Production of ^{13}N Using D-^{3}He Fusion Protons

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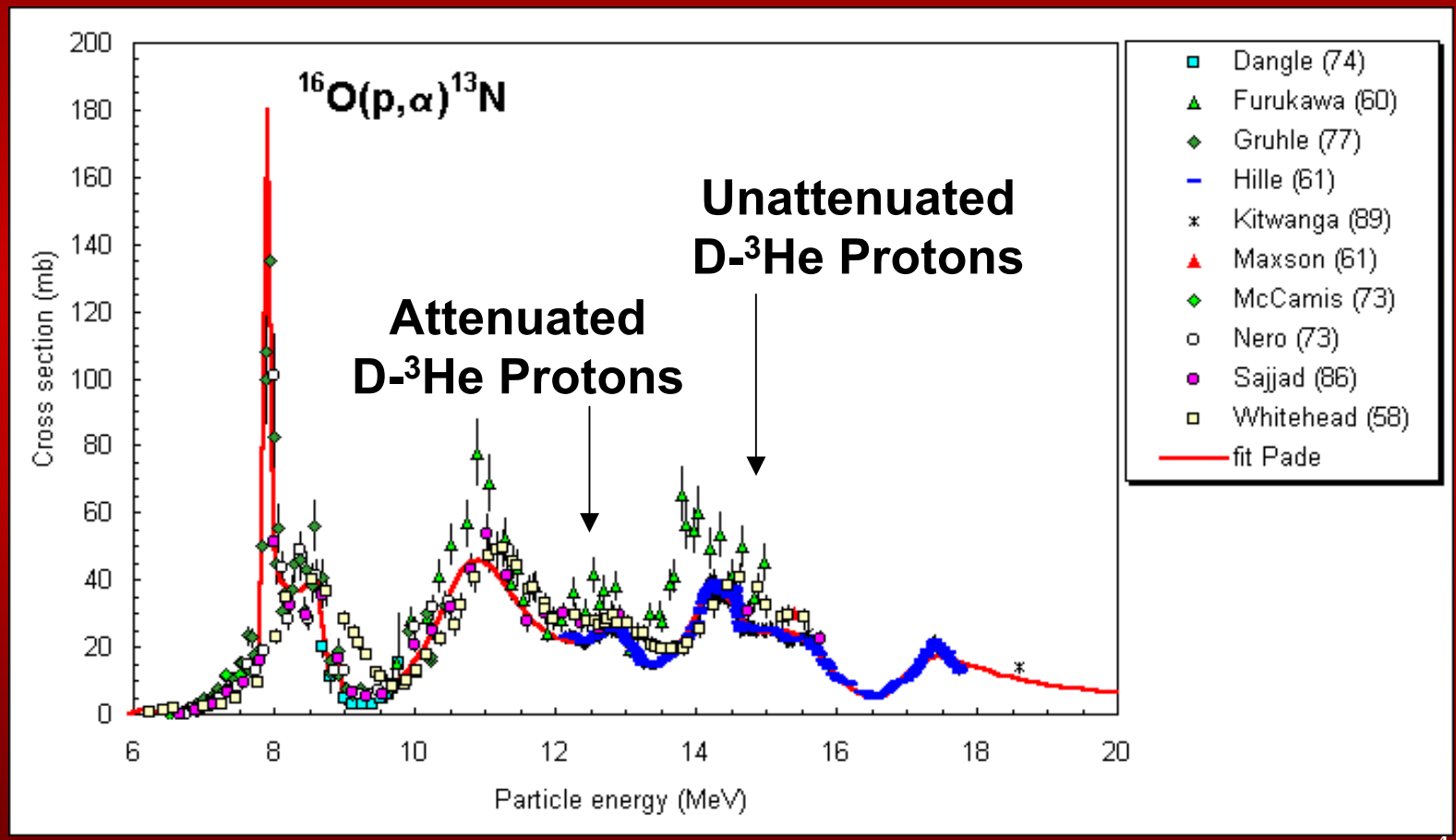
Agenda

- Experiment purpose
- Experimental setup
- Lessons learned
- Expected Results
- Summary

Experiment will create ^{13}N from D-^{3}He fusion protons

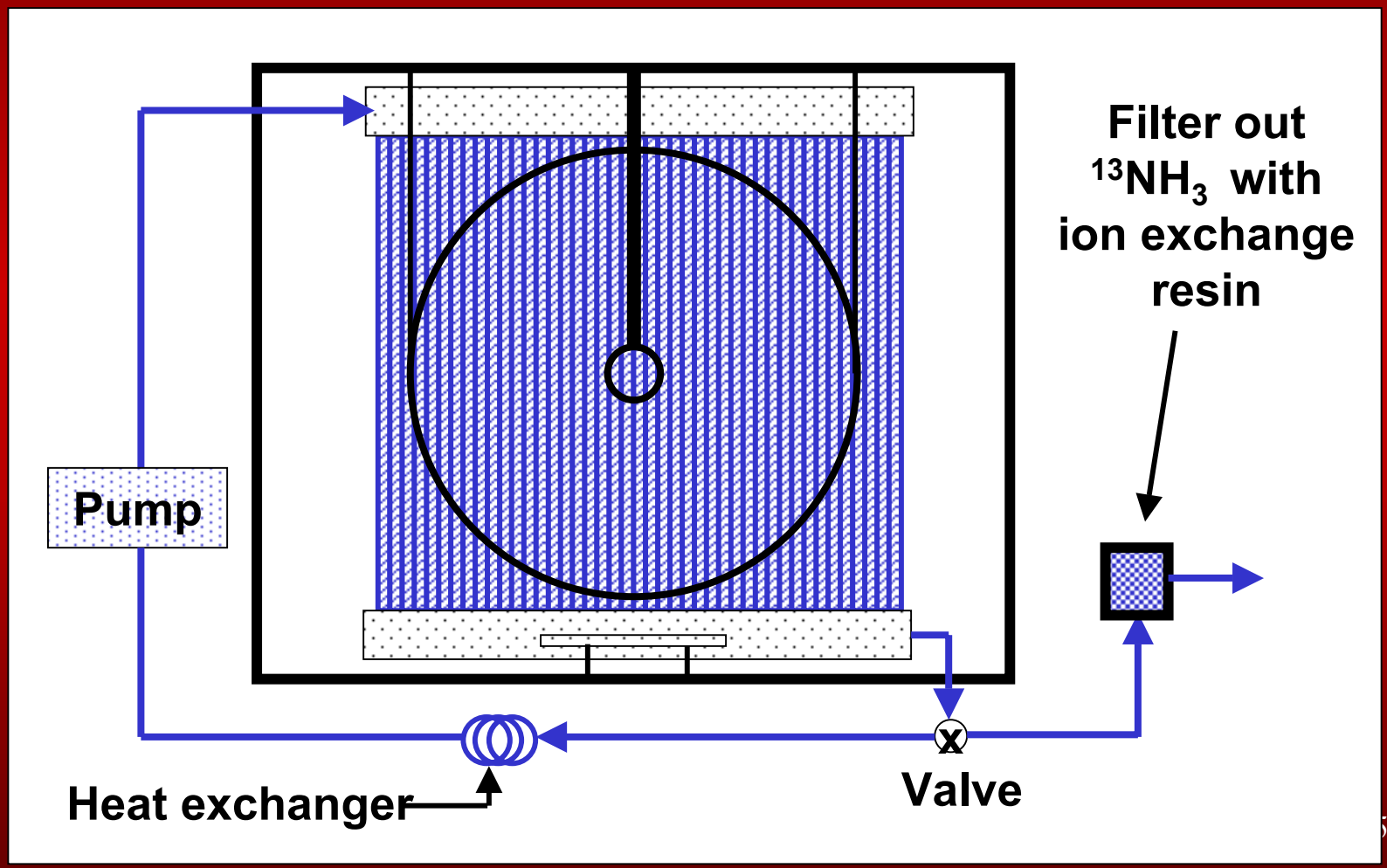
- Create ^{13}N using 14.7 MeV protons from D - ^{3}He reaction via ^{16}O (p,α) ^{13}N
- Selected ^{13}N because
  - Limited commercial production due to 10-minute half life
  - ^{13}N PET scans should increase in response to Medicare/Medicaid coverage
  - Cross sections match proton energies

Oxygen cross section matches proton energy

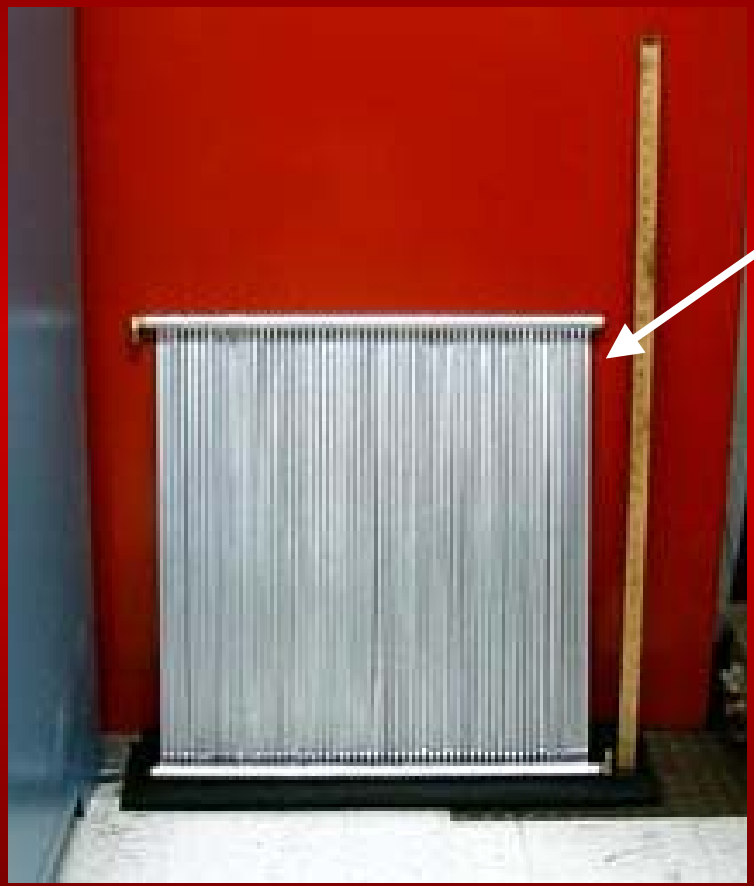


Cross section data from IAEA cross section database for radioisotope production

Water target setup



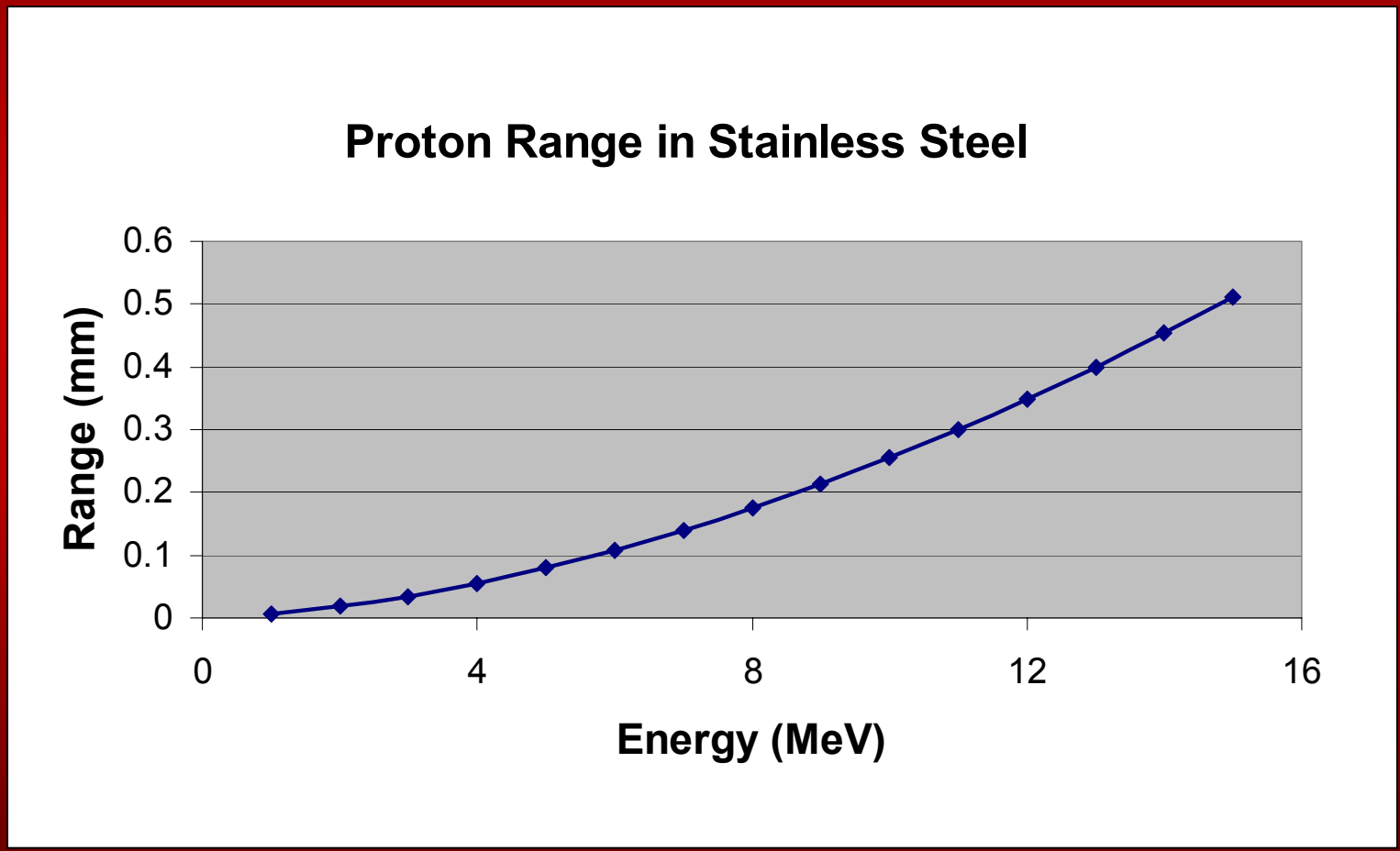
Water containment apparatus



Model AI-M1

- First versions were Al
  - Model Al-M1
  - Model Al-M2
- Latest version stainless steel; Model SS-M1
- Radiator is 61 cm x 61 cm
- Tube wall thickness ~ 0.127 mm
- Protons lose ~ 2.2 MeV in stainless steel tube wall

D-^{3}He protons easily pass through tube wall



AI-M1 radiator during construction

Al-M1 radiator mounted in UW IEC chamber

Al-M1 radiator was sensitive to electron jets

^{13}N can be extracted from a water target

- Assume point source of 10^8 p/s at 12.4 MeV, 2720 cm^2 target and 15 minute run time
- Yield ~ 6 nCi ^{13}N
- Capturing all protons would yield ~ 35 nCi
- Clinical ^{13}N PET routine requires ~ 35 mCi

Summary

- Water target should yield ~ 6 nCi of ^{13}N
- Radiator models Al-M1 & Al-M2 had several limitations
- Model SS-M1 stainless steel radiator under construction
- Need increased reaction rate to improve yield