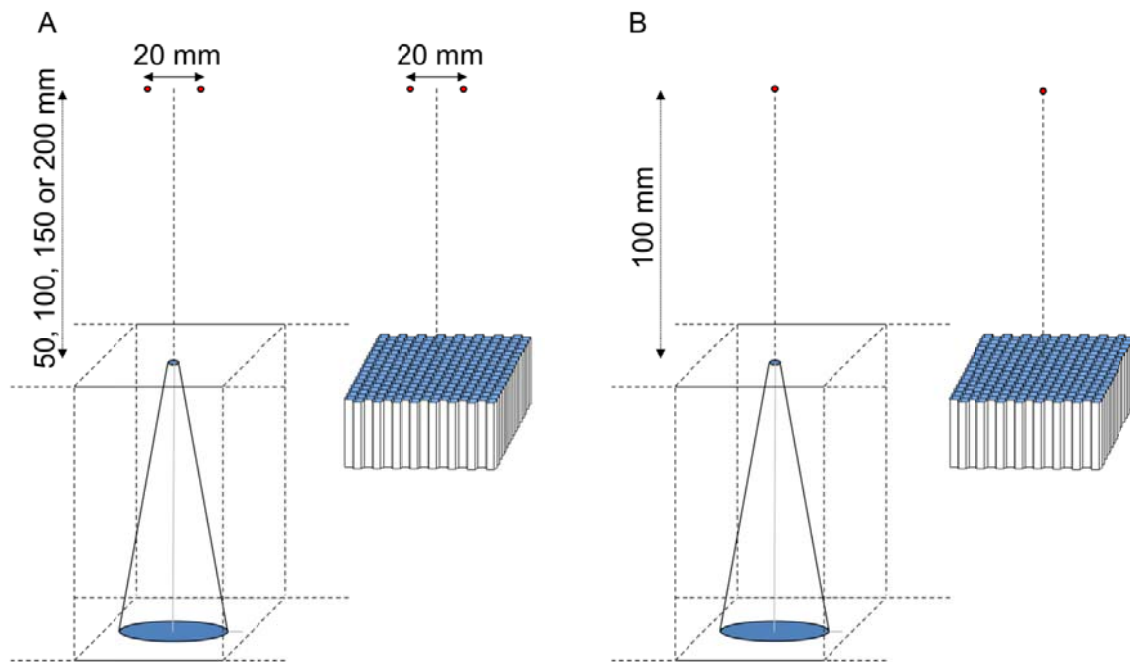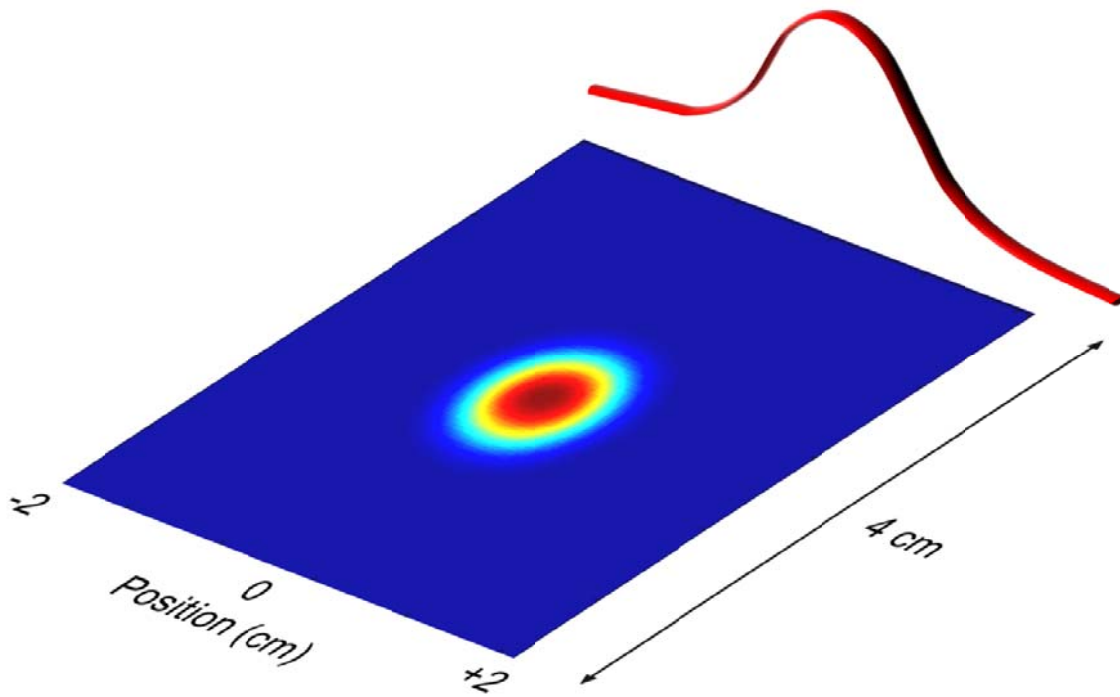**SUPPLEMENTAL FIGURE 1.** Picture of the Parallel Cone collimator prototype.

SUPPLEMENTAL FIGURE 2. Schematic drawing of (A) the double point source Monte Carlo simulation geometry and (B) the single point source Monte Carlo simulation geometry (not drawn to scale).

SUPPLEMENTAL FIGURE 3. Schematic drawing of how one dimensional profiles were created from simulated detector data.
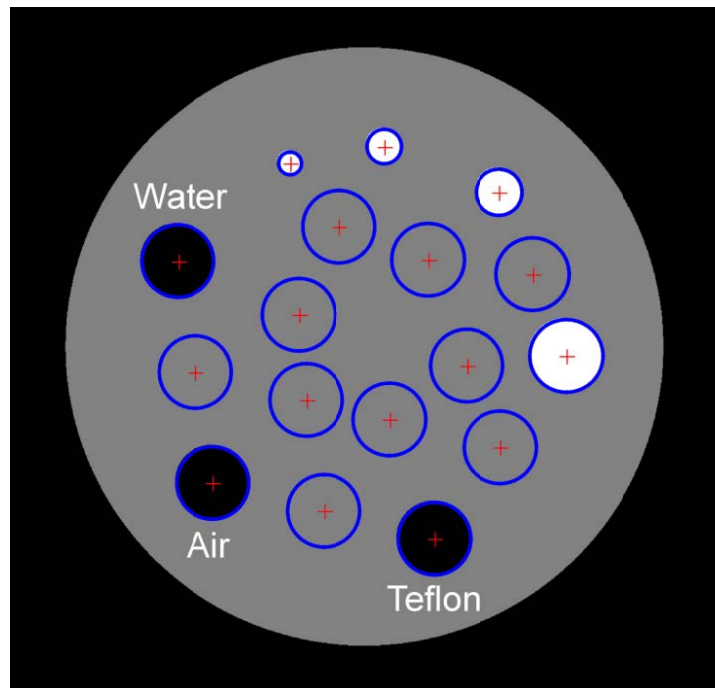
SUPPLEMENTAL FIGURE 4. Schematic drawing of the phantom with hot cylinders (white), cold cylinders (black) and background ROIs (grey).
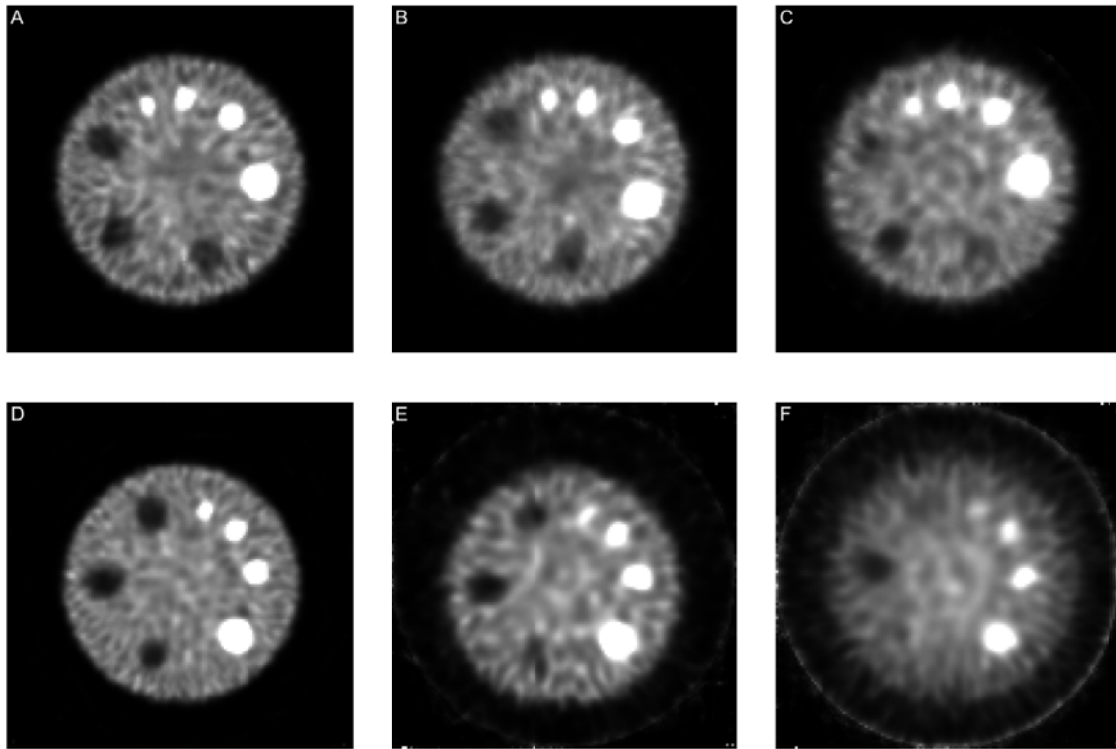
SUPPLEMENTAL FIGURE 5. Reconstructed data at constant noise levels (CV=15%) for the PC collimator in (A), (B), and (C), LEHR collimator in (D) and HEGP collimator in (E) and (F) for Tc-99m, I-131 and F-18 respectively. The maximum of the color scale is twice the average background value.
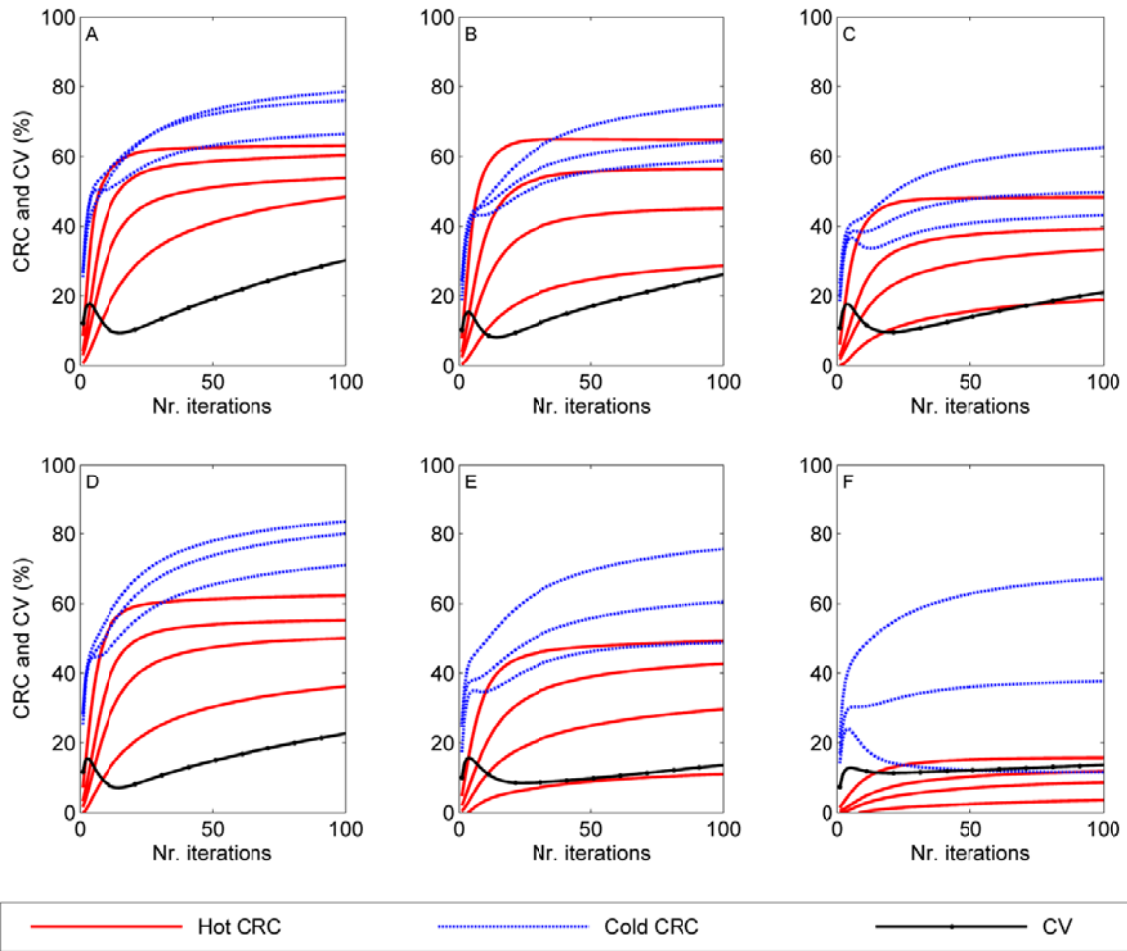
SUPPLEMENTAL FIGURE 6. The graphs in (A), (B), and (C) for the Parallel Cone (PC) collimator, in (D) for the LEHR collimator and in (E) and (F) for the HEGP collimator show the contrast recovery coefficients and noise as a function of the number of iterations, for Tc-99m, I-131 and F-18 respectively.