Project title:

Theoretical study of radiation induced damage in the microstructure of shielding materials

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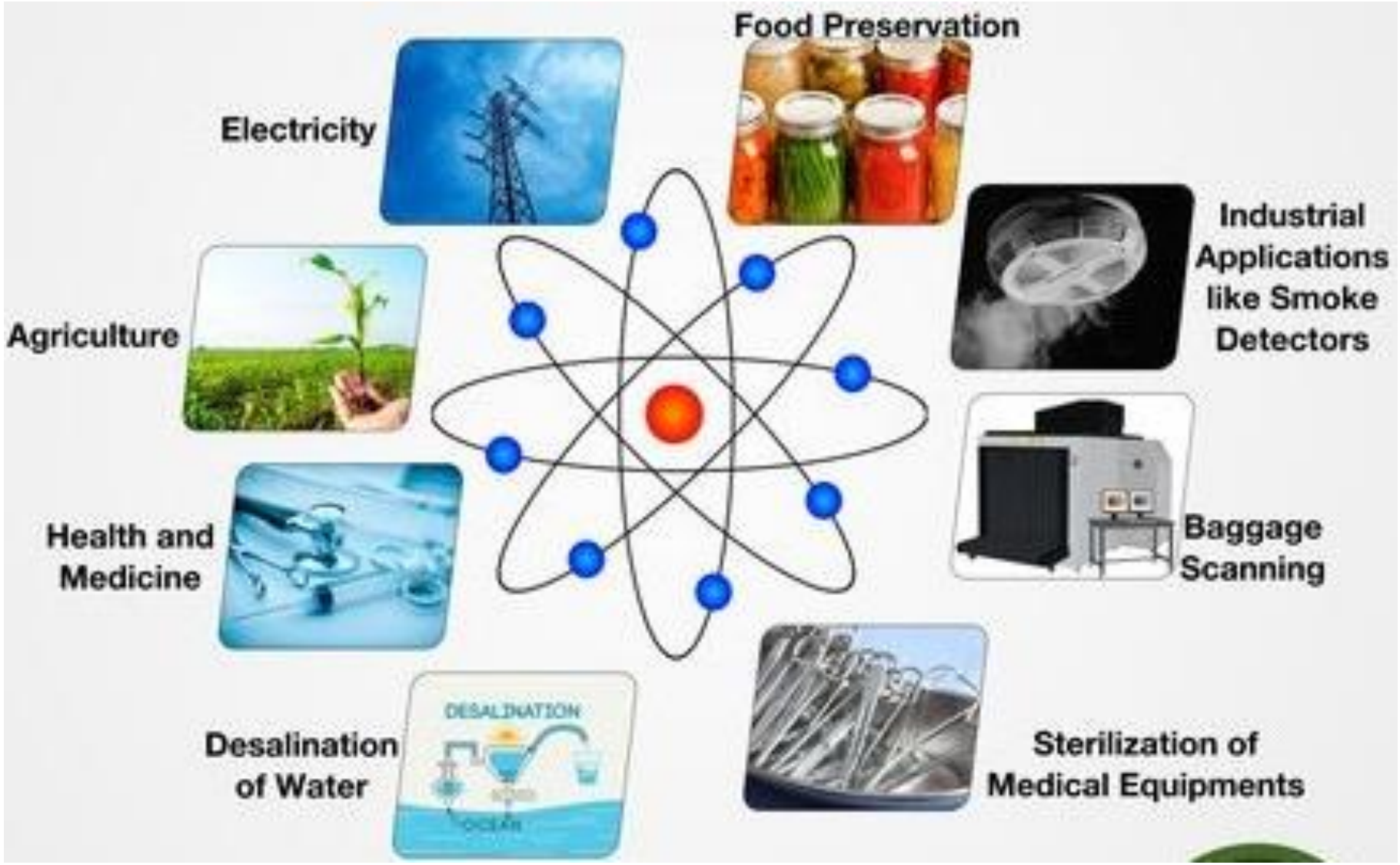
Outline

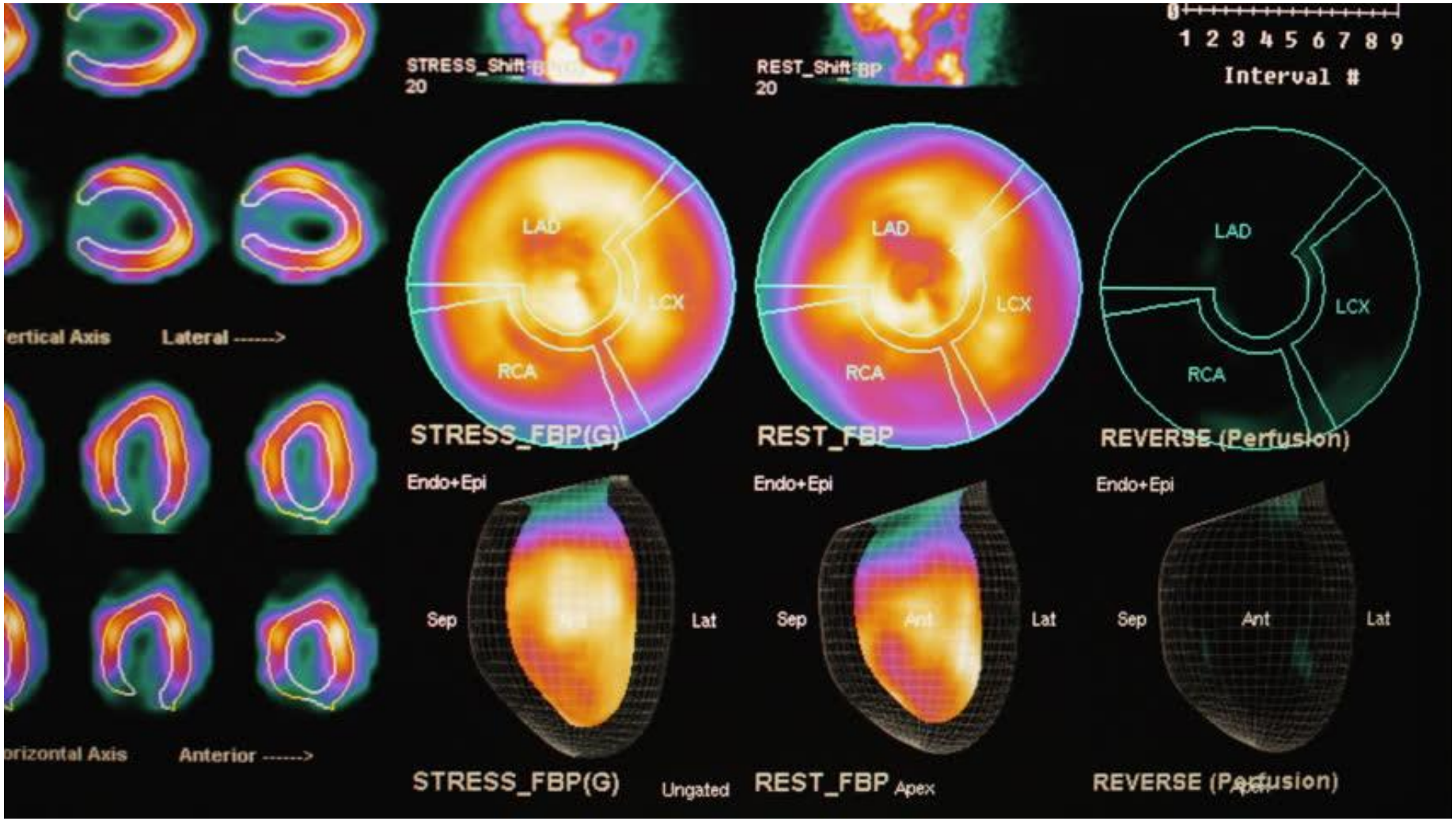
- Nuclear technology
- Research scope
- Our Proposal
- Advantage & disadvantage
- Estimated cost

Application of Nuclear technology



#NuclearFacts

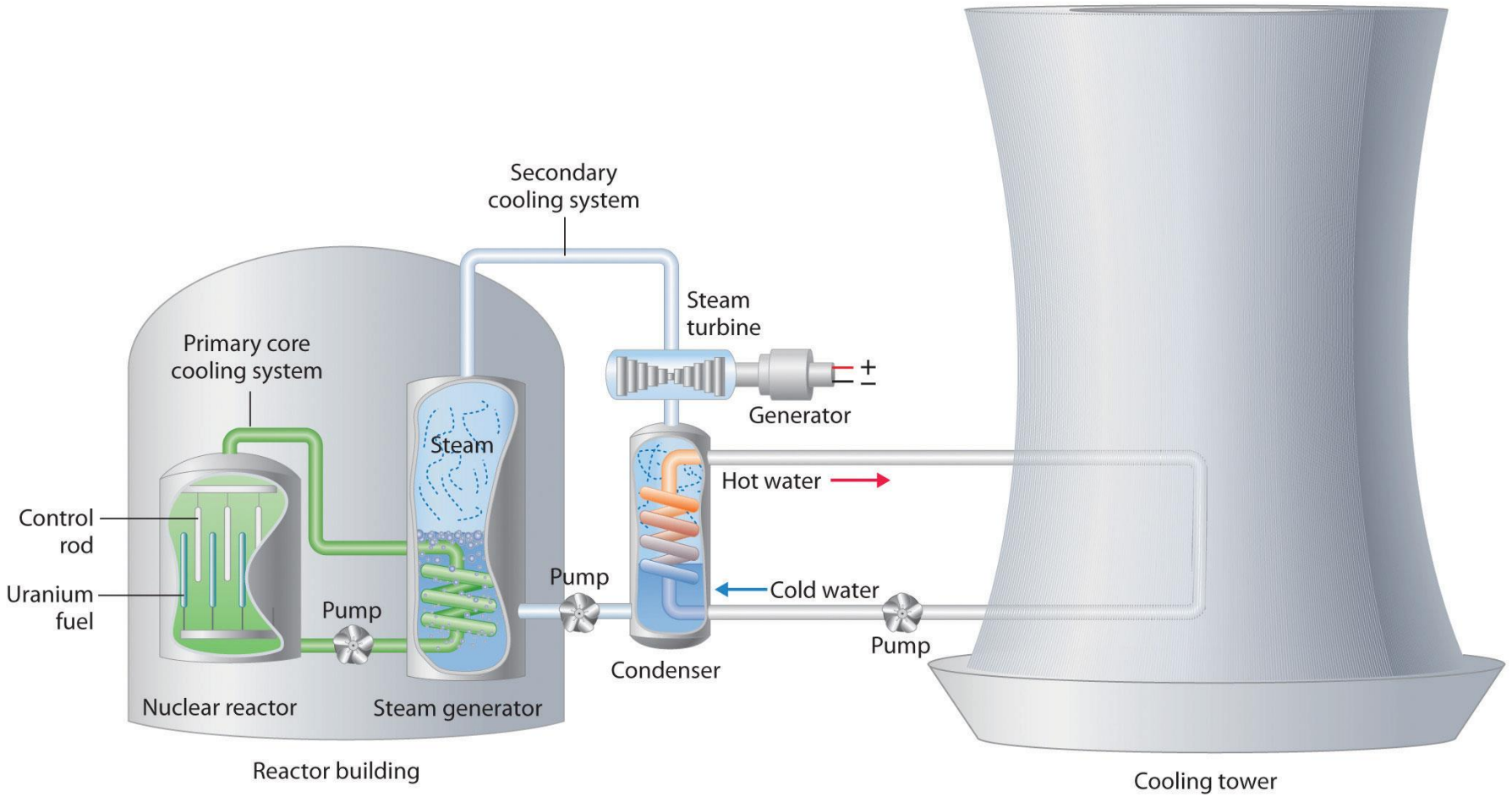
Nuclear technology & Bangladesh



Nuclear technology & Bangladesh

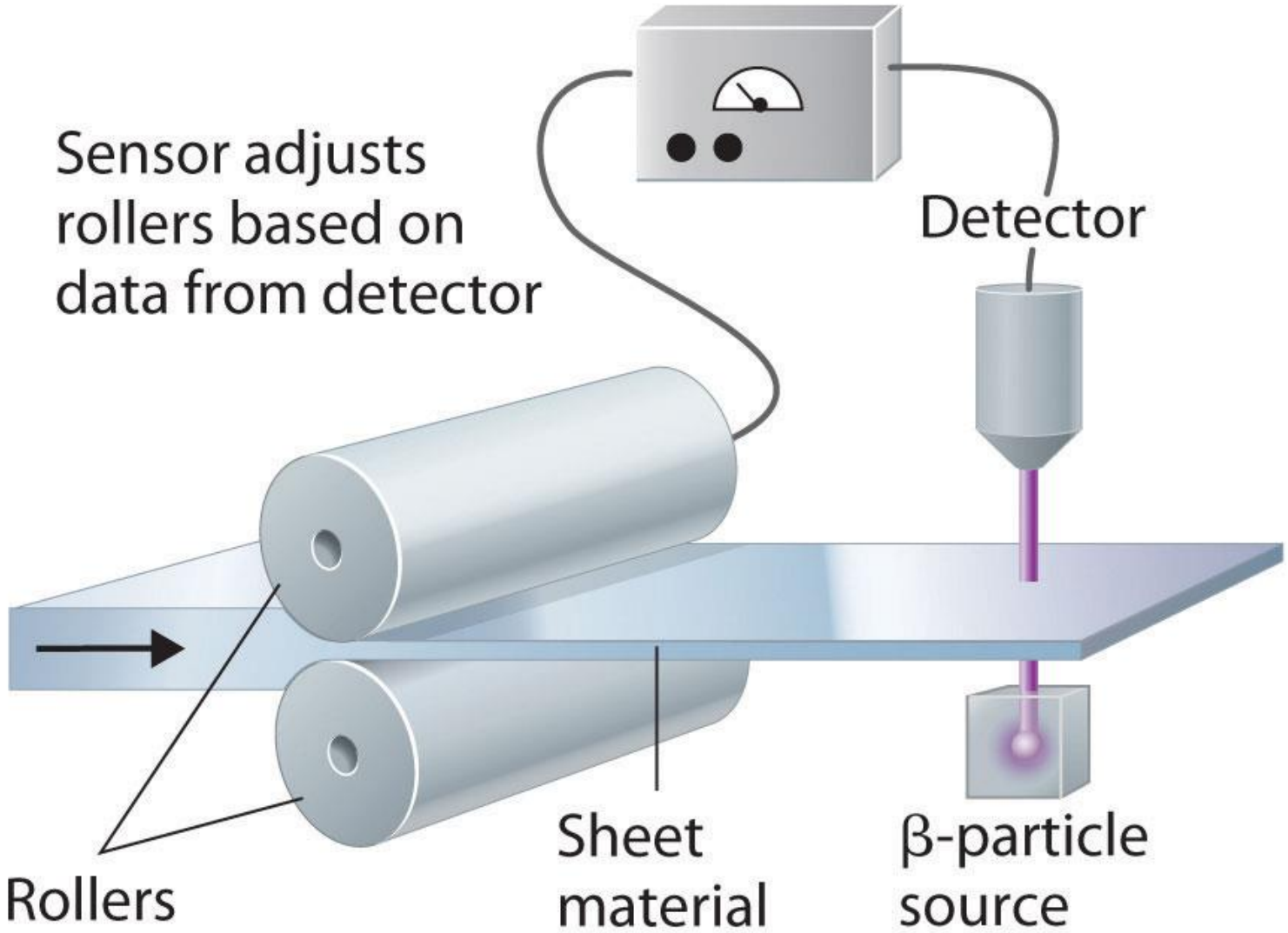
- New varieties of rice through mutation breeding
- Increased crops production three-fold in the last few decades
- Enabled us to achieve food security and improved nutrition

Nuclear technology & Bangladesh



saylordotorg.github.io

Nuclear technology in industry



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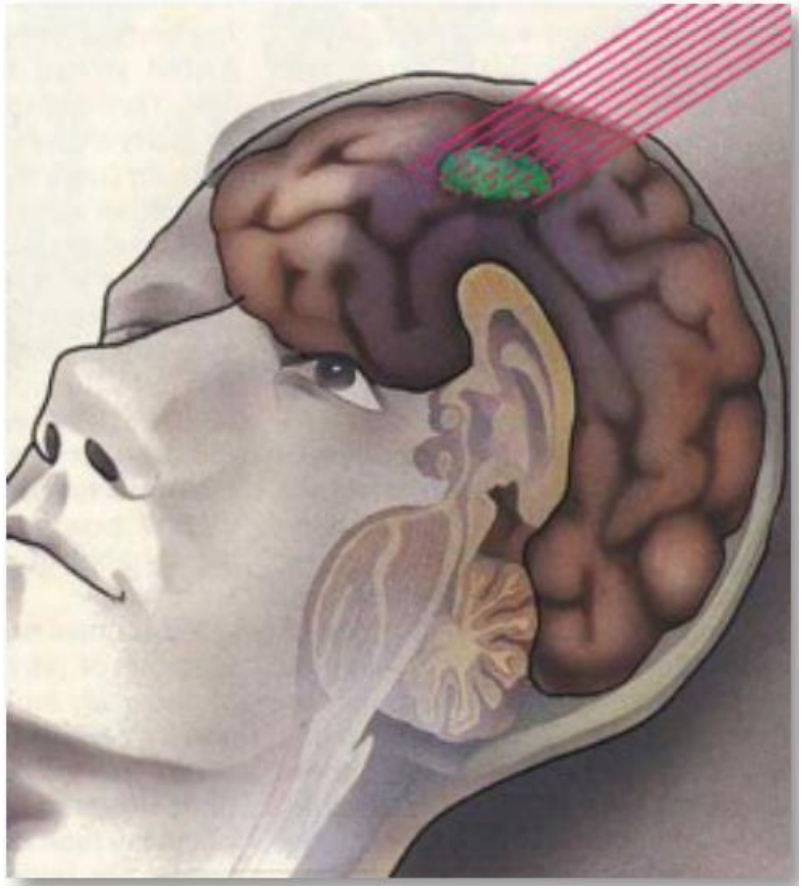
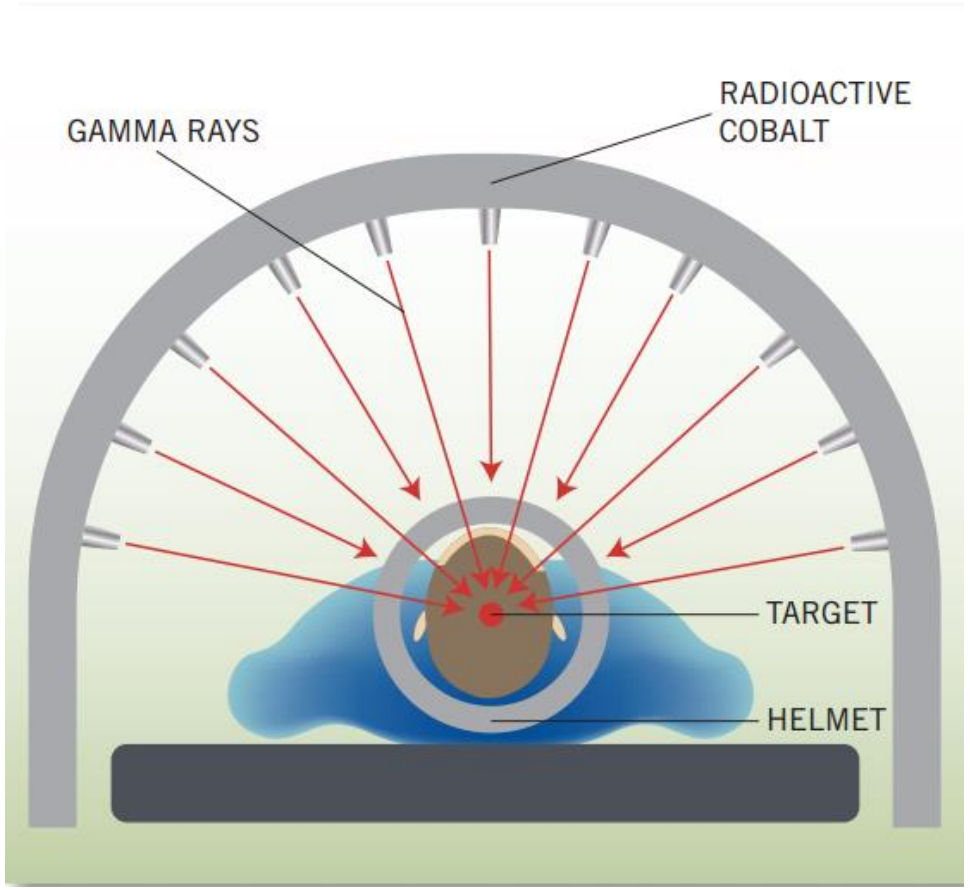
Nuclear technology in medicine





American Nuclear Society

Today, about one-third of all procedures used in modern hospitals involve radiation or radioactivity.

Comparison of nuclear reactor

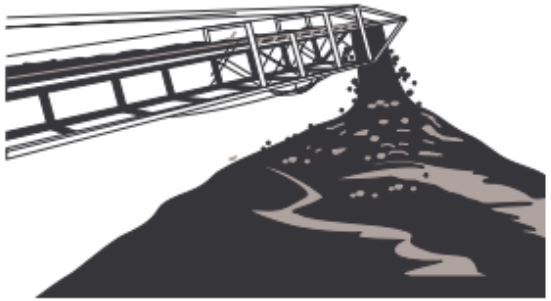
American Nuclear Society

Source Energy Equivalents

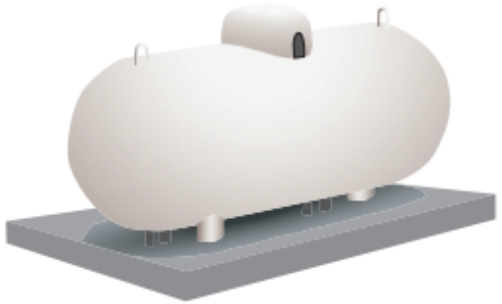
1 Uranium Fuel Pellet, without being reprocessed and recycled, has about as much energy available in today's light water reactor AS...

Uranium Fuel Pellet
(actual size)

3 Barrels of Oil
(42 gal. each)



1 Ton of Coal



17,000 Cubic Feet of Natural Gas

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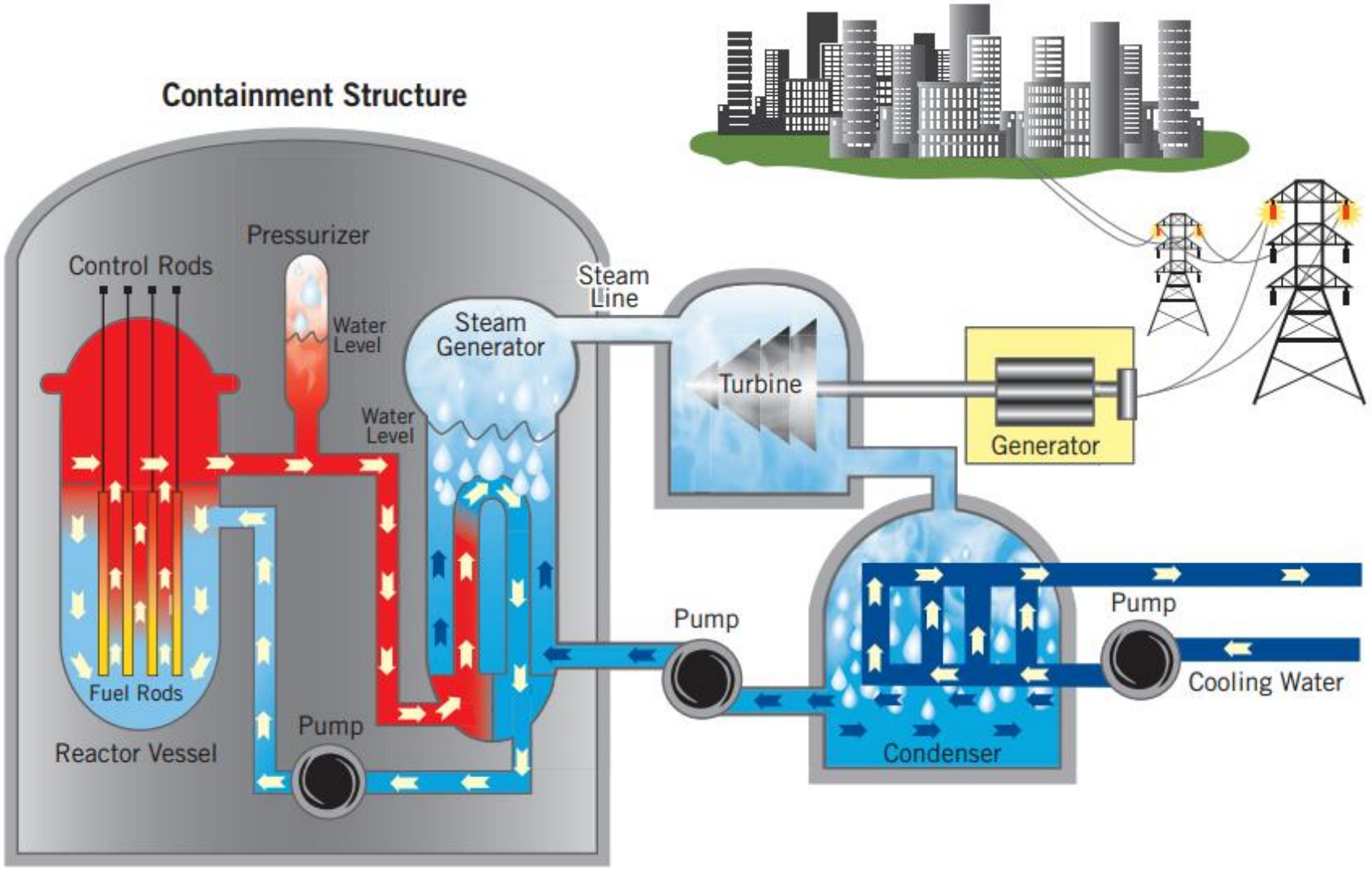
Research scope



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Research scope

- ❑ designing new reactors
- ❑ adding new safety features
- ❑ radiation induced damage in materials
- ❑ designing fuel elements
- ❑ radioactive waste management

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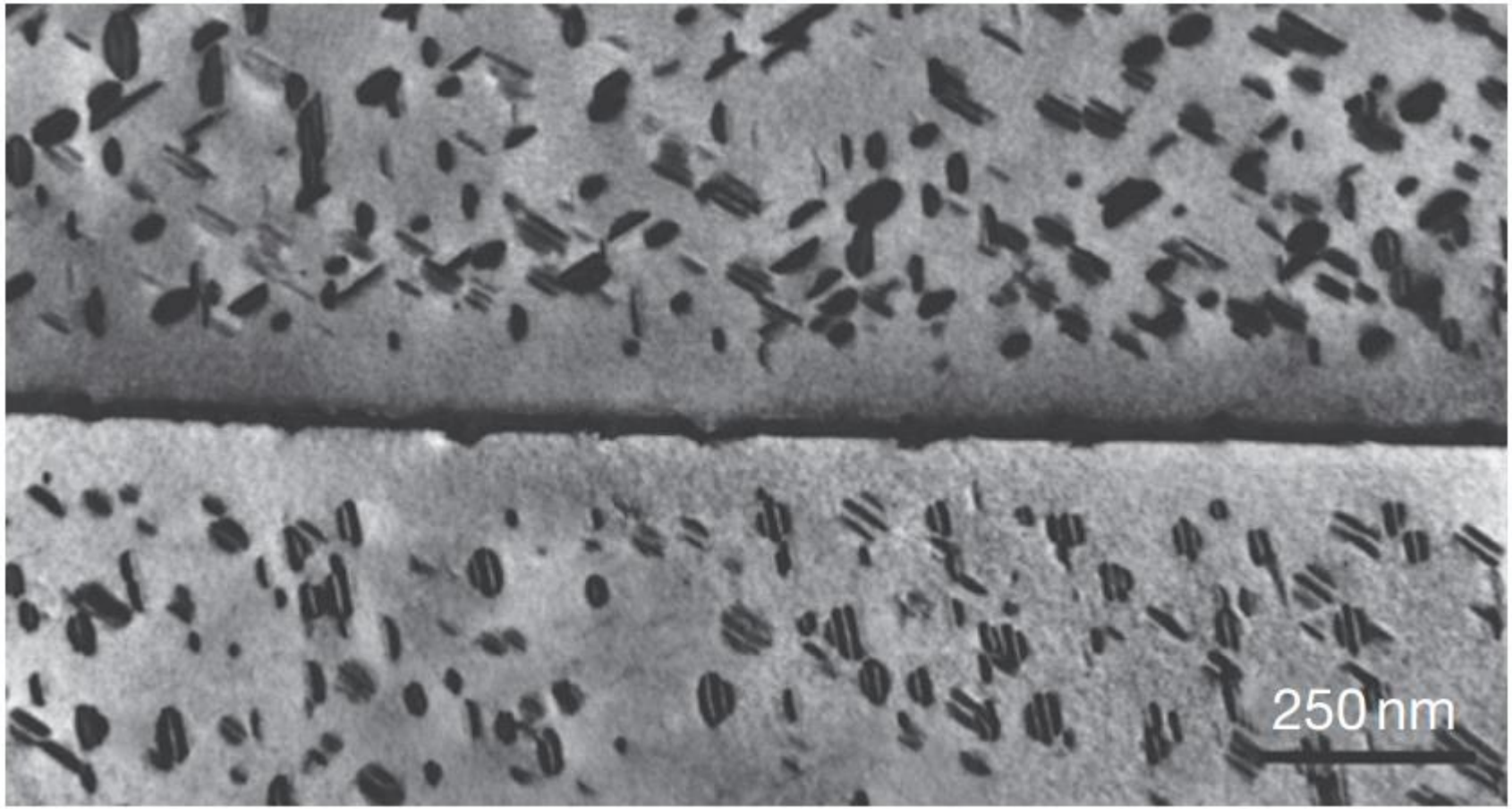
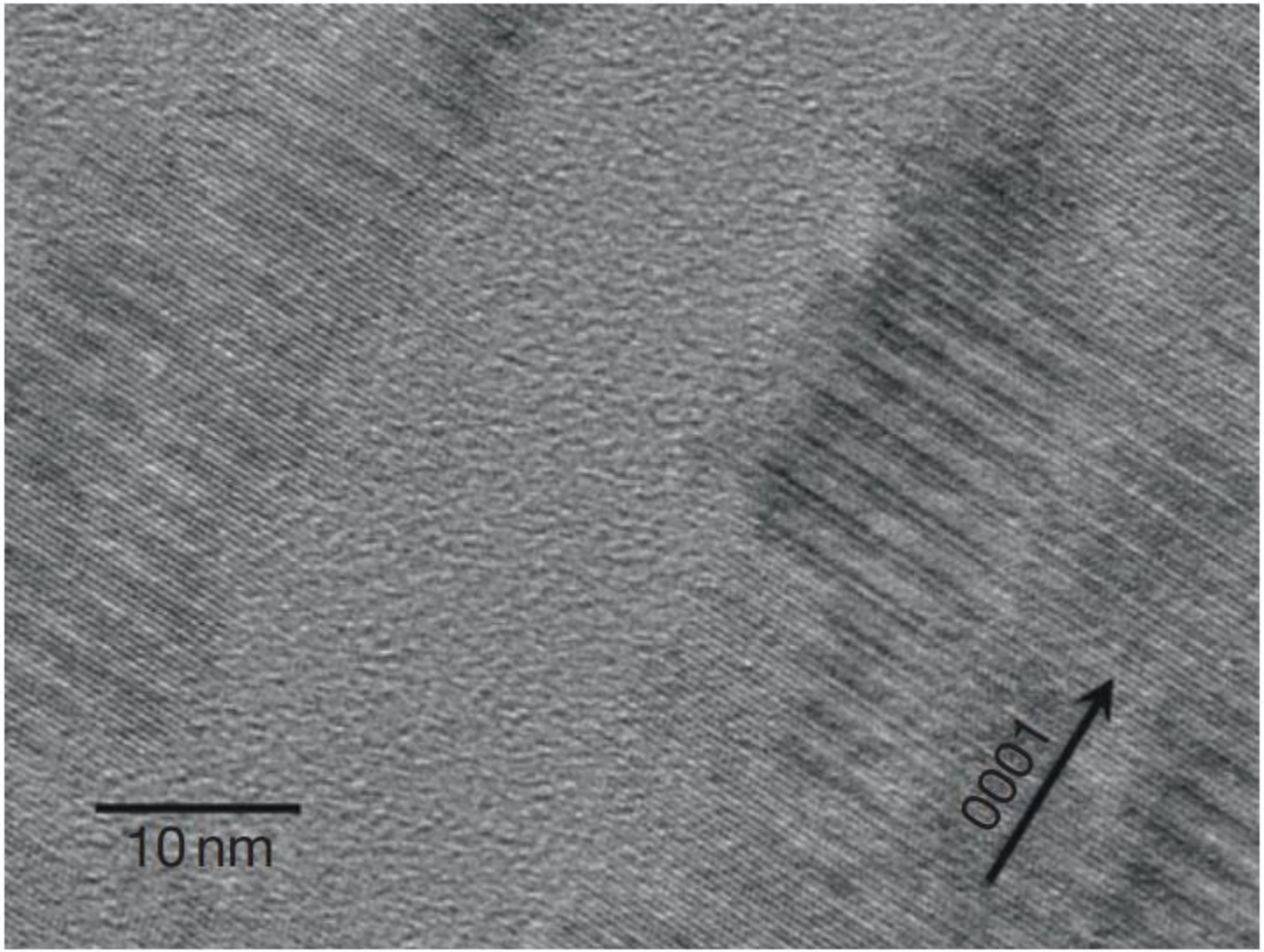
Radiation-induced precipitates on {001} habit planes observed next to a grain boundary in V–4Cr–4Ti following neutron irradiation



Rice et at., **Nucl. Mater.** 258–263, 1414–1419 (1998).

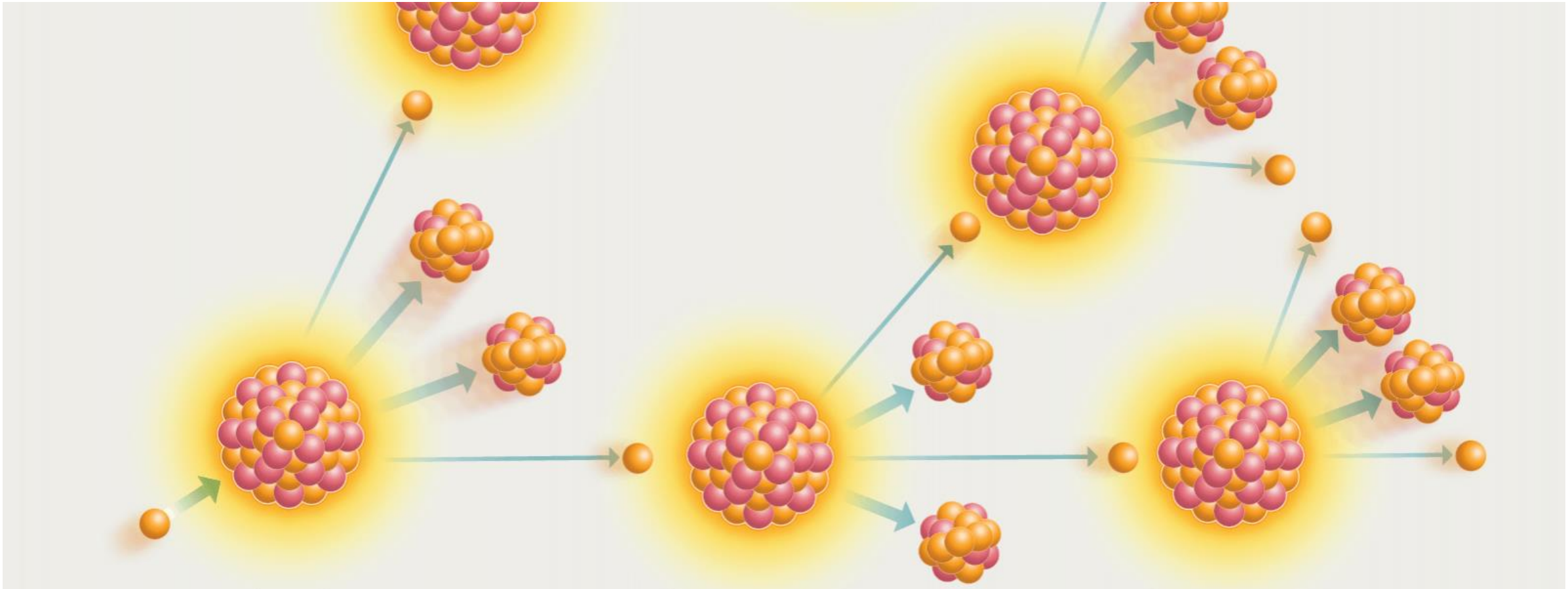
High-resolution TEM image of single crystal 6H–SiC following 0.56MeV Si ion irradiation



Snead *et al.*, **J. Nucl. Instrum. Methods B**, 141, 123–132 (1998).

Shielding radioactive materials

Nuclear reaction in reactor



Neutron absorption coefficients (μ) of ceramicrete samples

Composition	μ
$MgKPO_4 \cdot 6H_2O$	0.51
$MgKPO_4 \cdot 6H_2O + 10\%\ CaSiO_3$	0.38
$MgKPO_4 \cdot 6H_2O + 10\%\ CaSiO_3 + 1.5\%\ H_3BO_3$	0.52
$MgKPO_4 \cdot 6H_2O + 10\%\ CaSiO_3 + 1.5\%\ H_3BO_3 + 4\%\ DyO_3$	0.45
$MgKPO_4 \cdot 6H_2O + 10\%\ CaSiO_3 + 1.5\%\ H_3BO_3 + 4\%\ HfO_2$	0.53
$MgKPO_4 \cdot 6H_2O + 10\%\ CaSiO_3 + 1.5\%\ H_3BO_3 + 4\%\ B_4C$	1.6

Proposed samples

- $CaSi_2$+B_4C
- CaB_6 +B_4C

Material	Density (g/cm^3)
$CaSi_2$	2.50
CaB_6	2.45

Work Plane

- Study theoretically the radiation induced defect of the proposed material by MD and DFT simulation.

- By changing the concentration of boron find an optimal concentration of boron in the material which will best serve the shielding.

Strategic Analysis

- DFT is the most accurate theoretical tool to estimate any physical, chemical and mechanical properties.
- Accuracy of DFT depends on the choice of exchange correlation function.
- Theoretical results need to be verified by experiments.

Category wise break down of the cost

Item type	Cost (BDT)
DFT simulation software (WIEN2k)	60,000.00
Stationery, necessary books, furniture, etc	40,000.00
PC to prepare and test files for DFT simulation	150,000.00
HPC (high performance computers) for DFT simulation	600,000.00
IPS 3000 VA (control unit, battery, service, total setup)	100,000.00
Publication cost	50,000.00
Total	**1,000,000.00**

Thank You