SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF RADIOGRAPHY TECHNOLOGY

COURSE NAME: GENERAL PHYSICS , RADIATION PHYSICS& PHYSICS OF DIAGNOSTIC RADIOLOGY

UNIT -5 PHYSICS OF DIAGONESTIC RADIOLOGY

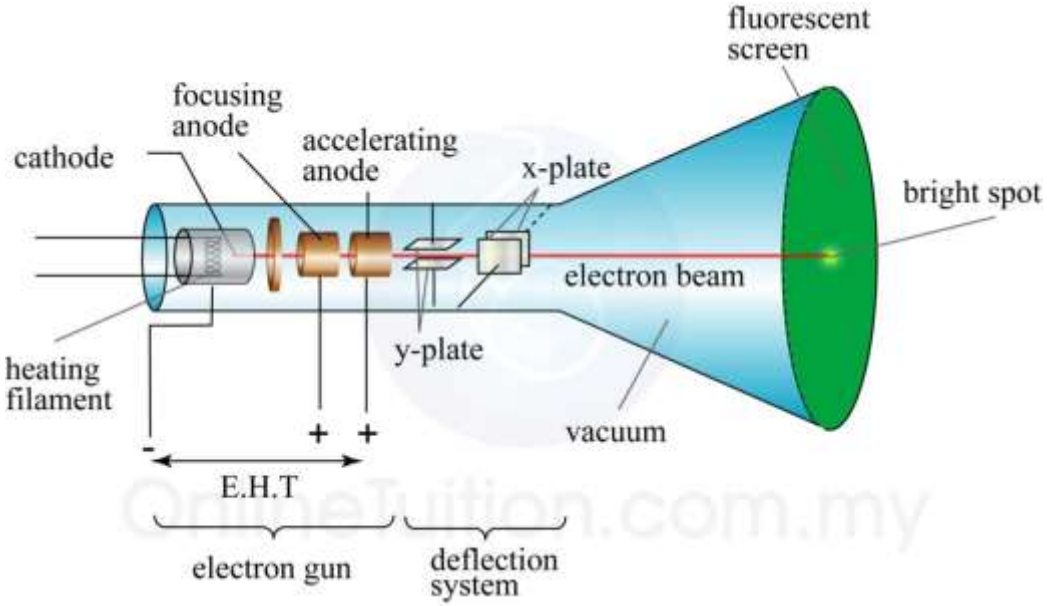
TOPIC :CATHODE RAY OSCILLOSCOPE

FACULTY NAME: MS.M.DHANALAKSHMI

CATHODE RAY OSCILLOSCOPE – {define}

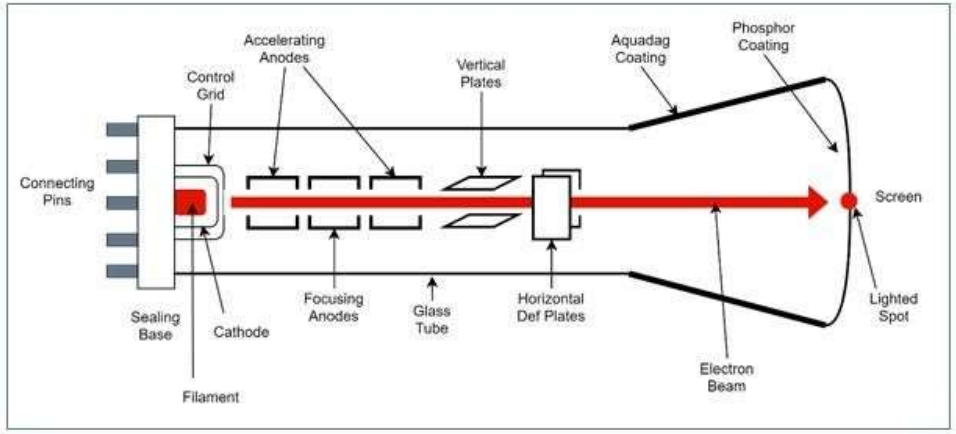
❖ INTRODUCTION

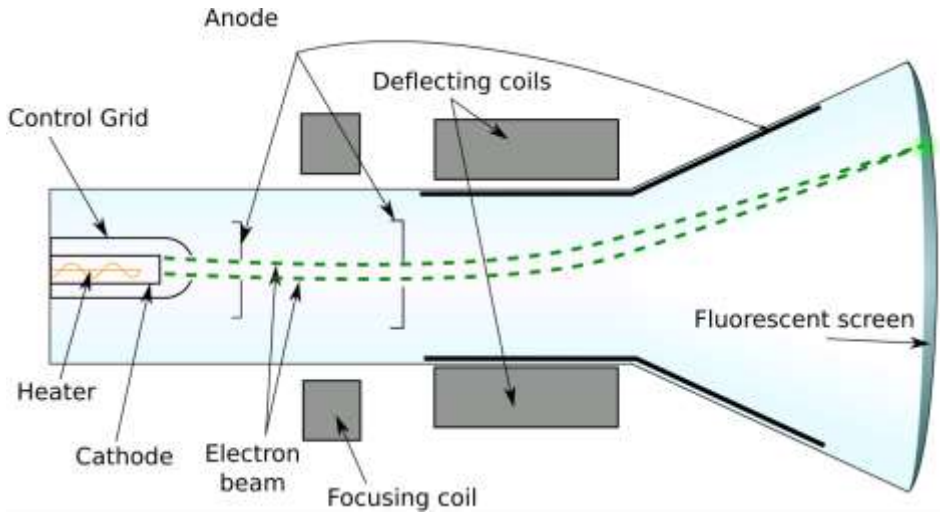
- ❖ CRO is an electronic instrument to display voltage waveforms.
- ❖ Converts electrical signals into visible traces on a fluorescent screen.
- ❖ Main part: Cathode Ray Tube (CRT).
- ❖ Used in physics labs, medical ECG, and radiology signal analysis.
- ❖ Displays amplitude, frequency, and phase of signals



CATHODE RAY TUBE (CRT) CONSTRUCTION

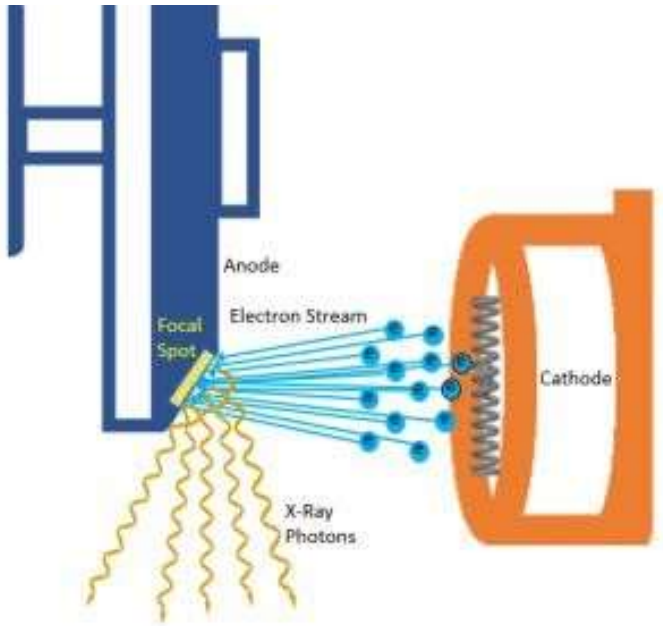
- Evacuated glass envelope with fluorescent screen (phosphor).
- Electron gun: heated cathode + control grid
- + anodes.
- Deflection plates: X-plates (horizontal) and Y-plates (vertical).
- High voltage (2–20 kV) accelerates electrons.

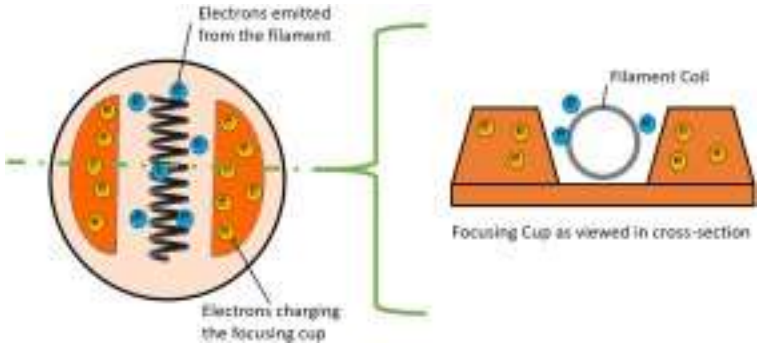




ELECTRON GUN & FOCUSING

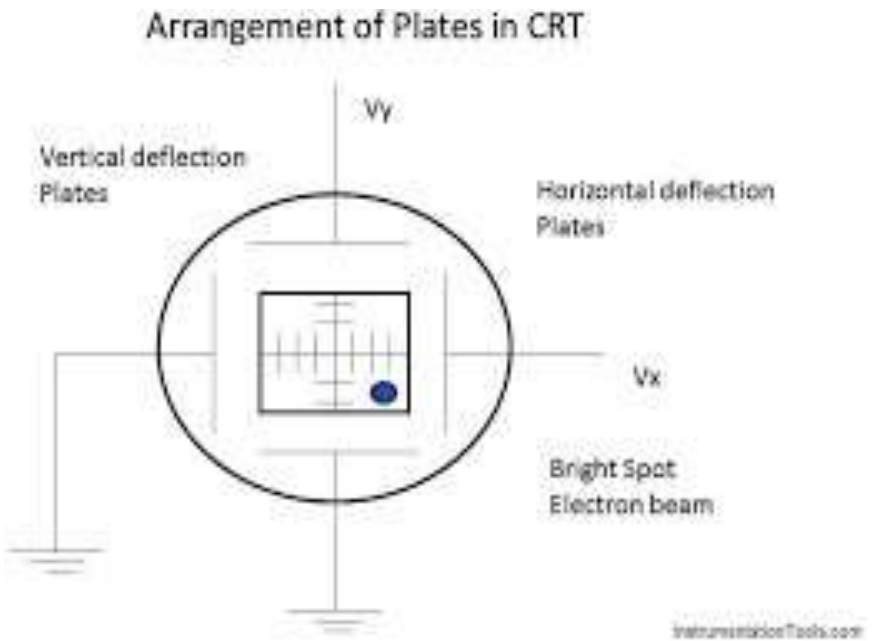
- Cathode emits electrons by thermionic emission.
- Control grid regulates beam intensity (brightness).
- Focusing anode forms narrow electron beam.
- Accelerating anode gives high speed to electrons
- Beam focused into a sharp spot on screen.





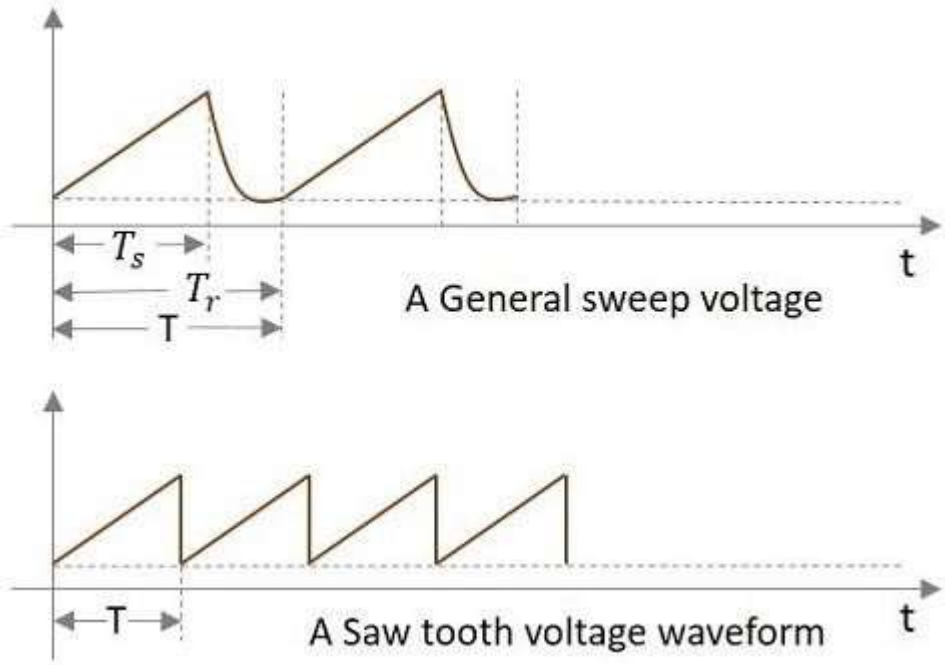
DEFLECTION SYSTEM

- Y-plates control vertical deflection (voltage amplitude).
- X-plates control horizontal deflection (time base).
- Electrostatic deflection: voltage changes beam path.
- Sensitivity: mm/V for Y, ms/div for X.



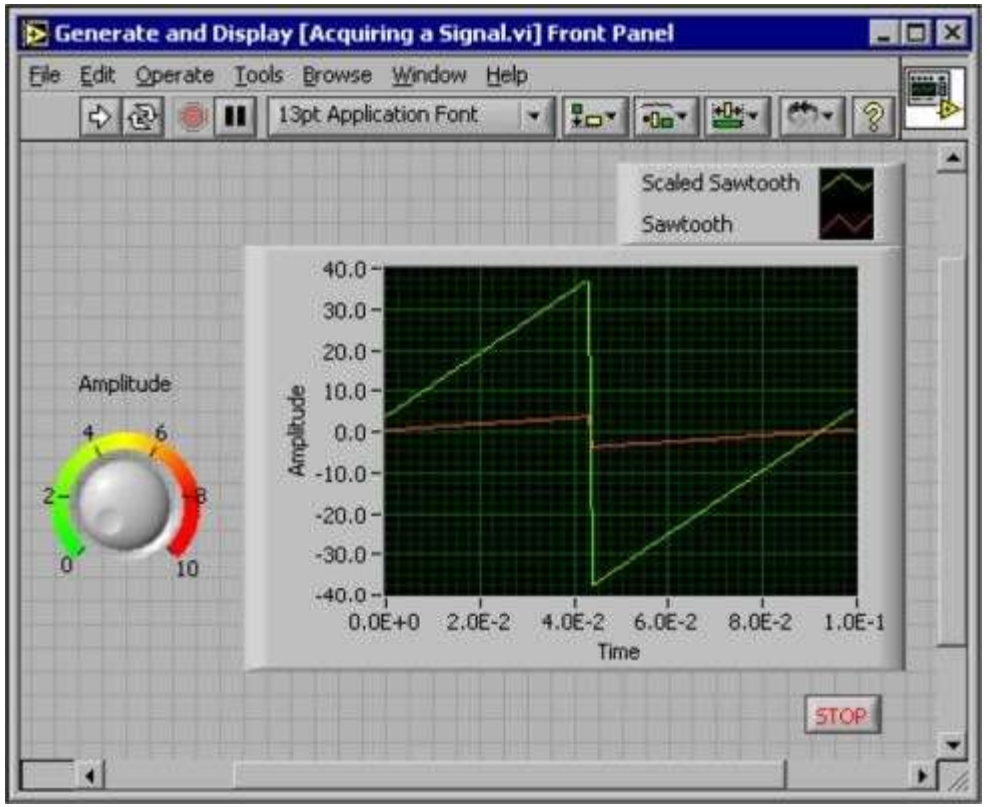
TIME BASE & SWEEP

- Time base generator produces sawtooth voltage for X-plates.
- Sawtooth wave moves beam left to right
- constant speed.
- One cycle = one sweep across screen.
- Trigger circuit synchronizes sweep with input signal.
- Frequency = 1 / (time per division × divisions).



FRONT PANEL CONTROLS

- Intensity: controls electron beam current (brightness).
- Focus: sharpens the spot.
- X-shift & Y-shift: moves trace horizontally/vertically.
- Volts/div & Time/div: set scale for measurement.
- AC/DC/GND switch: couples input signal.



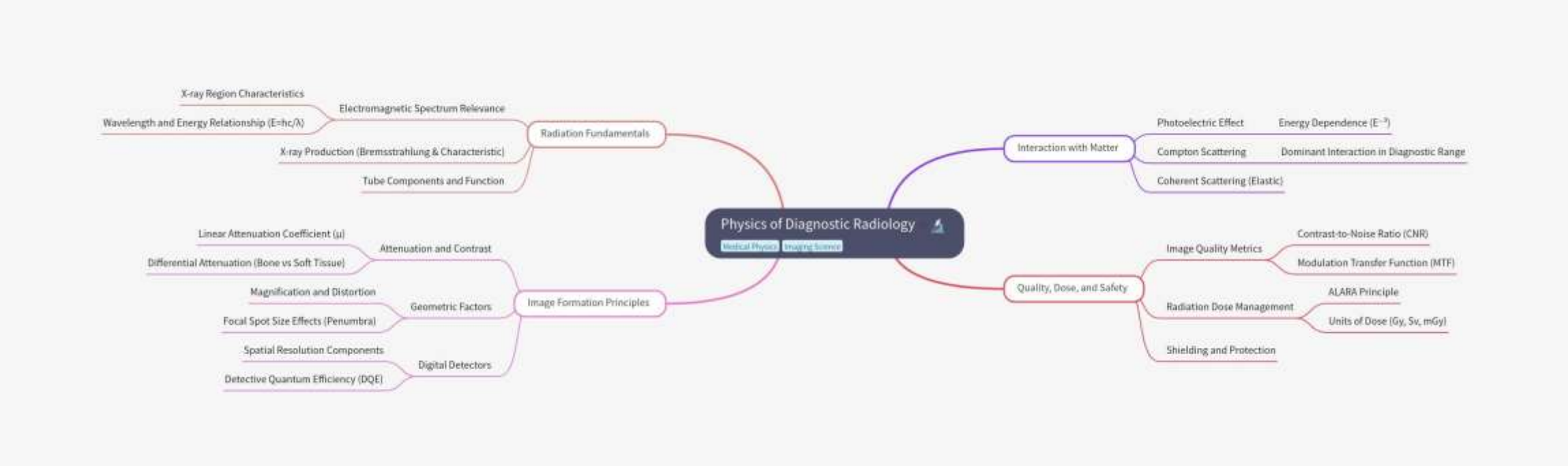
MEASUREMENTS USING CRO

- Voltage: Peak-to-peak height ×volts/div.
- Time period: Horizontal distance × time/div.
- Frequency: f = 1 / T.
- Phase difference: using Lissajous patterns.
- Accurate for sine, square, and pulse waveforms.

APPLICATIONS IN RADIOLOGY

- Displays ECG, EEG, and pulse waveforms in
- medical monitors.
- Tests X-ray generator ripple and timing pulses.
- Calibrates ultrasound and Doppler signals.
- Analyzes kVp waveform in diagnostic X-ray units.
- Teaches waveform analysis in biomedical instrumentation

SUMMARY


Physics of Diagnostic Radiology
Medical Physics
Imaging Science
Radiation Fundamentals
X-ray Region Characteristics
Electromagnetic Spectrum Relevance
Wavelength and Energy Relationship (E=hc/λ)
X-ray Production (Bremsstrahlung & Characteristic)
Tube Components and Function
Image Formation Principles
Attenuation and Contrast
Linear Attenuation Coefficient (μ)
Differential Attenuation (Bone vs Soft Tissue)
Geometric Factors
Magnification and Distortion
Focal Spot Size Effects (Penumbra)
Digital Detectors
Spatial Resolution Components
Detective Quantum Efficiency (DQE)
Interaction with Matter
Photoelectric Effect
Energy Dependence (E⁻³)
Compton Scattering
Dominant Interaction in Diagnostic Range
Coherent Scattering (Elastic)
Quality, Dose, and Safety
Image Quality Metrics
Contrast-to-Noise Ratio (CNR)
Modulation Transfer Function (MTF)
Radiation Dose Management
ALARA Principle
Units of Dose (Gy, Sv, mGy)
Shielding and Protection

REFERENCE

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•**Publisher:** Jaypee Brothers Medical Publishers (2nd Edition, 2014)

2.Basic Radiological Physics

•**Author:** K. Thayalan

•**Publisher:** Jaypee Brothers Medical Publishers (3rd Edition, 2017)

3.Christensen's Physics of Diagnostic Radiology

•**Authors:** Thomas S. Curry III, James E. Dowdey, Robert C. Murry Jr.

•**Publisher:** Lippincott Williams & Wilkins (4th Edition, 1990)