Detection of HEU Using a Pulsed D-D Fusion Source

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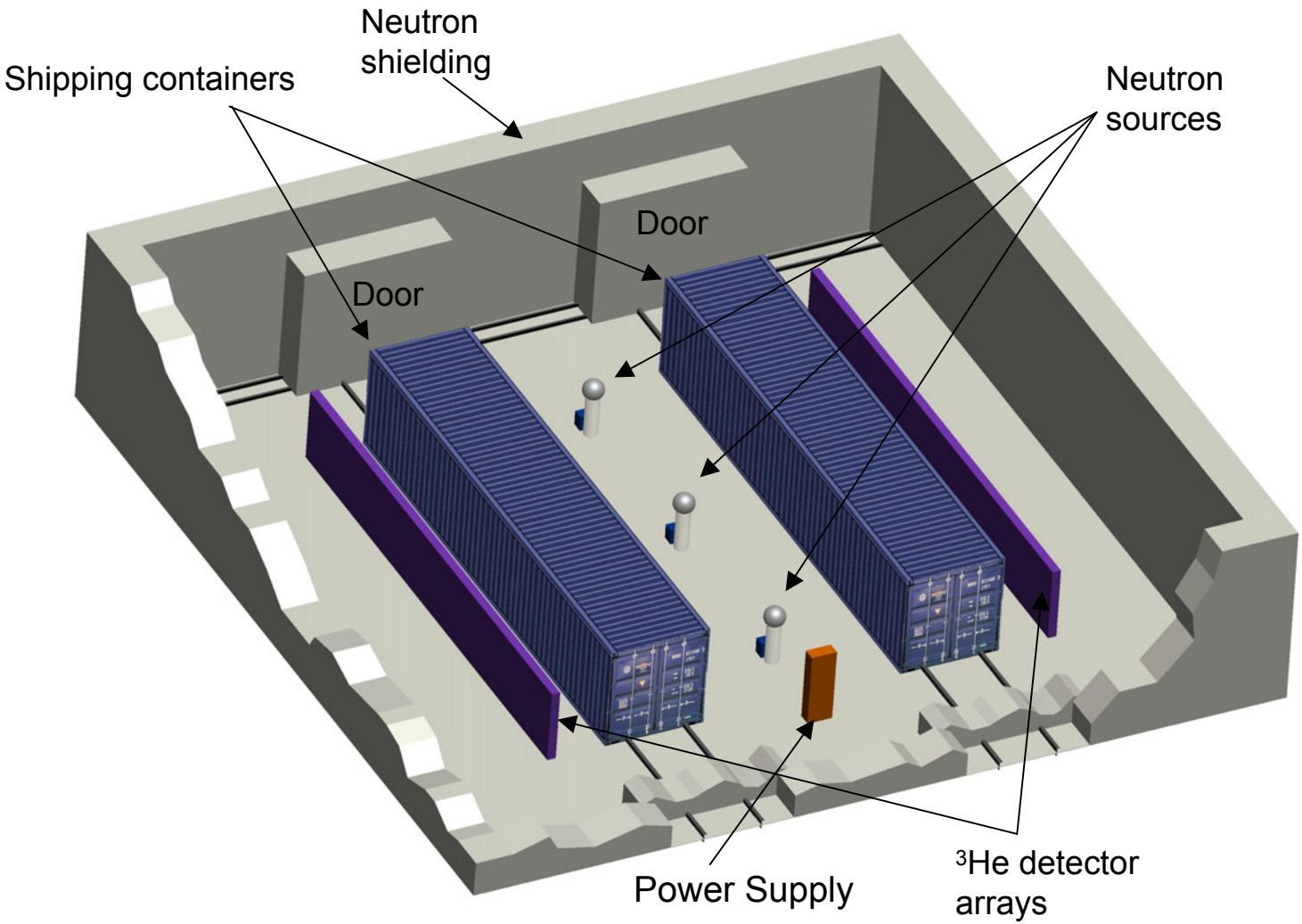
IEC Fusion-Based HEU Detection Concept



Source: Greg Sviatoslavsky

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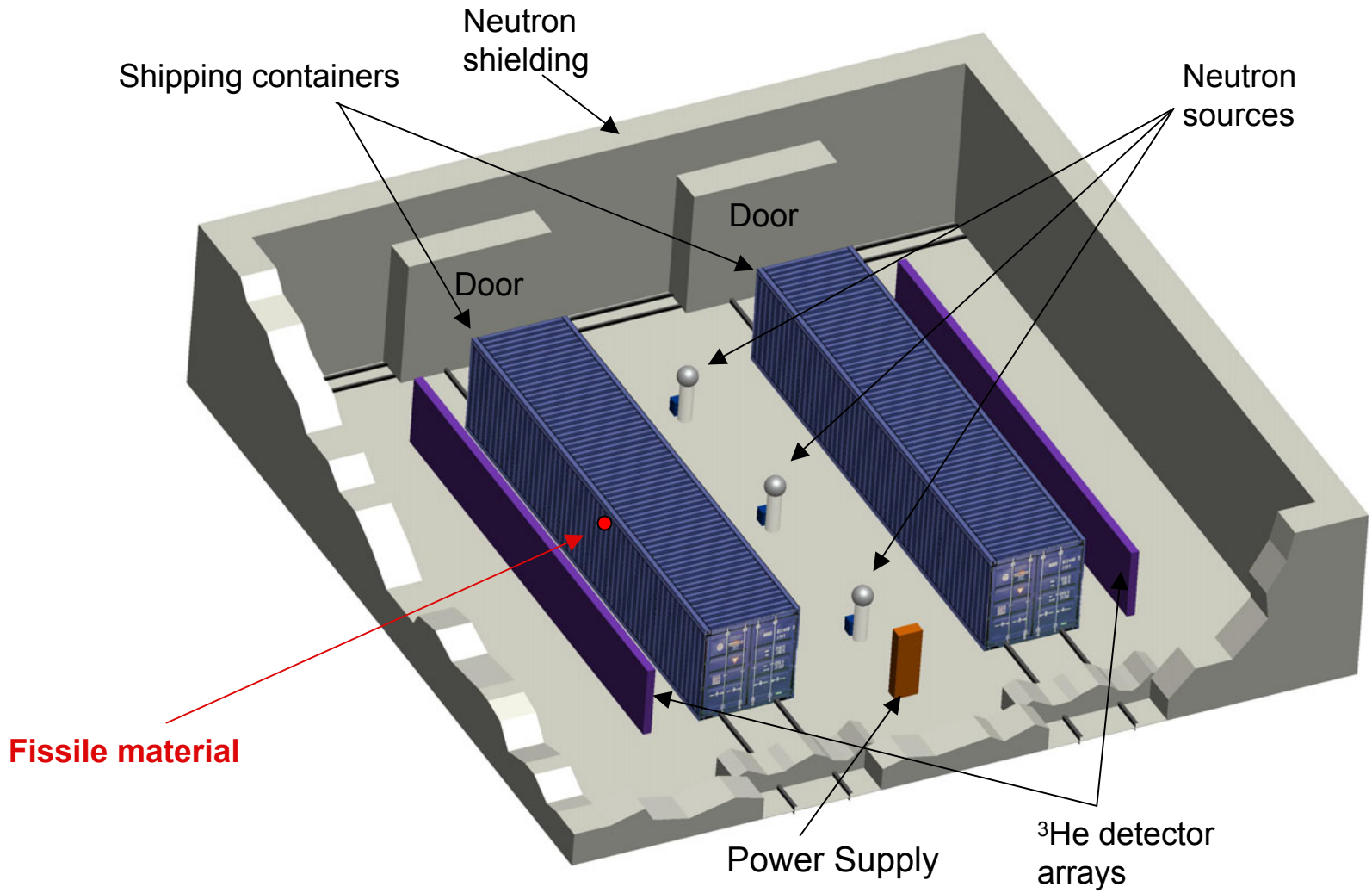

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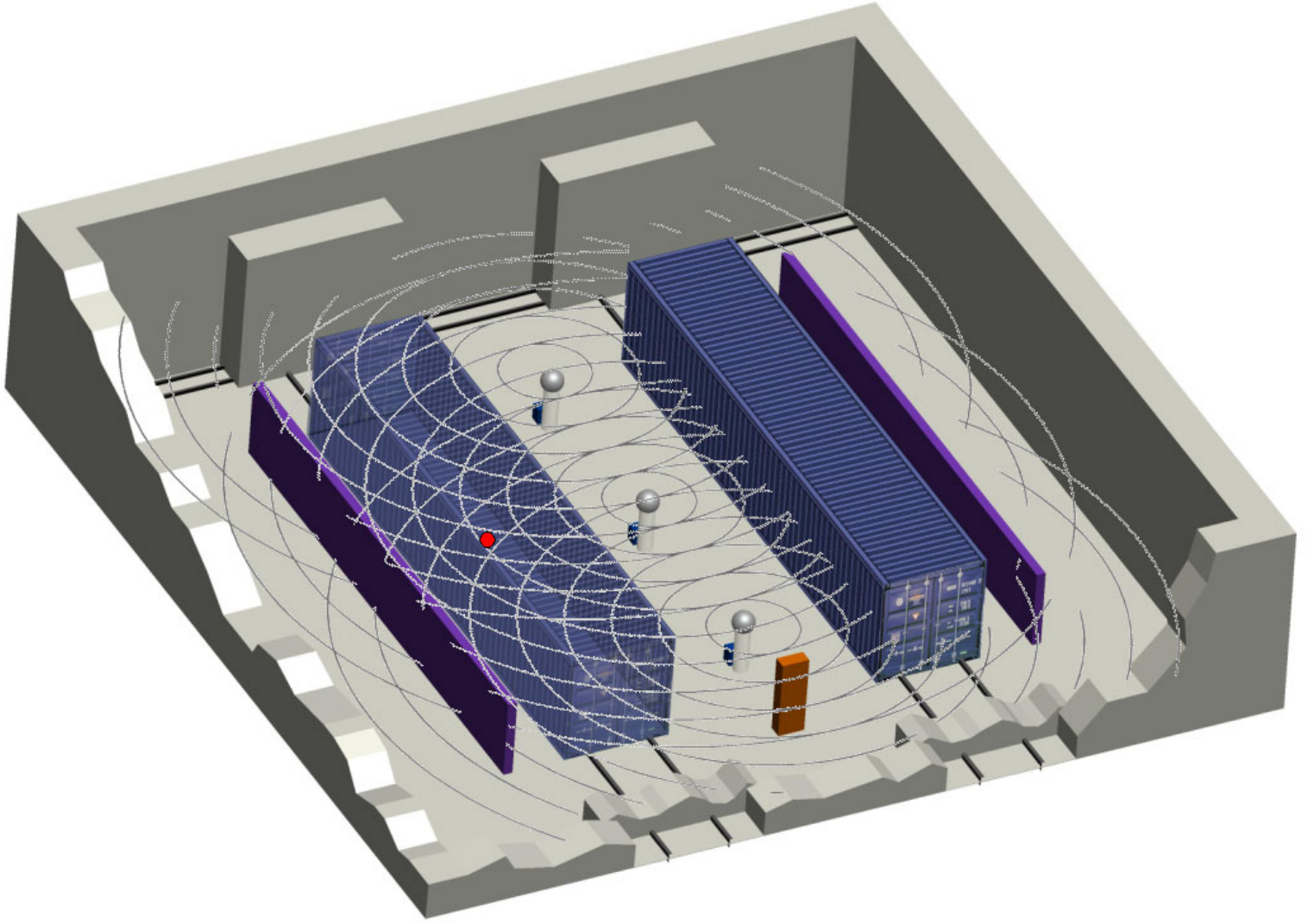
Pulsed Fusion Neutrons Induce Fissions within the Shipping Container



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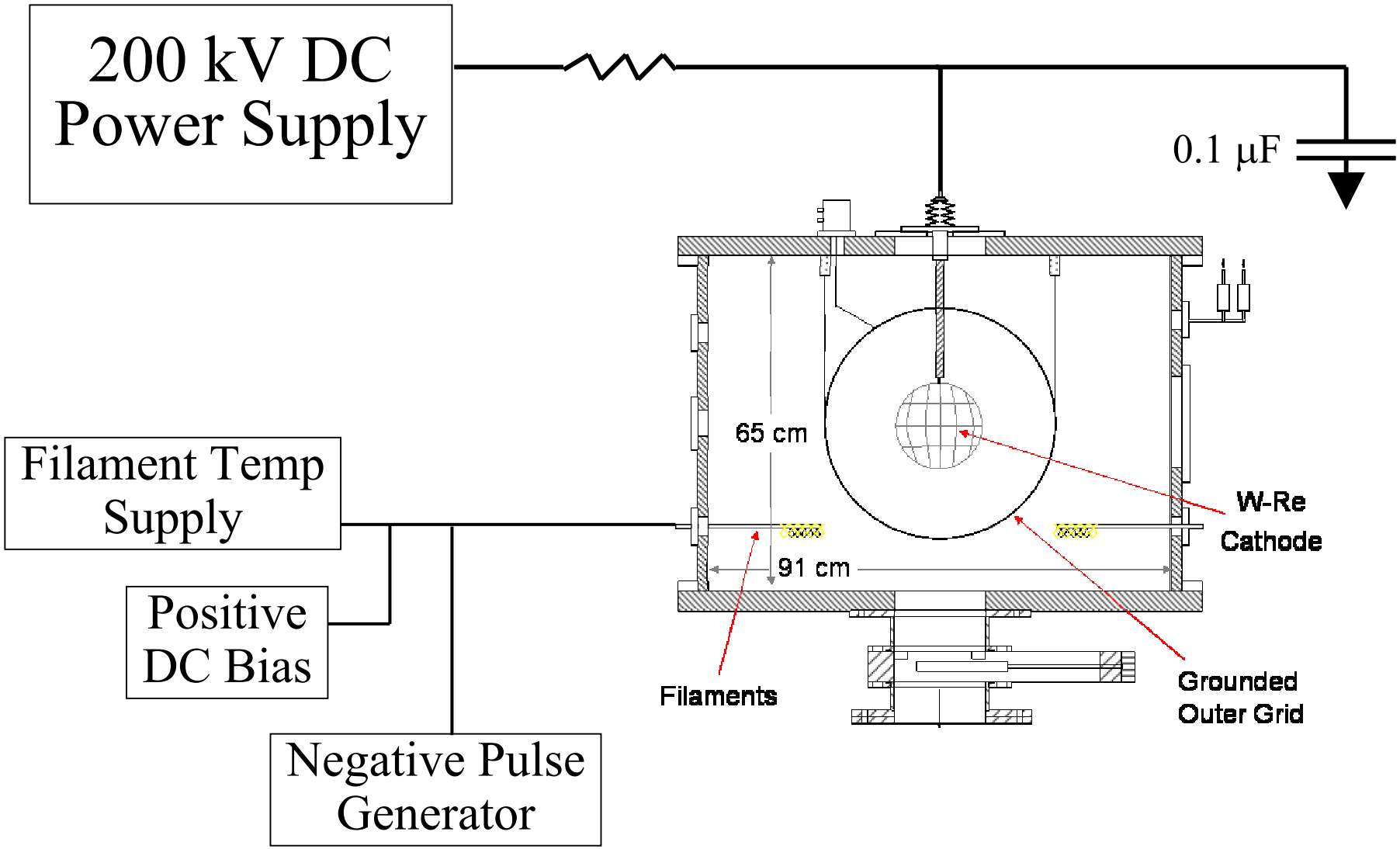
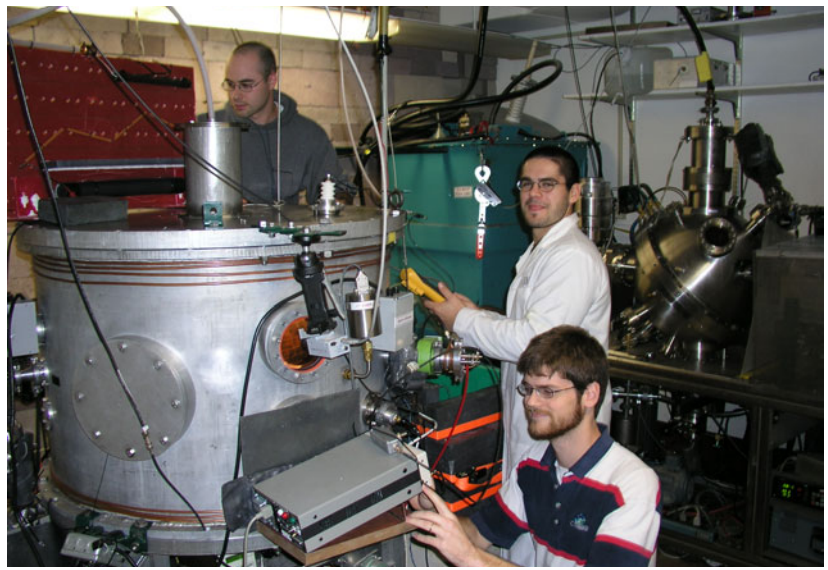
Wisconsin Design Uses Ion Source to Generate Pulses



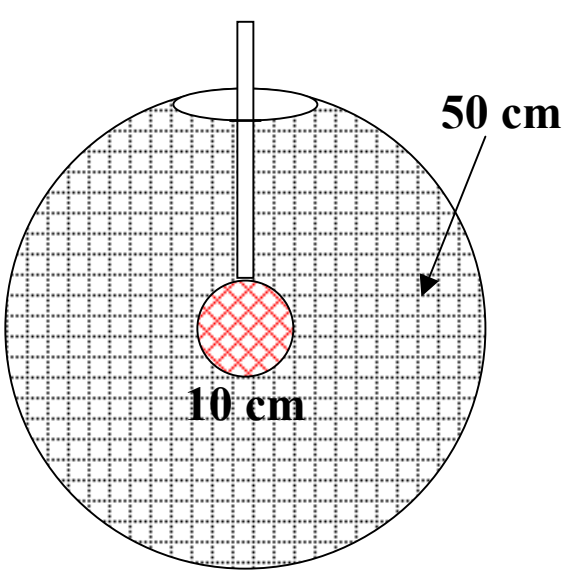
Current Pulsed IEC Status

- Max Voltage: 115 kV
- Max Pulse Current: 3 Amps
- Max Neutron Rate: 1.8×10^9 n/s
  - (96 kV , 2.9 A, 3 mTorr)
  - (500μs pulse width, 10 Hz)

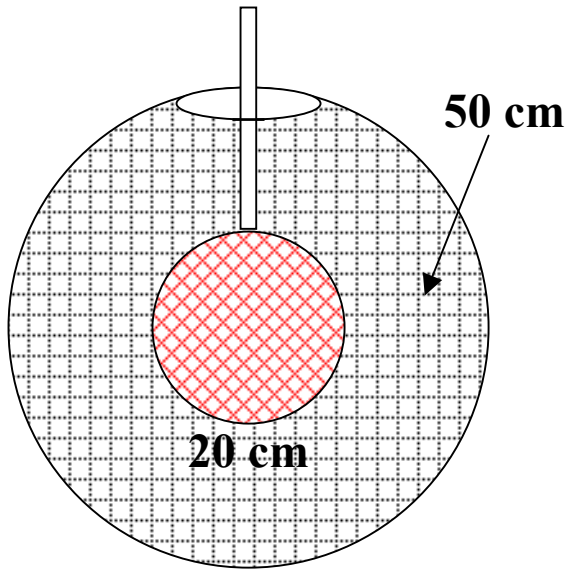


Larger Cathode Yielded Higher Pulse Current and Neutron Rates

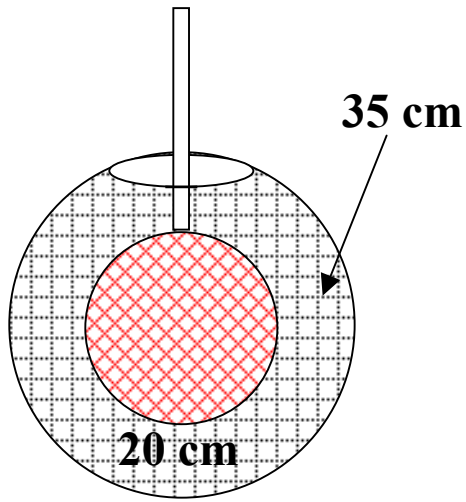
- Pulse current increased by ~20% when switching from 10 cm to 20 cm diameter cathode
- Average ion energy is higher
  - Ions encounter fewer neutrals as they are accelerated
  - Steady-state neutron production increased by ~80% at 100 kV



Standard Configuration

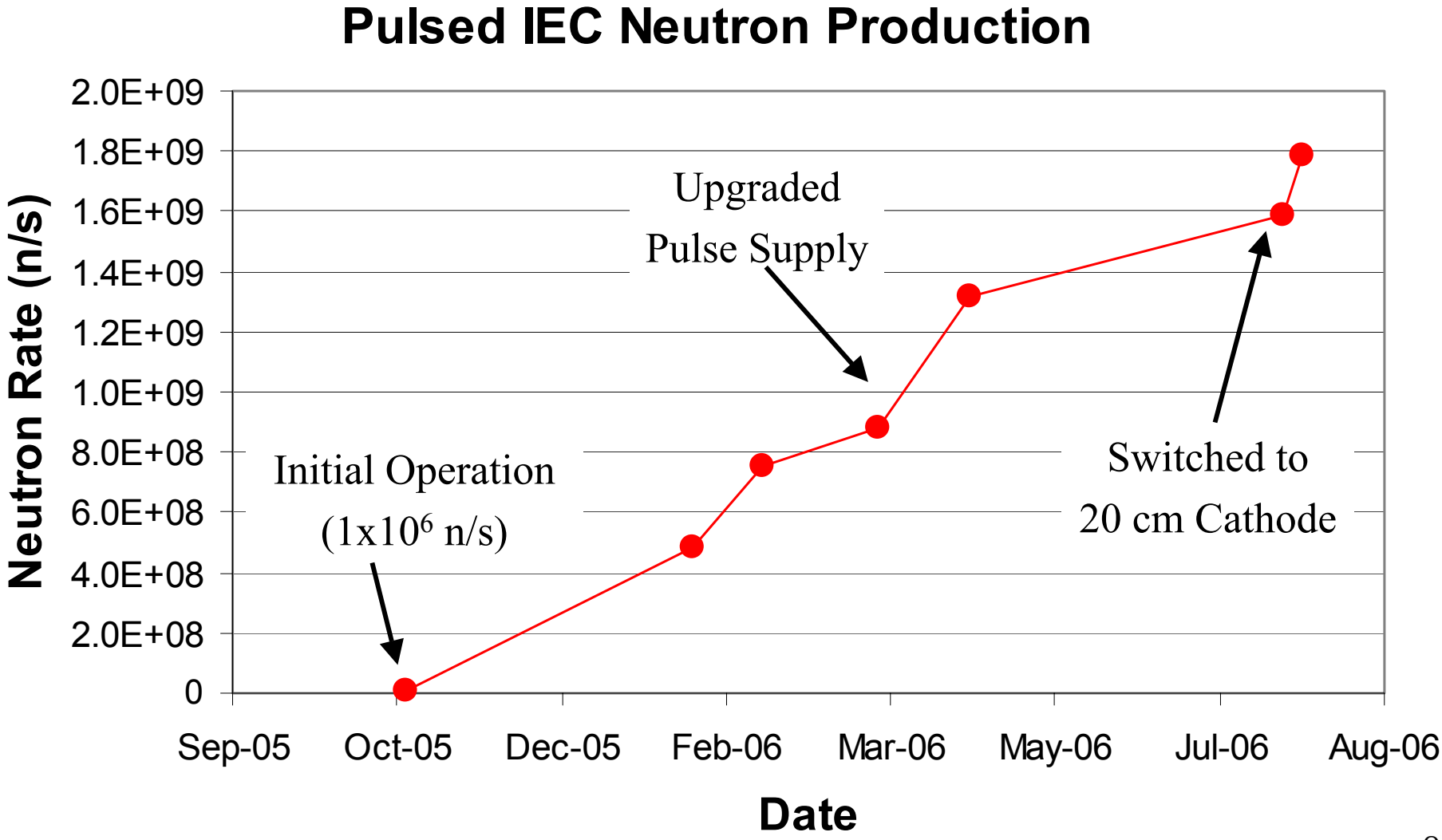


Previous Configuration

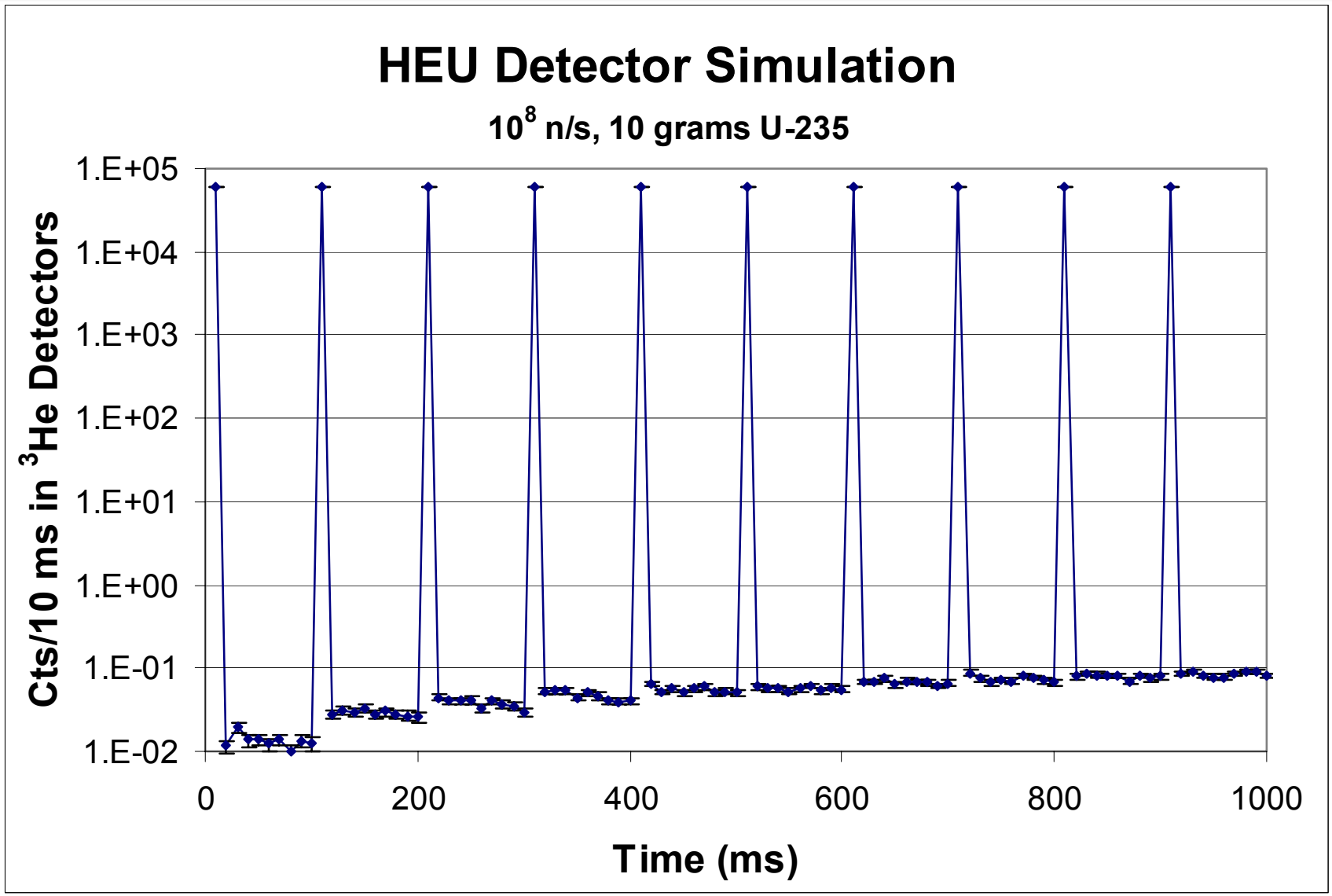


Current Configuration

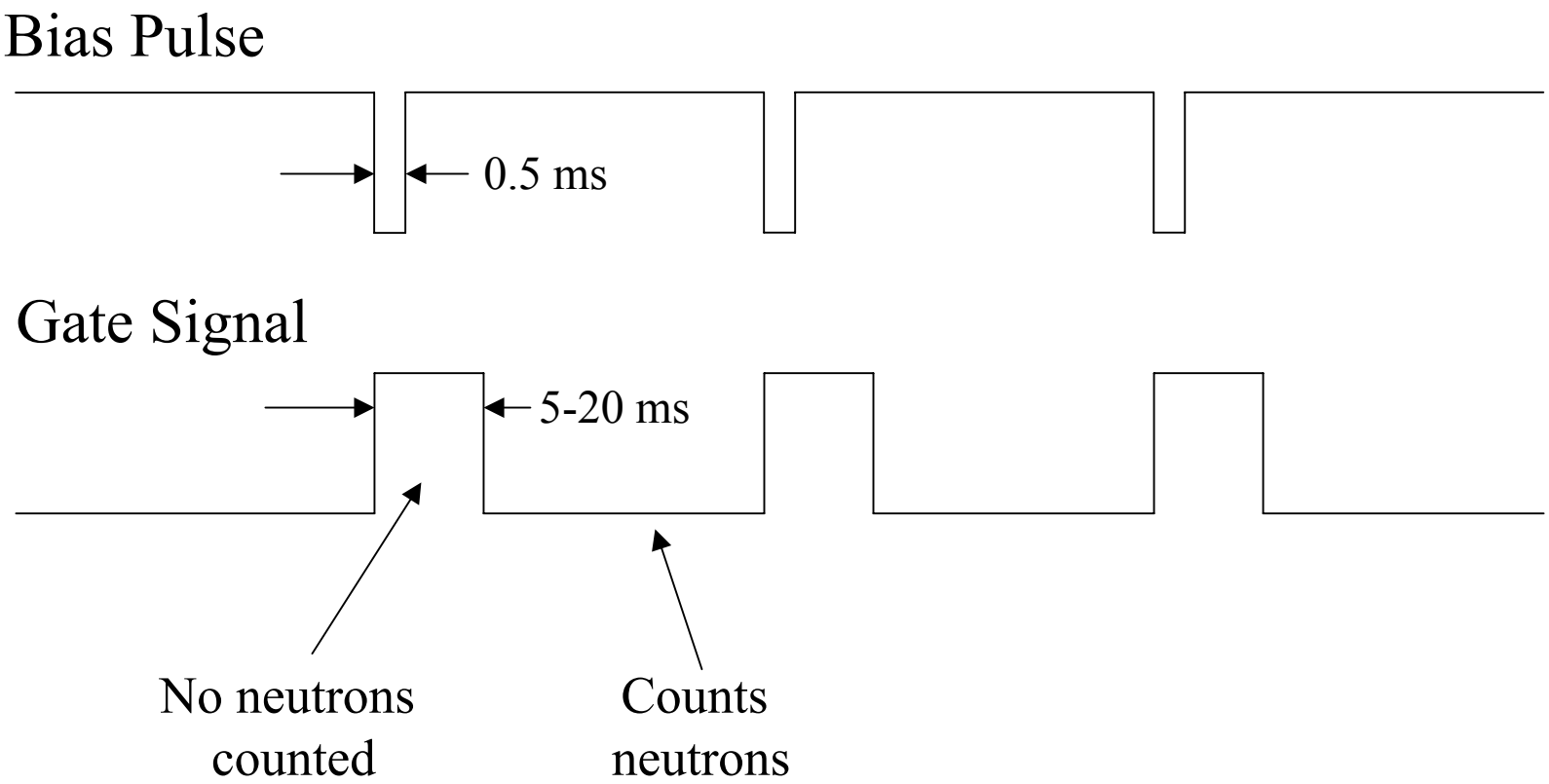
Significant Progress has been Made Over the Past Year



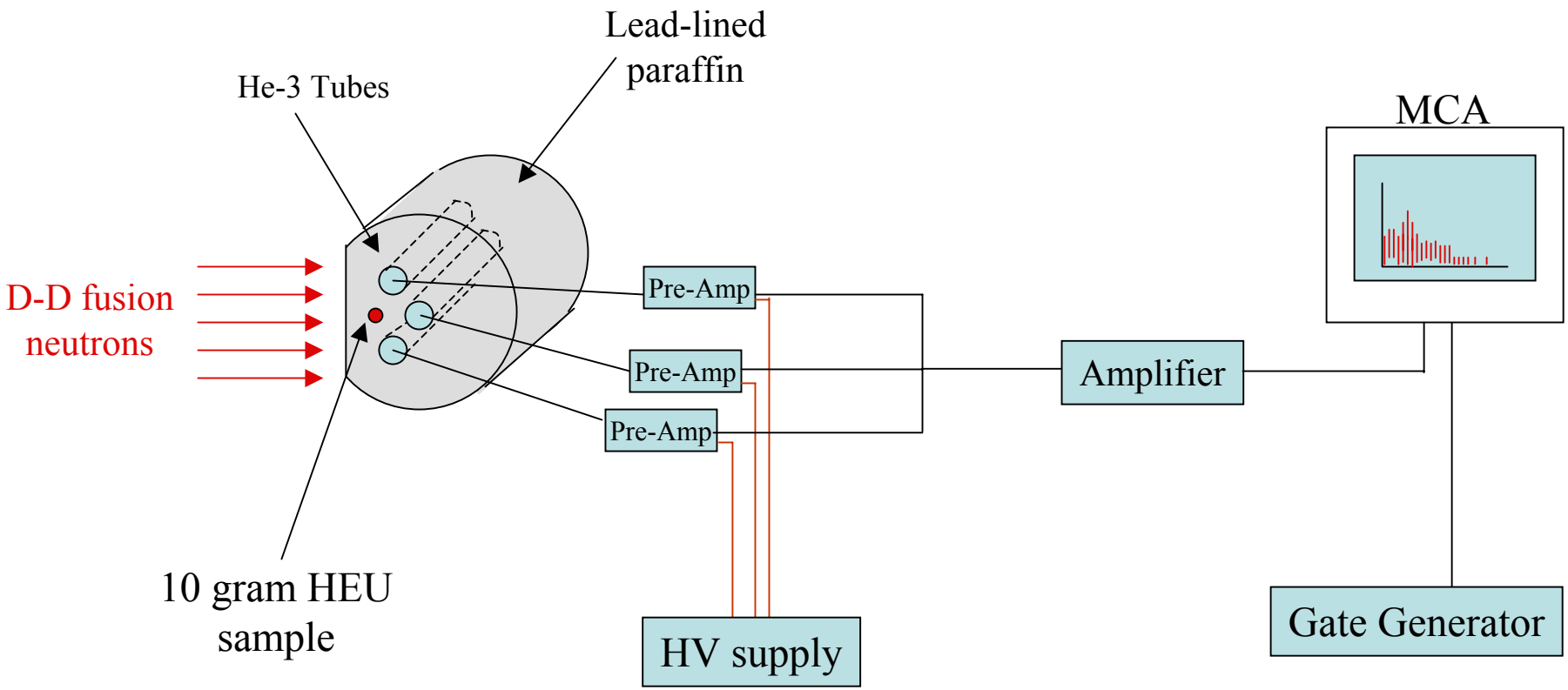
Initial MCNP Results are Encouraging



Pulsed Gate Ensures no Neutrons are Detected Between Pulses



Initial Neutron Detector Construction has Been Completed



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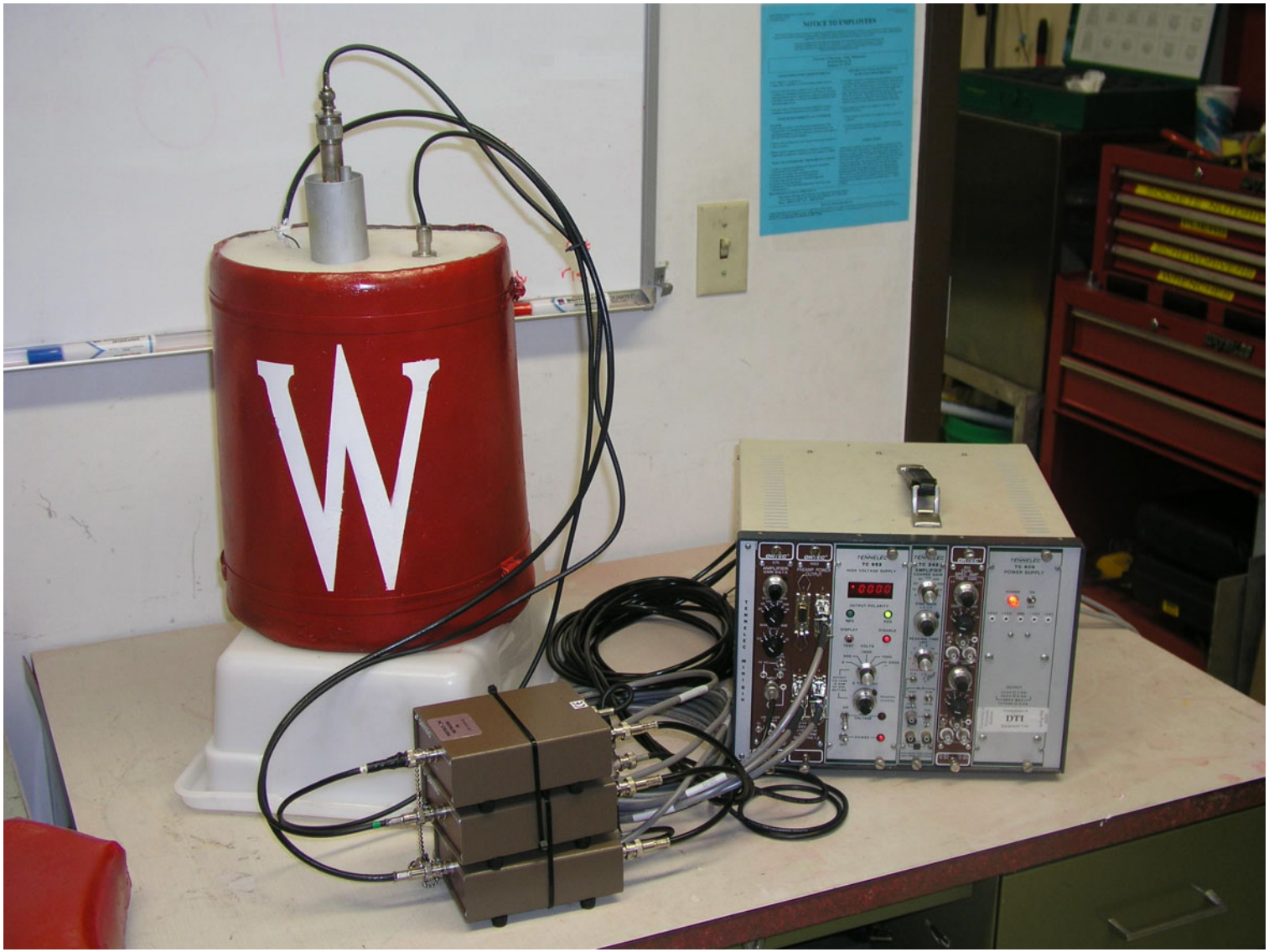
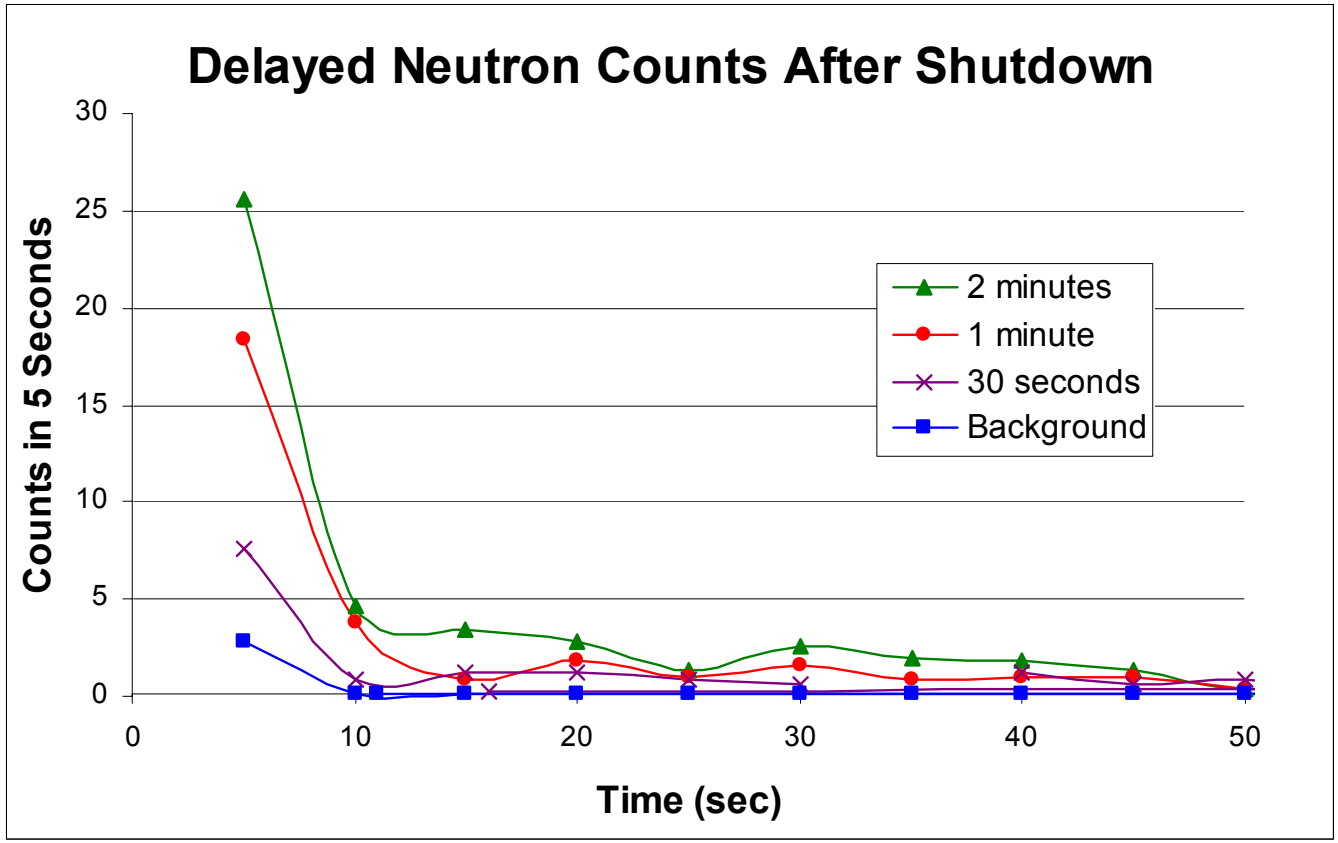


Preliminary HEU Data Yields Promising Results

- Steady-state
  - 130 kV
  - 60 mA
  - 2.7 mtorr D_2
  - ~1.5×10^8 n/s

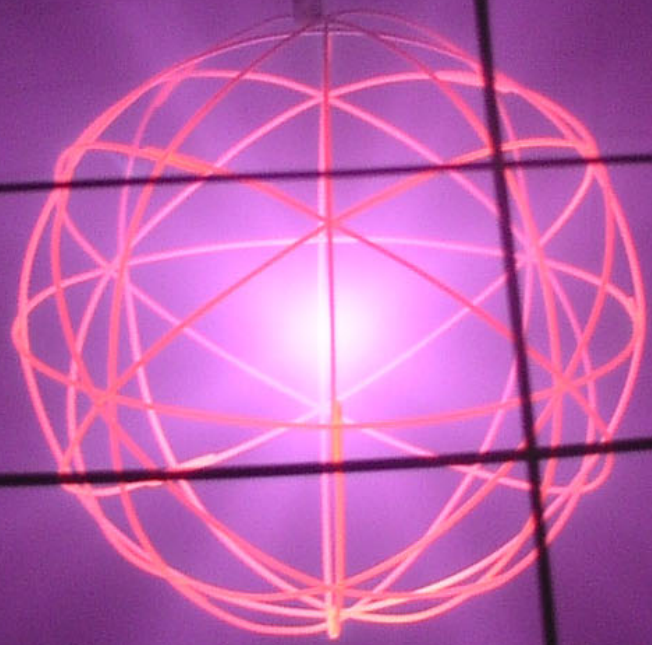


- Pulsed
  - 80 kV, 1 A pulse current, 2.5 mtorr D_2, 1 ms pulse width, ~6×10^8 n/s
  - ~1.6 neutron counts/second between pulses with HEU
  - ~0.4 neutron counts/second background

Summary

- Pulsed IEC has been developed that is capable of operation at 115 kV, 3 A, 3 mTorr D_2
- Pulsed neutron rates of 1.8×10^9 n/s have been achieved during 500 μs pulses
- MCNP results indicate that Wisconsin IEC device is capable of HEU detection experiments
- Detection circuitry has been tested, and has demonstrated HEU detection capability

Questions?



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