

Event-by-Event Attenuation Measurement for ACS2-Based PET Systems

J. Langner¹⁾, H. Mölle¹⁾, S. Dittrich¹⁾, E. Will¹⁾, J. van den Hoff^{1,2)}

¹⁾ PET centre, Research Centre Dresden-Rossendorf, Dresden, Germany

²⁾ Clinic of Nuclear Medicine, University Hospital, Technical University Dresden, Dresden, Germany

Motivation

- Patient **motion reduces the image quality** and affects accurate analysis of tracer kinetics in PET
 - Also **misalignment** between **transmission** and **emission** has an influence on the image quality and quantification
 - PET systems (e.g. ECAT Exact HR+) usually allow “**motion gating**” and **list-mode acquisition** during **emission only**
 - Potential motion correction approaches therefore compensate for motion during **emission phase only**
 - Recent developments on **PET/MR** (long MR acquisition times) suggest an **increasing importance** on that matter
- ➔ Analysis of the feasibility of **list-mode-based** acquisition of **transmission** data (for HR+)
- ➔ **Development** of necessary **hardware** and **software** for list-mode-based transmissions

Methods

- Development of **new acquisition protocols** for automatic extraction of the transmission sources [⁶⁸Ge] during a list-mode-based emission (simulated transmission)
- Enhancement of **list-mode sorter software** (ImSorter) to incorporate differences of list-mode transmission scans (i.e. scattered bit usage)
- **Evaluation** of feasibility and accuracy:
 - (1) Quantitative comparison of a histogram-mode transmission vs. a list-mode transmission scan via **intensity correlation histograms** (of images at rest)
 - (2) **Phantom measurement** with simulated **respiratory motion** and amplitude-based gating (Figure 1)

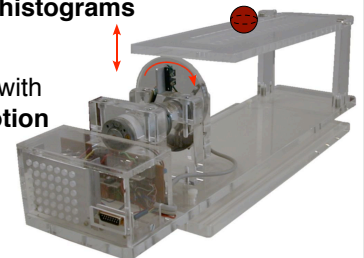
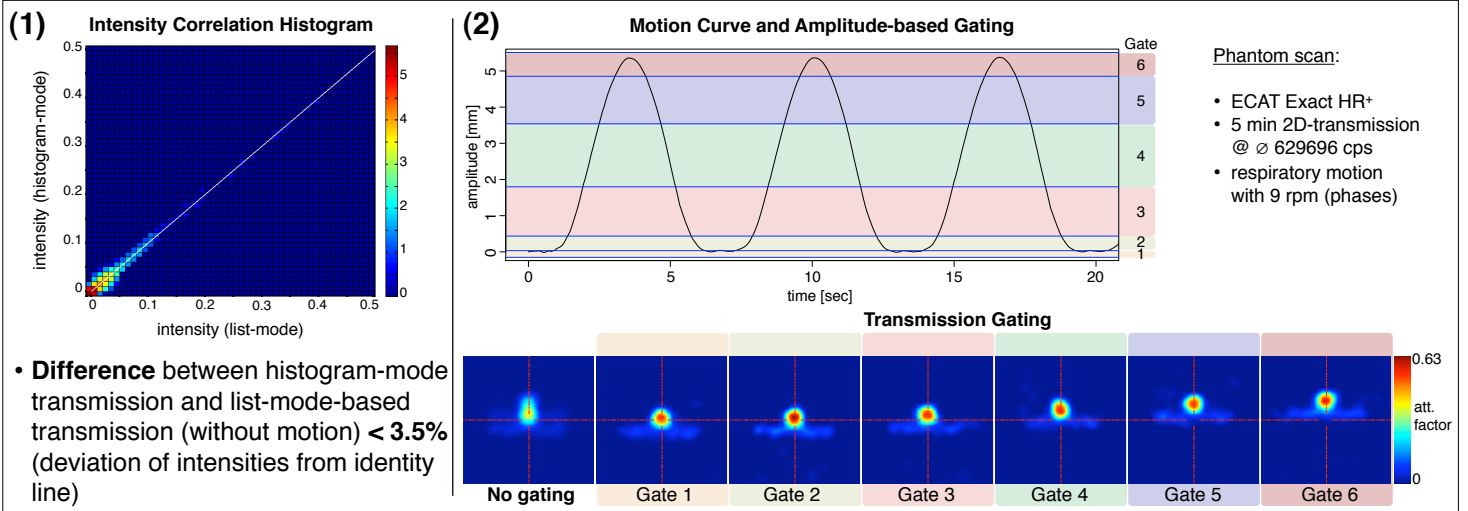


Figure 1: Respiratory phantom with motion tracked steel ball (red) attached

Results



Conclusions

- **List-mode-based transmission** scans are **feasible** with ECAT Exact HR+ PET scanners and require only minimal modifications of the standard protocols
- Only **low differences** due to the hardware-based **insertion of time stamps** during a “simulated transmission”
- **Gated transmissions** (in addition to a gated emission) facilitate the **accurate correction for motion** considerably



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