

# 1 Accomplishments of Oliver Gutsche

## 1.1 Scientific Accomplishments

I joined the CMS collaboration at the LHC in 2005 and my research focus has been the search for New Physics Beyond the Standard Model of Particle Physics as well as precision Standard Model measurements.

I was a founding member of an analysis group with members from Fermilab/UCSD/UCSB, focusing on final states with leptons. The approach proved to be successful; after early publications such as a measurement of the [top quark cross section](#), the focus shifted to new physics and beyond the Standard Model processes. We were leaders of the WW to dilepton analysis in the [CMS Higgs discovery paper](#), and searches for SUSY in same-sign and opposite-sign dilepton as well as single lepton channels. The group is currently continuing the searches for SUSY in lepton final states as well as Standard Model processes.

I have been supervising several Fermilab postdoctoral researchers helping me to pursue my research interests.

- Together with Jacob Linacre, I concentrated on exploiting the dilepton signature to search for [pair production of a heavy top-like quark \( \$t'\$ \)](#). I continued studying the properties of top quarks exploiting angular distributions of the dilepton final state. We were the first to use the dilepton final state to measure the top pair charge asymmetry at the LHC to further investigate the deviations seen at the Tevatron. We published LHC Run 1 papers for top pair spin correlations and top quark polarization for the [7 TeV](#) and [8 TeV](#) datasets as well as the top pair charge asymmetry for the [7 TeV](#) and [8 TeV](#) datasets.
- Since 2015, I am supervising Fermilab PostDoc Matteo Cremonesi. He created a new dark matter analysis effort at the Fermilab LHC Physics Center (LPC), searching for dark matter particles in various channels. The first publication presented the [search for dark matter in events with energetic, hadronically decaying top quarks and missing transverse momentum](#) in the 13 TeV 2016 dataset of LHC Run 2. The second publication describes the [search for dark matter produced in association with a Higgs boson decaying to a pair of bottom quarks](#) in the same dataset. The group is now concentrating on other mono-object channels with an expanding effort at the LPC.
- Since 2018, I am supervising Fermilab PostDoc Nick Smith. He joined the Higgs efforts of the LPC and is contributing to the analysis of the Higgs decay channel into two bottom quarks.

## 1.2 Managerial Accomplishments

### 1.2.1 Fermilab

- From September 2014 to September 2016, I was appointed Assistant Scientific Computing Division Head for Science Operations and Workflows in the Scientific Computing Division of Fermilab. I was responsible for the delivery of scientific computing services to all Fermilab experiments, including High Energy Physics experiments (e.g. CMS), Neutrino Physics experiments (e.g. NOvA, Minerva), Intensity Frontier experiments (e.g. mu2e, Muon g-2) and Astroparticle Physics experiments (e.g. DES). As member of the senior management team, I developed strategic plans to evolve the infrastructure and operational procedures. For example, I developed a new storage strategy that simplifies the operation and usage of the more than 30 PB of disk space at Fermilab. I was also responsible for maintaining the computing strategy as part of the Laboratory Strategy Effort and reported to the laboratory directorate.
- In October 2016, I was appointed Deputy Head of the Scientific Services Quadrant. This quadrant is the user facing arm of the Scientific Computing Division, and develops computing infrastructure software components for data and workload management for the whole scientific program of Fermilab, supporting neutrino, muon, and astro-particle experiments as well as CMS.

### 1.2.2 U.S.CMS LHC Operations Program

- In March 2019, I was appointed the U.S. CMS Software and Computing Operations Program manager enabling U.S. CMS collaborators to analyze the CMS experiment's data. From October 2016 to February 2016, I was the deputy manager for the same operations program. I am overseeing the operation of the

U.S. CMS Tier-1 site at Fermilab and 7 U.S. Tier-2 sites at Caltech, Florida University, MIT, University of Nebraska-Lincoln, Purdue University, UC San Diego, and University of Wisconsin-Madison. The program funds over 80 FTE of effort to administer the sites, maintain the computing infrastructure and aid in strategic R&D projects.

- In the U.S. CMS Software and Computing Operations Program, I was responsible for the Software and Support area from October 2016 to February 2019. Under my guidance, the CMS software framework CMSSW was maintained and evolved, as well as critical R&D was started in the areas of vectorized tracking software, machine learning and novel analysis facilities.

### 1.2.3 CMS Software and Computing project

- The CMS collaboration appointed me Focus Area Lead for Services and Infrastructure in the CMS Software and Computing project in 2015. I am coordinating the efforts of the worldwide submission infrastructure, innovative new ways of using resources at commercial clouds and supercomputing centers, and the development of computing infrastructure services like data management and workflow management systems.

## 1.3 Technical Accomplishments

- I am employing my extensive knowledge of scientific software and computing in contributing to the worldwide community efforts to plan for the software and computing infrastructure for the High Luminosity LHC (HL-LHC). Starting in 2026, the HL-LHC will produce many times the amount of data of the current LHC running periods. In addition, the collisions and the corresponding simulations will be many times as complex as today. I was an integral part of the community planning process and my input was documented in the [Roadmap for HEP Software and Computing R&D for the 2020s](#). In addition, I was co-editor of the [HEP Software Foundation Community White Paper Working Group - Data Analysis and Interpretation](#).
- My recent research interest in computing infrastructure is asking the question if analysis in HEP can be conducted more efficiently using tools developed and used by industry. Instead of employing the [ROOT](#) toolkit that was entirely developed by the HEP community, I am exploring using toolkits like [Apache Spark](#) or similar technologies. I created a research group spanning researchers from Fermilab, CERN and the Universities Princeton, Padova and Vanderbilt. The [CMS Big Data Project](#) is also very closely working together with industry, latest in a project with [Intel](#) concluded in January 2019 in the context of [CERN openlab](#). To realize this project, Fermilab joined CERN openlab and I organized the DOE approval process with the help of the Fermilab Office of Partnership and Technology Transfer and the Fermilab Legal Office. I also managed a Lab Directed Research and Development project (LDRD) to develop innovative technology for Big Data delivery to array-based analysis code, the [Striped Data Server for Scalable Parallel Data Analysis](#). The project concluded successfully in January 2019 and produced a prototype that is currently being used by a diverse set of experiments from collider physics to astro-particle physics.
- In 2017, I was asked to pay tribute to 50 years of computing innovations at the Fermilab 50th Anniversary Symposium.
- In 2017 I was asked to join the editorial board of the In 2017, I was asked to join the editorial board of the journal for “[Computing and Software for Big Science](#)” published by Springer.
- In 2018, I was asked to be Co-Editor of the [American Physics Society \(APS\) Division of Particles and Fields \(DPF\)](#) white paper as input to the [European Particle Physics Strategy Update 2018 – 2020](#), responsible for the computing section.