Monte Carlo Dose Calculations for Irradiation of Foods (meat) using Electrons and X-rays Beams.

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Outline

1. Aim(s)
2. Food Irradiation
3. FLUKA simulations
4. Outlook
5. Acknowledgements

Aim(s)

- Study how electron radiation interact with matter (meat) using FLUKA
- ~~Use FLUKA to design an optimal radiation-shielding infrastructure for the Rhodotron facility~~

Food Irradiation

- Use of ionizing radiation (electrons, X-rays and gamma rays) to reduce the population of, or prevent the growth of, undesirable biological micro-organisms in food.
- Sources of ionizing radiation:
  - Radioactive isotopes
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- High dose (above 10 kGy)
  -Sterilization of spices, dry vegetable seasonings
  -Sterilization of hospital foods

FLUKA simulations

What is FLUKA?
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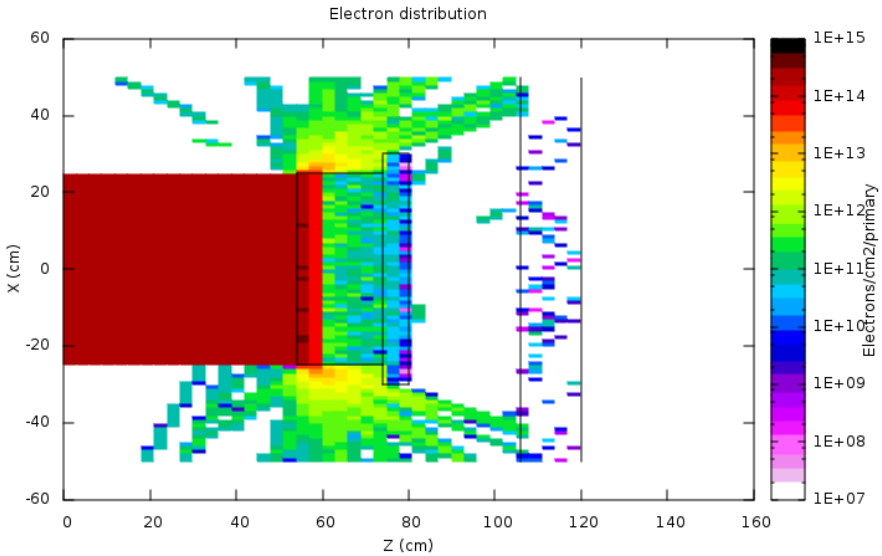
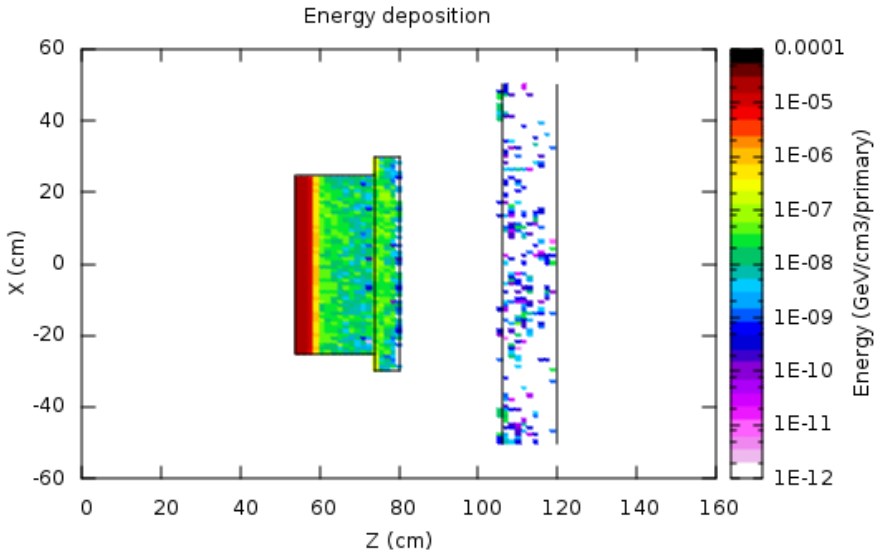
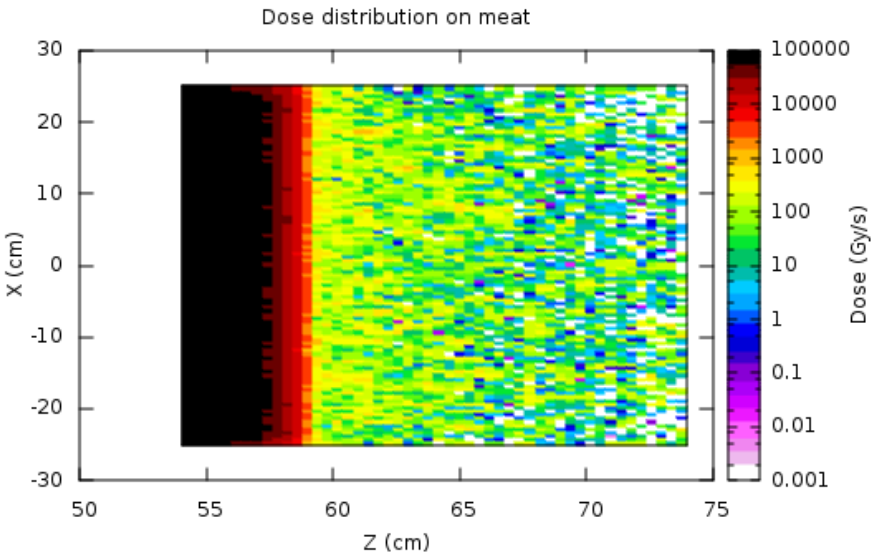
- Accelerator shielding to target design
- Activation
- Dosimetry
- Detector design
- Medical applications e.g. treatment planning

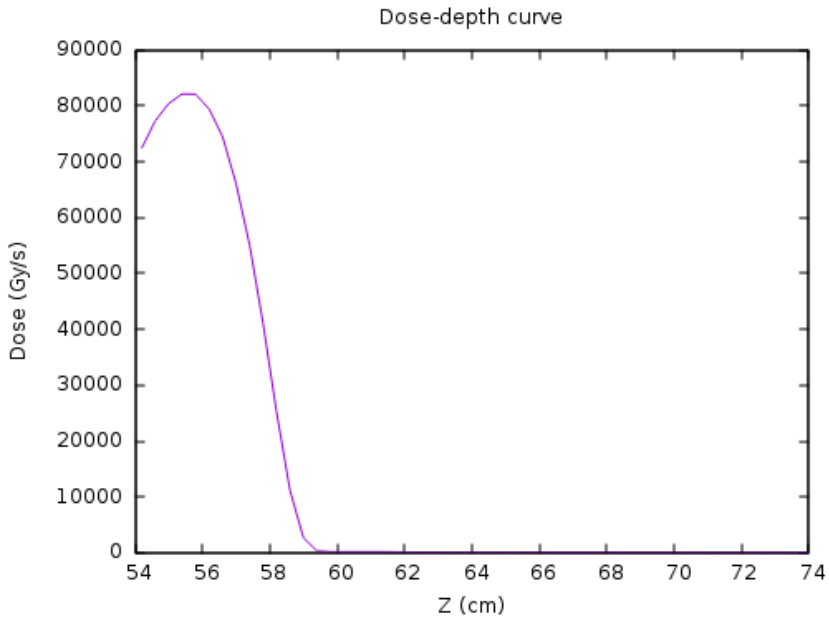
FLUKA simulations





Dose depth plots for 10 MeV electron beam

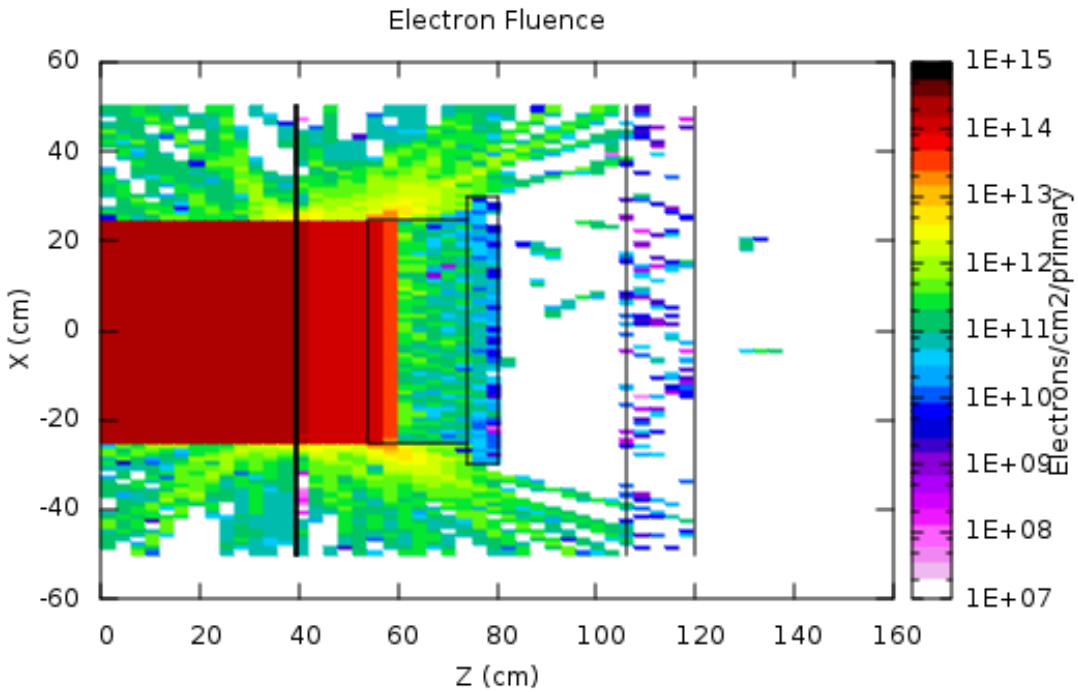




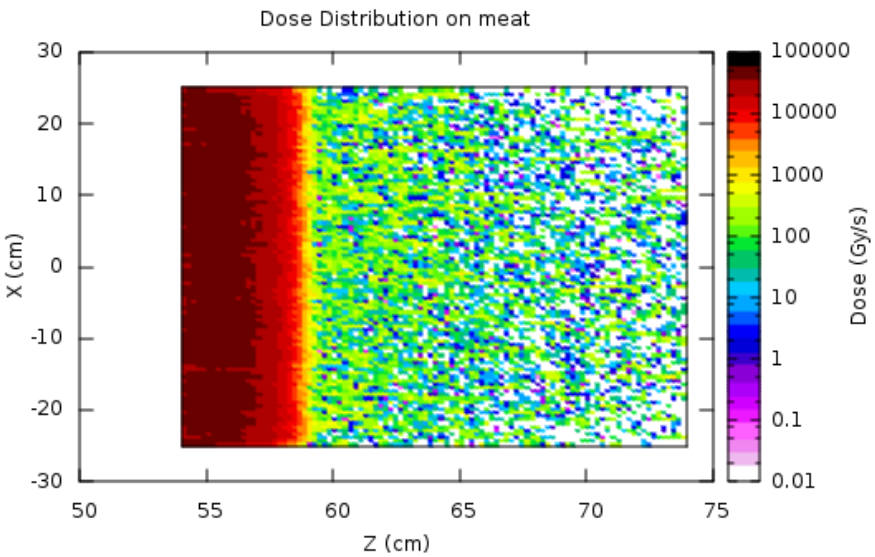
- Electrons penetrates depth of approx 5 cm
- Single-sided E-beam irradiation
- Conveyor system used for double-sided irradiation
- If areal density > 8.5 g/cm^2, X-rays used

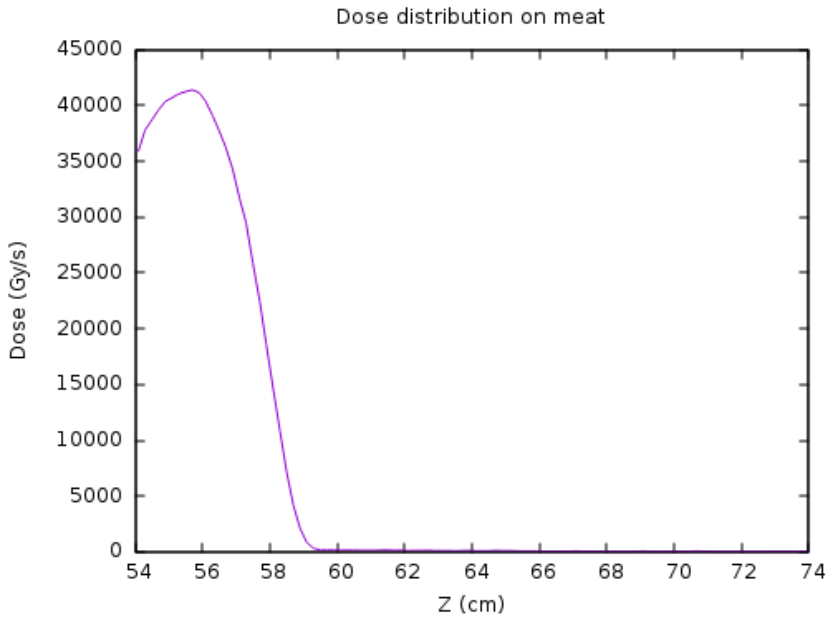
E-beam to X-rays conversion

- Use high-Z (Ta-target) to convert electrons to X-rays
- Optimum thickness 1.7 mm
- X-rays for treatment of high density products

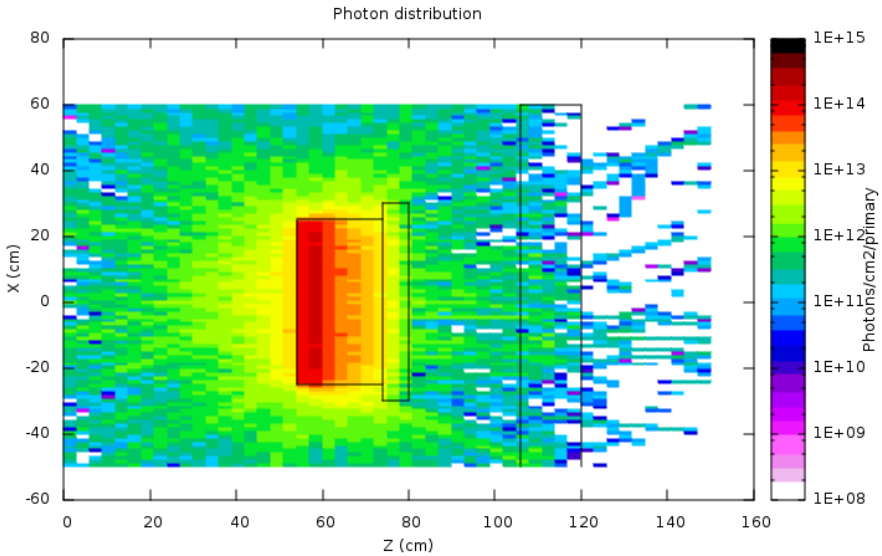


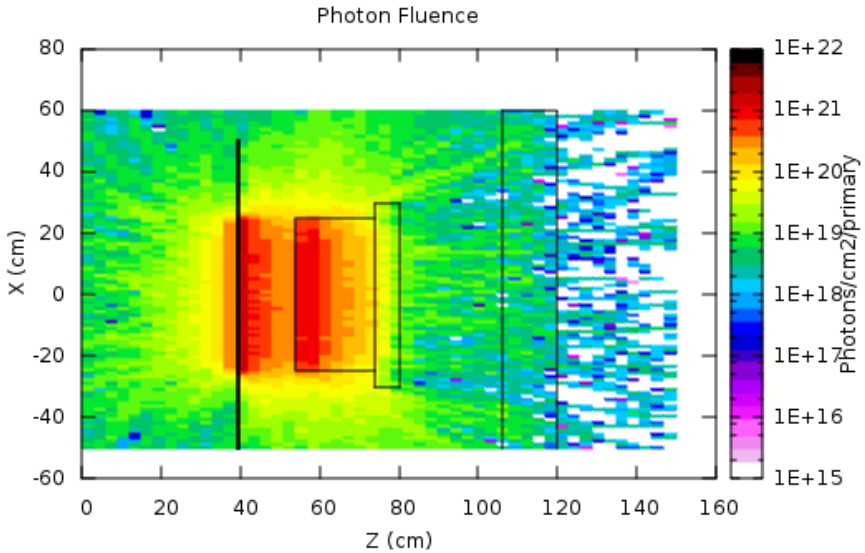
Dose distribution on meat



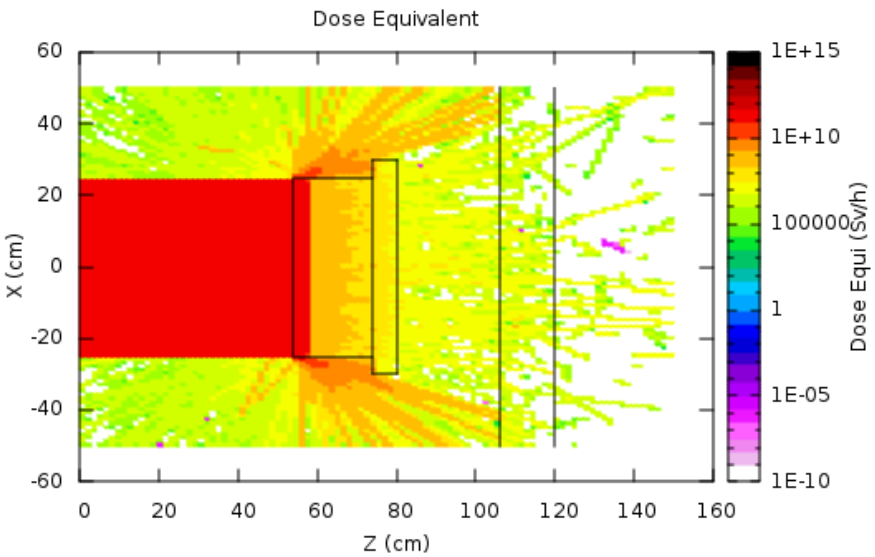


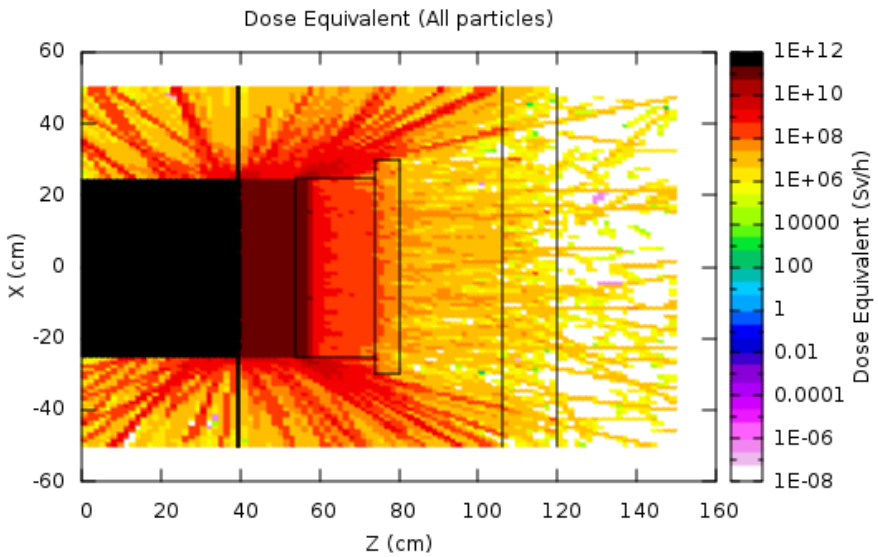
Photon distribution plots





Dose Equivalent plots





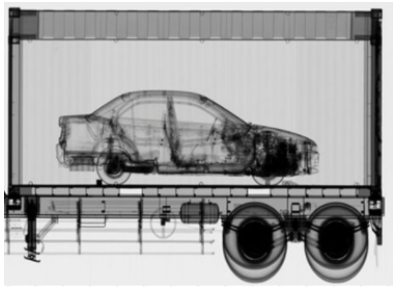
Outlook

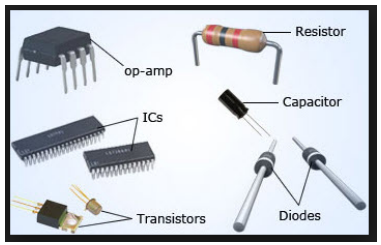
Design an optimal radiation-shielding infrastructure for the Rhodotron facility

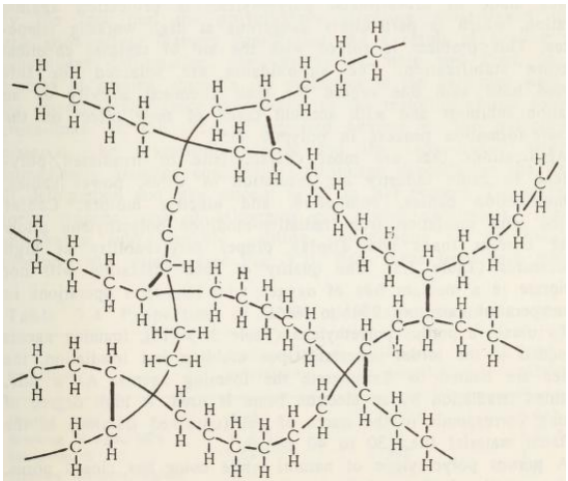
Characteristics of the Rhodotron accelerator

- A compact continuous-wave high intensity industrial recirculating electron beam accelerator.
- 1 MeV $\leq$ E $\geq$ 10 MeV.
- Relatively new

Rhodotron industrial applications







A typical Rhodotron facility layout

Acknowledgements