APPH 226: Apparatus and Image Management

Introduction to Equipment Objectives: 1.2, 2.2

Medical Radiologic Technology Program

Types of X-Ray Units

- Diagnostic X-Ray imaging system
  - Tube currents: 100-1200 mA
  - Exposure times: very short, measured in ms
  - Tube voltages: 25 – 150 kVp

- Therapeutic X-Ray Unit
  - Tube current: Below 20 mA
  - Exposure times: 1-60 minutes
  - Tube voltages: 4-40 meV (million electron volts)

Principle Components

- Operating Console
- X-Ray Tube
- High Voltage Generator

Operating Console

- Allows operator to select the exposure factors
- Control the x-ray beam
  - Tube current (mA), voltage (kVp), exposure time (ms)
  - X-ray beam quality and quantity
- Image receptor selection
- Meters display **actual** exposure taken
- Exposure switch is considered to be part of the console

Control Panel – Example



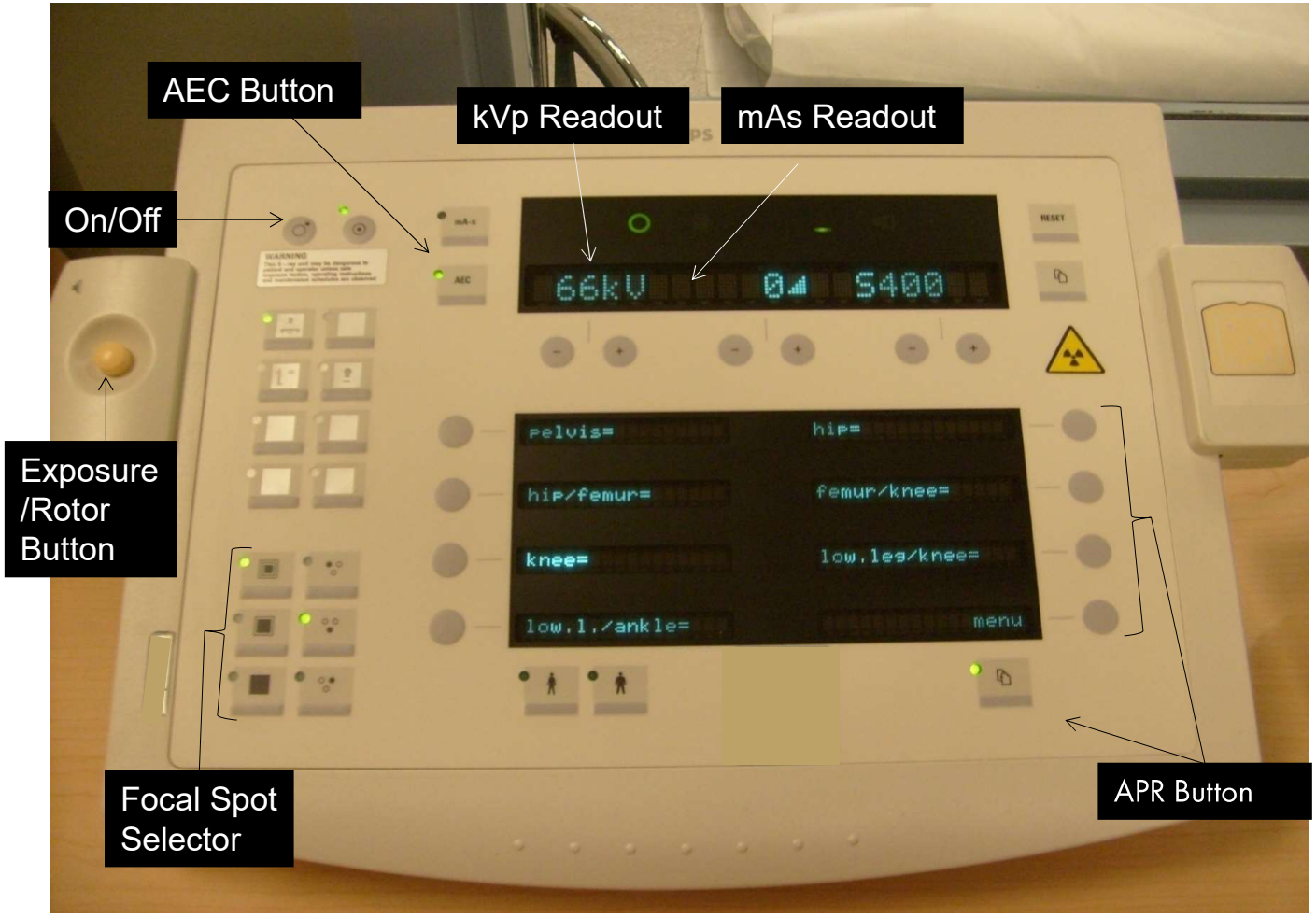
Control Panel – Example



Operating Console

- Operating Console includes:
  - On/off switch
  - Exposure switch
  - Settings for kVp and mA
  - Exposure time
  - Focal Spot size selector
  - AEC (automatic exposure control)
  - APR (anatomically programmed radiography)
  - Back up timer

Control Panel – Example



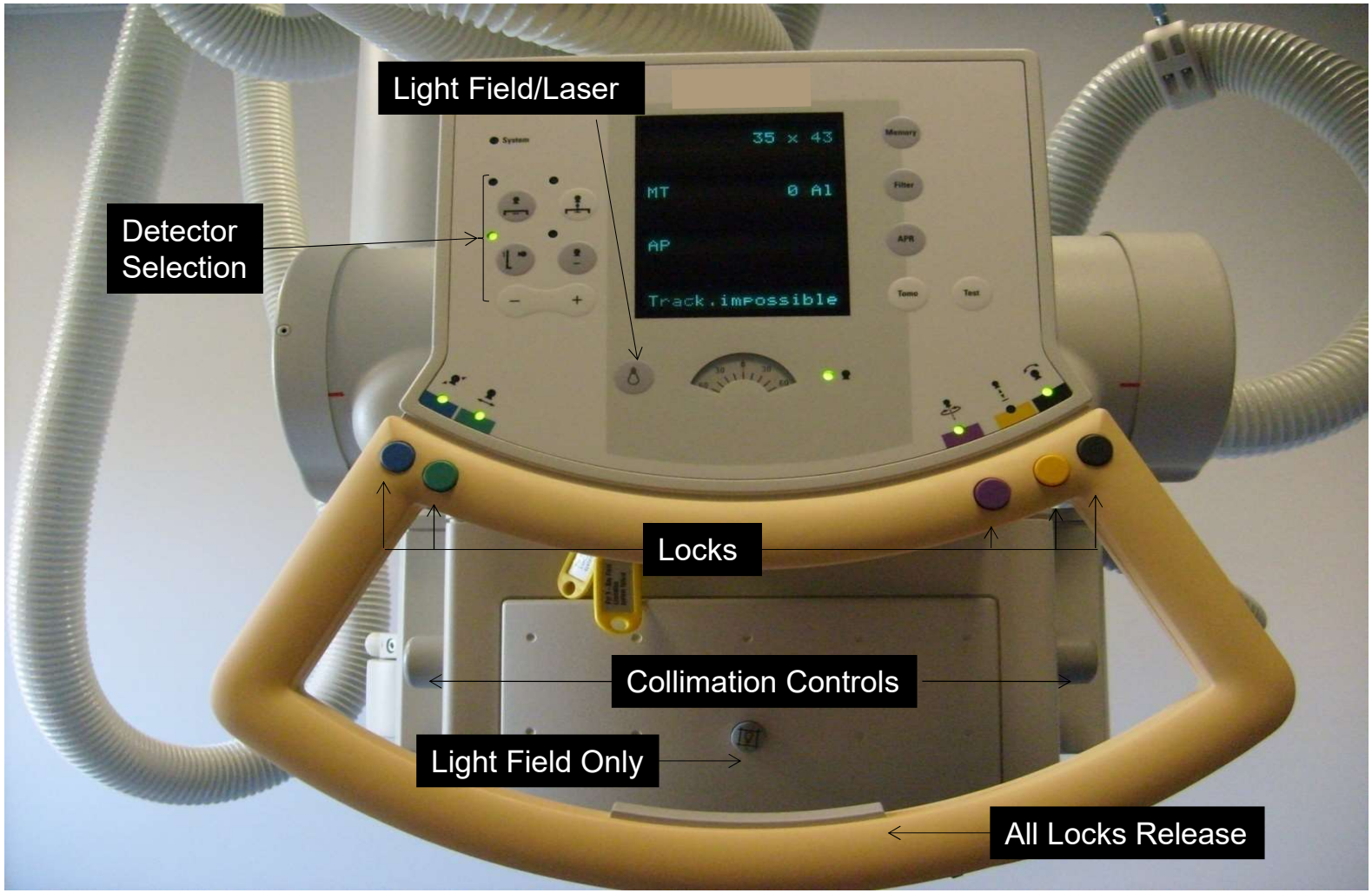
Control Panel – Example



X-ray Tube Assembly

- Main functions on the tube assembly
  - Digital Distance Measure
  - Angulation Measure
  - Locks (Longitudinal, transverse détentes)
  - Light field
  - Collimator Scale
  - Collimator Adjustment Knob
  - Manual measuring tape

Tube and Tube Support



Tube and Tube Support

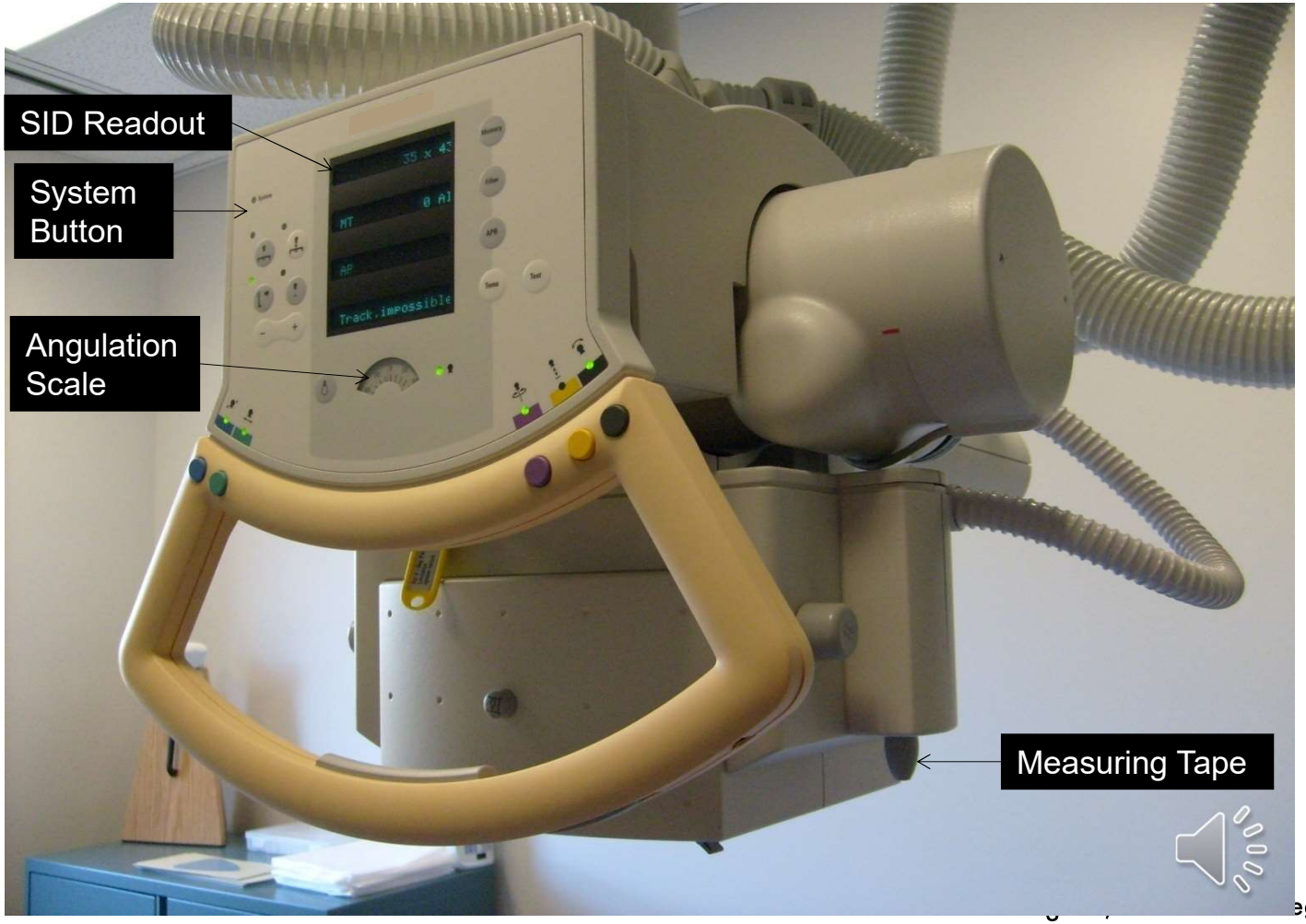


Table – Example



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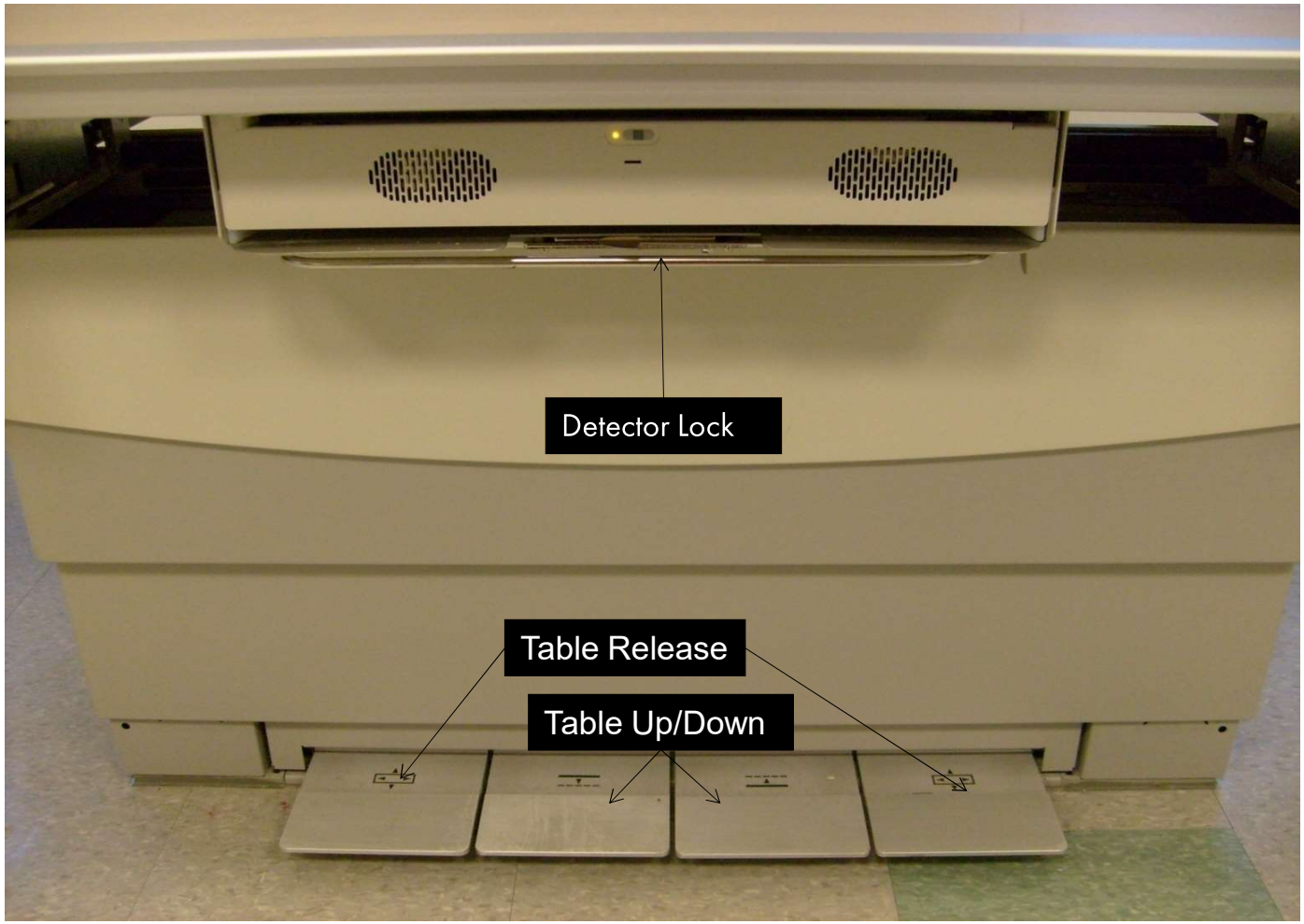
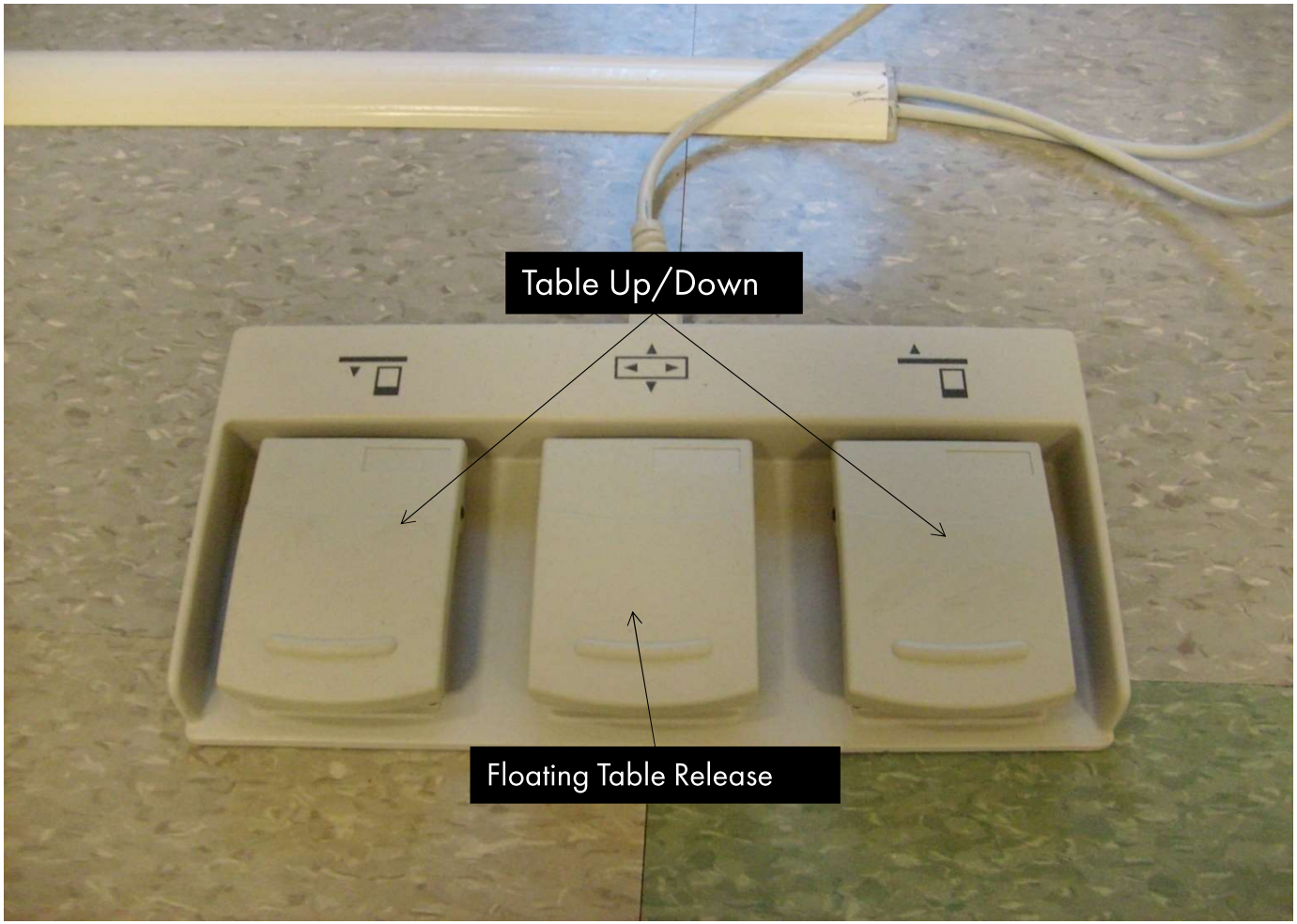


Table – Example

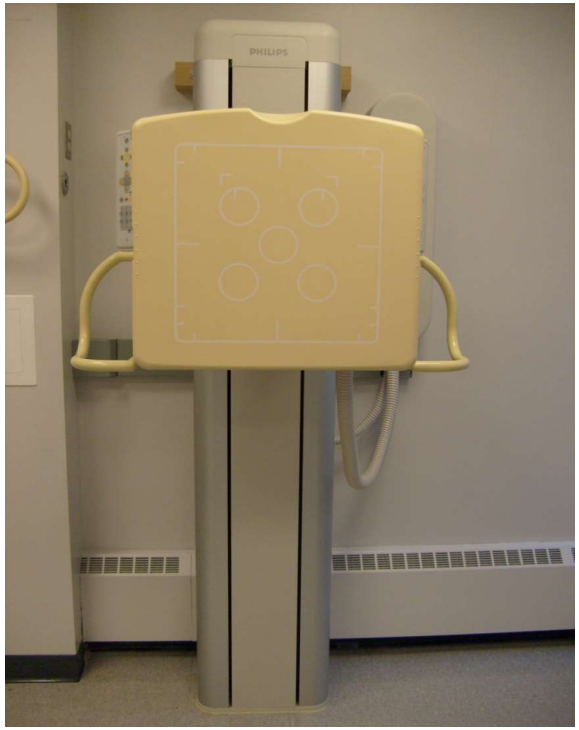


Detectors

- Images can be attained using cassettes or detectors
- Detectors can also be called “cassette-less” systems

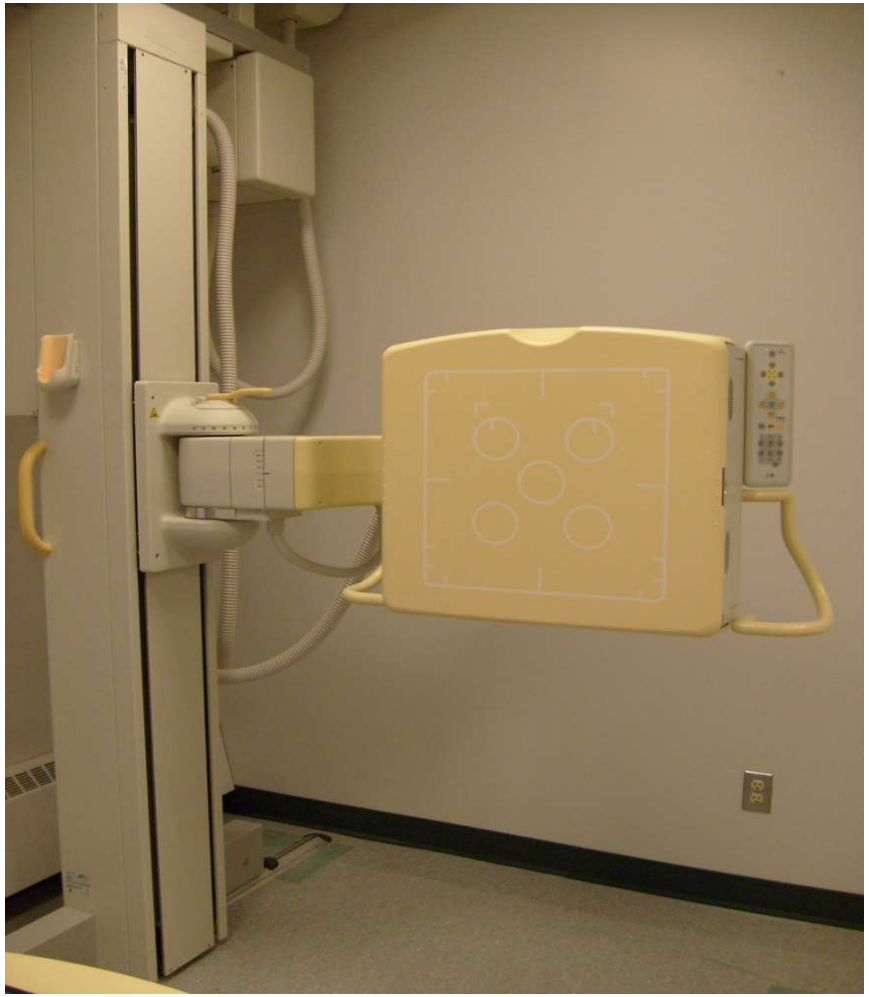


Dual Detector Room

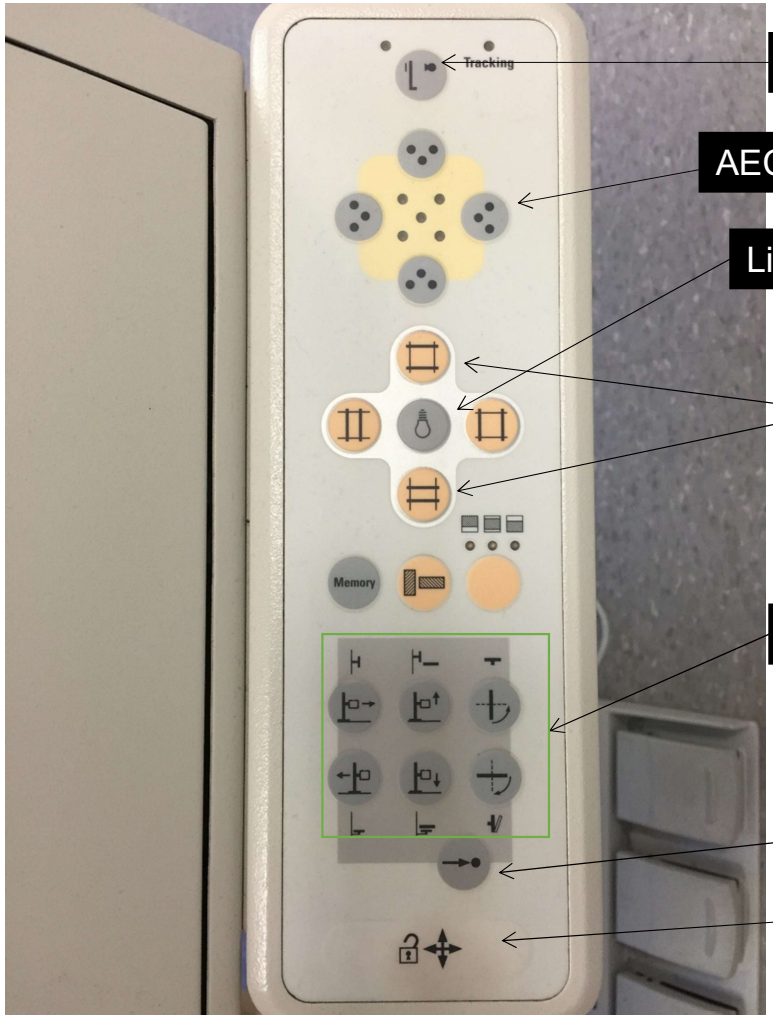




Upright Single Detector - Example



Detector Controls



Tracking

AEC Indicator

Light Field

Collimators

Moves detector position

Secondary function

All locks release

High Voltage Generator



Tube Supports

- Tube supports are part of the external structure of the x-ray tube
  - Physical support of the assembly
  - Made up of rails, column, tube head, housing and tube
- Other external structures include the protective housing & glass or metal envelope



Tube Supports

- Purpose: to support the x-ray tube and housing assembly for manipulation and immobilization as required

- Types of Tube Suspension systems
  - Ceiling mounted
  - Floor-to-Ceiling mounted
  - Floor mounted
  - C-arm

Ceiling Tube Mount

- Likely the most common installation
- Most versatility
- Two perpendicular sets of rails
- Telescoping column
  - Angulation
  - Rotation
- Limited only by the range of the rails



Floor to Ceiling Support system

- Single column attached to two rails
  - Ceiling rail and floor rail
- Limited movement of the x-ray tube
  - Travel along rails
  - Tube attached to a telescoping arm to allow transverse movement and angulation
  - Adjustable column allows for vertical movement
- Less versatile than the ceiling mount



Floor Mounted System

- Attached to floor and table pedestal
- Column allows vertical movement
- Telescoping arm allows for transverse movement and angulation
  - Rotation capabilities common
- Movement is most restricted with this system



C-arm

- Can be ceiling mounted or standalone (mobile)
- Commonly used:
  - OR (operating rooms)
  - Trauma Bay
  - Interventional/Angiography suites
  - Fluoroscopy suites
- X-ray tube on one side, IR on the other
- Some have capabilities for dynamic (fluoroscopic) imaging



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C-arm

- Efficient
- Design allows for obtaining images without having to move the patient
  - Critical for trauma and OR scenarios
  - Trauma imaging often requires images at 90 degrees to each other (AP and lateral)



Courtesy of Fischer Imaging, Inc.

Table Characteristics

- Shape
  - Flat – most common for general radiography
  - Curved – angiography, CT
- Uniform radiolucency
- Durable
  - Must stand up to wear/tear
  - Able to support patient's weight
- Carbon fiber is most common
  - Strong
  - Minimal absorption of radiation

Table Characteristics

- Easy to clean
  - Removal of body fluids and debris
- Hard to scratch
- No crevices
- High weight limit
- Can include a detector, or cassette holder (bucky)
  - Bucky-Potter tray
  - Has oscillating grid and holds cassettes
  - Grid is activated and moves automatically during the exposure



Fixed vs. Tilting

- Majority of tables are floating table tops, some are motor driven
- Tilting
  - Move 90º to upright(standing) and 15-30º head down
  - Fixed height

- Fixed
  - Can be adjustable in height for patients and technologists

Readings

- Radiologic Science For Technologists, Mosby 11th Ed.
  - Pg. 85-87, 105