

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

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Agenda



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



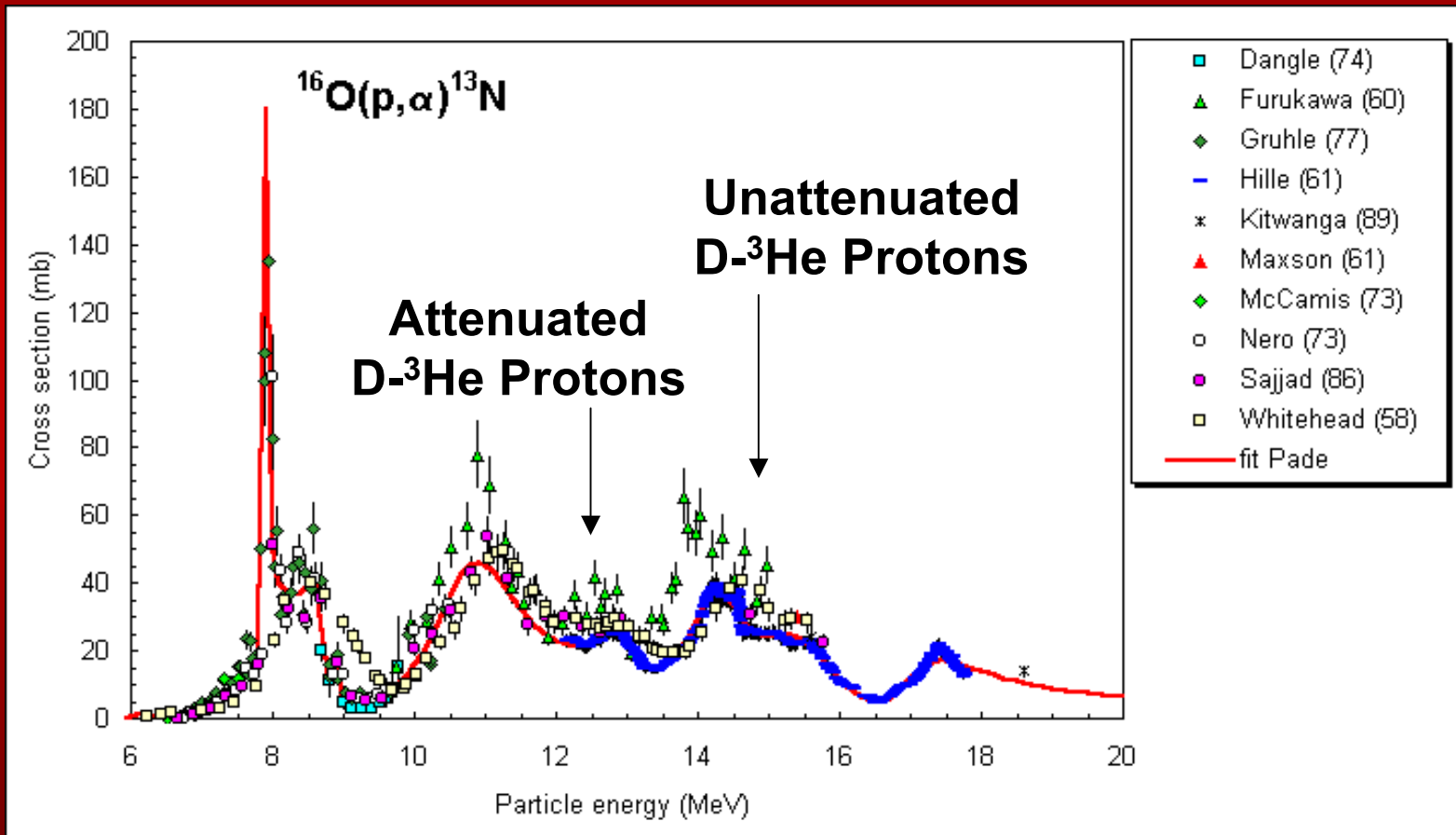
Experiment will create ^{13}N from $\text{D}-^3\text{He}$ fusion protons



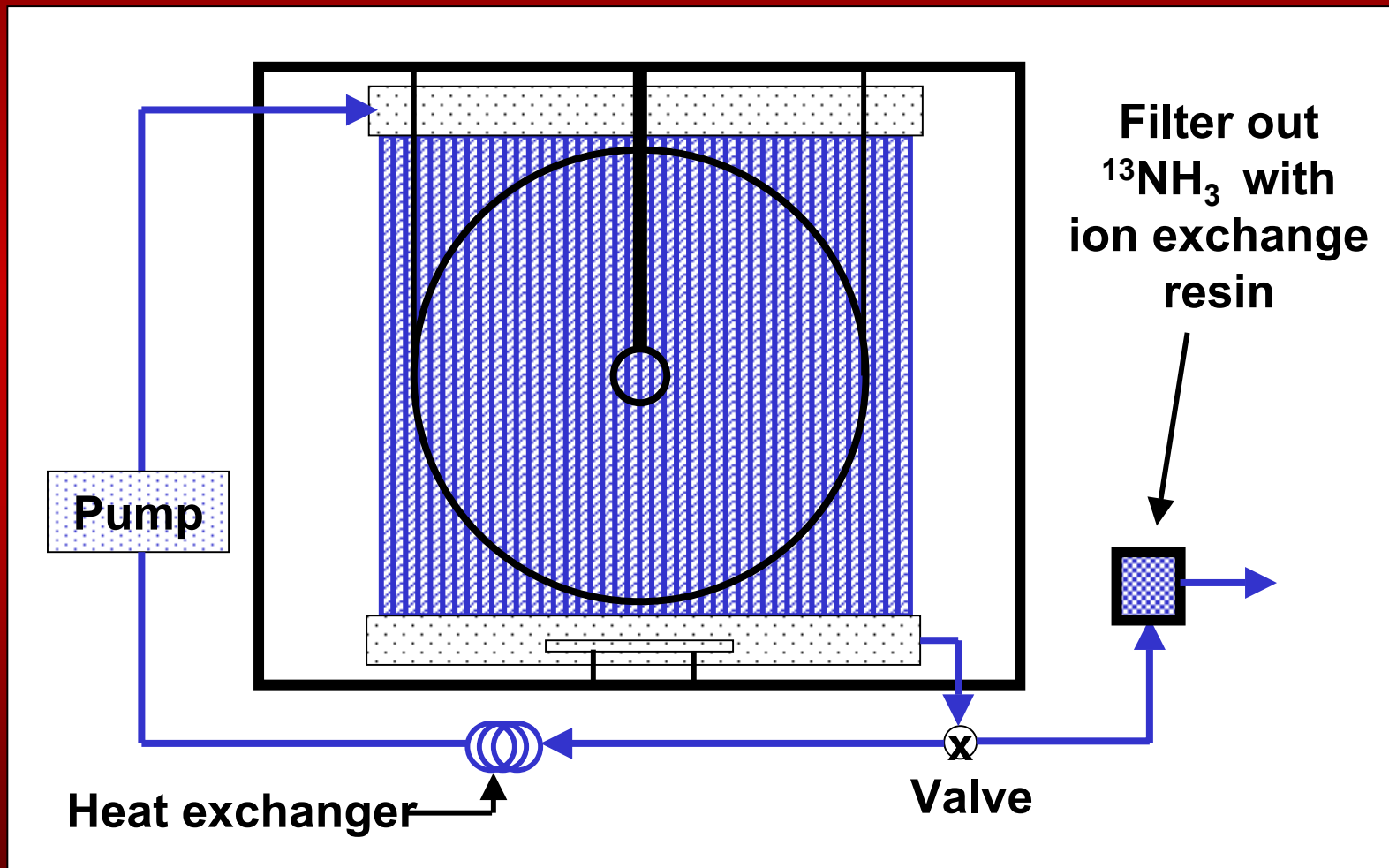
- Create ^{13}N using 14.7 MeV protons from $\text{D}-^3\text{He}$ reaction via $^{16}\text{O}(\text{p},\alpha)^{13}\text{N}$
- Selected ^{13}N because
 - Limited commercial production due to 10-minute half life
 - ^{13}N PET scans should increase in response to Medicare/Medicaid coverage
 - Cross sections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



Oxygen cross section matches proton energy



Water target setup



Water containment apparatus

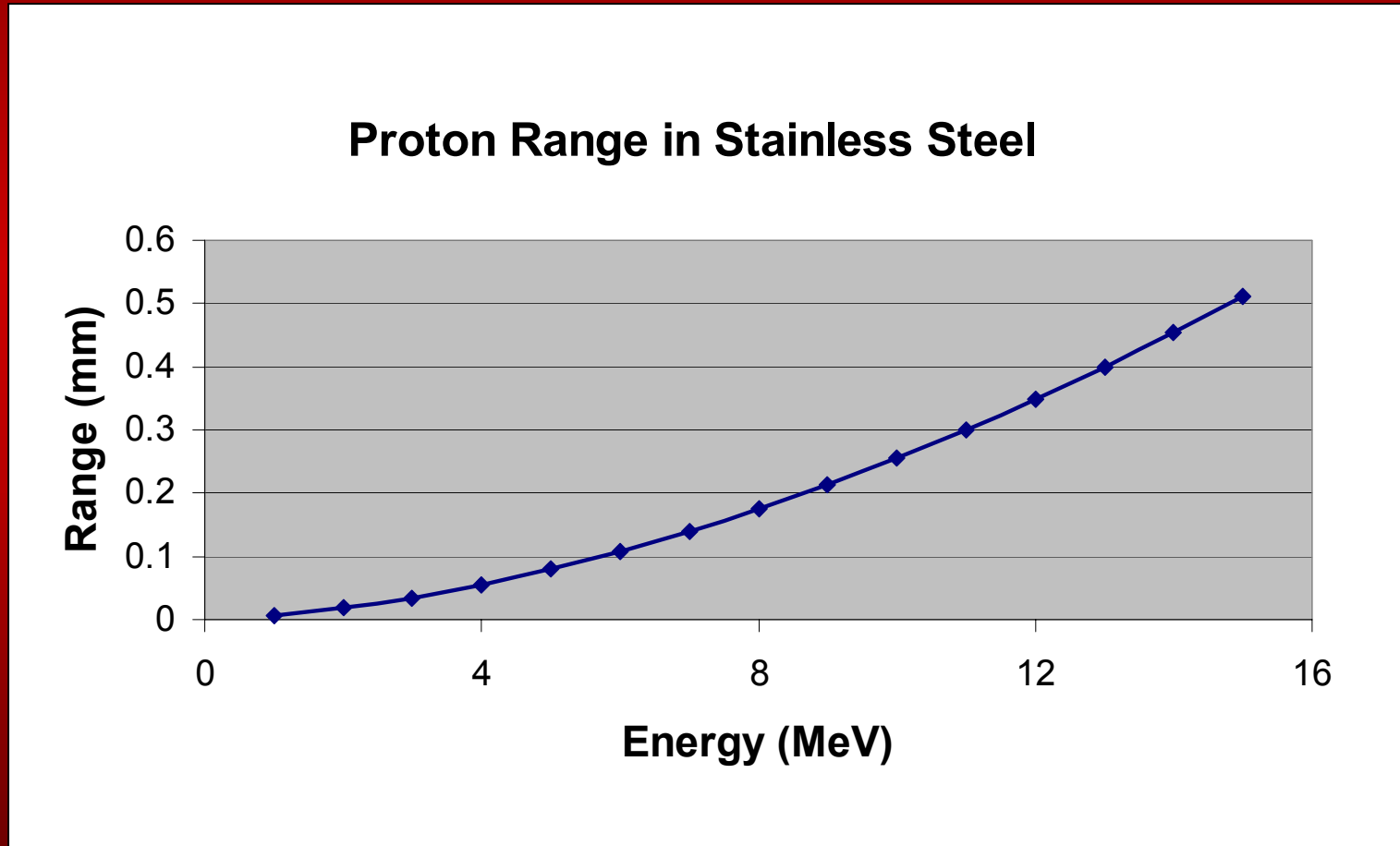


Model AI-M1

- First versions were Al
 - Model AI-M1
 - Model AI-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-³He protons easily pass through tube wall



AI-M1 radiator during construction



AI-M1 radiator mounted in UW IEC chamber



AI-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 cm² 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 AI-M1 & AI-M2 had several limitations**
- **Model SS-M1 stainless steel radiator under construction**
- **Need increased reaction rate to improve yield**

