Semra Türkçapar

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Like most scientists, I am a naturally curious person. Throughout my particle physics career, I have been curious about not only physics but also electronics. So, in addtion to focusing SUSY searches, I have pursued hardware projects and contributed significantly to the assembly, testing, and commissioning of the Phase-1 upgrade of the CMS Hadronic Calorimeter (HCAL) at the LHC. I am now looking for a hardware-focused position, where the work will continue to spark my curiosity and where I can continue to develop new skills.

Education

Sep. 2014 - Mar. 2023 **Doctor of Philosophy in Physics**, Çukurova University, Adana / TURKEY.

- **Thesis:** "*Search for Stealth SYȳ Top Squark Decays with an Automated ABCD Method using a Double DisCo Neural Network*"
- **Advisor:** *Prof. Dr. Ayşe Polatöz, Çukurova University*

Sep. 2010 - Feb. 2014 **Master of Science in Physics**, Çukurova University, Adana / TURKEY.

- **Thesis:** "*Pedestal Analysis for HO and HF Calorimeters in CMS Experiment*"
- **Advisor:** *Prof. Dr. Ayşe Polatöz, Çukurova University*

2009 - 2010 **English Language Program**, Çukurova University Foreign Languages Teaching Research and Application Center, Adana / TURKEY.

2004 - 2008 **Bachelor of Science in Physics**, Dicle University, Diyarbakır / TURKEY.

Employment

2019 **LHC Physiscs Center (LPC) Guest&Visitor Program - Visitor Ph.D. Student**, Fermilab / U.S.

- Primary analyst for the CMS Supersymmetry (SUSY) searches since 2019

2019 **Research Assistant**, USCMS / CERN.

- Led the testing and integration of Calibration Units (CUs) of the HCAL Barrel (HB)

2017 **Research Assistant**, USCMS / CERN.

- Participated in Installation and Commissioning of Front-End (FE) Electronics of the HCAL Forward (HF)
- Participated in Calibration test with a radioactive source of the HF

2015-2019 **Research Assistant**, Turkish Atomic Energy Authority (TAEK) / CERN.

- Contributed to detector upgrades of the HB, HCAL Endcap (HE) and HF
- Contributed to a B-Physics analysis looking for existence of exotic mesons at the CMS

2014 **English Lecturer**, Bilgi Yon Private Teaching Institution, Mersin / TURKEY.

- Taught English to primary and secondary school students

2012-2013 **Research Assistant**, Turkish Atomic Energy Authority (TAEK) / CERN.

- Contributed to assembly and tests of 4-anode PMTs of the HF

- Contributed to tests of SiPMs of the HCAL Outer (HO)

2009 - 2010 **Teaching Assistant**, Çukurova University, Adana / TURKEY.

- Taught to laboratory sessions for Bachelors students studying physics

Academic Activities

Publications

As a member of the CMS collaboration, I am an author of more than 600 publications. A complete list of all my publications can be found through *INSPIRE*. The following list shows a publication of the SUSY search for which I made a contribution as a primary author. There are also couple of chosen publications based on the CMS Phase-1 upgrades where I had direct involvement in various aspects of the detector development.

2021 **CMS Collaboration**, *Search for top squarks in final states with two top quarks and several light-flavor jets in proton-proton collisions at* $\sqrt{s}$ *= 13 TeV*, *Phys. Rev. D 104, 032006*.
Primary author

2020 **CMS Collaboration**, *Measurements with silicon photomultipliers of dose-rate effects in the radiation damage of plastic scintillator tiles in the CMS hadron endcap calorimeter*, *JINST 15 P06009*.

2018 **CMS Collaboration**, *Brightness and uniformity measurements of plastic scintillator tiles at the CERN H2 test beam*, *JINST 13 P01002*.

2017 **CMS Collaboration**, *Radioactive source calibration test of the CMS Hadron Endcap Calorimeter test wedge with Phase I upgrade electronics*, *JINST 12 P12034*.

Also, there have been an ongoing SUSY search which I am a primary author (my thesis based on this version). This will be go trough the publications steps in the CMS soon. There will be two publications based on this analysis that one is for the analysis and another is for the Double DisCo NN itself. The draft paper titles are listed below.

2023 **CMS Collaboration**, *Search for top squarks with the ABCDisCoTEC method in final states with two top quarks and several light-flavor jets in proton-proton collisions at* $\sqrt{s}$ *= 13 TeV*, *SUS-23-001*.
Primary author

2023 **CMS Collaboration**, *ABCDisCoTEC with LHC data: Extension and first application of the ABCDisCo method*, *MLG-23-003*.
Primary author

Oral Presentations

APS DPF21, Parallel session talk, 12 July 2021.

- **Title:** "*Search for top squarks in final states with two top quarks and several light-flavor jets in proton-proton collisions at* $\sqrt{s}$ *= 13 TeV*"

Conference Posters

EPS-HEP Conference 2021, Poster Presentation, 26-30 July 2021.

- **Title:** "*Search for top squarks in final states with two top quarks and several light-flavor jets in proton-proton collisions at* $\sqrt{s}$ *= 13 TeV*"

Workshops

- **HGCAL Workshop 2019-1**, 11-14 March 2019, CERN
- **Impact of B** $\rightarrow \mu\mu$ **on New Physics**, 18-19 December 2017, PSI, Zurich
- **CMS Machine Learning Workshop**, 5-6 July 2017, CERN
- **High Energy Physics: Theory and Experiment Workshop**, 11-13 September 2013, Izmir High Technology Institute, TURKEY
- **High Energy Physics: Theory and Experiment Workshop**, 27-30 December 2011, Ankara University, TURKEY

Tutorials & Courses

- **CMS Data Analysis School at LHC Physics Center**, 3-17 January 2020, Fermilab
- **Hands-on Advanced Tutorial: CMS Upgrade Detectors at LHC Physisc Center**, 2019, Fermilab
- **Hands-on Advanced Tutorial: (B, t, H, W, Z) Tagging at LHC Physisc Center**, 2019, Fermilab
- **Inverted CERN School of Computing 2019**, 4-7 March 2019, CERN
- **The 2nd McM and pMp Tutorial**, 17 October 2017, CERN
- **CMS Induction Course**, 15-16 June 2017, CERN

Supervisions

I have informally supervised 2 master students while performing their thesis researches.

Jun. 2016 - Sep. 2016 **Ilknur Baldan, Master Student at Çukurova University**, supervised on testing the QIE10 chips of the CMS HCAL Forward (HF) detector.

Currently **Derya Kalir, Master Student at Çukurova University**, supervising on testing the performance of SiPMs of the CMS HCAL sub-detectors.

Physics Research Experiences

I have been a member of the **CMS Collaboration** since my master term. I have been a primary analyst of the CMS **Supersymmetry (SUSY) searches** since 2019, as a visitor student of the LPC Guest & Visitor program at Fermilab in 2019. My main focus has been a SUSY search (*SUS-23-001*), that my Ph.D. dissertation is based on. Also, early in my graduate school career, I contributed to a **B-Physics analysis** looking for existence of exotic mesons at the CMS experiment.

CMS SUSY Searches

Since 2019 **Primary analyst for "Search for top squarks with the ABCDisCoTEC method in final states with two top quarks and several light-flavor jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV"**.

- I started as a part of the ***LPC Guest&Visitor program at Fermilab***, performing this analysis for new explorations which haven't been commonly searched for in the CMS.
- I developed a framework to validating the ABCD method, calculating the $t\bar{t}+jets$ systematics for all of three analysis channels.
- I also focused the fully-hadronic analysis channel to improving the performance of the Double DisCo NN, optimizing the working point for the Hadronic Top Tagger, calculating the jet trigger efficiency scale factors and determining the signal region selection.

2019 **Primary analyst for "Search for top squarks in final states with two top quarks and several light-flavor jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV"**.

- I contributed the analysis during my LPC Guest&Visitor term.
- I performed a study to understand if modeling of the top quark caused an issue which was a data-MC disagreement between the events for 2016 and 2017—since the different MC generator tunes were used for 2016 (CUETP8M2T4) and 2017 (CP5).

CMS B-Physics Analysis

2016-2018 **Contributor analyst for "Inclusive Production of the Y(4140) State in Proton-Proton Collisions at the LHC with the CMS Detector"**.

- Early in my graduate school, I contributed this analysis to new experimental observations and measurements for the exotic mesons.
- I updated a framework for ntuple production of the data.
- I built a framework including a sideband subtraction method to estimate the number of background events.

Hardware Research Experiences

I have been working on the CMS HCAL phase-1 upgrades since 2012. I had direct involvement in various aspects of detector development for these upgrades to improving my skills for the detector operations: Setting up test stands for PCB testing, Assembling and testing analog components of PCBs, Assembling and testing electrical and optical (laser maintenance) systems, Using the tool for programming the FPGAs on the PCBs, Using the systems such that taking local runs; controlling and monitoring the voltages, power, etc.; running a laser. Also, I took several local, remote and central shifts where I improved good skills for the detector operetions and communications.

CMS HCAL HB upgrades

2018-2019 **Led the testing and integration of CUs**.

- Characterized and validated performance of electronics and optical system of CUs, which consist of a laser system generating the LED light and electrical system distributing the LED light to the photo-detectors to checking responses of detector and photo-detectors for in situ calibration of the CMS HCAL
- Advised junior PhD students and teaching assembly and test procedures to them

CMS HCAL HF upgrades

2017 **Calibration test with a radioactive source**, funded by USCMS.

- Prepared the software for local data and joined the shifts to take this sourcing runs to perform a specific calibartion test for radiation damage with a radioactive source which propagates the cherenkov light to the PMTs for checking data path for the whole HF detector

2017 **Installation and Commissioning of the FE Electronics**, funded by USCMS.

- Participated in all steps of both installation and commissioning of the FE electronics - included labeling, cabeling, mounting, adjusting voltage and power, controling data link, taking local runs

2017 **Improved the software for detector monitoring in the HCAL online software group**.

- Contributed to software updates for monitoring the HF by using the servers configuring directly electronics, making xml files to include information about the detector, etc.

2015 **Assembled and tested the QIE cards individually and the brun-in test stand including photo-detectors and Back-End (BE) electronics.**.

- Contributed to assamble each component of the QIE cards and set up the burn-in stand
- Contributed to develop a framework analyzing taken local runs to examining conditions and characterizing behaviour of QIEs

2012-2013 **Assembled and tested 4-anode PMTs and performed analysis to monitor pedestal values of PMTs, assembled the readout boxes where the PMTs are placed**.

CMS HCAL HO upgrades

2012-2013 **Tested SiPMs with the other FE electronics and performed stability analysis to monitor temperature, current, LED and pedestal values of SiPMs**.

CMS Shifts

2017-2018 **CMS HCAL Detector On-Call shift**, *which is a weekly central shift taken at the CMS control room to coordinate the commissioning and maintenance activities during the data taking for the CMS HCAL.*

2017 **CMS HCAL HF sourcing shift**, *which is a spesific calibration shift taken at the CMS control room to check data path for the whole HF detector with the received radioactive source data.*

2016 **CMS BRIL shift**, *which is a central shift taken at the CMS control room to monitor luminosity and beam conditions of the CMS detector.*

2015 **CMS HCAL HE test beam shift**, *which is a local shift to test the response of the HCAL Endcap (HE) detector with a beam.*

2011-2013 **CMS Computing Shift Personnel (CSP) shift**, *which is a remote shift to monitor a computing grid system where physics data are stored.*

Documents and Certificates

- Çukurova University, Foreign Languages Teaching Research and Application Certificate of Achievement (for English language), August 2010

Interests

- Machine Learning techniques
- Analog and digital circuit designs
- Verilog (beginner), Vivado (beginner)
- Playing with Xilinx Basys 3 FPGA Board to learn how to develop Verilog, how to implement Vivado for testing and sourcing digital circuits on FPGA chips

Technical Skills

Physics Tools

- Higgs Combine Tool: CMS Internal RooFit based fitting package
- CMSSW: CMS Software Framework
- ROOT, RooFit, ProofLite
- GitHub, GitLab

Programming Languages

- Python, C++
- html (beginner), xml (beginner)

Scripts

- Bash, LaTeX

Operating Systems

- Linux (ubuntu, mint), Mac

Languages

- Turkish, (native)
- English, (fluent)