Basil Schneider

contact

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languages

German (native)
English (fluent)
French (moderate)
Croatian (beginner)
Norwegian (beginner)

computing

Linux
C++, Python, Rust
Root, RooFit, RooStats
bash, sed, awk
git, svn
HTML, CSS
LaTeX

besides physics

Cycling
Hiking
Music

education & employment

Nov '15 - now **Research Associate** at the **CMS experiment** — Fermilab

Nov '14 - Oct '15 **Postdoctoral Fellow** at the **ATLAS experiment** — TRIUMF

Jan '11 - Jul '14 **Ph.D.** at the **ATLAS experiment** — University of Bern
Ph.D. Thesis: A general approach to search for supersymmetry at the LHC by combining signal enhanced kinematic regions using the ATLAS detector (Supervisor: Prof. A. Ereditato)

Sep '08 - Mar '10 **Master** of Science in **Theoretical Physics** — ETH Zurich
Master Thesis: The partition function of meromorphic conformal field theories at higher genus (Supervisor: Prof. M. Gaberdiel)

Oct '04 - Sep '08 **Bachelor** of Science in **Experimental Physics** — ETH Zurich
Bachelor Thesis: Untersuchung der Cluster-Struktur von Elastomerpartikeln durch Simulation des Aggregationsvorganges und Partikelgrössen mittels dynamic light scattering (Supervisor: Dr. Cornelius Gauer)

Sep '04 **Comprehensive entrance exam** — ETH Zurich
Exam at the level of a Matura

awards

Mar '15 **Faculty award winner of the University of Bern**
Award for the best PhD thesis in physics at the University of Bern in the year 2014

leadership

Jan '18 - now **SUSY Leptonic subgroup co-convener**

Oct '16 - May '17 **Coordinator of the Single Lepton dPhi Analysis group**

conferences

Oct '17 **IEEE Nuclear Science Symposium and Medical Imaging Conference**
Poster: "A new DAQ solution: *otsdaq*" Atlanta, GA, USA

Aug '17 **Meeting of the Division of Particles and Fields of the American Physical Society**
Fermilab, Batavia, IL, USA
Speaker: "Searches for electroweakly produced supersymmetry with CMS"

May '17 **Phenomenology 2017 Symposium** Pittsburgh, PA, USA
Speaker: "Searches for supersymmetry in single or opposite-charged dilepton final states with CMS"

Jun '16 **49th Annual Fermilab Users Meeting** Fermilab, Batavia, IL, USA
Poster: "Characterization of the pixel ASIC with a laser beam in the Outer Tracker upgrade of the CMS detector"

May '15 **Mitchell Workshop on Collider and Dark Matter Physics**
Texas A&M University, College Station, TX, USA
Speaker: "Supersymmetry searches in ATLAS"

May '13 **1st LHC Physics Conference (LHCP)** Barcelona, Spain
Poster: "Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in 21 fb^{-1} of pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector"

Jun '12 **Swiss Physical Society** ETH, Zurich, Switzerland
Speaker: "New Optical receiver modules for the insertable B-Layer at the ATLAS project"

Jun '11 **Physics at LHC** Perugia, Italy
Poster: "SUSY Searches at ATLAS in Multilepton Final States with Jets and Missing Transverse Energy"

Jun '11 **Swiss Physical Society** EPF, Lausanne, Switzerland
Speaker: "Insertable b-Layer: A new layer for the ATLAS detector at CERN"

journal publications

I am co-author of 475 ATLAS publications and 111 CMS publications; for a full list, see
http://inspirehep.net/author/profile/B.Schneider.1
Publications with substantial contributions from me:

2018 Performance of the Prototype CBC3-based Outer Tracker Module for the Phase-2 Upgrade of CMS in preparation

2018 Performance of Prototype Silicon Detectors for the Outer Tracker for the Phase-2 Upgrade of CMS in preparation

Jan '18 Search for new physics in events with two soft oppositely charged leptons and missing transverse momentum in proton-proton collisions at $\sqrt{s}$ = 13 TeV arXiv:1801.01846 [hep-ex]

Sep '17 Search for supersymmetry in events with one lepton and multiple jets exploiting the angular correlation between the lepton and the missing transverse momentum in proton-proton collisions at $\sqrt{s}$ = 13 TeV
10.1016/j.physletb.2018.03.028

Sep '16 Search for supersymmetry in events with one lepton and multiple jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV Phys. Rev. D 95, 012011 (2017)

Sep '15 Search for the electroweak production of supersymmetric particles in $\sqrt{s}$ = 8 TeV pp collisions with the ATLAS detector
Phys. Rev. D 93, 052002 (2016)

May '14 Search for supersymmetry in events with four or more leptons in $\sqrt{s}$ = 8 TeV pp collisions with the ATLAS detector
Phys. Rev. D. 90, 052001 (2014)

Feb '14 Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in $\sqrt{s}$ = 8 TeV pp collisions with the ATLAS detector JHEP04(2014)169

Aug '12 Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in $\sqrt{s}$ = 7 TeV pp collisions with the ATLAS detector Phys.Lett. B718 (2013) 841-859

proceedings

Jun '13 Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in 21 fb^{-1} of pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector
EPJ Web of Conferences 60, 20040 (2013)

Nov '11 The ATLAS IBL BOC Demonstrator
Proceedings, 2011 IEEE Nuclear Science Symposium and Medical Imaging Conference

Oct '11 SUSY Searches at ATLAS in Multilepton Final States with Jets and Missing Transverse Energy Proceedings, Physics at LHC 2011

public notes

2018 Search for Supersymmetry at the HL-LHC with the Upgraded CMS Detector in preparation

Apr '18 The Phase-2 Upgrade of the CMS Endcap Calorimeter – Technical Design Report CERN-LHCC-2017-023

Sep '17 The Phase-2 Upgrade of the CMS Barrel Calorimeters – Technical Design Report CERN-LHCC-2017-011

Jun '17 The Phase-2 Upgrade of the CMS Tracker – Technical Design Report
CERN-LHCC-2017-009

Dec '16 Search for new physics in the compressed mass spectra scenario using events with two soft opposite-sign leptons and missing transverse momentum at $\sqrt{s}$ = 13 TeV CMS PAS SUS-16-025

Aug '16 Search for supersymmetry in events with one lepton and multiple jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV in 2016 CMS PAS SUS-16-019

Jul '15 First look at proton proton collision data at $\sqrt{s}$ = 13 TeV in preparation for a search for squarks and gluinos in events with missing transverse energy, jets, and an isolated electron or muon ATL-PHYS-PUB-2015-029

Mar '15 Expected sensitivity studies for gluino and squark searches using the early LHC 13 TeV Run-2 dataset with the ATLAS experiment
ATL-PHYS-PUB-2015-005

Jun '14 A general approach to search for supersymmetry at the LHC by combining signal enhanced kinematic regions using the ATLAS detector (PhD thesis)
CERN-THESIS-2014-056

Mar '13 Search for supersymmetry in events with four or more leptons in 21 fb^{-1} of pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector
ATLAS-CONF-2013-036

Mar '13 — Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in 21 fb^{-1} of pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector — ATLAS-CONF-2013-035

Nov '12 — Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in 13.0 fb^{-1} of pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector — ATLAS-CONF-2012-154

Nov '12 — Search for Supersymmetry in events with four or more leptons in 13 fb^{-1} pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector — ATLAS-CONF-2012-153

organization

Aug '12 — **Co-organizer of workshop: ATLAS SUSY Statistical Interpretations workshop**
Wrap up lessons learned in previous round of publications and spot possible improvements for next round

Sep '11 — **Co-organizer of outreach event: Nacht der Forschung** — University of Bern
Performing experiments in public and discussing results

outreach

Jan '16 — **Fermilab Open House**
Explaining the purpose and the mission of Fermilab to the public

Nov '13 - now — **Official ATLAS underground guide**
Showing the ATLAS detector to the public during LHC shutdowns

Mar '12 - Mar '13 — **Masterclasses** — University of Bern
Helping high school students performing measurements on real LHC data

Sep '11 — **Nacht der Forschung** — University of Bern
Presenting LHC physics on a poster and answering questions of the public in a research outreach event at the University of Bern

committees

Feb '18 — Analysis Review Committee: Search for supersymmetry in events with two tau leptons and missing transverse momentum in $\sqrt{s}$ = 13 TeV proton-proton collisions with the CMS detector — to be submitted to JHEP

Jul '17 — Analysis Review Committee: Search for pair production of tau sleptons in $\sqrt{s}$ = 13 TeV pp collisions in the all-hadronic final state — CMS-PAS-SUS-17-003

Jan '17 — Analysis Review Committee: Search for physics beyond the standard model in events with two leptons of same sign, missing transverse momentum, and jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV
Eur. Phys. J. C 77 (2017) 578

Jul '16 — Analysis Review Committee: Search for SUSY in same-sign dilepton events at 13 TeV — CMS-PAS-SUS-16-020

teaching

Jan '11 - May '14 **Lab Course** — University of Bern
Supervising and assisting Physics undergraduate students working on fundamental experiments in mechanics and electronics

Jan '11 - May '14 **Physics for Biologists** — University of Bern
Assisting 1st year Physics course

Jul '11 - May '14 **Private lessons for high-school graduates** — Interlink Schulberatung GmbH
Private lessons in Mathematics, Statistics and Physics

Jun '08 **Exam preparation** — ETH Zurich
Exam preparation for 1st year Physics and Mathematics students

2007/2008 **Teaching assistant** — ETH Zurich
Teaching assistant for environmental science students in Calculus

supervision

Jul '16 - Oct '16 **David Jin**
Summer Student at Fermilab, University of Chicago

May '16 - Aug '16 **Christian Leefmans**
Summer Student at Fermilab, Cornell University

Dec '14 - Nov '15 **Felix Cormier**
MSc student at CERN, University of British Columbia

Nov '14 - Nov '15 **Matthew Gignac**
PhD student at CERN, University of British Columbia

Dec '12 - Mar' 14 **Benjamin Gerber**
MSc student, University of Bern

Analysis activities in ATLAS (up to 2015)

- I was the main analyzer of the search for charginos and neutralinos in events with three leptons and missing transverse momentum based on 8 fb^{-1} of data collected by ATLAS at $\sqrt{s}$ = 8 TeV (JHEP 04 (2014 169)). A large improvement in sensitivity was obtained, compared to previous analyses, by splitting the signal region in multiple bins depending on several kinematic variables and the multiplicity of taus in the final state. In addition to leading the analysis effort, I guided the optimization of the signal region for the final states with at least one tau. I was chosen to present the analysis in front of the collaboration for its approval.
- I carried out the statistical interpretations for four publications in ATLAS, all searching for supersymmetry in either three lepton or four lepton final states (Phys. Rev. D 93, 052002 (2016), Phys. Rev. D. 90, 052001 (2014), JHEP04 (2014) 169, Phys.Lett. B718 (2013) 841-859) and became the reference person for statistical interpretations in ATLAS SUSY EWK searches. In one these searches I also measured the most important background, WZ.
- I combined the three lepton electroweak SUSY search with a search in a final state with two leptons (JHEP 05 (2014) 071).
- During the Long Shutdown 1, I supervised a student and we released a public note (ATL-PHYS-PUB-2015-005) assessing the discovery potential of gluinos as a function of their mass and the integrated luminosity in the final state with one lepton.

Analysis activities in CMS (since 2015)

- I thoroughly studied and compared the software packages that ATLAS and CMS use to carry out their statistical interpretations of analyses to understand the differences in features and scope.
- I carried out a phenomenological study to understand what parts of the SUSY phase space can explain the relic abundance of dark matter, but is not currently covered by SUSY searches.
- I led the search for strongly produced SUSY particles in final states with a single lepton to a publication (10.1016/j.physletb.2018.03.028). I was responsible for organizing and coordinating the analysis, optimizing the analysis strategy and presenting the analysis to the collaboration for approval. The optimization of the search strategy led to an improvement in the exclusion limit for the gluino mass of 100 GeV in the limit of low LSP masses. In addition I was responsible for the measurement of the multijet background.
- I am one of the main analyzers in the soft multilepton group that is targeting light natural higgsinos. I carried out phenomenological studies and added an interpretation, that could solve the hierarchy problem and provide an excellent candidate for dark matter. This analysis is expected to be one of the first SUSY searches to use the combined dataset of 2016 and 2017. I am the contact person for the publication that is submitted to PLB (arXiv:1801.01846 [hep-ex]).
- I assessed the sensitivity of a SUSY search in a final state of two low momentum leptons for the HL-LHC with an integrated luminosity of 3000 fb^{-1} at a center-of-mass energy of 14 TeV and 200 additional pileup events. To develop the analysis itself, I contributed significantly to the validation of Delphes (JHEP 02 (2014) 057) for HL-LHC searches. This in turn enabled the development of

searches for SUSY in the final states with two same-charge leptons and taus. These analyses will be included in the upcoming Yellow Report for the European Strategy for Particle Physics and documented in a PAS that is in preparation.

- I am the SUSY Leptonic co-convener, organizing biweekly meetings, coordinating and reviewing the effort of several analyses that either search for electroweakly produced SUSY or use at least two leptons in their final state.

Detector R&D for the Phase-1 upgrade and MC simulations for HL-LHC on ATLAS (up to 2015)

- I set up the laboratory at the University of Bern that was used for the test of the optical receivers for the read out of the insertable b-layer (IBL), which is the additional pixel detector layer, closest to the interaction point, that was added in the ATLAS experiment during the Long Shutdown 1. I defined the acceptance criteria for the optical receivers, based on the reliability, sensitivity to the input light intensity and frequency range, and then used them to qualify the receivers finally installed in the cavern. I presented the results on this qualification in the ATLAS IBL general meetings. My work has helped establishing the group of the University of Bern as a leader for this kind of measurements in ATLAS.
- While at TRIUMF, I have contributed to the design of the Phase-2 tracker upgrade of the ATLAS detector with Monte Carlo studies of different geometries of the silicon inner detector (ITk), focusing in particular on the benefits, from the point of view of physics analyses, of a possible extension of the rapidity coverage of the tracker. I also studied the impact of using a new tracking algorithm originally developed for Run-2 of ATLAS, called TIDE (Tracking in dense environments) on the proposed ITk layouts. Finally, I supervised a Ph.D. student who was studying the tracking efficiency as a function of the total number of pixel and strip layers in the ATLAS tracker. All these studies have been an important input to the ITk community in defining the best layout of the inner tracker.

Detector R&D for HL-LHC on CMS (since 2015)

- I have worked in two areas related to the R&D program for the CMS Phase-2 Outer Tracker: the development of a data acquisition tool (*otsdaq*) that could be used in all phases of the detector development and construction (from bench tests of individual components to data taking in a beam with multiple detectors), and hardware tests of prototypes of modules and of parts of modules.
- I measured the properties of the first macro-pixel prototype, the MaPSA-Light, that combined a silicon sensor with a dedicated readout chip. In CMS, these macro-pixel detectors will be attached to a strip detector to form the PS modules. Using a laser system to generate charges in the silicon sensor I performed efficiency and time-walk measurements for the first time in a MaPSA-Light prototype.

- Later I measured the properties of all the available (three) Phase-2 2S modules (these are modules with two silicon strip sensors and electronics that form spatial coincidences between hits in the two layers). The characterization studies of these modules led to the discovery of several flaws in the firmware, software and module design, all of which have been later fixed. The results from these tests have been included in the CMS Technical Design Report for the Phase-2 tracking system.
- I have qualified all full-sized hybrids for the 2S modules (these are flexible circuits that are used to connect the two silicon strip layers in a 2S module) that have been commercially manufactured, prior to their use for the construction of prototype modules in different CMS member institutions.
- I have set up several read out systems at CERN and at Fermilab, both to read out Outer Tracker modules and hybrids. The read out system set up at Fermilab has later been used in the test beam, where we measured for the first time the response of version 3 of the CBC ASIC to a particle beam.
- I developed the Outer Tracker part of *otsdaq* (off-the-shelf DAQ), a generic data acquisition tool for particle physics experiments. *otsdaq* has been used in several test beams, both at CERN and at Fermilab. It provides a graphical user interface for simple and efficient data taking, live data quality monitoring and a graphical user interface to configure the detector.
- I participated in several test beams, by setting up the system and allow for efficient data taking. The data from these test beams will be used for a publication that is in preparation.