

# Master thesis in experimental particle physics – Simulations of antiproton/antihydrogen detection with FLUKA

The Stefan Meyer Institute for Subatomic Physics ([www.oeaw.ac.at/smi/home/](http://www.oeaw.ac.at/smi/home/)) is currently looking for a Master student for the antihydrogen group ([www.antimaterie.at](http://www.antimaterie.at)) which is part of the ASACUSA collaboration at CERN's Antiproton Decelerator. The main goal of the experiment is measurement of the ground state hyperfine splitting of antihydrogen [1], and one of the key parts of the ASACUSA apparatus is the tracking detector which consists of a two layered hodoscope that detects the pions from the antihydrogen/antiproton annihilations [2].

Precise simulation of the annihilation process and of the detector is crucial for efficient detection. ASACUSA had hereto made use of the GEANT4 simulation tool for this purpose, but recent studies have shown that FLUKA Monte Carlo simulation package describes better the antiproton annihilation in terms of pion multiplicity. Thus, developing simulations using FLUKA is important for the next phase of the experiment, when the measurement of the hyperfine structure of antihydrogen will be attempted.

**This master thesis:** The goal of this master thesis is to develop full simulations, using FLUKA, of the ASACUSA antihydrogen detection system.

**Requirements:** Solid knowledge of particle physics and good programming skills (C/C++), as well as familiarity with GEANT4 and/or FLUKA are welcome. Familiarity with TCAD or another tool for simulating electric field is an advantage. Good language skills (English) are helpful.

**Planned start:** Autumn 2019-10-28

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## References:

- [1] E. Widmann et al. (2013). Measurement of the hyperfine structure of antihydrogen in a beam. *Hyperfine Interactions*, 215, 1–8
- [2] C. Sauerzopf et al. (2016). Annihilation Detector for an In-Beam Spectroscopy Apparatus to Measure the Ground State Hyperfine Splitting of Antihydrogen. *NIM A*. doi.org/10.1016/j.nima.2016.06.023
- [3] T.T. Böhlen, F. Cerutti, M.P.W. Chin, A. Fassò, A. Ferrari, P.G. Ortega et al., The FLUKA Code: Developments and Challenges for High Energy and Medical Applications, *Nucl. Data Sheets* 120 (2014) 211.