

INFLUENCE OF NEW CONTRAST AGENT ON CT BASED RADIOTHERAPY TREATMENT PLANNING

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Purpose/Objective

The patient is often given a contrast agent, to improve visibility of an organ for contouring purposes. The contrast agent is given by nurses or RTTs, and must reflect the density of an organ, but also allow better visualisation. This particular study was done to determine the appropriate concentration of a new contrast agent which was used in the same manner as the previously used type. Due to high atomic number of a contrast agent, large value of a CT number is obtained, if inappropriate concentration is used. High HU value in TPS correlates to the high density of tissue, which certainly will change the treatment planning result as contrast area is seen by TPS as high density material .

Materials/Methods

The newly purchased contrast agent was used to mark vagina in gynecological patients, according to the prescription for an old type of contrast agent. The first patient scanned on CT gave glowing white area instead of vagina, after which the investigation and study were done. The cylindrical phantom with inserts was CT scanned and analyzed. The inserts were filled with contrast agent of different concentrations. The evaluation was done, and new prescription was issued for the use of new contrast agent.

Results

The concentrations of 100%, 50%, 25%, 12.5%, 6.25%, 5%, 2.5%, 1.25%, 0.65% and 0.325% were made and CT scanned. The HU values accordingly were obtained: 3071 HU, 3071 HU, 1822 HU, 117 HU, 668 HU, 440 HU, 356 HU, 291 HU, 123 HU and 56 HU. The prescription given for the new contrast was set to 1.25%, that is 12.5 ml to 1 l of water. The prescription for previous contrast agent was 25 ml to 1 l of water. It was concluded that the high concentration of contrast agent in the treatment planning system, may influence up to 6% on the time of irradiation, depending on the concentration of an agent. High concentration of the agent causes underestimation of a dose, and consequently overirradiation of a patient.

Conclusion

Concentration of a contrast agent must be as low as possible, so that its influence on treatment planning result is minimized, but also visibility enhanced. The upper limit in HU units, is locally set to be less than 350 HU, as this does not change significantly the result of treatment planning. In case patient is scanned with higher concentration, the area must be manually adjusted in the TPS.

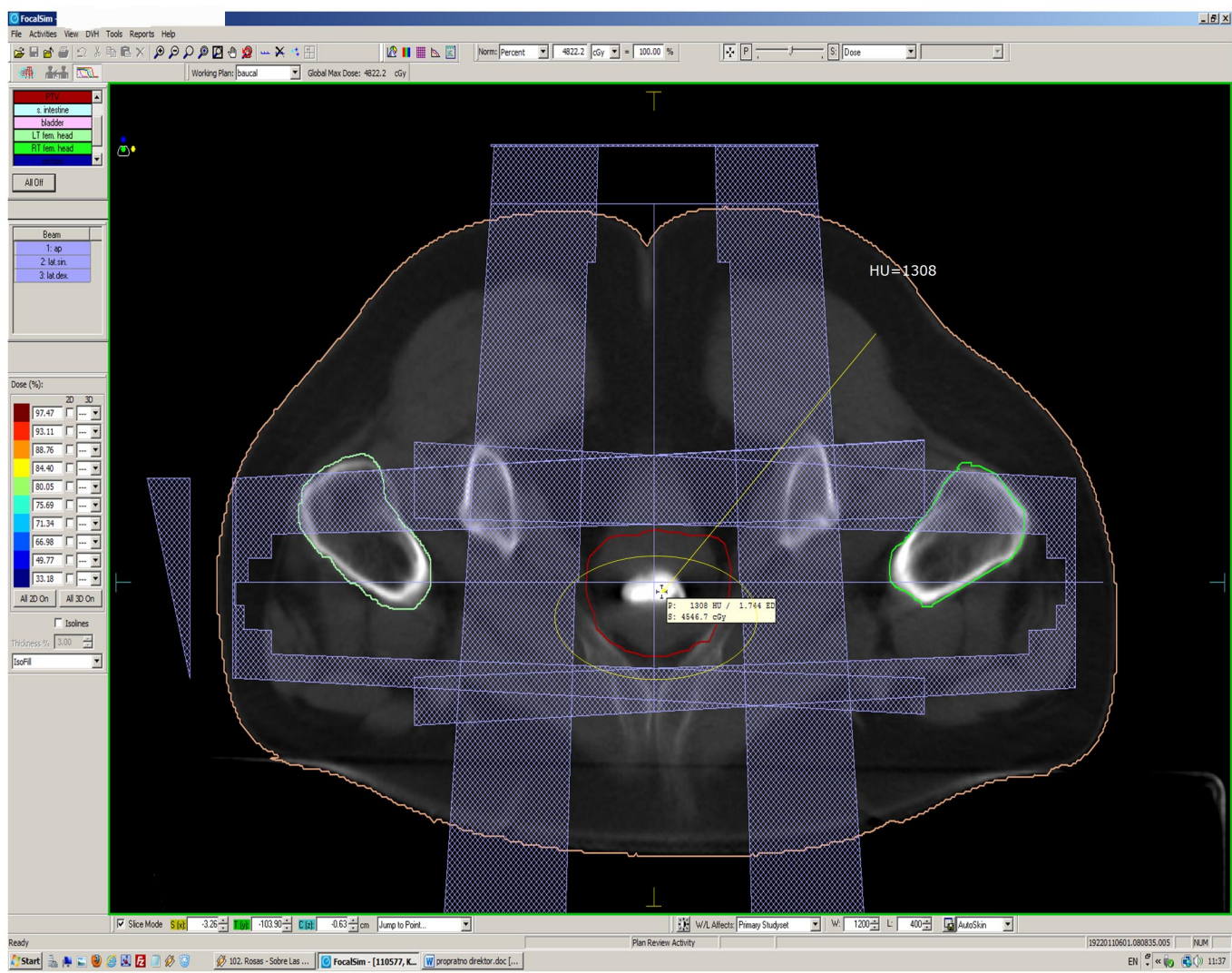


Fig 1. After new contrast agent was purchased, Patient 1 is CT scanned according to previously adopted prescription, giving the white blowing area of the contrast agent in vagina

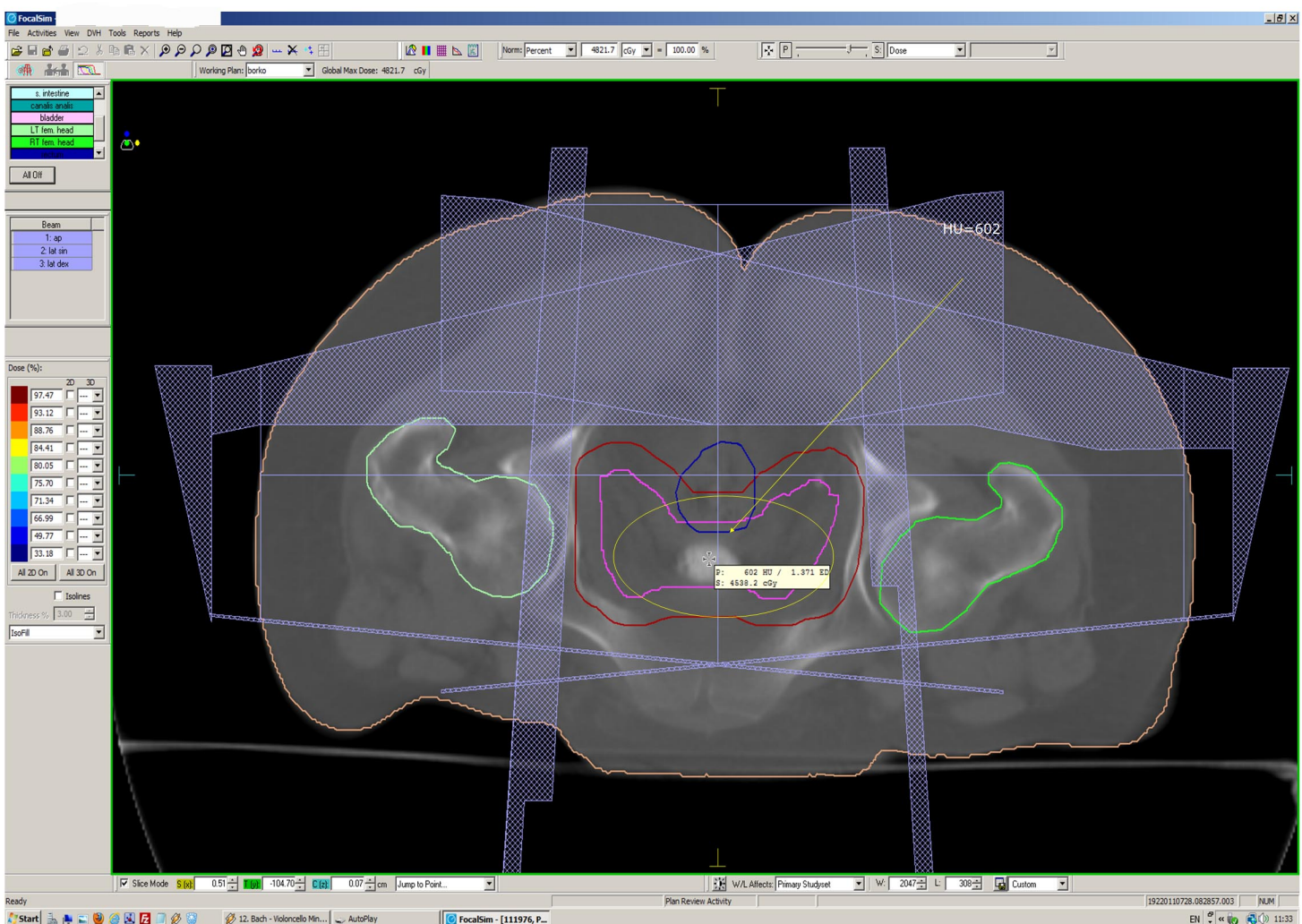


Fig 2. Another patient scanned with diluted contrast agent, after which study with phantom was done

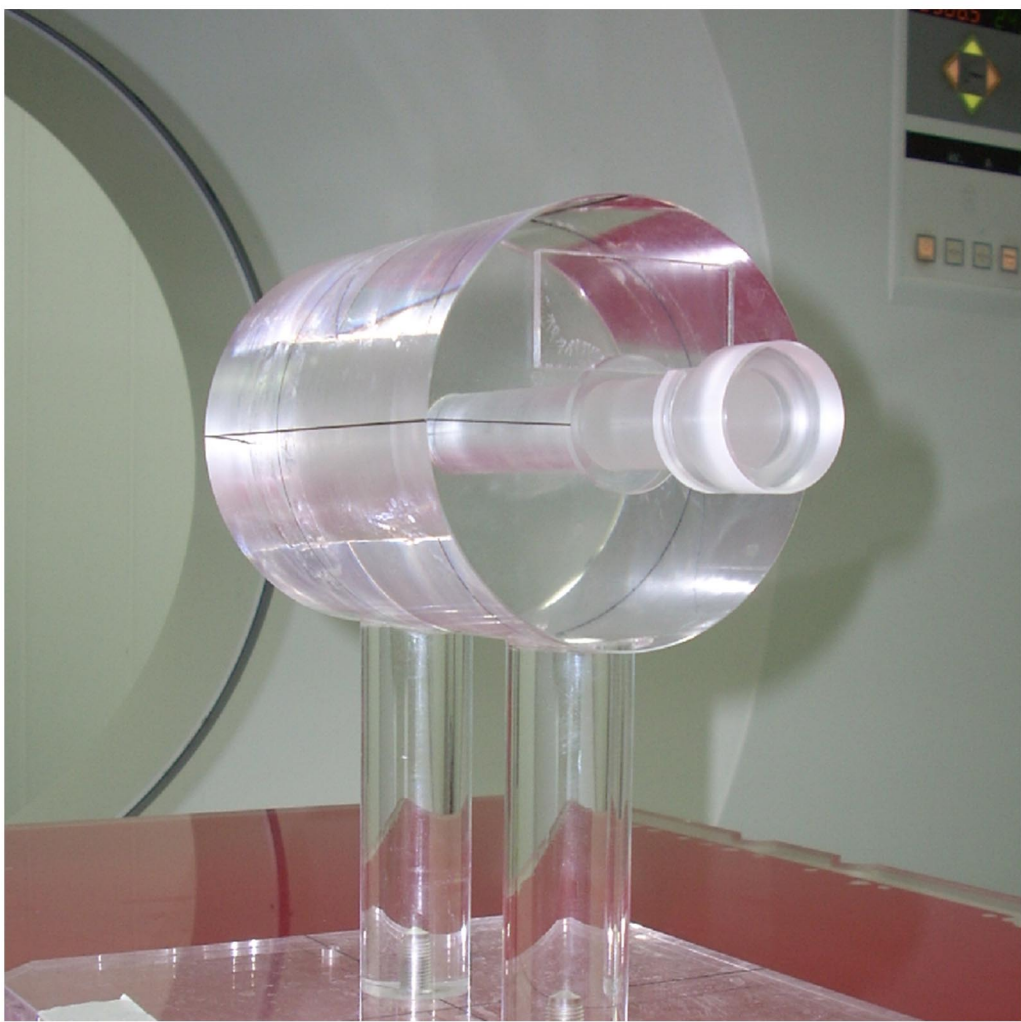


Fig 3. Phantom was used for CT scanning of inserts of different concentrations of ultravist.

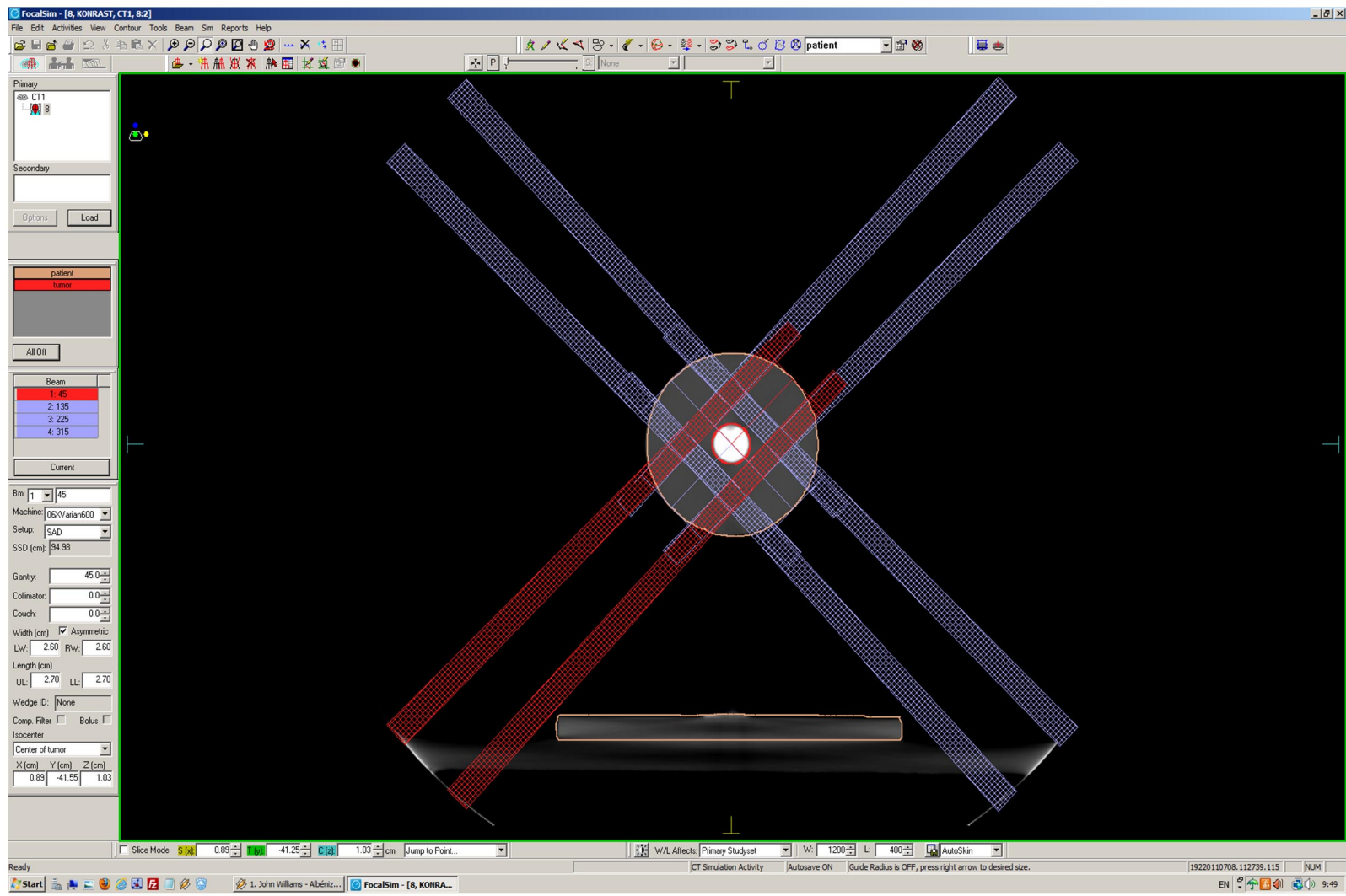


Fig 4. Treatment plan of the phantom with inserts of different concentrations. The plan was also used for evaluation of CT number.

	Concentration of ultravist (%)										water	Pb ball	PMMA	air	bone
	0,325	0,65	1,25	2,50	5,00	6,25	12,5	25,0	50,0	100,0					
MU	228,4	229	228,8	228,9	229,3	232,1	241,9	239,1	243,6	242,7	229,2				
(CT HU)	56	123	291	456	440	668	1117	1822	3071	3071	-4	2800	130	-1000	785

Tab 1. Tabular presentation of correlated data concentration of ultravist vs read CT number, with the resulted number of MUs calculated from the four filed treatment plan on phantom.

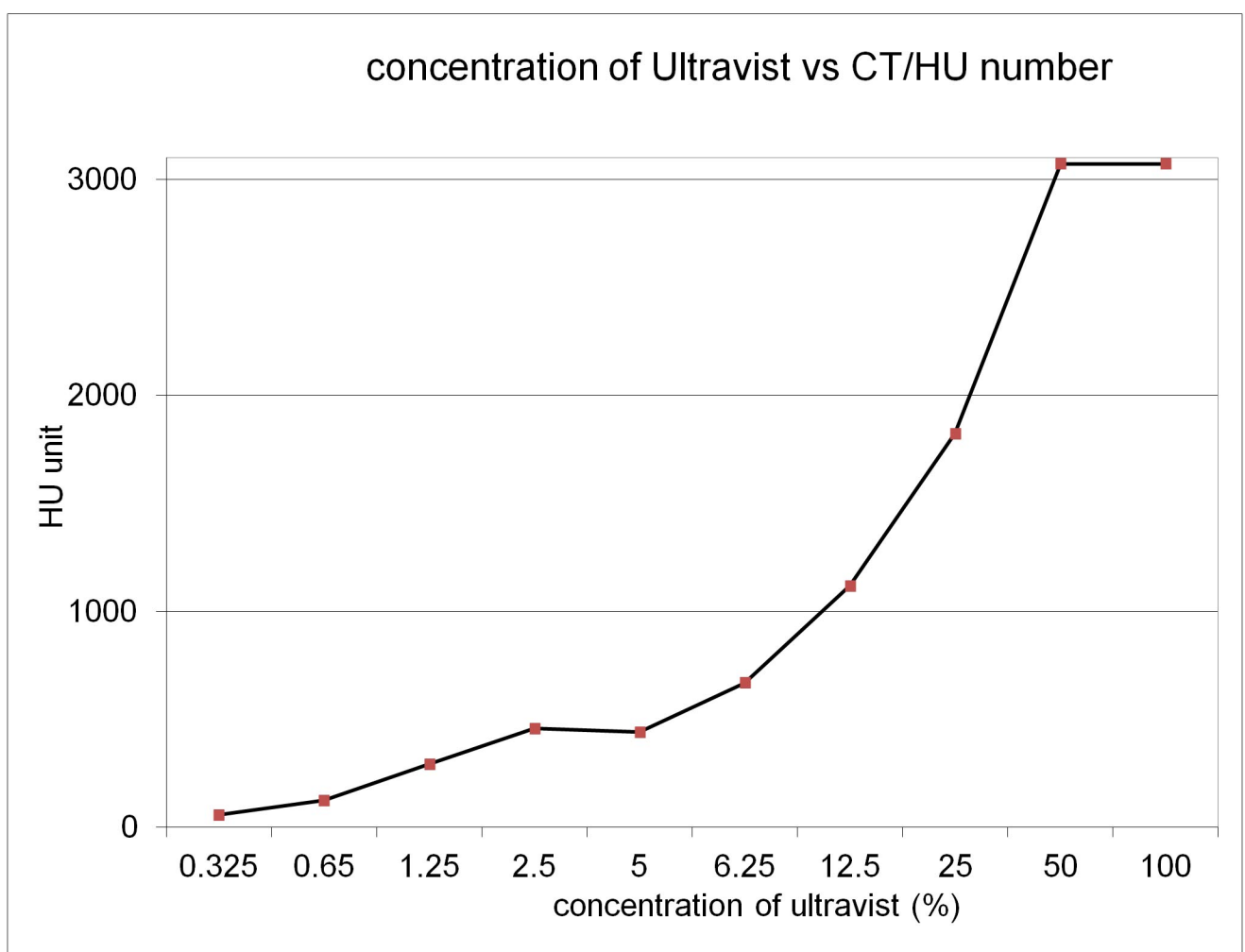


Fig 5. Graphical presentation of data presented in Tab 1.

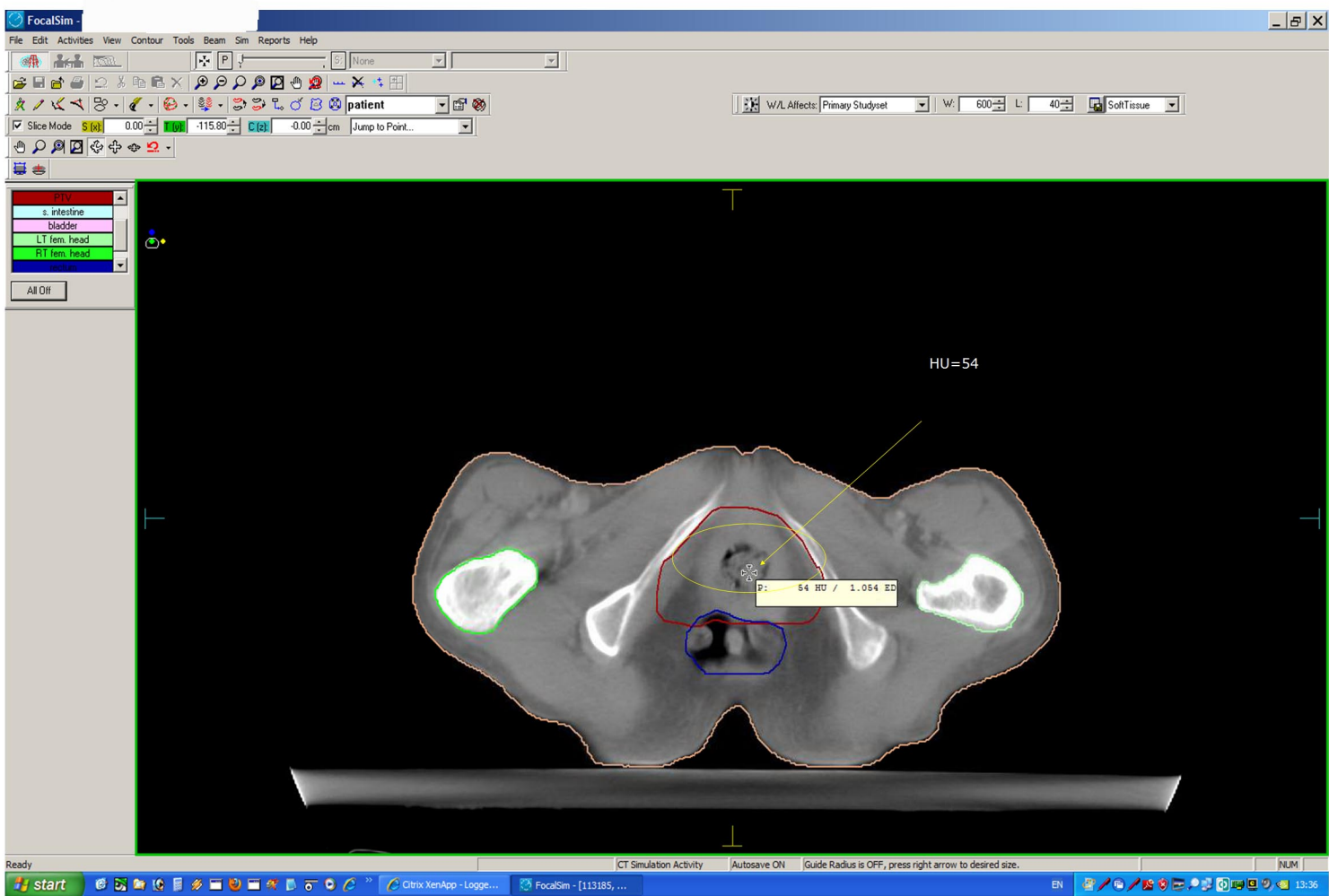


Fig 6. Patient CT scanned according to recommended concentration of ultravist