Supplementary material for Korhonen et al. Influence of MRI-based bone outline definition errors on external radiotherapy dose calculation accuracy in heterogeneous pseudo-CT images of prostate cancer patients. Acta Oncol 2014;53:1100–6.

Supplementary Figure 1. Construction schematics of the phantom as a transversal slice at femur position. The letters represent the analyzed distances in the phase- (A, B₁, C) and in the frequency-encoding (D, B₂, E) directions.

Supplementary Figure 2. Example patient case presenting dose distribution comparisons between the standard CT image and the pseudo-CT images with the 2D gamma index method for a 360° VMAT plan calculated by the XVMC. The tested pseudo-CT images are presented as follows; the image without additional segmentation error is shown in (b), and the images with additional -3 mm and +3 mm bone segmentation errors are illustrated in (c) and (d), respectively. The reference standard CT image is shown in (e). These planning images illustrate the PTV (red) and the isodose lines for 100% (brown), 90% (orange), 60% (yellow), and 20% (light blue) of prescription dose. Figures from (f) to (k) represent the dose points, which have failed (cold = blue and hot = red) the local gamma index criteria of 1% & 1 mm [(f), (g) and (h)] and 2% & 2 mm [(i), (j) and (k)]. The original MR image is shown in (a).

Supplementary Video-clip

Supplementary Video-clip 1. Pseudo-CT image construction with the dual model HU conversion technique. The Video-clip progresses as follows; an original MR image adopted for the conversion is illustrated (time period 0:04–0:08), the HU conversion is turned on (0:09) and the method retrieves the mandatory pre-contoured bone and body segments (also the target volume and OAR segments are illustrated), the MR image intensity values are recognized by thresholds and transformed into HUs by following the separate conversion models within and outside of bone segment (0:10–0:37), and the resulted pseudo-CT image series is illustrated slice by slice (0:38–1:19). This pseudo-CT image represents an average case considering the local HU accuracies.

Supplementary Table I. Dose distribution comparisons between the standard CT images and the pseudo-CT images^a with variable-sized bone segments. The percentages of dose points that passed the local 2D Gamma index criteria^b are shown as mean $\pm$ SD (range) for 15 prostate cancer patients.

		Additional systematic error in bone segment						
Plan	Criteria	−3 mm	−2 mm	−1 mm	0 mm	+ 1 mm	+ 2 mm	+ 3 mm
VMAT ^c	1% & 1 mm	80 ± 9 (58–92)	82 ± 8 (62–94)	88 ± 5 (74–96)	88 ± 4 (79–96)	86 ± 6 (71–94)	79 ± 9 (56–90)	74 ± 11 (47–89)
	2% & 2 mm	97 ± 3 (88–100)	98 ± 2 (91–100)	99 ± 1 (97–100)	99 ± 0 (99–100)	99 ± 1 (97–100)	98 ± 2 (91–100)	96 ± 3 (86–99)
	3% & 3 mm	100 ± 1 (96–100)	100 ± 1 (98–100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (99–100)	99 ± 1 (98–100)
IMRT ^d	1% & 1 mm	88 ± 8 (75–98)	91 ± 7 (78–99)	97 ± 4 (88–100)	98 ± 2 (95–100)	97 ± 3 (88–100)	91 ± 7 (75–99)	87 ± 8 (68–99)
	2% & 2 mm	98 ± 3 (93–100)	99 ± 1 (95–100)	100 ± 0 (99–100)	100 ± 0 (all 100)	100 ± 0 (all 100)	99 ± 2 (94–100)	99 ± 3 (89–100)
	3% & 3 mm	100 ± 0 (99–100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (all 100)	100 ± 0 (all 100)

^aThe pseudo-CT images were constructed by the dual model HU conversion technique transforming the intensity values of T_1/T_2^* -weighted in-phase MR images into HUs by following separate conversion models within and outside of bone segment; ^b The dose evaluations were conducted for a transversal image slice, which included as many pelvic bones as possible (such as the femoral heads, the greater trochanters, the acetabulums, the pubic bone and the coccyx). Doses below 20% of the maximum dose were suppressed from the analysis; ^c The 360° VMAT plans were calculated with the XVMC algorithm by 0.5% MC uncertainty and 0.2 cm grid-size; ^d The seven-field IMRT plans were calculated with the AAA by 0.1 cm grid-size.