Positronium Lifetime Measurements using $^{82}$Rb in a Long-Axial FOV PET/CT Scanner

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Abstract

This work details results from two positronium (Ps) lifetime measurements performed in a long-axial FOV PET/CT scanner using $^{82}$Rb. Ps lifetime measurements are of interest for PET because they can yield additional diagnostic information. The first measurement placed drops of a $^{82}$Rb solution in between aluminum disks, quartz disks, and into a gelatin mixture. The extracted ortho-Ps (o-Ps) lifetime for the quartz sample was measured to be 1.53+/-0.04 ns, which agrees well with the previously published value of 1.56+/-0.08 ns. The lifetime of the aluminum is also compared with previous results, however, the lifetime exhibits a longer o-Ps lifetime due to positrons leaking into the surrounding plastic holder. The second measurement performed assessed the uniformity of the extracted lifetimes across a uniform cylinder (20φ×30 cm$^3$) filled with water and an activity of approximately 73.3 MBq. The resulting histo-image was sliced into 1.25 cm thick cross sections, which resulted in lifetime distributions containing on average $1.98\times10^5$+/-$1.06\times10^4$ counts. These lifetime distributions were integral normalized and compared to an averaged lifetime across the uniform cylinder. Overall average deviation in the lifetime measured across the cylinder was determined to be -0.015+/-1.53 %.

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References

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