

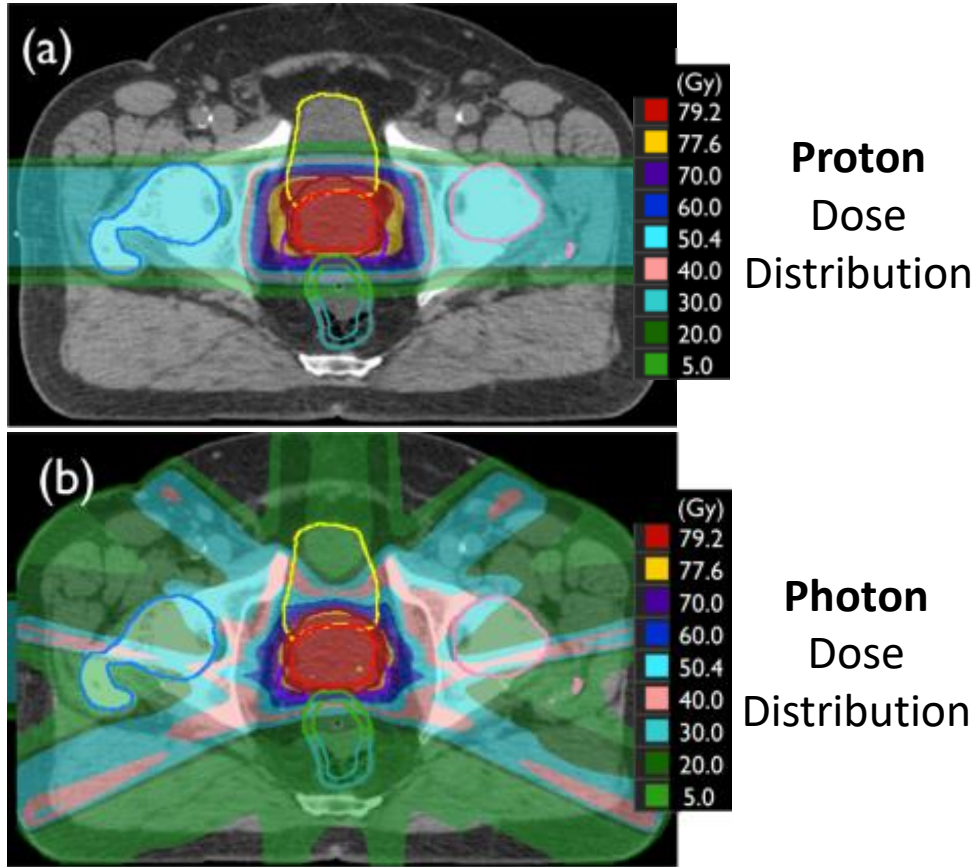


Dictionary-based protoacoustic imaging for proton range verification

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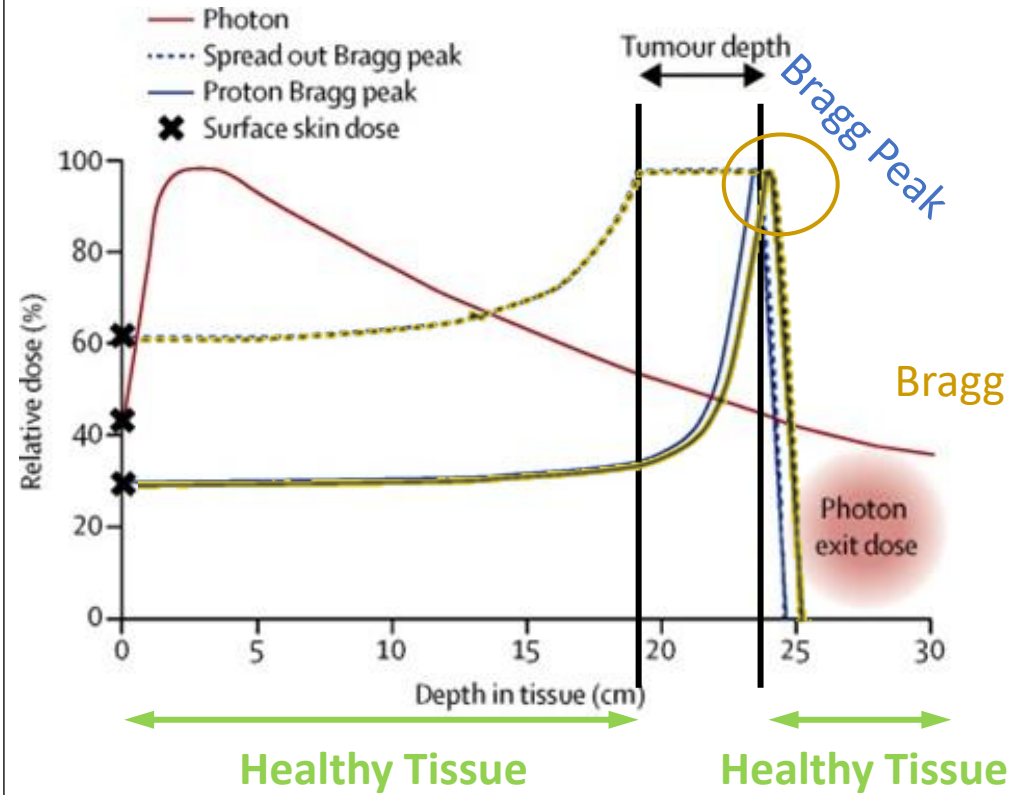




Benefits:

- More conformal dose distribution
- Lower dose in healthy tissue

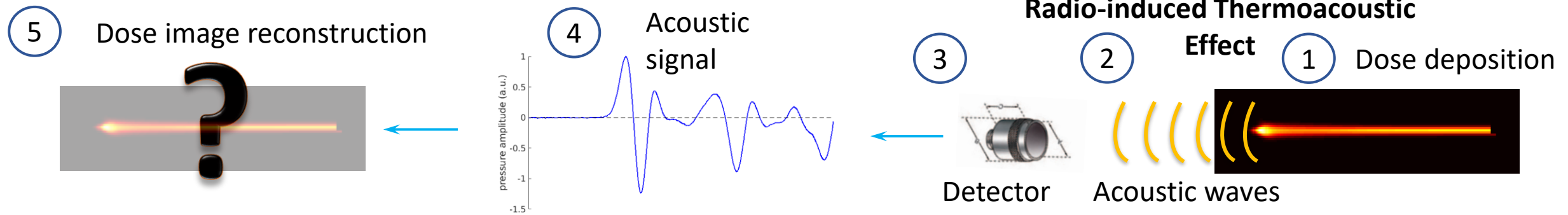
Problem: Proton Range Uncertainty



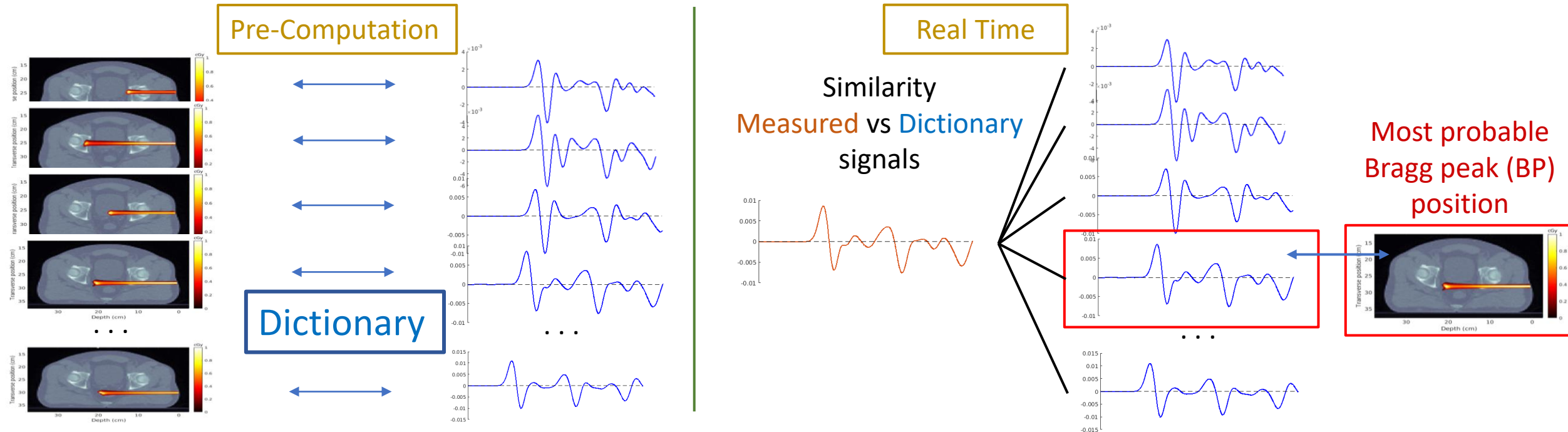
Small ERROR

Bragg Peak in Healthy Tissue

Solution:
Proton Range
Verification

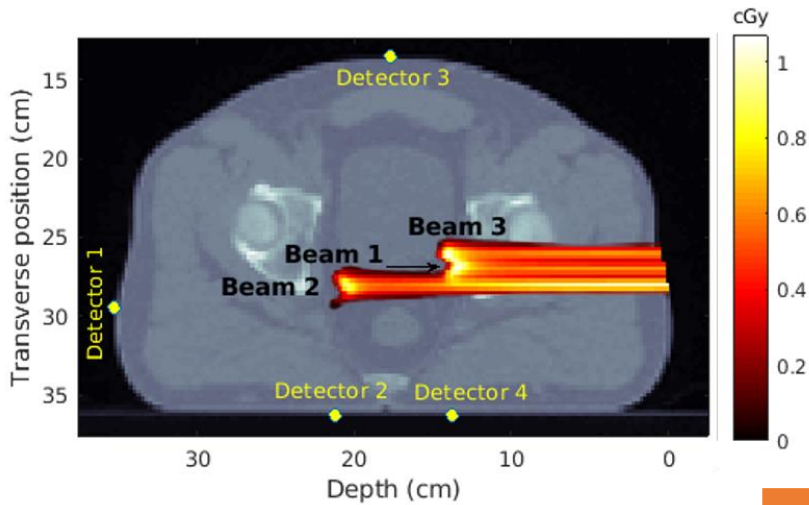


Novel Approach: Dictionary-based proton range verification



Application: Detection of Deviations from Protontherapy Plan

Simulation Setup



Robustness Evaluation

Changes from the original plan:

1. Air bubble
2. Weight gain
3. 1 mm Shift in patient position
4. 3.5 % error in HU to relative stopping power conversion

ΔZ_{real} Real change in BP position

vs

ΔZ_{dic} Change detected in BP position

Results

1.1 mm
Average
Accuracy

Next Step

- Experimental validation

	1. Air bubble			2. Weight gain			3. 1 mm Shift			4. 3.5% error HU		
	B1	B2	B3	B1	B2	B3	B1	B2	B3	B1	B2	B3
ΔZ_{real} (mm)	12.0	11.8	11.3	1.6	1.7	1.4	0.6	0.5	0.3	5.7	8.1	5.3
ΔZ_{dic} (mm)	12.7	9.0	8.6	1.3	2.4	1.7	0.9	0.8	0.0	7.4	8.4	8.1
accuracy (mm)	0.7	2.8	2.7	0.3	0.7	0.3	0.3	0.3	0.3	1.7	0.3	2.8