Universität Siegen / HEP Experimental High Energy Physics / CPPS Center for Particle Physics Siegen / color meets flavor

<u>Mögliche Themen für Bachelorarbeiten, Februar 2026</u>

ATLAS Datenanalyse

- Studien der Sensitivität in t -> Hq für verschiedene beyond-Standard-Modell-Szenarien
- Sensitivität von (teil)geboosteten Ereignissen in ttH, H->cc Suchen

Simulation und Rekonstruktion

- Entwicklung einer robusten Datenproduktionspipeline für sekundäre Vertices
- Validierung von GEANT4 Monte Carlo durch Erzeugung virtueller Teststrahlen (SHiP)
- Zerfallsketten und Kinematik von Mesonen in EvtGen (SHiP)
- Messung und Anpassung der ACTS-Tracking-Performanz bei SHiP

Detektorphysik

- KI-Identifizierung von UHE Photonen: intelligente Hardware-Implementierung (Auger)
- ITk-Pixelmodulscans inbesondere bezüglich Pixel unterschiedlicher Größe (ATLAS)

Derzeit laufend:

- ITk Pixel Testsystem (ATLAS)
- Investigation of the core-column issues (ATLAS)

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Possible Master's thesis topics, February 2026

ATLAS Physics

- Sensitivity of (semi)boosted events in ttH,H->cc searches
- Using charge asymmetry to access Higgs Yukawa couplings to light-mass quarks in WH production

Reconstruction, Simulation

- Improving robustness of modern jet identification algorithms against changing experimental conditions using advanced machine learning methods
- Unified ML model for CaloCluster energy calibration and pileup suppression (ATLAS)
- Investigating the usage of raw calorimeter information for tagging light-quark jets (ATLAS)
- Vertexing with ACTS at SHiP (TrackOpt)
- Improved simulation description of secondary production in a thick target (SHiPCharm)

Detector physics

- Setup and first operation of an ITk pixel module test-stand for module debugging purposes, without radioactive source (ATLAS)
- AI-Identification of UHE Photons: intelligent hardware implementation (Auger)
- From Noise to Trigger: AI-Based Denoising for Rare-Event Detection (IHL)
- From Simulation to Silicon: End-to-End Validation of an AI Trigger on FPGA (IHL)

Current master theses

- All-silicon modules (DRD3)
- AI-enabled FPGA trigger for radio (Auger)

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