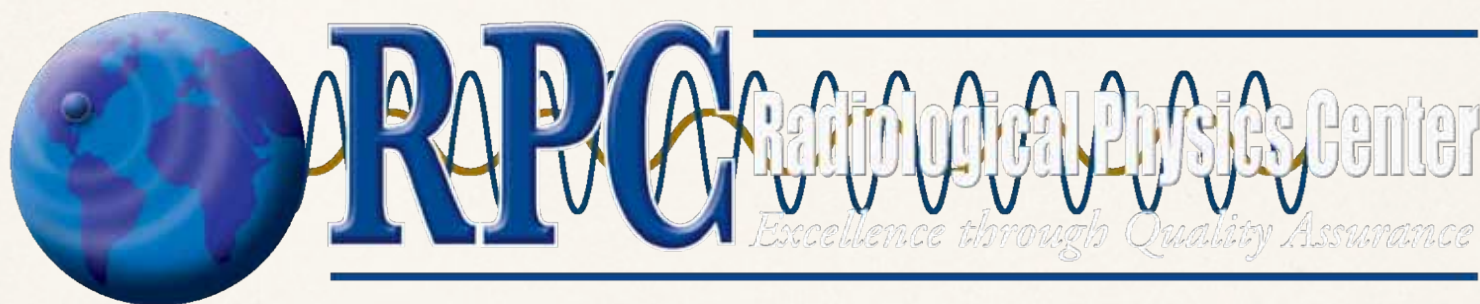


# The RPC's QA Activities in Support of Advanced Technology Clinical Trials



April 14, 2009  
Geoffrey S. Ibbott, Ph.D.  
and RPC Staff

 <http://rpc.mdanderson.org>

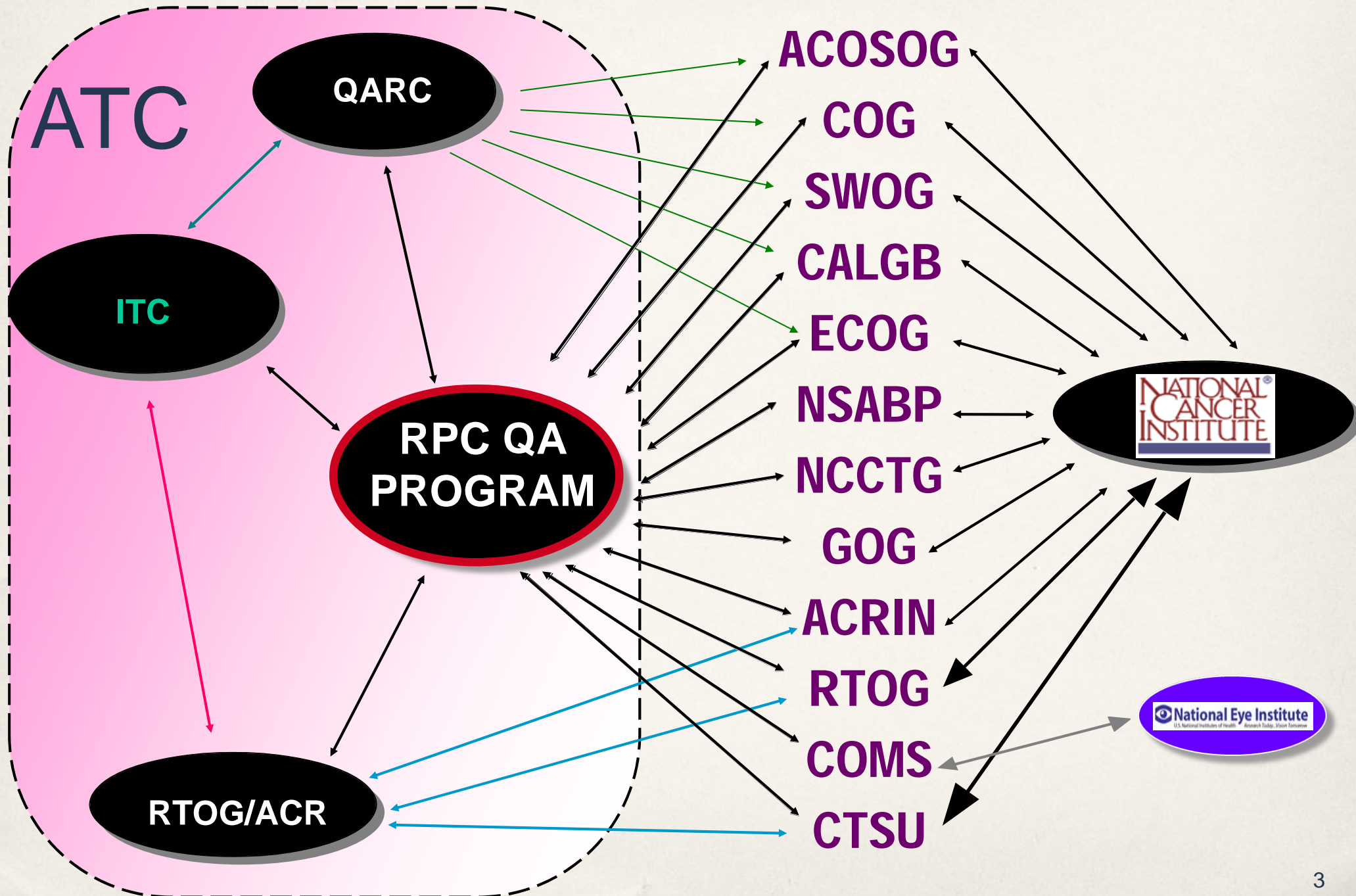
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Supported by NCI  
grants CA10953 and  
CA81647

THE UNIVERSITY OF TEXAS  
**MD ANDERSON**  
**CANCER CENTER**  
*Making Cancer History®*

# RPC has relationships with all study groups



# Study Group Participation



**RPC** Radiological Physics Center  
*Excellence through Quality Assurance*

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<a href="#">Services</a>
<a href="#">Forms</a>
<a href="#">Publications</a>
<a href="#">Brachy Sources</a>
<a href="#">Research/TG-51</a>
<a href="#">Upcoming Meetings</a>

## Joint AAPM/RPC Registry of Brachytherapy Sources Meeting the AAPM Dosimetric Prerequisites

<a href="#">Source Registry</a>	<a href="#">Prerequisites</a>	<a href="#">Dosimetry Datasets</a>	<a href="#">Application for Registry</a>
<a href="#">Registry Policy</a>	<a href="#">Disclaimer</a>	<a href="#">3<sup>rd</sup> Party Checks</a>	<a href="#">TG-43 U1(2004)</a>

The AAPM, through its Brachytherapy Subcommittee, has determined that the following brachytherapy source models comply with the AAPM's dosimetric prerequisites as set forth in "Dosimetric prerequisites for routine clinical use of new low energy photon interstitial brachytherapy sources: Recommendations of the American Association of Physicists in Medicine Radiation Therapy Committee" Med. Phys. 25, 2269-2270 (1998).

# RPC's Monitoring Activities

---

- Annual checks of machine output
  - ◆ 1,672 institutions, 14,188 beams measured with TLD (2008)
- On-site dosimetry reviews
  - ◆ 50 institutions visited (~150 accelerators measured)
- Credentialing
  - ◆ Phantoms, benchmarks, questionnaires, rapid reviews
- Treatment record reviews
  - ◆ Review for GOG, NSABP, NCCTG, RTOG (brachy)
- Independent recalculation of patient dose
  - ◆ Continue to find errors



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**Monitored Institution Search**

<b>City</b> <input type="text"/>	<b>Institution Name</b> (wildcard = %) <input type="text"/>
<b>State/Province</b> <input type="text"/>	<b>or RTF Number</b> <input type="text"/>
<b>Zip Code</b> <input type="text"/>	<input type="button" value="Show Institutions"/> <input type="button" value="reset"/> <input type="button" value="clear"/>
<b>Country</b>	<input type="text"/> <input type="button" value="Go"/>

**Total number of distinct** **selected location: 1674 (1674 total active institutions monitored)**

on Friday Apr 03, 2009 at 8:53 AM

- ✓ USA
- CANADA
- Non-USA
- AUSTRALIA
- AUSTRIA
- BELGIUM
- CHINA
- HUNGARY
- INDIA
- IRELAND
- ISRAEL
- ITALY
- JAPAN
- N/A
- NETHERLANDS
- NEW ZEALAND
- PERU
- POLAND
- REPUBLIC OF KOREA
- SAUDI ARABIA
- SERBIA
- SINGAPORE
- SLOVAKIA
- SOUTH AFRICA
- SPAIN
- SWEDEN
- SWITZERLAND
- TAIWAN
- TURKEY

1,674 RT facilities in 27 countries throughout the world, including 52 EORTC members

# International Activities (Cont'd.)

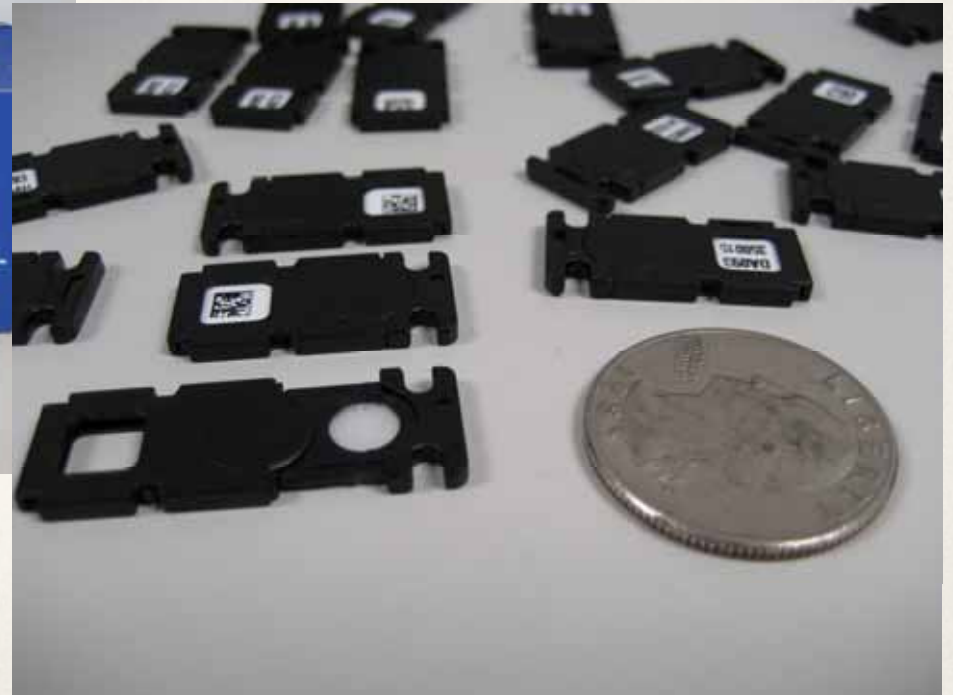
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- ↳ Auditing of EORTC institutions
- ↳ Discussions with EORTC
- ↳ Presentations at TROG
- ↳ Discussions on collaboration with proposed ACDC

# Transition to OSL

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# RPC's Monitoring Activities

---

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# On-Site Dosimetry Review Visit

 The only completely independent comprehensive radiotherapy quality audit in the USA and Canada

- Identify errors in dosimetry and QA and suggest improvements.
- Collect and verify dosimetry data for chart review.
- Improve quality of patient care.



# On-Site Dosimetry Review

Selected discrepancies discovered 2004 –  
2008

Errors Regarding	Number of Institutions (%)
Review QA Program	127 (77%)
*Wedge Transmission	53 (32%)
*Photon FSD (small fields)	46 (28%)
Off-Axis, Beam Symmetry	42 (25%)
*Photon Depth Dose	34 (21%)
*Electron Calibration	25 (15%)
*Photon Calibration	22 (13%)
*Electron Depth Dose	19 (12%)

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

# RPC's Monitoring Activities

---

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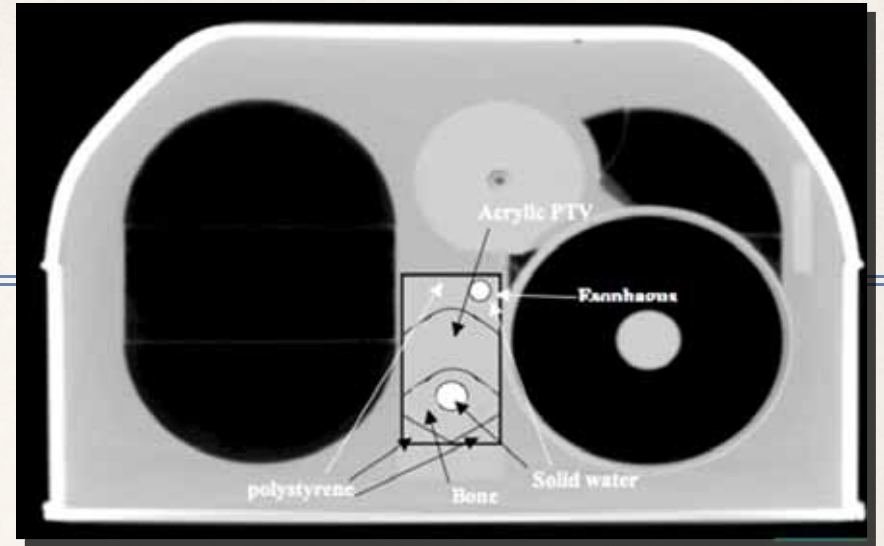
# General Credentialing Process

- ★ Previous patients treated with technique
- ★ Facility Questionnaire
- ★ Knowledge Assessment Questionnaire
- ★ Benchmark case or phantom
- ★ Electronic data submission
- ★ RPC QA & dosimetry review
- ★ Clinical review by radiation oncologist

# RPC Phantoms



**Pelvis (14)**



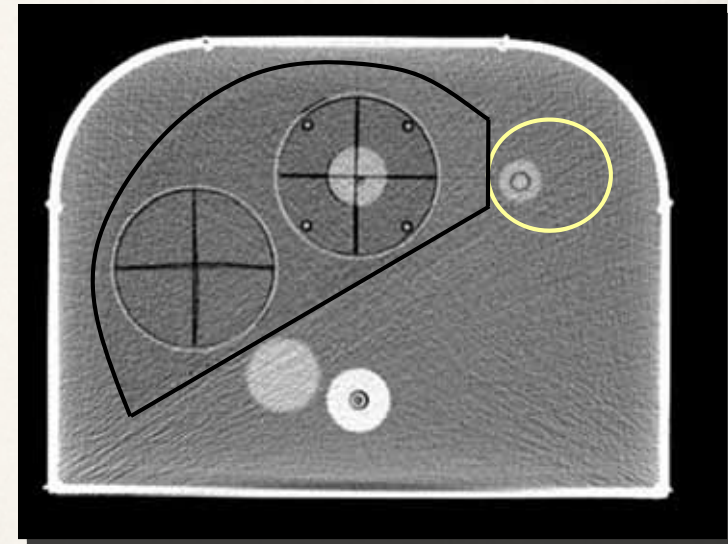
**Thorax (15)**



**H&N (30)**

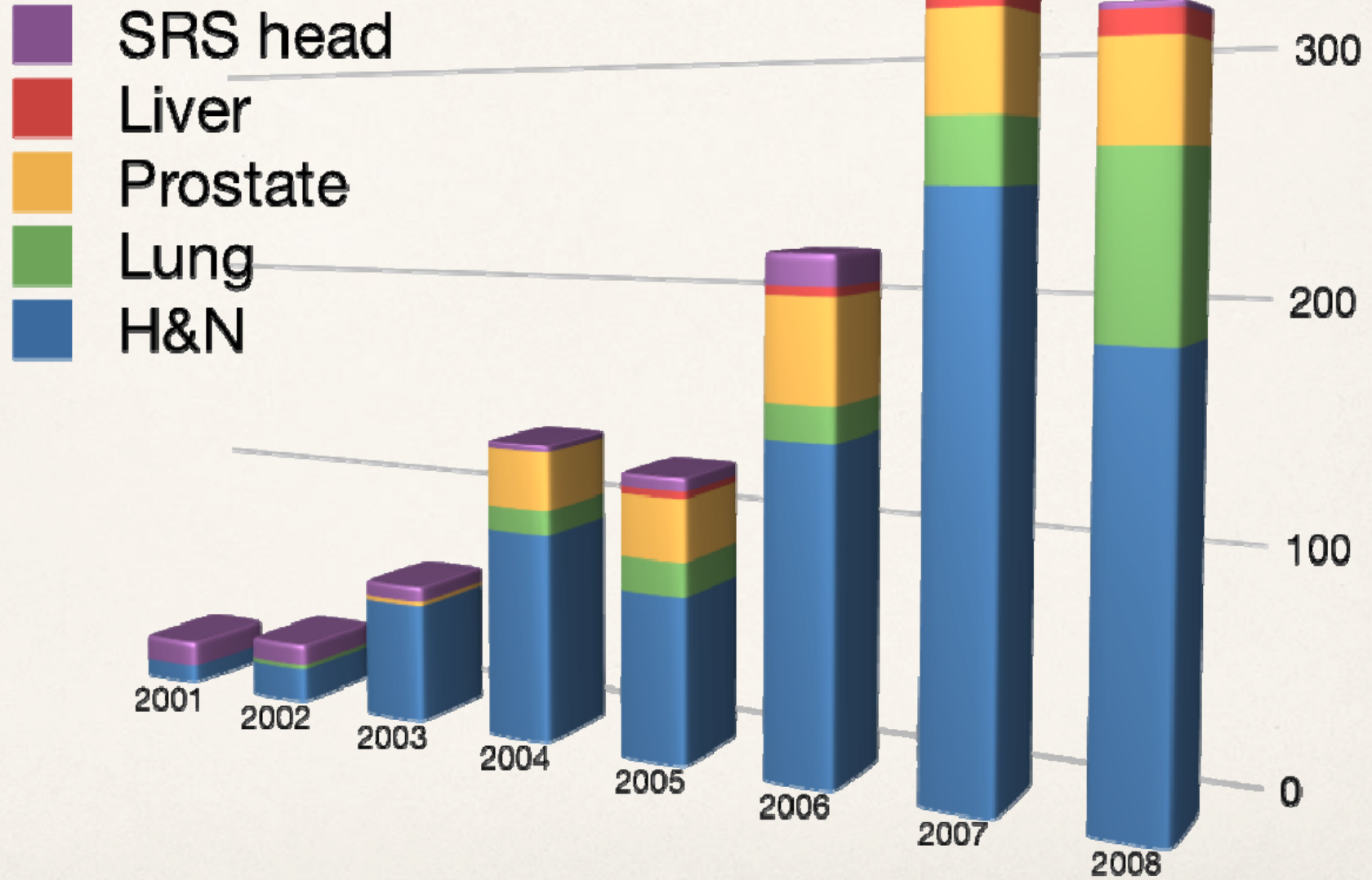


**SRS Head (4)**



**Liver (2)**

# Number of Phantoms Mailed per Year



# Phantom Results

Comparison between institution's plan and delivered dose.

Criteria for agreement: 7% or 4 mm DTA (5%/5mm for lung)

Site	Institutions	Irradiations	Pass
H&N	472	631	75%
Pelvis	108	130	82%
Lung	67	77	71%
Liver	15	18	50%



# RPC's Monitoring Activities

---

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# Purpose of Patient Dose Review

---

- ☞ Maintain low uncertainty in doses delivered to protocol patients by discovering and correcting errors
- ☞ Provide study groups with accurate dose data

Improve Clinical Trials

# RPC Patient Dose Review

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- ☞ Independent calculation of tumor dose
- ☞ Agree within 5% (15% for implants)
- ☞ Verify dose, time, fractionation per protocol
- ☞ Notify institution if major deviation seen during review to prevent further deviations

# Data Used in Patient Record Review

---

## Visited Institutions

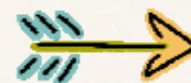
## Data Needed

## Not Yet Visited

Measured



Machine Output

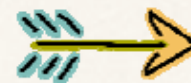


TLD

Measured



Output Factors

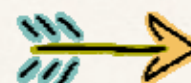


Standard

Measured



Wedge/Tray Factors

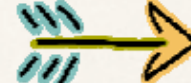


Standard

Measured



Off-axis Factors



Standard

Measured



Depth Dose

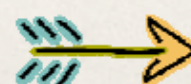


Standard

Measured



End Effect



None

# Errors Greater than 5% (15% for Brachytherapy) Found in Patient Record Review

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# Errors > 5% (15% for brachy) Found in Dose Review

---

- 1% Systematic errors
- 11% Individual errors
- 27% Reporting errors

Without RPC review 39% of the doses used by the study group would be incorrect

# Future Projects

---

1. Monte Carlo beam modeling in CERR for IMRT and heterogeneous dose calculations
  - Continue development for 3 major manufacturers
  - Extend development to non-TG-51 compliant machines
  - Increase use for patient record reviews
2. Increase the use of rapid reviews via electronic means
3. Facilitate electronic data submission, review and access for GOG protocols

# Future Projects (cont'd.)

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4. Contribute to retrospective studies of lung patients using Monte Carlo calculations
5. Develop procedures to perform clinical and technical reviews for charged particle dose delivery
6. Analyze impact to patient calculation results using single closest TLD vs averaged TLD results