of SMEFT operators in altering the SM predictions for VBS processes is included in both resonant and non-resonant diagrams $O(\alpha_{EW}^6)$, as well as in the corresponding QCD-induced backgrounds $O(\alpha_{EW}^4 \alpha_S^2)$.

An expected 95% CL confidence interval on the corresponding Wilson coefficient is then obtained by fitting an Asimov dataset generated under the SM hypothesis. Finally, the relative importance of each analysis is investigated by performing a simultaneous fit across all channels.

Based on A sensitivity study of VBS and diboson WW to dimension-6 EFT operators at the LHC.

Primary author: PIZZATI, Giorgio (Universita & INFN, Milano-Bicocca (IT))

Co-authors: TARABINI, Alessandro (ETH Zurich (CH)); MASSIRONI, Andrea (Universita & INFN, Milano-Bicocca (IT)); VAGNERINI, Antonio (University of Nebraska-Lincoln); BRAMBILLA, Daniele (Universita & INFN, Milano-Bicocca (IT)); VERNAZZA, Elena (Centre National de la Recherche Scientifique (FR)); CETORELLI, Flavia (INFN, Milano-Bicocca (IT)); Mr BOLDRINI, Giacomo (Universita & INFN, Milano-Bicocca (IT)); Dr ORTONA, Giacomo (Universita e INFN Torino (IT)); BRIVIO, Ilaria (University & INFN Bologna); XIAO, Jie (Centre National de la Recherche Scientifique (FR)); OLIVI, Leonardo (Universita e INFN Torino (IT)); CHIUSI, Marco (Centre National de la Recherche Scientifique (FR)); GOVONI, Pietro (Universita & INFN, Milano-Bicocca (IT)); GEROSA, Raffaele Angelo (Universita & INFN, Milano-Bicocca (IT)); BELLAN, Riccardo (Universita e INFN Torino (IT)); BRUSA, Riccardo (Universita & INFN, Milano-Bicocca (IT)); COVARELLI, Roberto (University/INFN Torino (IT)); DEL TATTO, Vittorio (Università degli Studi di Milano-Bicocca)

Presenter: PIZZATI, Giorgio (Universita & INFN, Milano-Bicocca (IT))

Session Classification: Short Talks Session

Contribution ID: 9

Type: **not specified**

CMS Vector Boson Scattering SM combination and EFT at dimension-6 in the $l\nu qq$ decay channel

Thursday, 29 February 2024 18:48 (10 minutes)

Effective Field Theory (EFT) interpretations of the LHC data are gaining popularity as they allow to decouple analyses from a specific UV-complete model. All the leading dimension-six terms can be constrained only by combining inputs from Top, Higgs, EW and QCD physics. While typically Vector Boson Scattering (VBS) measurements are interpreted in terms of subleading dimension-eight EFT operators, they can provide useful orthogonal constraints in a global view. This work explores the sensitivity of the semileptonic VBS $WV \rightarrow l\nu qq$ to constrain eight dimension-six Wilson coefficients using 138/fb of data collected by CMS during Run-II. In view of a global EFT interpretation of VBS measurements, the simplest SM VBS combination will be presented using six public results from CMS using the Run-II dataset. The combination aims at measuring six purely EW production cross sections for W and Z boson pairs.

Primary author: Mr BOLDRINI, Giacomo (Universita & INFN, Milano-Bicocca (IT))

Presenter: Mr BOLDRINI, Giacomo (Universita & INFN, Milano-Bicocca (IT))

Session Classification: Short Talks Session

Contribution ID: **10**

Type: **not specified**

Jet substructure measurements in multiboson processes with emphasis on VBS/VBF channels in ATLAS and CMS [20+10]

Wednesday, 28 February 2024 15:30 (20 minutes)

Presenter: NORJOHARUDDEEN, Nurfikri (Helsinki Institute of Physics (FI))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 11

Type: **not specified**

State of the art of searches for Higgs exotic decays in ATLAS and CMS [20+10]

Wednesday, 28 February 2024 16:00 (20 minutes)

Presenter: SCULAC, Toni (University of Split Faculty of Science (HR))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 12

Type: **not specified**

State-of-the-art of polarization measurements in multi-boson physics in ATLAS and CMS [20+10]

Wednesday, 28 February 2024 15:00 (20 minutes)

Presenter: MANJARRES, Joany (Laboratoire des 2 Infinis - Toulouse, CNRS / Univ. Paul Sabatier (FR))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 13

Type: **not specified**

Flavour tagging performance in ATLAS and CMS with emphasis on HH and MultiHiggs searches [20+10]

Thursday, 29 February 2024 11:00 (20 minutes)

Presenter: HARTMAN, Nicole Michelle (TUM (DE))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 14

Type: **not specified**

State of the art of VHH/VVH searches in ATLAS and CMS [20+10]

Thursday, 29 February 2024 10:30 (20 minutes)

Presenter: PRESILLA, Matteo (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 15

Type: **not specified**

HEFT and multi-Higgs predictions

Wednesday, 28 February 2024 10:30 (20 minutes)

Presenter: Mr SALAS-BERNÁRDEZ, Alexandre (Universidad Complutense de Madrid)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 16

Type: **not specified**

Precise SMEFT predictions

Wednesday, 28 February 2024 10:00 (20 minutes)

Presenter: ROSSIA, Alejo Nahuel (University of Manchester)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 17

Type: **not specified**

Precise polarisation predictions

Wednesday, 28 February 2024 11:00 (20 minutes)

Presenter: PONCELET, Rene (IFJ PAN Krakow)

Session Classification: WG 1,2,3 Presentations

Contribution ID: **18**

Type: **not specified**

Precision physics in hh, Zh, and ZZ production

Thursday, 29 February 2024 12:00 (20 minutes)

Presenter: VITTI, Marco

Session Classification: WG 1,2,3 Presentations

Contribution ID: 19

Type: **not specified**

BSM physics in multi-boson production

Thursday, 29 February 2024 13:00 (20 minutes)

Presenter: ARCO, Francisco (UAM - IFT)

Session Classification: WG 1,2,3 Presentations

Contribution ID: **20**

Type: **not specified**

Precise VBS predictions

Thursday, 29 February 2024 12:30 (20 minutes)

Presenter: Mr SCHWAN, Christopher (Universität Würzburg)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 21

Type: **not specified**

State-of-the-art of HH and multi-Higgs searches in ATLAS and CMS [20+10]

Thursday, 29 February 2024 10:00 (20 minutes)

Presenter: BOKAN, Petar (CERN)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 22

Type: **not specified**

Taggers for boosted HH searches within the ATLAS experiment

Wednesday, 28 February 2024 12:00 (20 minutes)

Presenter: CADAMURO, Luca (IJCLab - CNRS/IN2P3 - Université Paris-Saclay (FR))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 23

Type: **not specified**

Machine Learning for EFT interpretation

Wednesday, 28 February 2024 12:30 (20 minutes)

Presenter: SCHOEFBECK, Robert (Austrian Academy of Sciences (AT))

Session Classification: WG 1,2,3 Presentations

Contribution ID: 24

Type: **not specified**

Kernel methods for new physics searches

Wednesday, 28 February 2024 13:00 (20 minutes)

Presenter: Dr LETIZIA, Marco

Session Classification: WG 1,2,3 Presentations

Contribution ID: 25

Type: **not specified**

Normalizing flows for lattice field theory

Thursday, 29 February 2024 16:00 (20 minutes)

Presenter: NADA, Alessandro (Università di Torino)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 26

Type: **not specified**

Machine Learning based multivariate observables for global SMEFT fits

Thursday, 29 February 2024 15:30 (20 minutes)

Presenter: TER HOEVE, Jaco (Nikhef and VU Amsterdam)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 27

Type: **not specified**

Precision machine learning approaches

Thursday, 29 February 2024 15:00 (20 minutes)

Presenter: HUETSCH, Nathan (Heidelberg University, ITP Heidelberg)

Session Classification: WG 1,2,3 Presentations

Contribution ID: 28

Type: **not specified**

WG5 Introduction and Updates

Wednesday, 28 February 2024 17:00 (20 minutes)

Presenter: DE ALMEIDA DIAS, Flavia (Nikhef National institute for subatomic physics (NL))

Session Classification: WG5 Activities

Contribution ID: 29

Type: **not specified**

Brainstorming on WG5 activities

Wednesday, 28 February 2024 17:20 (25 minutes)

Session Classification: WG5 Activities

Contribution ID: 30

Type: **not specified**

Report on WG1 Activities

Friday, 1 March 2024 10:00 (15 minutes)

Primary authors: PELLICCIOLI, Giovanni (Max-Planck-Institut für Physik); GROEBER, Ramona (Università di Padova and INFN, Sezione di Padova)

Presenter: PELLICCIOLI, Giovanni (Max-Planck-Institut für Physik)

Session Classification: WG Summaries

Contribution ID: 31

Type: **not specified**

Report on WG2 Activities

Friday, 1 March 2024 10:20 (15 minutes)

Primary authors: CAPPATI, Alessandra (Centre National de la Recherche Scientifique (FR)); Dr KRAUSE, Claudius (HEPHY Vienna (ÖAW)); Dr FINOTELLO, Riccardo (CEA Paris-Saclay)

Presenter: Dr KRAUSE, Claudius (HEPHY Vienna (ÖAW))

Session Classification: WG Summaries

Contribution ID: 32

Type: **not specified**

Report on WG3 Activities

Friday, 1 March 2024 10:40 (15 minutes)

Primary authors: PRESILLA, Matteo (KIT - Karlsruhe Institute of Technology (DE)); CAIRO, Valentina (CERN)

Presenter: PRESILLA, Matteo (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: WG Summaries

Contribution ID: 33

Type: **not specified**

Report on WG5 Activities

Friday, 1 March 2024 11:00 (15 minutes)

Primary authors: DE ALMEIDA DIAS, Flavia (Nikhef National institute for subatomic physics (NL)); DREIMANIS, Karlis (Riga Technical University (LV))

Presenter: DREIMANIS, Karlis (Riga Technical University (LV))

Session Classification: WG Summaries

Contribution ID: 34

Type: **not specified**

Panel session on Combined experimental analyses

Friday, 1 March 2024 11:20 (45 minutes)

Presenter: GOVONI, Pietro (Universita & INFN, Milano-Bicocca (IT))

Session Classification: Panel Discussion

Contribution ID: 35

Type: **not specified**

Panel session on Boosted hadronic bosons

Friday, 1 March 2024 13:20 (45 minutes)

Presenter: BOKAN, Petar (CERN)

Session Classification: Panel Discussion

Contribution ID: 36

Type: **not specified**

Panel session on W and Z boson polarizations

Friday, 1 March 2024 12:35 (45 minutes)

Presenter: SIEGERT, Frank (Technische Universitaet Dresden (DE))

Session Classification: Panel Discussion