

# Lab Experiment # 9

## Inverse and Direct Square Law

### *Computed Radiography (CR)*

#### ***Purpose***

This digital (CR) system experiment is designed to demonstrate how to maintain exposure index 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. Explain the Inverse and Direct Square law.
6. Summarize the mAs and SID relationship with exposure index and SNR.
7. Predict the effect of the change in mAs and SID on exposure index and SNR.
8. Calculate the appropriate mAs to compensate for a change in SID to maintain exposure index and SNR.

#### ***Materials Needed***

- 10 x 12 IP
- Hand phantom
- Set of lead numbers

# Pre-Lab Discussion

## ***Direct Square Law – Exposure Maintenance Law***

*The direct square law is used to maintain 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:

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

### ***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 .

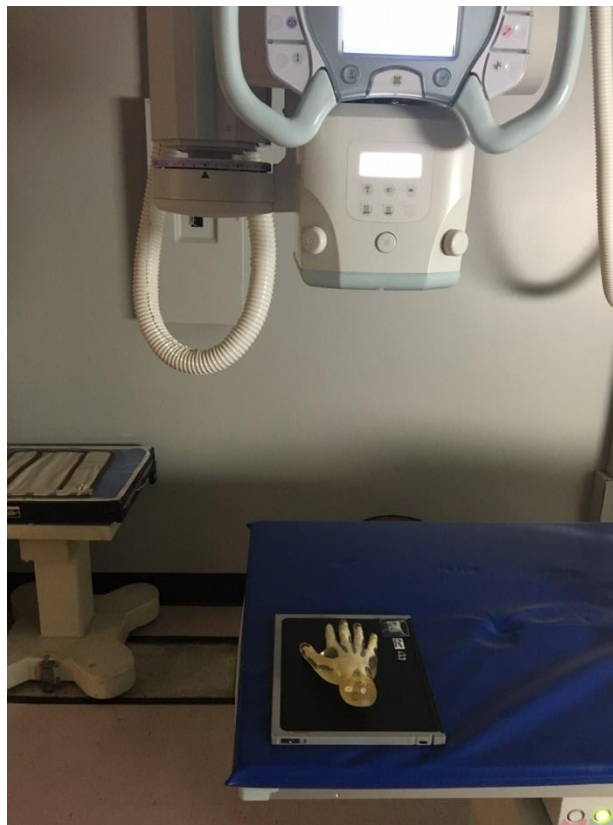
# Procedure

## Computed Radiography

### Hand Radiograph

#### ***Instructions for Exposures 1 through 3. (No autorescale)***

1. When adding images to your new exam use system diagnostic menu.
2. Use the Computed 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 1 and 2** .
7. In the worksheet write LGM numbers. Indicate overall image brightness of each image.



# Worksheet 1 Inverse Square Law

CR

	kVp	Focal Spot	SID	mAs	mode	bucky	LGM
<b>1</b>	<b>65</b>		18" (46 cm)	<b>2</b>	No autorescale	TT	
<b>2</b>	<b>65</b>		36" (92 cm)	<b>2</b>	No autorescale	TT	
<b>3</b>	<b>65</b>		72" (183 cm)	<b>2</b>	No autorescale	TT	

# Worksheet 1 Inverse Square Law

LGM	Briefly describe the overall brightness of each image.
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1		
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2		
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3		
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## Worksheet 2 Direct Square Law

CR

	kVp	Focal Spot	SID	mAs	mode	bucky	LGM
<b>4</b>	<b>65</b>		18" (46 cm)	<b>0.5</b>	No autorescale	TT	
<b>5</b>	<b>65</b>		36" (92 cm)	<b>2</b>	No autorescale	TT	
<b>6</b>	<b>65</b>		72" (183 cm)	<b>8</b>	No autorescale	TT	

## Worksheet 2 Direct Square Law

LGM	Briefly describe the overall brightness of each image.
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4		
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5		
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6		
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1. Is there a difference in brightness between images 1,2, and 3?
2. Is there a difference in brightness between images 4,5, and 6?