

Development of a single photon emission microscope with $\sim 200\mu\text{m}$ spatial resolution

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With a low energy pinhole gamma camera, spatial resolution is mainly determined by the intrinsic spatial resolution of the imaging detector, pinhole diameter and magnification ratio of the collimator. However the pinhole diameter was so far limited to around 1 mm due to the manufacturing difficulty of tungsten. To overcome the limitation of the spatial resolution of the pinhole gamma camera, we manufactured a 0.1 mm diameter pinhole and combined with a YAP(Ce) imaging detector to form a ultrahigh resolution pinhole gamma camera. The imaging detector used a 40 mm x 40 mm x 1mm thick YAP(Ce) plate optically coupled to a 2-inch square flat panel photomultiplier tube (FPPMT) with a 1mm thick light guide. The intrinsic spatial resolution of the YAP(Ce) imaging detector was ~ 1.4 mm FWHM for 60 keV gamma photons. YAP(Ce) imaging detector was encased in a tungsten shield and 1 0.1 mm diameter pinhole collimator was set 100 mm from the imaging detector surface. At 10mm from the pinhole center with the magnification ratio of 10, the spatial resolution of $\sim 200 \mu\text{m}$ was obtained with the developed pinhole camera. The system sensitivity was $\sim 0.001\%$. The developed ultrahigh-resolution pinhole gamma camera was named "single photon emission microscope". The developed single photon emission microscope will be useful for single photon imaging where ultrahigh resolution is required.

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