

## Recent Innovations in Cardiac MR: MR PET

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### Highlights

- The latest generation of MR-PET instruments provide for acquisition of PET events simultaneously with MR imaging.
- MR can provide attenuation correction scans used for PET reconstruction, similar to those obtained from CT [1].
- The 'obvious' cardiac application for these instruments tracks cardiac and respiratory motion by MR during the acquisition of PET data, followed by the integration of displacement information in the PET reconstruction. Significant improvements in PET resolution have been obtained [2,3].
- Opportunities exist for the quantitative integration of MR and PET, such as in assessing myocardial perfusion, detection and quantification of arterial plaques, and other yet-to-be-identified applications.

### Principles and Applications of MR-PET in the Diagnosis and Treatment of Cardiac Disease

Target audience: MR scientists and clinicians with interest in the latest generation of combined MR-PET scanners, as applied to cardiac diagnosis and treatment.

Objectives: Participants will learn

1. The essential characteristics of these machines, and how they differ from stand-alone MR and PET instruments,
2. New technical capabilities provided by combining MR and PET in a single instrument,
3. Some potential enhancements of cardiac PET scanning provided by the integration of PET with MR imaging, and
4. New acquisition techniques that could provide cardiac diagnostic information from simultaneous MR and PET, unobtainable by other means.

Purpose: By focusing on cardiac applications, participants will gain an understanding of the capabilities and challenges facing this new imaging modality, and learn something that could benefit their research and patients.

Methods: To provide a useful overview, the material will focus both on the presenter's experiences with combined MR-PET for cardiac imaging at the MGH, and other group's recent work in the field. A significant part of the presentation will focus on the technical capabilities of the instrument [4], and how that affects cardiac scanning.

Results: The cardiac MR-PET modality is new, and several groups are exploring new methods that could have clinical impact. The presentation will cover some of these emerging applications, and give examples of early results.

Discussion : The presentation will suggest some unexplored areas where simultaneous MR and PET could be significantly synergistic.

Conclusions: The presentation concludes with a pointwise review of the major topics covered.

[1] MRI-based attenuation correction for whole-body PET/MRI: quantitative evaluation of segmentation- and atlas-based methods. Hofmann M, Bezrukov I, Mantlik F, Aschoff P, Steinke F, Beyer T, Pichler BJ, Schölkopf B. J Nucl Med. 2011 Sep;52(9):1392-9.

[2] MRI-based nonrigid motion correction in simultaneous PET/MRI. Chun SY, Reese TG, Ouyang J, Guerin B, Catana C, Zhu X, Alpert NM, El Fakhri G. J Nucl Med. 2012 Aug;53(8):1284-91.

[3] MRI-based motion correction of thoracic PET: initial comparison of acquisition protocols and correction strategies suitable for simultaneous PET/MRI systems. Dikaios N, Izquierdo-Garcia D, Graves MJ, Mani V, Fayad ZA, Fryer TD. Eur Radiol. 2012 Feb;22(2):439-46.

[4] Latest advances in molecular imaging instrumentation. Pichler BJ, Wehrl HF, Judenhofer MS. J Nucl Med. 2008 Jun;49 Suppl 2:5S-23S.