**Subject Name: Biomedical Instrumentation Design II 2**

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**Lecture No.: 4**

**Lecture Title: Data Acquisition, Part 2.**

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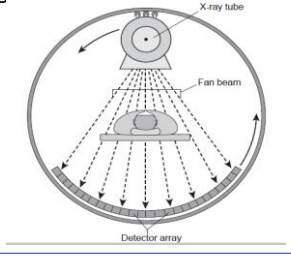
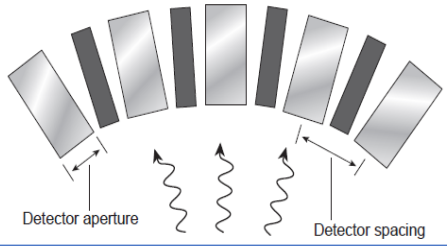
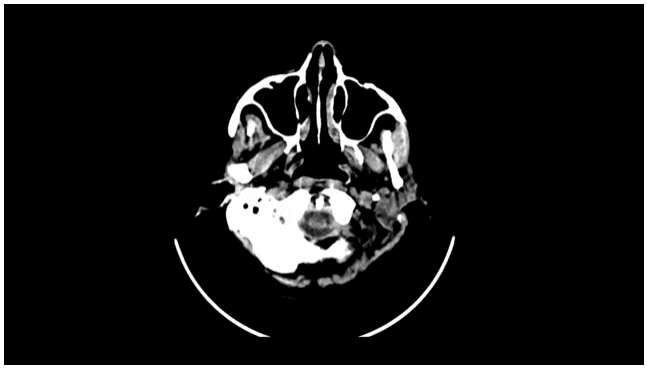
# Data Acquisition, Part 2

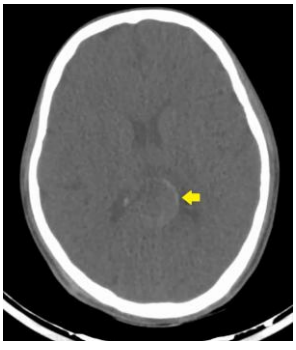
- Third-generation CT scanner.
- Reference detectors are typically located at either end of the detector array to measure the unattenuated x-ray beam.
- The rotating detector design allows all of the readings that make up a view to be recorded instantaneously and simultaneously >>> thus reducing scan times and patient motion artifacts. resulting from patient motion.
- An advantage of the third-generation system is that the tube is directly focused on the detector array.



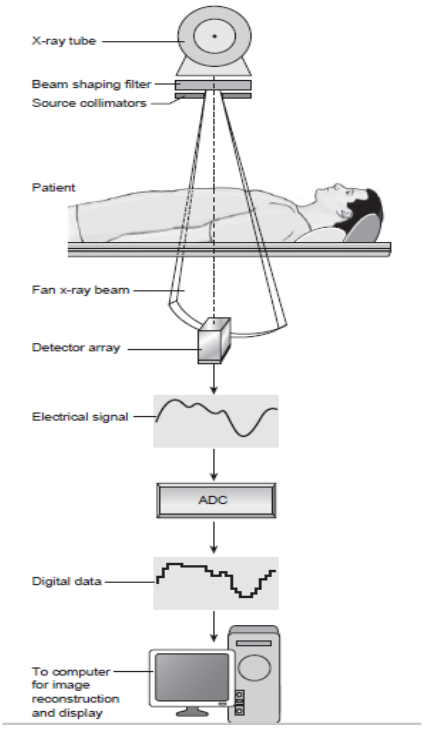



- A disadvantage of the third-generation design is the more frequent occurrence of ring artifacts. Because the same bank of detectors is used repeatedly, *even a very small misalignment of a single detector will result in a visible ring artifact*.

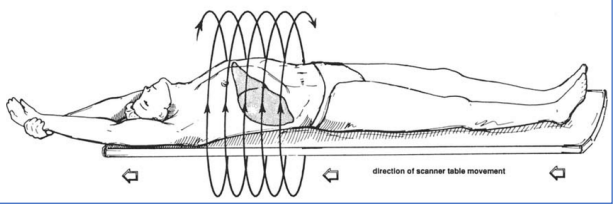




- ***Detector Electronics***
- X-ray photons that strike the detector must be measured, converted to a digital signal, and sent to the computer.
- This is accomplished by the data-acquisition system (DAS), which is positioned within the gantry near the detectors.
- Signals emitted from the detectors are analog (electric), whereas computers require digital signals. Therefore, one of the tasks of the DAS is to convert the analog signal to a digital format.
- To measure the x-ray photons that have penetrated the patient, the DAS samples the detectors as many as 1,000 times per second.



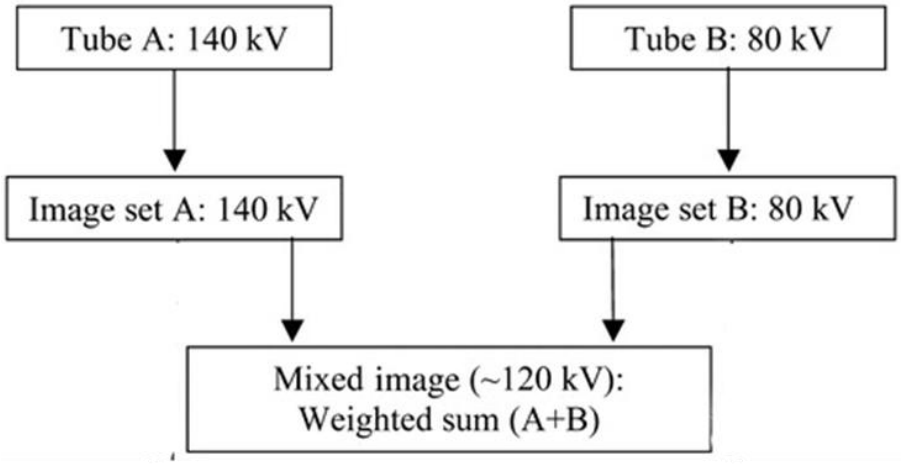

- ***Patient table***
- The patient lies on the table (or couch) and is moved within the gantry for scanning.
- The process of moving the table by a specified measure is most commonly called incrementation, feed, step, or index.
- Helical CT table incrementation is quantified in millimeters per second because the table continues to move throughout the scan.
- The degree to which a table can move horizontally is called the scannable range, and will determine the extent a patient can be scanned without repositioning.



# CT GANTRY CONTROL PANEL

1. Gantry Tilt (+/-30 degrees).
2. Laser Alignment Lights on/off.
3. Couch in/out.
4. Free (manual) Couch Movement.
5. Zero Couch Position.
6. Couch up/down.
7. Home Button (couch out & down).


- ***Dual Energy CT (DECT)***
- Dual-energy CT, also known as spectral CT, is a computed tomography technique that uses two separate x-ray photon energy spectra, allowing the interrogation of materials that have different attenuation properties at different energies.
- Whereas conventional single-energy CT produces a single image set, dual-energy data (attenuation values at two energy spectra) can be used to reconstruct numerous image types:
- Weighted average images (simulating single energy spectra).
- Virtual monoenergetic images (attenuation at a single photon energy rather than a spectrum).




- ***material decomposition images:*** is a method for differentiation and quantification of materials in a sample and it utilizes the energy dependence of the linear attenuation coefficient, i.e. mapping or removing substances of known attenuation characteristics, such as iodine, calcium, or uric acid):
- virtual non-contrast images (iodine removed).
- Iodine concentration (iodine maps): used to detect pulmonary embolism (PE) with CT angiography.
- Calcium suppression (calcium removed (CaSupp)): used to observe bone marrow edema by removing calcium components from the image.
- Uric acid suppression (uric acid removed): used for the diagnosis of gout. It is a good noninvasive alternative to synovial fluid aspiration.

# THANK YOU