

Appendix 1 Phantom evaluation

As illustrated in Supplementary *Figure 1*, use a transverse image centered on the hot spheres for analysis. Draw circular ROIs with a diameter equal to the inner sphere, allowing for partial pixel inclusion and 1 mm ROI movement. The same slice should be used for all spheres. ROIs of the same size should be drawn on the background of the phantom, with 12 at a distance of 15 mm from the edge of the phantom and none closer than 15 mm to any sphere. Smaller ROIs of 10, 13, 17, 22, and 28 mm should be concentrically drawn around the 37 mm ROIs. The ROIs should also be drawn on slices as close as possible to ± 1 and ± 2 cm on either side of the central slice, for a total of 60 background ROIs of each size. ROI locations should remain fixed between scans, and the average counts in each background ROI should be recorded. The NEMA NU-2 2018 standard was used to calculate the contrast recovery coefficients (CRC) and background variability (BV) (24).

$$CRCH, j = \frac{(CH, j / CB, j) - 1}{(aH / aB) - 1} \times 100 \quad [1]$$

Where $CRCH, j$ is the percent contrast of the sphere j – one of six hot spheres, CH, j and CB, j are the average counts in sphere j and corresponding background ROIs, aH and aB are the activity concentration in the sphere and the background of the phantom.

$$BVj = \frac{SDj}{CB, j} \times 100\% \quad [2]$$

$$SDj = \sqrt{\sum_{k=1}^K (CB, j, k - CB, j)^2 / (K - 1)} \quad [3]$$

For sphere j , BVj is the percent BV calculated from background ROIs, and SDj is the SD of the background ROI. The sum is taken over a total of $K=60$ background ROIs.

Table S1 Group naming rules

Group	Reconstruction algorithm	Time (sec)	B value
O20	OSEM	20	NA
R20.09	TVREM	20	0.09
R20.18	TVREM	20	0.18
R20.27	TVREM	20	0.27
R20.36	TVREM	20	0.36
R20.45	TVREM	20	0.45
O40	OSEM	40	NA
R40.09	TVREM	40	0.09
R40.18	TVREM	40	0.18
R40.27	TVREM	40	0.27
R40.36	TVREM	40	0.36
R40.45	TVREM	40	0.45
O60	OSEM	60	NA
R60.09	TVREM	60	0.09
R60.18	TVREM	60	0.18
R60.27	TVREM	60	0.27
R60.36	TVREM	60	0.36
R60.45	TVREM	60	0.45
O120	OSEM	120	NA
R120.09	TVREM	120	0.09
R120.18	TVREM	120	0.18
R120.27	TVREM	120	0.27
R120.36	TVREM	120	0.36
R120.45	TVREM	120	0.45
O300	OSEM	300	NA
R300.09	TVREM	300	0.09
R300.18	TVREM	300	0.18
R300.27	TVREM	300	0.27
R300.36	TVREM	300	0.36
R300.45	TVREM	300	0.45

OSEM, ordered subset expectation maximization; TVREM, total variation regularized expectation maximization.

Table S2 SUV_{mean}, image noise, and normalized SUV_{max} of the study

Group	SUV _{mean} of the liver, n=51	Image noise (%) of the liver, n=51	Normalized SUV _{max} of the lesions, n=84	TBR-liver background, n=84	CR-liver background, n=84
O20	4.29 [2.1, 8.59]	29.25 [18.71, 47.14]	1.05 [0.36, 2.07]	3.13 [0.67, 20.93]	1.01 [-0.81, 4.94]
R20.09	4.34 [2.07, 8.62]	18.56 [10.46, 35.61]	1.09 [0.32, 2.61]	3.08 [0.6, 26.84]	1.07 [-1.32, 3.4]
R20.18	4.35 [2.04, 8.60]	14.1 [6.85, 29.06]	1.04 [0.29, 2.61]	3.04 [0.55, 27.07]	1.02 [-3.63, 3.33]
R20.27	4.36 [2.03, 8.58]	11.87 [5.29, 24.53]	0.99 [0.26, 2.61]	2.79 [0.49, 27.23]	0.94 [-5.14, 3.29]
R20.36	4.37 [2.01, 8.58]	10.21 [4.62, 21.51]	0.93 [0.24, 2.6]	2.6 [0.45, 27.38]	0.82 [-6.2, 3.24]
R20.45	4.37 [2, 8.57]	9.15 [4.18, 19.29]	0.89 [0.22, 2.58]	2.52 [0.4, 27.41]	0.79 [-6.78, 3.19]
O40	4.27 [1.96, 8.57]	20.95 [11.84, 38.08]	1.02 [0.68, 1.51]	3.21 [0.72, 20.79]	1.01 [-0.05, 9.21]
R40.09	4.32 [1.96, 8.57]	14.92 [9.28, 27.35]	1.18 [0.65, 2.23]	3.88 [0.66, 27.39]	1.24 [0.12, 8.25]
R40.18	4.33 [1.94, 8.57]	11.84 [7.03, 21.86]	1.17 [0.59, 2.24]	3.85 [0.61, 27.54]	1.21 [-0.03, 6.06]
R40.27	4.37 [1.92, 8.57]	10.07 [5.29, 19.26]	1.15 [0.53, 2.24]	3.83 [0.55, 27.56]	1.21 [-0.2, 4.28]
R40.36	4.36 [1.91, 8.56]	8.97 [4.12, 17.62]	1.13 [0.46, 2.25]	3.8 [0.49, 27.66]	1.2 [-0.35, 4.3]
R40.45	4.35 [1.90, 8.56]	7.89 [3.53, 16.13]	1.1 [0.38, 2.25]	3.79 [0.45, 27.7]	1.12 [-0.48, 4.3]
O60	4.27 [1.88, 8.41]	16.78 [10.84, 37.75]	1.02 [0.75, 1.72]	2.91 [0.62, 22.43]	0.99 [0.4, 5.05]
R60.09	4.28 [1.88, 8.4]	13.35 [7.5, 29.25]	1.21 [0.72, 2.3]	3.78 [0.59, 26.7]	1.25 [0.61, 5.94]
R60.18	4.30 [1.87, 8.41]	11.17 [5.82, 24.31]	1.2 [0.66, 2.29]	3.76 [0.55, 26.69]	1.25 [0.54, 4.74]
R60.27	4.33 [1.86, 8.41]	9.64 [4.99, 20.7]	1.19 [0.62, 2.28]	3.74 [0.5, 26.71]	1.23 [0.48, 3.63]
R60.36	4.34 [1.85, 8.42]	8.38 [4.37, 17.9]	1.19 [0.57, 2.26]	3.73 [0.47, 26.78]	1.22 [0.39, 3.63]
R60.45	4.36 [11.84, 8.43]	7.62 [4.14, 16.38]	1.18 [0.53, 2.26]	3.71 [0.43, 26.77]	1.2 [0.3, 3.64]
O120	4.25 [1.87, 8.26]	12.27 [7.32, 18.73]	1.01 [0.76, 1.25]	2.94 [0.63, 22.82]	1 [0.63, 2.9]
R120.09	4.23 [1.88, 8.2]	10.87 [5.93, 17.06]	1.2 [0.77, 2.09]	3.72 [0.64, 28.24]	1.32 [0.7, 13.93]
R120.18	4.24 [1.88, 8.21]	9.51 [5.1, 16.24]	1.19 [0.74, 2.08]	3.7 [0.61, 28.25]	1.31 [0.69, 13.12]
R120.27	4.25 [1.88, 8.22]	8.52 [4.3, 15.56]	1.19 [0.7, 2.08]	3.68 [0.58, 28.32]	1.31 [0.69, 12.31]
R120.36	4.25 [1.88, 8.23]	7.8 [3.82, 14.9]	1.19 [0.67, 2.07]	3.66 [0.55, 28.34]	1.29 [0.68, 11.56]
R120.45	4.25 [1.88, 8.23]	6.88 [3.33, 14.24]	1.19 [0.63, 2.07]	3.64 [0.52, 28.34]	1.27 [0.68, 10.59]
O300	4.17 [1.86, 7.97]	8.96 [5.17, 15.31]	1 [1, 1]	2.97 [0.81, 21.51]	1 [1, 1]
R300.09	4.19 [1.87, 7.91]	8.26 [4.84, 14.9]	1.22 [0.94, 2]	3.77 [1.4, 24.55]	1.29 [-2.31, 19.56]
R300.18	4.19 [1.87, 7.92]	7.74 [4.52, 14.46]	1.22 [0.94, 2]	3.76 [1.4, 24.54]	1.28 [-2.27, 19.35]
R300.27	4.20 [1.87, 7.92]	6.99 [4.2, 14.05]	1.22 [0.94, 1.98]	3.75 [1.4, 24.48]	1.28 [-2.29, 18.93]
R300.36	4.20 [1.87, 7.92]	6.52 [4.05, 22.58]	1.22 [0.94, 1.98]	3.75 [1.4, 24.49]	1.28 [-2.26, 18.71]
R300.45	4.20 [1.87, 7.93]	6.1 [3.74, 13.21]	1.22 [0.94, 1.96]	3.74 [1.39, 24.48]	1.27 [-2.27, 18.45]

Data were presented as the median [range]. SUV_{mean}, mean standard uptake value; SUV_{max}, maximum standard uptake value; TBR, tumor-to-background ratio; CR, contrast recovery.

Table S3 The inter-rater agreement of subjective PET image quality scores

Parameters	O300	R120.09	R120.18	R120.27	R120.36	R120.45
Noise						
Cohens K	0.45	0.52	0.47	0.48	0.42	0.48
P value	0.00	0.00	0.00	0.00	0.00	0.00
Lesion						
Cohens K	0.35	0.52	0.32	0.38	0.48	0.48
P value	0.00	0.00	0.00	0.00	0.00	0.00

PET, positron emission tomography.

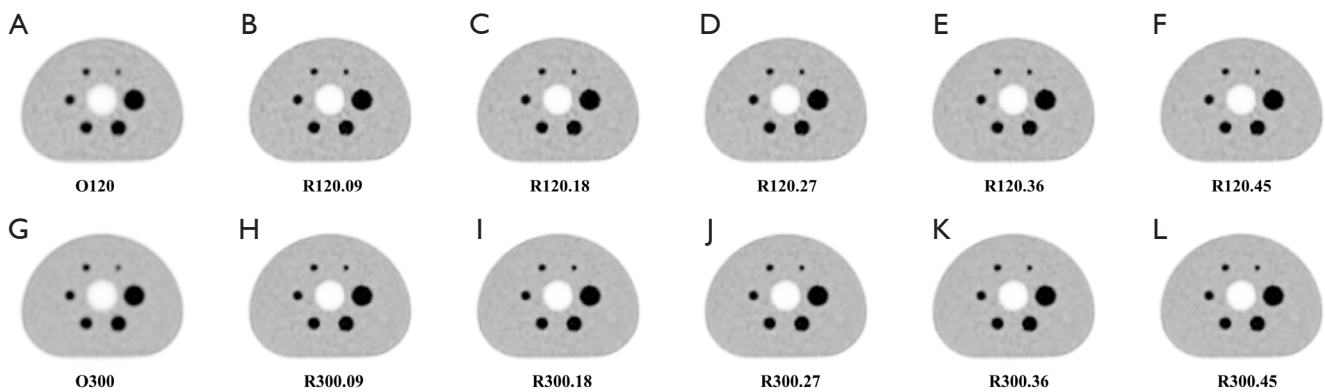


Figure S1 Comparison of transverse views of the NEMA body phantom images. With different reconstruction algorithms and scan durations. The first row (A-F) shows results of scanning duration of 120 sec, and second row (G-L) for scanning duration of 300 sec. The subplot images in the column from left to right were reconstructed by OSEM (A,G) and TVREM algorithms with penalization of 0.09 (B,H), 0.18 (C,I), 0.27 (D,J), 0.36 (E,K), and 0.45 (F,L), respectively. NEMA, National Electrical Manufacturers Association; OSEM, ordered subset expectation maximization; TVREM, total variation regularized expectation maximization.

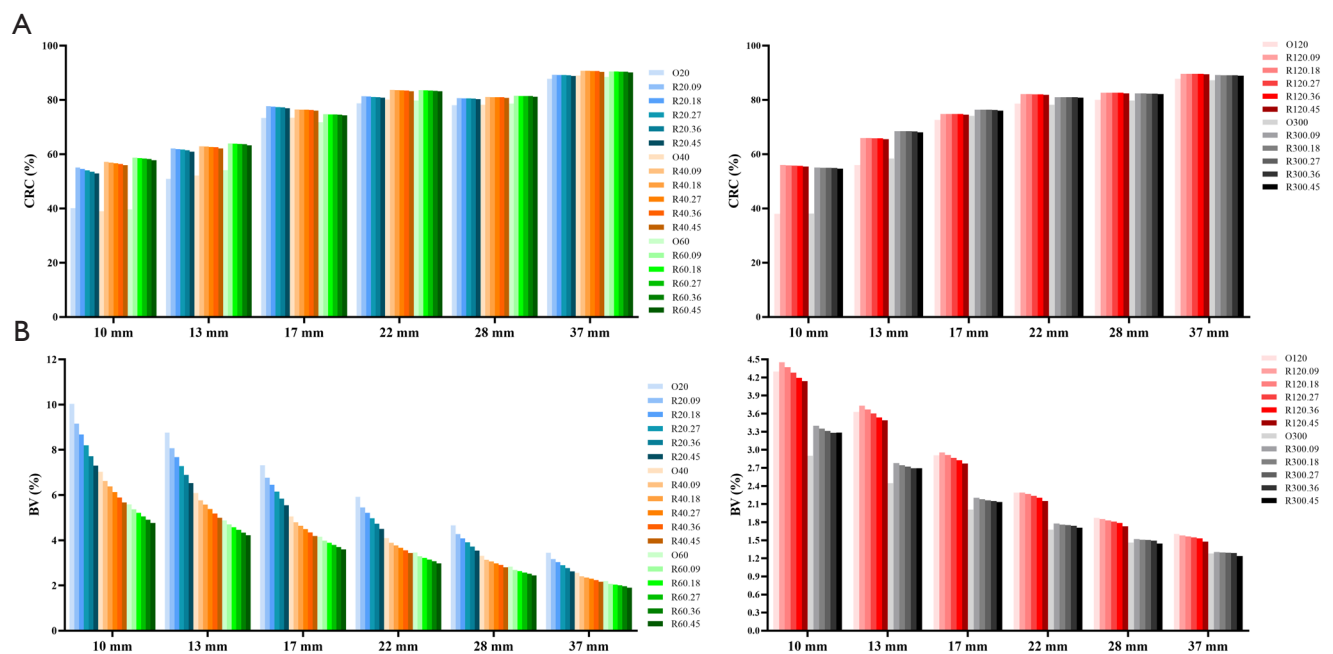


Figure S2 CRC (A) and BV (B) analyses for 10-, 13-, 17-, 22-, 28-, and 37-mm spheres with different reconstruction settings of 20-, 40-, 60- (first column), 120-, and 300 sec (second column) in the phantom studies. Both CRC and BV increased with smaller penalization factors. CRC, contrast recovery coefficients; BV, background variability.