Introduction to Medical Physics

Liz Fletcher
liz.fletcher@carleton.ca

Carleton Laboratory for
Radiotherapy Physics

EIEIOO Workshop

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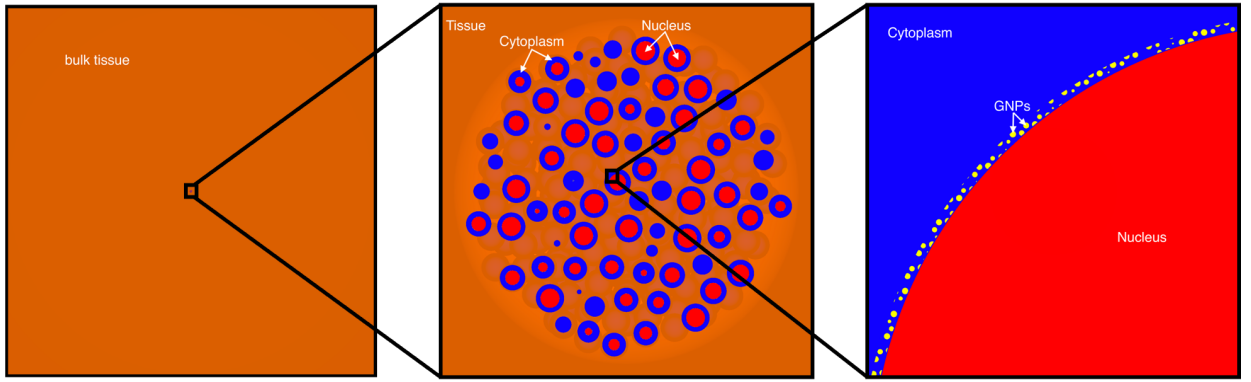
@CLRPhysics
@CarletonMedPhys

Who am I?

- PhD student in medical physics working on Monte Carlo modelling of novel radiotherapy techniques



Bio:

- BSc at Queen's
  - honours physics
- MSc at Queen's
  - particle physics with SNO+
- PhD at Carleton
  - medical physics with CLRP

What is medical physics?

"… an applied branch of physics concerned with the application of the concepts and methods of physics to the diagnosis and treatment of human disease"

- American Association of Physicists in Medicine

What do medical physicists do?

Imaging

- Using physics to look inside people from the outside

Nuclear Medicine

- Using physics to look inside people from the inside

Radiation Oncology

- Treating disease (cancer) using physics

Where do medical physicists work?

Hospitals

- Clinical physicists doing treatment planning, QA/QC, imaging

Research

- Academia or government (NRC, Health Canada)

Industry

- Designing/building imaging/treatment equipment
- Radiation protection
- Production of medical isotopes

Medical physics in Canada

- 18 graduate programs, 13 of which are CAMPEP accredited
- 13 accredited residency programs
- ~500 clinically certified physicists
- ~550 members in COMP

THE CANADIAN COLLEGE OF PHYSICISTS IN MEDICINE

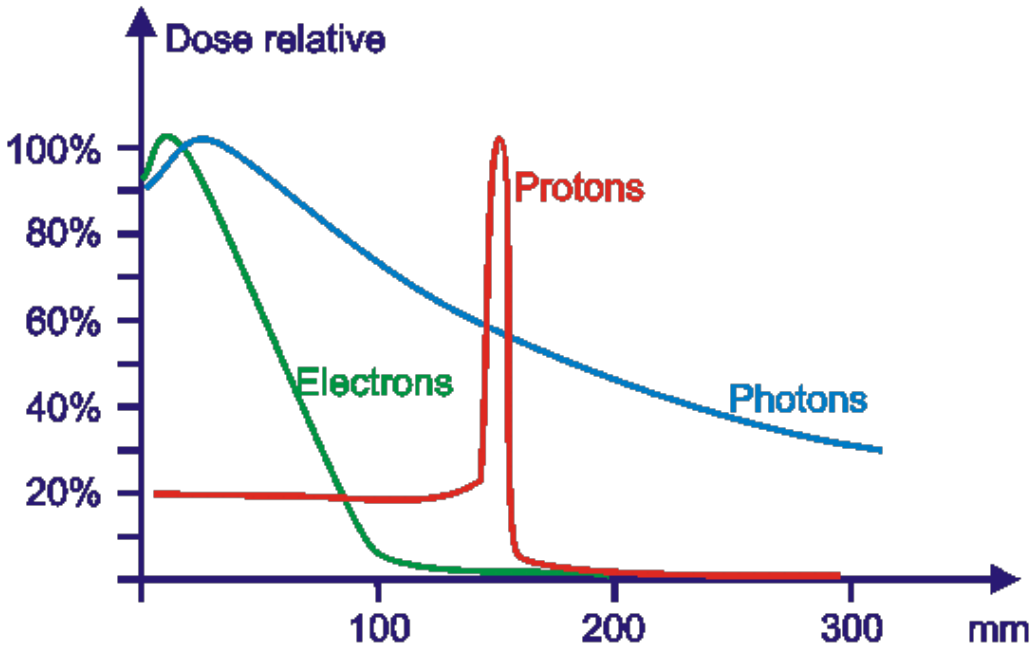
LE COLLÈGE CANADIEN DES PHYSICIENS EN MÉDECINE

COMP
Canadian Organization of Medical Physicists

OCPM
Organisation canadienne des physiciens médicaux

How does this relate to particle physics?

- It is particle physics! We just have a different target
- All the same physical interactions
- All the same physical principles
- Even some of the same technology!



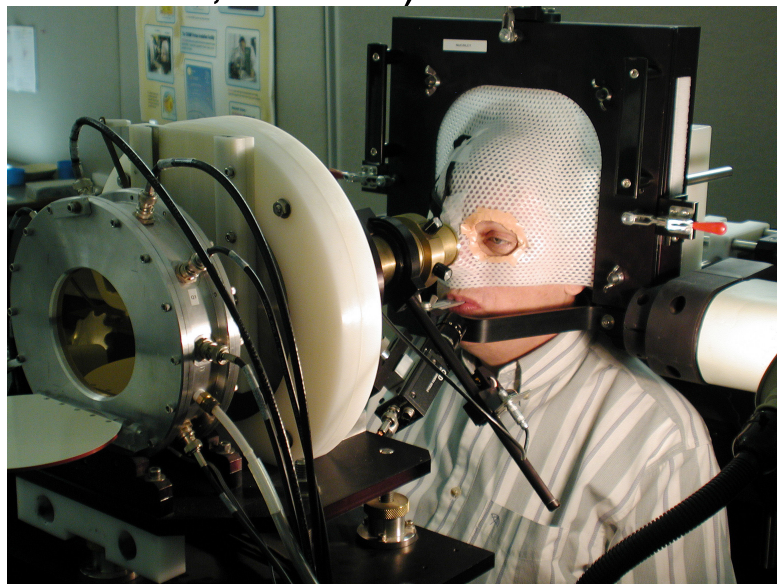
Particle accelerators

Linear Accelerators

- Used for radiotherapy
- Electrons accelerated across a potential of a few MV, then hit a target to produce a photon beam

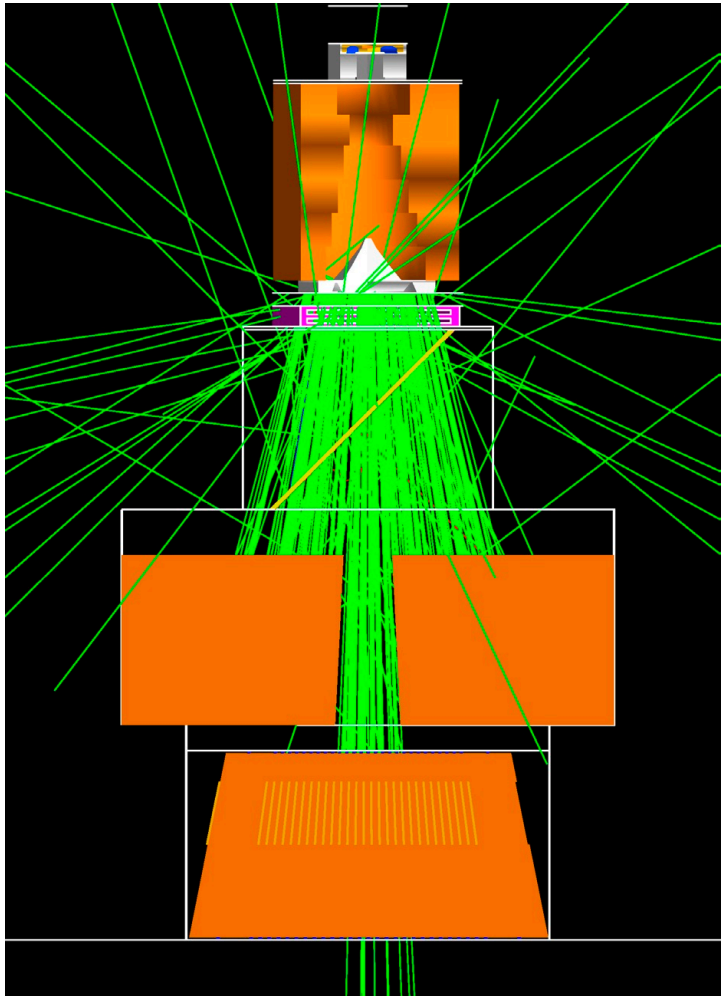
Cyclotrons

- Used to generate isotopes for nuclear medicine (^{18}F, ^{11}C,^{13}N, ^{99m}Tc)
- Also used to generate particle beams for treatment (protons, neutrons, carbon)



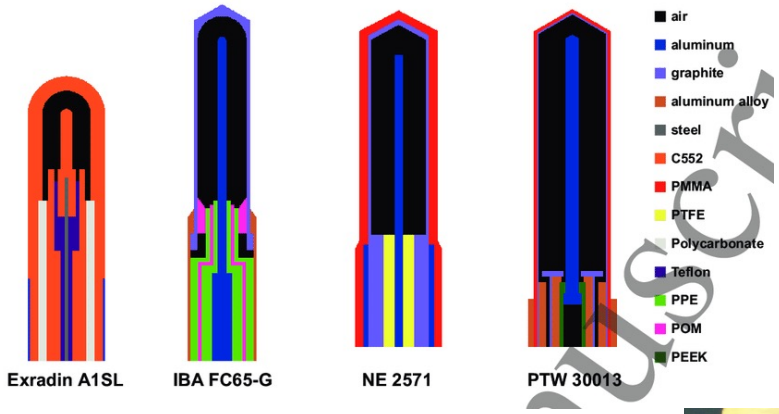
Monte Carlo simulations

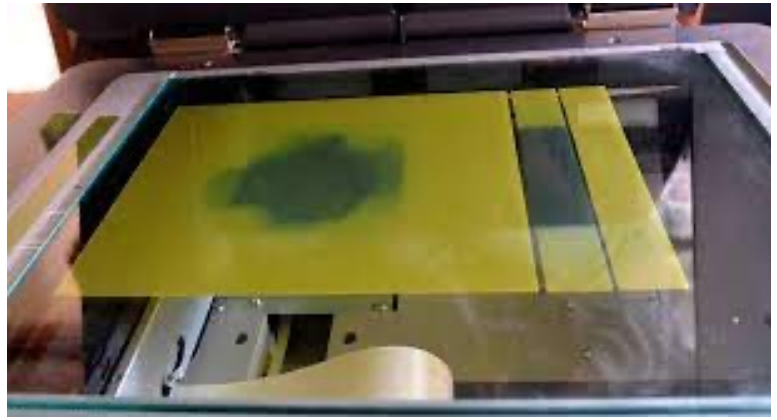
- MC is used to model particle transport and energy deposition
- Codes like EGSnrc, Penelope, Geant4-DNA, ALGEBRA



Dosimeters

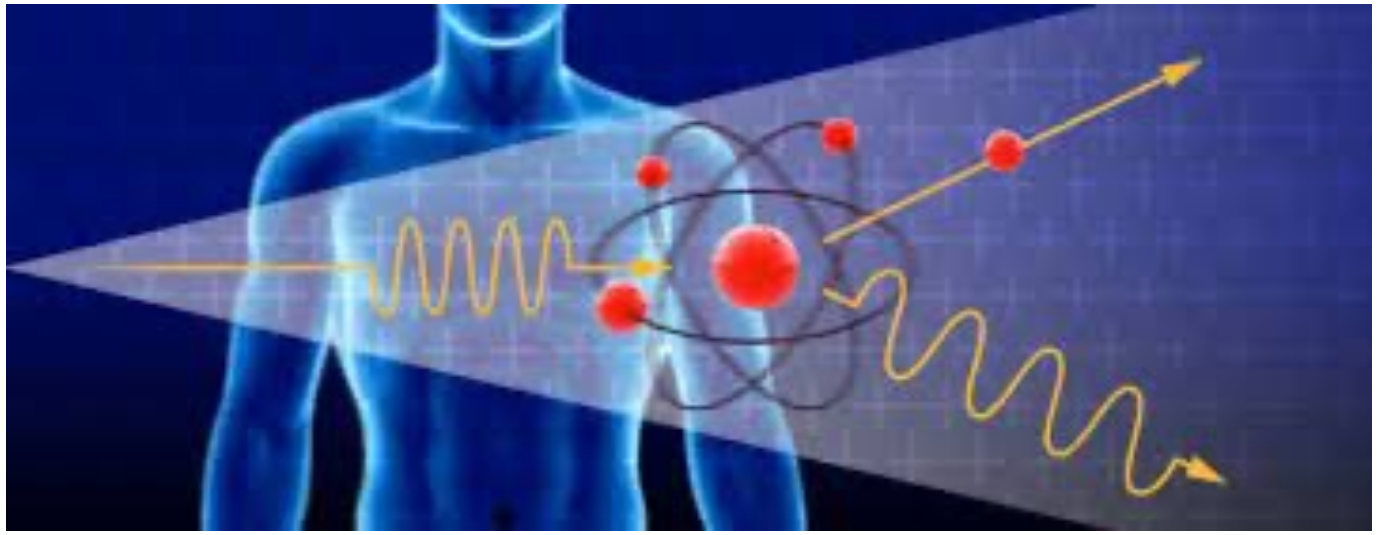
- Devices to measure absorbed dose
- Ion chambers, calorimeters, OSLDs, film,…





Summary

- Medical physics lets you use your particle physics skills to directly help people
- Lots of different career pathways – clinical, academic, or a mix



Thanks!

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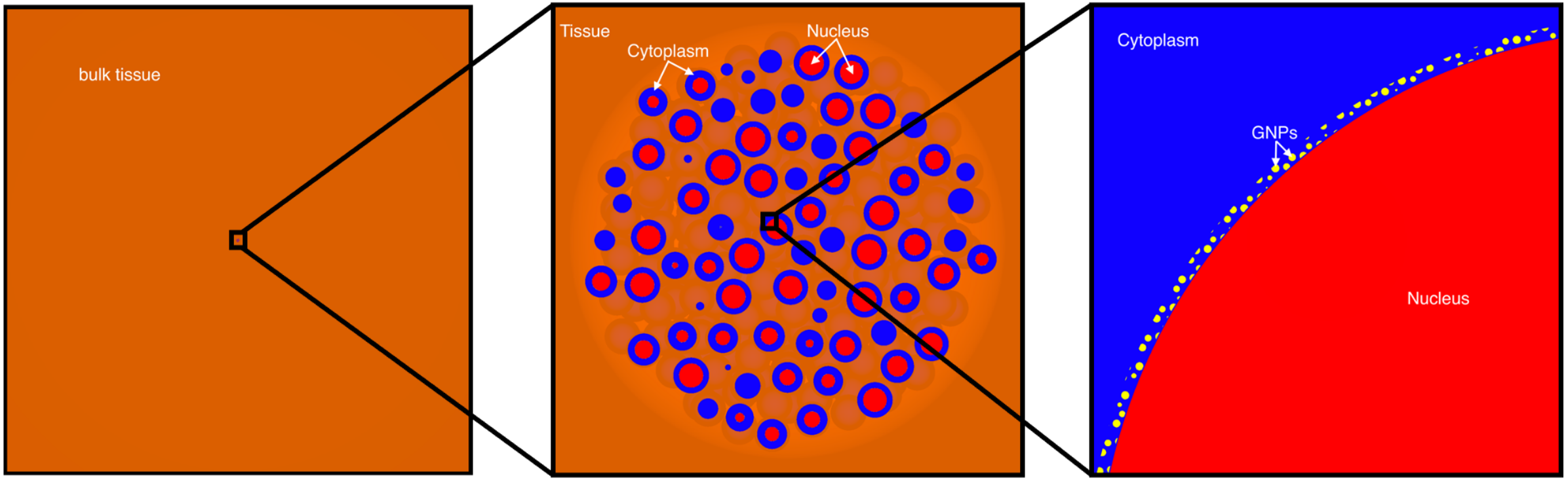
Physics

My work


bulk tissue
Tissue
Cytoplasm
Nucleus
Cytoplasm
GNPs
Nucleus