# Definition of motionless phases for monitoring gated reconstruction of SPECT images in alive mice

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# DEFINITION OF MOTIONLESS PHASES FOR MONITORING GATED RECONSTRUCTION OF SPECT IMAGES IN ALIVE MICE

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## Abstract

The present method aims at defining motionless phases for monitoring gated reconstruction of SPECT images in the movable area containing lungs and liver among others. It is based on the filtering of gating signals that are generated from an abdominal pressure variation signal. This method is considering gating signals only for cycles for which the period is included in a defined range around periods mean. This correction is essential to improve the quality of SPECT reconstruction.

## Objectives

Definition of motionless phases for monitoring gated reconstruction thanks to filter gating signals

Optimization: Delay relevant gating peaks at the beginning of steady phase of studied organs

## Study Protocol

Abdominal pressure signal and Gating signals are record for 21 mice of different lineages, weights and ages

4D-CT of lungs are acquired for 3 of them with 24 to 28 volumes each, every 25 or 32 ms along the respiratory cycle according to the mouse

## 1st step: Statistics on period of pressure signal

Average period of pressure variation $\mu_0$ = 770, 86 ms

Standard deviation $\sigma_0$ = 72,25 ms : High value due to instability in free breathing

## 2nd step: Filtering of length outliers cycles

Considering only gating signals for cycles with:

$$period \in [90\,\%\,\mu_0; 110\,\%\,\mu_0]$$

Average period of pressure variation $\mu_1$ = 771,89 ms

Standard deviation $\sigma_1$ = 33,09 ms

Rate of kept gating signals: 81,56%

## 3rd step: Superimposition with lungs volume variation

Superimposition of lungs volume variation with mean abdominal pressure variation (see Figure 2). The lungs volumes are obtained thanks to segmentation with Asclepios MIPS library[1].

Observations:

•Delay of ~100 ms between lungs and abdominal motion

•Similar behaviour with steady phase of ~400 ms

## Acquisition system

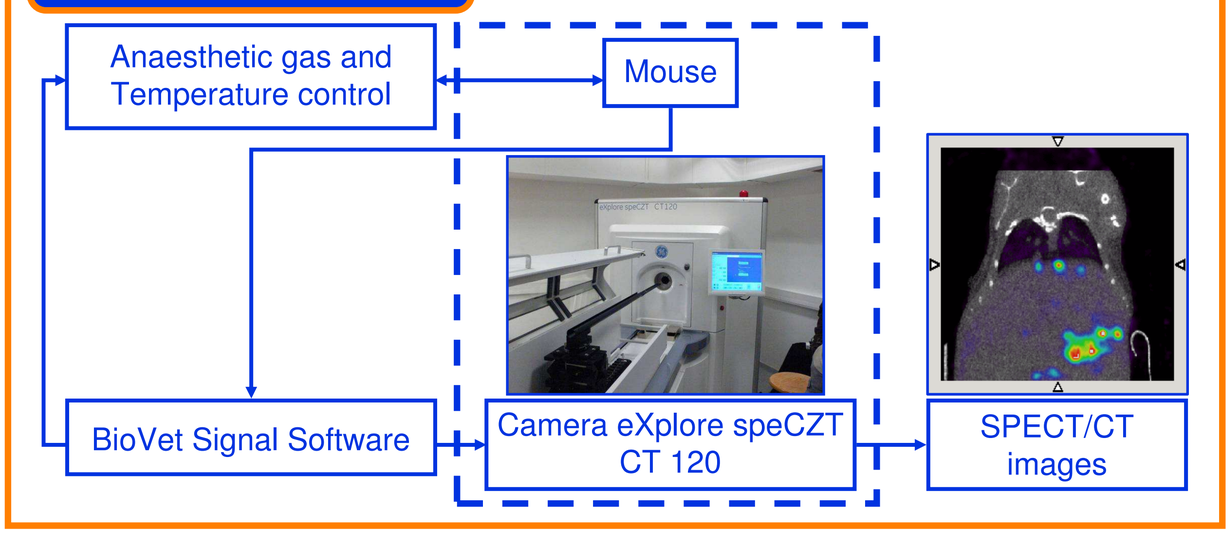


Diagram: The pressure sensor (balloon) is set up under the abdomen of mice. Mice are breathing freely air with anaesthetic gas (Isoflurane). The camera eXplore speCZT CT 120 is a coupling SPECT and CT images. The picture above present liver metastasis from PRObmNIS adenocarcinoma injected in NOD-SCID mouse.

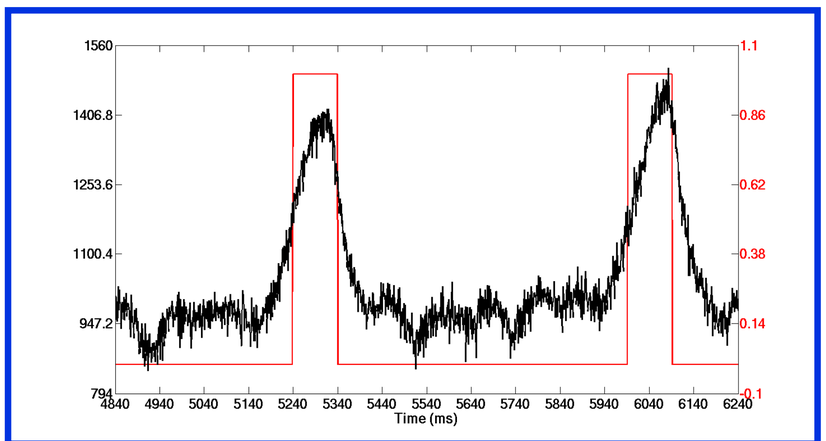


Figure 1: Extract of abdominal pressure signal (black) with corresponding original gating signal (red)

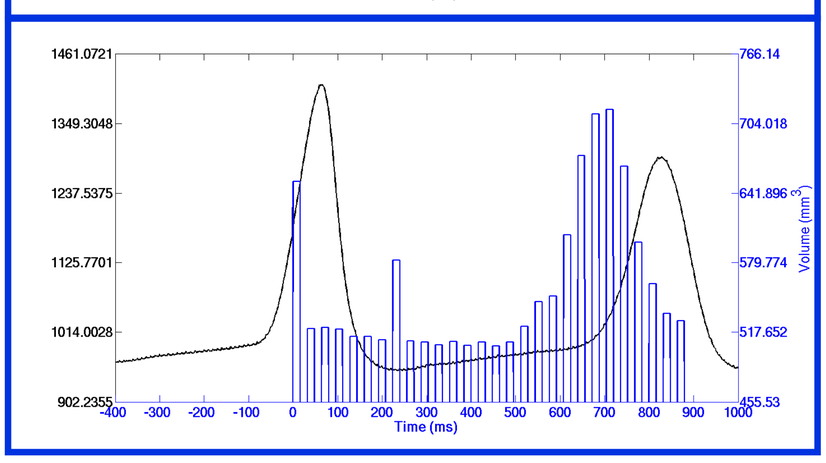


Figure 2: Mean abdominal pressure signal after filtering (black) with corresponding lungs volume variation (blue)

## Conclusion

This method provides a good way to free SPECT reconstruction from motion artefacts by using optimized gated signals. The addition of a delay in reconstruction is then justified by the noticing of a delay between abdominal organs motion.

Moreover there is no need to set up a costly and heavy breathing ventilation.

[1]http://www-sop.inria.fr/asclepios/

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