# *Virtual Talks* 20th MCnet Meeting

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CERN

# Book of Abstracts

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## Interferometric Signatures of Collectivity in Small Systems

**Author:** Christopher Plumberg[None]

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Particle interferometry has proven to be an indispensable tool in probing the space-time evolution of femtoscopic collision systems. In this talk, I show how hydrodynamic predictions for the space-time evolution of high-multiplicity pp and p+Pb collisions can be tested against interferometric observables designed to probe their size and shape. In particular, I consider how the dependence of these observables on the multiplicity $dN_{\rm ch}/d\eta$ may reflect the hydrodynamic nature of the evolving system, as well as briefly describing some ongoing efforts to perform similar analyses using the Pythia/Angantyr framework.

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## The Chirality-Flow Formalism for the Standard Model

**Author:** Andrew Lifson[1]

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The chirality-flow formalism has recently been developed as a graphical representatin of the spinor-helicity method. In this method, Feynman diagrams are directly represented in terms of chirality-flow lines corresponding to spinor inner products, without the need to resort to intermediate algebraic manipulations. In this talk the completed massless QED and QCD cases will be discussed. Also, ongoing work extending the chirality-flow formalism to the massive case, and hence the full standard model, will be discussed.

**Student & Postdoc Talks** / **75**

## fortran vs Cpp speed for matrix-element

**Author:** Olivier Mattelaer[1]

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I will compare here the speed of Fortran and C++ code.

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## A program for SU(Nc) color structure decomposition into multiplet bases using Wigner 3j and 6j coefficients and birdtrack techniques

**Author:** Andris Potrebko[None]

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QCD color structure decomposition in modern event generators is usually done using non-orthogonal and overcomplete sets of bases, such as trace bases and color-flow bases. An alternative method for color structure decomposition is to use orthogonal multiplet bases, corresponding to the irreducible representations of SU($N_c$). Due to the orthogonality of these basis states, this method could significantly speed up calculations of the amplitude squares. In this talk, I am going to demonstrate my recent successes in computationally implementing this basis decomposition with the aid of Wigner 3j and 6j coefficients.

**Student & Postdoc Talks** / **77**

## Hydrodynamics with Spin

**Author:** Rajeev Singh[1]

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Measurements made recently by the STAR collaboration show that the Lambda hyperons produced in relativistic heavy-ion collisions are subject to global spin polarization with respect to an axis coincident with the axis of rotation of the produced matter. Recently formulated formalism of relativistic hydrodynamics with spin, which is a generalization of the standard hydrodynamics, is a natural tool for describing the evolution of such systems. This approach is based on the conservation laws and the form of the energy-momentum tensor and spin tensor postulated by de Groot, van Leeuwen, and van Weert (GLW). Using Bjorken symmetry we show how this formalism may be used to determine observables describing the polarization of particles measured in the experiment.

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## NLO+PS matching for loop-induced processes in SHERPA

**Author:** Simon Luca Villani[1]

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I'll give a review of the state-of-the-art of NLO+PS matching for loop-induced processes and the associated uncertainties. The current state of the implementation in SHERPA will be discussed

**Student & Postdoc Talks** / **79**

## Matching & Merging of High Energy Jets with Pythia

**Author:** Marian Heil[1]

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Partons showers are highly successful in describing LHC physics. However they only account for soft and collinear logarithms. High Energy Jets resums wide angle, large rapidity logarithms, but lacks the collinear enhancement. I will present a modified CKKW-L merging to combine collinear and high energy logarithmics.

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## SingularPhasespace and helcitiy recycling in MadGraph

**Author:** Kiran Ostrolenk[1]

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I will present progress on SingularPhasespace, a phasespace generator for exploring the singular limits of Matrix Elements. I will also introduce a new project to implement helicity recycling within MadGraph, which should speed up the calculation of matrix elements. □

**Student & Postdoc Talks** / **81**

## A universal framework for t-channel dark matter models

**Author:** Luca Mantani[None]

I will report on our efforts to offer a general framework for simplified t-channel dark matter models at colliders and complementary cosmology calculations.

**Student & Postdoc Talks** / **82**

## Hadronic Rescattering in Pythia

**Author:** Marius Utheim[1]

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We have developed a new framework for hadronic rescattering in Pythia. In this presentation, I will explain how the model works and present a study of the effects of rescattering on pp events.

**Student & Postdoc Talks** / **83**

## Finite Temperature Effects on Particle Decays

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At high densities and temperatures the standard quantum field theoretical approach to particle physics must be modified. Temperature enters explicitly in observables, for instance in decay rates, and, under certain conditions, expected results deviate significantly from the case of zero-temperature. I have put together a collection of thermal decay rates covering scalars, pseudoscalars and fermions consequently expanding the existing literature. I aim to introduce the procedure of thermal calculations and point out how temperature enters theory, specifically in the two-point correlation function. I also show calculated thermal effects on decay rates in comparison with the zero-temperature ditto.

**Student & Postdoc Talks** / **84**

## Boosted tops

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After the discovery of the final missing piece of the Standard Model jigsaw, we have been entered an age of plethora of data. LHC has been reached 300 $fb^{-1}$ since then, but the signs of a new physics yet to be observed. Due to their weak-scale mass, Higgs and top quark are expected to shed light on the electroweak symmetry breaking. With the current centre-of-mass energy of the LHC, we observe over one million tops per inverse femtobarns. The massive production rate of top pair unfolds excruciating amount of background for searches on combinations of jets, leptons and missing-energy final states. However, this also means a plethora of statistical data to analyze top quarks.

There have been many studies which tried to capture geometrical substructure of top decay products. It has been shown that currently, the most reliable tool to identify tops is shower deconstruction method. Recent studies have shown that event deconstruction method has also a significant impact on top identification. However, these methods are based on likelihood analysis with respect to truth level top pair and QCD events, and it is not possible to have a feasible measure of tagging efficiency.

Since the initial attempts, geometrical analysis on the substructure to reconstruct parent objects from decay products has been increasingly studied. Such analyses generally based on a single condition such as Massdrop, jet filtering, pruning etc. However, it has been shown that the combination of different methodologies improves identification efficiencies drastically. In this report, we will summarize the methodology that HEPTopTagger has been adapted to combine several substructure analysis techniques. We will discuss the relevant usage to suppress the background and identify boosted tops which are further going to be used in the EFT analysis. Furthermore, we will discuss the effects of detector biases, theoretical errors originated from showering and hadronization models and computational challenges to implementing such tagger in current analysis tools.

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## My three-month internship at IBA

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Presentation of the project carried on during my internship at IBA in Louvain-la-Neuve.