

Lecture information

Lecture Number: 2

Lecture Title: General Introduction to Physics of Computed Tomography

Target Audience: Second-year students – Radiology Techniques Department

Suggested Duration: 90 Minutes Lecture + 30 Minutes Discussion

OUTLINES:

- **Basic idea of CT image.**
- **CT image matrix.**
- **CT image pixel and voxel.**
- **How does the CT image depend on attenuation correction and form the image matrix?**
- **CT number (Hounsfield Unit HU).**
- **Different ranges of HU.**
- **Examples of calculating HU.**
- **Some questions on the lecture contents.**

Learning Objectives

By the end of this lecture, students should be able to:

- Explain the fundamental limitations of conventional radiography (superimposition) and how Computed Tomography addresses it through slice acquisition.
- Describe the basic scanning geometry of a CT system, including the roles of the rotating X-ray tube and detectors.
- Differentiate between the concepts of image matrix, pixel (2D picture element), and voxel (3D volume element), and explain the influence of slice thickness on the voxel.
- Define the Linear Attenuation Coefficient (μ) and explain its role in determining the shade of gray assigned to a pixel during image reconstruction.
- Define the Hounsfield Unit (CT Number) and justify why water is used as the calibration reference point for the scale.
- Recall the approximate Hounsfield Unit values for common materials, including air, lung, fat, water, soft tissue, and bone.
- Apply the standard Hounsfield Unit formula to calculate the specific CT number of a tissue when given the attenuation coefficients of that tissue and water.