Guidelines for the application of IMRT for Intra-Thoracic Lesions

J. Palta
J. Galvin
J. Purdy
M. Urie
K. Forster

Goals

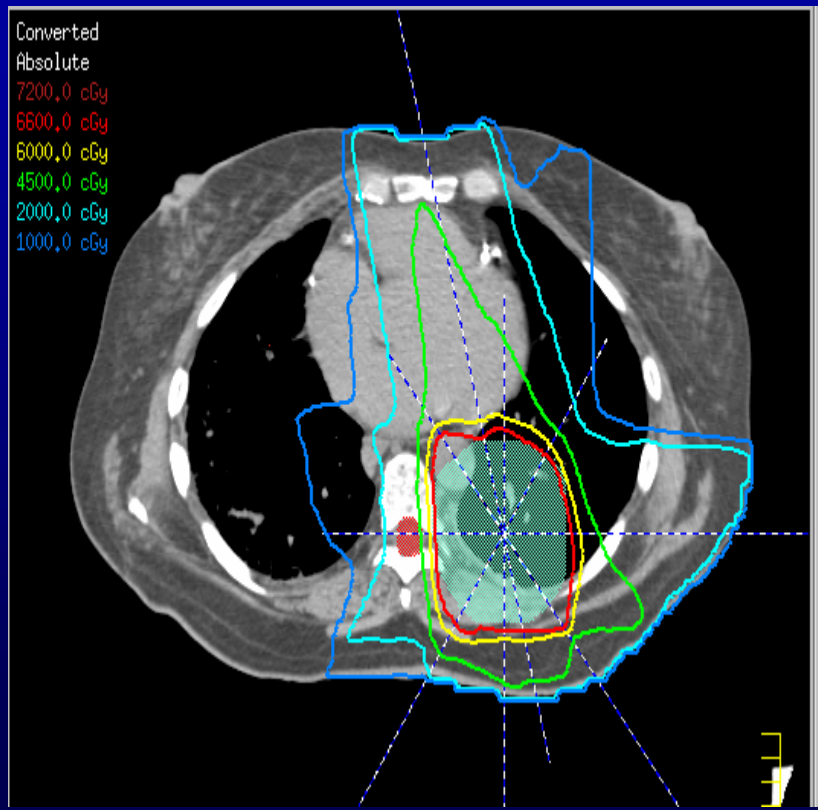
- Define protocol guidelines for investigators
- Define methods of dose prescription
- Define how to handle motion
- Define how to handle localization
  - How do we localize?
  - How often do we localize?
- Define benchmarks

Motivation

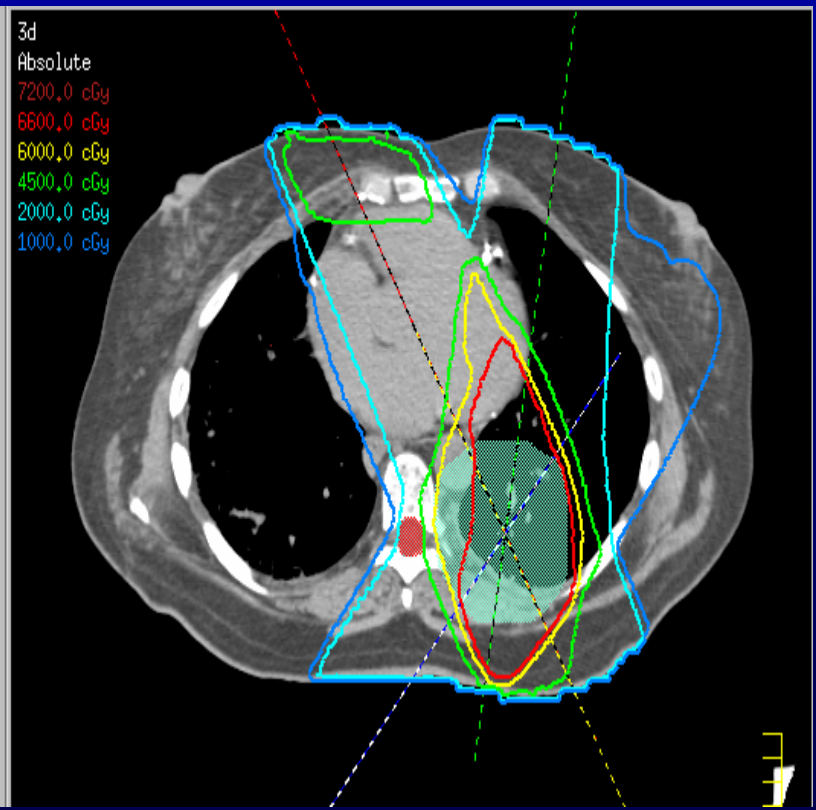
[Clinical Rationales]

Comparison of IMRT vs 3D for NSCLC

IMRT



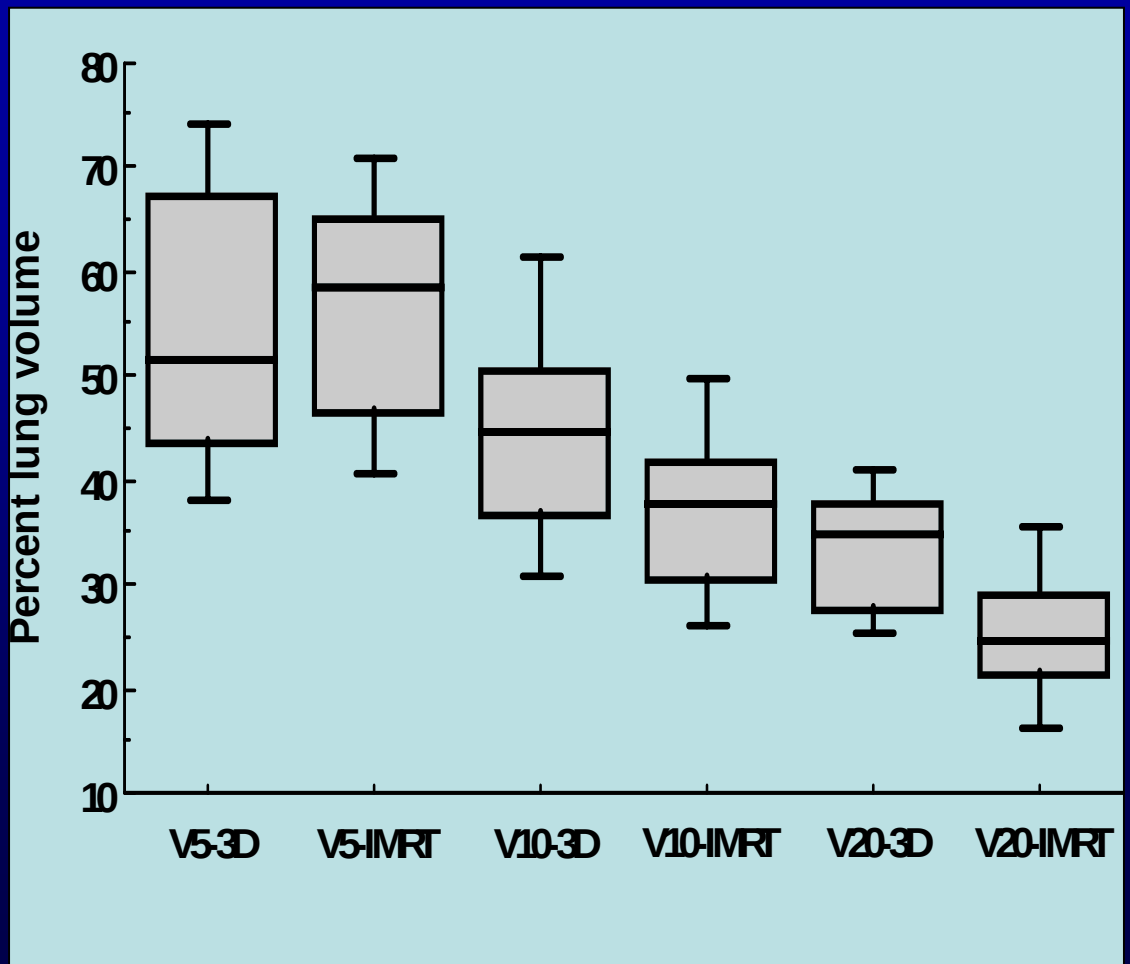
3D



H. Liu MDACC

[Clinical Rationales]

Comparison of IMRT vs 3D for NSCLC

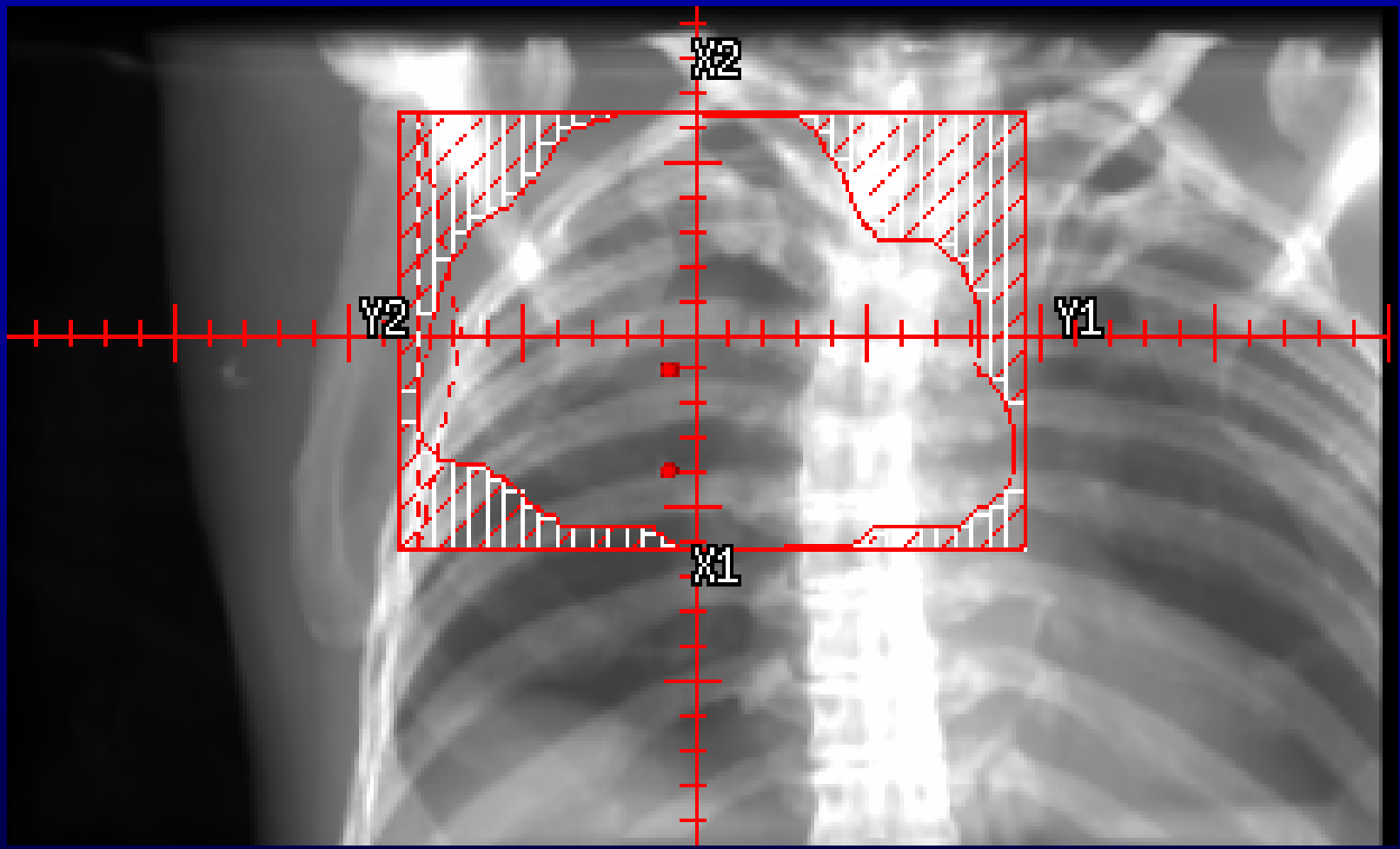


H. Liu MDACC

Issues

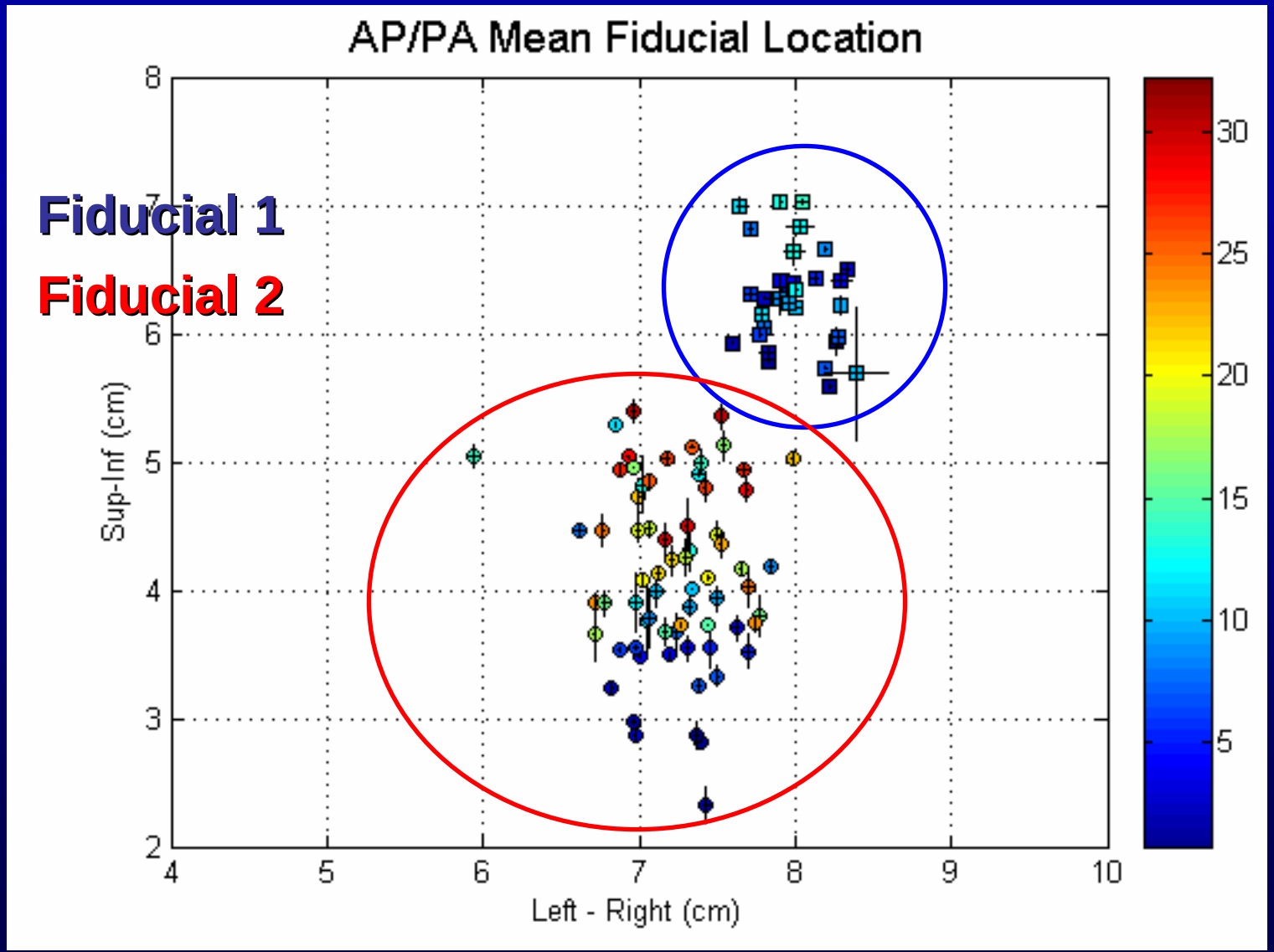
Implanted Fiducial Data

Starckschall et al MDACC

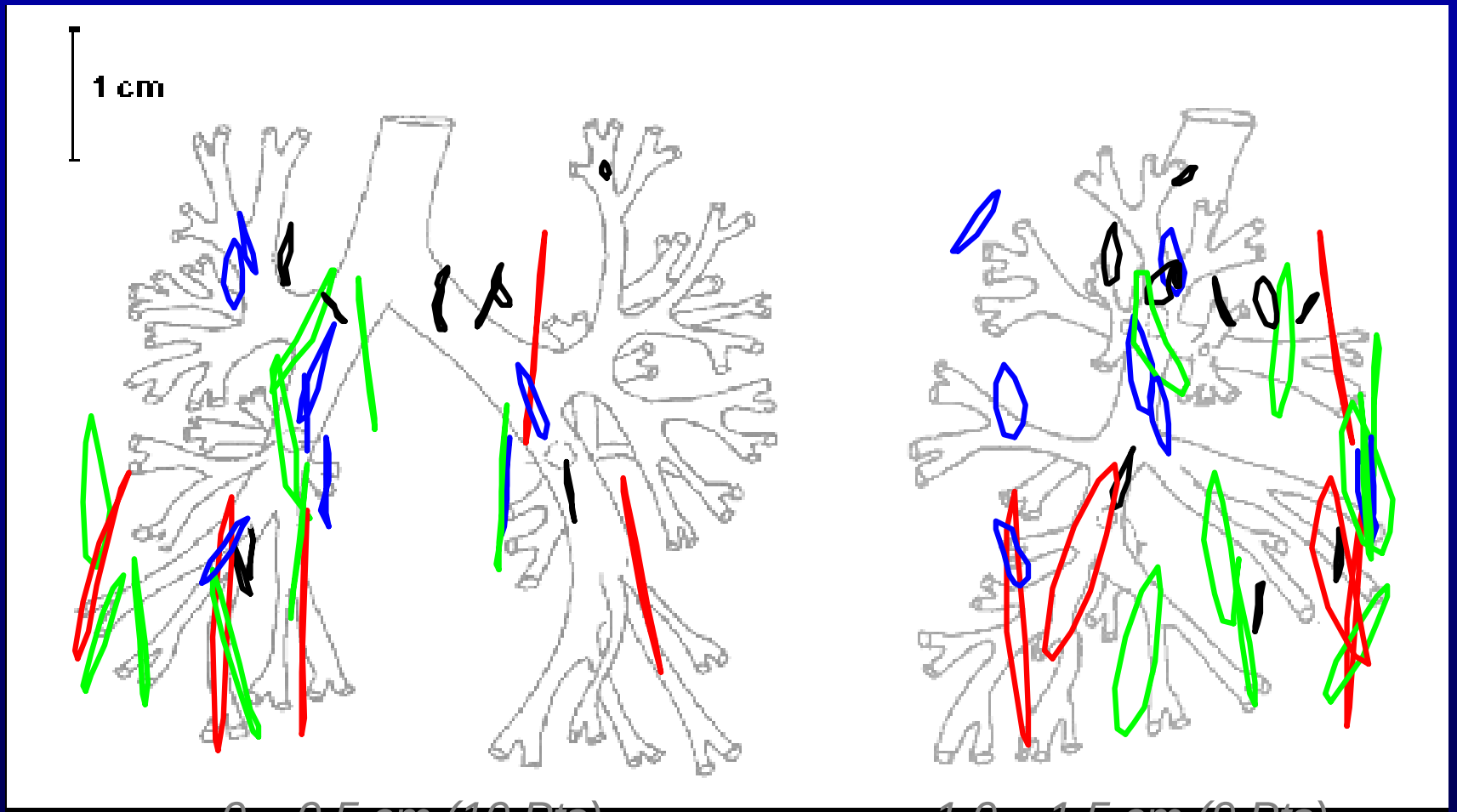


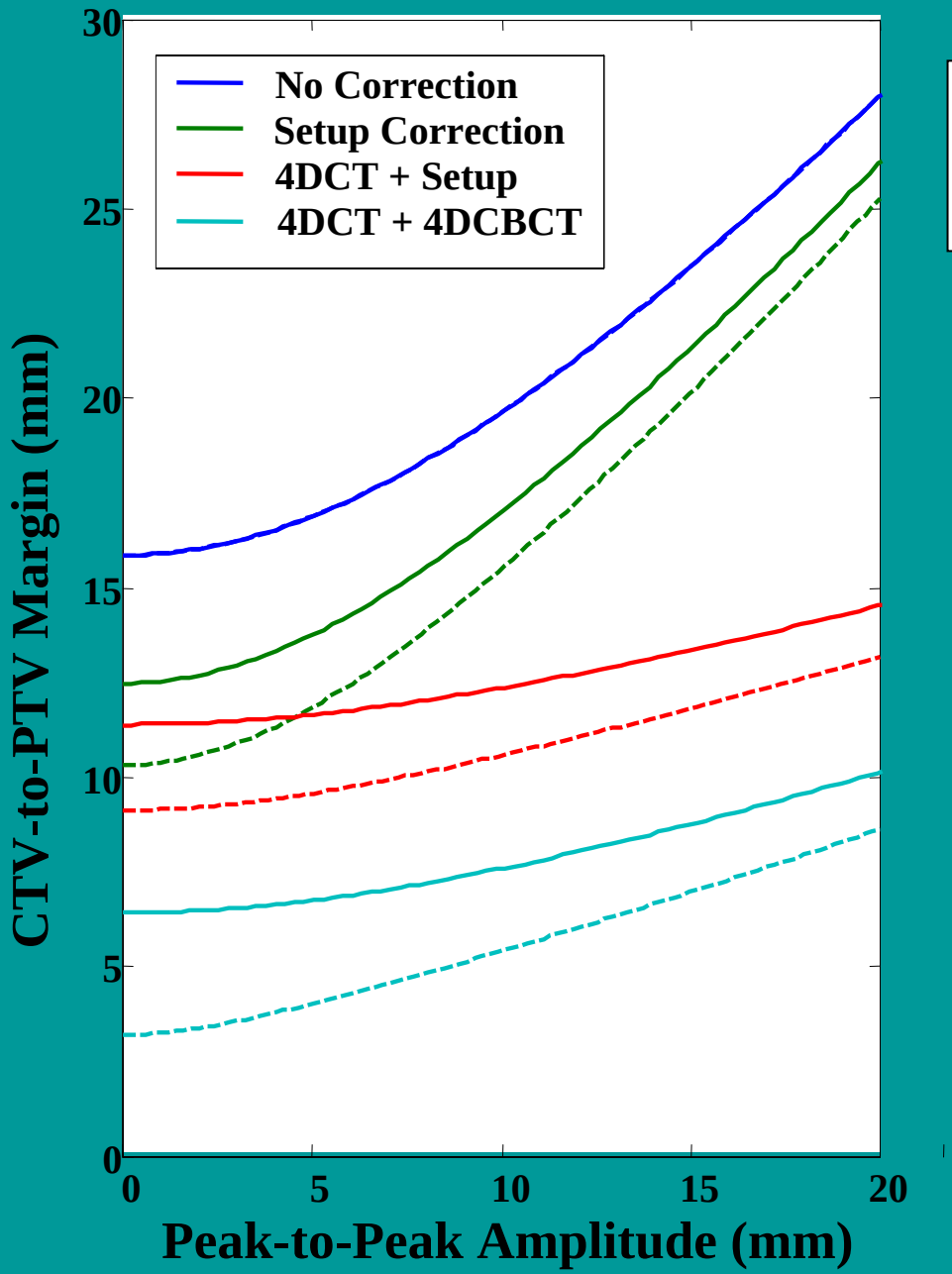
Results – Setup Reproducibility

Chris Nelson MDACC



Averaged Tumor Trajectory





Offline correction

Online correction

Assuming 1mm or 1mm/cm residual error

Not accounting for uncertainties in target definition!!!

$$m_{PTV} = 2.5\Sigma + 0.7\sigma$$

van Herk et al., IJROBP 2002

Protocol Requirements

- The protocol must require appropriate patient immobilization and localization. The immobilization in this case is not just for the patient's body, but also the tumor.
- It will be the responsibility of the protocol PIs to assess the adequacy of these systems for their protocol. For IMRT delivery, tumor immobilization with respiration should be limited to 5 mm.

Protocol Requirements

- Protocols permitting IMRT treatment delivery must be written using the nomenclature defined in the NCI IMRT Working Group Report (*Int. J. Radiat. Oncol. Biol. Phys. 51:880-914, 2001*) and the ICRU Reports 50 and 62

Protocol Requirements

- The protocol must provide a rationale for the choice of margins (IM and SM) to be used by the participating institutions to expand CTV to PTV
- The protocol must require that a heterogeneity-corrected dose distribution be prepared for plan evaluation and dose prescription

Protocol Requirements

- The dosimetry must be benchmarked for the protocol to verify that the dose algorithms are within accepted ranges of accuracy.
- The protocol must provide a clear definition of the prescription dose and dose heterogeneity allowed throughout the PTV. If 3D conformal and IMRT treatments are allowed on the same protocol, the dose heterogeneity requirements for the IMRT patients and non-IMRT patients must be similar. The protocol must also specify the prescription dose to the volume, for example 60 Gy to cover 95% of the PTV.

Protocol Requirements

- The protocol must clearly define the OARs and/or PRVs that are required for each study and provide clear guidelines for contouring each OAR/PRV defined in the study.
- . The GTV, CTV, PTV, OAR (s), PRV(s), and skin contours (to delineate unspecified tissue) must be depicted on all slices of the 3-D volumetric imaging study in which each structure exists. Lung volume will be defined as total lung minus CTV at some fixed level of inspiration as defined in the protocol.

Protocol Requirements

- The protocol must require that specific procedures be in place to insure correct, reproducible positioning of the patient and the associated lesion. The frequency of the verification should be justified so as to assure daily targeting within specified tolerances.

Protocol Requirements

- Copies of all the data normally associated with an IMRT protocol, and the additional localization data, and all associated imaging studies will need to be submitted in digital form to the ITC.

Credentialing Requirements

- IMRT questionnaire and benchmark developed by QARC and adopted by the ATC
- Satisfactory completion of the benchmark and its approval by the cooperative group's QA process credentials the institution for treatment with IMRT on one or more clinical trials, as determined by the cooperative group

Credentialing Requirements

- Dry run first patient (RTOG 0236)
- Demonstrate ability to meet simulation and planning requirements
- Demonstrate the ability to localize lesion daily
- Demonstrate the ability to keep residual motion to 5mm or less.

Next Steps

- There is a draft of a paper describing this proposal
- The paper needs to be finalized (and blessed)
- Paper to go to IJROBP
- Paper to go to NCI