Contribution ID: **399** Type: **Poster**

Feasibility study of a Single Probe Compton Camera for Laparoscopic Surgery

Purpose
This study shows the one solution to detect radioactive biomarker at laparoscopic surgery by using single Compton camera probe and position sensor.

Methods
We designed prototype imaging-probe including radiation detectors and optical markers. Position sensor (POLARIS) measure spatial coordinates of detector positions by tracking attached optical markers. And Compton scattering angle was calculated from detected energy values using GAGG scintillators and SiPMs. Gamma-ray incident direction is estimated by three-dimensional mapping of each position's Compton cones, which is represented by Compton scattering angle θ.

Experiments
137Cs with the energy peak value of 662 keV was used as radiation source. After acquisition of coincidence events, Compton cones were calculated and reconstructed image using back projection method (BP). The staying time at each probe spatial positions were also recorded and calculate sensitivity distribution on projected image. And calibration value was calculated and multiplied to back projection image.

Results
Measurement results indicated the possibility of imaging radiation source, and we achieved spatial resolution 130 mm FWHM at BP image and 61 mm FWHM at sensitivity calibrationed image. To achieve higher spatial resolution, optimization of the detection system is necessary in future.

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Track Classification: Medical Applications