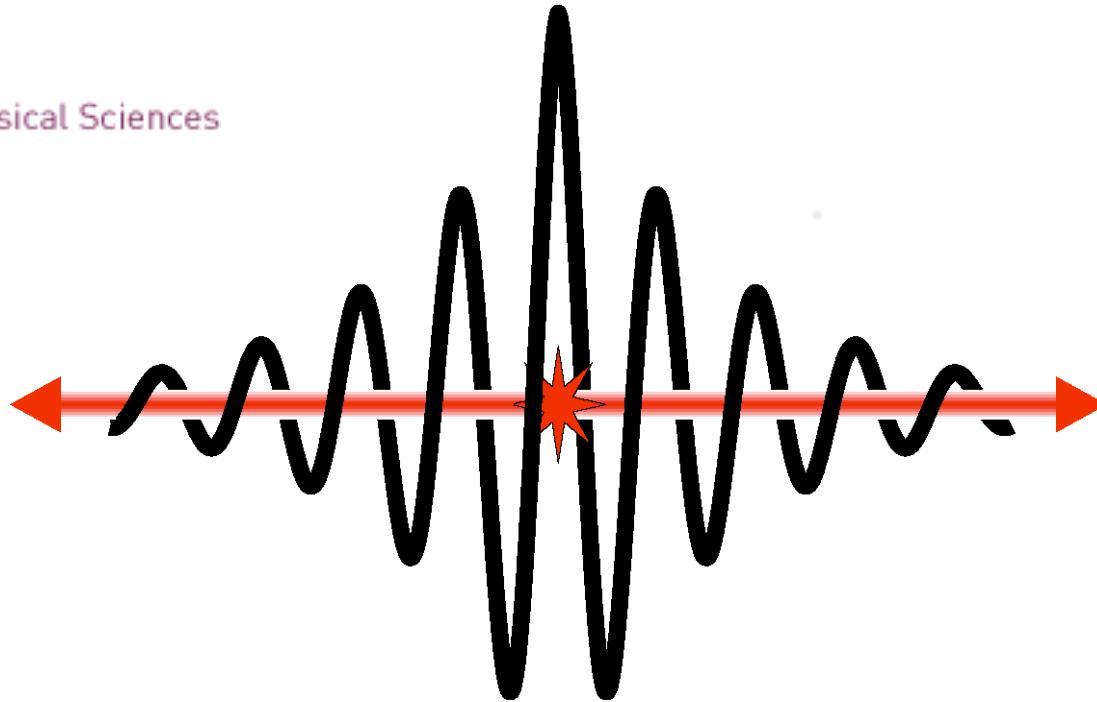


EPSRC

Engineering and Physical Sciences
Research Council



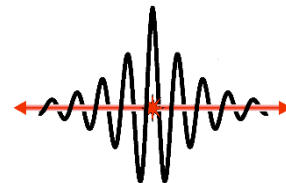
Synergistic PET-MR Reconstruction

David Atkinson
Julian Matthews
Claudia Pietro
Andrew Reader

Kris Thielemans

Aims for today

- finalize User Specification document (“what do we want to be able to do”)
- provide an update on STIR and the Gadgetron as examples of current packages
- create pseudo-code for initial use cases (“how do we want to use the software”)
- discuss implementation of MATLAB/Python interface to STIR/the Gadgetron (*if time permits*)



Agenda

- Overview of last meeting
- General updates
- User specification document review
“what do we want to be able to do”
- Packages
 - Overview of CCPi recon software
 - Update on the Gadgetron and STIR
 - Example interfaces to STIR
- User specification document review
“how does the interface look like”
- Use-cases: construct pseudo-code
- Future plans



Software aims

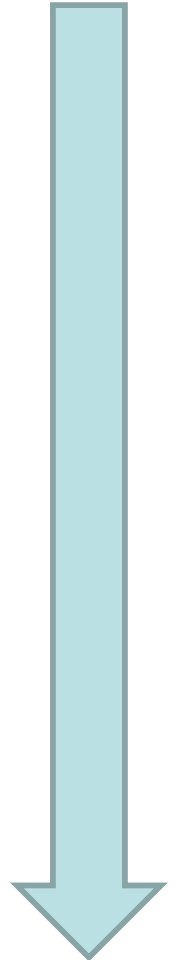
- ***Framework*** for 3D and 4D reconstruction of PET-MR data
- ***Simple enough*** for education and teaching
- ***Powerful enough*** for processing of real data in a research context
- ***Open Source (Apache 2.0 license)***
see software document in first WG Meeting notes
- ***Easy installation***
(e.g. installation script, precompiled, virtual machine, Docker, remote access in the Cloud)



Usage examples

- MRAC for PET with segmentation
`image=Reconstruct(PET_data, mu_map);`
- Joint reconstruction with “coupling” prior
`myObjfun = PET_objfun + MR_objfun + myPrior;`
`image=Maximise(myObjfun);`
 - Needs gradients/values of PET and MR objective functions.
- Develop new reconstruction algorithm
 - Needs access to PET projectors, scatter etc
- Acquisition design for synergistic reconstruction
 - Get sinograms from PET list mode data
 - Simulate MR (under)sampling patterns
 - ...

High-level

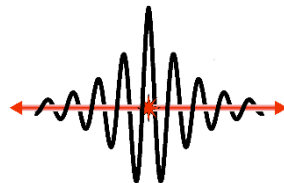


Low-level

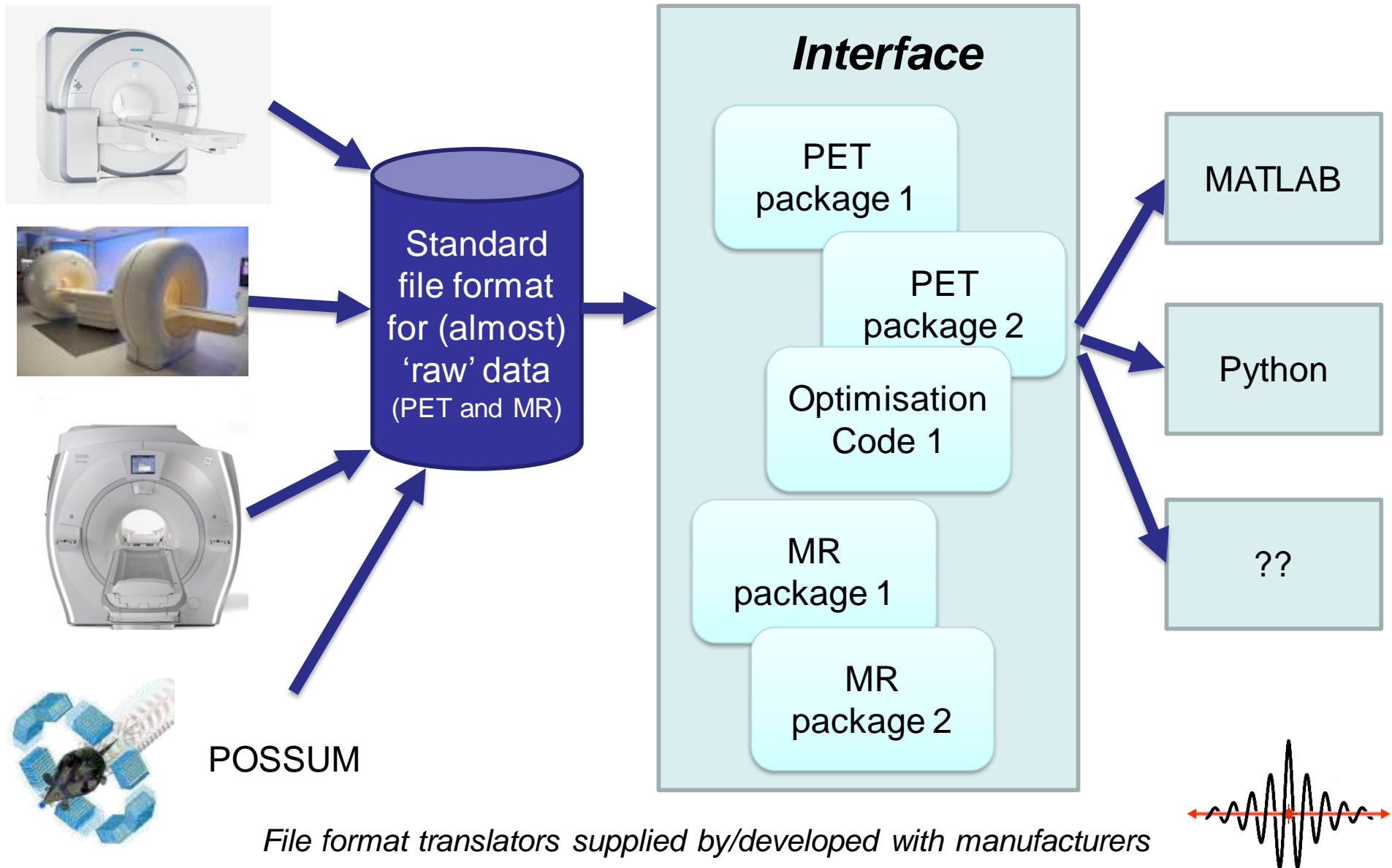


Consequences

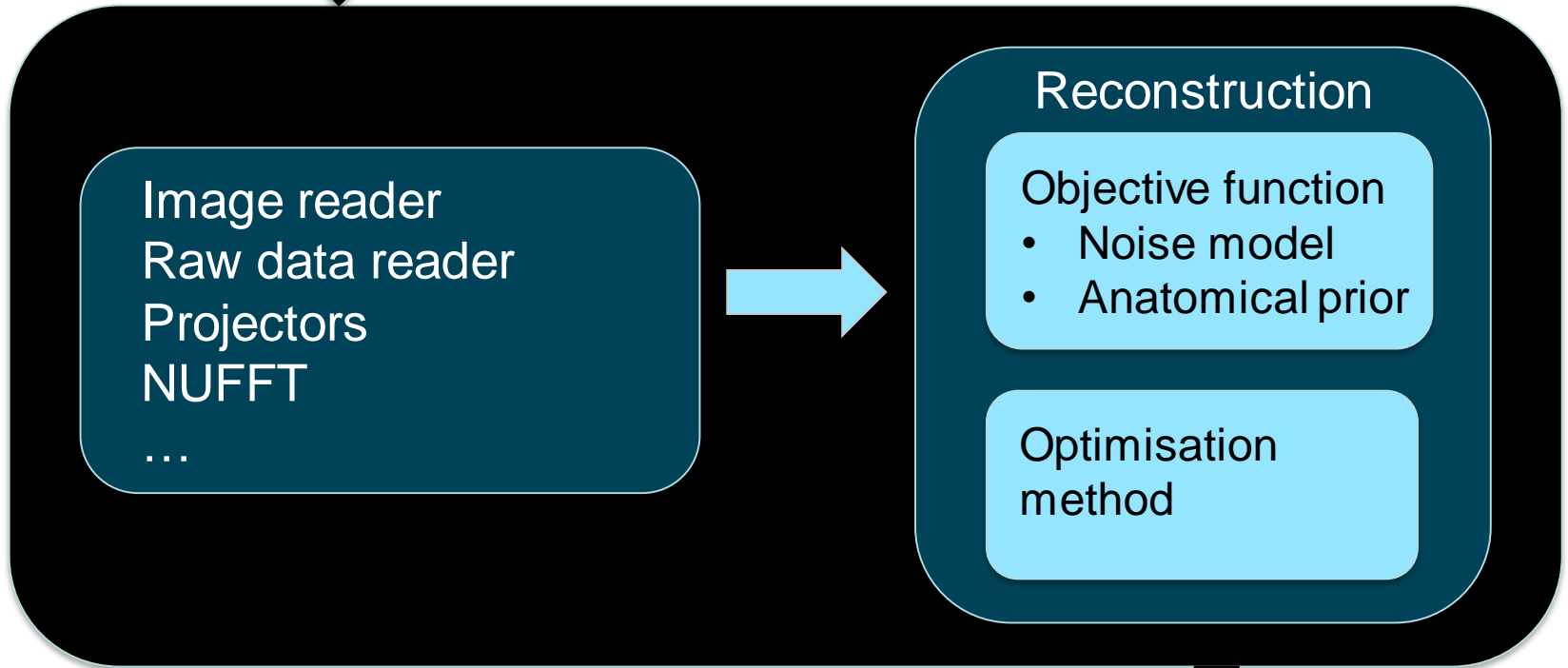
- Corresponding “levels” in the framework
 - Top-level as simple as possible
 - Lowest-level is powerful as possible
- Needs thought on software design



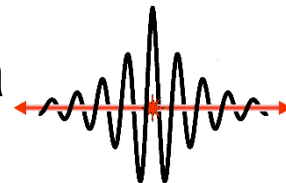
Architecture overview



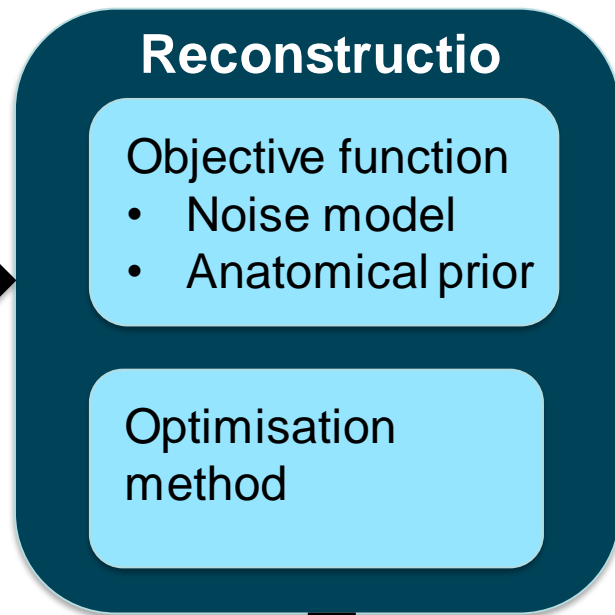
Input data



Output data



Input data



Output data



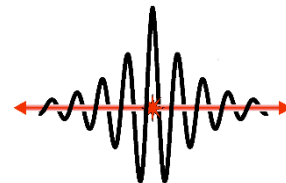
Example use cases

- read in reconstructed images, align, display
- read in raw PET and MR data and do basic QA and display
- reconstruct undersampled multi-coil MR T1
- reconstruct PET data with MR image as anatomical prior
- use numerical optimisation library as reconstruction tool



General updates

- UK DP
- File formats and converters
- CCP Workshop on joint reconstruction?
- Satellite Workshop at IEEE MIC



IEEE MIC 2015 Satellite Workshop on Open Source Software in Medical Imaging

Chairs

- Charalampos Tsoumpas, University of Leeds
- Kris Thielemans, University College London

Where and when

- [IEEE Medical Imaging Conference, San Diego, CA, USA](#)
Saturday, 7 November, 2015, 13:00-16:30

Speakers

- **S. Pedemonte:** Occiput: unified PET, MR and SPECT reconstruction
- **D. Visvikis:** TBC
- **J. Adler:** A python library for inverse problems
- **M. Hansen:** Gadgetron: An open source framework for medical image reconstruction
- **TBC:** ASTRA
- **K. Thielemans:** STIR



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