

**Radiological Physics Center**  
*Report to*  
**Advanced Technology Consortium**

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and RPC Staff

# Charged particle beams

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- ❖ Presently 7 clinically-active US proton therapy centers
- ❖  $\geq 2$  new centers expected to open this year, perhaps 5 more in next 2 years
- ❖ No heavy particle beam centers anticipated today
- ❖ RPC anticipates that by 5th year of next grant cycle, will need to prepare to audit helium/carbon ion beam facilities

# Proton Facility Credentialing

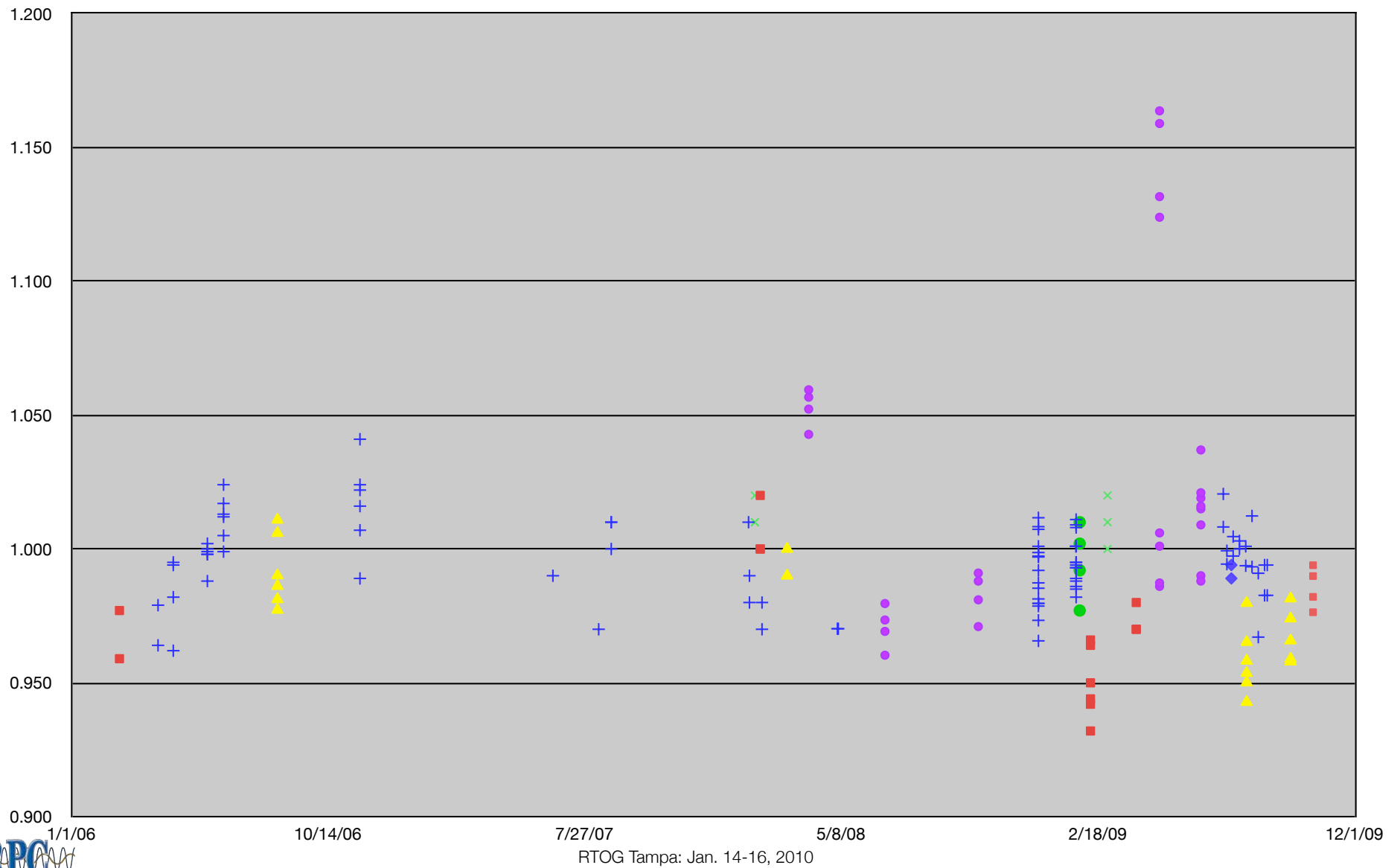
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- \* NCI Guidelines mandate –
  - \* Questionnaire - sent to facilities by QARC
    - \* Completed by 4 of 5 centers
    - \* Recently reviewed and updated by MDACC
- \* TLD monitoring
  - \* Mailed to 7 US centers + 1 Japanese center
- \* On-site dosimetry review visits
  - \* 1 visit largely completed, 3 visits under way
- \* Anthropomorphic phantom
  - \* Modified existing pelvis phantom, under evaluation

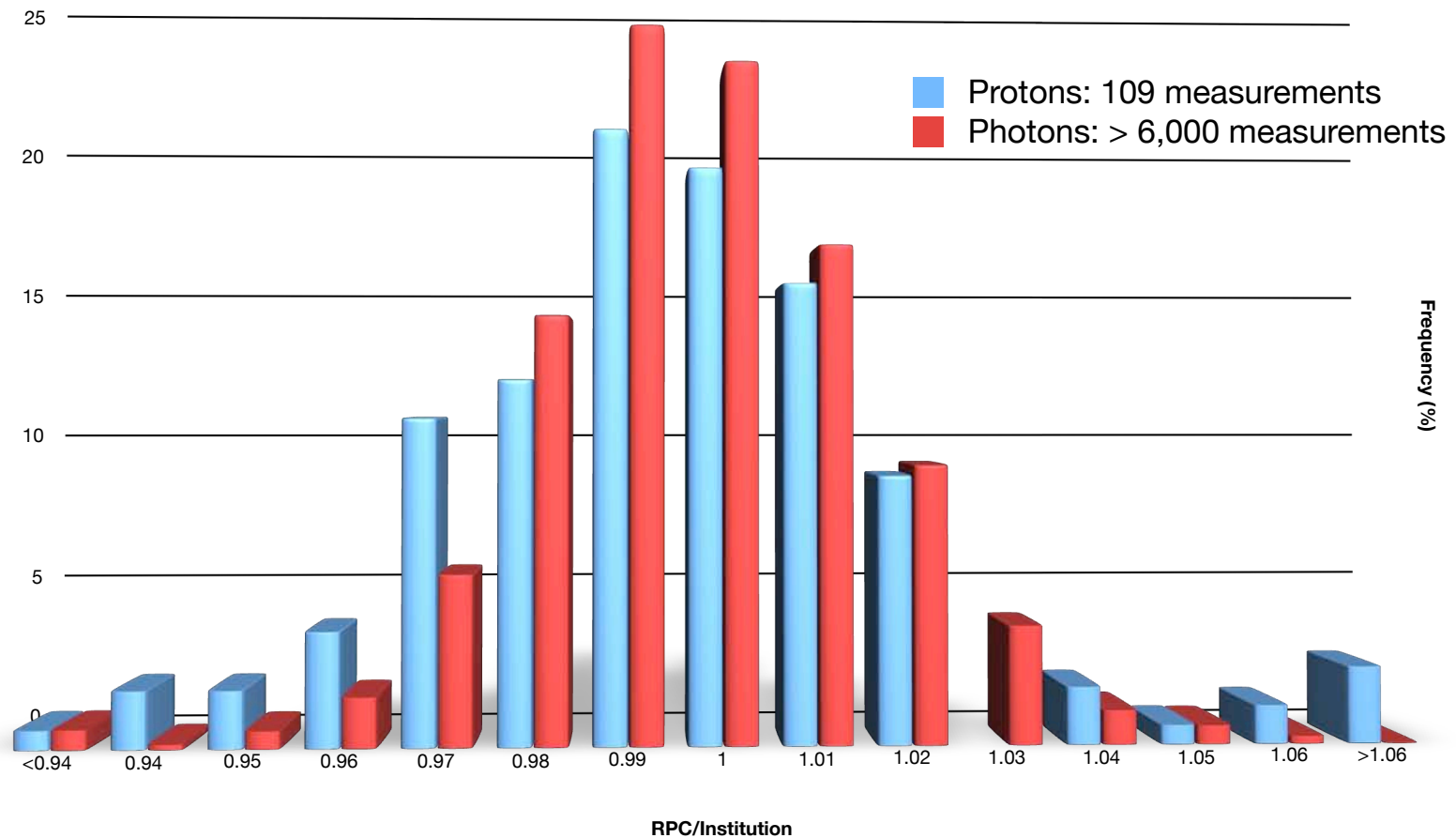
# RPC TLD System



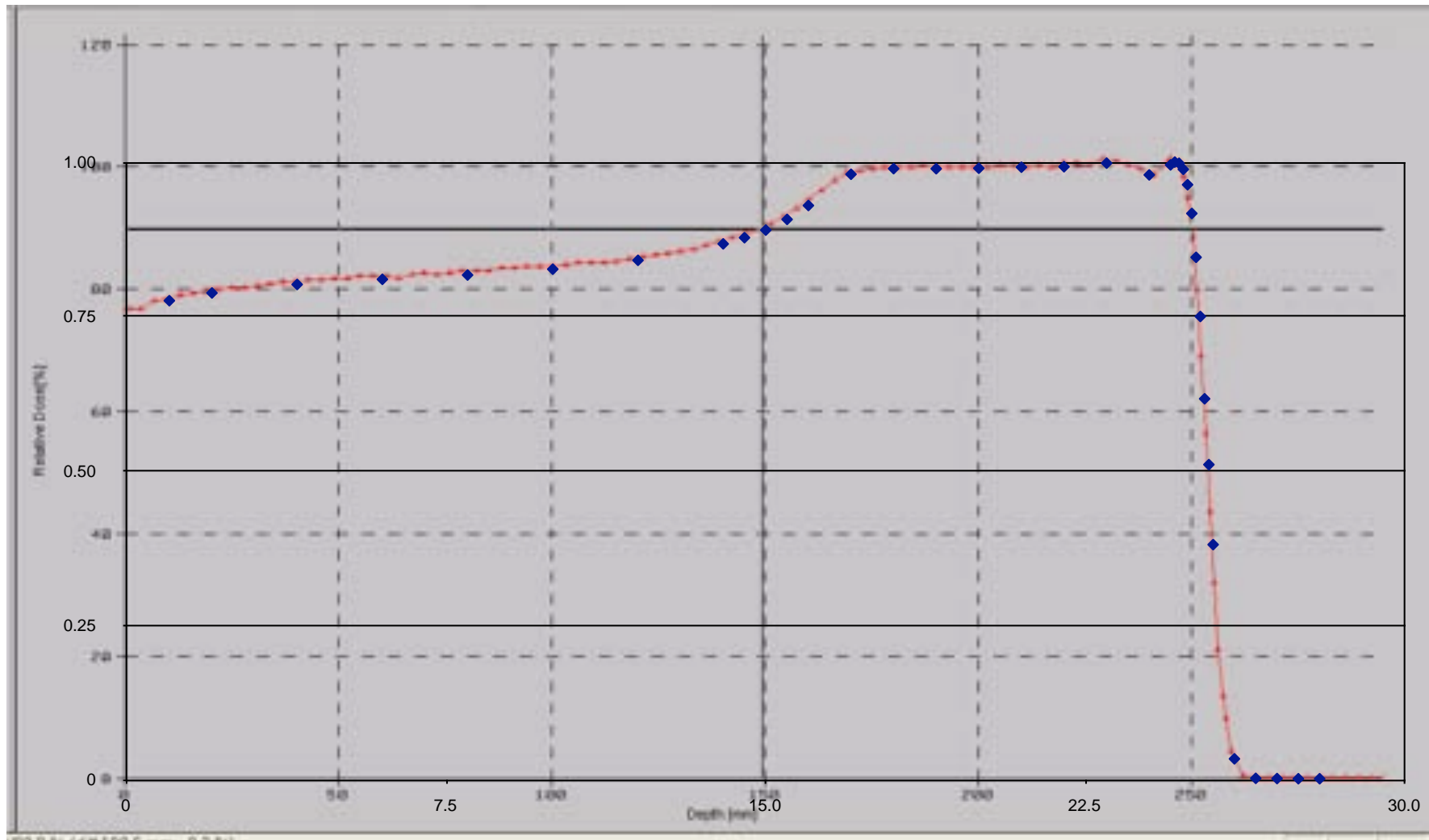
# Proton Beam Monitoring



# Distribution of Photon Beam TLD Measurements



# Visits: Depth Dose Measurements



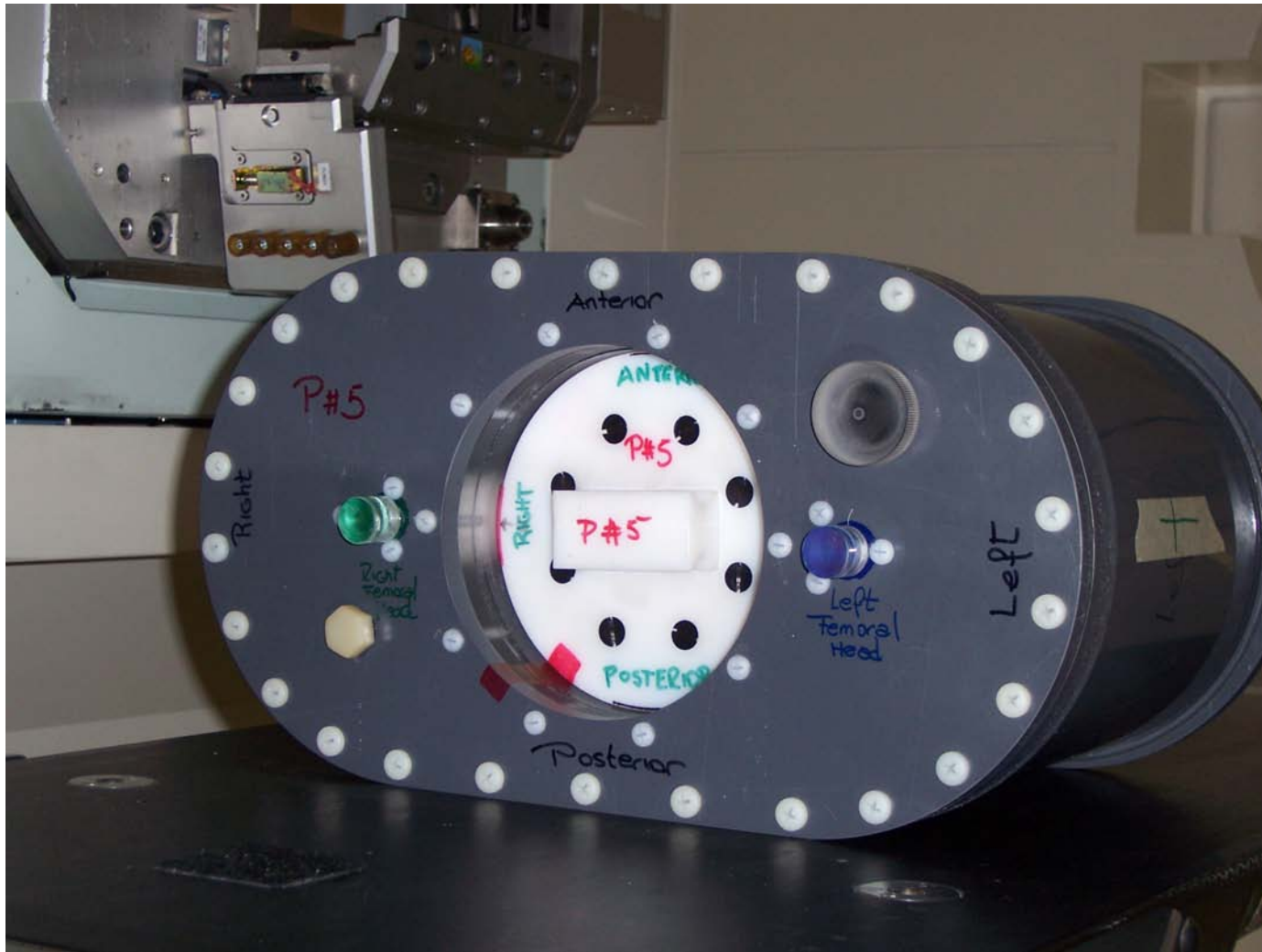
# Phantoms

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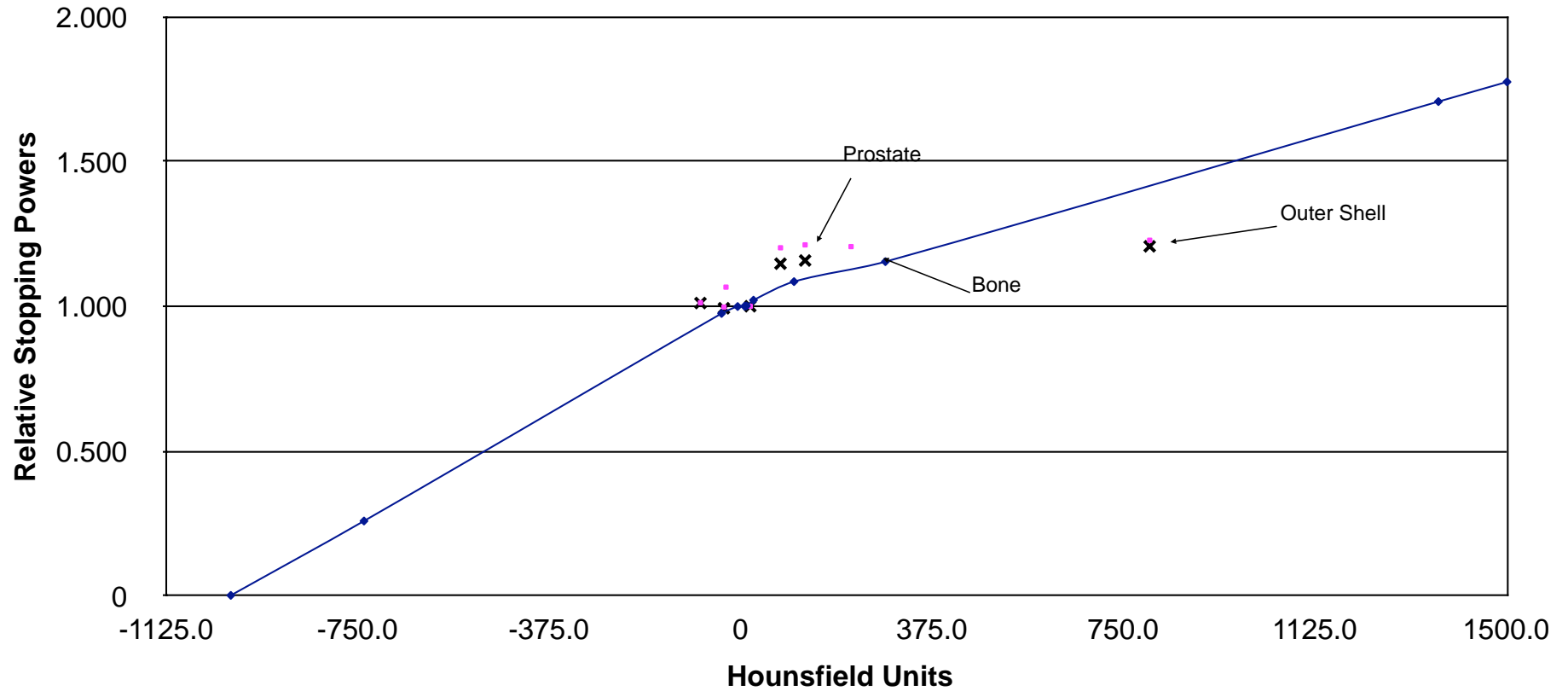
- ❖ Pelvis phantom has been developed
  - ❖ Evaluation is essentially completed
- ❖ Lung phantom evaluation will begin this fall
  - ❖ Evaluation of materials will be considerably more complex
  - ❖ Likely to extend into next grant cycle



# Proton Pelvis Phantom



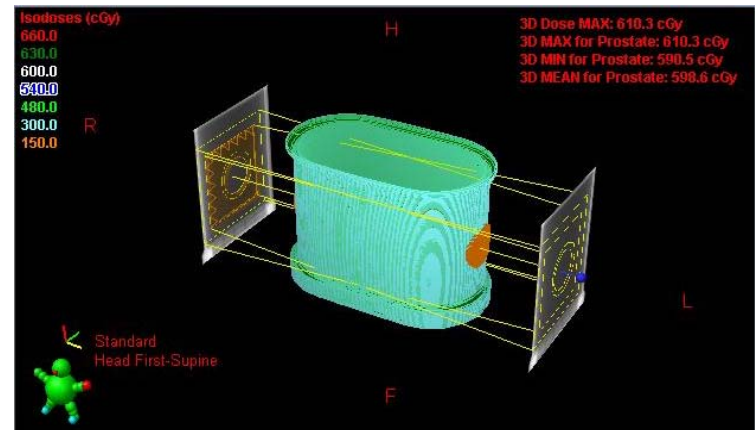
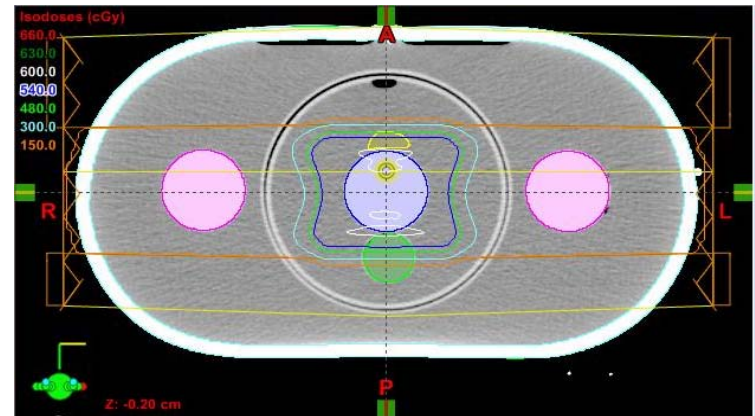
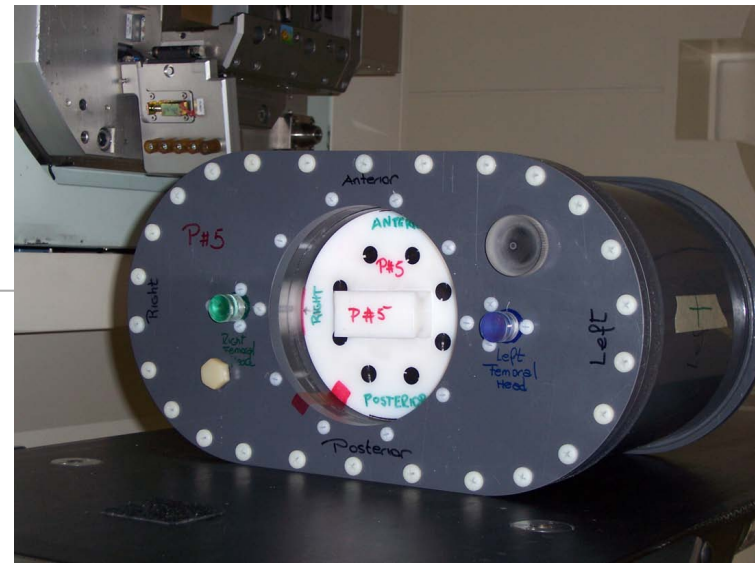
# Material Stopping Powers



◆ Treatment Planning Values    ■ Phantom Values    × Stopping Powers Literature

# Phantom Treatment

- ❖ Treatment plan created with a prescription of 6 Gy to the prostate
- ❖ Plan delivered 3 times with film and TLD inserted in phantom
- ❖ Plan accounting for difference in patient and material SP also created



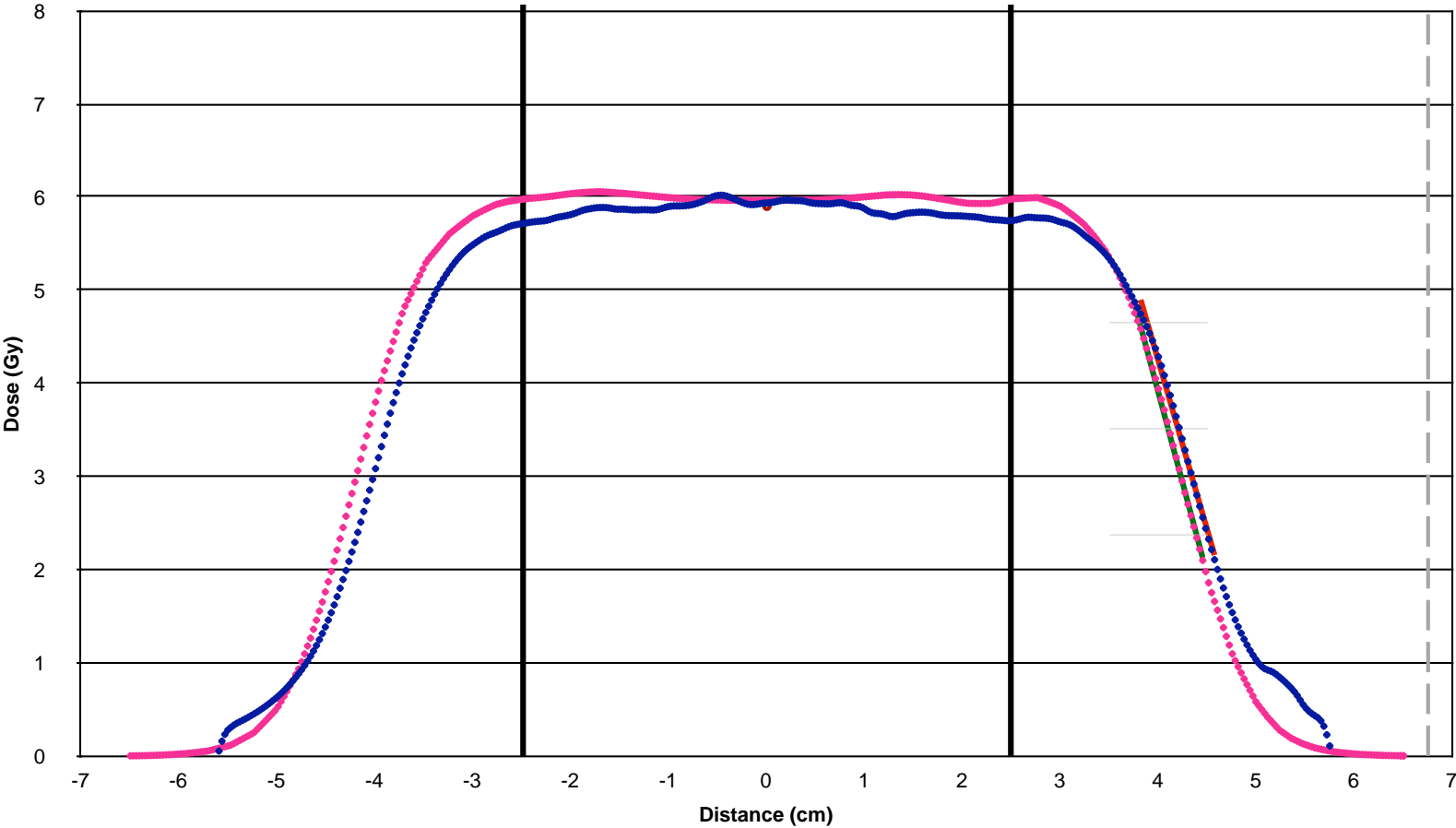
# TLD results

	<b>PTV Right</b>	<b>PTV Left</b>	<b>Femur Right</b>	<b>Femur Left</b>
<b>Institution Predicted Dose (cGy)</b>	600.2	600.2	247.3	243.8
<b>TLD Measured Dose (cGy)</b>	589.8	595.1	242.1	240.4
<b>Measured / Predicted Dose</b>	<b>0.983</b>	<b>0.992</b>	<b>0.979</b>	<b>0.986</b>

- ❖ PTV within 1.7% of predicted value
- ❖ Femur within 2.1% of predicted value

# Film Results

## Superior Inferior Profile - Coronal Plane

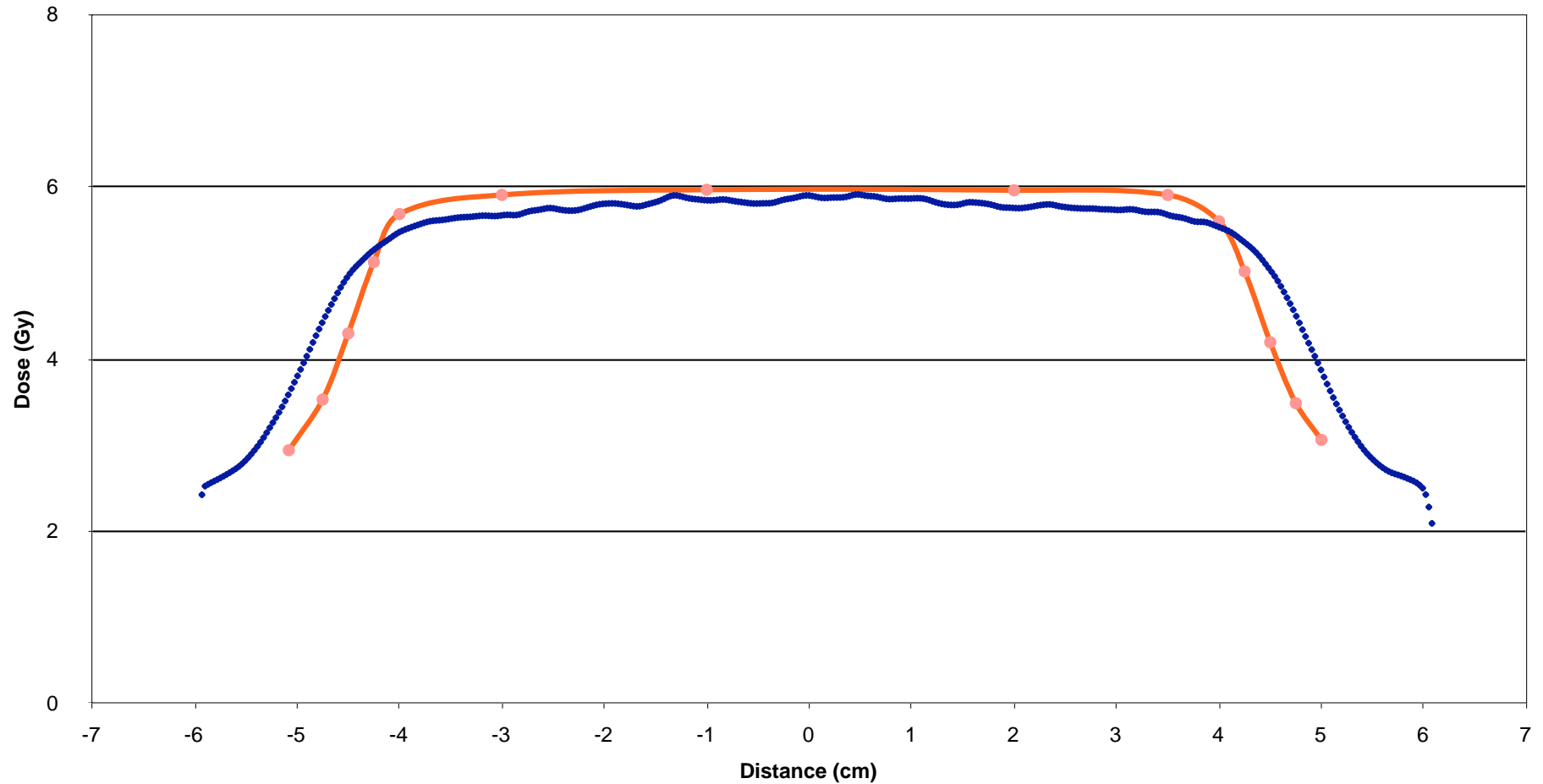


◆ RPC Film	◆ Institution Values	— Primary PTV	— ptv1	— Bladder	— Bladder2	+ TLD Left
○ TLD Right	— 75%	— 50%	— 25%	— RPC Regression	— Institution Regression	+ TLD Right
min						max



# Film Results - Left-Right

## Right Left Profile- Coronal Plane



◆ RPC Film 75% right    Primary PTV 50% right    Institution Values 25% right    pvt1 75% left    — 2 pvt 50% left    ● TLD left 25% left    ● TLD Righth 25% left    ● RPC Reg left    RPC Regression Inst Reg left    Institution Regression Eclipse



# Next Steps

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- Focus on credentialing proton centers
- Funding received from NCI through the MGH grant
  - Supports a consultant 0.25 FTE
  - Supports travel to each proton center
  - Supports some development work to construct phantoms
- Goal is to have at least 5 proton centers credentialed by end of 2010

# RPC's QA Activities

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- Remote audits of machine output
- Treatment record reviews
- On-site dosimetry reviews
- **Credentialing**
  - ◆ Questionnaires, rapid reviews, benchmarks, phantoms
- Independent recalculation of patient dose
- Audits of Proton Therapy Centers
  - ◆ Questionnaires, TLD audits, visits, phantoms
- **International Activities**
  - ◆ Independent remote audits



# International Participation

- RPC has audited international institutions that are members of US study groups, as part of routine audits
- In 2007, RPC was approached by EORTC to consider offering TLD audits to EORTC members, at cost
- Following agreement among RPC, EORTC and NCI, EORTC began recommending RPC's TLD service to their members
- Subsequent meetings between RPC, EORTC, and other groups have been held to discuss expanding auditing procedures
- RPC now auditing 156 non North-American institutions
  - Including 60 EORTC members

# International Clinical Trials

- RTOG (and several other study groups\*) are expanding trials to international participation
- Through agreements with EORTC, RPC will likely make phantoms available to international participants in NCI-sponsored clinical trials
  - Funding source yet to be determined
- Proposal for international workshops in development

\*NCCTG and GOG, among others

# International Study Groups

RPC has developed relationships with several international clinical trials QA offices, leading to reciprocal visits and collaborations:

- TROG – Trans-Tasman Radiation Oncology Group
- EORTC – European Organization for Research and Treatment of Cancer
- Japanese National Cancer Center: Outreach Radiation Oncology and Physics



RTOG Tampa: Jan. 14-16, 2011

# Irradiation of RPC Phantoms

- Through various arrangements, 18 international institutions have already irradiated RPC phantoms
- Arrangements are being discussed for providing phantoms to additional institutions in Europe, the Middle East, Australasia and Latin America
- Through agreement with the RTOG and NCI, international non-member institutions participating in RTOG trials will meet the same QA requirements as member institutions



Questions?

