Production of ^{13}N Via D-^{3}He Fusion in an IEC Device

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Objective

Proof of principle experiment that demonstrates the production of short lived positron emission tomography (PET) isotopes from fusion energy

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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

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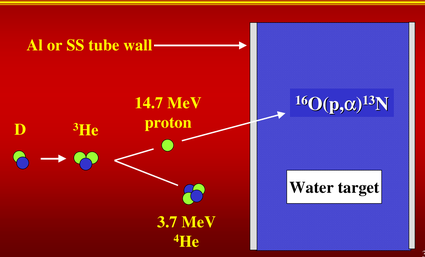
Production methodology



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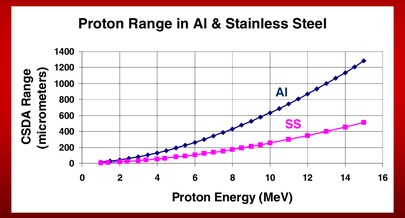
D-^{3}He protons easily pass through tube wall



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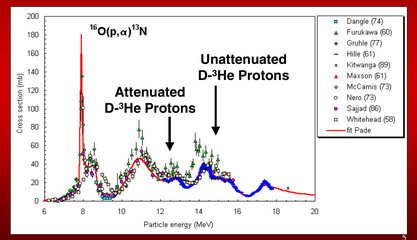
Oxygen cross section matches proton energy



Cross section data from IAEA cross section database for radioisotope production

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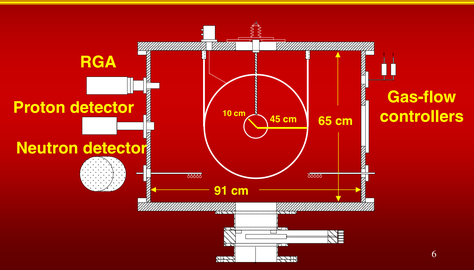
UW-Madison IEC chamber



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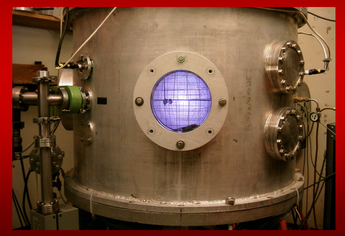
UW-Madison IEC chamber in operation



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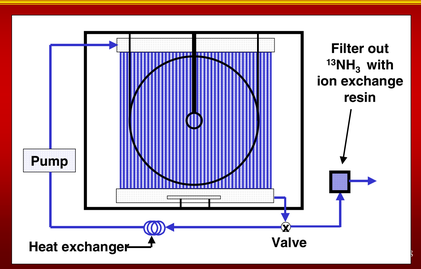
Water target setup



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Stainless steel prototype

- Three models under development
  - 2 using aluminum
  - 1 using stainless steel
- All models approximately 61 cm x 61 cm

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Al device mounted in UW IEC chamber

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Production yield assuming 1 mW D-^{3}He fusion power

- 1 mW D-^{3}He fusion power = $3x10^{8}$ p/s
- $3x10^{8}$ p/s = 6630 p/s-cm^{2} at 60 cm
- 6630 p/s-cm^{2} x 2700 cm^{2} target = $1.79 x10^{7}$ p/s or 0.06 mW on target
- 384 nCi/mW (saturated) x 0.06 mW = 22.9 nCi of ^{13}N

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Status

- Testing aluminum models
- Fabricating stainless steel model
- Calibrating detection equipment
- Optimizing isotope extraction techniques

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