The State of Radiotherapy Physics Through the Eyes of a Quality Auditor

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Brief Background

- **Originated through agreement between AAPM and CRTS**

- **Founded in 1968 to monitor institution participation in clinical trials**

- **Funded continuously by NCI as structure of cooperative group programs have changed**

- **Now 38 years of experience of monitoring institutions and reporting findings to study groups and community**

Why do we do this?

We have an NCI grant to:

1. Assure NCI and cooperative groups that institutions participating in clinical trials deliver prescribed doses that are comparable and consistent.

2. Help institutions to make any corrections that might be needed.

3. Report findings to the community.

Only QA Office with relationships with <u>all</u> study groups

QARC

RCET

RPC QA PROGRAM

ITC

RTOG/ACR

ACOSOG
COG
SWOG
CALGB
ECOG
NSABP
NCCTG
GOG
ACRIN
RTOG
COMS
CTSU

NATIONAL CANCER INSTITUTE

National Eye Institute
U.S. National Institutes of Health · Research Today...Vision Tomorrow
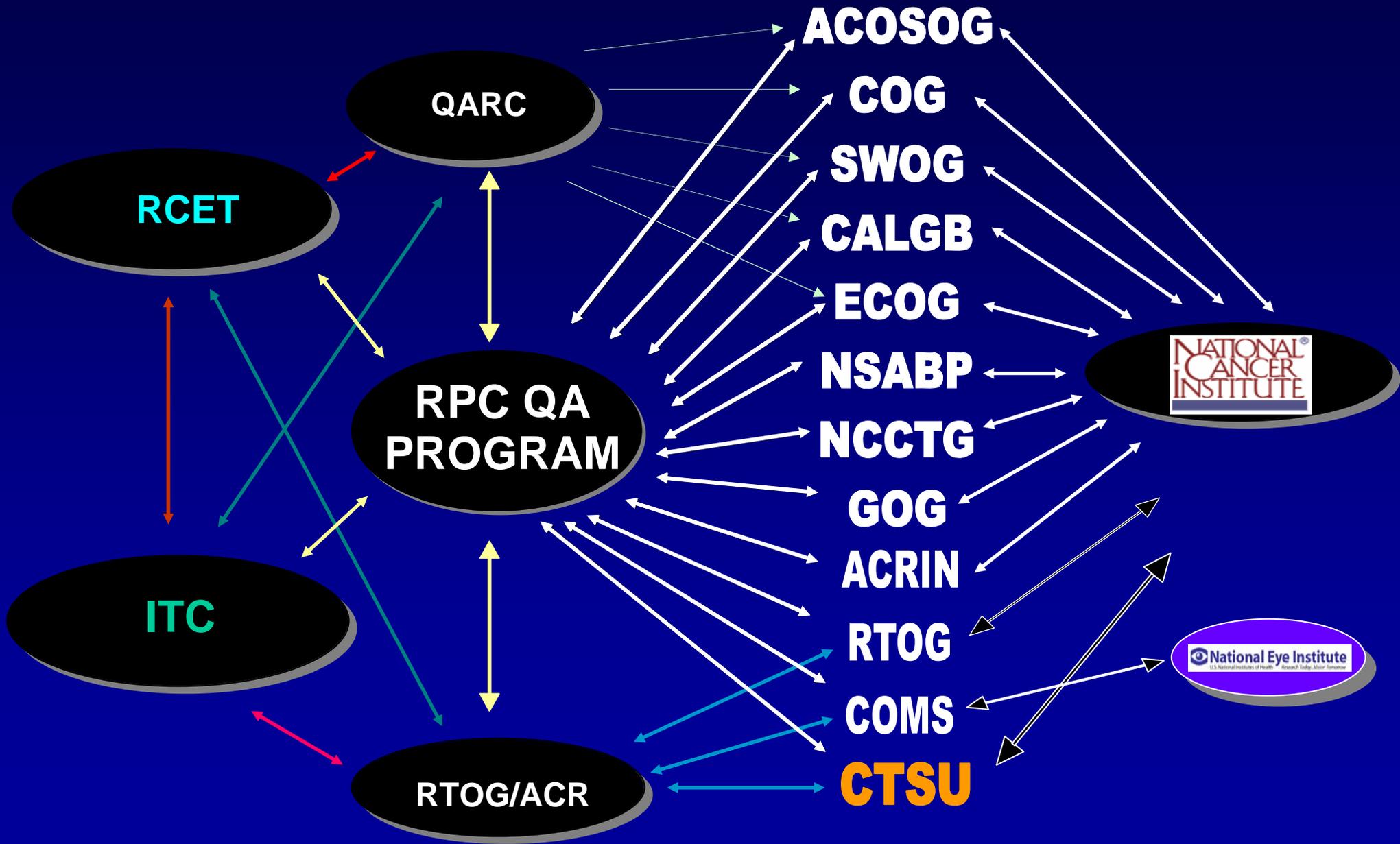
Clinical Trial Participants

- Number of Active Institutions – 1435
  - 2864 megavoltage machines
  - 7279 active megavoltage beams
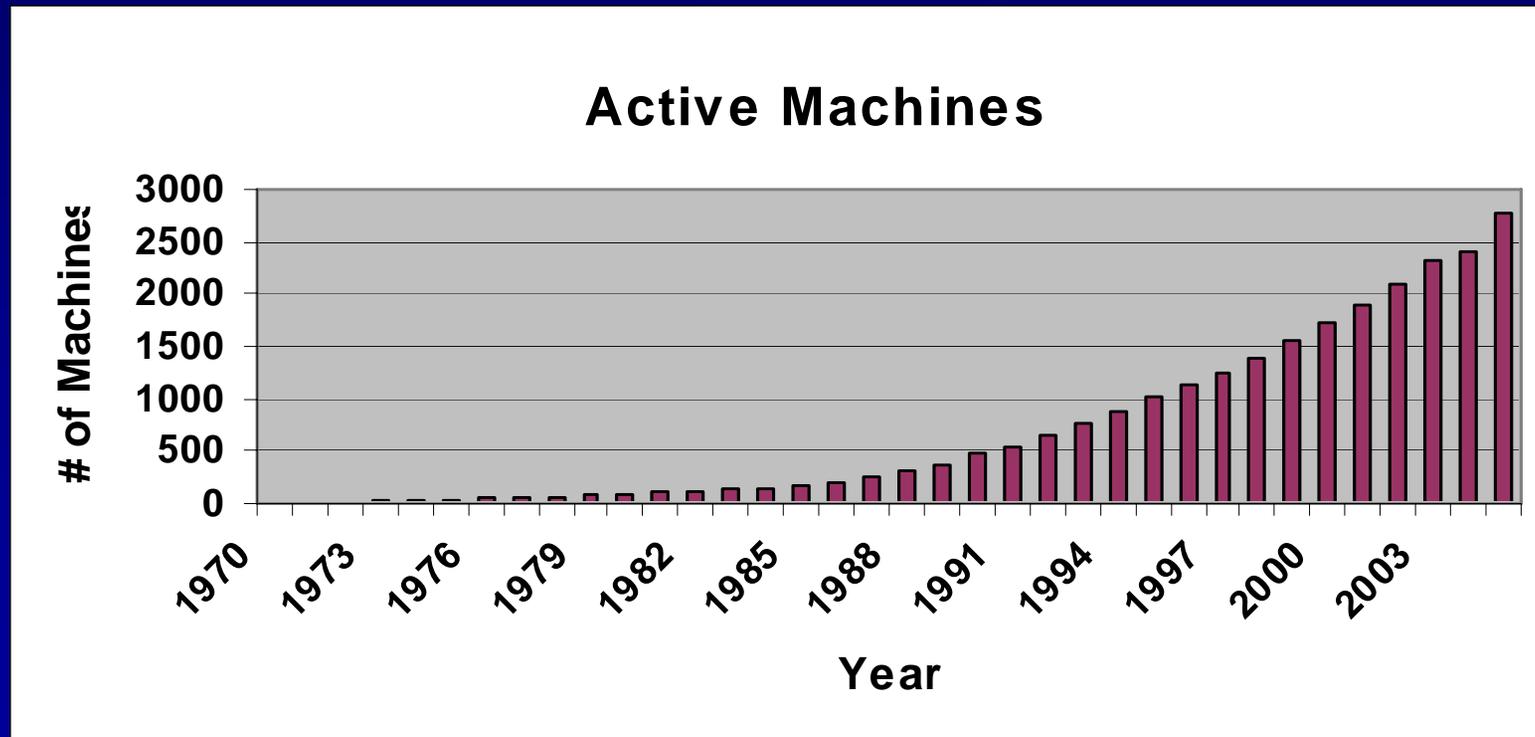
RPC QA Audit Techniques

- **On-site Dosimetry Review Visits**
- Remote Reviews
- - **TLD Program**
- - **Phantom Program**
- - Off-site Dosimetry Reviews
- - Patient Dosimetry Reviews
- - Benchmark case Reviews
- - QA Program Reviews

RPC Radiological Physics Center
Excellence through Quality Assurance

RPC Verification of Institutions' Delivery of Tumor Dose

Reference calibration (NIST traceable) ← Evaluated by RPC Dosimeters

✕

Correction Factors:
Field size & shape
Depth of target
Transmission factors
Treatment time ← Evaluated by RPC visits and chart review

Tumor Dose ← Evaluated by RPC phantoms
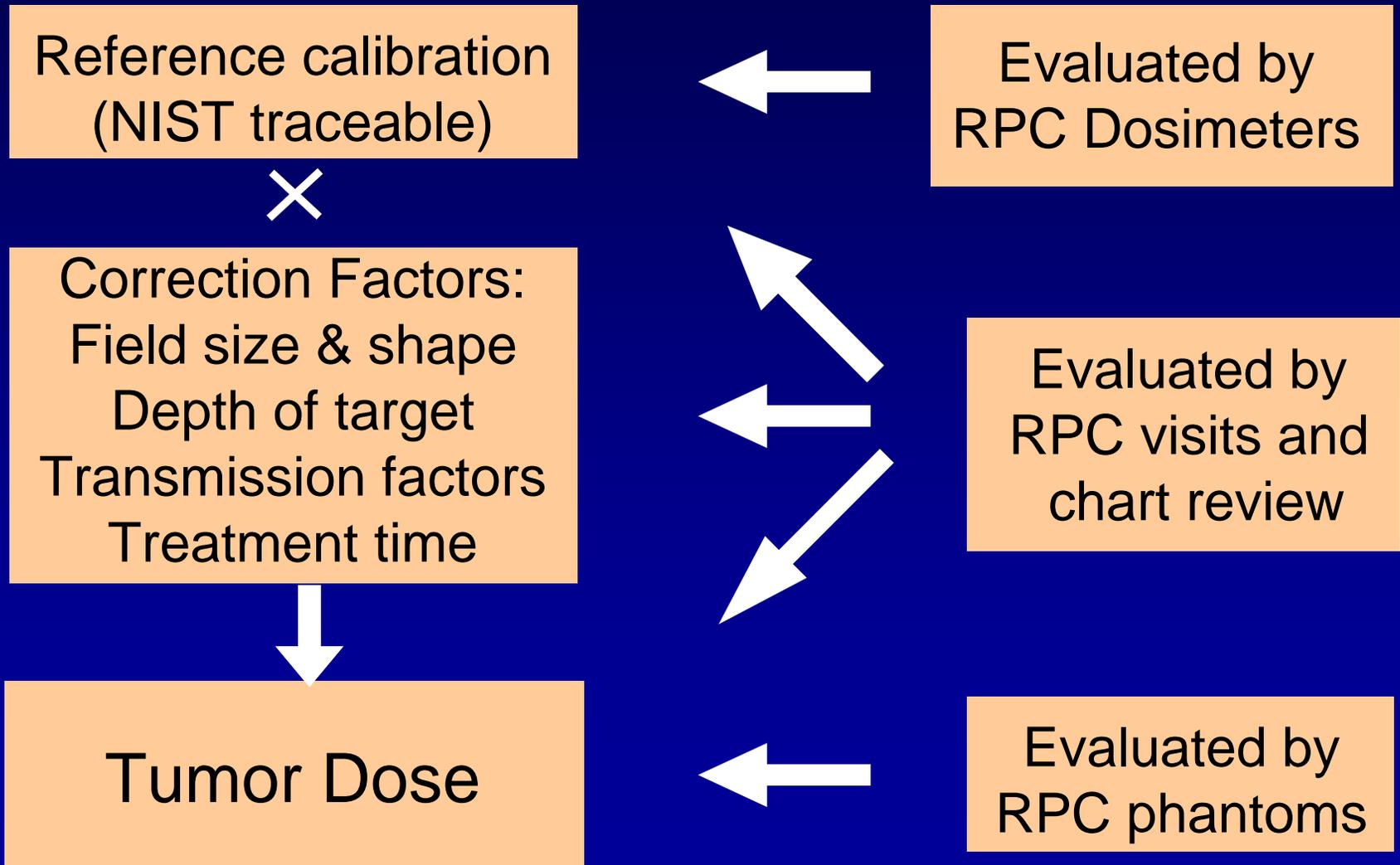
# The Thermoluminescent Dosimetry (TLD) Program

- Largest of its kind in operation (> 30 years)
- Verifies dose output and energy on megavoltage units (>9100 beams in 2006).
- Measure consistency of institutions based on TLD history
- Provides independent audit of the output as required by many states
- Other similar programs

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TLD Programs

EQUART

RPC

EQUAL

RDS

IAEA

Country participating in the IAEA/WHO TLD service

National QA network or participant in international network other than IAEA

QA network co-operating with IAEA

Data from J. Izewska

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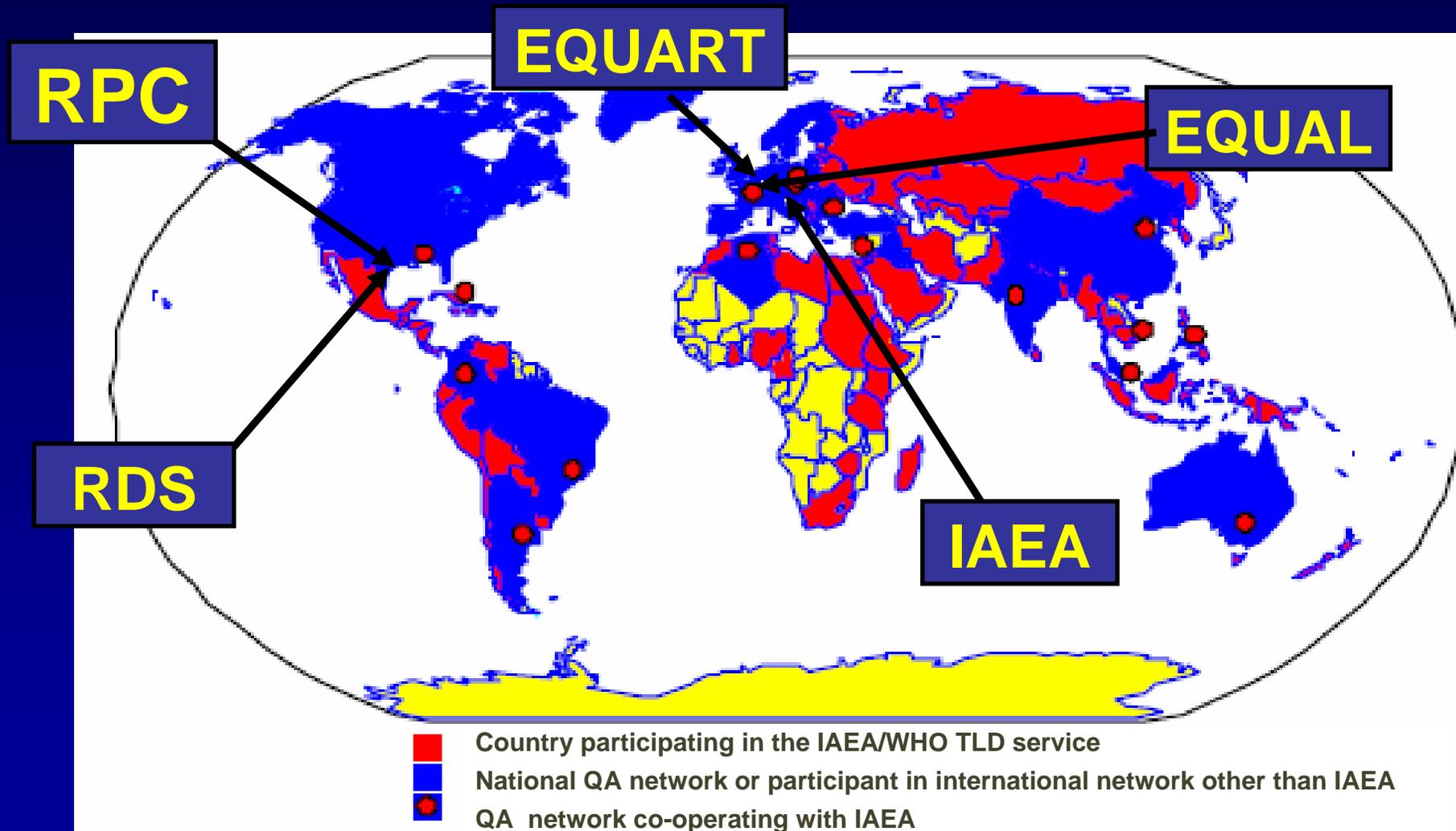
TLD Discrepancies
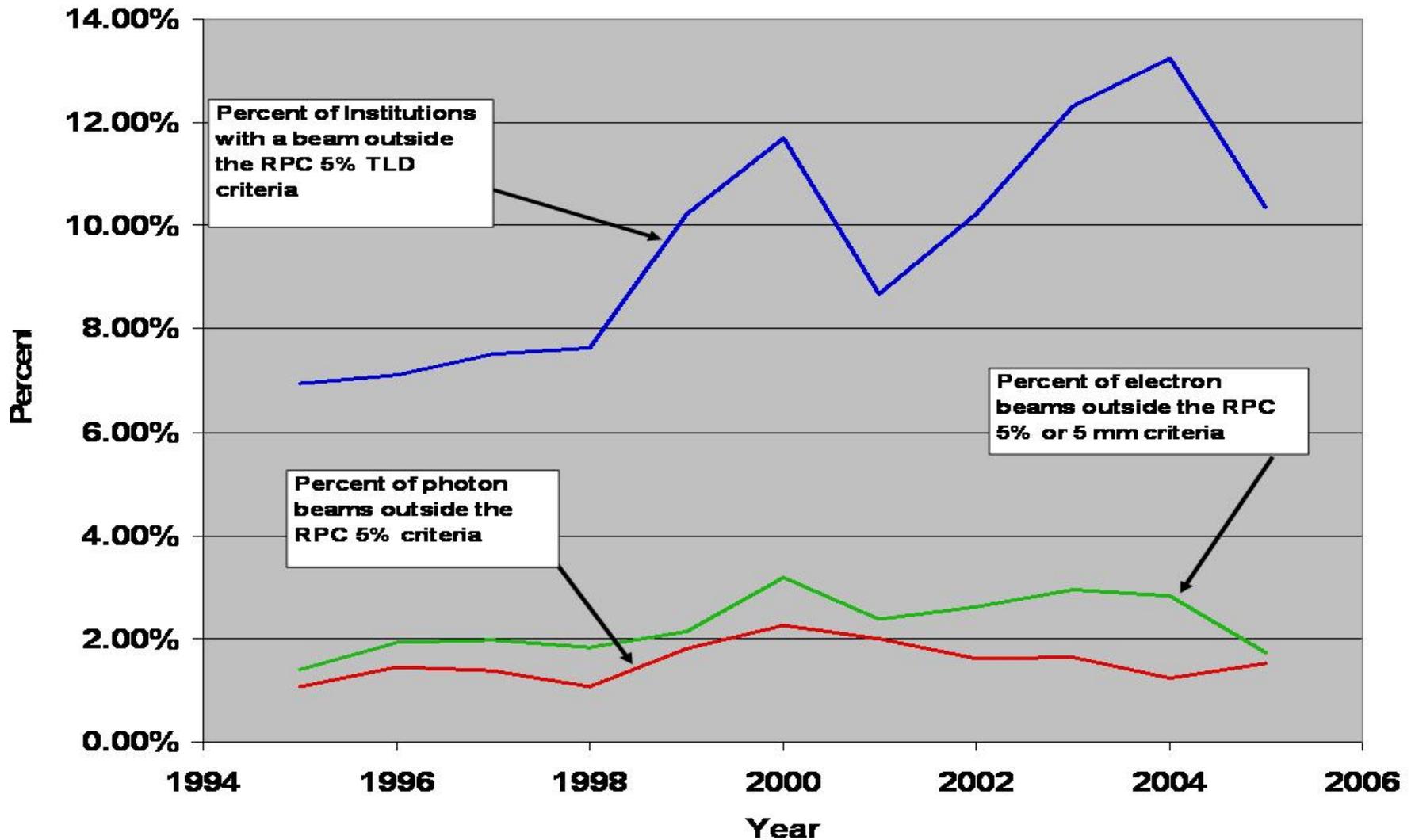
13 institutions visited recently to resolve TLD problems

RPC Phantoms

Pelvis
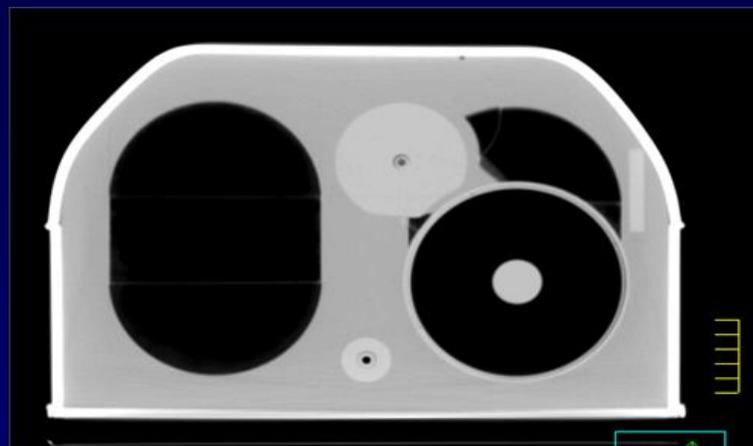
Thorax
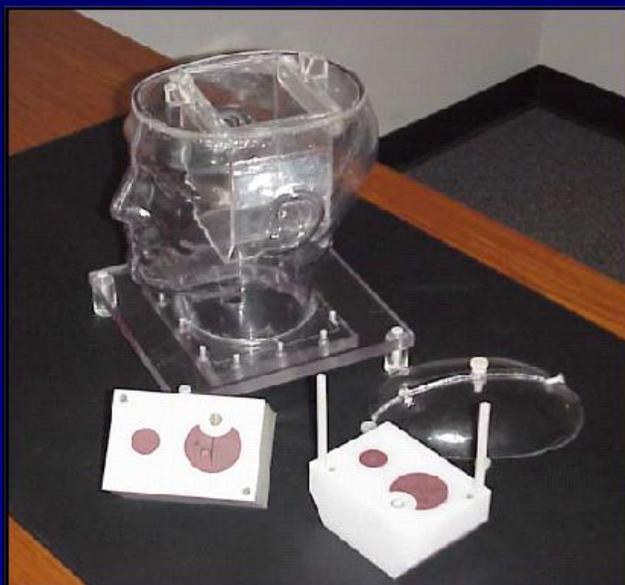
H&N IMRT

SRS Head
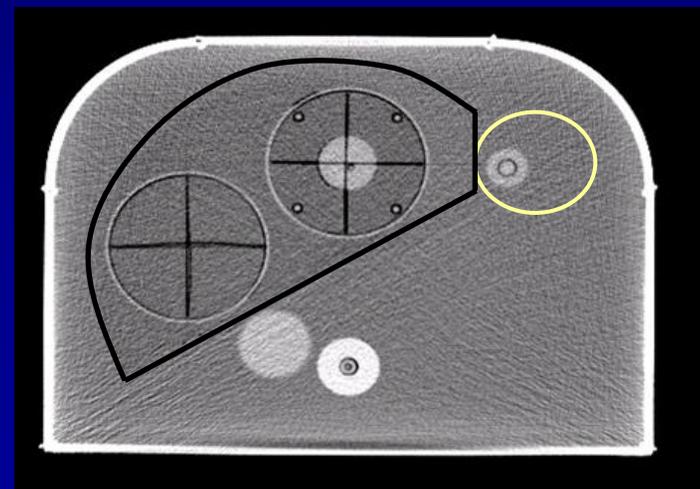
Liver

Number of H&N Phantom Mailings
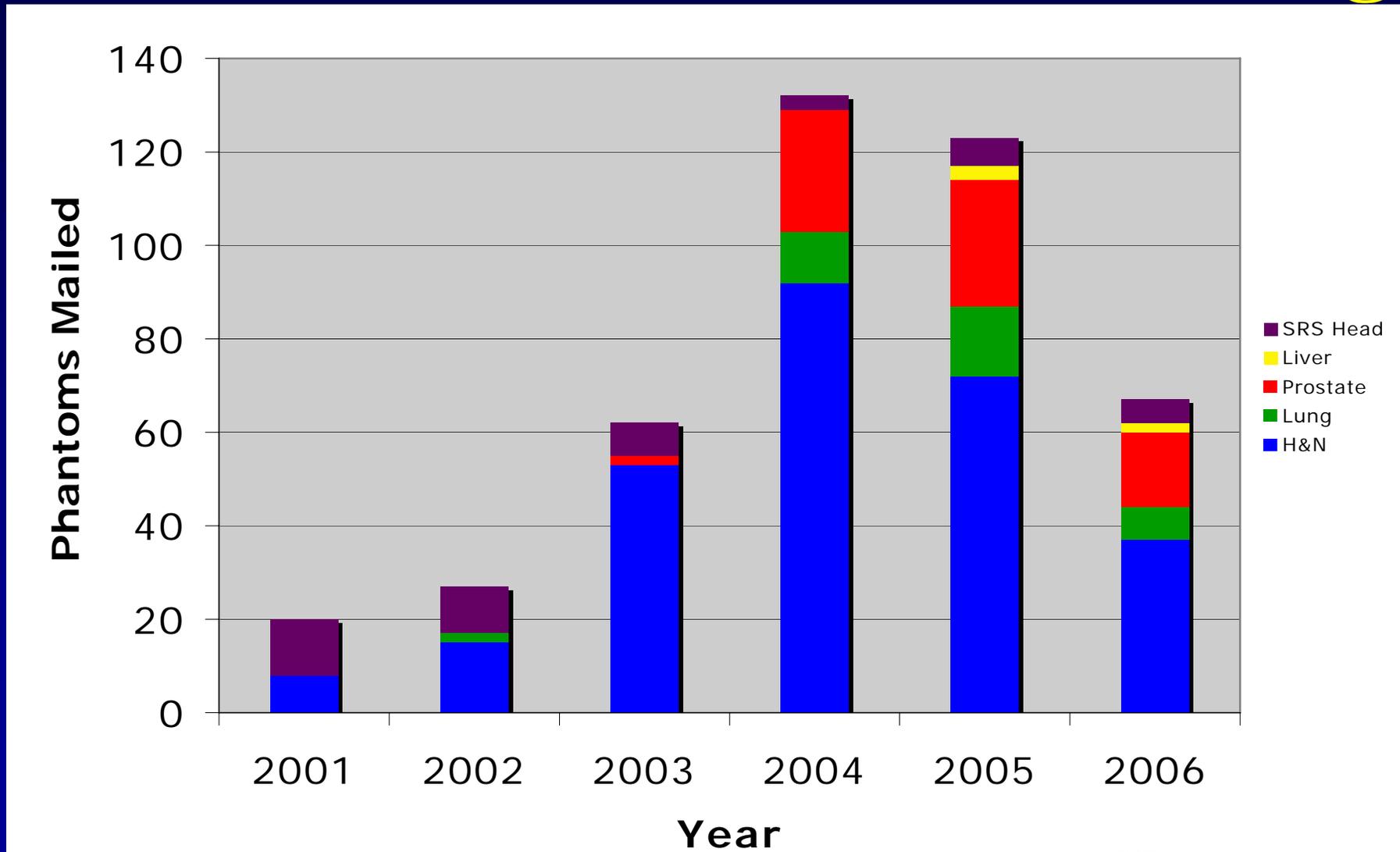
Plan vs. Treatment
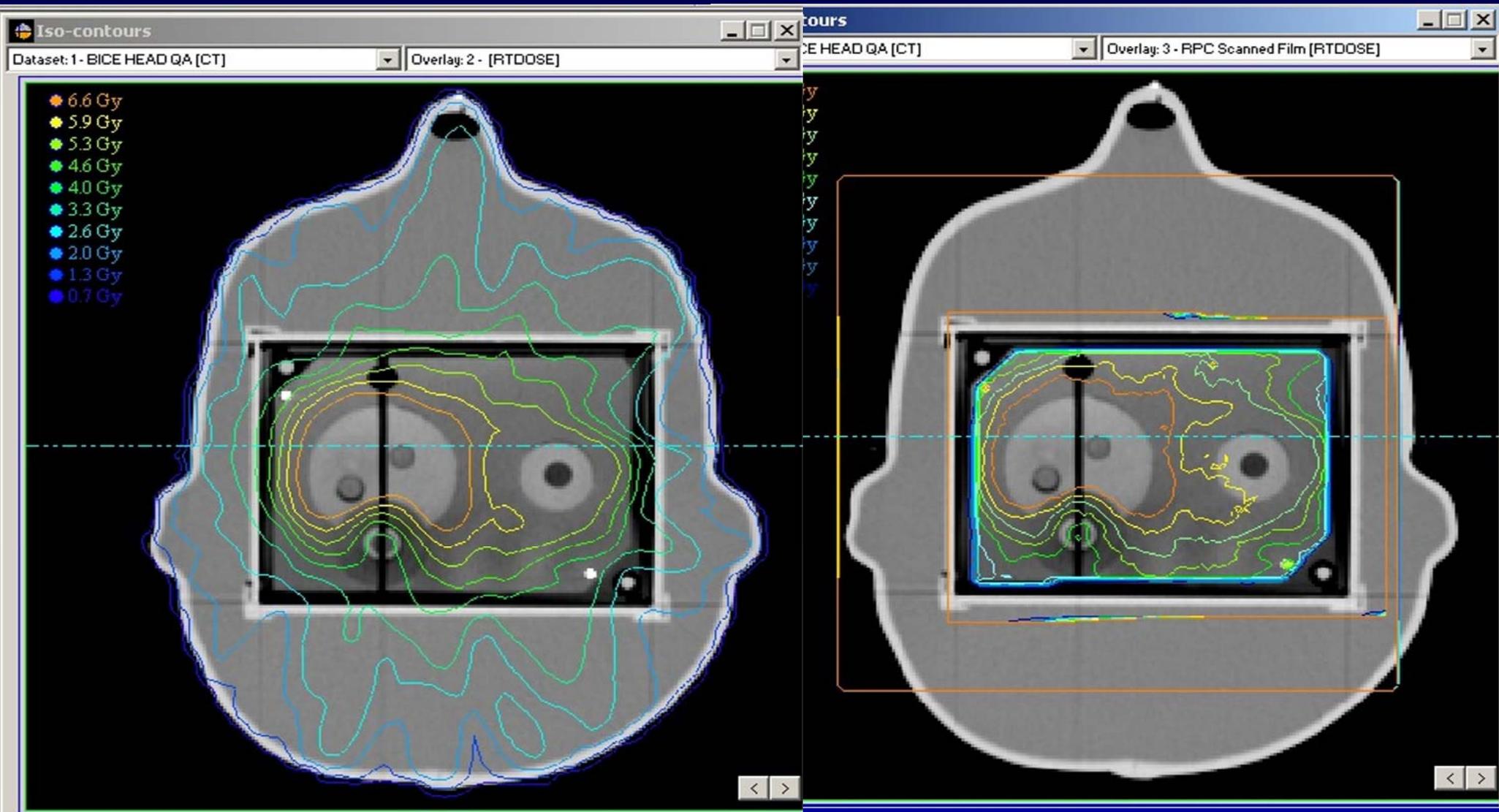
Examples of Failures
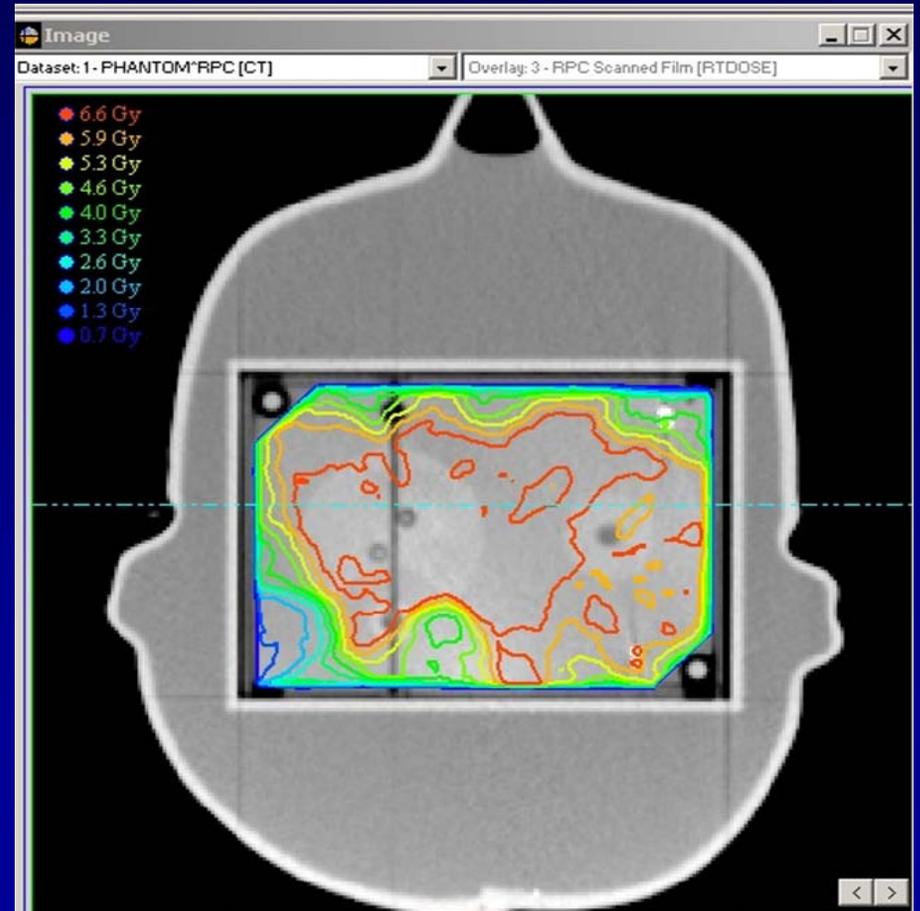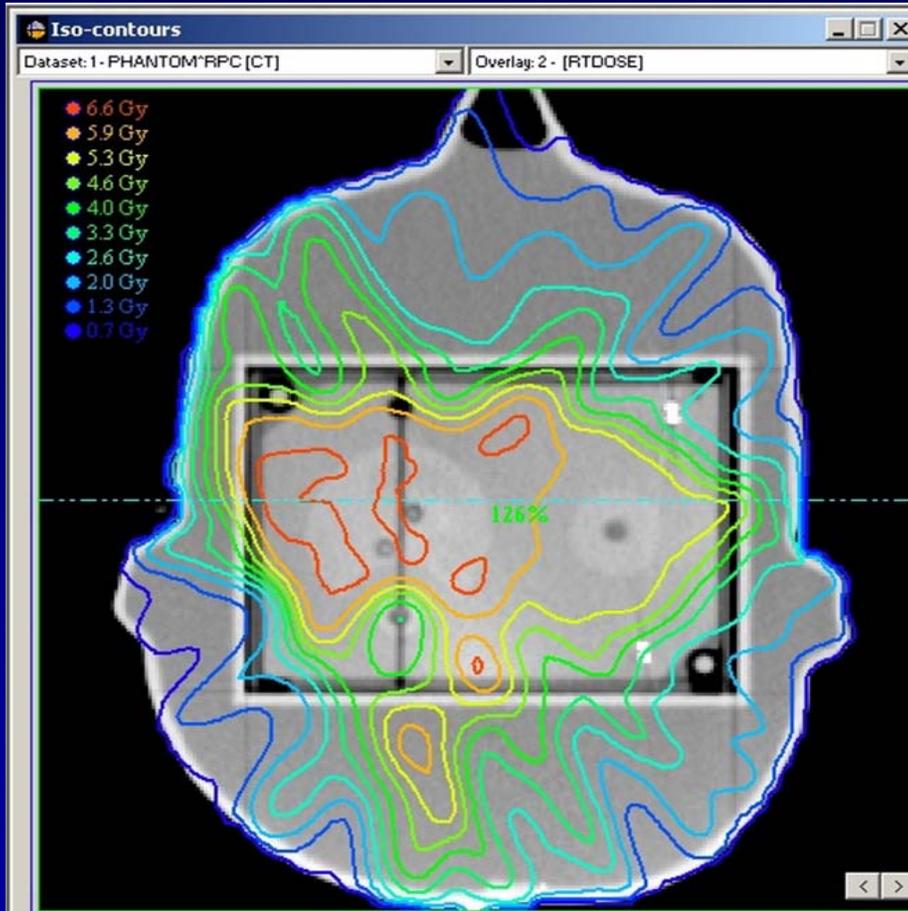
Phantom Results

Phantom	H&N	Prostate	Thorax	Liver
Irradiations	217	55	25	4
Pass	146	41	14	2
Fail	57	14	3	-
Under analysis or at institution	12	13	6	2
Unevaluable	12	3	4	1
Year introduced	2001	2004	2004	2005
Failure Rate	**34%**	**27%**	**14%**	**-**

On-Site Dosimetry Review Visit

- **The <u>only</u> completely independent comprehensive radiotherapy quality audit in the USA and Canada**

  - Identify errors in dosimetry and QA program and suggest methods of improvements.

  - Collect and verify dosimetry data needed to review patient charts.

  - Improve quality of patient care for all patients.

On-Site Dosimetry Review Visit

~1435 institutions participating in clinical trials

|	visited	not visited yet
Institutions:	728	707
Patient accrual:	20,130	1,095
	(95%)	(5%)

Prioritization schema focuses our visit resources where the majority of the patients are treated!

Reference Calibration

BEAM CALIBRATION
PROJECTION POST TG-51
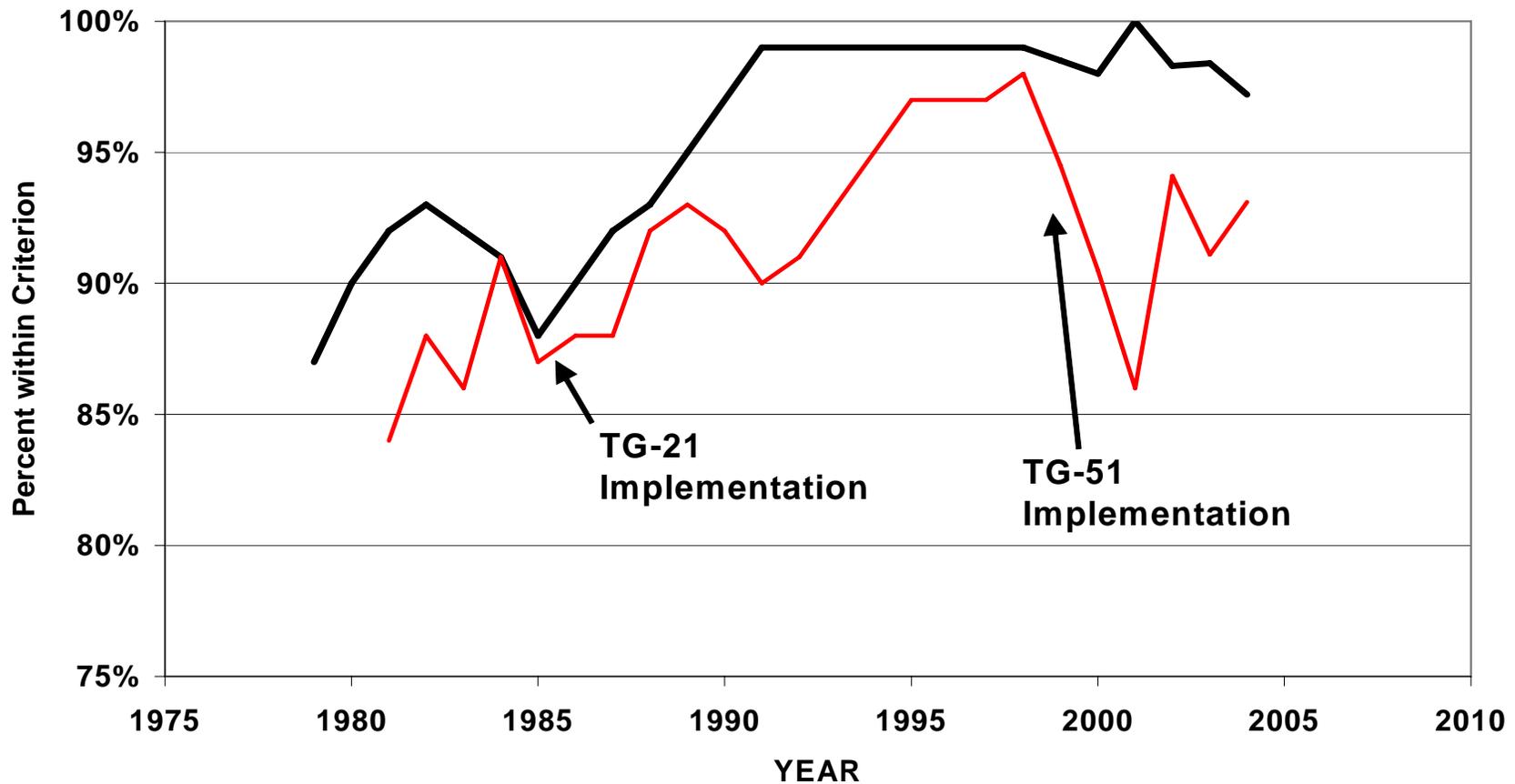
On-Site Dosimetry Review Visit

	Percent of Institutions
Errors Regarding:	Receiving
Review QA Program	(84%)
*Photon Depth Dose	(30%)
Switch to TG-51	(24%)
*Wedge Transmission	(24%)
*Electron Calibration	(22%)
*Photon Calibration & FSD	(24%)
*Off-axis Factors	(16%)

*70% of institutions received at least one of the significant dosimetry recommendations.

# On-Site Dosimetry Review Visit for TLD Problems

Clinac 23EX

Reason: Electron output low for two energies

E	TLD Before	Ion chamber Visit	Compounding Individual errors
16 MeV	0.948	0.961	0.963
20 MeV	0.943	0.942	0.946

1. Dosimetry system comparison (- 0.1 %)

2. Incorrect barometric pressure (+ 1.3%)

3. Incorrect $N_{d,w}K_{ecal}$ for parallel plate chamber (- 2.0%)

4. Use of %Ion for d_{ref} to d_{max} correction (-2.9 to -5.4%)

Visit Recommendations

Over 500 errors and 85 lapses in QA programs were identified at institutions visited by the RPC during this past 5 year period

Home

Services
Publications
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Research / TG-51
Upcoming Meetings

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Notic
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expor
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NCI
IMRT

RPC WEBPAGE NEWSLETTER

Volume 3, Issue 1

March 2004

Water or muscle - does it matter?

The RPC has received a number of comments about the question on our TLD forms that asks if the institution calibrates to water or muscle. Several callers were concerned that they needed to report their calibration in the same medium as is used by the RPC to report dose. Others asked for the converse; for the RPC to report dose in the same medium as used by their institution for calibration.

The medium used for reporting dose is not necessarily the same as the medium in which the beam output is measured. TG-51 requires that beam output be measured in water, and many institutions report the calibration that way. In other words, they describe the output as 1.00 cGy to water per MU under reference conditions. However, quite a few institutions apply a 1% correction at the time of calibration, and adjust the treatment unit output to 1.00 cGy to muscle per MU under reference conditions. The RPC database indicates that 35% of the institutions report their calibration to muscle and the remaining 65% to water.

We would like institutions to indicate on the TLD forms how their beams are calibrated, not how patient doses are described. If a 1% correction is applied at the time of beam calibration, you should check the box for "muscle". Otherwise you should check "water", even if you apply the 1% correction when calculating MU settings for patient treatments.

Done

Ongoing Communications with Community

1. Via the web site and email

2. AAPM newsletter

3. Workshops, Posters, oral talks and publications

4. Phone (713) 745-8989

Redundancy

Vigilance

Resolution

Time

Support

There is no other organization within the USA and Canada that serves as a **National Resource** for the Radiation Oncology Community like the RPC does.