Application Note

Bruker PET/CT Si78 & Single/Two-Channel Gated PET

Overview

The Bruker PET/CT Si78 system may include an optional Small Animal Imaging (SAI) cardiac and respiratory monitoring system. The SAI system is controlled by a desktop application PCsam. The system can also be used for cardiac and/or respiratory gated PET. The intention of this note is to provide details for defining the PCsam Software Gating Menu settings and ParaVision 360 Software Protocol settings to achieve the desired gatelist/reconstruction. For a more complete description on the general use of the SAI setup hardware/software please reference the SAI manual & ParaVision 360 manual.

Bruker PET/CT Si78 systems with optional SAI system can be configured for the following gated scans:

1) Single-Channel Cardiac Gated PET.

2) Single-Channel Respiratory Gated PET.

3) Single-Channel Dual Cardiac/Respiratory Gated PET.

4) Two-Channel Dual Cardiac/Respiratory Gated PET.

IMPORTANT: Dual Cardiac/Respiration Gated PET reconstruction frames will have lower total counts per frame than ECG Only Gated PET. In many cases, the lower count values can result in insufficient contrast for cardiac features. For ECG gated PET imaging, it's recommended to typically use Single-Channel Cardiac Gated PET or Two-Channel Cardiac/Respiratory PET (which has the benefit of being able to also perform a post single-channel ECG only PET gated reconstruction where the dual channel reconstruction has insufficient counts).

Single-Channel Gated PET

ECG, Respiration, or ECG/Respiration gated PET can be achieved using single channel PET. For these scans, the gate signal is defined using the PCsam Gating menu as shown in Figures 1, 2, and 3. For ECG (Figure 1) and Respiration (Figure 2) gated PET, the user will check only ECG or Respiration in the PCsam Gating menu and Channel 1 set in ParaVision360.

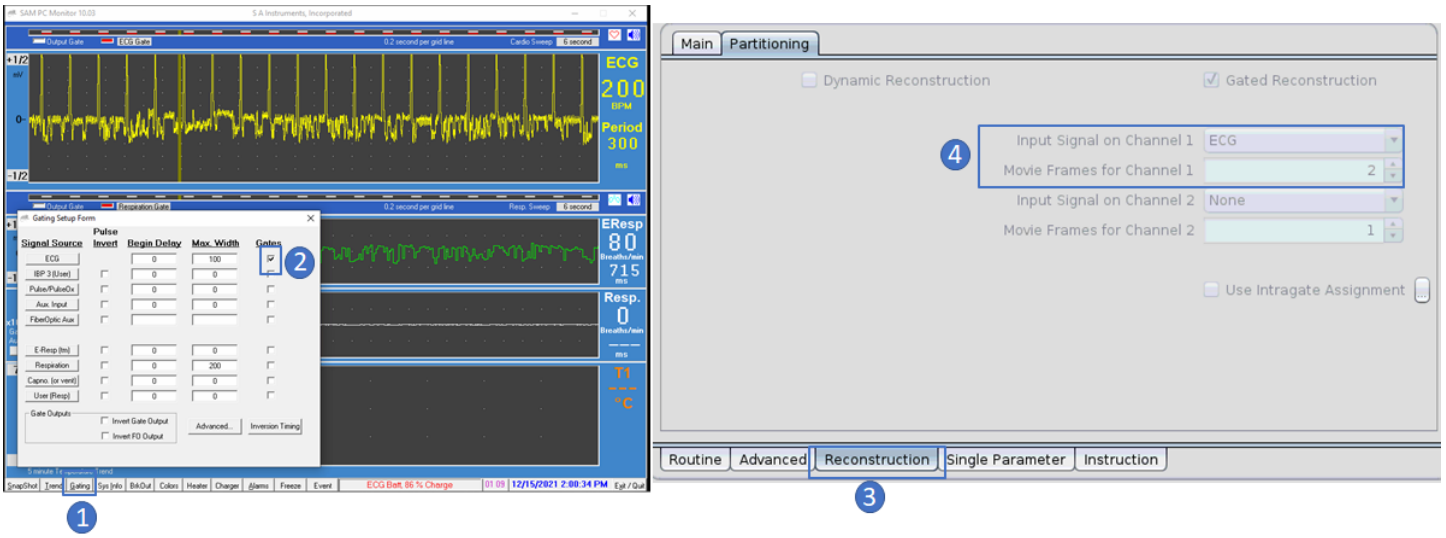

Figure 1. Single-Channel Cardiac gated PET settings. 1) Open the PCsam gating menu. 2) Check the ECG Check Box. 3) Open the ParaVision 360 Reconstruction tab. 4) Check the Gated Reconstruction Check Box, set Input Signal on Channel 1 to ECG, and enter a desired Movie Frames (typically 4 or 8) for Channel 1. 5) A gatelist for Channel 1 will be created and will be applied for reconstruction.

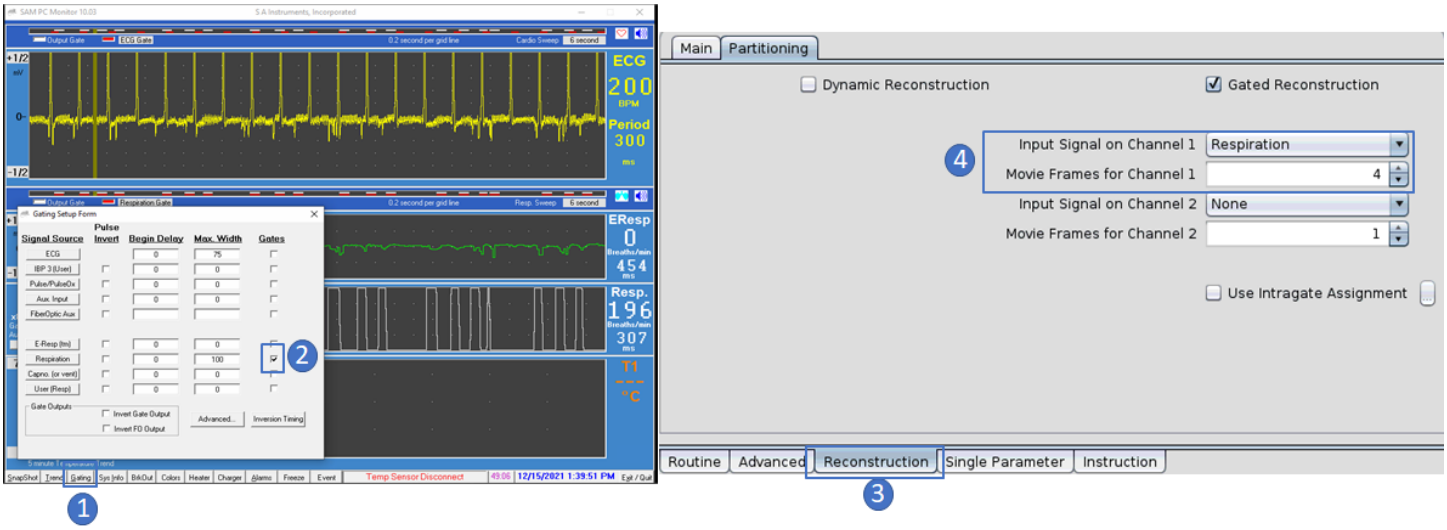

Figure 2. Single-Channel Respiration gated PET settings. 1) Open the PCsam gating menu. 2) Check the Respiration Check Box. 3) Open the ParaVision 360 Reconstruction tab. 4) Check the Gated Reconstruction Check Box, set Input Signal on Channel 1 to Respiration, and enter a desired Movie Frames for Channel 1. 5) A gatelist for Channel 1 will be created and will be applied for reconstruction.

For single-channel dual gated PET, intersecting ECG/Respiration signal are collected checking both boxes at the PCsam Gating menu and Channel 1 set in ParaVision 360 (Figure 3). Dual ECG/Respiration PET gating can theoretically provide reduced motion blur for cardiac gated data. Using, single-channel gated PET, there is no possibility to isolate the ECG or Respiration signal once the intersecting gatelist is generated and the scan is complete.

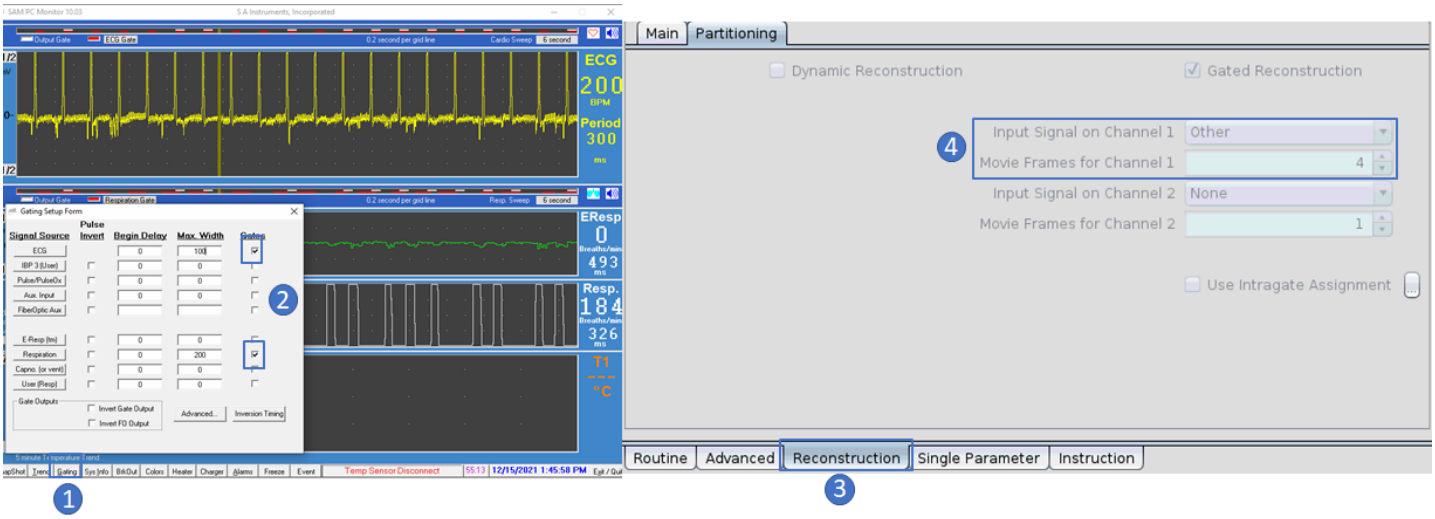

Figure 3. Single-Channel Dual Cardiac/Respiration gated PET settings. 1) Open the PCsam gating menu. 2) Check both the ECG & Respiration Check Boxes. 3) Open the ParaVision 360 Reconstruction tab. 4) Check the Gated Reconstruction Check Box, set Input Signal on Channel 1 to Other (value is for subsequent reference only), and enter a desired Movie Frames (typically 4 or 8) for Channel 1. 5) A gatelist for Channel 1 will be created and will be used for reconstruction.

Two-Channel Gated PET

As mentioned above, single-channel ECG/Respiration gated PET does not provide possibilities for subsequent separation of the ECG or Respiration signals for multiple reconstructions of the same data. In contrast, two-channel gated PET does provide possibilities for reconstructing the same data with ECG/Respiration gatelists and/or the ECG gatelist only. The PET/CT Si78 is configured with two channel inputs (includes two BNC cables: GATE & RespGATE).

Where users wish to complete a two-channel gated PET, the PCsam Gating menu should be set for ECG only (Figure 4). The PCsam Gating menu affects Channel 1 only. Do not check Respiration in the PCsam Gating menu. A separate respiration gatelist will be collected and is hardwired to Channel 2. Reconstruction should be set with Channel 1 and Channel 2 inputs to ECG and Respiration respectively and at least 2 Movie Frames selected for each. Using these settings, the initial PET reconstruction is made using both the ECG and Respiration gatelists. Subsequent reconstructions of the same data can be completed using the ECG gatelist only by setting ParaVision Reconstruction Channel 2 to None.

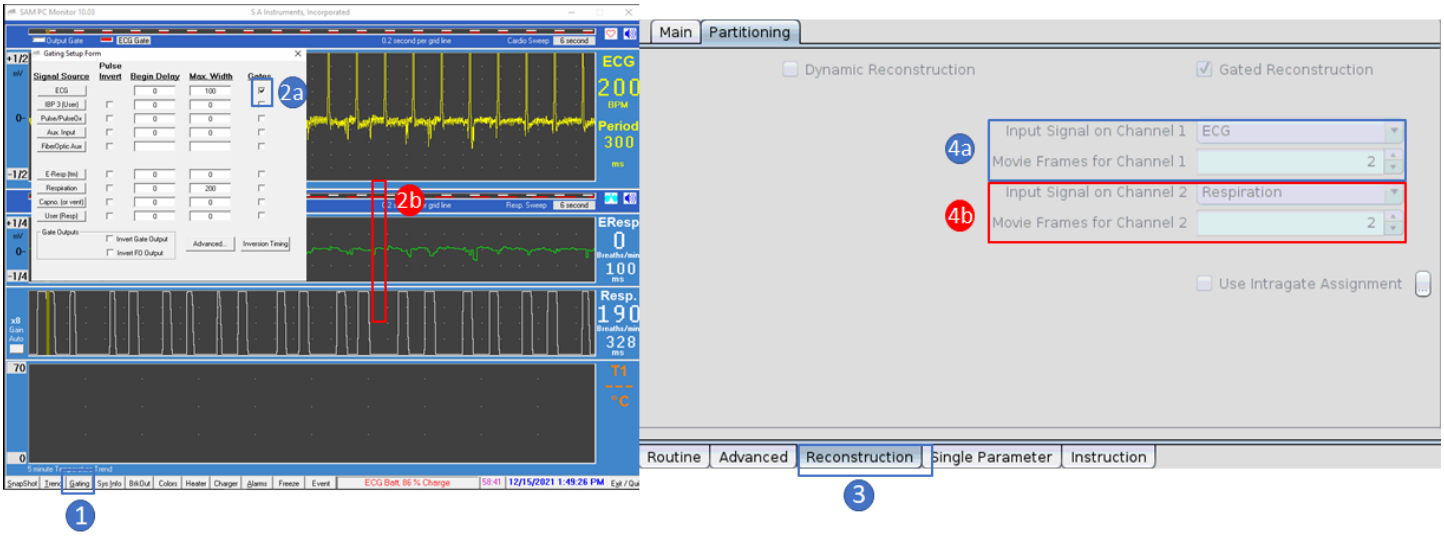

Figure 4. Two Channel Dual Cardiac/Respiration gated PET settings. 1) Open the PCsam gating menu. 2) Check the ECG Box only. A respiration gatelist is generated by default to the channel 2. 3) Open the ParaVision 360 Reconstruction tab. 4) Check the Gated Reconstruction Check Box, set Input Signal on Channel 1 to ECG and Channel 2 to Respiration, and enter a desired (typically 4 or 8) Movie Frames for each. 5) PET data will be reconstructed using both gatelists, though a second reconstruction using the ECG gatelist only is also possible.