P23 |

Simulations on reducing the influence of backscattered slow positrons on lifetime measurements.

D. Dinescu[1,2*], and N. Djourelov[1]

[1] *Extreme Light Infrastructure - Nuclear Physics, Horia Hulubei National Institute for Physics and Nuclear Engineering, 30 Reactorului Street, 077125 Magurele, Ilfov county, Romania*
[2] *University Politehnica of Bucharest, Applied Science College, Splaiul Independentei, nr. 313, 060042, Bucuresti, Romania*

[*]email: Doru.Dinescu@eli-np.ro

For the development of new functional materials, the investigation of lattice defects and various atomic imperfections in solids constitutes an important step. For analyzing subsurface layers and thin films, slow e^+ beams are necessary. At the European Light Infrastructure – Nuclear Physics (ELI-NP), a brilliant γ-beam will produce fast e^+ by the pair production in a suitable converter made of tungsten foils, which will also act as a moderator [1]. One of the positron annihilation techniques, which over the years has become an increasingly valuable tool for study of the defect structure in materials is the Positron Annihilation Lifetime Spectroscopy (PALS). In order to perform PALS with a slow e^+ beam a start signal is needed. For obtaining the start signal, at ELI-NP, the slow e^+ beam will be pulsed using the chopping and bunching technique [2]. For depth profiling purposes, the slow e^+ are accelerated by a few graded electrodes to a desirable energy up to typically 30 keV.

When incident e^+ hit the target a fraction of them is backscattered. If the backscattered e^+ reach back the accelerator they can be reflected by the electric field and implanted into the sample with a delay from the initial e^+ bunch. Despite their small overall contribution, the caused satellite structures can make the spectrum analysis difficult.

The method implemented at the EPOS beam line of guiding the e^+ through a 45° bent tube equipped with steering coils after they pass the accelerator will not allow the e^+ backscattered from the target to reach the acceleration field [3]. The same method will be implemented at the ELI-NP e^+ line. To understand the origin of these satellite structures and to further improve the performance of the system, comprehensive simulations were performed in Comsol Multiphysics and Geant4. The aim of the study conducted in the present paper is to determine the optimum parameters of the designed system in order to obtain PALS spectra with minimum distortions caused by the backscattered e^+.

[1] N. Djourelov, C. Hugenschmidt, S. Balascuta, V. Leca, A. Oprisa, C. Piochacz, C. Teodorescu and C. A. Ur, *Romanian Reports in Physics* 68, S735 (2016)
[2] N. Djourelov and D. Dinescu, *J. Phys.: Conf. Serie*s 791, 012010 (2017)
[3] M. Jungmann, J. Haeberle, R. Krause-Rehberg, W. Anwand, M. Butterling, A. Wagner, J. M. Johnson and T. E. Cowan, *J. Phys.: Conf. Serie*s 443, 012088 (2013)