

HOW DO YOU AIM INVISIBLE ENERGY?

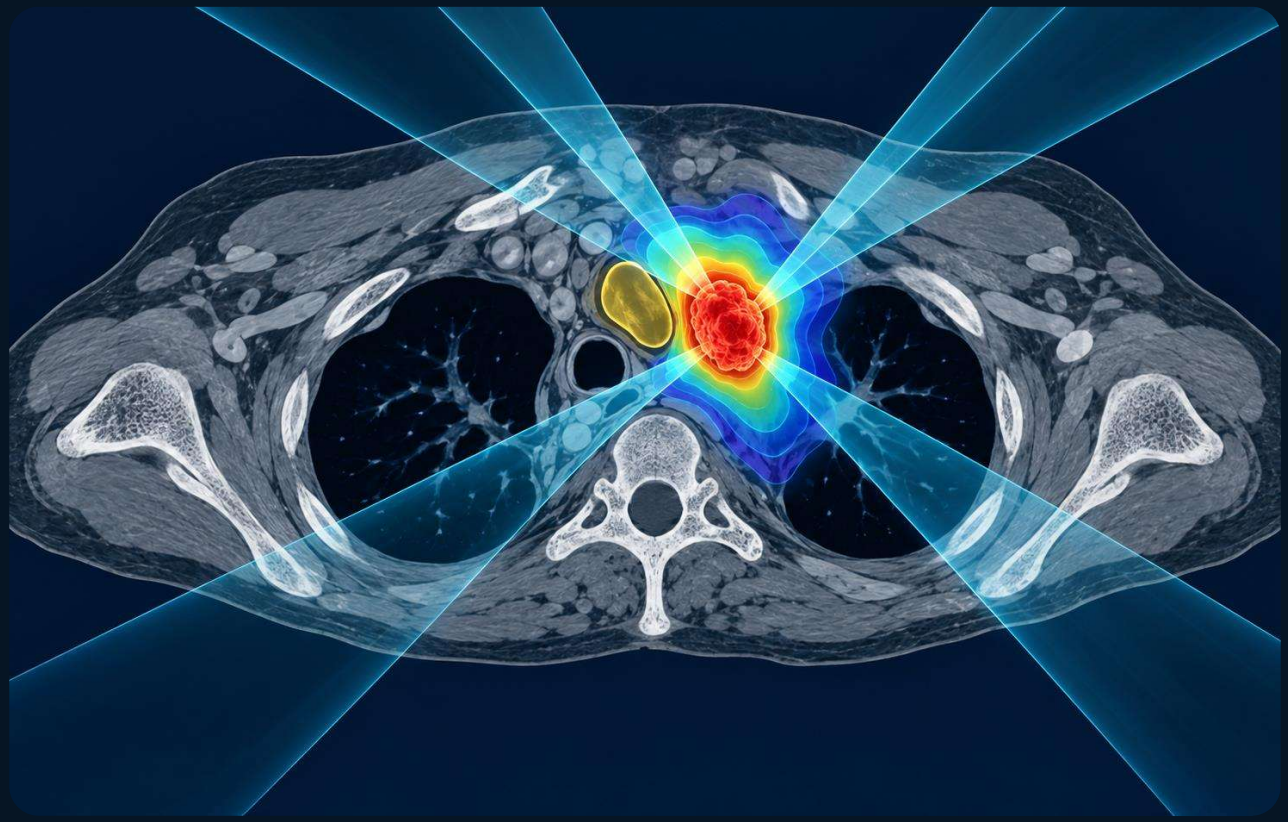
Introduction to medical physics

Physics applied to medicine and patient care

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One target. One organ we cannot miss.

Audience vote: Where would you aim the radiation?



A One powerful beam

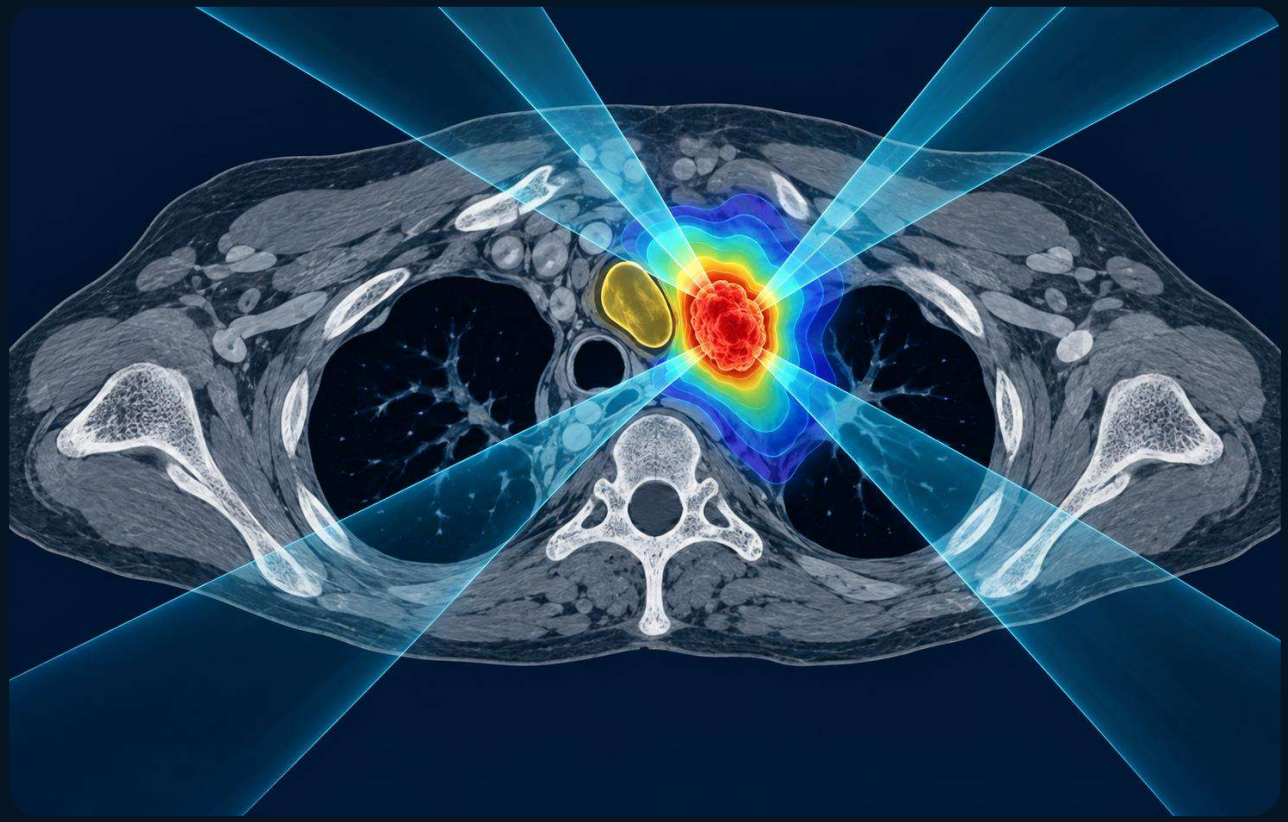
B Two opposing beams

C Many beam angles

D A source inside the body

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All four can be correct.

The medical physicist

The person who proves that an image, dose, machine, and software can be trusted

IMAGE
Can we see the anatomy accurately?

DOSE
How much energy reaches each tissue?

SAFE, PRECISE PATIENT CARE

MACHINE
Will the system deliver what we calculated?

SOFTWARE
Can we detect errors before treatment?

The physics toolbox

The same undergraduate ideas become clinical instruments

ELECTROMAGNETISM

MRI

Nuclear spins respond to magnetic fields and radiofrequency pulses.

See soft tissue without ionizing radiation.

ATOMIC + NUCLEAR

PET / SPECT

Radioactive tracers reveal function. Annihilation photons reveal location.

See biology, not only anatomy.

INTERACTIONS + COMPUTATION

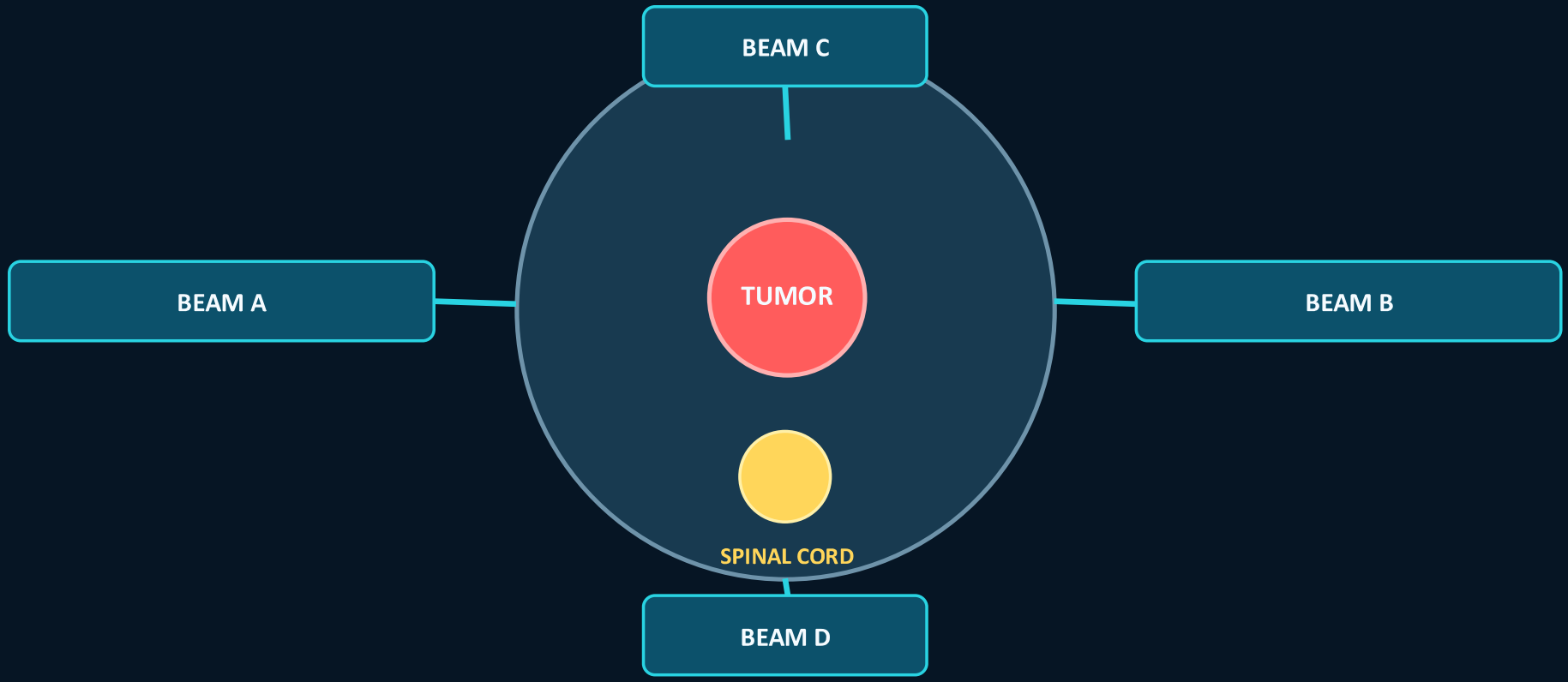
RADIATION THERAPY

Photons, electrons, and particles deposit energy in tissue.

Shape dose around a tumor.

The beam-angle challenge

Audience: select two beams that hit the tumor and avoid the spinal cord



Clinical reality: optimize thousands of beamlets, then test the plan against motion and uncertainty.



THE 3% MYSTERY

This morning, the measured output is 3% lower than expected.

A Correct the treatment time

B Treat because 3% sounds small

C Stop and investigate

D Reboot and measure again



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Problems the field is solving now

Each advance creates a new measurement and validation problem

ADAPTIVE THERAPY	Recalculate treatment as anatomy changes	*How much change requires a new plan?*
ARTIFICIAL INTELLIGENCE	Contour anatomy and predict dose	*How do we detect a confident wrong answer?*
THERANOSTICS	Use one molecule to image and treat cancer	*How do we personalize activity and absorbed dose?*
PARTICLE THERAPY	Place energy at a chosen depth	*How do range uncertainty and biology change the result?*

A career built around difficult decisions

The work moves between patients, machines, data, and teams

08:00

QA

A measurement looks unusual.

10:30

PLAN REVIEW

Can the plan survive uncertainty?

13:00

PROCEDURE

The anatomy differs from the expectation.

16:00

DEVELOPMENT

Can automation reduce tomorrow's risk?

What I value most: the physics matters today, to a real patient.

Could this be your kind of physics?

Choose the problem you would most like to solve

SEE DISEASE

Improve an image without adding unnecessary radiation.

TREAT DISEASE

Concentrate dose in a moving target while protecting normal tissue.

INVENT WHAT COMES NEXT

Build and validate the tools clinicians will use tomorrow.

1 Physics degree 2 CAMPEP graduate education 3 Clinical residency 4 Board certification

Someone must prove the technology is safe. That someone could be you.