

**Additional Material: Dual-Layer Scintillator-Based Detector for Photon-counting Computed Tomography with Improved Spectral and Spatial Performance**

**1. System Concept -----**

To further leverage the advantages of the scintillator-based PCCT, we propose a **dual-layer scintillator-based PCCT system**. The system employs a thin front layer optimized for low-energy X-rays and a thicker rear layer for high-energy photons. In addition, by applying sub-pixel shifts between the two layers, spatial resolution is enhanced beyond that of conventional scintillator-based CT.

**2. Experimental Setup -----**

A prototype was built using stacked scintillator detectors, as shown in Figure 1.

**3. Results -----**

**Spatial Resolution**

Using a hole phantom, the dual-layer system with sub-pixel shift resolved smaller holes than the single-layer configuration (Figure 2).

**Contrast Agent Imaging**

Iodine and gold nanoparticle (AuNP) phantom images and concentration maps (Figure 3) demonstrated superior image quality (higher contrast and lower noise) as well as improved material extraction in the dual-layer system.

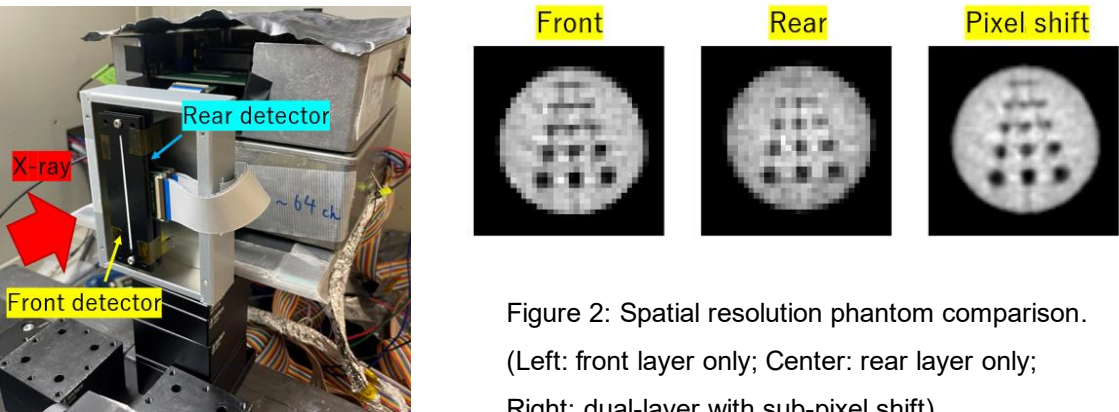


Figure 1: System setup.

Figure 2: Spatial resolution phantom comparison.  
(Left: front layer only; Center: rear layer only;  
Right: dual-layer with sub-pixel shift)

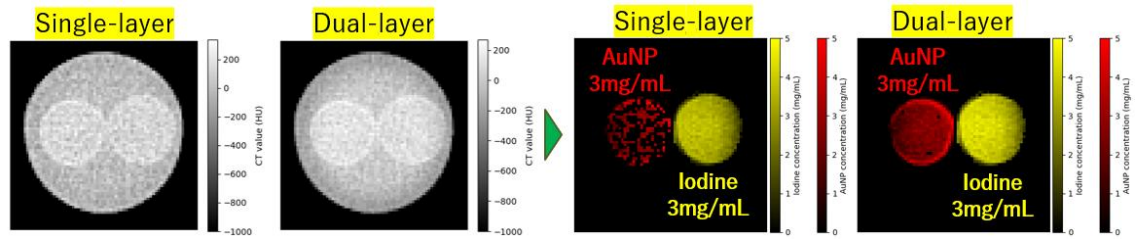


Figure 3: Contrast agent phantom comparison. (Left: CT images; Right: concentration maps)