RADIOLOGIC SCIENCE 2

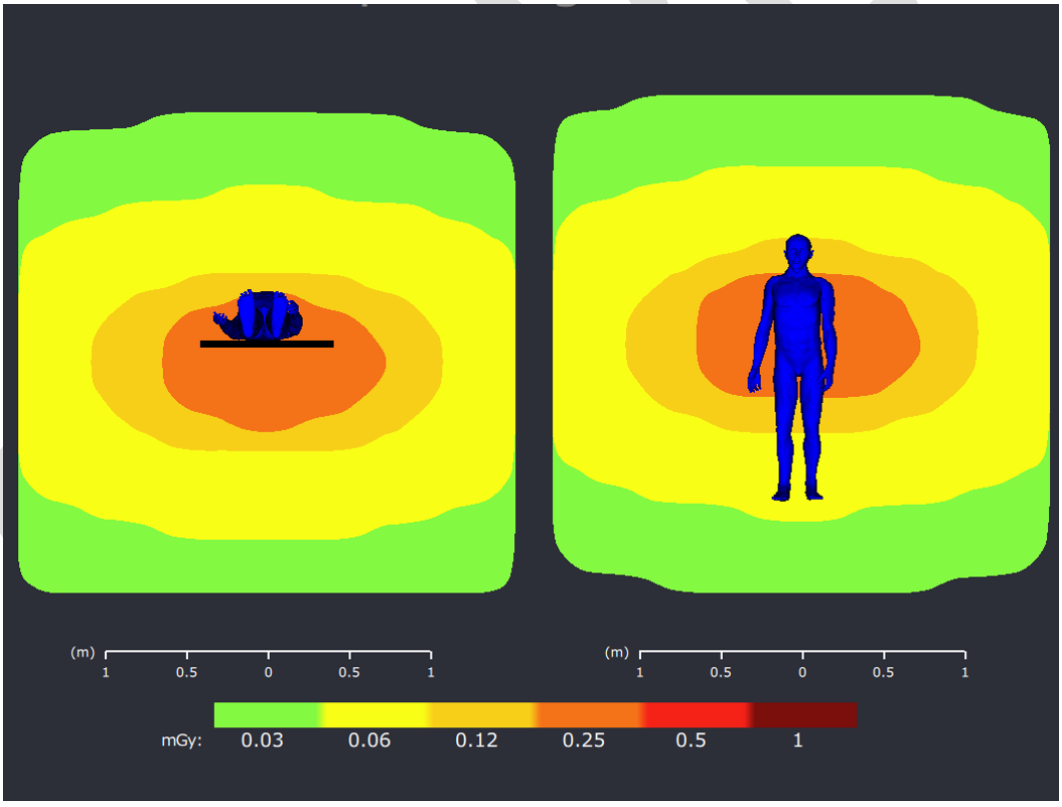
Prof. Stelmark

Course:

XRA 121

Title:

Secondary and Scatter radiation



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February 9th 2017

Team Room D

Lab Experiment # 2

Secondary and Scatter Radiation

Purpose:

The purpose of this experiment is to demonstrate how the secondary scatter radiation appears on an image receptor that is not exposed directly and how its intensity is affected by several factors such as:

- Distance from source of scatter;
- Technical factors;
- Collimation.

We predict that the scatter radiation will considerably decrease when we increase the distance from the source of scatter (pixie phantom) following the inverse square law.

A change in kV will produce more scatter radiation, but, if this change is compensate with the 15% rule, we expect that the quantity of radiation received by the image receptor will remain almost the same.

The amount of scattered radiation is proportional to the field size being exposed. Increasing the field size increases the total amount of scattered radiation and the value of the contrast-reduction factor.

Hence, we expect that an increase in collimation will correspond to a reduction of the amount of secondary scatter produced that reaches the image receptor.

Lab Objectives:

Upon conclusion of this lab, the student should be able to:

- Use the laboratory equipment properly;
- Set up the control console and ceiling tube mount correctly;
- Function effectively in group work;
- Perform the experiment independently;
- Evaluate the effect of S/S and collimation on image brightness;
- Manipulate the collimation to improve visibility of detail;
- Explain the effect of collimation and S/S on image brightness;
- Predict the effect of the change in S/S and collimation on image brightness.

Equipment used:

- 35 x 43 CR image receptor (IR);
- Pixie phantom;
- Set of lead numbers;
- Vertical image receptor holder;
- Wire mesh test tool.

Method:

Experiment is carried out with a pixie phantom in supine position and a CR image receptor in the vertical holder. In addition we attach a grid test to the image receptor that will leave a grid pattern on the image and will help us to evaluate the intensity of the scatter radiation and visibility of detail.

The first three exposures are taken with the same mAs, kV and collimation but different distance between IR and pixie phantom as follow:

	IR DISTANCE FROM PIXIE	mAs	kVp	lgm	collimation
1	1 inch (2.54 cm)	20	86	2.88	35 X 43 cm
2	10 inches (25.4 cm)	20	86	2.52	35 X 43 cm
3	20 inches (50.8 cm)	20	86	2.19	35 X 43 cm

The second three exposures are taken with same IR to pixie distance and collimation but with different mAs and kVp:

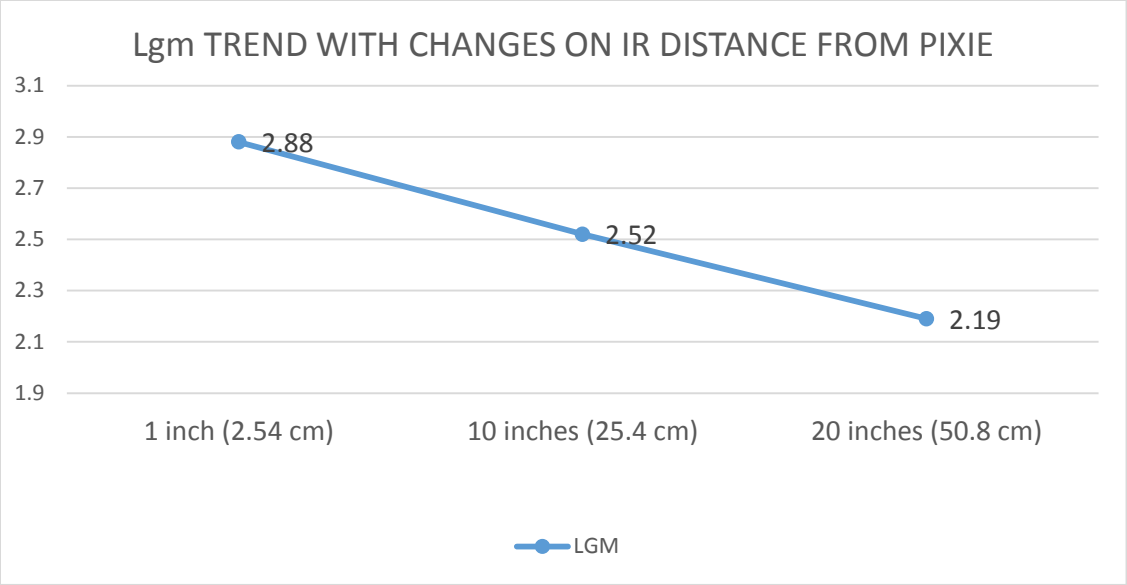
	IR DISTANCE FROM PIXIE	mAs	kVp	lgm	collimation
4	1 inch (2.54 cm)	80	62	2.99	35 X 43 cm
5	1 inch (2.54 cm)	20	86	2.97	35 X 43 cm
6	1 inch (2.54 cm)	5	115	2.72	35 X 43 cm

The last three exposures are taken changing only the collimation:

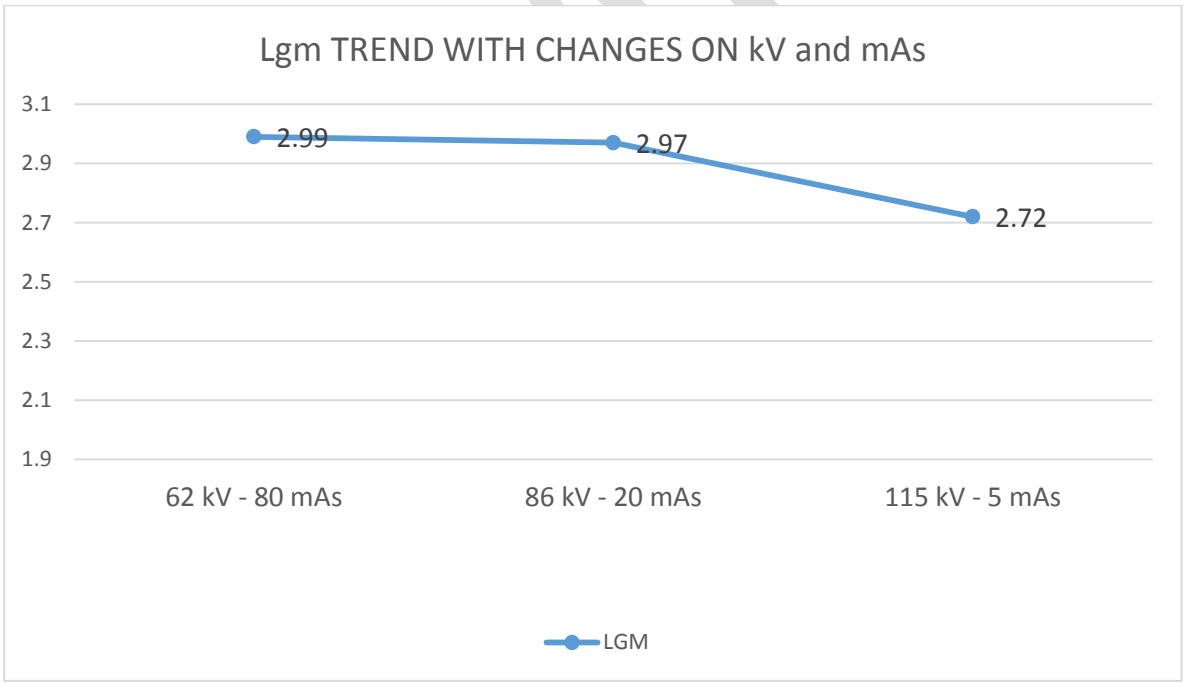
	IR DISTANCE FROM PIXIE	mAs	kVp	lgm	collimation
7	1 inch (2.54 cm)	20	86	2.97	35 X 43 cm
8	1 inch (2.54 cm)	20	86	2.18	17 X 20 cm
9	1 inch (2.54 cm)	20	86	1.48	8 X 10 cm

Experiment analysis:

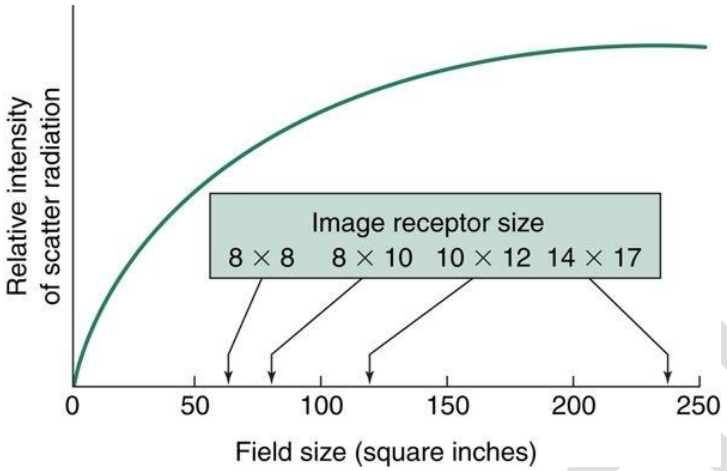
The exposures 1,2,3 show how the secondary radiation loses its intensity when we increase the distance from the source of scatter. The images become brighter as we increase the distance because less scatter photons interact with the image receptor.

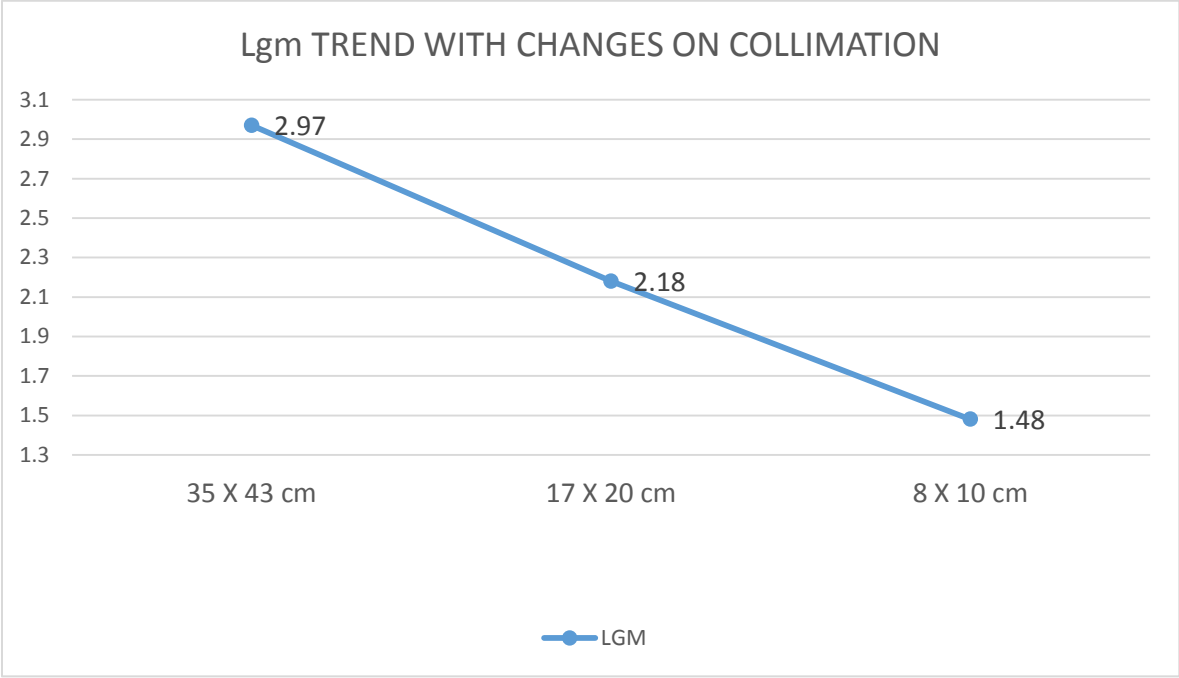


The exposures 4,5,6 show that an increase in kV compensated by a decrease in mAs (15 % rule) maintain the exposure of the IR at the same level: the lgm doesn't change substantially.



The exposures 7,8,9 demonstrate that an increase in collimation reduces the amount of scatter. As the graphic shows, the intensity of scatter radiation is directly proportional to the field size being exposed:





As a result, increased collimation determines:

- Less patient dose;
- Less scatter radiation (lgm drop);
- More quantum noise, because a lower quantity of photons reach the patient (unless technical factors are increased).