

# Effect of Spatial Filtering on Parametric Image Reproducibility Using Simplified Reference Tissue Model

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## Simplified reference tissue model

Simplified reference tissue model (SRTM) is a common model used to calculate parametric images where voxel values represent binding potential (BP) of neuroreceptor ligand. Our aim was to study the effect of spatial filtering of dynamic [11C]-FLB 457 images on reproducibility of BP values at voxel level.

## Eight pairs of test-retest scans

Eight pairs of test-retest scans of [11C]-FLB 457 were used in this simulation study. Each scan contained 16 frames with voxel size of 2.34 mm x 2.34 mm x 4.25 mm.

## Added noise

Normally distributed noise with normalised variance of 0.1 was added to each time activity curve.

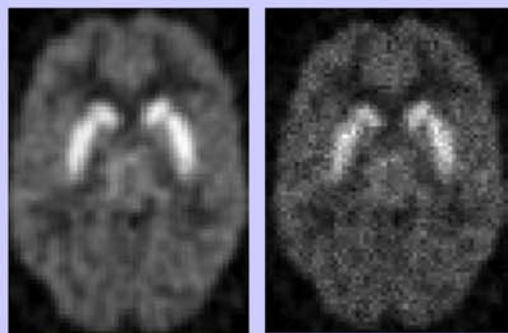


Figure 1. Effect of used noise level on dynamic image, frame 8. Left original image and on right image with noise level of 0.1.

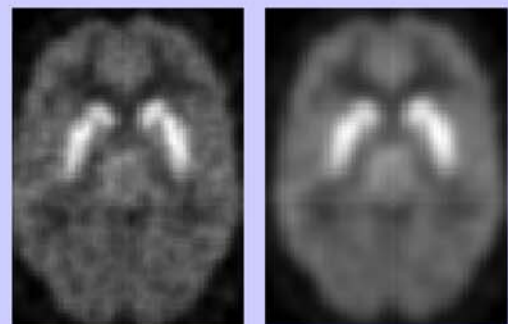


Figure 2. Effect of using Gaussian filtering on dynamic image, frame 8. Left image with noise level 0.1 filtered with Gaussian 4 mm and on right with 8 mm.

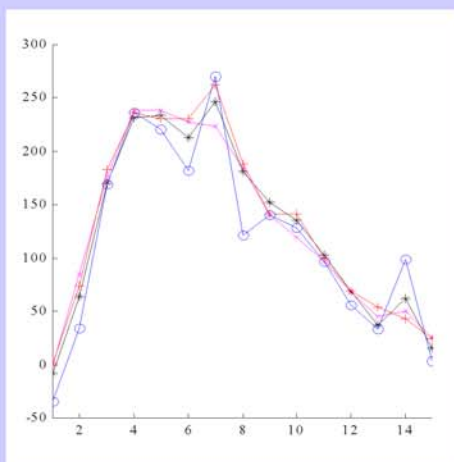


Figure 3. Example time activity curve (TAC). Original curve (+), added 0.1 noise (o), filtered with Gaussian 4 mm (\*) and with Gaussian 8 mm (x).

## Receptor Parametric Mapping

Parametric images were calculated using Receptor Parametric Mapping (RPM) software [1] and spatially normalized to MNI space using SPM99 software [2]. Calculation was done using original, noisy and spatially filtered dynamic images.

## Reproducibility

Comparison was made by calculating average extrastriatal Intra Class Correlation (ICC) and variability between normalized test-retest pairs, table 1 and 2.

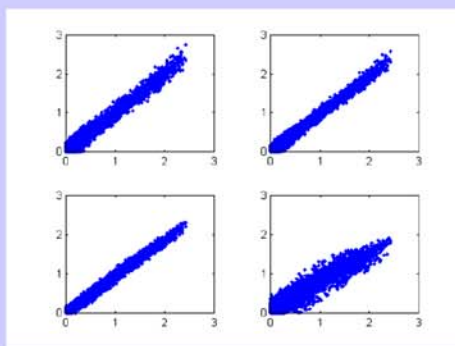


Figure 4. Example plot of BP values of filtered dynamic images in relation to original BP values with different 0 mm (top left), 2 mm (top right), 4 mm (bottom left) and 8 mm (bottom right) Gaussian filtering.

Table 1. Effect of filtering on ICC and variability:

	No filter	2 mm	4 mm	6 mm	8 mm	10 mm
ICC						
no noise	0.64	0.66	0.67	0.70	0.72	0.74
noise 0.1	0.57	0.60	0.64	0.68	0.71	0.73
Variability						
no noise	16.9 %	16.7 %	16.4 %	16.0 %	15.9 %	15.8 %
noise 0.1	18.2 %	17.6 %	16.9 %	15.7 %	16.1 %	16.0 %

Table 2. Effect of filtering on ICC and variability when negative BP values are excluded:

	No filter	2 mm	4 mm	6 mm	8 mm	10 mm
ICC						
no noise	0.73	0.74	0.72	0.77	0.78	0.79
noise 0.1	0.66	0.68	0.72	0.75	0.77	0.79
Variability						
no noise	14.2 %	14.1 %	14.3 %	14.5 %	15.2 %	16.3 %
noise 0.1	15.9 %	15.4 %	14.8 %	14.9 %	15.5 %	16.6 %

## Reducing effect of noise

Spatial filtering of dynamic images enhances test-retest reproducibility of extrastriatal BP values and reduces the effect of noise on reproducibility. Although the advantages of filtering depend on noise level of data, filtering with approximately 6 mm Gaussian kernel seems to be useful as it impairs only minimally the final resolution of voxel-level statistical analysis.

## References

- [1] Gunn RN et al (1997). Neuroimage 6: 279–287.
- [2] Friston KJ. et al (1995). Hum. Brain. Mapp. 2:189–210.