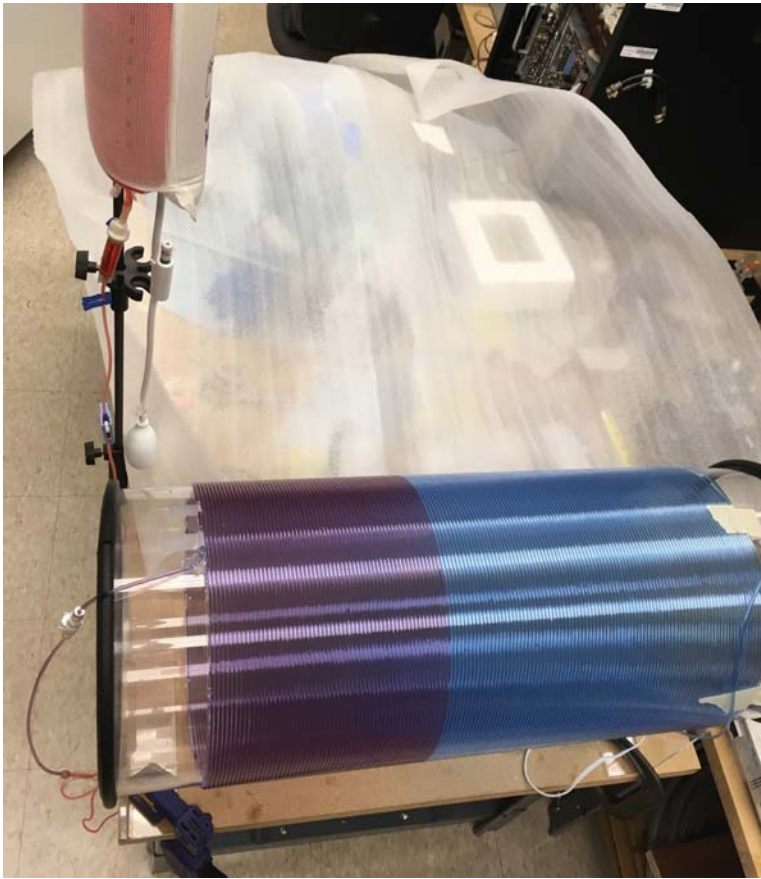
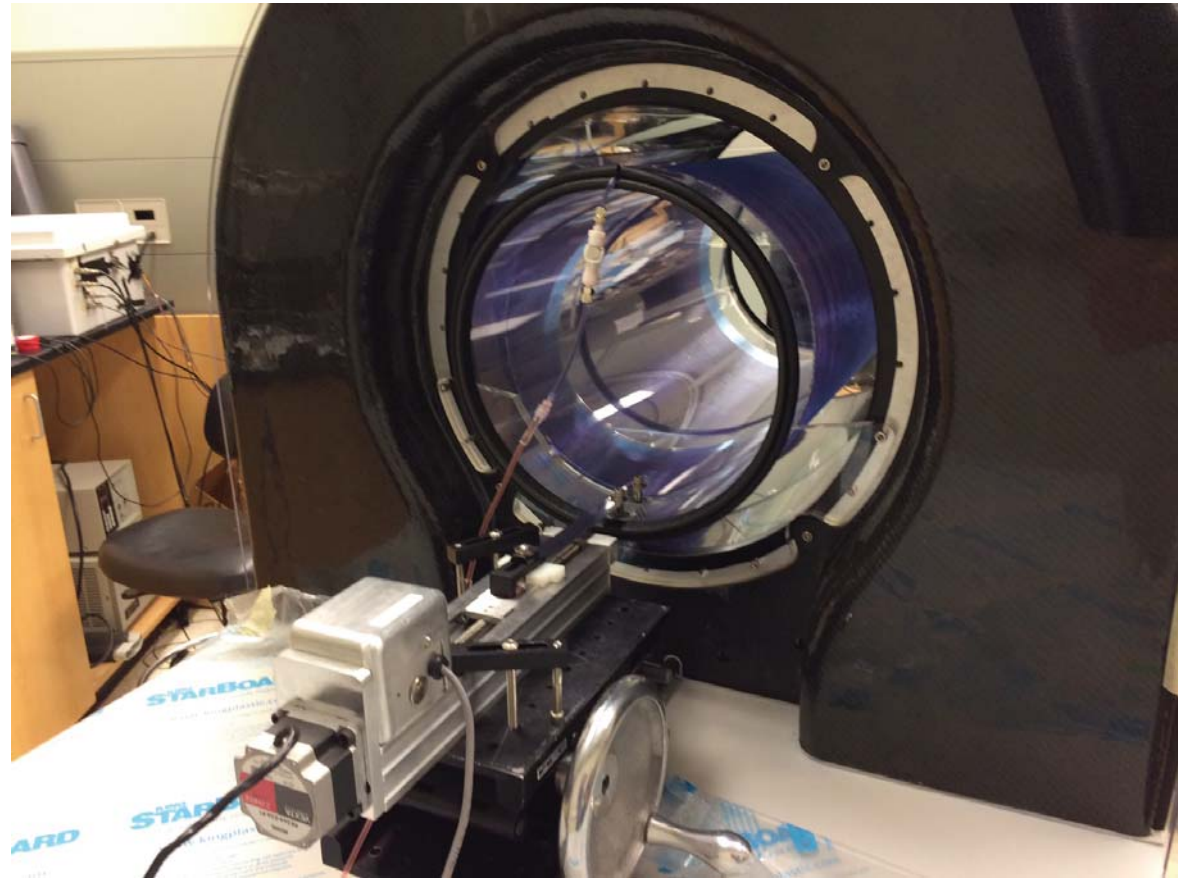


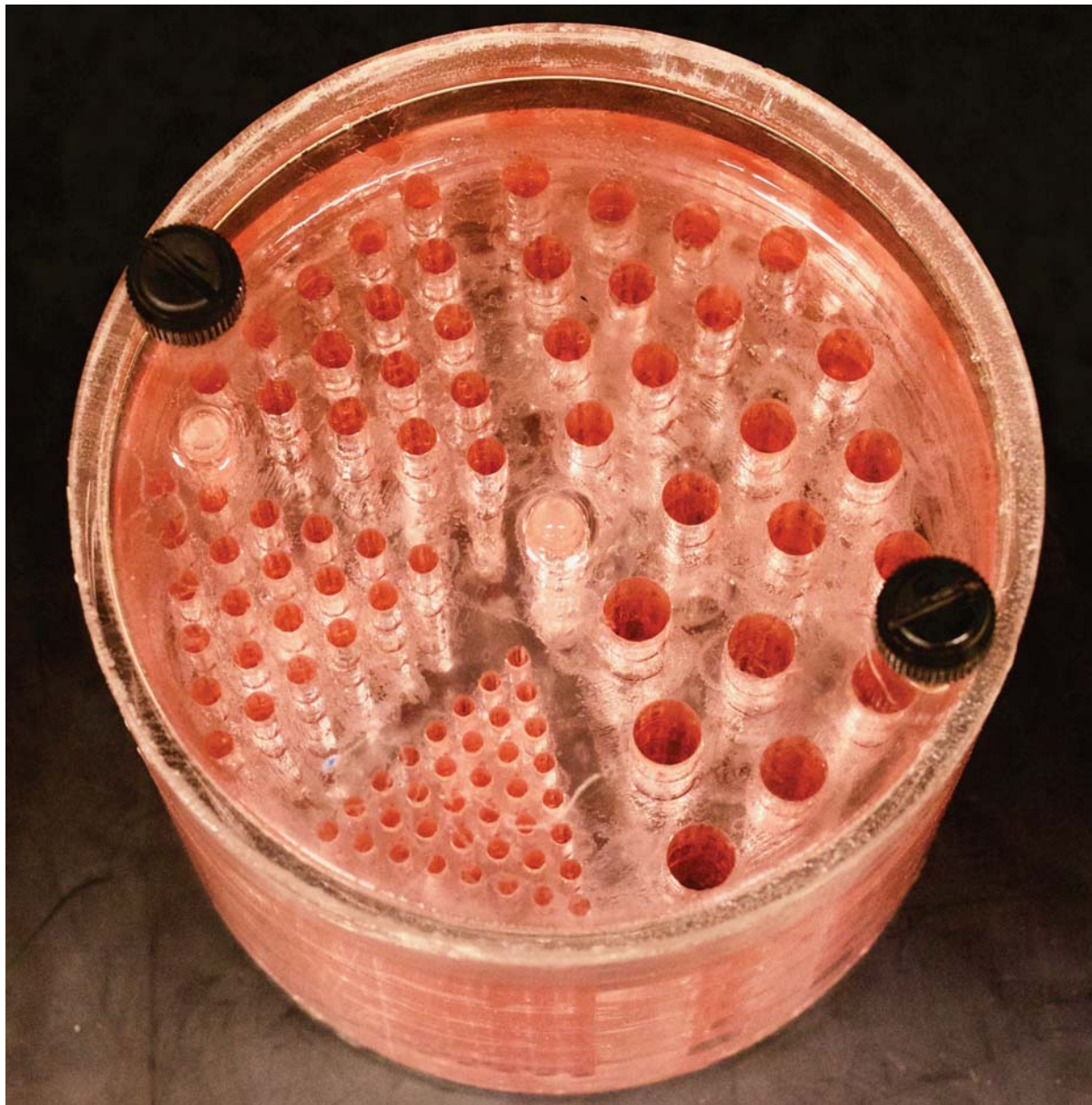
(a)



(b)

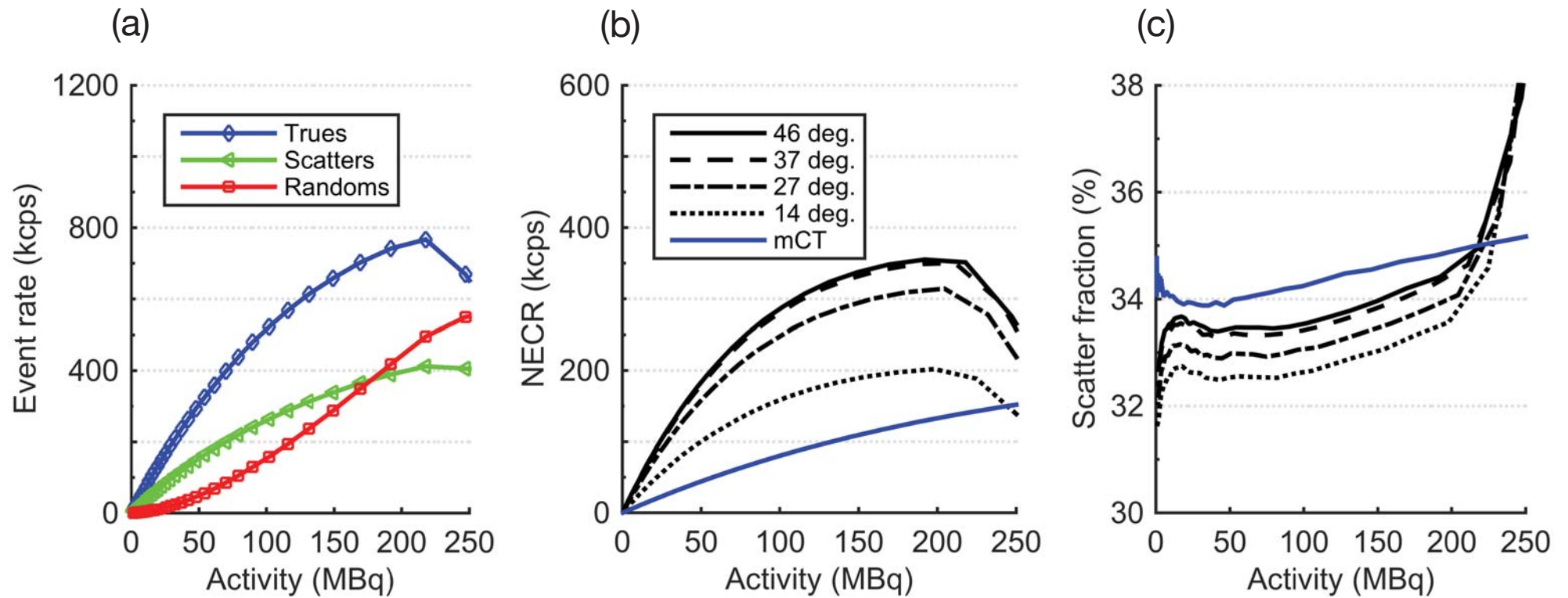


Supplemental Figure 1. (a) Photo of the annular phantom used to acquire normalization factors. The phantom is partially filled with radioactive solution (dyed red). (b) The annular phantom inside the scanner and fastened to a translation stage used to wobble the phantom axially during data acquisition. The annular phantom consisted of hard, flexible urethane tubing (3 mm inner diameter, 4 mm outer diameter) coiled around a 30 cm diameter hollow acrylic cylinder. The tubing was filled with  $\sim 20$  MBq  $^{18}\text{F}$ -FDG ( $\sim 700$  mL volume) and imaged for  $\sim 6$  hours, resulting in  $\sim 12$  billion prompt coincidences. .



Supplemental Figure 2. Photograph of the Derenzo phantom. The phantom was constructed by cutting circular holes in acrylic stock using a CO<sub>2</sub> laser cutter. Red food dye was added for visual aid for the phantom structure.



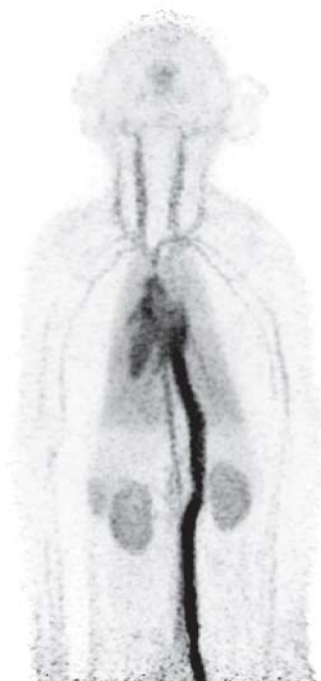


Supplemental Figure 3. NEMA NU-2 scatter phantom count rate performance. (a) True, scatter, and random coincidences rates measured with the 46 degree acceptance angle. (b) NECR vs. activity for each acceptance angle. (c) Scatter fraction vs. activity for each acceptance angle.

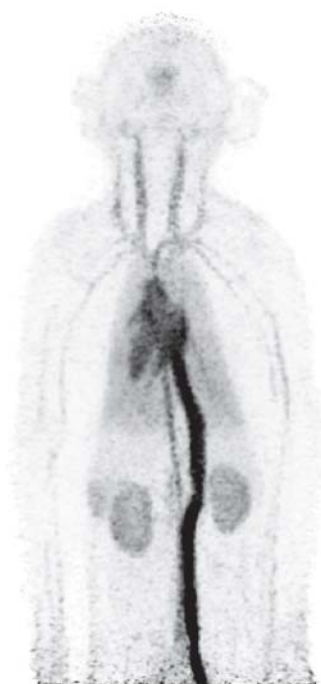
**0- 30 seconds**

**55 – 60 minutes**

*14 degrees*



*46 degrees*



Supplemental Figure 4. Comparison of maximum projection monkey images for the full 46 degree acceptance angle compared to a 14 degree acceptance angle.