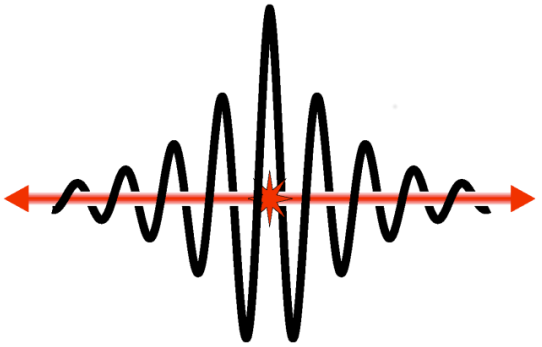
ISMRM British Chapter



BC-ISMRM 2016 Workshop

PET-MR Image Reconstruction

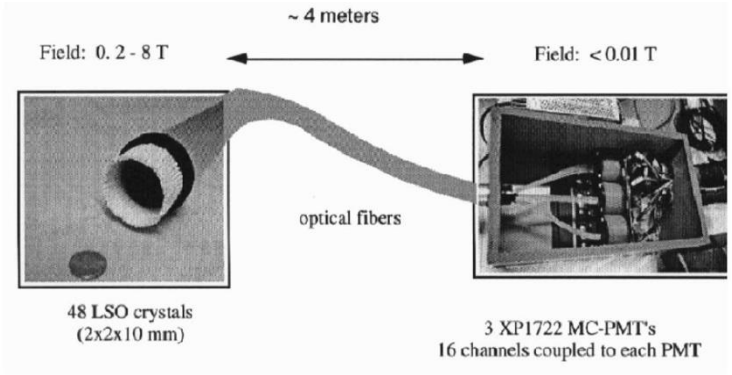
Organising committee

Kris Thielemans

Steven Sourbron

Charalampos Tsoumpas

Integrated PET-MR systems are now available in the clinic



Y Shao *et al, IEEE TNS 44 (1997)*

Siemens mMR

GE Signa PET/MR

Figures from S Vandenberghe and P K Marsden, Phys Med Biol 60 (2015)

Clinical PET-MR systems

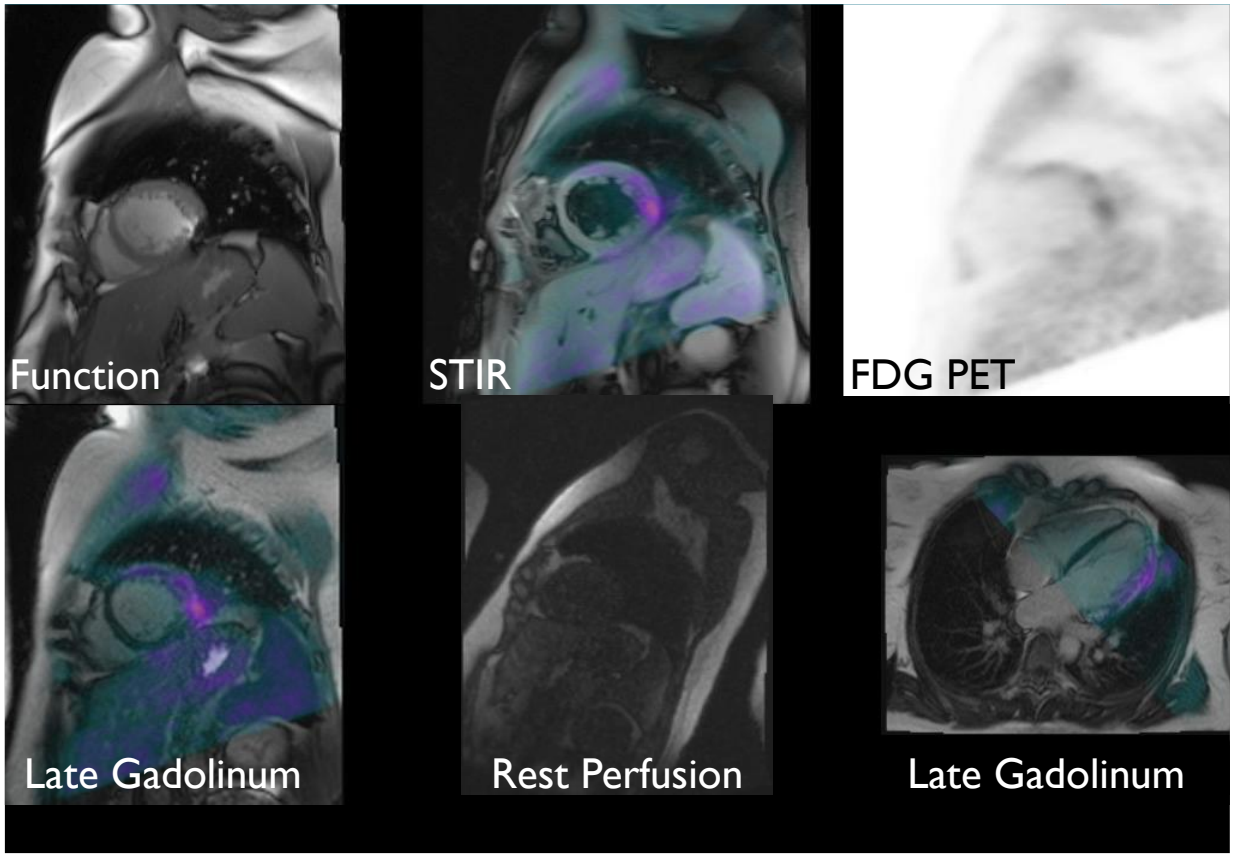
- World-wide:

  ~70 systems (not all allowing simultaneous acquisition)
  at Oct 2015, source: Fendler et al, J Nucl Med (Aug 2016)

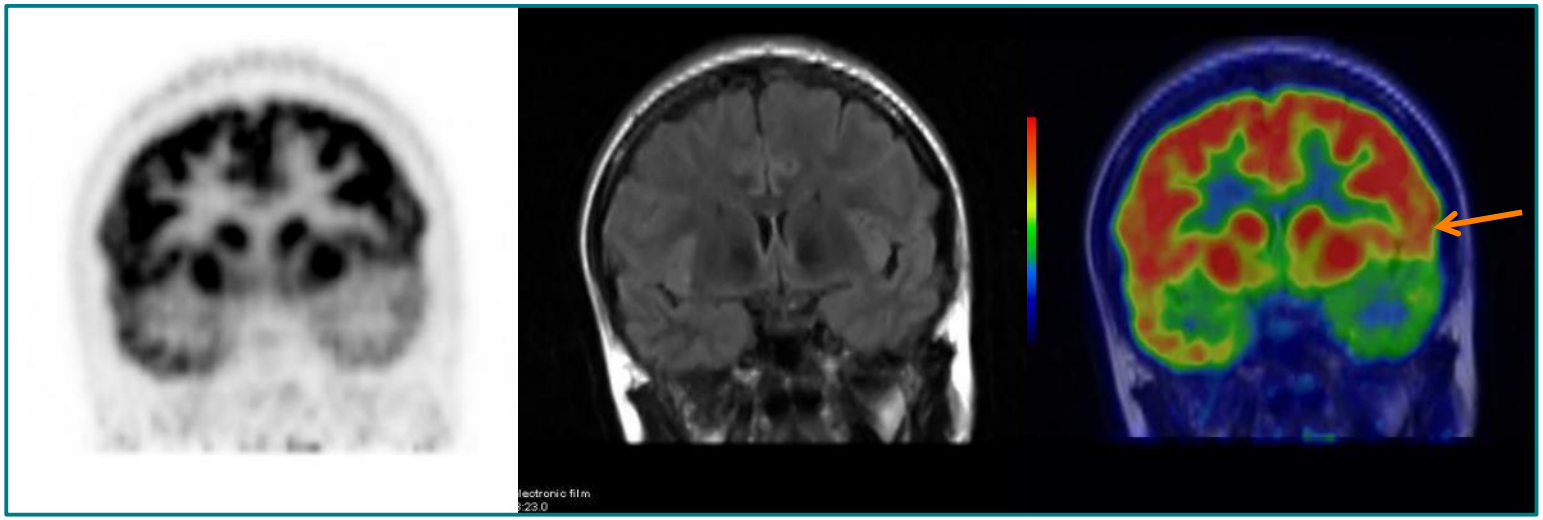
- UK:
  - 2 systems operational (KCL & UCL)
  - 5 new systems currently in installation

Dementias Platform UK
Medical Research Council

Imaging Cardiac Inflammation
18F-FDG PET/MRI

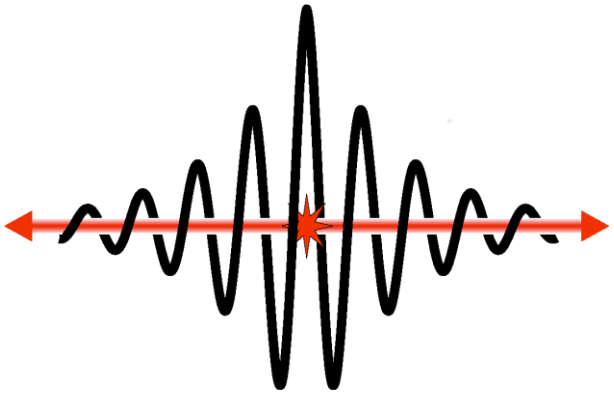


Left Temporal Lobe Epilsepsy with FDG



EPSRC

Engineering and Physical Sciences Research Council



Collaborative Computational Platform for Synergistic PET-MR Reconstruction

2015-2020

David Atkinson (UCL)

Julian Matthews (Univ Manchester)

Claudia Prieto (KCL)

Andrew Reader (KCL)

Kris Thielemans (UCL), PI

Aims of CCP PET-MR

- Network formation: bringing together expertise in each modality
  - advancing understanding of PET-MR
  - enhancing understanding of the algorithms used for each modality

- Developing software infrastructure
  - creating an Open Source software platform for integrated PET-MR image reconstruction
  - standardisation of data formats
  - database with test cases

Software

- ***Framework*** for 3D and 4D reconstruction of PET-MR data
- ***Simple enough*** for education and teaching
- ***Powerful enough*** for processing of real data in a research context
- ***Open Source***
- ***Easy installation***
  (installation script, virtual machine)

Architecture overview

Standard file format for (almost) 'raw' data (PET and MR)

simulators

POSSUM

Framework

- PET package 1
- PET package 2
- Optimisation Code 1
- MR package 1
- MR package 2

Images (DICOM, Nifti,…)

File format translators supplied by/developed with manufacturers

Framework

- “Glue” between different packages
- Provides consistent interface to user
  - It should not matter which package you are using for e.g. the PET part
- Language interfaces
  - MATLAB
  - Python

Software Status

- Underlying packages:

- Functionality
  - Basic data manipulation
  - Acquisition modelling
  - Access to some reconstruction algorithms
  - Processing of data from Siemens mMR

Software distribution

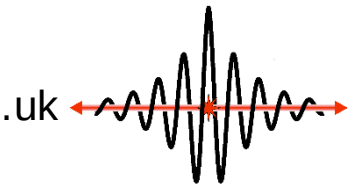
- https://github.com/CCPPETMR
  - All source code (Apache 2.0 license)
  - Installation instructions

- Virtual Machine (VirtualBox)
  http://www.ccppetmr.ac.uk/downloads
  - Preinstalled STIR, Gadgetron
  - Preinstalled CCP-PETMR software for Python
  - Easy update mechanism
    (choice between stable and experimental)

BC-ISMRM 2016 Workshop
PET-MR Image Reconstruction

Introduction	13:00
Session 1: MR reconstruction	13:15
10 minute break	14:35
Session 2: PET reconstruction	14:45
coffee break	16:05
Session 3: PET-MR reconstruction	16:25
Closing Statement	17:40
end	17:45

http://www.ccppetmr.ac.uk

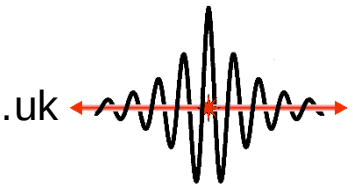


BC-ISMRM 2016 Workshop
PET-MR Image Reconstruction

Session 1: MR reconstruction

Chairs: *Julian Matthews* and *Steven Sourbron*

Basic principles of MR reconstruction *Claudia Prieto*	13:15
Live demo of MR reconstruction with Gadgetron *David Atkinson*	13:55
10 Minute Break	14:35
Session 2: PET reconstruction	14:45



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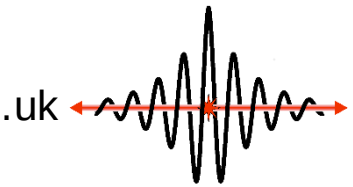


BC-ISMRM 2016 Workshop

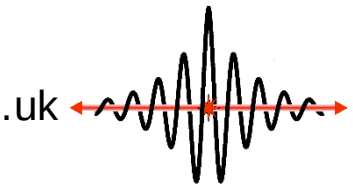
PET-MR Image Reconstruction

Session 2: PET reconstruction

Chairs: *Claudia Prieto* and *Charalampos Tsoumpas*

Basic principles of PET reconstruction *Andrew Reader*	14:45
Live demo of PET reconstruction with STIR *Kris Thielemans*	15:25
20 Minute Coffee Break	16:05
Session 3: PET-MR reconstruction	16:25

http://www.ccppetmr.ac.uk



BC-ISMRM 2016 Workshop
PET-MR Image Reconstruction

Session 3: PET-MR reconstruction

Chairs: *David Atkinson* and *Andrew Reader*

Using MR as anatomical prior for PET *Julian Matthews*	16:25
Using MR for motion correction in PET *Charalampos Tsoumpas*	16:45
Joint kinetic model-driven reconstruction *Steven Sourbron*	17:05
Synergistic image reconstruction *Kris Thielemans*	17:25
Closing statement	17:45

http://www.ccppetmr.ac.uk