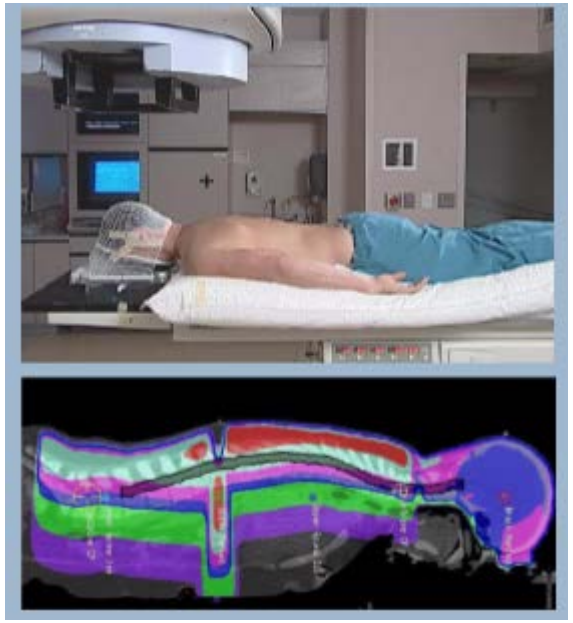
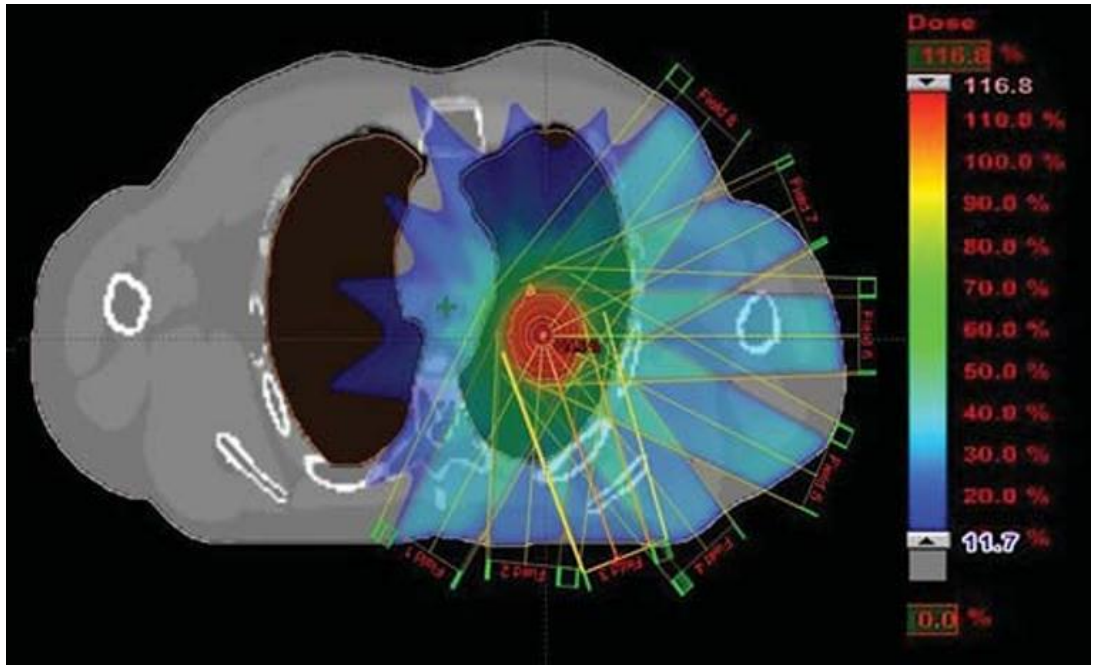
- What kind of treatment is shown in the pictures below?
- What are the planning and delivery issues for this treatment and how do you minimize them?



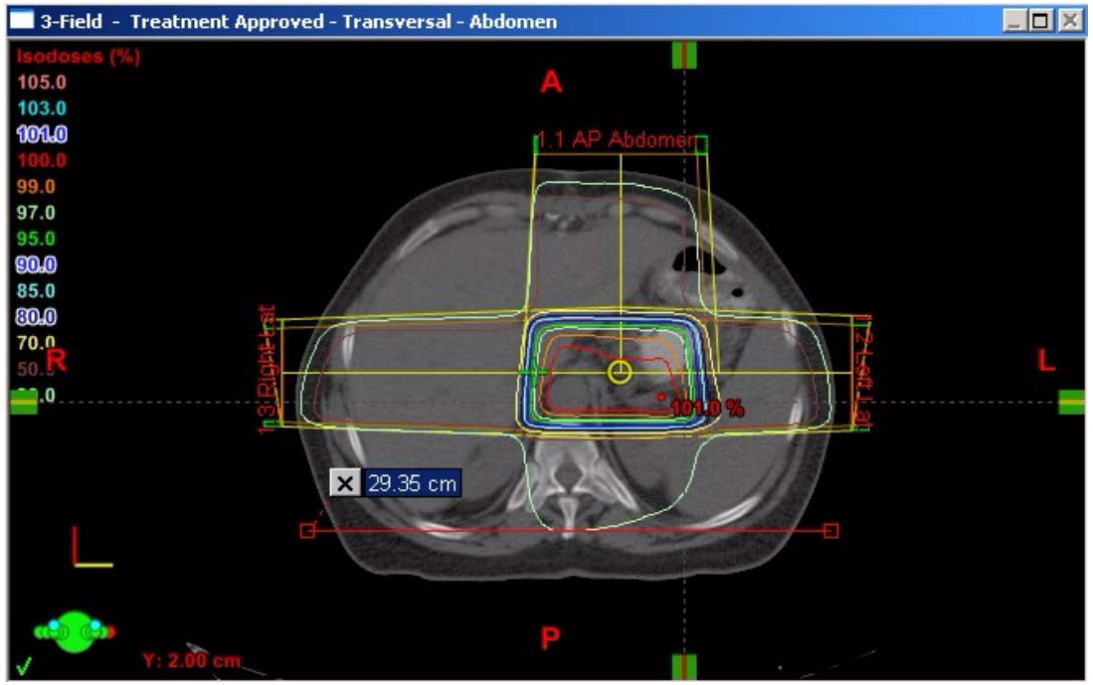
1. What are the indications for this tx?
2. What are typical doses for this tx?
3. What is the tolerance dose of the spinal cord? Where did you get that number from?
4. Your clinic wants to start a program of this type. How would you recommend them to proceed and what do you need to do to ensure its safety?

How would you implement a new SBRT program?



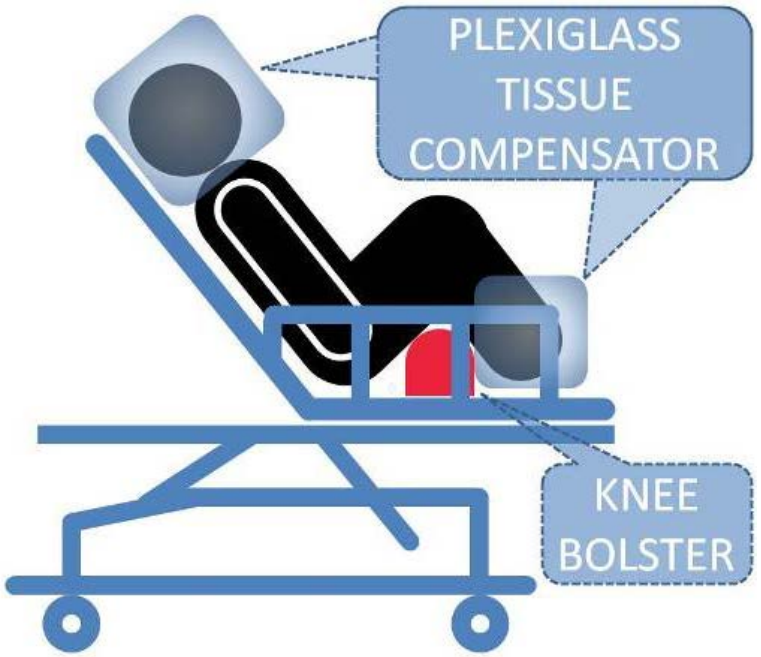
1. How might your QA program change with the addition of SBRT patients?
2. What kind of guidance would physicians and dosimetrists need for planning?
3. How would you establish dose limits for the SBRT program?

What wedge angles and beam energy would you use in this plan? Why?



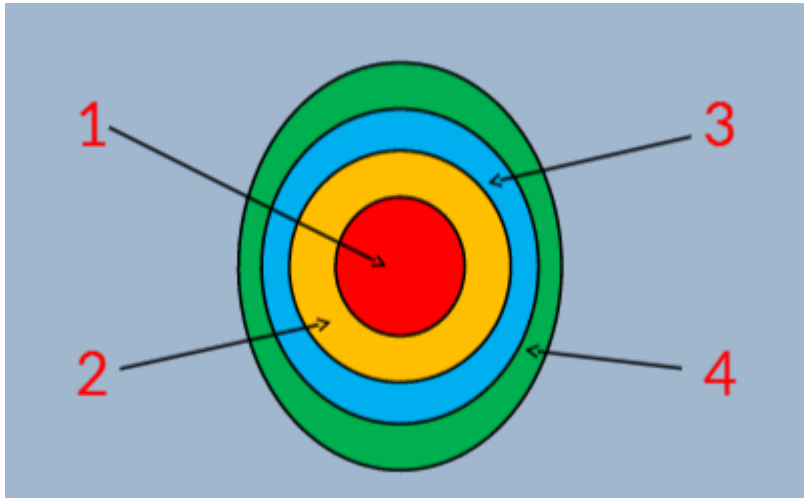
1. What is the target in the plan?
2. Why wouldn't a posterior beam be used here?
3. Should the right lateral or left lateral beam have a higher 'weight'? Why?

- What kind of treatment is shown in this picture?
- How would you clinically prepare this treatment?



1. Do you do this treatment at your clinic?
2. Do you do this treatment this way at your clinic? If not, why do you do it differently?
3. What is the purpose of this treatment? What is the typical dose for it? What fractionation?

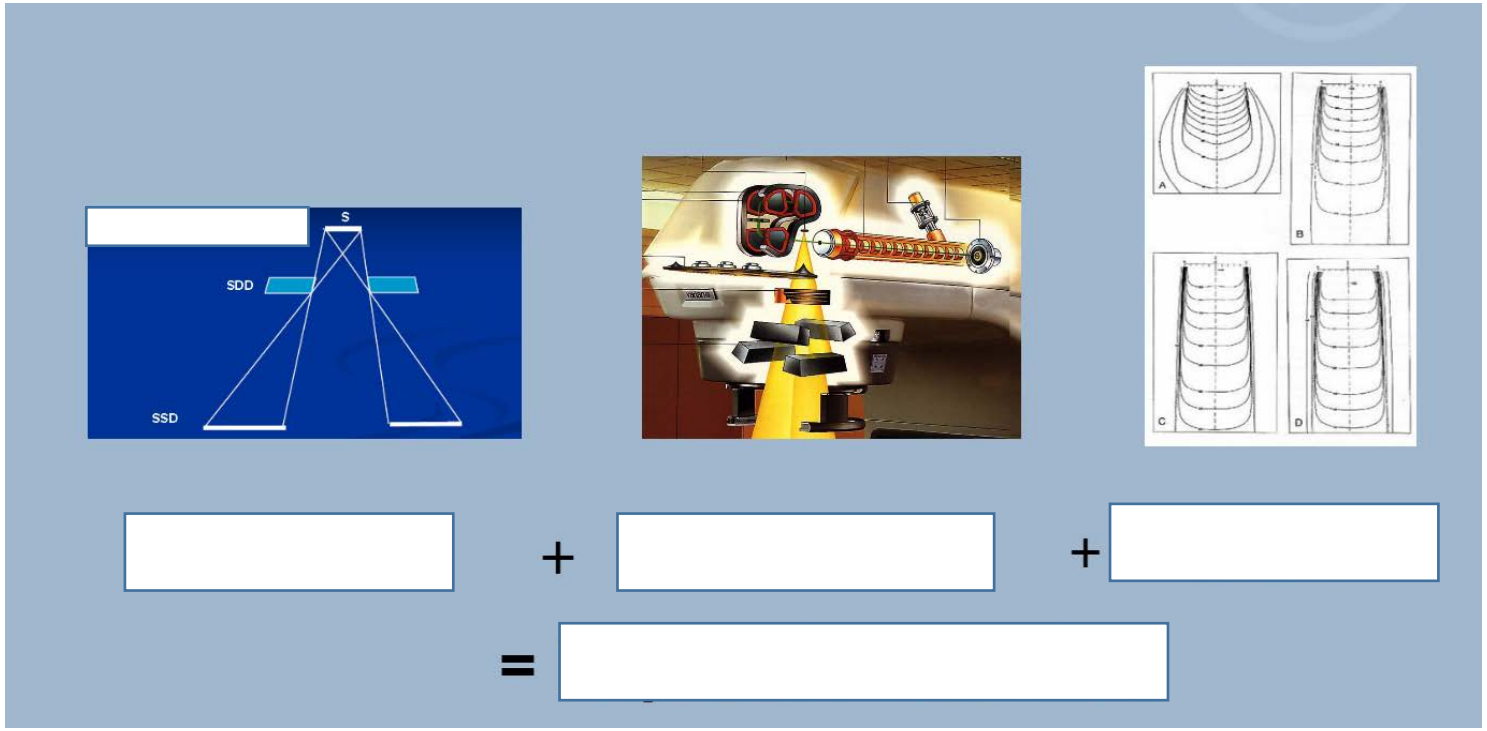
- Please define the following terms: CTV, GTV, PTV, and ITV.
- Put them in order according to size.



1. Who defined these concepts, and why are they needed?
2. You have a PTV, should you use its projection in the BEV as the field shape?
3. Can you simply add internal margin and setup margin to obtain the total margin?

4. What is the difference between a serial and parallel organ? Can you give an example of each? How do normal tissue dose constraints differ when dealing with a serial or parallel organ?
5. Do you know of any documents or resources that outline normal tissue constraints for radiotherapy?

Please describe the figures

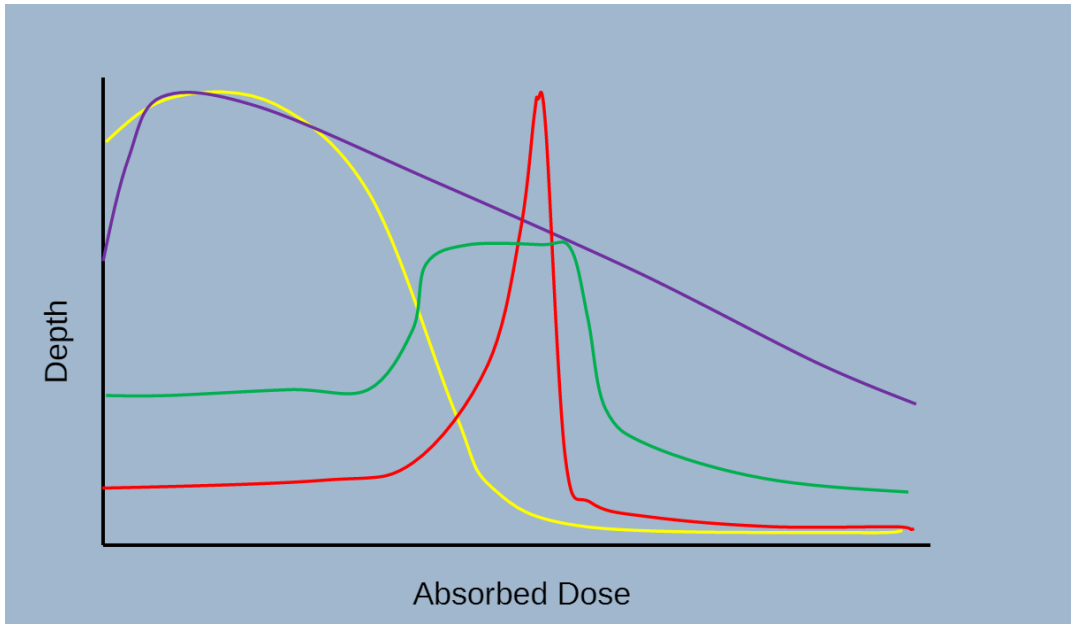


1. How do you measure this effect?

2. How does this effect change with SSD, source size, depth, field size, and Energy? How about electron Energy?

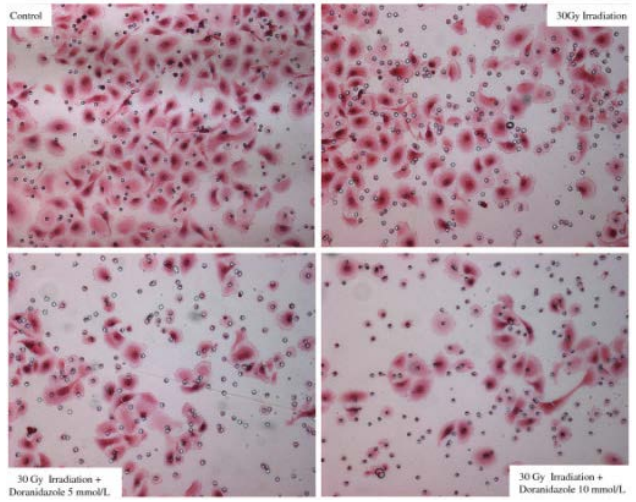
3. Please describe the MLC designs for reducing effect

What beams produce the curves shown below?



1. Why don’t electrons have a Bragg Peak?
2. Can protons use the standard HU vs. electron density curve for treatment planning?
3. Which would you expect to have a lower integral dose, a photon plan or a proton plan?

What is the biologically effective dose (BED) and how is it used clinically?



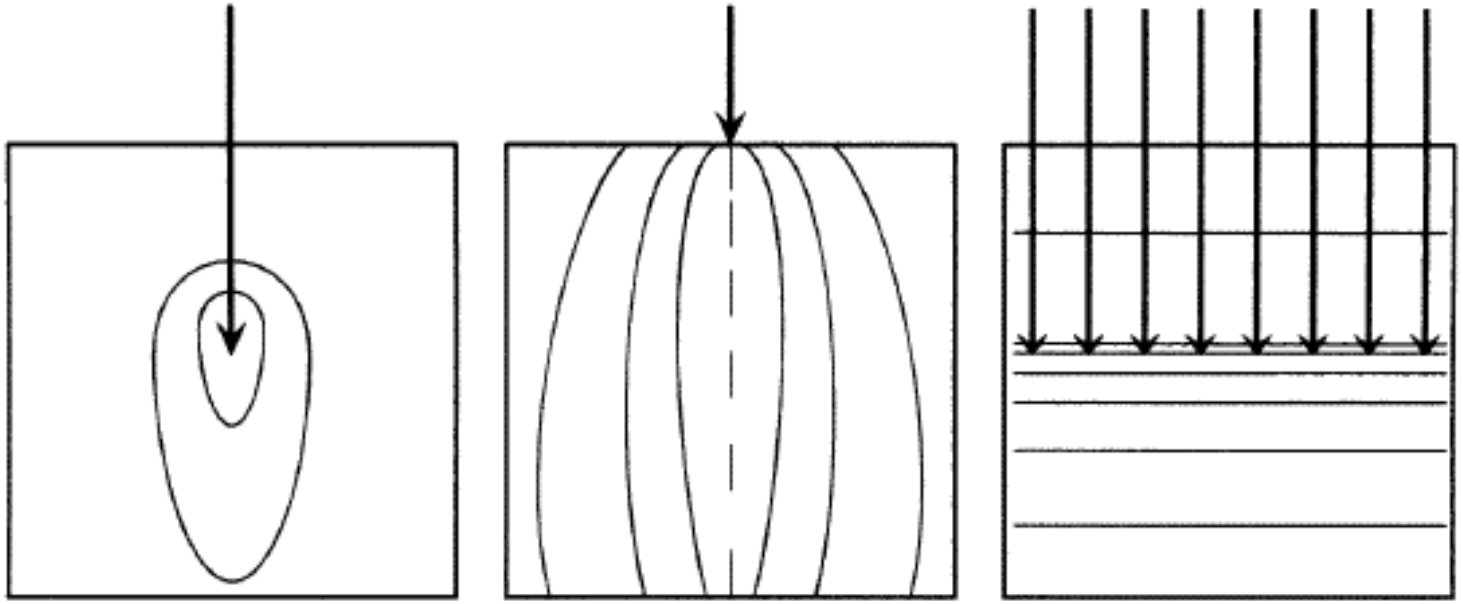
1. What is the linear quadratic model?
2. Write out an example BED calculation
3. What are the cell cycle phases and their relative radiosensitivities?
4. How does the presence or absence of oxygen affect radiation-induced cellular damage?

What is this equation? Why would it be used?

$$\frac{D_{med}}{D_{gas}} = \left(\frac{\bar{L}}{\rho}\right)_{gas}^{med}$$

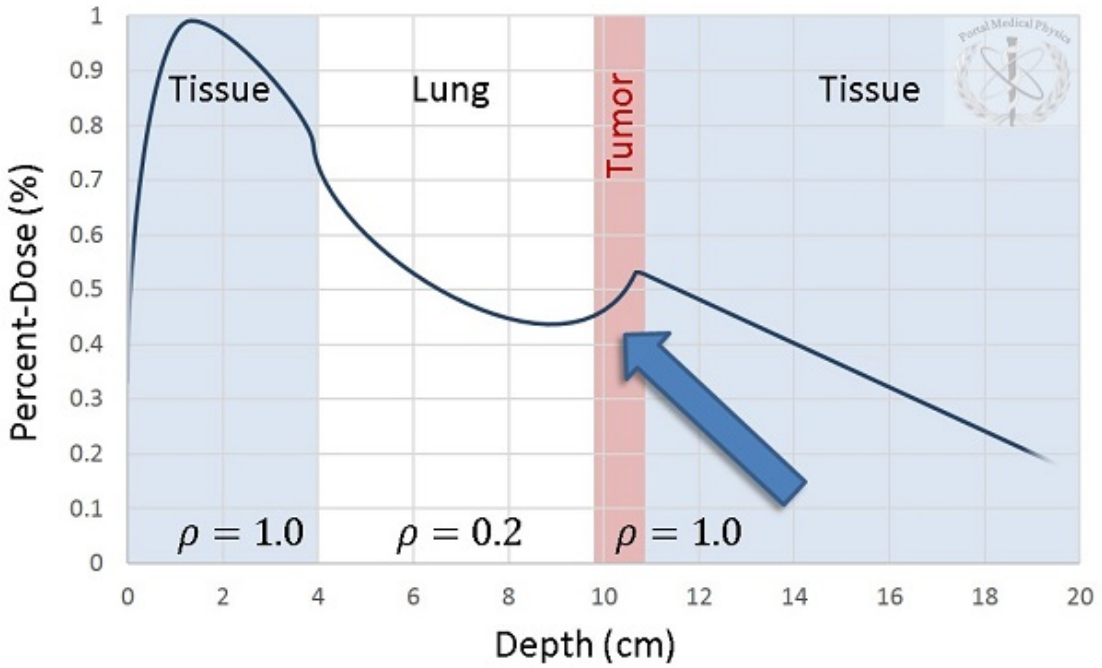
1. What is energy fluence, and how does it relate to patient dose?
2. What is TERMA? What is KERMA?
3. What is a kernel?
4. What is convolution? What is a convolution-superposition? How do these terms take into account material heterogeneities?

- What are these figures?
- How are they created?
- What class of algorithms use them?
- How is the primary dose contribution calculated?



Ahnesjo & Aspradakis. PMB 1999.

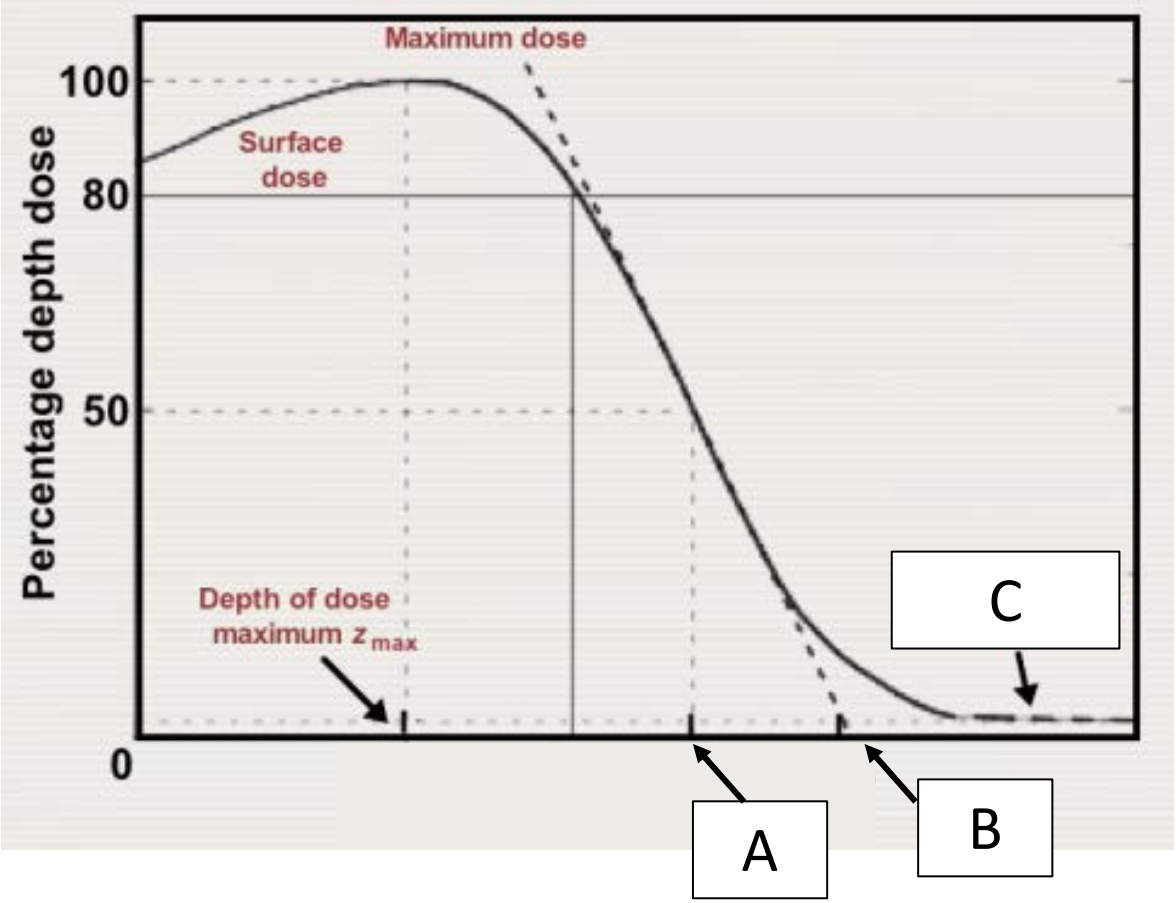
Describe the effect that is being shown here with respect to lung SBRT treatment planning.



1. For lung SBRT planning, what would be considered an appropriate dose calculation algorithm?

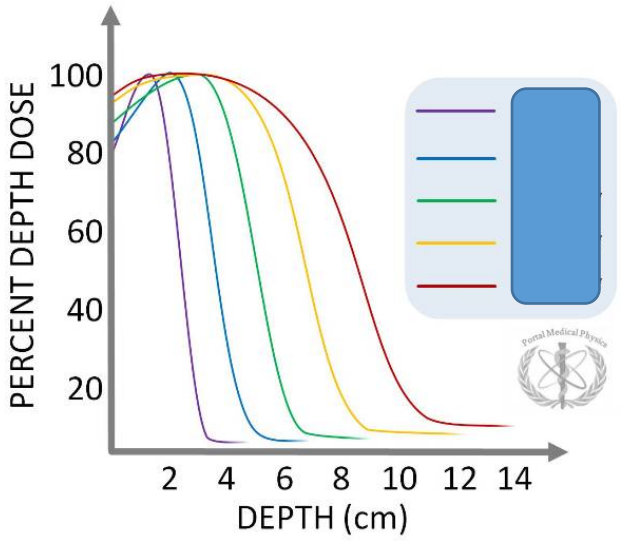
1. For a lung SBRT plan treated with modulating MLCs, what is the name of the effect describing the interaction between MLC leaf motion and organ motion? What are some factors that can impact the severity of this effect?

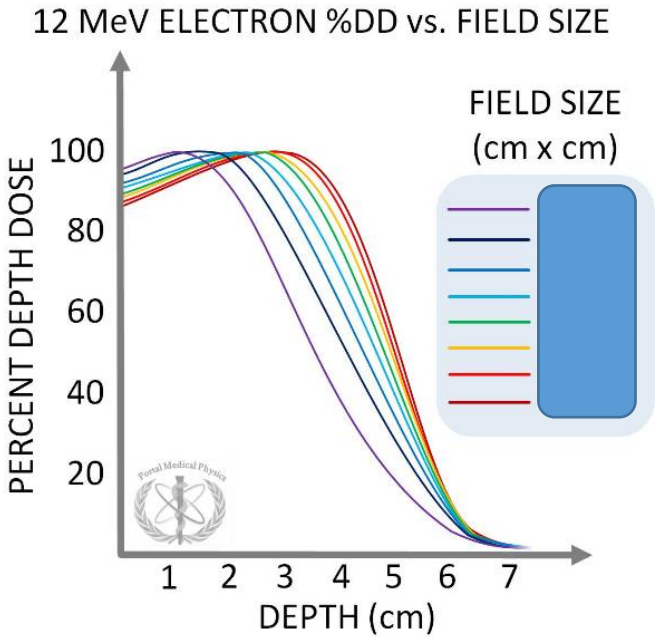
Describe the graph below.

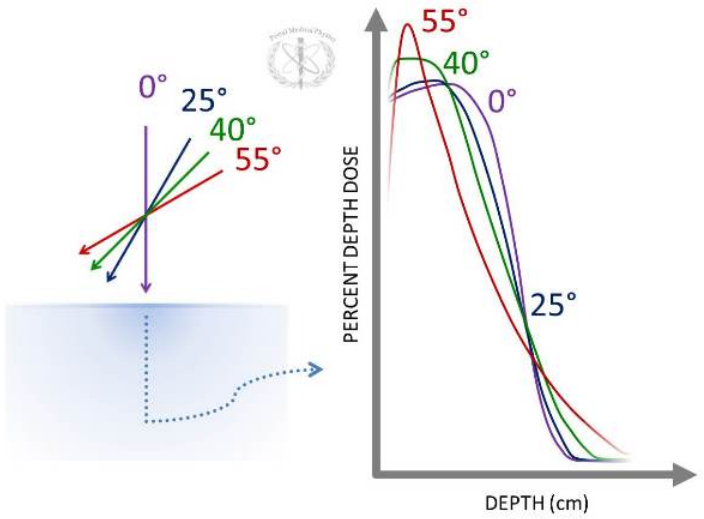


- If B = 3 cm, approximately what is the energy of the beam?
- How would you expect surface dose to change with energy?
- How would you expect surface dose to change with field size?

Discuss how electron PDDs vary with Energy and Field Size and angle of indidence;

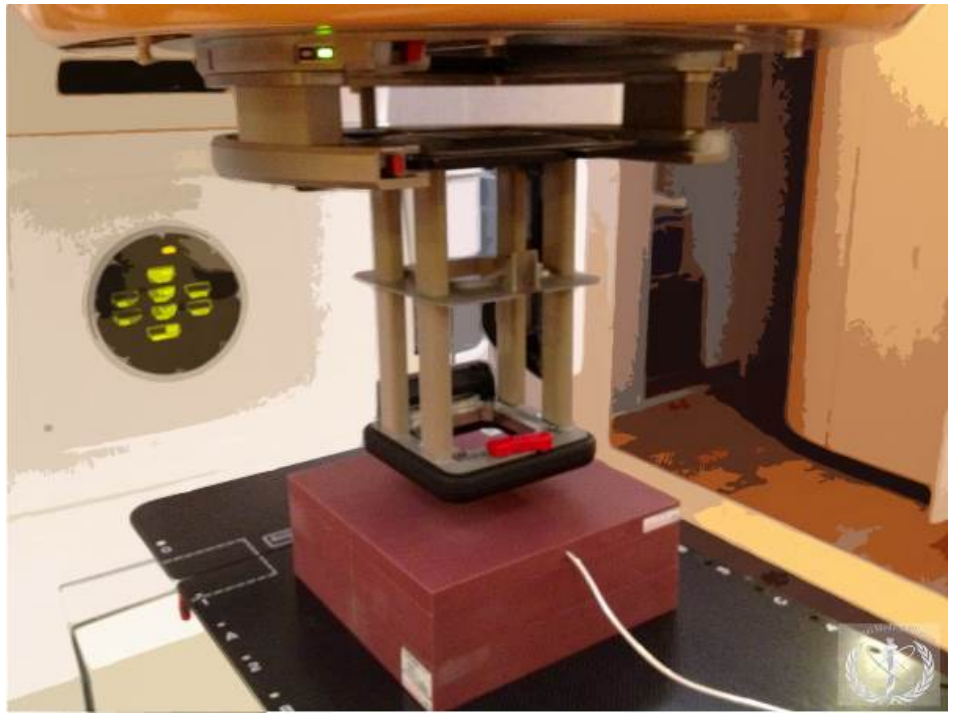






1. How do you measure electron PDDs?
2. Dose this require a shift of your measuring device?
3. Do you shift when measuring output? Why/Why not?

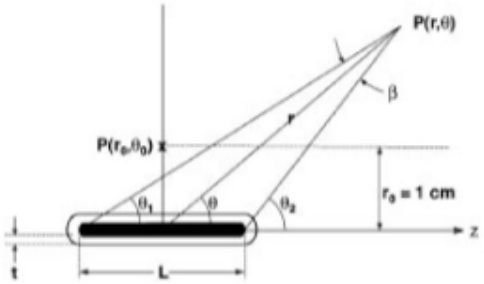
Describe what is shown below, and why we use it;



1. Do electrons follow an inverse square relationship?
2. Do we ever use extended SSD for electron treatments?

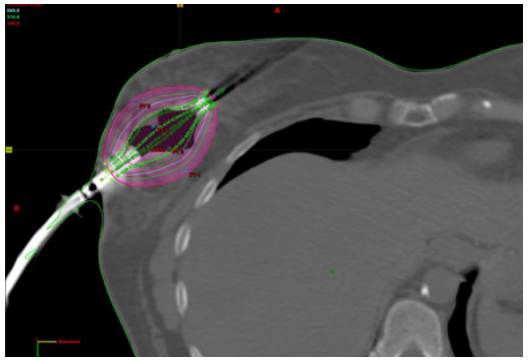
Identify and define the terms of the Modular Dose Rate Equation as presented in TG-43 using the equation as presented with this question.

$$\dot{D}(r,\theta) = S_K \cdot \Lambda \cdot \frac{G_L(r,\theta)}{G_L(r_0,\theta_0)} \cdot \mathrm{g}_L(r) \cdot F(r,\theta)$$



1. How is source strength characterized for contemporary HDR sources? What units are used?
2. How would you carry out an HDR source exchange?
3. What periodic quality assurance should be performed for an HDR unit?

Unfortunately, your overzealous junior resident treated a full fraction of HDR APBI while you were standing 1 meter away from the patient. Estimate the dose you received from this accident.



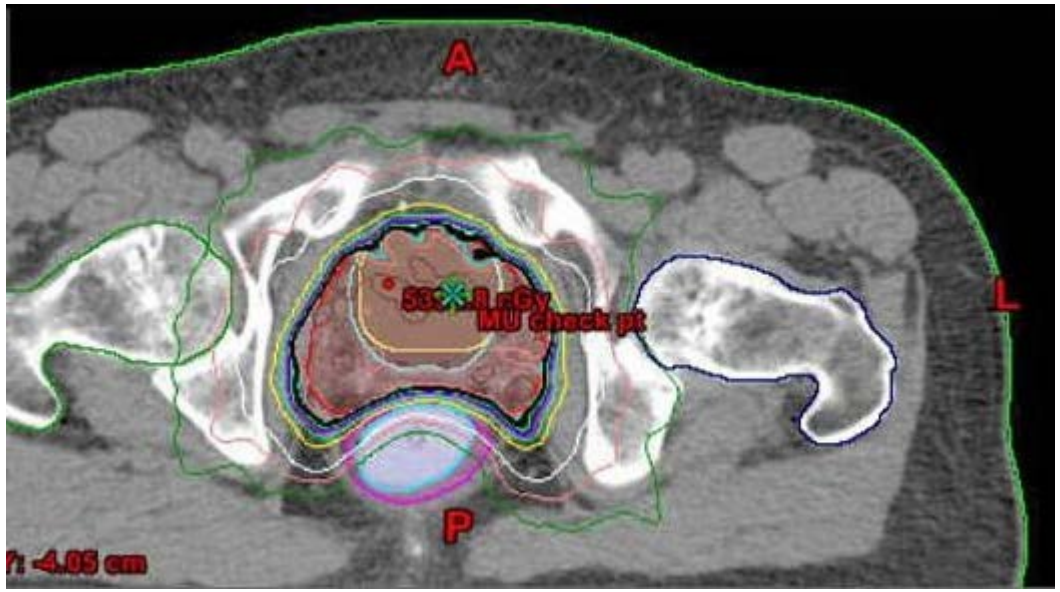
Ch. 1	Ch. 2	Ch. 3	Ch. 4	Ch. 5	Ch. 6	Ch. 7
125.4	120.4	120.4	120.4	120.4	120.5	120.4
Time (s)	Time (s)	Time (s)	Time (s)	Time (s)	Time (s)	Time (s)
2.1			7.6	1.8		1.5
18.0						
		4.2	1.9		7.9	
	3.9	5.2	5.1	10.7	5.8	7.2
	1.9	3.1	2.8		1.8	
	8.6	6.5	1.0	4.7		4.6
	3.5	3.7	8.1		9.7	2.8
					3.6	
50.4						

Total Treatment Time

Total treatment time (sec.): 191.8
% of total time lost due to rounding off (%): 0.0

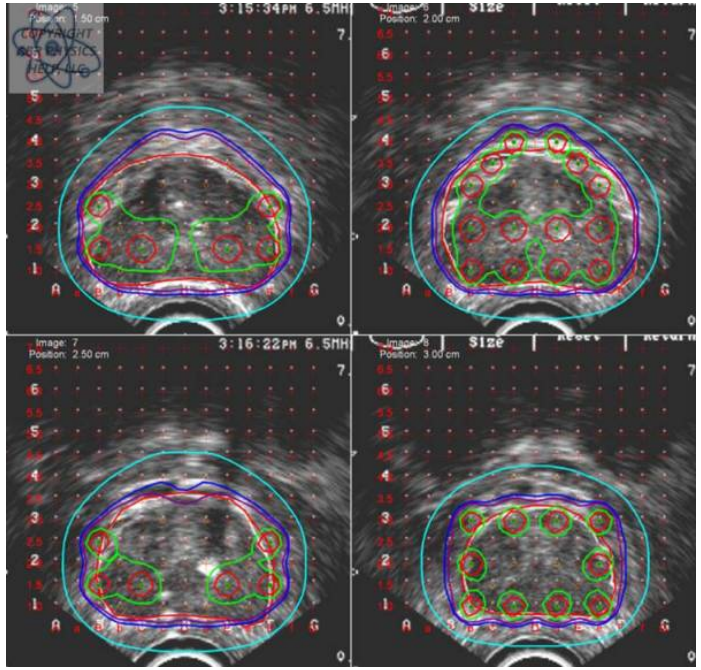
1. If you were to wait 74 days (1 half life) and return the favor (same patient plan), how would the dose differ?
2. Would this have been considered a medical event?
3. What HDR safety procedures were overlooked for this to have happened?

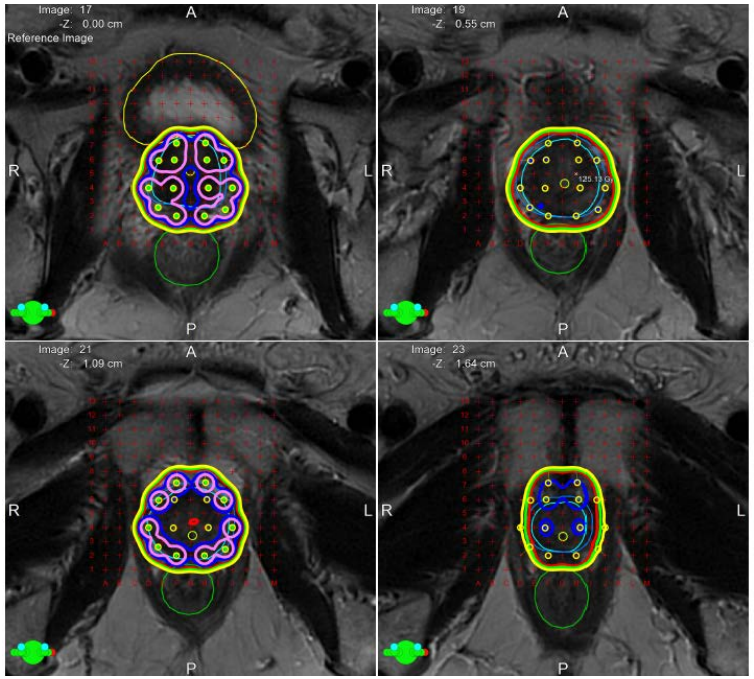
- Compare and contrast the different treatment techniques that could be employed for a prostate treatment. Include in your discussion external beam radiotherapy as well as brachytherapy techniques.



1. What are the motivating factors that might influence the decision to utilize hypofractionation for the external beam treatment of a prostate as opposed to conventional fractionation? In what details might these plans differ?
2. Where could you go to find guidance on planning SBRT prostate cases?

- What imaging modalities were used to create the images shown here? How do we calculate dose in this application?

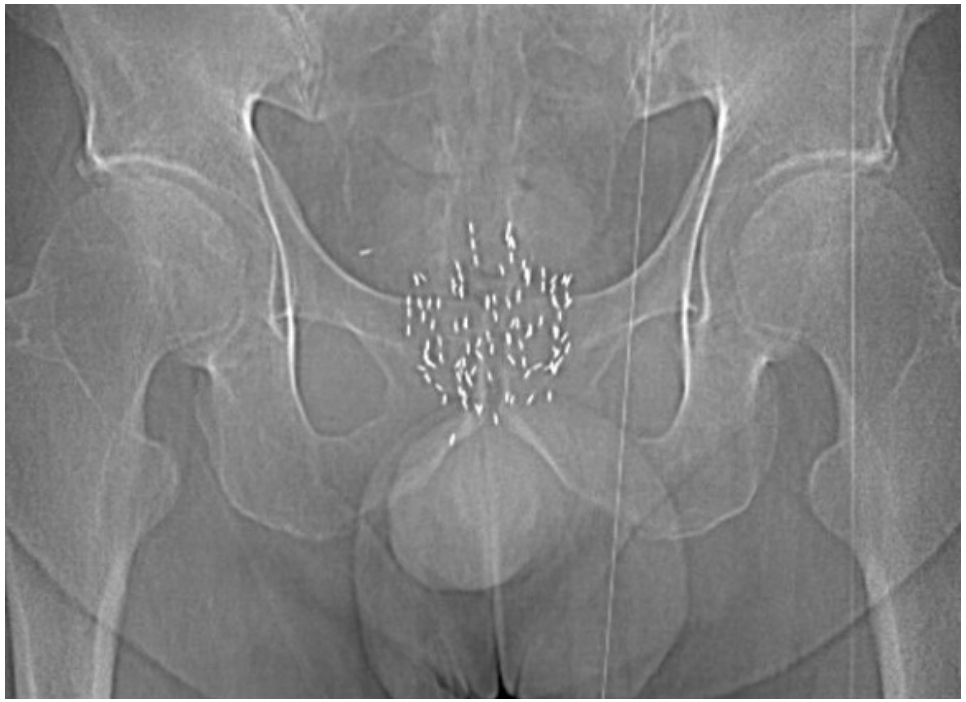




1. Define the applications specific to radiotherapy where ultrasound has proven useful. What application is most likely represented in the image included here?
2. Compare and contrast the different treatment techniques that could be employed for a prostate treatment.

- A patient is scheduled to receive an LDR I-125 brachytherapy implant for prostate cancer. Please provide a brief overview of a typical implant of this nature.

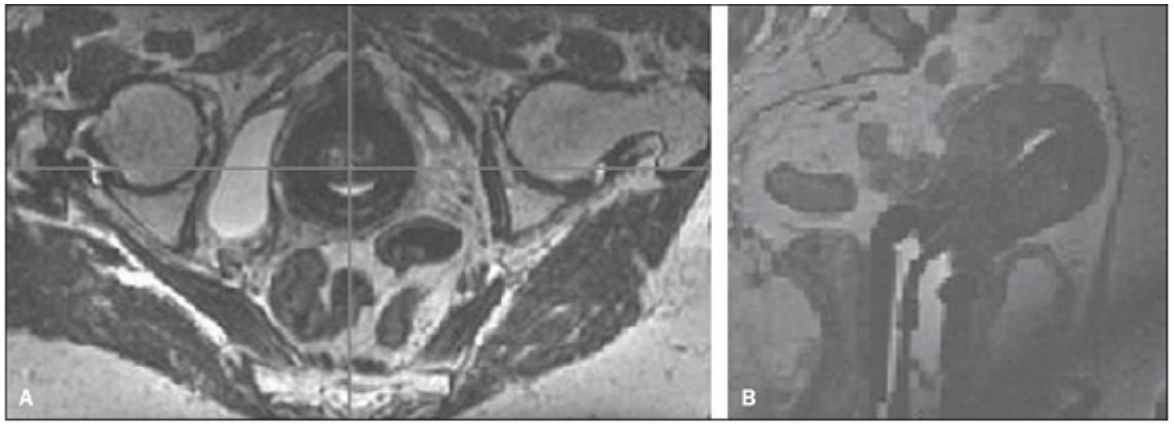
1. How is pre-planning performed for this treatment?
2. What is post implant dosimetry?
3. Discuss how seed migration might effect plan quality.
4. Where might seeds migrate to?



Describe the daily QA checks minimally required by the NRC for an Ir-192 remote afterloader as used for HDR brachytherapy. Be sure to define what is being checked and how this check is performed.

1. What is being tested in the image shown with this question?
2. When should a source calibration assay be performed?
3. What is an acceptable assay result for this context?
4. Describe how applicator specific QA can be performed.

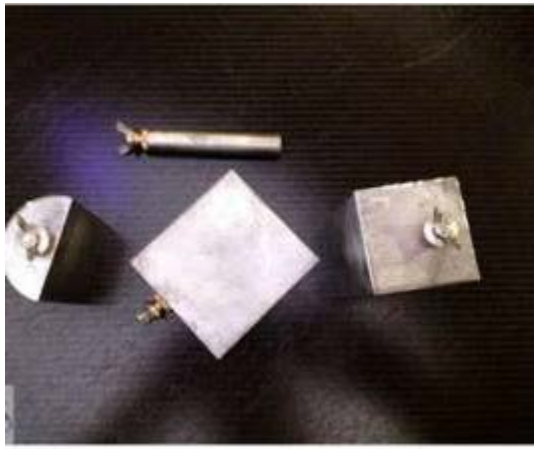
In general, what is the rationale for MRI-based brachytherapy?



Source: Sales CP, Carvalho HD, Taverna KC, et al. Evaluation of difference magnetic resonance imaging contrast materials to be used as dummy markers in image-guided brachytherapy for gynecologic malignancies. Radiologia Brasileira. 2016 Jun; 49(3): 165-9.

1. How would treatment planning be different when using MRI-based brachytherapy planning versus using CT simulation?
2. What are the device challenges that must be considered for MRI-based brachytherapy, and how are they overcome?

In the pictures provided, what are these objects?
What are they composed of? What are they used for?



1. What would be the consequence of making the objects of lower density? Of higher density?
2. How would you know how thick to make the objects?
3. What effect would increasing the distance of the block from the patient have on thickness of the block?