Objectives:
- Commission a new IEC device
- Investigate cathode and anode geometries
- Increase D-3He fusion rates
- Produce radiopharmaceuticals in an IEC device

New Inertial Electrostatic Confinement Device

$^3$HeCTRE: $^3$Helium Cylindrical Transmutation Reactor

High Voltage Feed-Through
- Tested to -150 kV

Vacuum System
- 250 liters/sec turbo-molecular pump
- Base Pressure 2x10^{-4} Pa (1.5x10^{-6} Torr)

Ion Source
- Tungsten light bulb filaments
- 4 filaments (maximum of 6)
- 60° apart around perimeter
- Adjustable along Z-axis, currently aligned with the chamber midpoint

Cathode
- 44.6 cm from center of chamber
- 1200 mm$^2$ x 700 µm silicon detector

Milestones:
- Began construction July 2005
- First D-D reactions April 2006
- Best neutron rate $2.7 \times 10^7$ neutrons/sec at 145 kV, 35 mA, and 0.3 Pa (2 mTorr)
- First D-3He reactions Oct. 18, 2006
- Best proton rate $2.0 \times 10^7$ protons/sec at 130 kV, 30 mA and 0.3 Pa (2 mTorr)

Fusion Rate Comparison: Anode and Cathode Geometry

Application:
PET Isotope Production

Predicted $^{11}$C Activity at Different Fusion Rates
MCNPX 2.5.0 Simulation