

Lab Experiment # 8

Inverse and Direct Square Law Compensating mAs in response to a changing SID

Direct Radiography (DR)

Purpose

This digital (DR) system experiment is designed to demonstrate how to maintain exposure index (EI) and SNR when changing SID.

Learning Objectives

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console and ceiling tube mount correctly.
3. Function effectively in group work.
4. Perform the experiment independently.
5. Calculate the appropriate mAs to compensate for a change in SID to maintain exposure index and SNR.
6. Explain the direct square law.
7. Summarize the mAs and SID relationship when exposure index and SNR.
8. Predict the effect of the change in mAs and SID on exposure index and SNR.

Materials Needed

- 14 x 17 FPD
- Hand phantom
- Set of lead numbers

Pre-Lab Discussion

Direct Square Law – Exposure Maintenance Law

The direct square law is used to maintain the Exposure index and SNR.

The change in mAs is directly proportional to the square of the change in SID

According to the Inverse Square Law, the amount of radiation received at a given point is inversely proportional to the square of the distance between the point and the radiation source.

To compensate for a change in distance you must make the exposure at the new distance equal what the exposure was at the old distance.

Therefore:

As distance **INCREASES**, mAs must be **INCREASED *significantly***

As distance **DECREASES**, mAs must be **DECREASED *significantly***

Symbolically:

$$\begin{array}{ccc} \uparrow & \left| \frac{\text{mAs}_{\text{new}}}{\text{mAs}_{\text{old}}} = \frac{(\text{Distance}_{\text{new}})^2}{(\text{Distance}_{\text{old}})^2} \right| & \uparrow^2 \\ & \text{Distance} = \text{SID or SSD} & \end{array}$$

Radiographically:

- ✓ An **INCREASE** in mAs will compensate for an **INCREASE** in SID and **MAINTAIN** exposure index and SNR.
- ✓ A **DECREASE** in mAs will compensate for a **DECREASE** in SID and **MAINTAIN** exposure index and SNR .

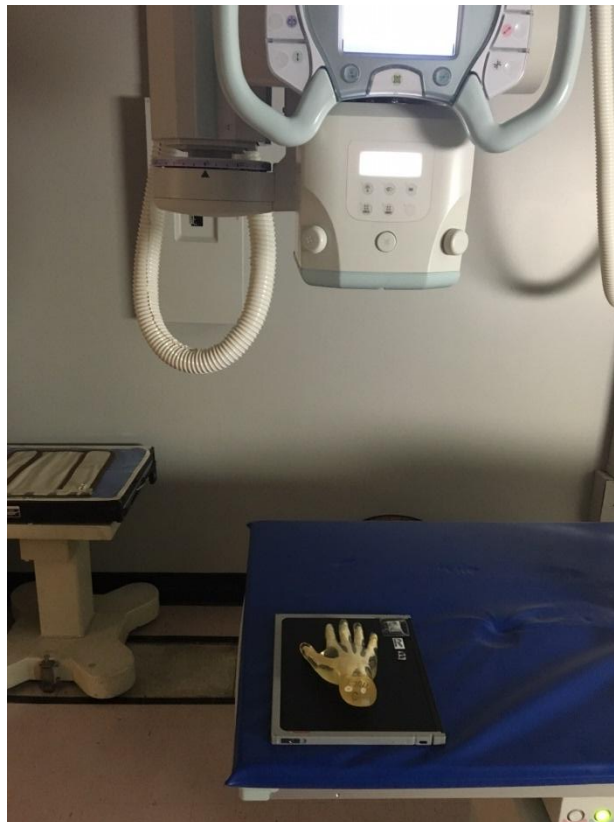
Procedure

Direct Radiography

Hand Radiograph

Instructions for Exposures 1 through 4.

1. When adding images to your new exam use system diagnostic menu.
2. Use the Direct Radiography IR.
3. Direct the central ray **perpendicular** to the third MP joint.
4. Tape the appropriate ID markers onto the image receptor within the collimated light field so they do not obscure any areas of interest.
(The room, side and exposure number must be labeled on **all** radiographs.)
5. Set the x-ray tube, mode of operation and focal spot size as indicated on **Worksheet**.
6. Make all the exposures using the settings indicated on **Worksheet**.
7. In the worksheet write EI and TEI numbers. Indicate overall image brightness and noise level of each image.



Dosimeter Worksheet

Exposure 1	Exposure 2	Exposure 3
20-inch Distance	40-inch Distance	60-inch Distance
Actual dosimeter reading	Actual dosimeter reading	Actual dosimeter reading
<p>Record the dosimeter reading in the row above. Then, calculate the expected dosimeter readings and record them in the boxes to the right.</p>	Expected dosimeter reading	Expected dosimeter reading

Worksheet Direct Square Law

DR

kVp	Focal Spot	SID	mAs	mode	Grid bucky	EI TEI
1	55	small	50"	2	manual	no
2	55	small	25"	?	manual	no

3	55	small	30"	?	manual	no	
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4	55	small	60"	?	manual	no	
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Worksheet

EI TEI	What was the change in SID? What was the change in mAs? Compare EI and DI of images 1 and 2 and images 3 and 4.
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1 and 2		
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3 and 4		
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