Innovation/impact: We consider this study to be innovative because it examines the **improvement of segmentation accuracy from Cone-beam computed tomography (CBCT) enhancement** while previous studies mostly focused on image quality improvement alone. Also, **previous work usually either use GAN or UNET and we innovatively combined both architecture for CBCT enhancement.** In online adaptive therapy using CBCT, organs at risk (OARs) must be segmented accurately with little or no edit required. Varian Ethos leverage iterative reconstructed CBCT (iCBCT) to help with the segmentation and dose calculation. However, it is only limited to one platform. This study aims to develop a CBCT enhancement model for most Linacs that does not have iCBCT capability. If successful, this will enable online adaptive therapy for all platforms.

Key results: Figure 1 shows the cycleGAN&U-Net architecture. By enhanced CBCT image quality, the auto-segmentation was able to achieve more accurate segmentation, as shown in Figure 2 as an example. Table 1 and Figure 3 shows the improvement of DSC, HD95, MSD and SDSC for OARs studied. Kidneys, Liver showed a statistically significant improvement. Spleen also showed decent improvement in both DSC and SDSC. The stomach showed large variations.

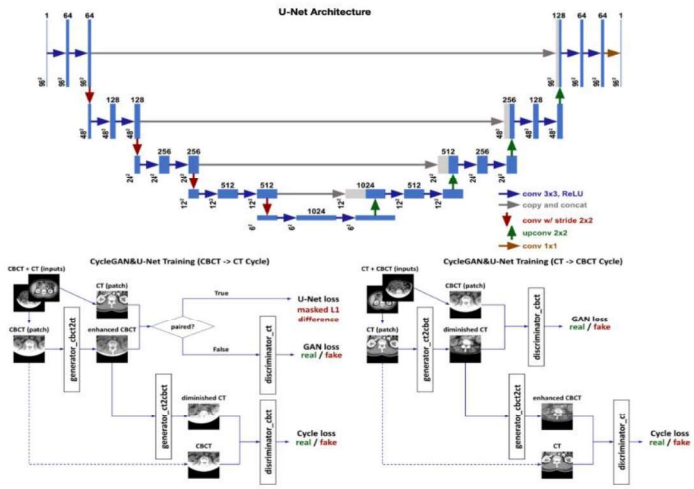

Figure 1 The 4-layer UNet structure with 96x96 input patch size is shown upper side. Two training cycles are shown lower side.

	Kidney_L			
	DSC	SDSC	HD95(mm)	MSD(mm)
Original CBCT	0.72±0.18	0.55±0.18	11.46±4.90	4.06±2.16
Enhanced CBCT	0.75±0.26	**0.68±0.23**	11.71±7.08	3.88±4.01
	Kidney_R			
	DSC	SDSC	HD95(mm)	MSD(mm)
Original CBCT	0.73±0.14	0.56±0.15	11.84±5.48	3.98±1.63
Enhanced CBCT	0.78±0.22	**0.72±0.23**	10.82±8.69	3.46±3.25
	Liver			
	DSC	SDSC	HD95(mm)	MSD(mm)
Original CBCT	0.81±0.08	0.48±0.15	17.43±3.30	5.12±1.20
Enhanced CBCT	**0.85±0.06**	**0.63±0.07**	19.02±7.79	4.43±1.29
	Spleen			
	DSC	SDSC	HD95(mm)	MSD(mm)
Original CBCT	0.68±0.25	0.53±0.25	14.32±8.95	5.02±3.43
Enhanced CBCT	0.72±0.28	0.65±0.26	14.16±10.83	4.77±4.95
	Stomach			
	DSC	SDSC	HD95(mm)	MSD(mm)
Original CBCT	0.52±0.30	0.34±0.22	41.83±48.76	22.26±43.38
Enhanced CBCT	0.54±0.24	0.40±0.16	33.58±12.93	10.80±4.99

Table 1 Geometric accuracy of abdominal organs auto-segmentation on original CBCT and enhanced CBCT

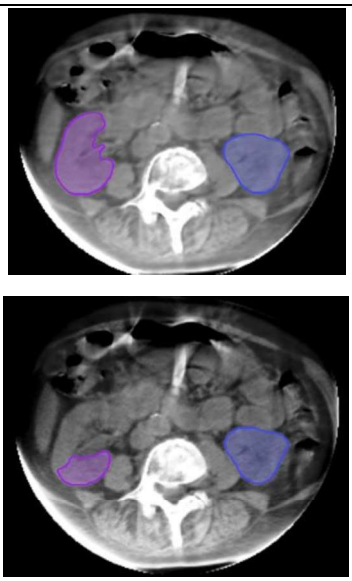

Figure 2 Example of contouring accuracy improvement with CBCT enhancement.

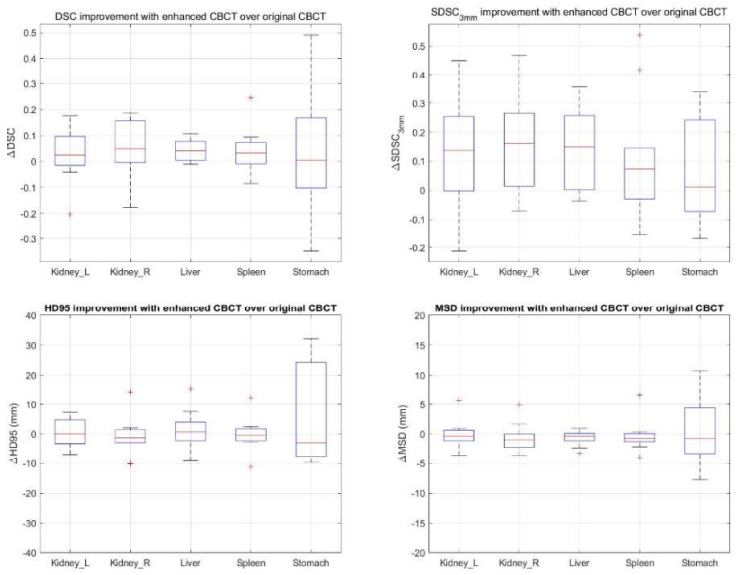

Figure 3 Geometrics improvement of contouring accuracy with CBCT enhancement. The **Bold font indicates statistical significance (p<0.05)** compared with original CBCT