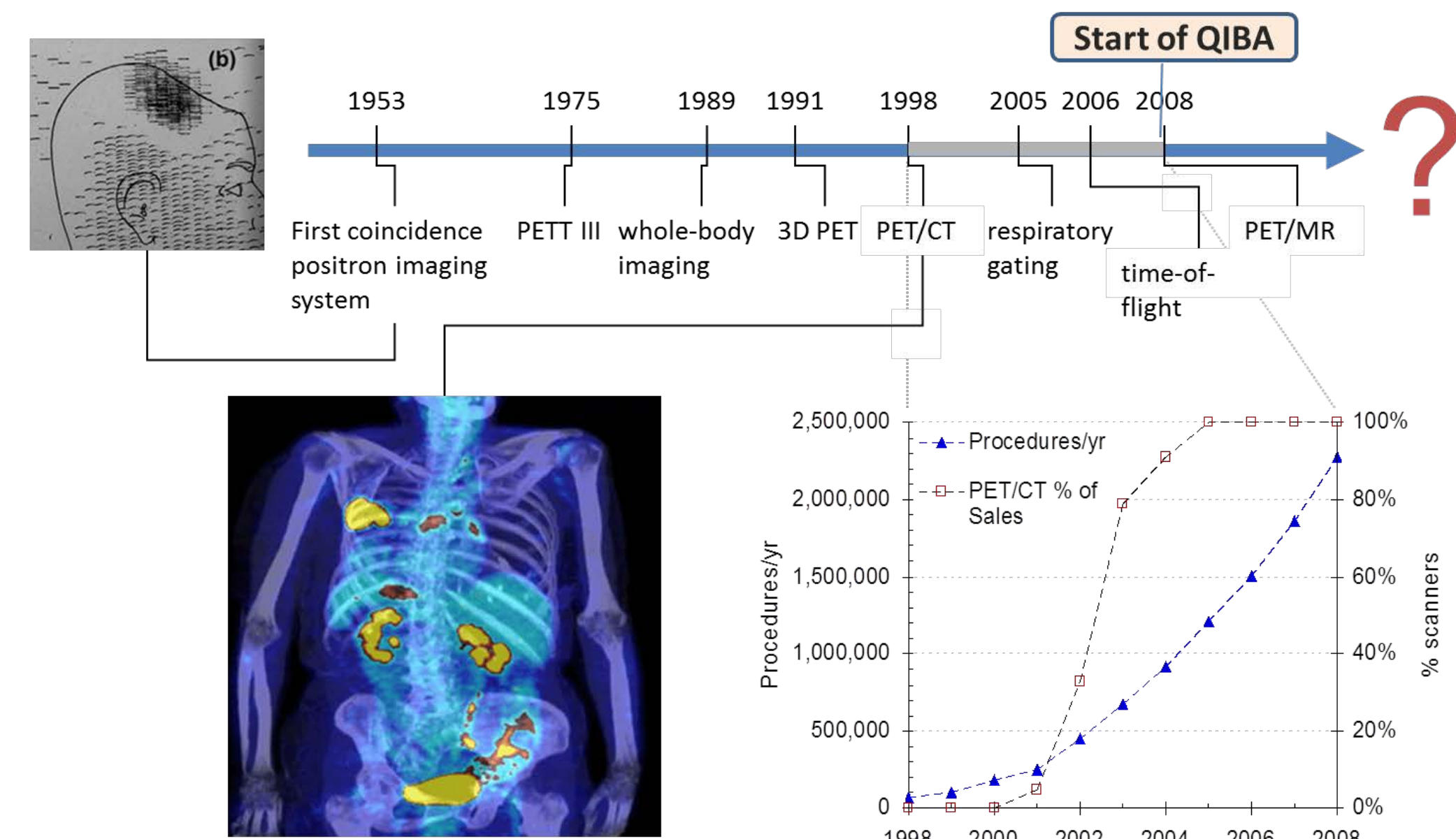# The QIBA FDG-PET/CT Biomarker Committee: An Overview and Status Update
Accelerating the development of new therapies and improving assessment of response

Quantitative Imaging Biomarkers Alliance — RSNA
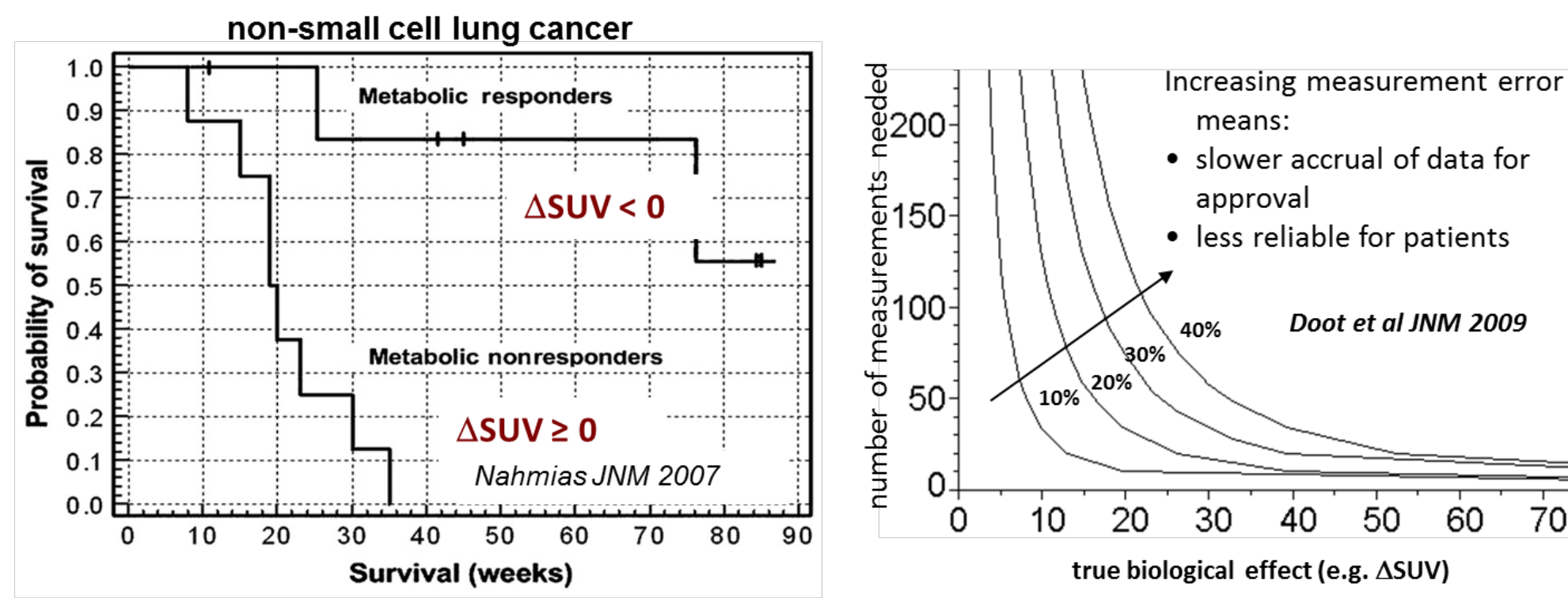

PET/CT Innovation & Quantitation

PET/CT: A Proud History of Innovation

Start of QIBA

1953 — First coincidence positron imaging system
1975 — PETT III whole-body imaging
1989 — 3D PET
1991 — PET/CT
1998 — respiratory gating
2005 2006 2008 — time-of-flight
PET/MR

Procedures/yr — PET/CT % of Sales

Biomarkers for Quantitative PET /CT

- Biomarkers To Quantify Hallmarks of Cancer
- Characterize Hallmarks of Disease and Response to Therapy

New molecular diagnostic agents
New uses for existing agents

Biologic Target:
18F-NaF, 18F-FDG, 18F-FLT, hypoxia, 18F-FMISO, apotosis, 18F-XXX, 18F-FES, receptor status, 18F-YYY, angiogenesis, Brain Amyloid, 18F-ZZZ
bone formation, glucose metabolism, proliferation

Response to therapy of liver met GIST
CT — PET/CT
Pre-therapy
1 wk imatinib therapy
PET SUV: 5 to 1.8

Castell and Cook, British J Cancer 2008
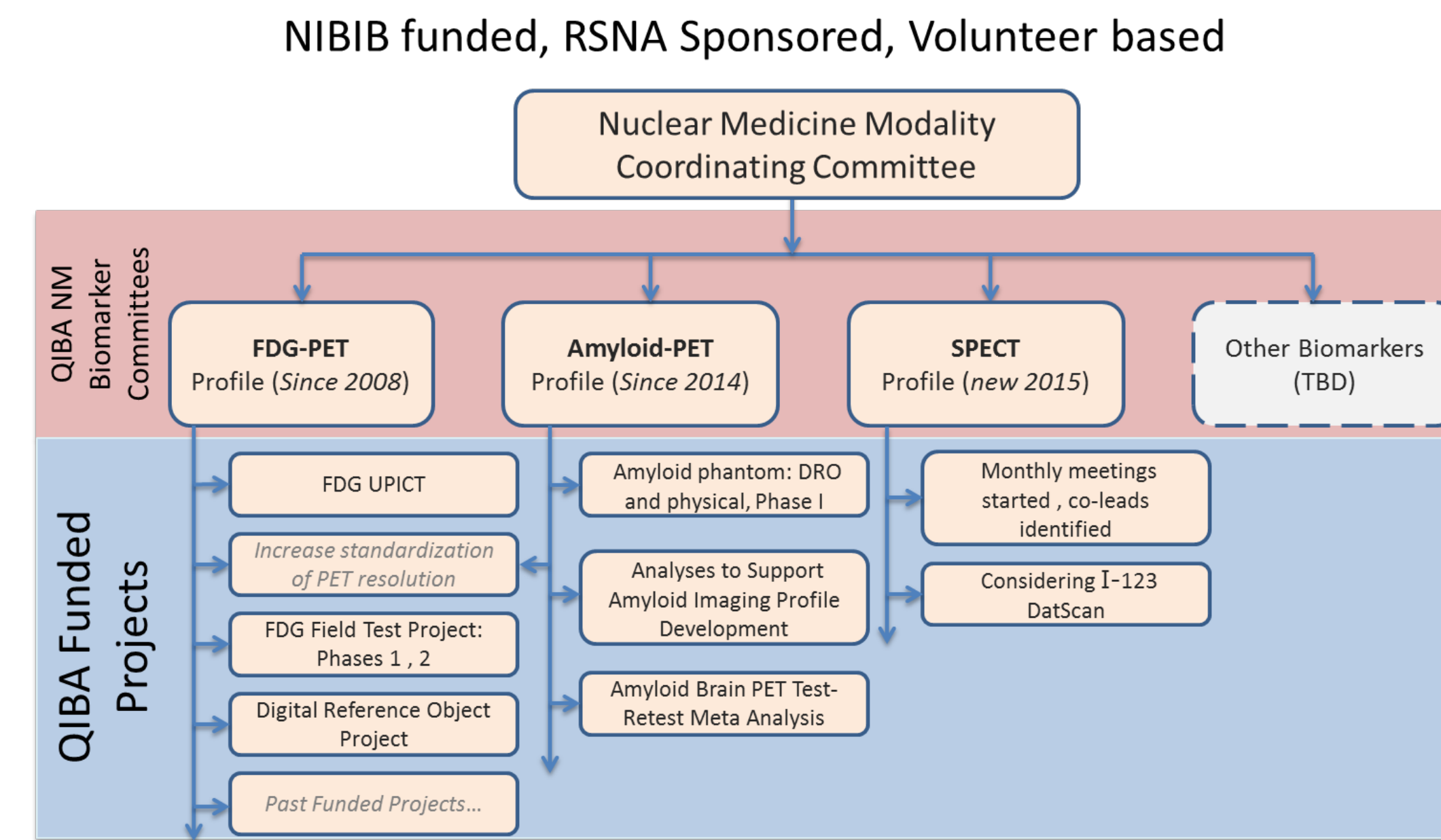
RSNA 2015

Quantitation – Why and How

Why Quantification?
Increase the Utility and Value of Imaging

- ❑ *Improve individual patient care*
  - Clinically proven detection and longitudinal quantitation for follow-up
  - Moves imaging from diagnostics and staging to therapy assessment
- ❑ *Accelerate adoption of new molecular diagnostics*
- ❑ *Make clinical trials of new therapies more effective*
- ❑ *All tied to quantitative accuracy*

non-small cell lung cancer
Metabolic responders — $\Delta SUV < 0$
Metabolic nonresponders — $\Delta SUV \geq 0$
Nahmias JNM 2007

Increasing measurement error means:
- slower accrual of data for approval
- less reliable for patients

Doot et al JNM 2009

QIBA Profiles:
Guidance for All Aspects of Quantitation

QIBA GROUNDWORK for ANALYZING/CREATING DATA to INFORM PROFILES

PRODUCT CREATION PROCESS of DEVICE and SOFTWARE MANUFACTURERS

Reports and Data Sets Analyzing:
- Technical characteristics and sources of errors
- Stand-alone performance on phantoms and synthetic data
- Clinical performance in terms of intra- and inter-reader variability
- Clinical efficacy
- Standardization across scanners

QIBA PROFILE
I. CLINICAL CONTEXT
II. CLAIMS
III. DETAILS
IV. COMPLIANCE
V. ACKNOWLEDGEMENTS

Imaging Site Requirements Specification
System Requirements Specification
Verification Plan and Protocol

Participation and visibility for all stakeholders

QIBA NM Organization & Efforts

Characterization of Quantitative Bias and Precision: Establishment of QIBA Profiles

NIBIB funded, RSNA Sponsored, Volunteer based

Nuclear Medicine Modality Coordinating Committee

QIBA NM Biomarker Committees:
- FDG-PET Profile (Since 2008)
- Amyloid-PET Profile (Since 2014)
- SPECT Profile (new 2015)
- Other Biomarkers (TBD)

QIBA Funded Projects:
- FDG UPICT
- Increase standardization of PET resolution
- FDG Field Test Project: Phases 1 , 2
- Digital Reference Object Project
- Past Funded Projects…
- Amyloid phantom: DRO and physical, Phase I
- Analyses to Support Amyloid Imaging Profile Development
- Amyloid Brain PET Test-Retest Meta Analysis
- Monthly meetings started , co-leads identified
- Considering I-123 DatScan

QIBA PET/CT Projects

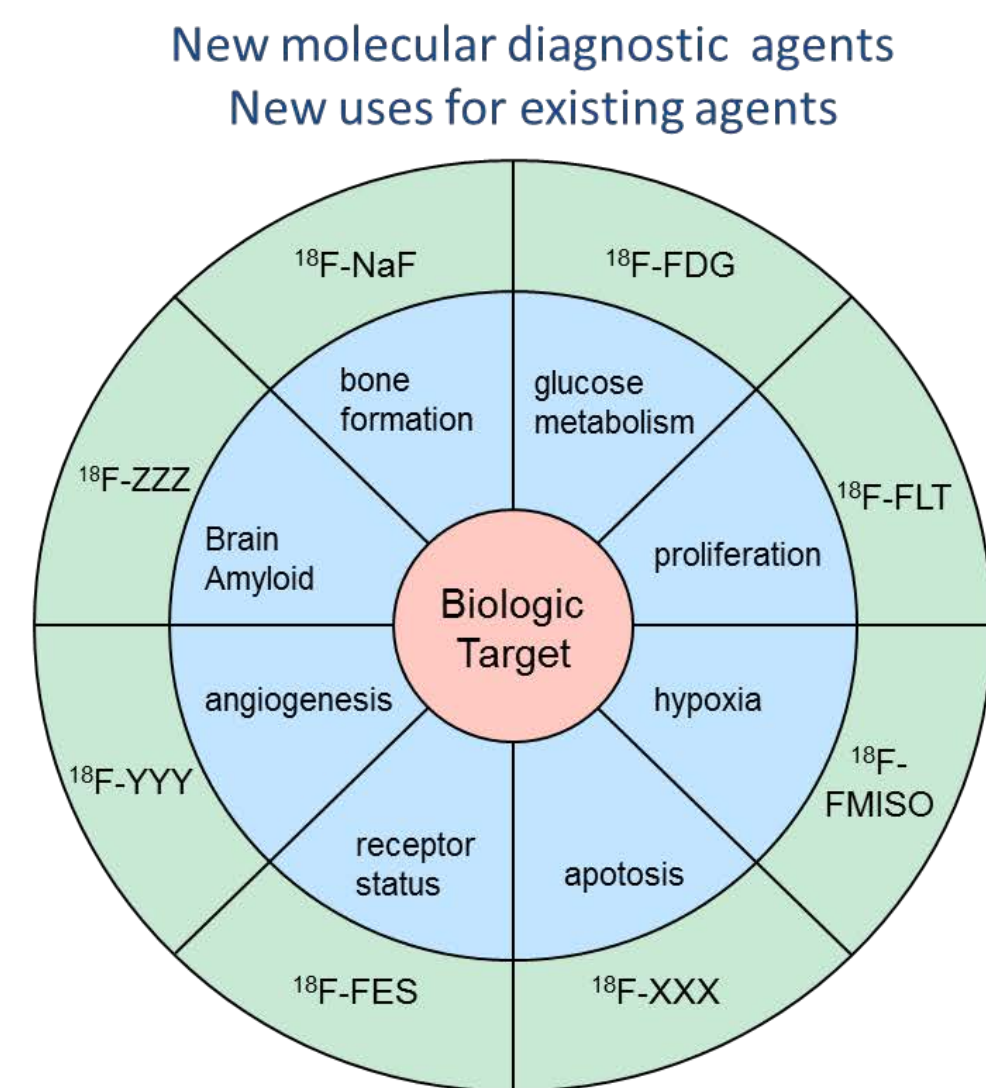| Round	Timeframe	Project Title	Principal Investigator	Status
1-3	2010-2014	9 previous projects completed during this timeframe	(various)	Completed
4	2014-2015	FDG-PET/CT Profile Multi-Center Field Test	Timothy Turkington, PhD (Duke)	**Completed**
4	2014-2015	Amyloid Profile Continued Support with Brain Phantom Development (physical phantom)	John Sunderland, PhD (U. of Iowa)	**Completed**
4	2014-2015	Amyloid Profile Continued Support with Brain Phantom Development (DRO)	Paul Kinahan, PhD (U. of Washington)	**Completed**
5	2015-2016	Analyses to Support Amyloid Imaging Profile Development	Dawn Matthews (ADM Diagnostics, LLC)	To begin
5	2015-2016	Biologic and Reader Repeatability of FDG and CT Volumetric Parameters (ACRIN 6678 & MERCK)	Rathan Subramaniam, MD, PhD, MPH (Johns Hopkins Med Ctr)	To begin
5	2015-2016	Amyloid Brain PET Test-Retest Meta Analysis	Rathan Subramaniam, MD, PhD, MPH (Johns Hopkins Med Ctr)	To begin
5	2015-2016	A PET-Metabolic Tumor-Volume-Digital Reference Object (PET-MTV-DRO)	Paul Kinahan, PhD (U. of Washington)	To begin
5	2015-2016	A Procedure to Facilitate Greater Standardization of PET Spatial Resolution	Martin Lodge, PhD (Johns Hopkins Med Ctr)	To begin

---

Ongoing Activities 2015-2016

What We're Doing
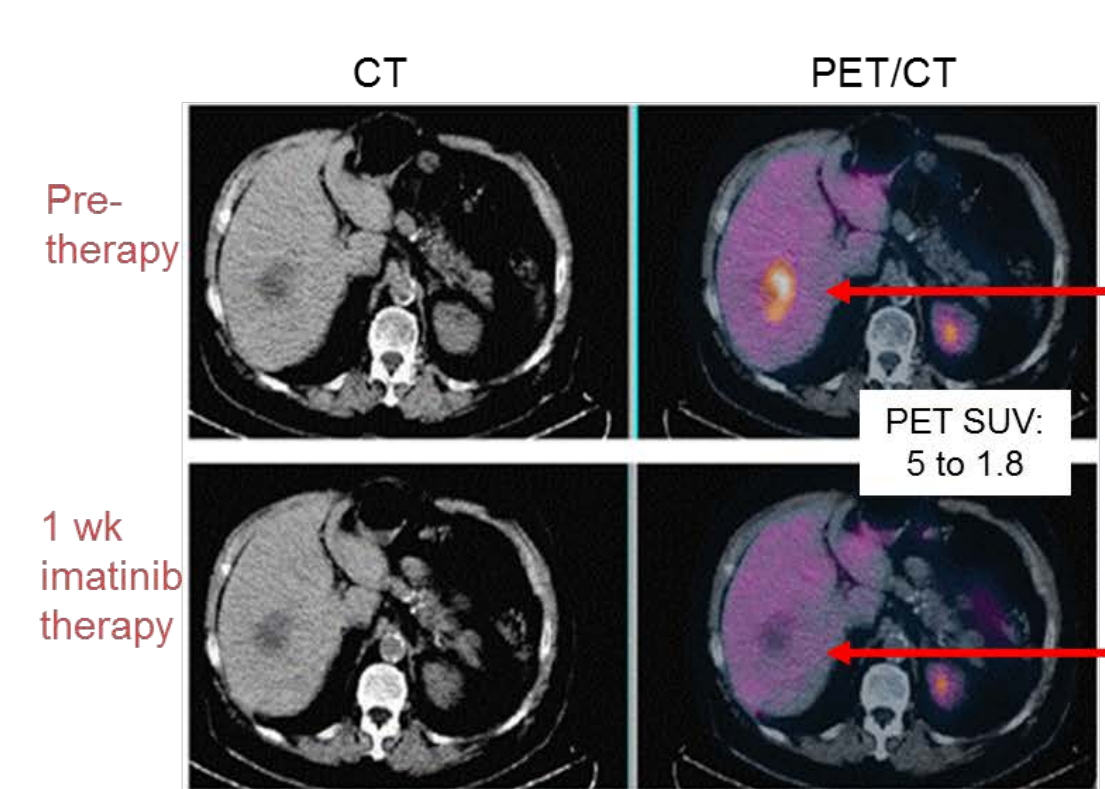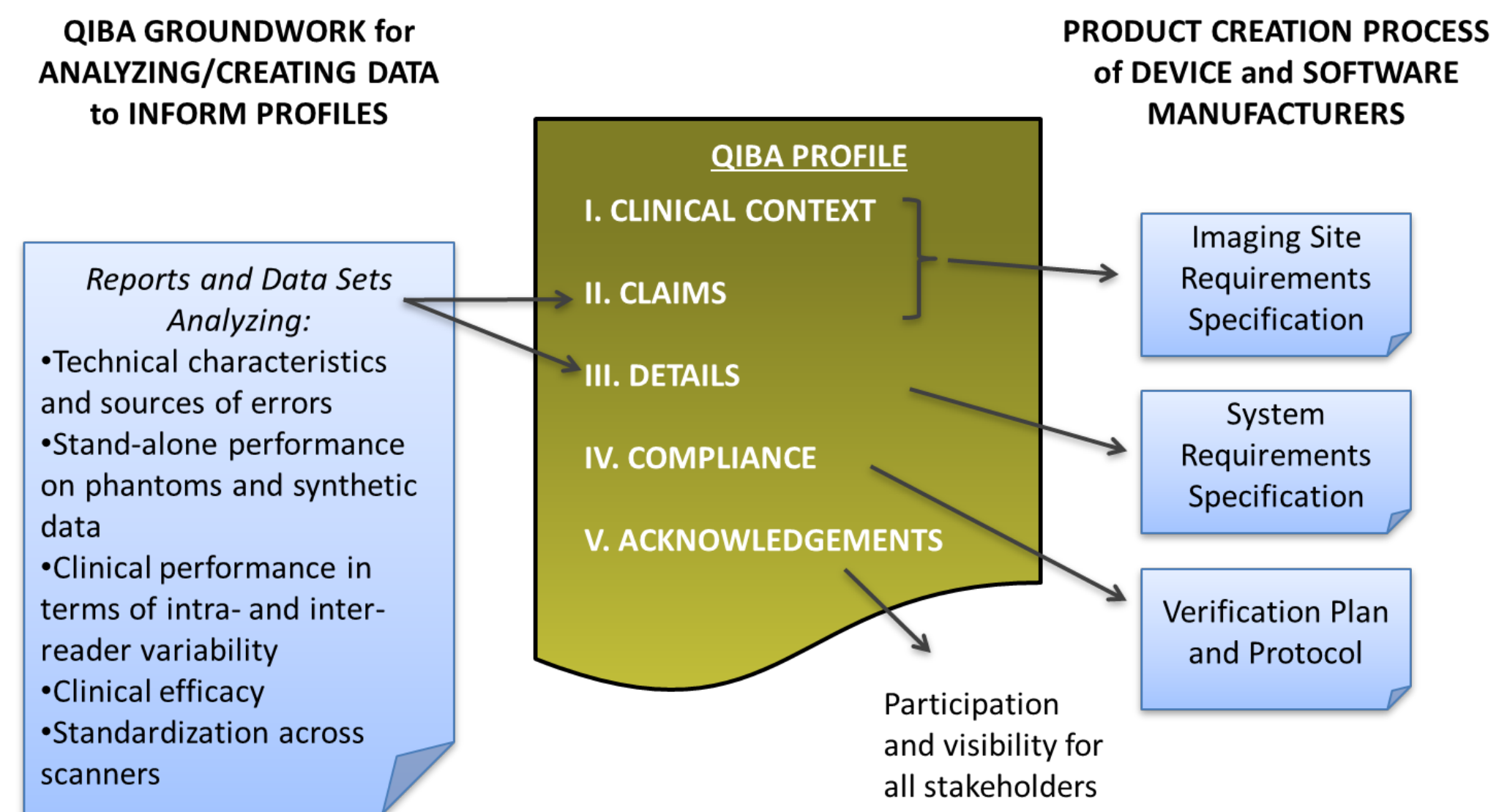### *and How You Can Participate*

Specific accomplishments and plan
- ✓ Collection of recommendations for quantitative PET
- ✓ Presentation (joint with FNIH) to FDA for Biomarker Status
- ✓ NIBIB grant applications to fund operations
- ✓ Year 1 -4 research projects accomplished
- ✓ Year 5 research project funding- progress
- ✓ FDG-PET/CT Profile published and publically reviewed
- ✓ Collaboration with UPICT on Protocols
- ✓ Amyloid Writing Group established, Draft profile approaching completion
- ✓ PET Amyloid Profile Writing Group working for 2 years and became an Affiliate of Global Alzheimer's Association Interactive Network
- ✓ SPECT Profile Writing Group initiated
- ✓ Completed Phase II Profile testing of PET/CT FDG profile.
- ✓ Implementation of Profiles
- ✓ Clinical use of Profile

Organization Standing Activities
- ✓ QIBA Monthly Steering Committee meeting
- ✓ Profile telephone conferences: Alternating weekly for FDG profile, Amyloid profile, and SPECT profile writing groups
- ✓ Bi-annual QIBA meetings, and updates at RSNA
- ✓ Working visits with vendors
- ✓ Special task force meetings – as necessary
- ✓ Profile testing
- ✓ Profile Implementation (by QIBA and vendors)

For more information, visit
http://qibawiki.rsna.org

FDG PET/CT Profile Field Test

The potential for widespread deployment of the profile was assessed as part of a clinical feasibility study that evaluated the importance and practicality of the profile recommendations

FDG PET/CT Profile
Individual specification

Phase 1: Academic sites (3)
For each specification:
1. Is it current practice (y/n)?
2. Is spec feasible (y/n)?
3. Is it feasible but objectionable (y/n)?
Summarize feasibility by spec

Phase 2: Additional sites (beyond academic)
For each specification:
1. Is it current practice (y/n)?
2. Is spec feasible (y/n)?
3. Is it feasible but objectionable (y/n)?
Checklist, Profile update
- Define update process
- Remove, modify specs as warranted*

Phase 3: Test a checklist
For each check:
1. Is it current practice (y/n)?
   a. If no, justification for non-compliance demonstrated (y/n)?
All yes: Compliant Site
≥1 no: Non-Compliant Site

*Modification or removal of each specification is based on reassessment of:
1) tradeoff of feasibility and impact on quantitation,
2) actual relevance to quantitation