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THE STUDY OF MULTIPLE PET RECONSTRUCTED PARAMETER

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Purpose: PET, compared with SPECT, uses some similar techniques in image reconstruction, on the other hand, there are some difference on the techniques. A phantom experiment was conducted and the result was evaluated objectively through quantitative analysis in order to find ideal filter and cutoff frequency (Fc) for clinical application.

Material and method: The PET phantom have 6 solid inserts (cold) in the upper half and 6 hollow ones (hot) in the lower part. The middle insert is 1cm in diameter, the outer five have diameters of 1 to 3cm respectively. The phantom filled with 111 MBq ^{18}F FDG and studied with segmentation acquisition. 25 set of images were reconstructed using HANN, HAMM, PARZEN, BUTTERWORTH, BUTTERWORTH2 filter and 0.1, 0.2, 0.3, 0.4, 0.5 Fc successively. A ROI of 4*4 pixels was drawn over middle 1 cm, outer 1cm, 3 cm cold column area and background area, the ratio between the ROI of cold column and background was calculated to evaluate the image contrast. A ROI of 15*15 pixels was drawn on the background area to get s.d as a judgment of image noise. A profile curve was drawn on the hollow column of middle 1 cm and outer 1 cm and their FWHM were compared with the real diameter to reflect linearity. **Result:** Table.

Fc	ROI	HANN	HAMM	PARZEN	BUTTERWORTH	BUTTERWORTH2
0.5 ratio	middle 1cm	0.48	0.41	0.53	0.53	0.72
	outer 1cm	0.42	0.40	0.48	0.52	0.72
0.3 ratio	middle 1cm	0.57	0.58	0.71	0.66	0.82
	outer 1cm	0.54	0.55	0.68	0.64	0.79
0.5 s.d	background	8.5^{-6}	8.9^{-6}	6.4^{-6}	7.2^{-6}	3.7^{-6}
0.3 s.d	background	5.4^{-6}	5.6^{-6}	4.1^{-6}	4.6^{-6}	2.8^{-6}

With the same Fc, the contrast using HANN and HAMM filter was superior to other filter, The effect of the filter on image noise is listed in high to low order as HAMM, HANN, BUTTERWORTH, PARZEN and BUTTERWORTH2. The higher Fc, the higher image noise. The FWHM will increases as the Fc value decreases. With same Fc, the FWHM of different filter from small to big is HAMM, BUTTERWORTH, HANN, PARZEN, BUTTERWORTH2. The outer FWHM is larger than the middle one. Conclusion: For brain image, we suggest HAMM and HANN with Fc 0.3, 0.4 For image demanding lower resolution, we suggest BUTTERWORTH with Fc 0.4, 0.5. 2. For hot image, we can increase Fc to get high resolution. The FWHM value closed to the real value when HAMM, HANN with Fc 0.3 and BUTTERWORTH with Fc 0.2. The 5% difference of FWHM between middle and outer inserts could be reduced to 1~2% by using BUTTERWORTH filter.