A Comparison of CT Number to Relative Linear Stopping Power Conversion Curves Used by Proton Therapy Centers

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IROC Houston and Proton Therapy

- IROC Houston (RPC) has monitored proton centers since 2006
- Currently monitor 18 centers (2 abroad) – all are interested in NCI-funded clinical trials
- GOAL: comparable and consistent dose delivery
Why do we want consistency?

- RLSP defines the range of protons in tissue
- If CT Number to RLSP conversion has error, range will be *incorrect*
How can IROC Houston catch errors in CTN-RLSP conversion?

- Anthropomorphic proton phantom audits
- On-site dosimetry audits – Phantom containing 6 tissue-equivalent materials scanned at each facility – Institution provides own calibration curve for comparison

Materials:
- Water
- Blue Water
- Balsa Wood
- Polyethylene
- HPV Techtron
- PRESAGE®
Scaled CTN for IROC Houston Phantom
CTN-RLSP Case Study 1

![Graph showing CTN-RLSP Case Study 1]
CTN-RLSP Case Study 1

Scaled CTN

RLSP

Institution 1 - Scanner A
Institution 1 - Scanner B
Mean
-2SD
+2SD

Mean ± 2SD
CTN-RLSP Case Study 2

![Graph showing Institution 2, Mean, -2SD, and +2SD lines compared to Scaled CTN and RLSP values.](image-url)
CTN-RLSP Case Study 2
Where is there still room for improvement?
Where is there still room for improvement? Fatty tissue
Where is there still room for improvement? Low CT Numbers
CTN-RLSP

• Phantom and on-site dosimetry audits have caught several errors and discrepancies among proton center CTN-RLSP conversion curves

• Several institutions have implemented corrections

• Still a few outliers around fatty tissue and low CTNs
Thank you
Questions?
On-site Dosimetry Audits

• 20 on-site dosimetry audits for scattered, uniform scanning, and PBS systems

• Review:
  – Absolute calibration
  – Dosimetry for reference and patient fields
  – Treatment planning procedures
  – Machine & patient-specific QA
  – IGRT
  – CT vs. RLSP calibration curve