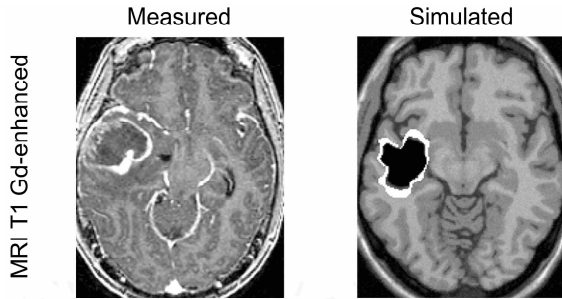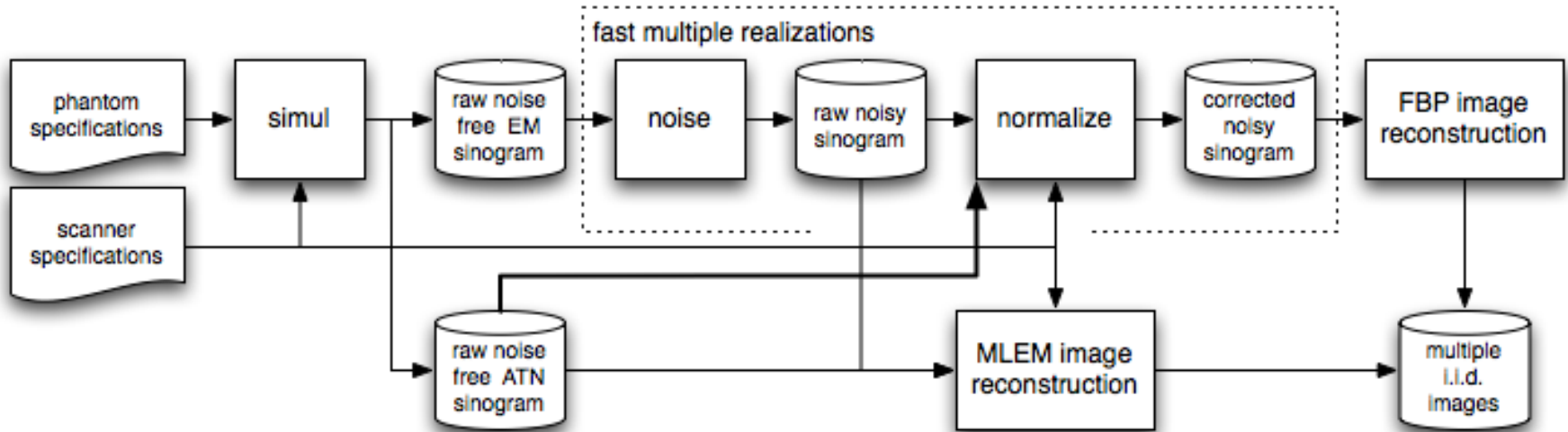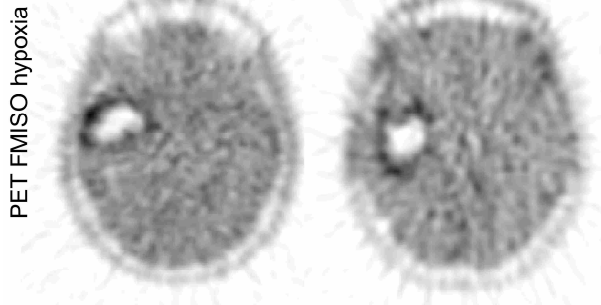# ASIM History

Paul Kinahan, University of Washington

- simul - Christian Michel and Michel Defrise 1993
  - added Poisson noise to analytic projections
  - built on ecat7 code base
- EVAL3DPET - Gabor Herman Sergio Furuie 1993
  - added noise to analytic projections based on earlier concepts by R. Wanda Rowe
  - recognized that foward model for simulation should not use same model as image reconstruction
- ASIM - 1996 Claude Comtat Paul Kinahan
  - NCI funded project
  - combined concepts of simul and EVAL3DPET
  - much more accurate noise and resolution models
  - many generalizations added to allow fast i.i.d. realizations for whole-body PET for detectability studies
 - many refinements added by C Comtat over years

ASIM In Operation

fast multiple realizations

phantom specifications → simul → raw noise free EM sinogram → noise → raw noisy sinogram → normalize → corrected noisy sinogram → FBP image reconstruction

scanner specifications

raw noise free ATN sinogram → MLEM image reconstruction → multiple i.i.d. images

Measured   Simulated

MRI T1 Gd-enhanced

PET FMISO hypoxia

Applying A Patient-Specific Bio-Mathematical Model of Glioma Growth to Develop Virtual [18F]-FMISO PET Images.

Mathematical Medicine & Biology, 2011.
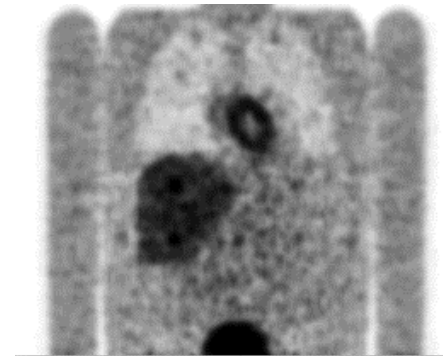
A Quantitative Approach to a Weight-Based Scanning Protocol for PET Oncology Imaging. IEEE MIC 2005

~2000 whole-body PET realizations (single cpu)

ASIMSET History

U Wash Lewellen / Kinahan/ Harrison 2007

- NCI funded resource for users
  - (ASIM piggybacked on SimSET gorilla)
- ASIM Goals:
  - Restructure ASIM as flexible, modular, transportable software.
  - Give ASIM flexible initialization for models, including deriving models from SimSET simulations.
  - Distribute ASIM as open source software.
  - Create/validate a meta-language for SimSET and ASIM parameter files.
  - Create user tools for creating meta-language parameter files and displaying the simulation setup.

Outcomes

- no longer tied to ecat7 code base
- extensive documentation

ASIMSET Future

ASIMSET Resource grant resubmission in 2012

- Dynamic sequences (kinetic modeling) for quantitative imaging
- Integration with image reconstruction resource
- Unified user visualization for ASIM and SIMET input objects
- List mode
- TOF
- new scanner models
- better scatter model (patient dependent profiles)

(more on SimSET by R Harrison)