# Manipulation techniques of a slow positron beam in AIST

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We reported the development of a simple and efficient method for enhancing a brightness of an intense slow positron beam produced by an electron linear accelerator (LINAC) in 2008 [1]. A LINAC-based positron beam is focused by a magnetic lens at a remoderator (transmission type). The remoderated positrons are again accelerated and focused on the sample by an objective lens. The beam diameter is 30 -100 μm at the sample. The beam is pulsed with a combination of two kinds of pulsing systems to measure positron lifetimes. Positron lifetime can be measured with a time resolution of about 200 ps. The counting rate of γ-rays during a positron lifetime measurement is ~$10^3$ $s^{-1}$. This positron lifetime measurement system is known as the positron probe microanalyzer (PPMA).

In 2009, three-dimensional positron lifetime mapping was demonstrated by moving the sample with an x-y translation system and varying the positron implantation energy into the sample during the positron lifetime measurement [2]. Figure 1 shows mean positron lifetime maps of a $SiO_2$ sample locally damaged by irradiations of ion beams through mesh masks. The measurement time for each pixel (50 μm x 50 μm) was 1 s. Mesh mask patterns are clearly seen as contrasts of positron lifetimes.

In 2011, we have developed an extraction technique of slow positrons to the outside of a vacuum chamber while keeping the beam energy low. We report about our recent progress on slow positron beam manipulation techniques concerning the PPMA.

[1] N. Oshima et al., J. Appl. Phys. **103**, 094916 (2008).
[2] N. Oshima et al., Appl. Phys. Lett. **94**, 194104 (2009).

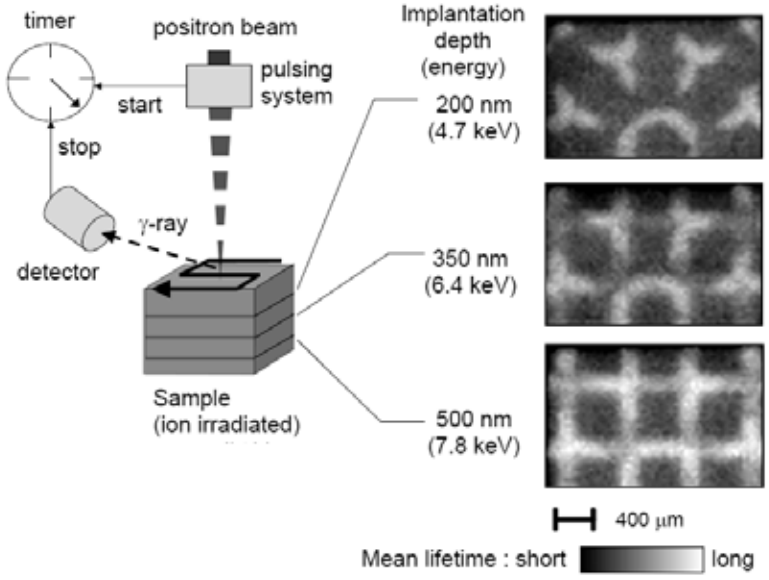


Fig. 1: Three-dimensional mean-positron lifetime mapping were demonstrated in 2009 [2].