

The impact of dose prescription on treatment volume

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Purpose of Study

- Previously published literature has stressed the importance of:
 - prescribing
 - recording
 - reportingradiation therapy treatment doses and their treatment volumes clearly and unambiguously so that they can be easily tracked worldwide.
- One of the recommendations of ICRU 50 and its supplement ICRU 62 is to prescribe to a point inside the planning target volume (ICRU reference point) instead of prescribing to the periphery of the PTV (an isodose line).
- Our study evaluated the effects on the dose distribution of prescribing to the ICRU reference point versus prescribing to an isodose line.



Introduction: Dose Specification

ICRU 50 states:

“The most significant difference found in the literature appears to be the location where one prescribes and delivers the dose and how one reports the full treatment.”



Introduction: ICRU reference point

- The ICRU Reference Point is selected according to the following criteria:
 - Must be clinically relevant and representative of dose throughout the PTV
 - Should be easy to define in a clear and unambiguous way
 - The point should be chosen where the dose can be accurately determined
 - The point should not lie in a region where there is a steep dose gradient
- These recommendations are fulfilled if the ICRU reference point is:
 - Always at the center (central part) of the PTV
 - When possible, at the intersection of the beam axis

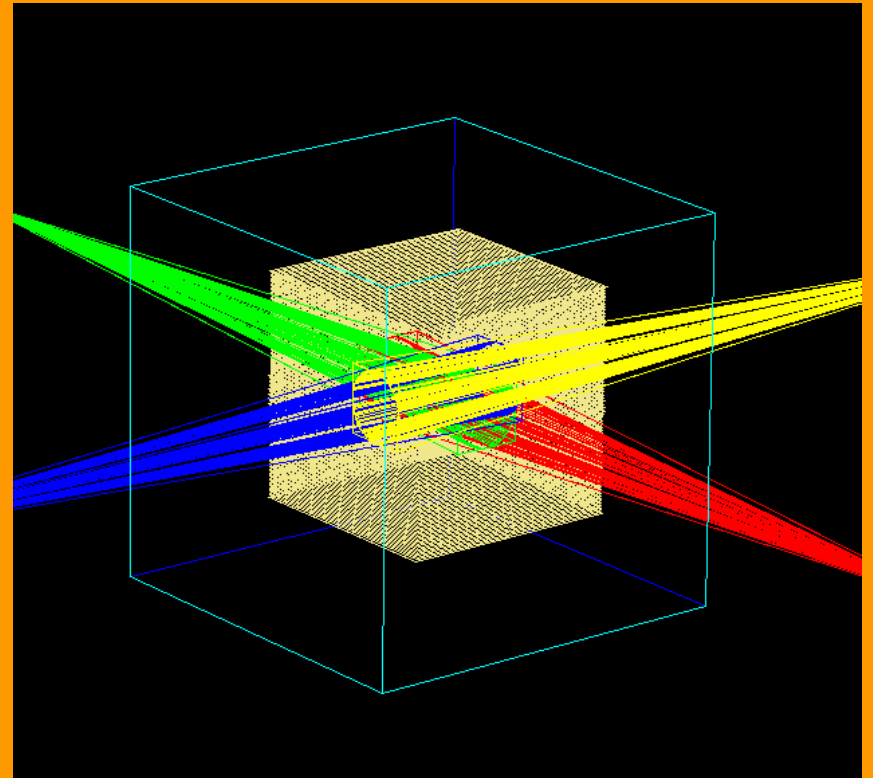
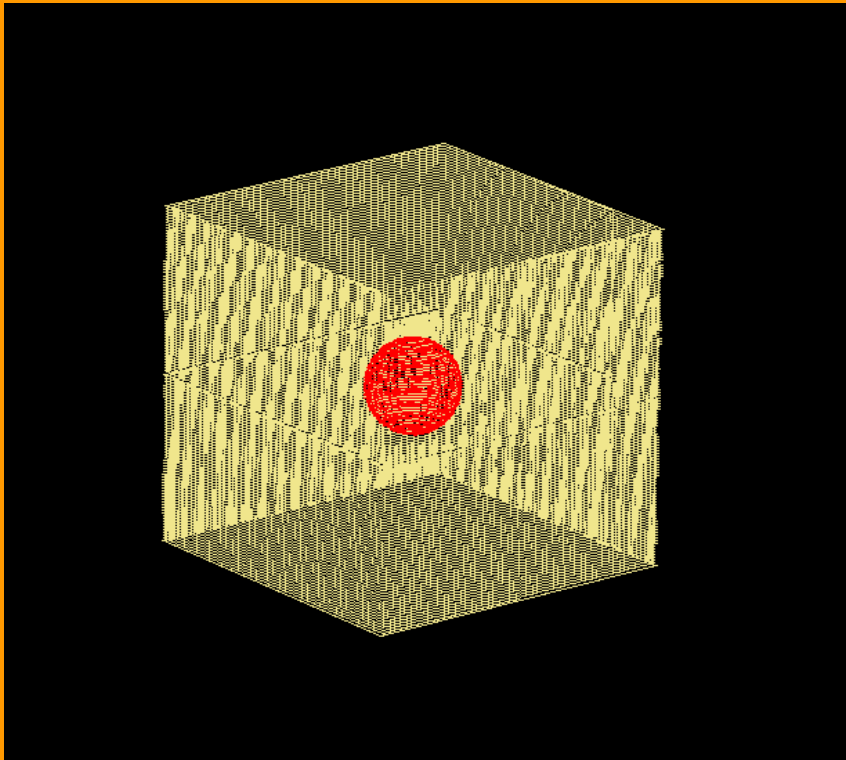


Methods

- Pinnacle treatment planning system
- Cases:
 - **Phantom:**
 - Drew 2 cm and 8 cm spherical diameter targets on 30 cm³ phantom
 - 4-field box
 - **Clinical:**
 - 4-field prostate
 - 10-field stereotactic body radiotherapy (SBRT) treatment plans
 - Different combinations of:
 - Block margin (0, 0.5 and 1.0 cm)
 - Prescriptions (ICRU or scaled)
 - 2 mm dose calculation grid



Phantom Plans



Methods

- Prescription Criteria:
 - **Prescription 1 - ICRU:** 100% dose to isocenter
 - **Prescription 2 - Scaled:** Pick an isodose line so that 95% volume gets 100% dose
- Our clinic tries to meet the following treatment planning goals (using ICRU):
 - 95% target volume gets 95% dose



Methods

Evaluations:

- The effect of different block margins (0, 0.5 and 1 cm) on doses and volumes
- The effect of different dose prescription (ICRU vs scaled) on normal tissue volumes

Plots:

- Calculated each plan and plotted dose vs. volume for comparison



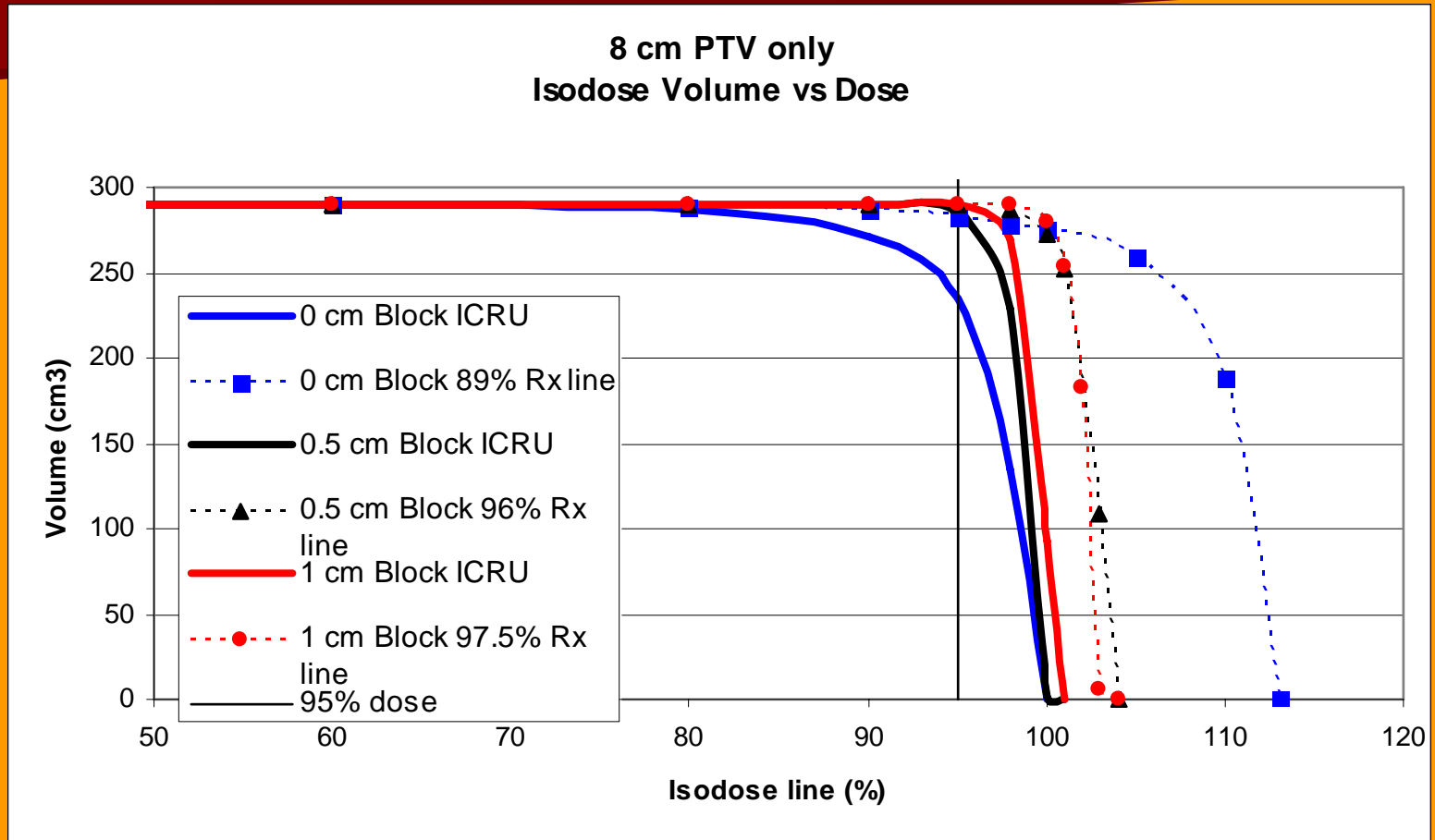
Overview

■ Plots:

- DVH plots for phantom and clinical plans
- Comparison of 2 different prescription methods
 - **Prescription 1** - ICRU: 100% dose to point
 - **Prescription 2** - Scaled: 95% volume gets 100% dose
 - Different scale factors were applied to these plans in order to meet the prescription criteria
- Our clinic goals: 95% planning target volume gets 95% dose



Baseline case: 8 cm sphere

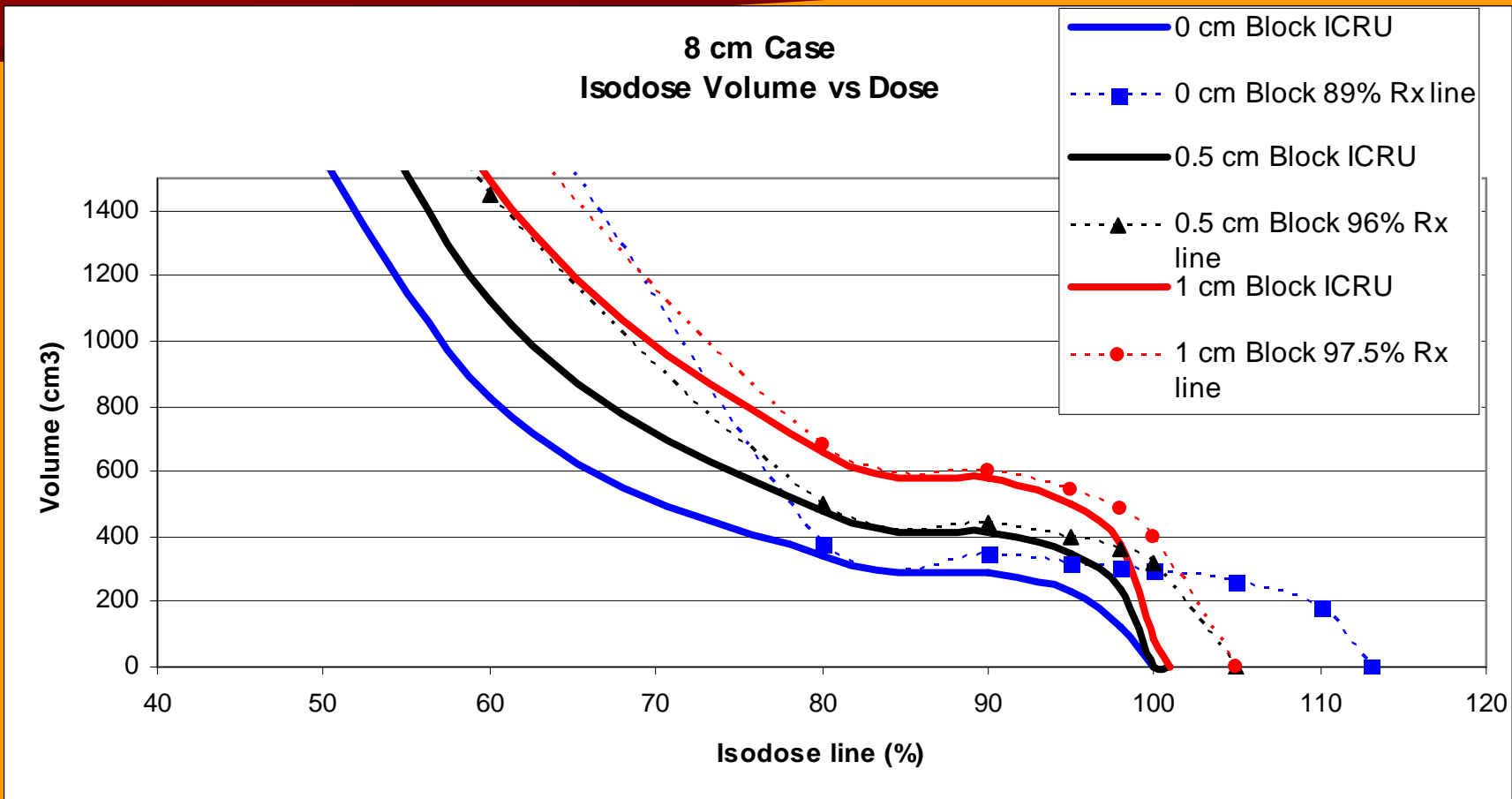


Solid line: ICRU prescription

Dotted line: Scaled prescription



Baseline case: 8 cm sphere



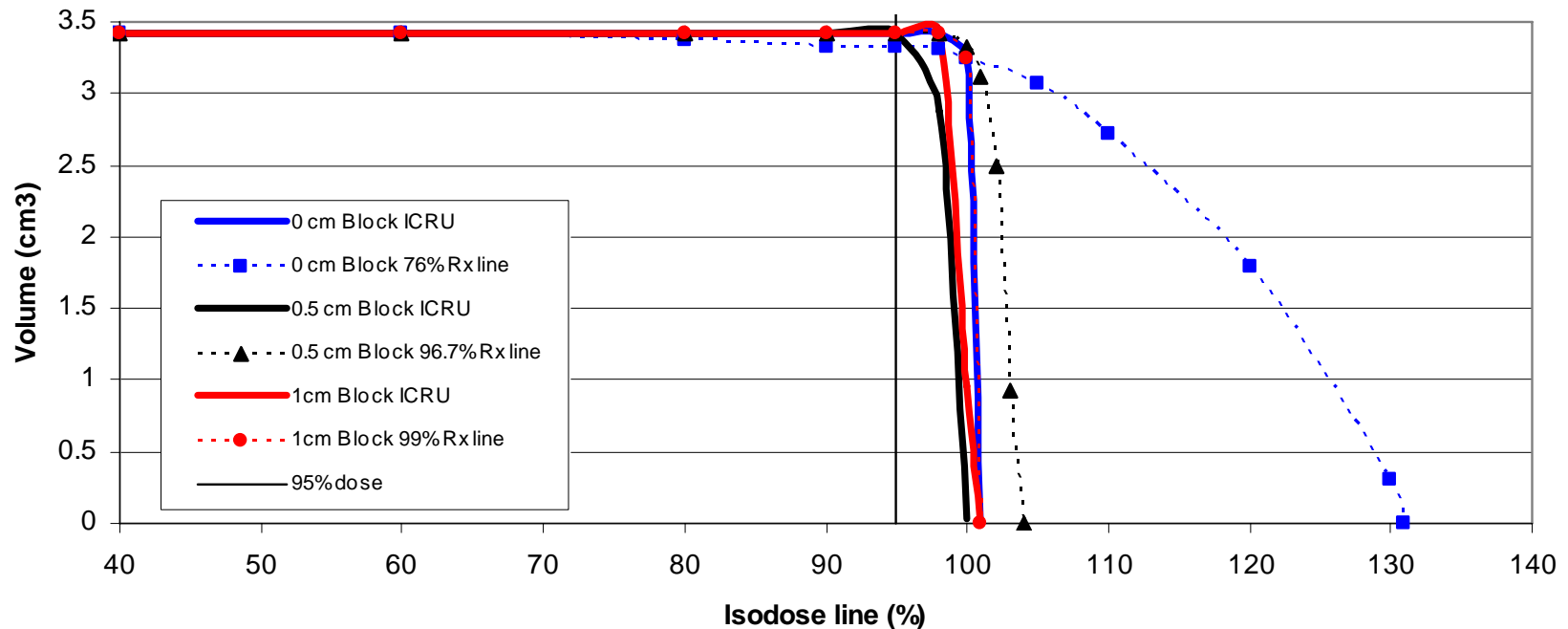
Solid line: ICRU prescription

Dotted line: Scaled prescription



Baseline Case: 2 cm sphere

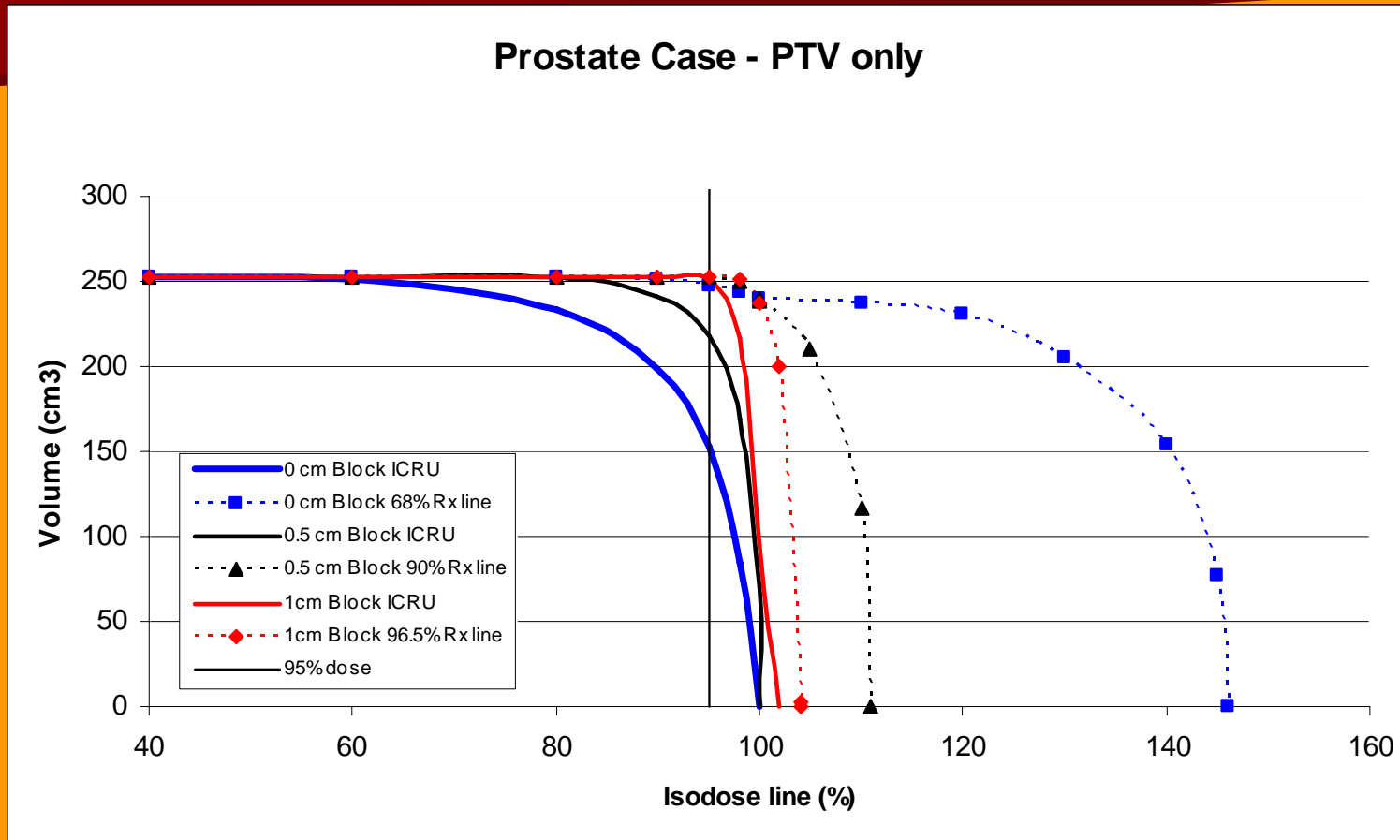
2 cm PTV only



Solid line: ICRU prescription
Dotted line: Scaled prescription



Example 1: Prostate



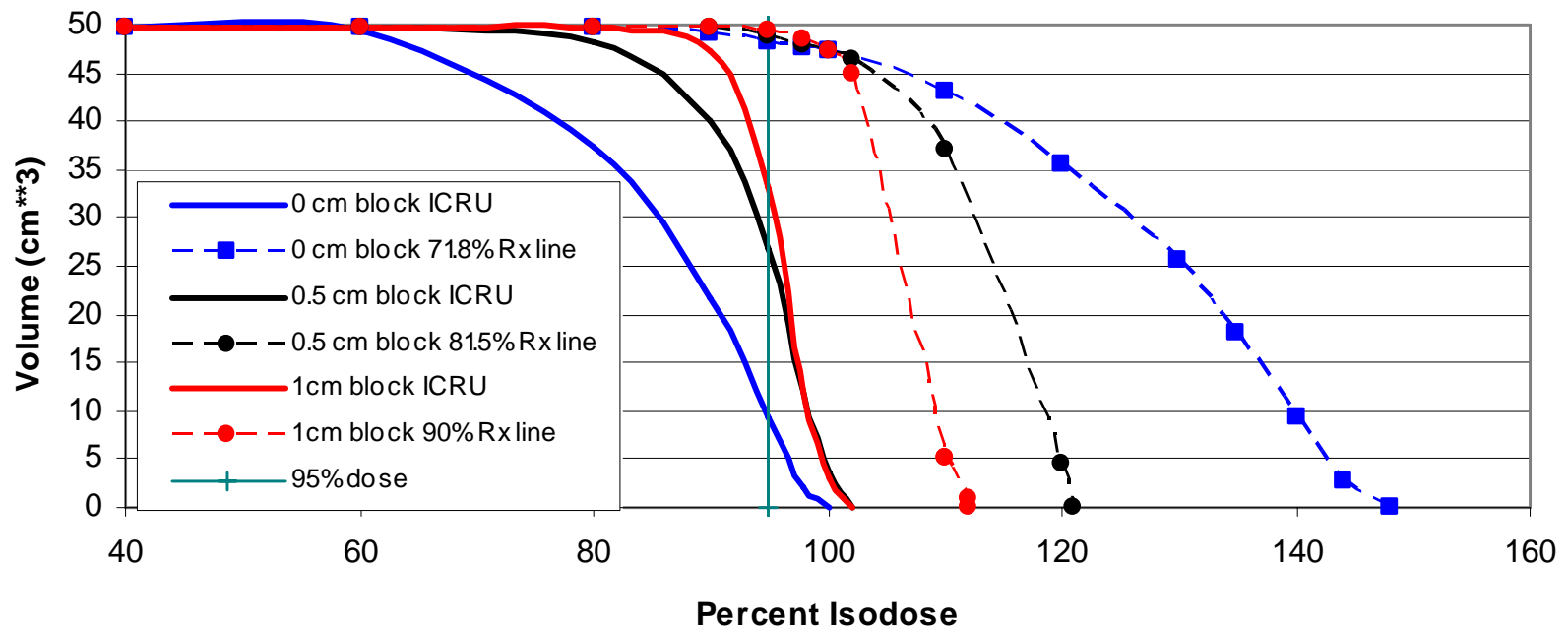
Solid line: ICRU prescription

Dotted line: Scaled prescription



Example 2: SBRT – small sized target

SBRT Target PTV only
Isodose Volume vs Dose
Case 1

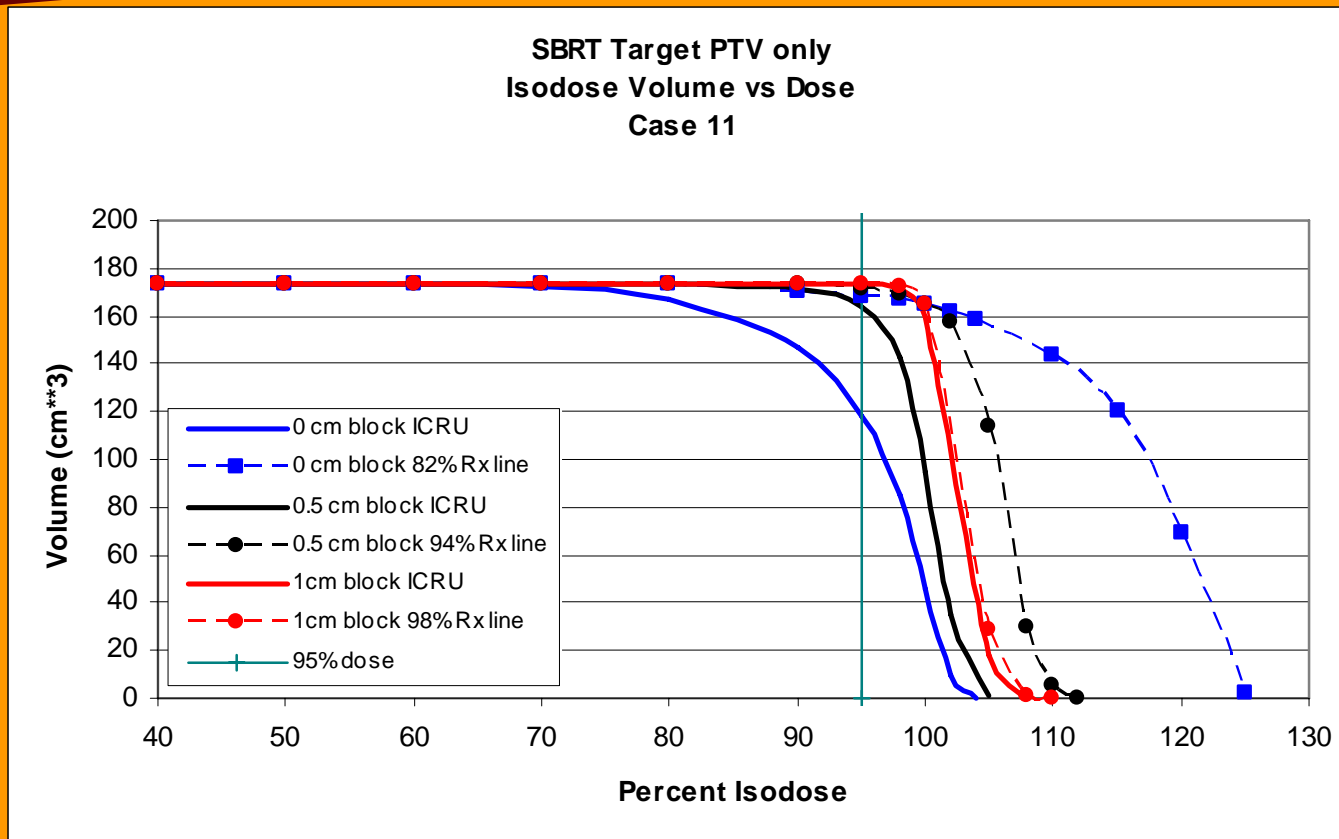


Solid line: ICRU prescription

Dotted line: Scaled prescription



Example 3: SBRT – Large sized target

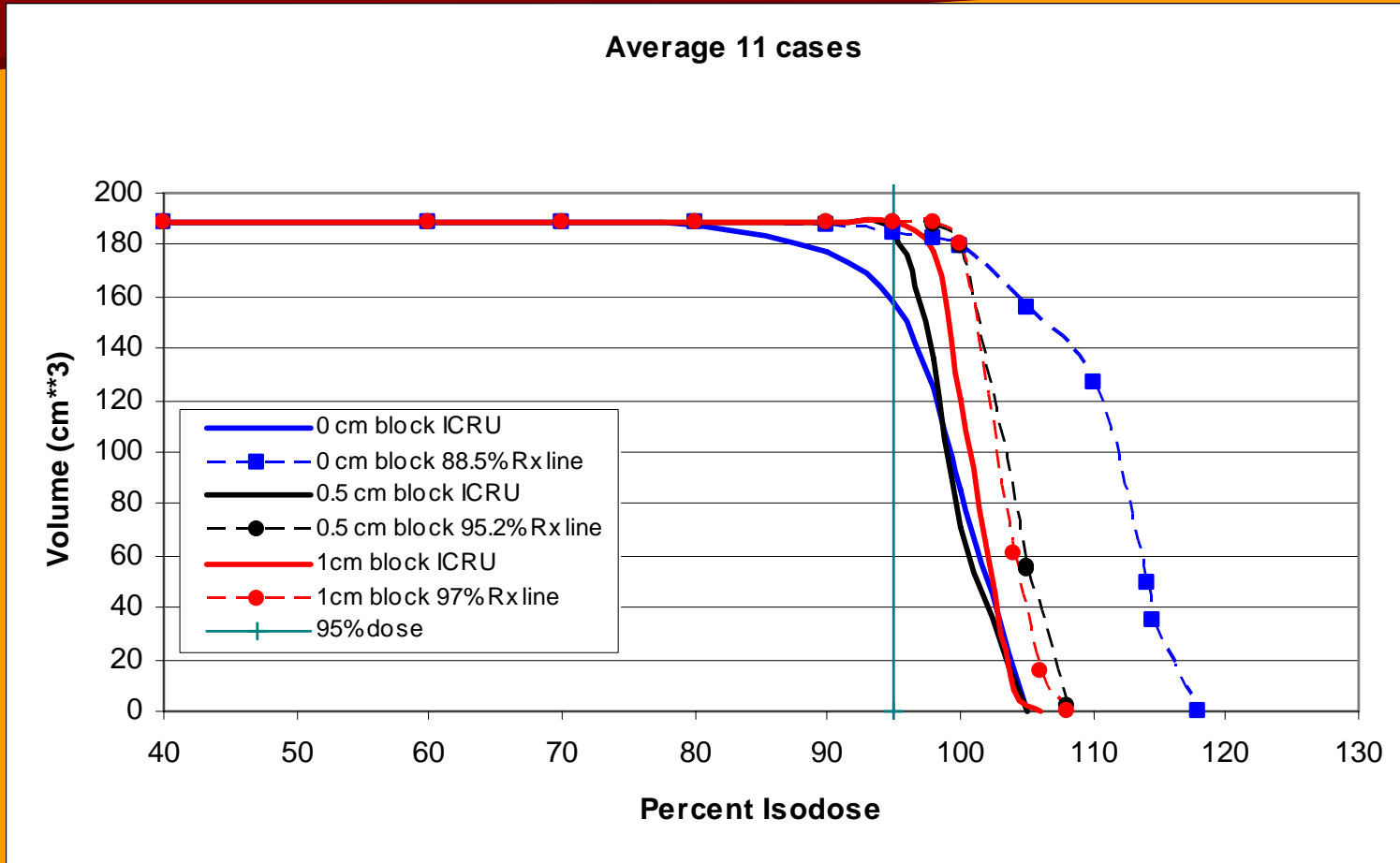


Solid line: ICRU prescription

Dotted line: Scaled prescription



Results – average 11 patients



Solid line: ICRU prescription

Dotted line: Scaled prescription



Conclusions

- Advantages of the ICRU definition of prescription:
 - Can meet the dose prescription criteria using adequate block margins
 - Can reduce the hot spot doses by as much as 30% as compared to the isodose prescription
 - Uniformity in dose reporting can be achieved



Summary

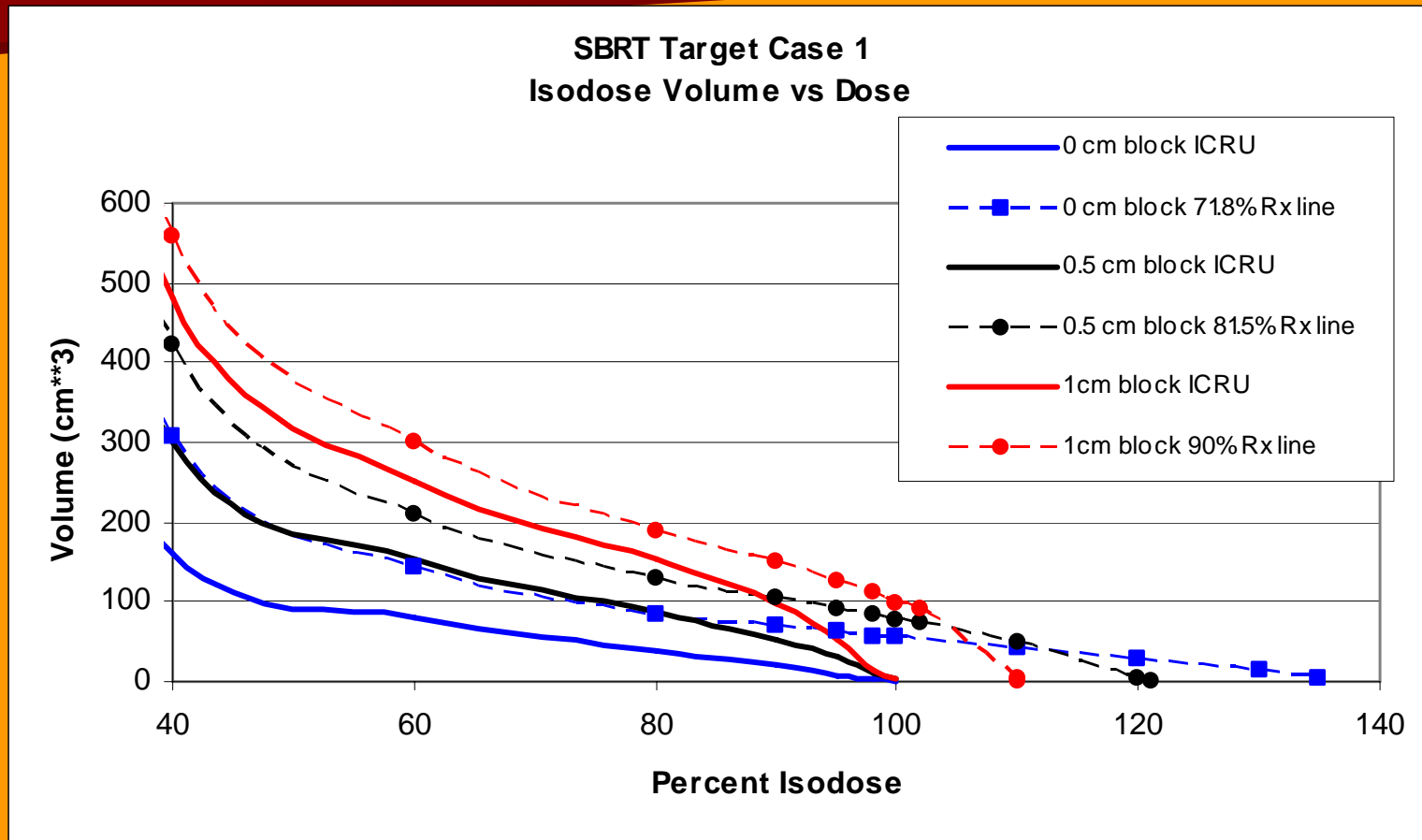
- If the ICRU reference point is used as the dose prescription point, the dose to the healthy tissue will be lower as compared to prescribing to an isodose line.
- Prescribing to the ICRU reference point will make it more feasible to record the dose in a way that follows the ICRU recommendations on dose prescription, recording and reporting.



Thank you!
Questions?



Example 2: SBRT- small sized target

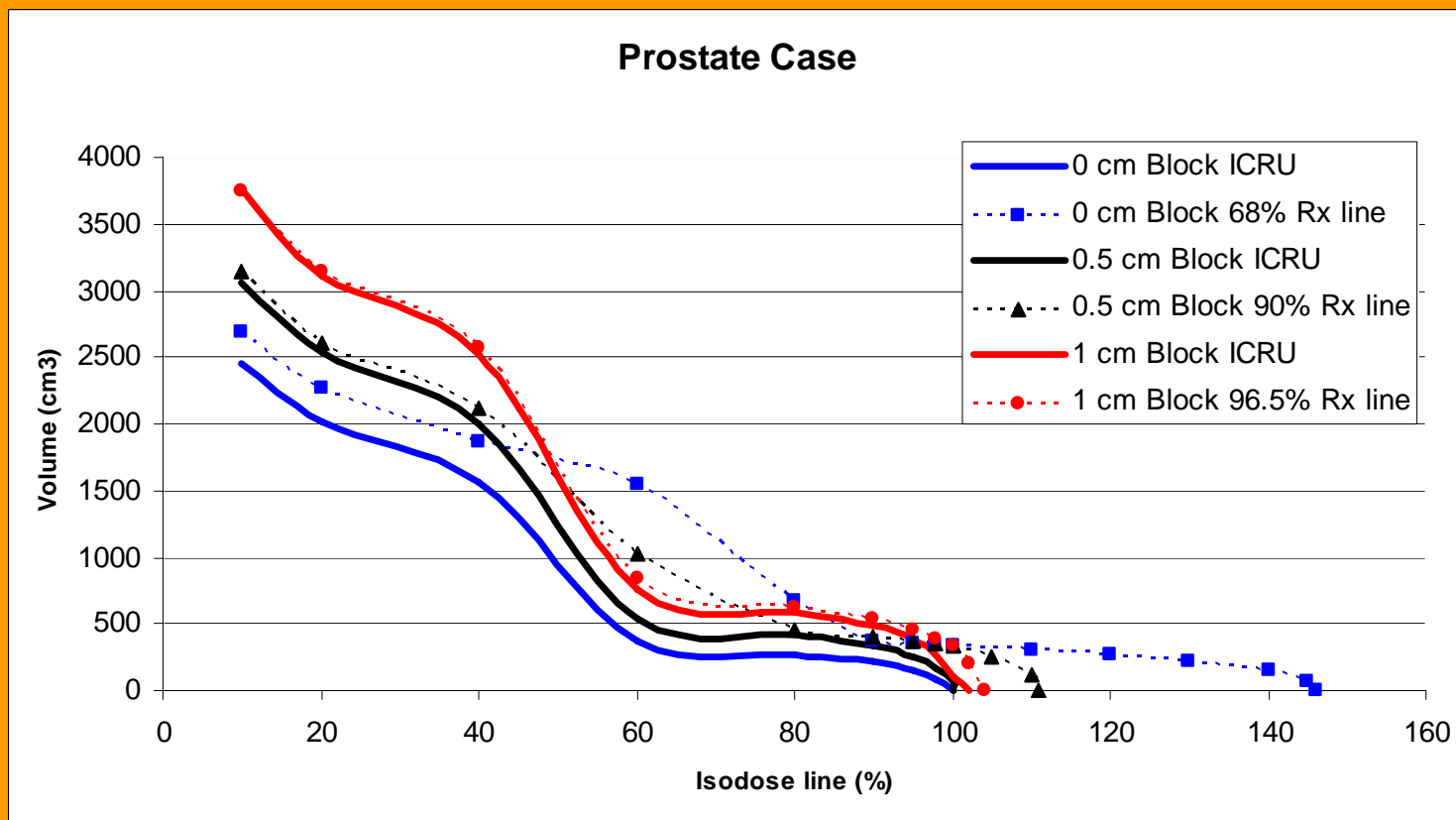


Solid line: ICRU prescription

Dotted line: Scaled prescription



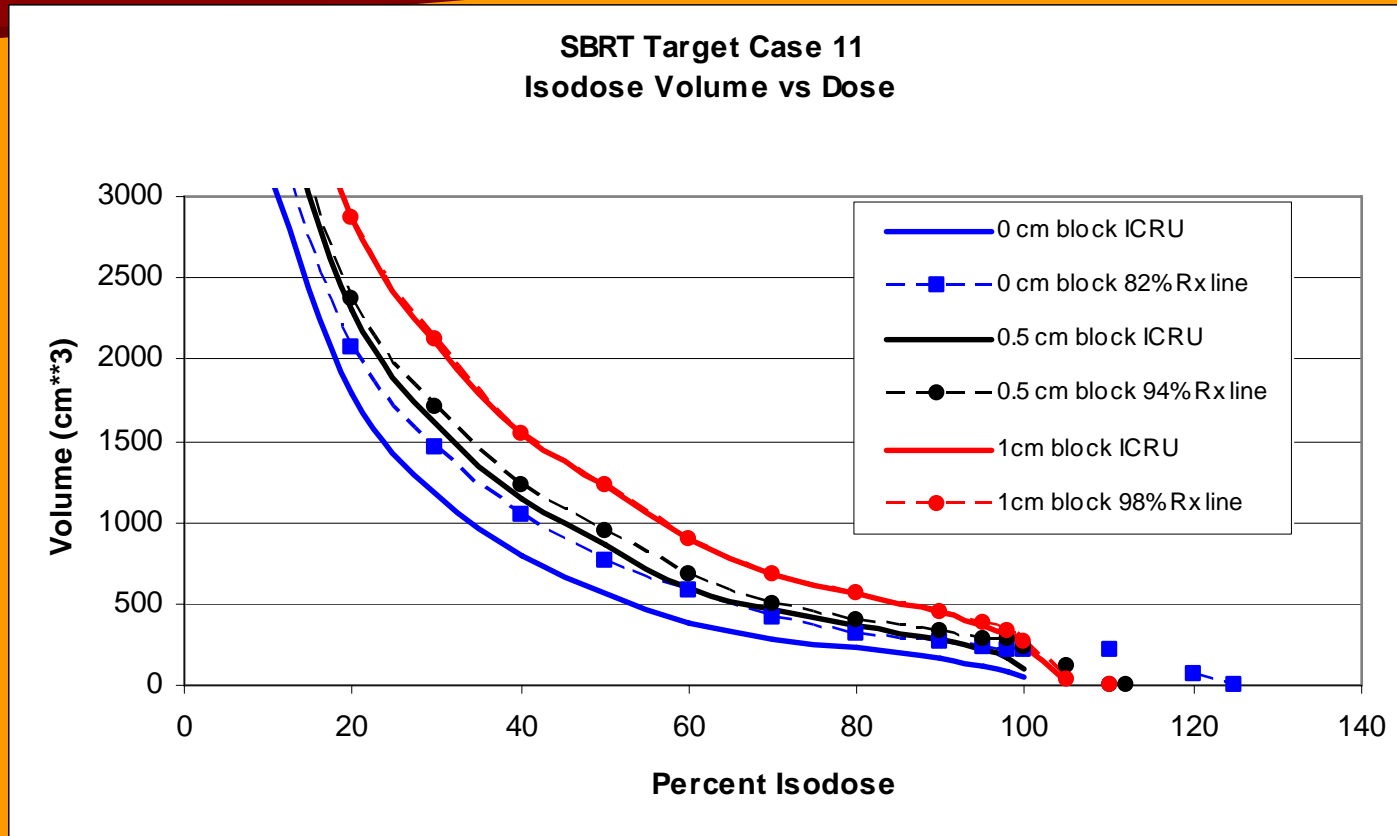
Example 1: Prostate



Solid line: ICRU prescription
Dotted line: Scaled prescription



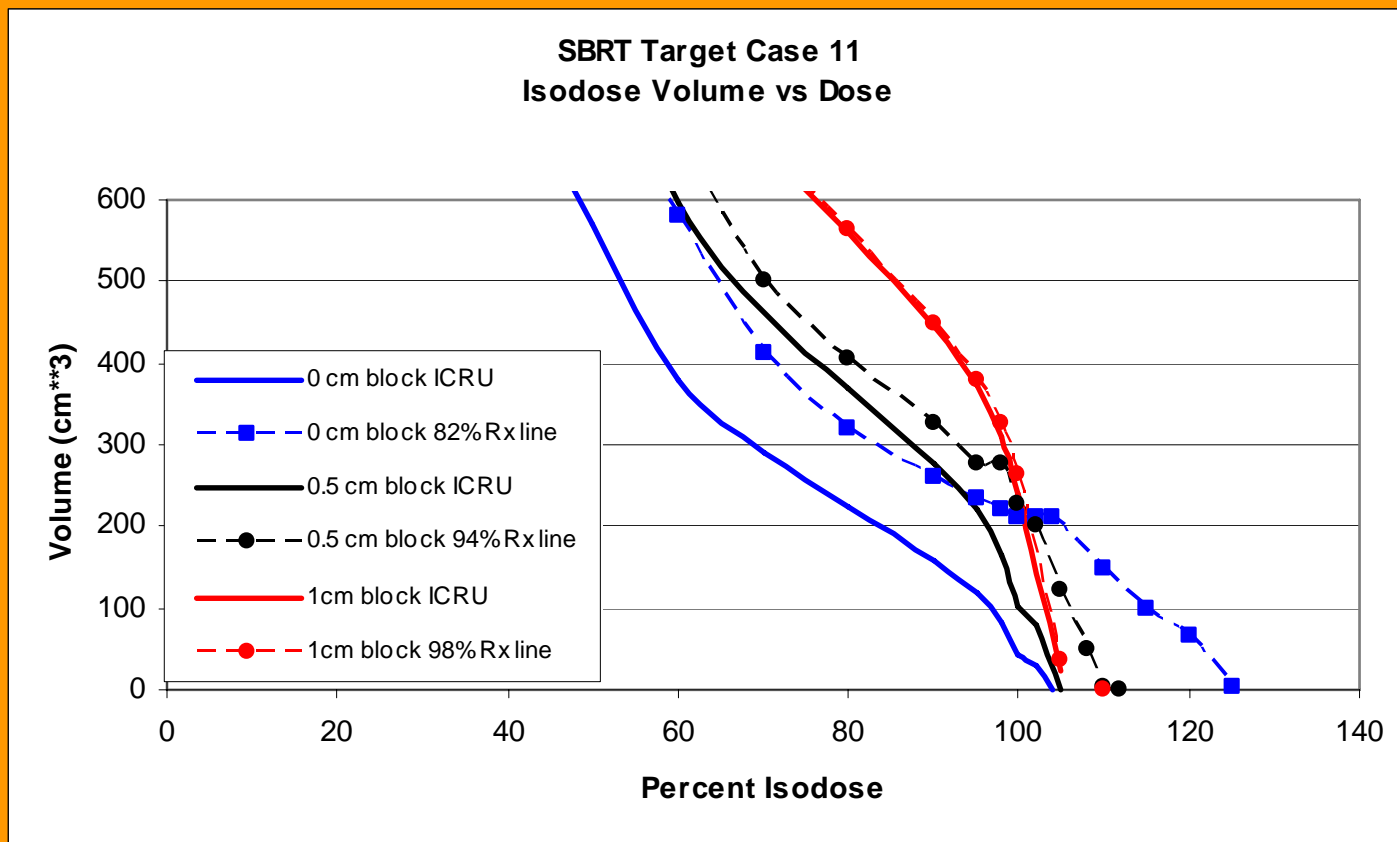
Example 3: SBRT – Large sized target



Solid line: ICRU prescription
Dotted line: Scaled prescription



Example 3: SBRT – Large sized target

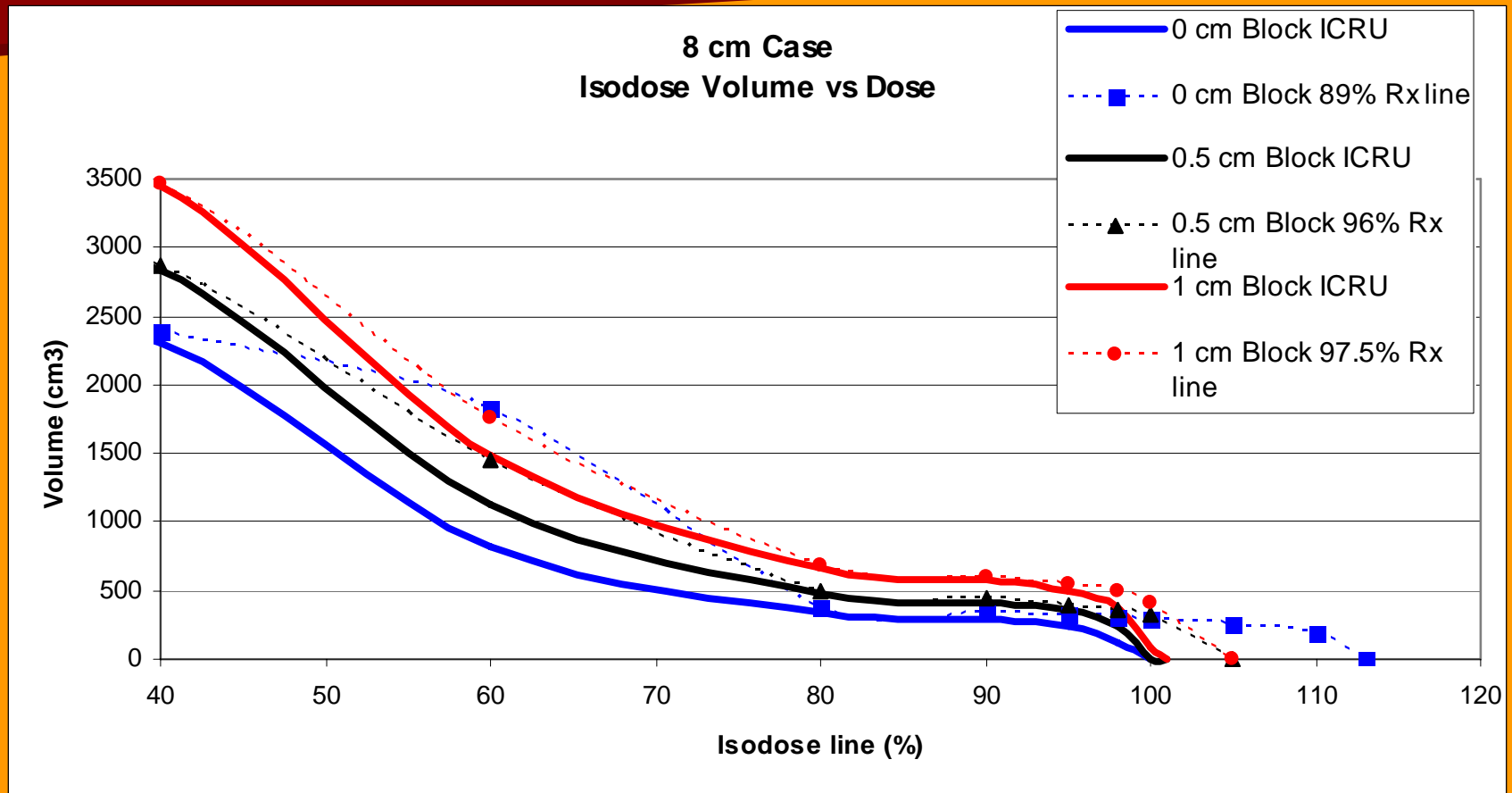


Solid line: ICRU prescription

Dotted line: Scaled prescription



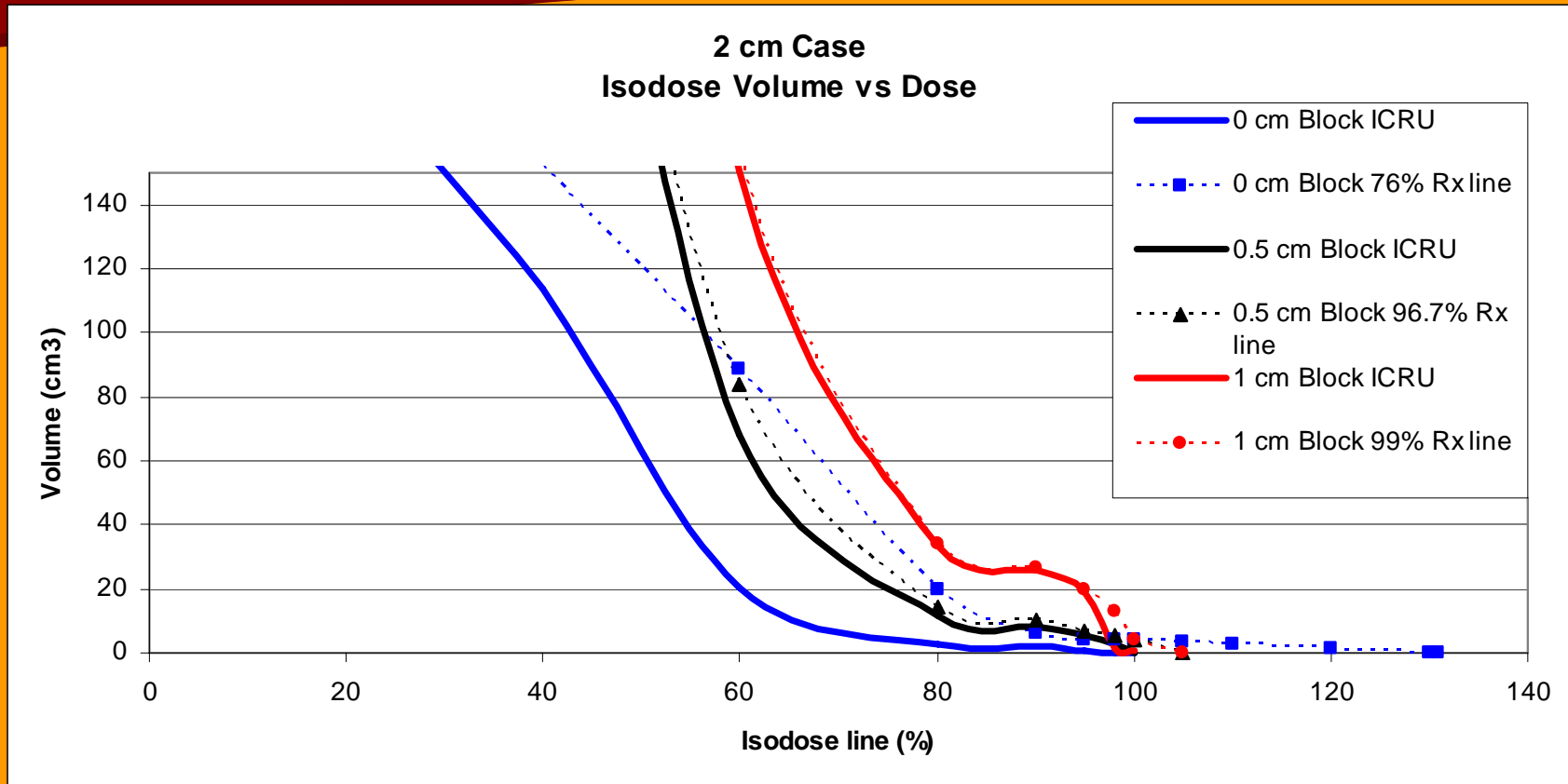
Baseline case: 8 cm sphere



Solid line: ICRU prescription
Dotted line: Scaled prescription



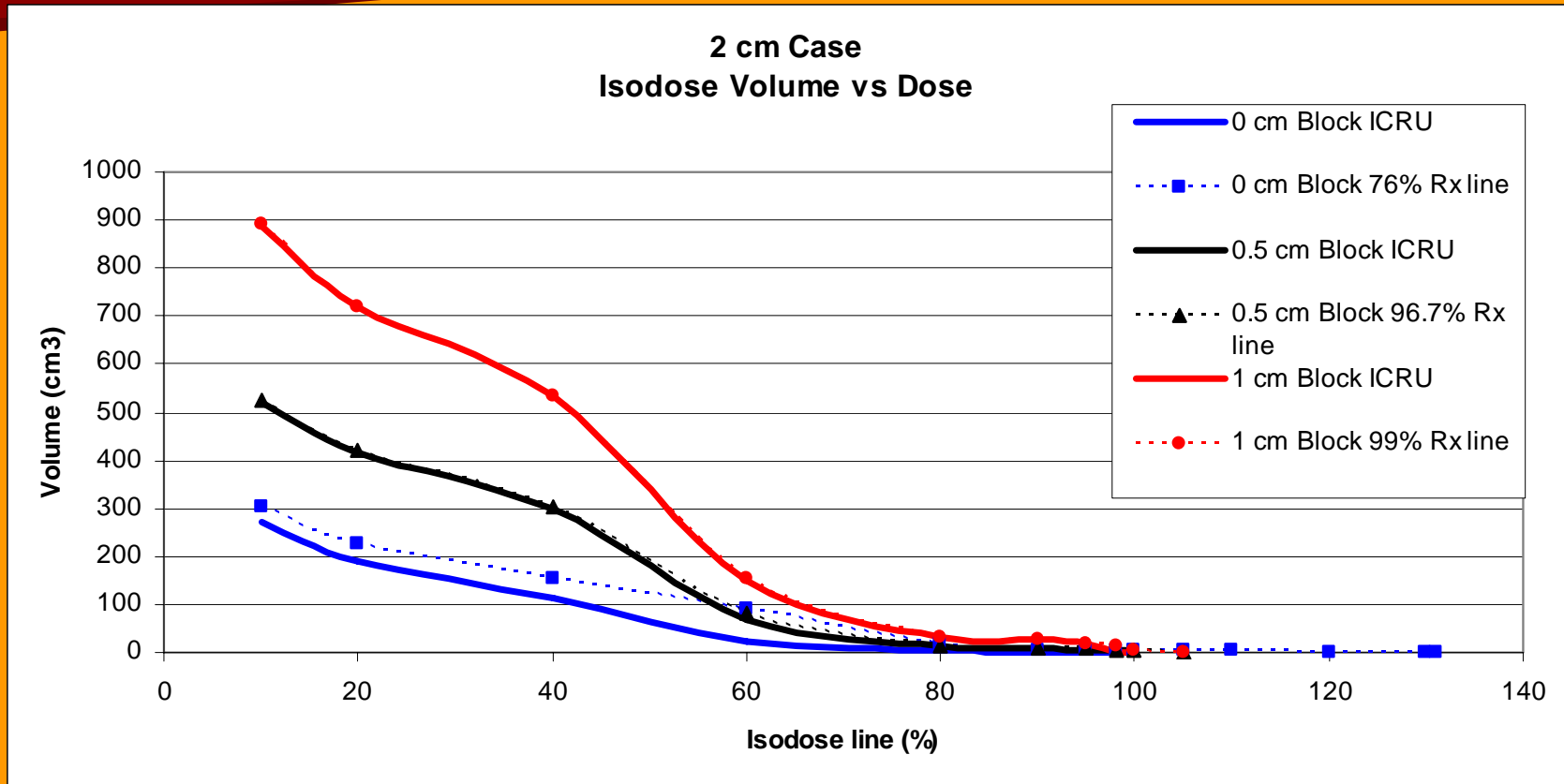
Baseline case: 2 cm sphere



Solid line: ICRU prescription
Dotted line: Scaled prescription



Baseline case: 2 cm sphere



Solid line: ICRU prescription
Dotted line: Scaled prescription

