



Physics of Computed Tomography

Second Semester

practical part- Experiment -1

Weak 4: Window Width and Window Level

By

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➤ Windowing

Windowing is the process in which the CT image grayscale of a particular image can be adjusted via the CT numbers; doing this will change the appearance of the picture to highlight particular structures (certain anatomy or pathology).

-This is typically done by the technologist or radiologist to better demonstrate certain anatomy or pathology.

*The **window width (WW)** is the range of the grayscale that can be displayed.

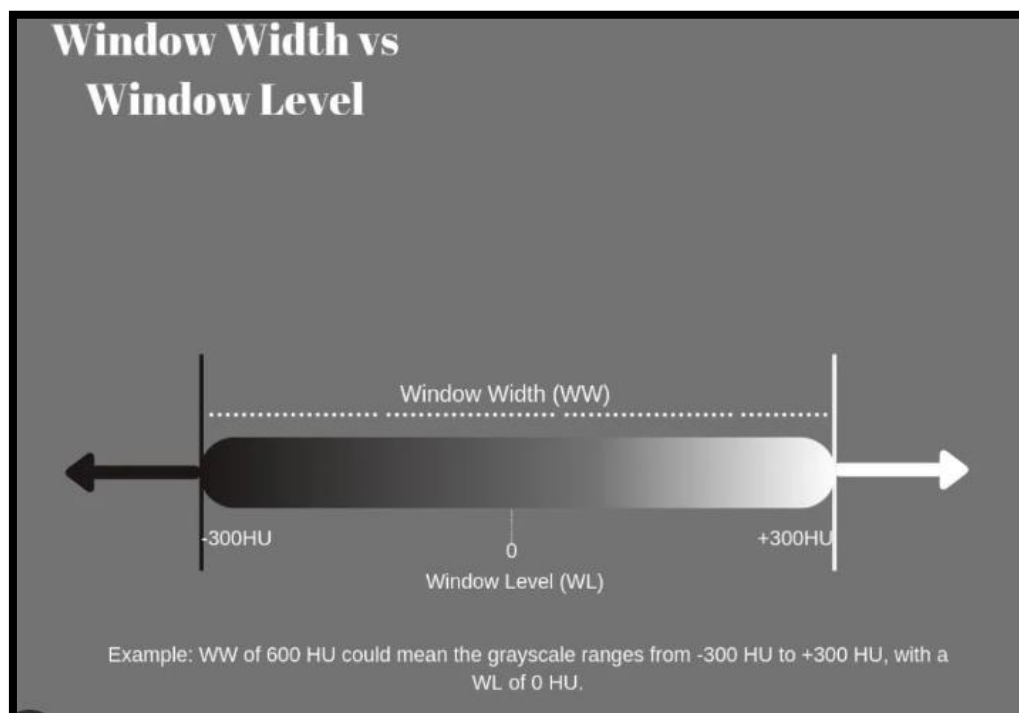
➤ **The window level (WL):** often also referred to as **window center**, is the midpoint of the range of the CT numbers displayed.

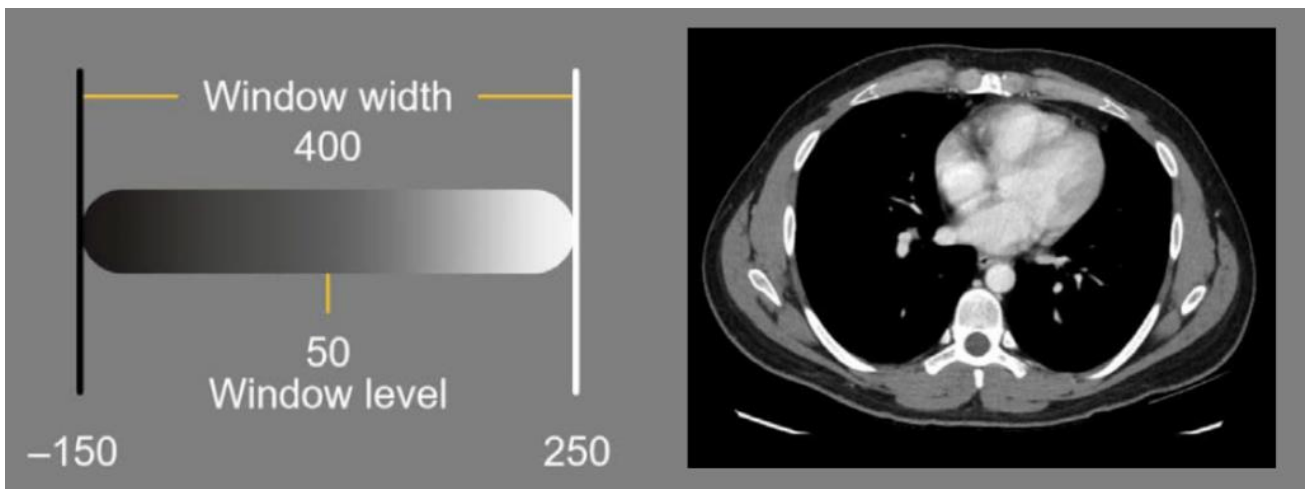
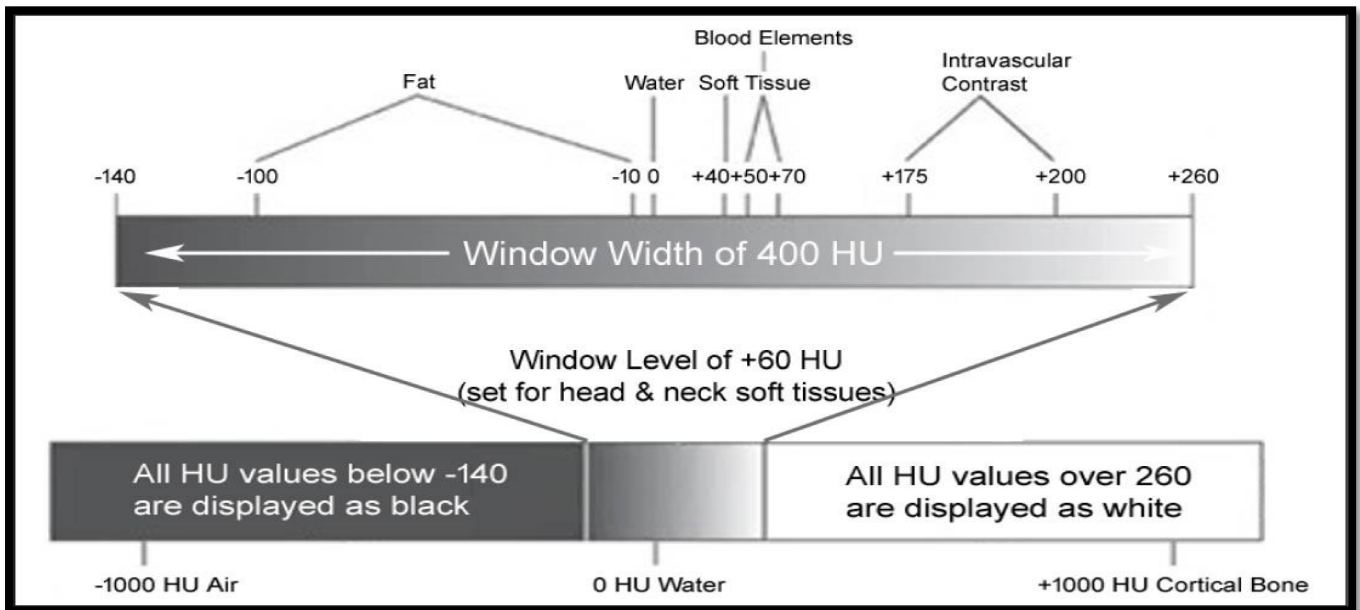
➤ **Upper and lower grey level calculation**

When presented with a WW and WL one can calculate the upper and lower grey levels i.e. values over **x** will be white and values below **y** will be black

the upper grey level (x) is calculated via $WL + (WW \div 2)$

the lower grey level (y) is calculated via $WL - (WW \div 2)$





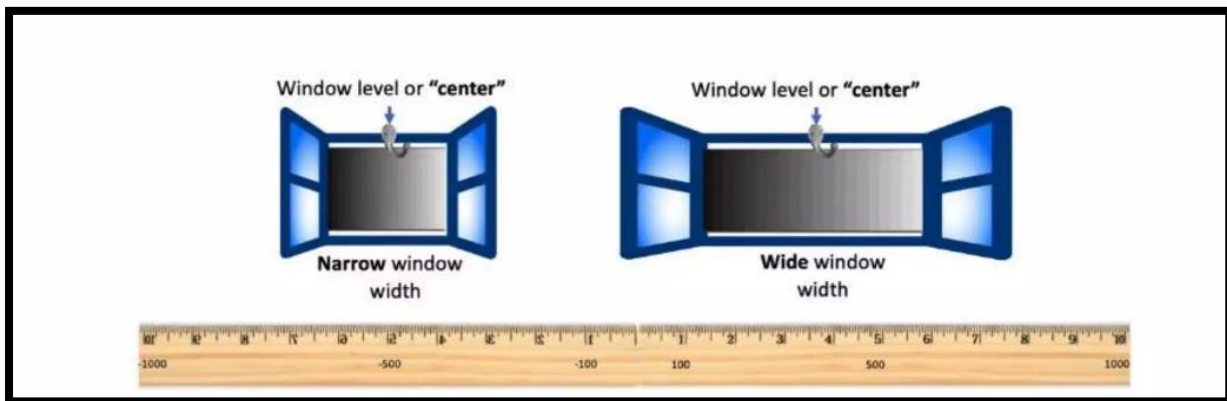
A **large window width** means there is a **long grayscale** and the transition from **black to white will take longer**.

A **narrow window width** means the transition from **black to white will take place much faster**. Some examples of WW and WL are listed below:

WW of 2000 HU, with a WL of 0 HU, could mean the grayscale ranges from -1000 HU to +1000 HU.

WW of 100 HU, with a WL of +50 HU. could mean the grayscale only ranges from 0HU to +100 HU

WW of 600 HU, with a WL of 0 HU. Could mean the grayscale ranges from -300 HU to +300 HU



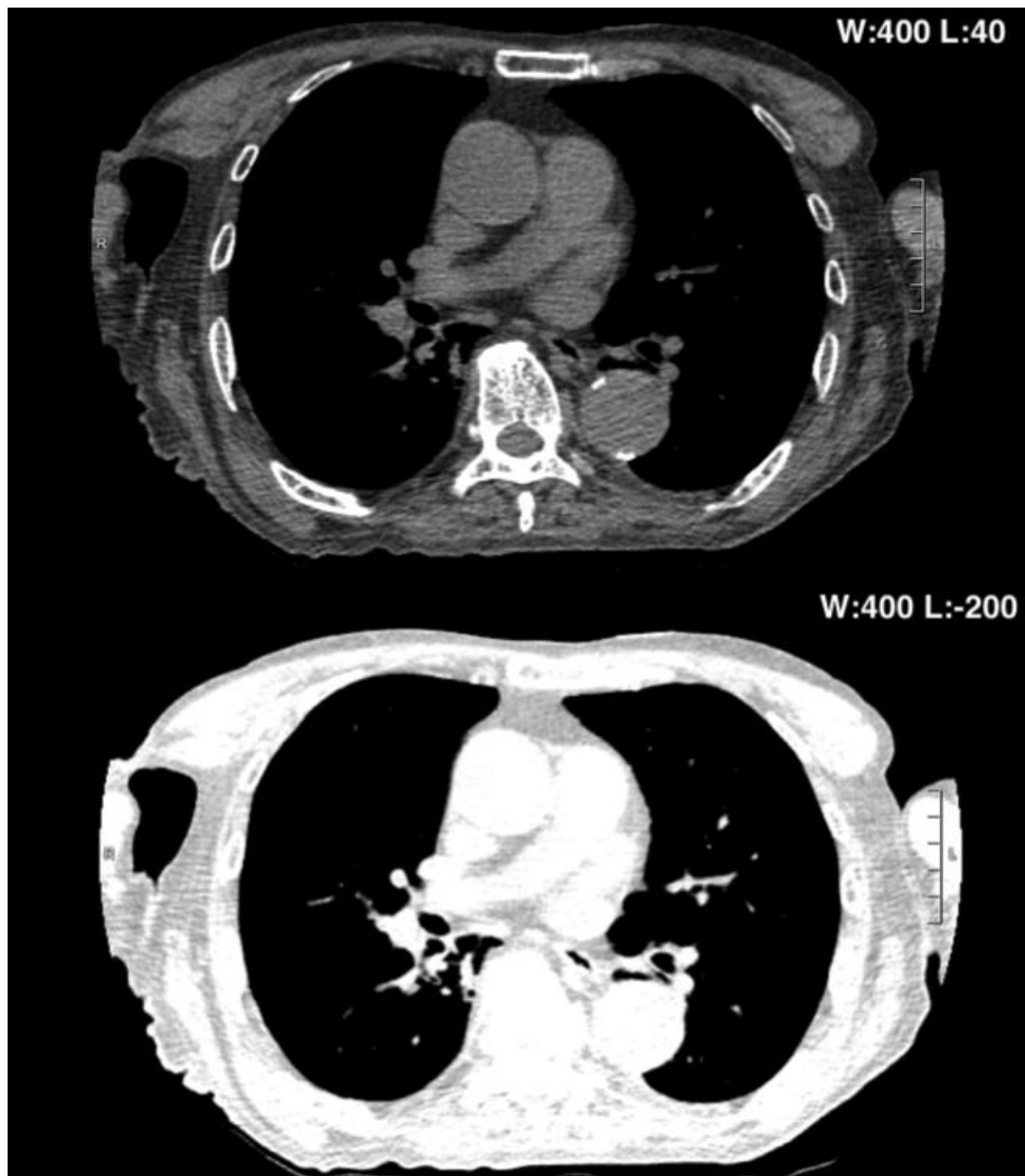
Displays narrow range of pixels	Displays wide range of pixels
Best for stuff with similar attenuation values	Best for stuff with markedly different attenuation values
Soft tissues	Lungs
WW=50-350	WW=400-2000
If the WW decreases, the contrast increases.	if the WW increases, the contrast decreases.

***If the abdomen** is the area that is being imaged, it is important to **include a wide WW** in order to properly display the **various tissues and densities present in the anatomical area**. It is common for abdomen imaging to contain fat, bone, air, and fluid.

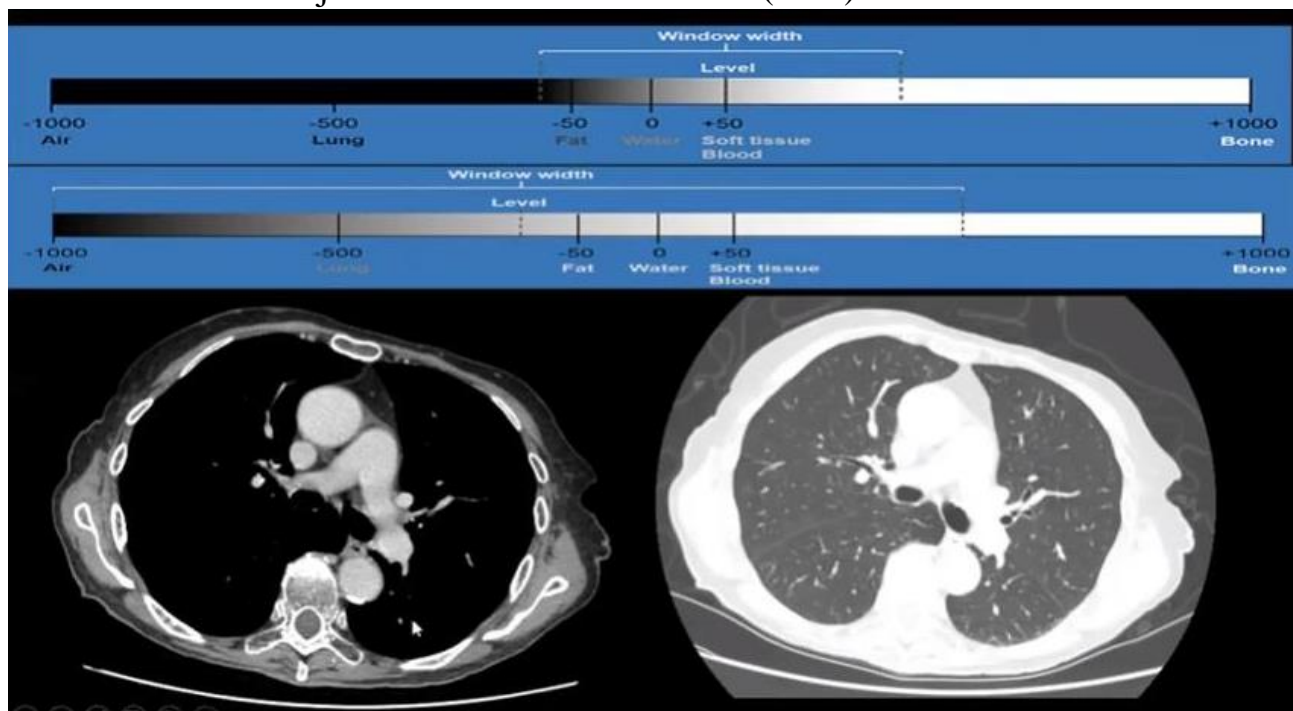
-If the area being imaged contains structures of **similar densities**, a **narrow WW** should be utilized to properly display the differences between the structures with **similar attenuation**.

-The WL should be set so that it is **near the CT number** for the area of interest that is being imaged.

By adjusting the WW, the contrast of the image can be changed.



a-The **contrast** is adjusted via the **window width** (WW).



b-***The brightness** of the image is adjusted via the **window level** (WL).

