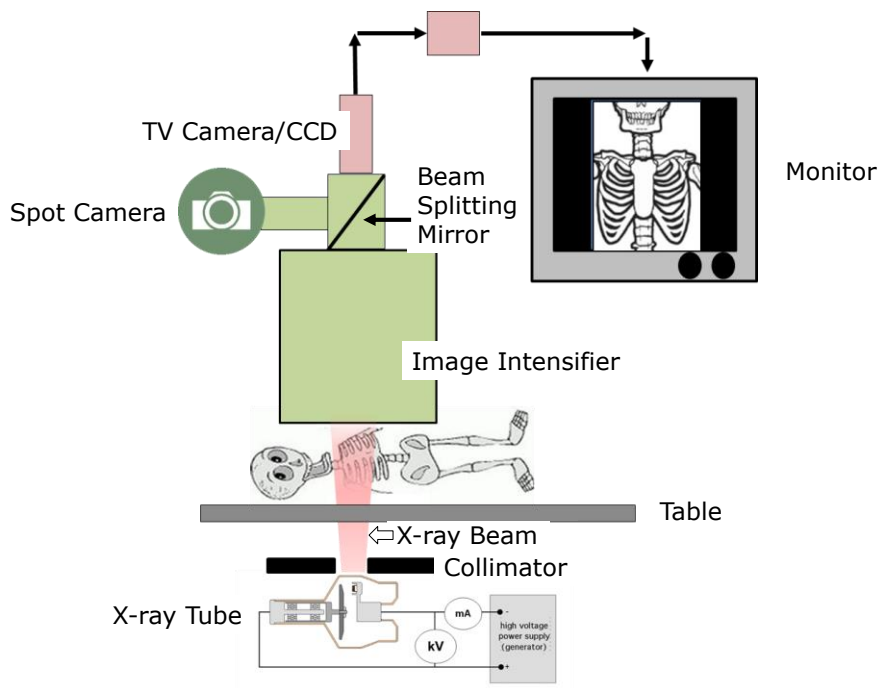


Fluoroscopy & Ancillary Equipment

Bushong, Chapter 25

© 2017 KPSAHS



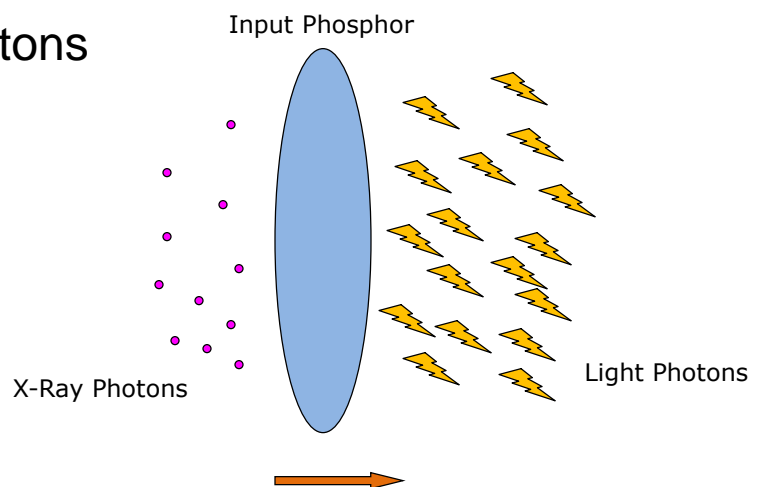
The Image Intensifier

-
-
-
-
-
-

© 2017 KPSAHS

Input Phosphor

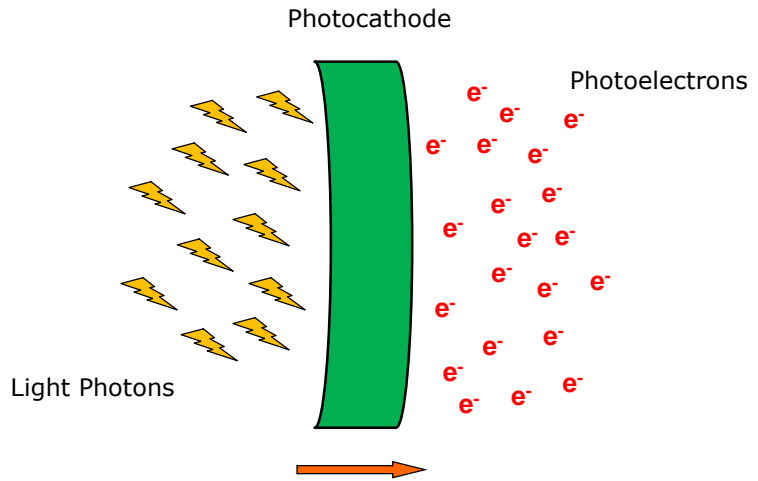
- Converts **x-ray** photons into **light** photons
- Convex in shape
-



© 2017 KPSAHS

Photocathode

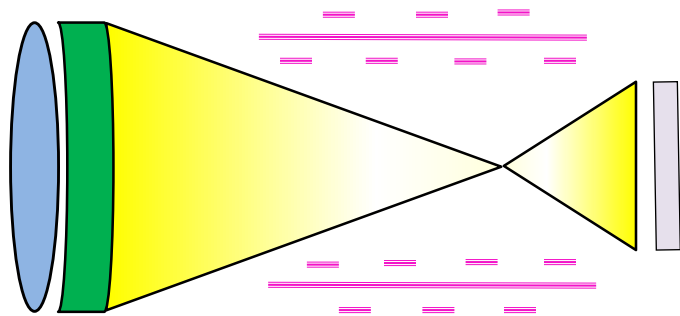
-



© 2017 KPSAHS

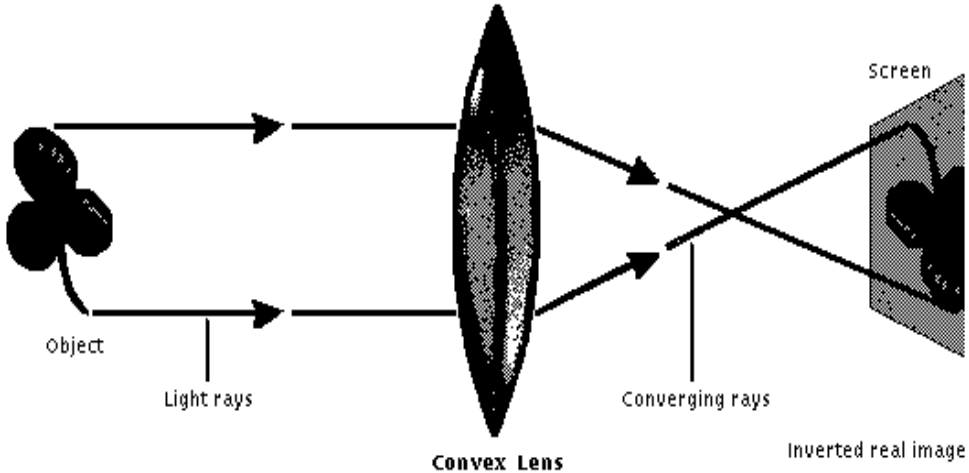
Electrostatic Lenses

- Focuses the beam to impact with the output phosphor
-



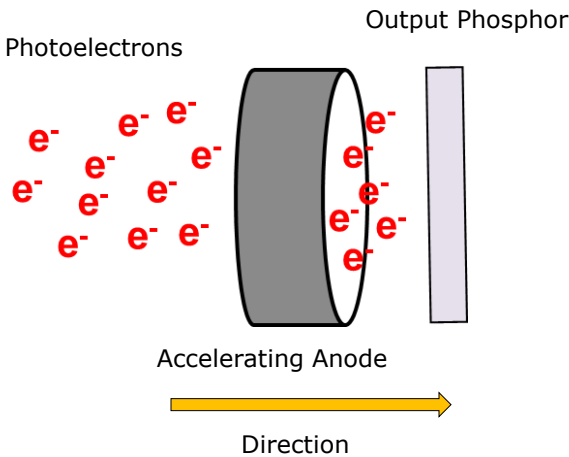
© 2017 KPSAHS

Relationship Between Virtual & Real (Actual) Image



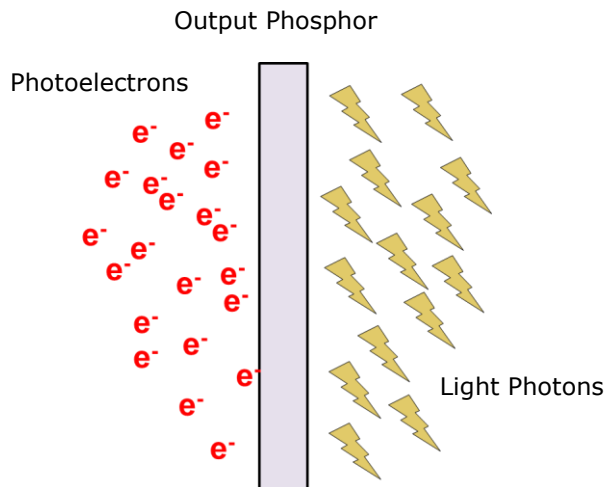
Accelerating Anode

-

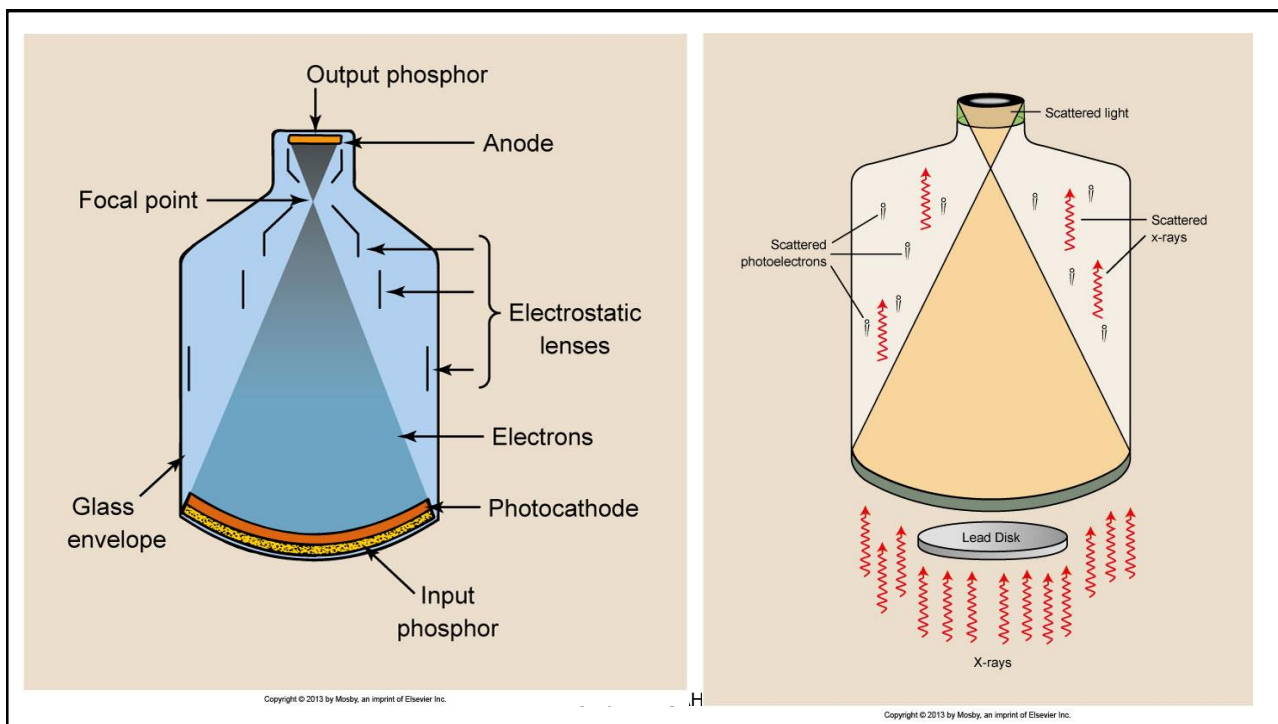


Output Phosphor

- Conversion of photoelectrons to light photons
- Zinc cadmium sulfide (ZnCdS)
- Scattered photoelectrons, light photons, and x-rays cause _____

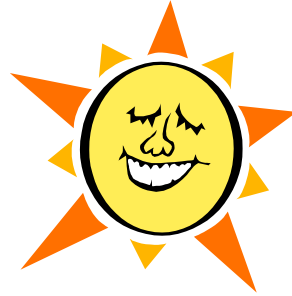


© 2017 KPSAHS



Brightness Gain

- The ability of the imaging system to increase the illumination level of the image is called brightness gain

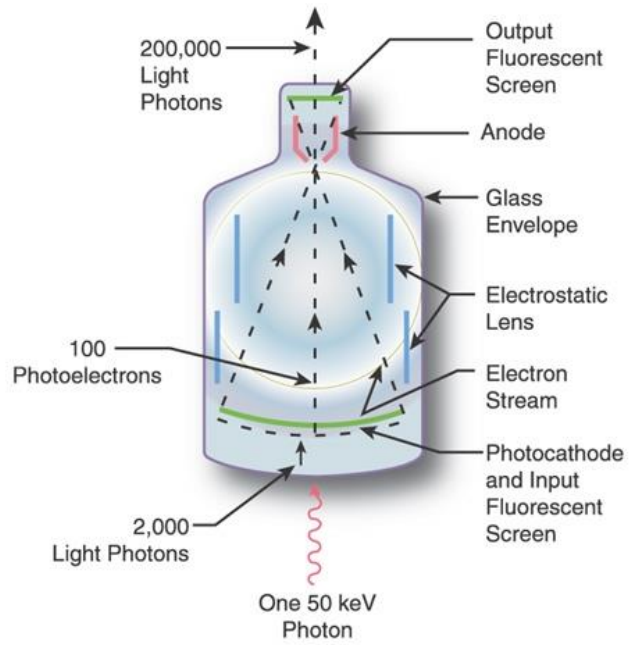


© 2017 KPSAHS

Minification Gain

- Occurs when the same number of electrons, which were produced at the large input phosphor, are compressed into the smaller area of the output phosphor

© 2017 KPSAHS



Minification Gain =

Minification Example

- What is the minification gain of a system which has a 10 inch input phosphor and a 1 inch output phosphor?

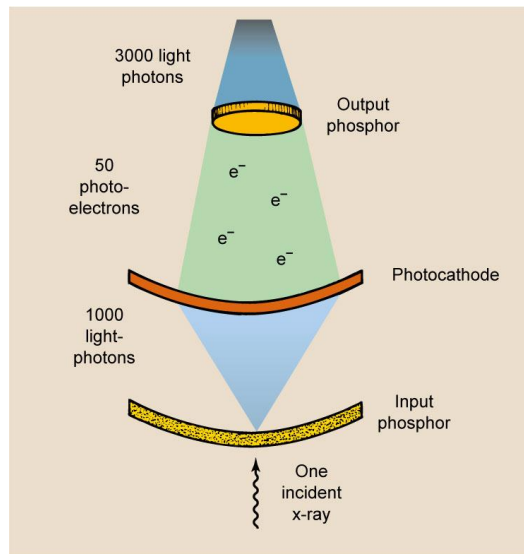
© 2017 KPSAHS

Minification Gain =

© 2017 KPSAHS

Flux Gain

- A number given by the manufacturer
- Expresses conversion efficiency of the image intensifier
- Definition:
 - ratio of # of light photons at the output phosphor to the # of light photons produced at the input phosphor



Total Brightness Gain (TBG)

-
- Expresses the gain of the unit, given a fixed flux gain
- Brightness gain can deteriorate by as much as 10% per year

Example

What is the total brightness gain of a unit that has a 12 inch input phosphor and a flux gain of 50?

© 2017 KPSAHS

First, the minification
gain...

© 2017 KPSAHS

Then,
Minification gain x flux gain

© 2017 KPSAHS

Conversion Factor

- Conversion Factor is used as a periodic check of brightness (related to deterioration of TBG)
- It expresses how well the unit converts photons into light at a given exposure rate.

© 2017 KPSAHS

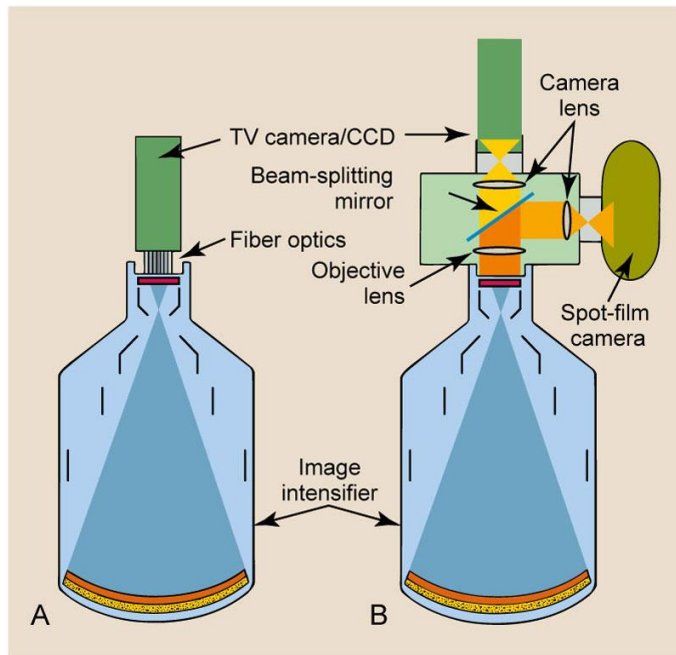
Conversion Factor =

© 2017 KPSAHS

Beam Splitter Mirror

-
- *Fiber Optic cabling, while far superior in terms of image quality, only allow one device to be coupled at a time

© 2017 KPSAHS



Copyright © 2013 by Mosby, an imprint of Elsevier Inc.

Multifield Image Intensifiers

- Field size of the image intensifier is increased or decreased by an adjustment in image intensifier tube voltage

-

© 2017 KPSAHS

Benefits of Multi-Field Intensification

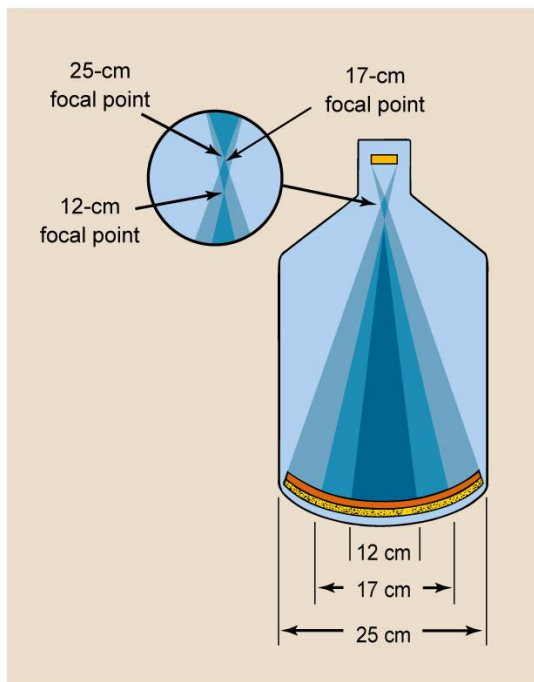
-
-
-
-

© 2017 KPSAHS

Negative Attributes of Magnification in Multi-Field Image Intensifiers

- Increased geometric distortion
- Increased visibility of quantum mottle
-

© 2017 KPSAHS



Increased Patient Dose with Magnification

Increased patient dose can be calculated
from the following formula:

Example

How much dose will a patient receive in the magnification mode as compared to the normal mode when a 6" vs. a 9" mode is used?

© 2017 KPSAHS

Change in Dose

© 2017 KPSAHS

Modulation Transfer Function

- The overall resolution of an imaging system
- The perfect system would have an MTF of 1
-

© 2017 KPSAHS

Automatic Brightness Control

-
- Adjusts both kVp and mA
- Another name for ABC would be ABS
(Automatic Brightness Stabilizer)

© 2017 KPSAHS

Types of ABS

- Variable mA, preset kVp
- Operator pre-sets the kVp
-
- The ABS adjusts the mA to achieve desired brightness
-

© 2017 KPSAHS

Variable kVp, Fixed mA

- Brightness sensor controls kVp
- mA is pre-set

© 2017 KPSAHS

Variable kVp/mA

- Brightness sensor adjusts both kVp and mA to achieve desired brightness
- May not allow operator discretion in selection for a particular body habitus or disease condition
- Most systems use this type of ABS

© 2017 KPSAHS

Fluoroscopic TV Cameras

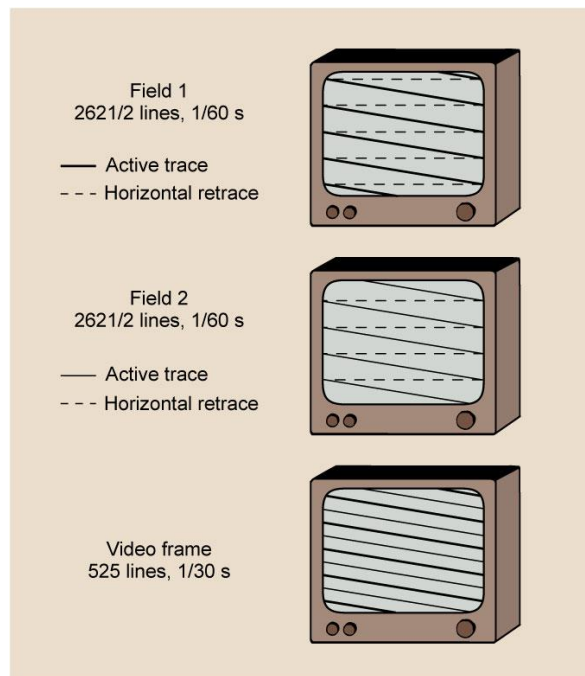
- Vidicon camera was most commonly used in television fluoroscopy (high lag, low dose)
- Plumbicon cameras are modified versions of vidicons (low lag, high dose)
- CCD (charged-coupled device) cameras have largely replaced video camera tubes
 - Solid state devices
 - Found in DF systems

© 2017 KPSAHS

Monitor (CRT Type)

- Weakest link in the imaging system
-
-
- Raster pattern conducted with an electron beam every 1/30 sec
- Many are interlaced monitors
- <https://www.youtube.com/watch?v=nEfEOhsJjpw>

© 2017 KPSAHS



Copyright © 2013 by Mosby, an imprint of Elsevier Inc.

Horizontal Resolution



-
-
-

© 2017 KPSAHS

Vertical Resolution

-
-



© 2017 KPSAHS

Vertical Resolution

Horizontal Scan Lines
2 x Diameter of the Object (mm)

© 2017 KPSAHS

Kell Factor

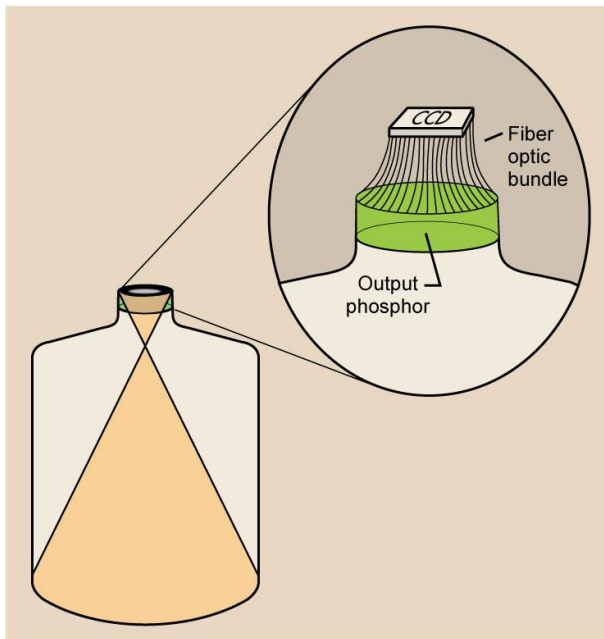
- Ratio between vertical resolution and the number of horizontal scan lines

© 2017 KPSAHS

Digital Fluoroscopy

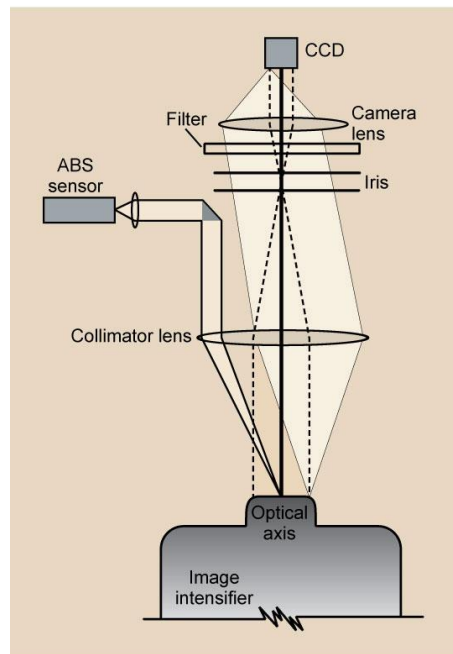
- Images are produced at the output phosphor
- May use a CCD or a lens-coupling system
- Studies performed are mask-mode, K-edge fluoroscopy, and time interval difference
- Digital fluoroscopy also uses a flat-panel image receptor instead of an image intensifier (discussed further in the digital portion of this course)

© 2017 KPSAHS

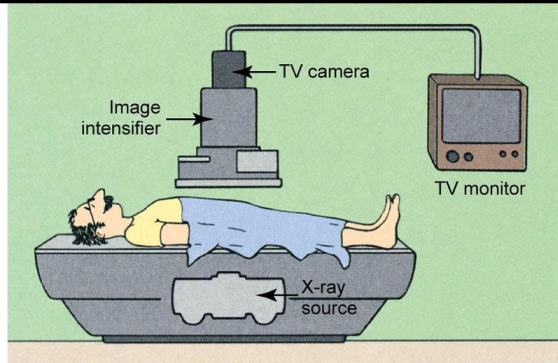


Copyright © 2013 by Mosby, an imprint of Elsevier Inc.

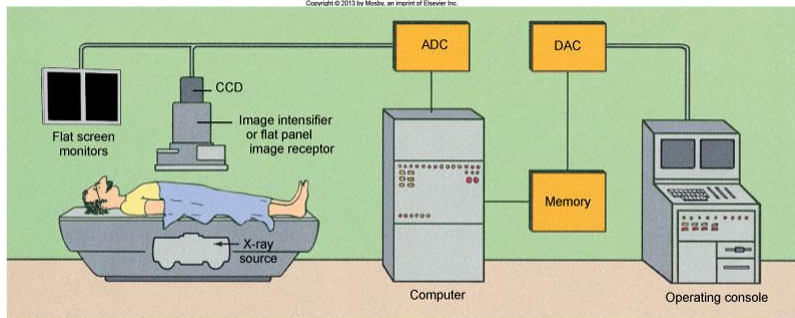
..... KPSAHS



Copyright © 2013 by Mosby, an imprint of Elsevier Inc.



Copyright © 2013 by Mosby, an imprint of Elsevier Inc.



Copyright © 2013 by Mosby, an imprint of Elsevier Inc.



Courtesy Siemens Medical Solutions USA.