U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Update on the Domestic Production of Mo-99

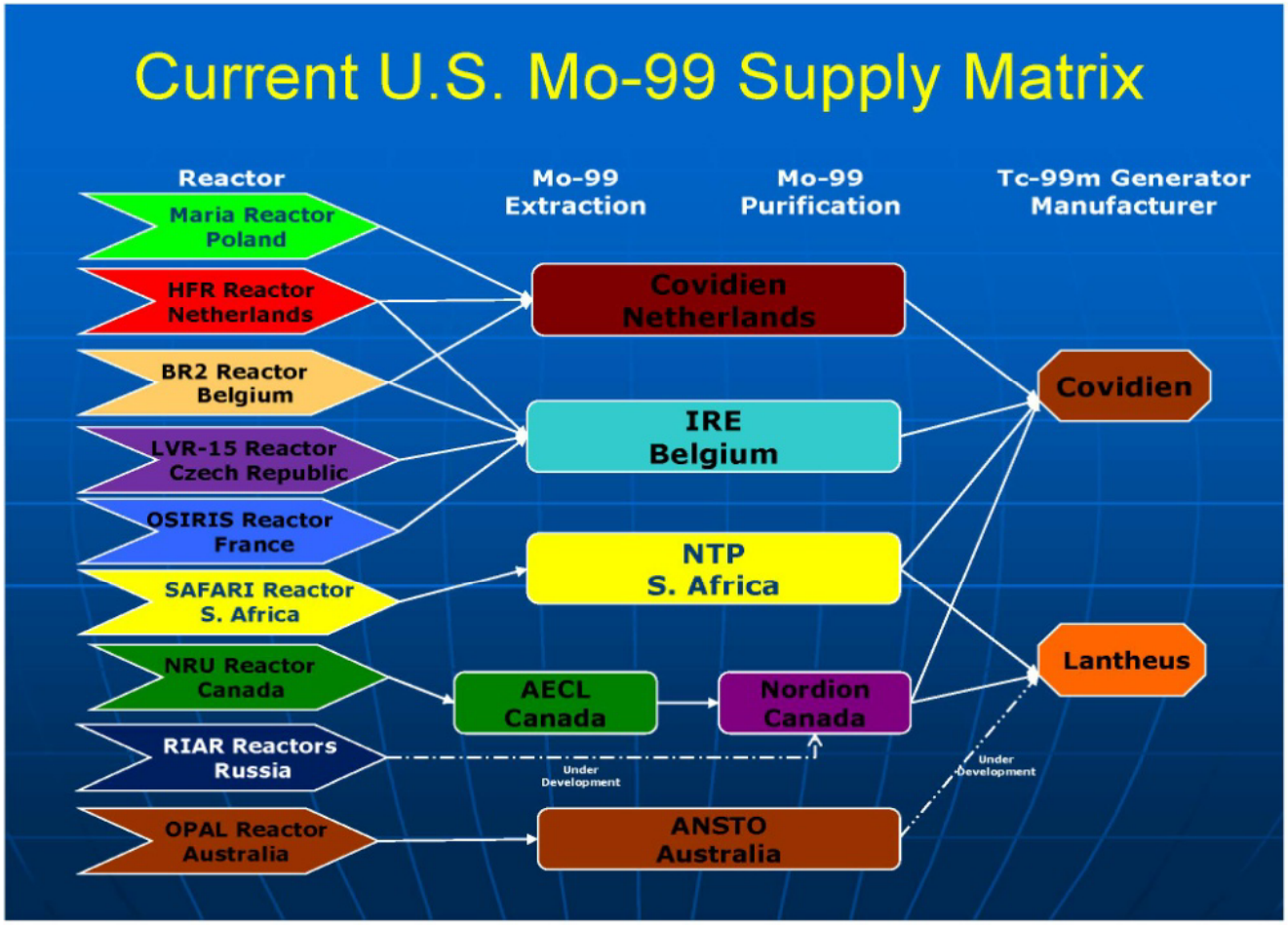
Steve Mattmuller

Advisory Committee

on the Medical Uses of Isotopes

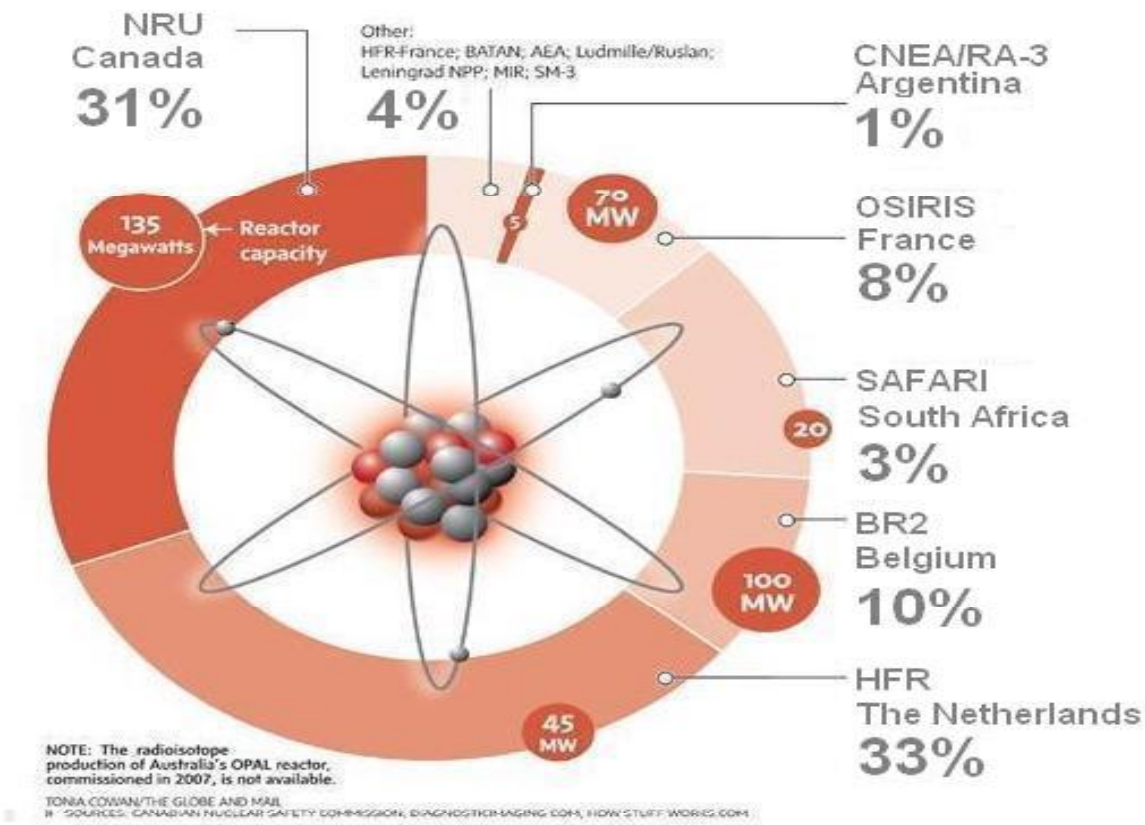
September 20-21, 2012

Mo99 Update: Supply – Fragile*



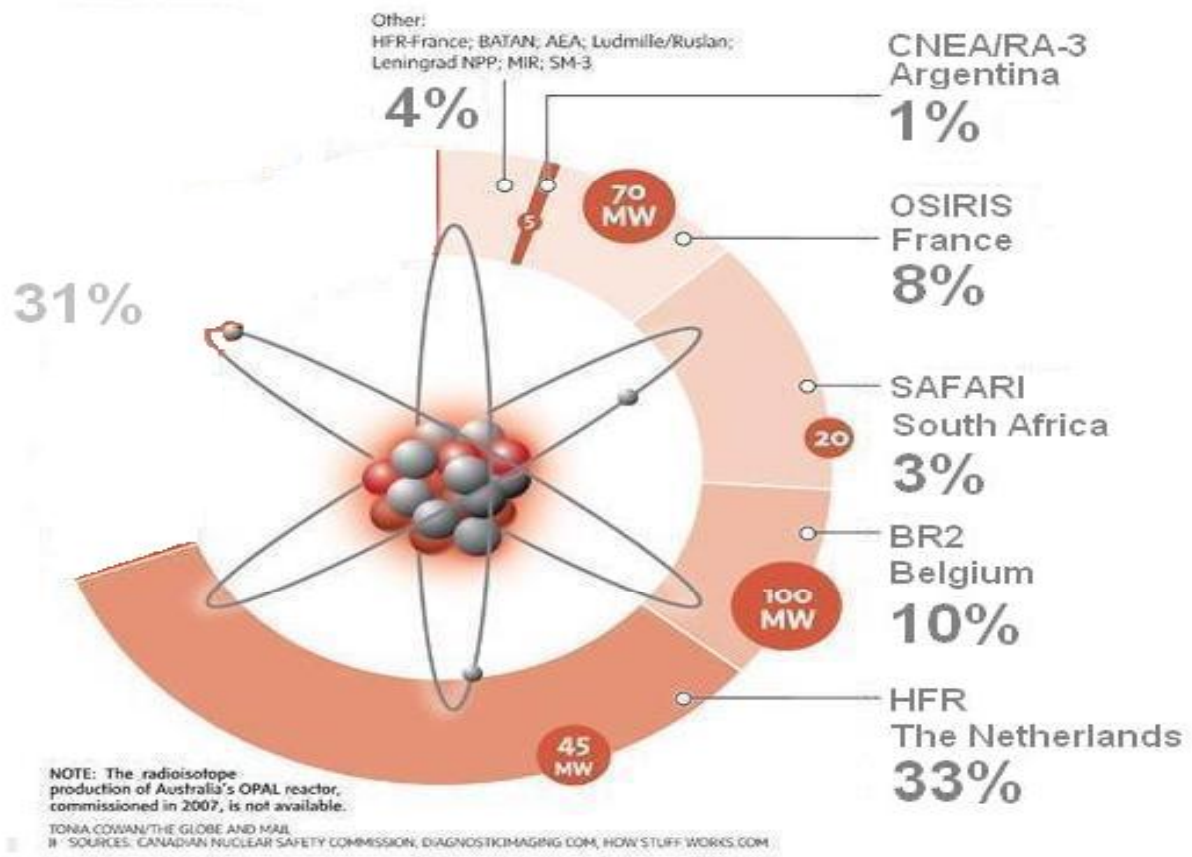
Covidien

Mo99 Update: Mo99 Producers



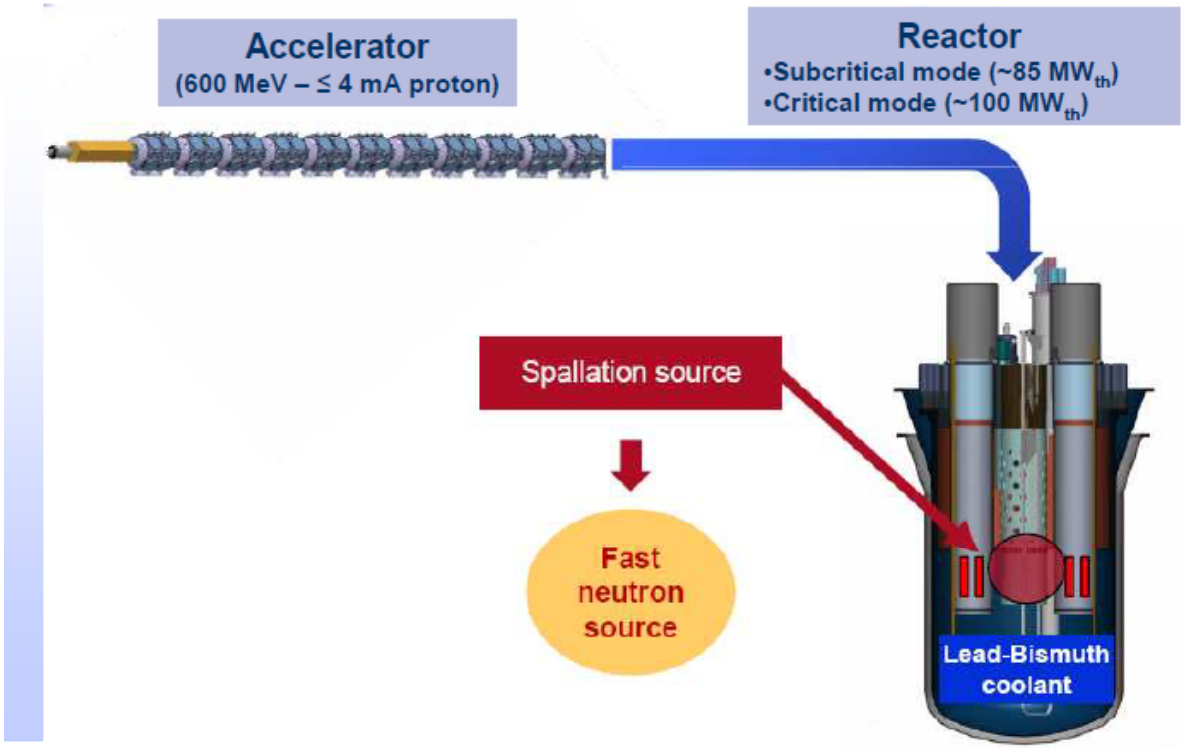
Mo99 Update: Mo99 Producers

31% needs to be replaced?



Mo99 Update: Mo99 Producers

Replacement Reactor for the BR2 in Belgium



MYRRHA: Multi-purpose hybrid research reactor for high-tech applications

Mo99 Update: Mo99 Producers

Replacement Reactors: HFR in the Netherlands

PALLAS

Mo99 Update: Mo99 Producers

Replacement Reactors

OSIRIS

France

Jules

Horowitz

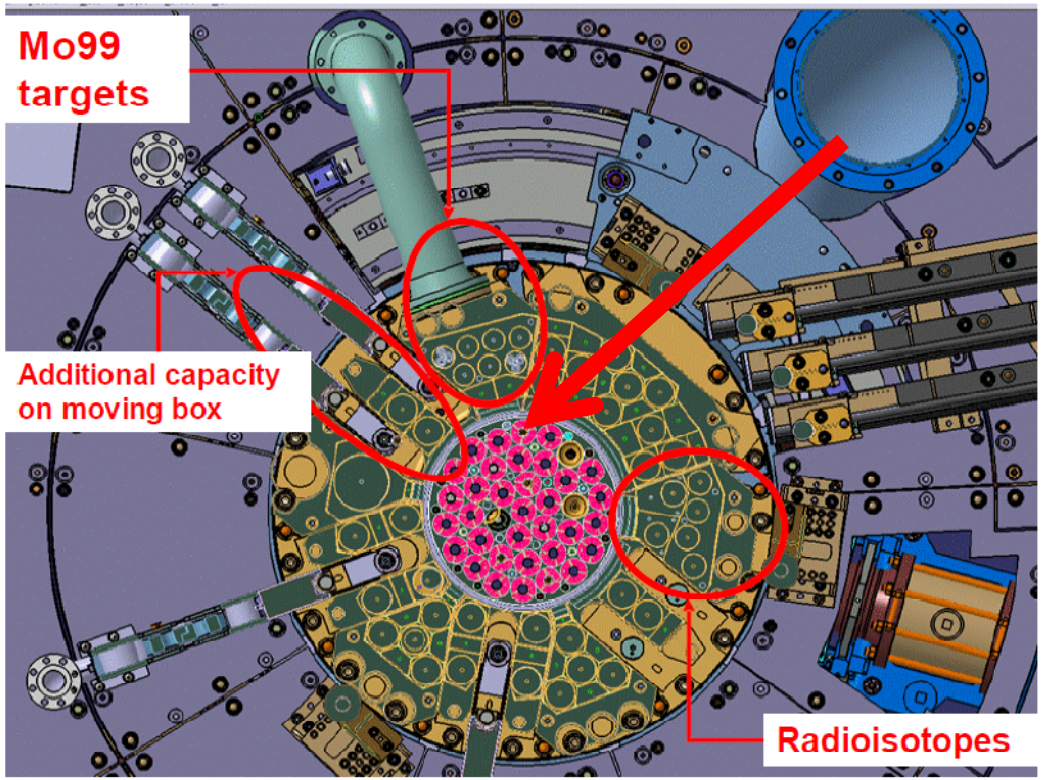
Reactor

Mo99 Update: Mo99 Producers

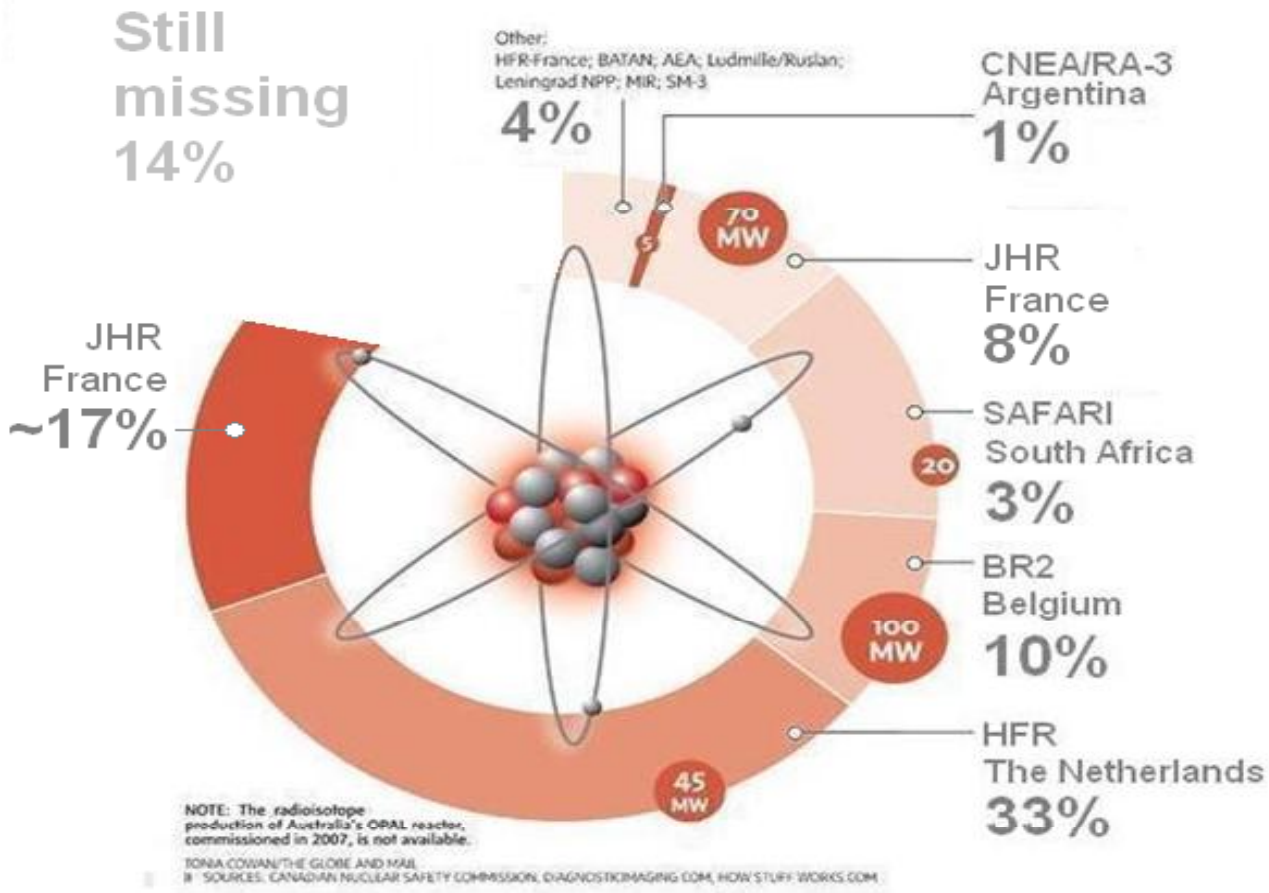
Replacement Reactors

Jules Horowitz Reactor

2015



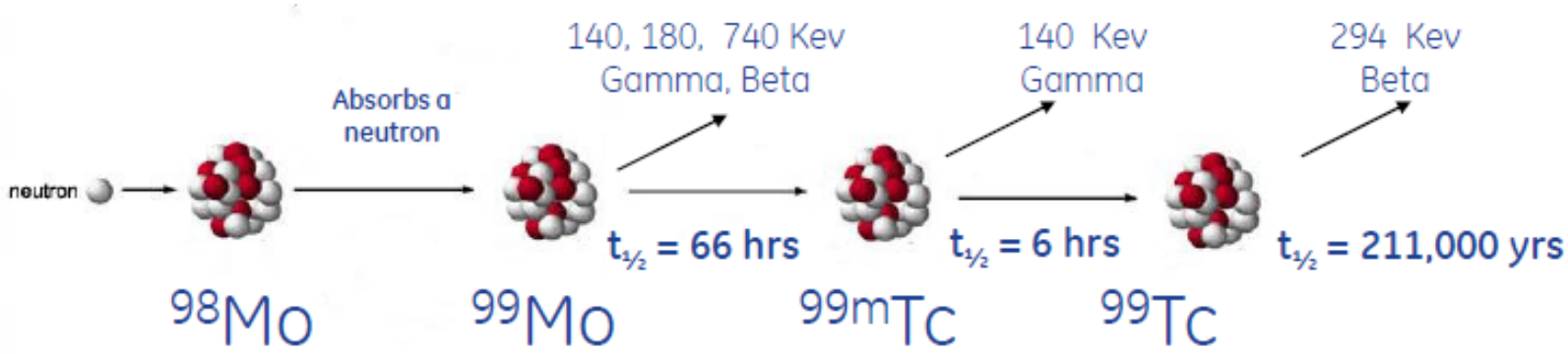
Mo99 Update: Mo99 Producers



Mo99 Update: US Domestic Mo99

Neutron Capture:

GEH process uses neutron capture to produce the parent of ^{99m}Tc from ^{98}Mo

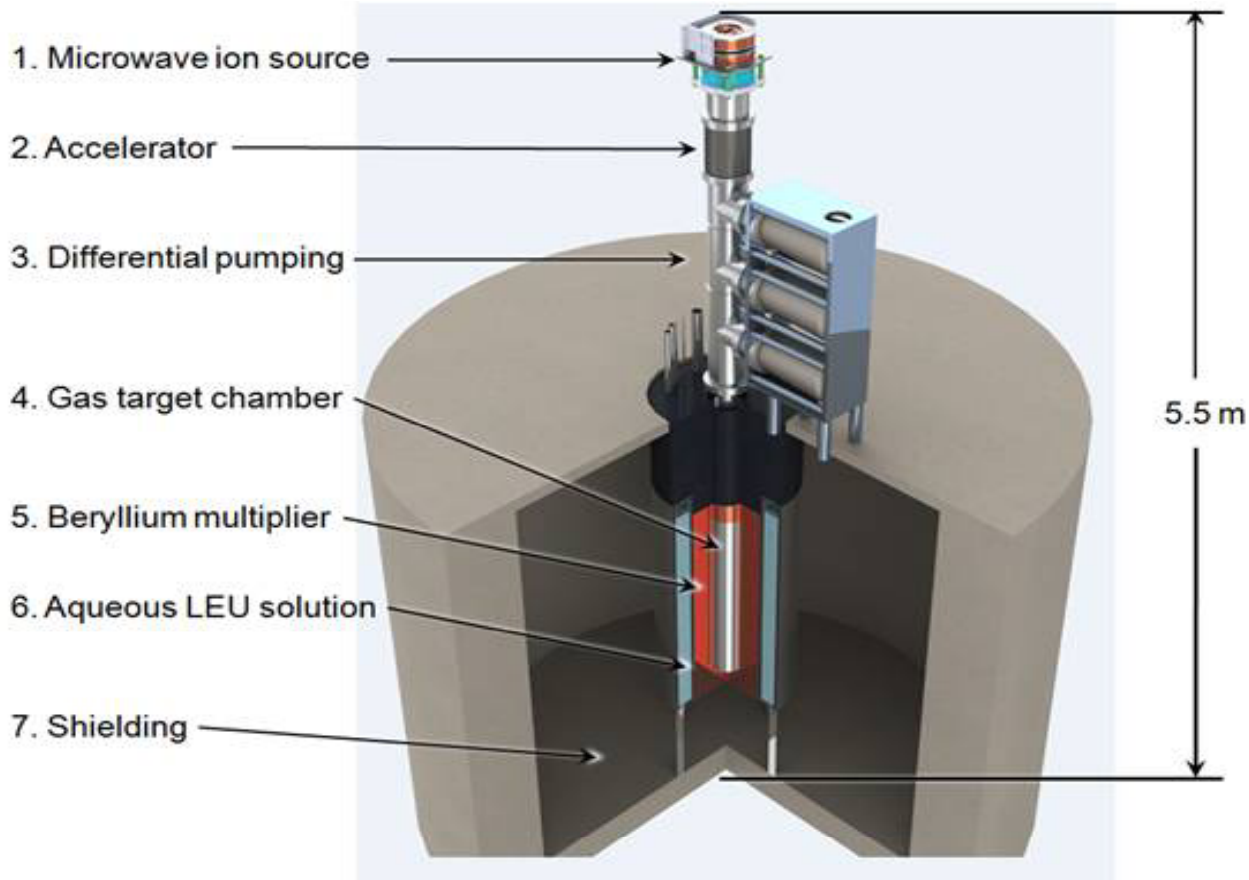


^{98}Mo	^{99}Mo	^{99m}Tc	^{99}Tc
42 Protons	42 Protons	43 Protons	43 Protons
56 Neutrons	57 Neutrons	56 Neutrons	56 Neutrons
98 = Atomic Wt	99 = Atomic Wt	99 = Atomic Wt	99 = Atomic Wt

HITACHI

Mo99 Update: US Domestic Mo99

Accelerator Technology:



SHINE Medical Technologies

MORGRIDGE INSTITUTE FOR RESEARCH

Mo99 Update: US Domestic Mo99

LEU Solution Reactor Technology:

B&W MIPS Technology

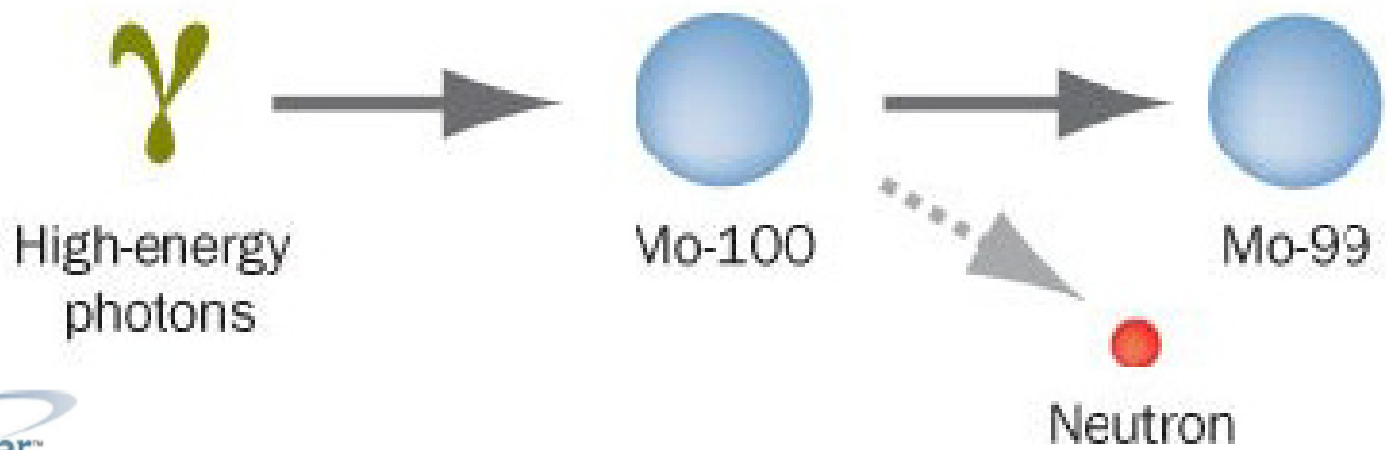
Phase 1: Completed

Phase 2: Addressing project business case prior to moving into next phase

Mo99 Update: US Domestic Mo99

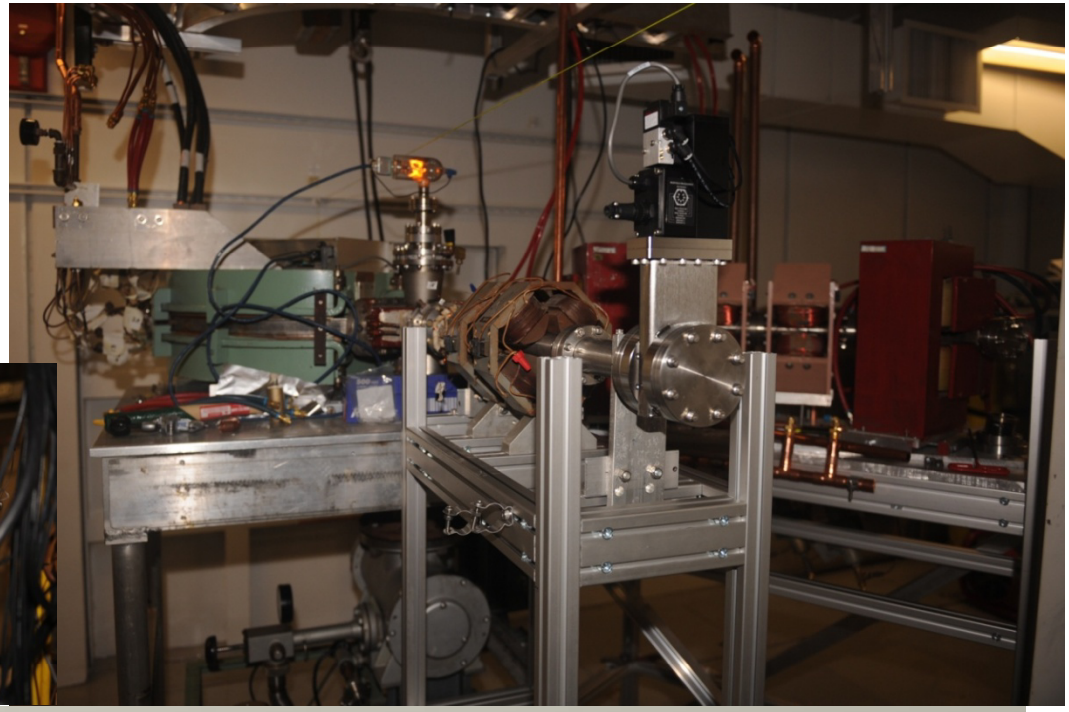
Accelerator Technology:

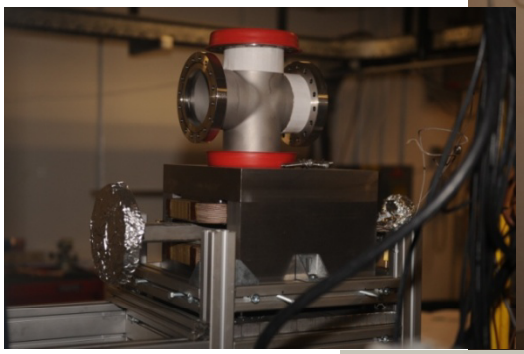
High energy photons are created from a high power electron beam through bremsstrahlung.

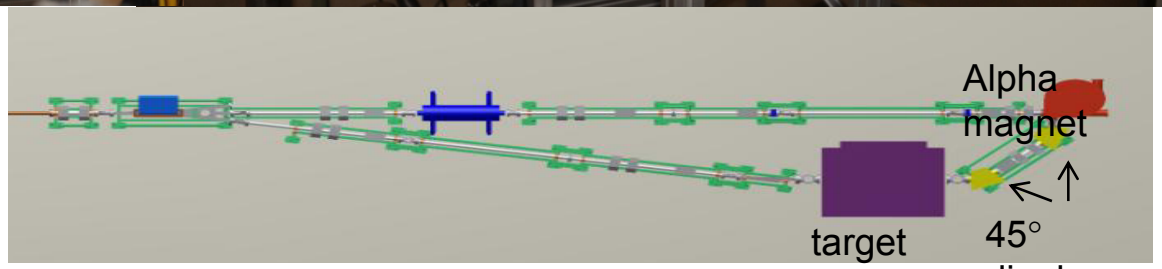


NorthStar

Mo99 Update: US Domestic Mo99

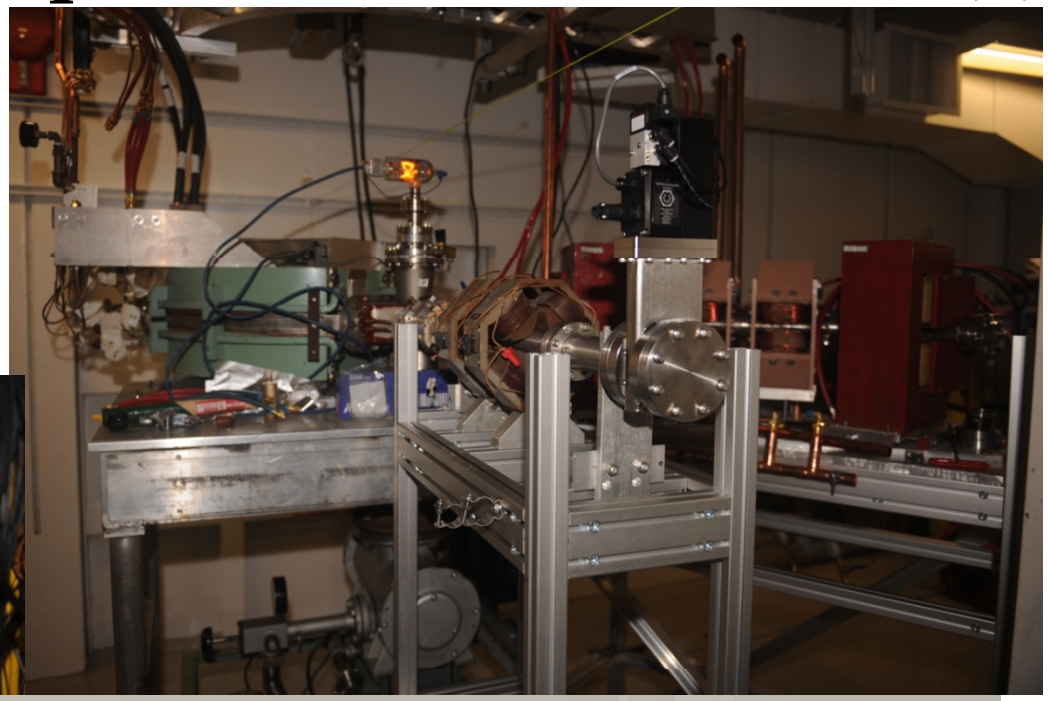


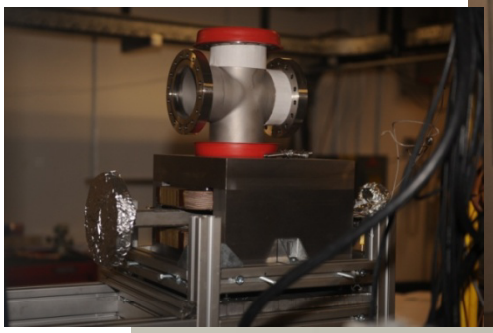


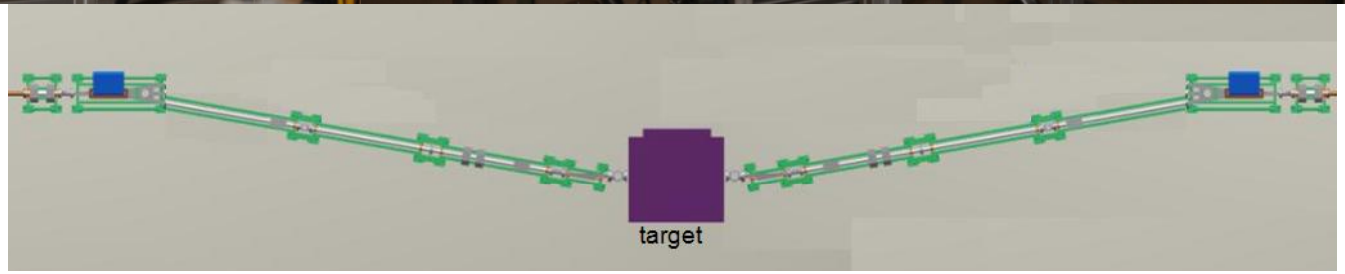


Argonne NATIONAL LABORATORY

Mo99 Update: US Domestic Mo99

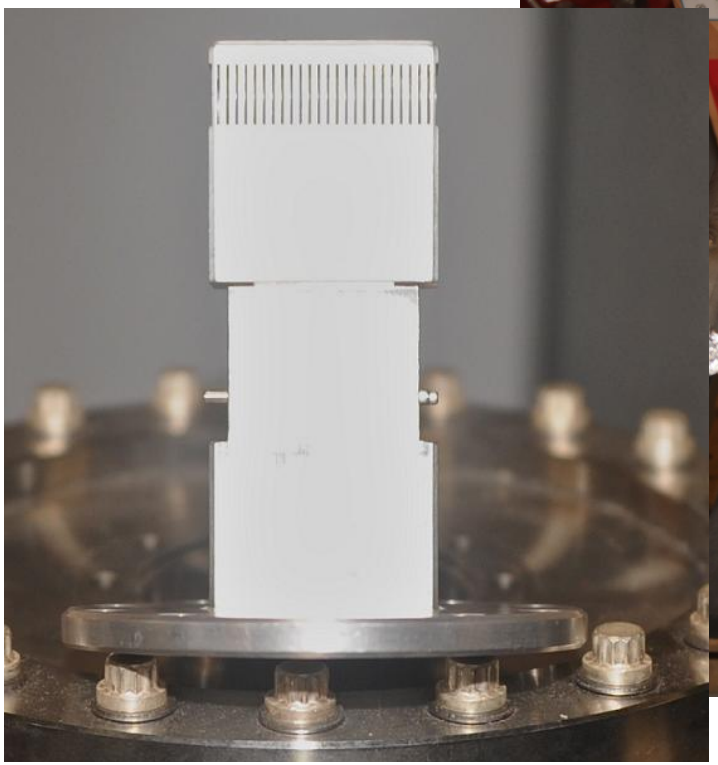


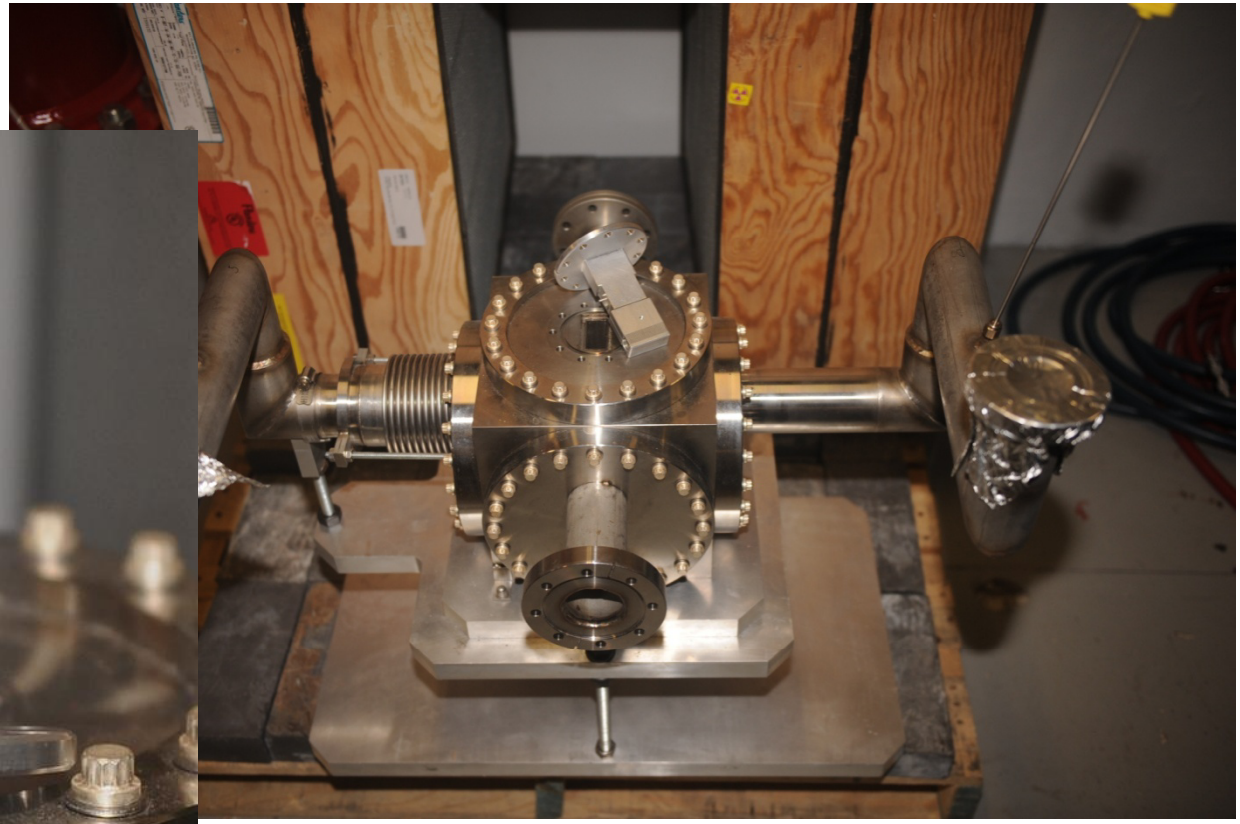




Argonne NATIONAL LABORATORY

Mo99 Update: US Domestic Mo99





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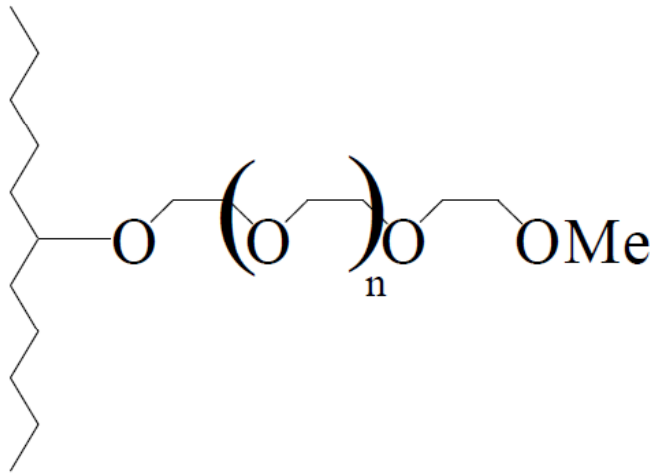
Mo99 Update: New Tc99m Generator

ABEC - Aqueous Biphasic Extraction Chromatography

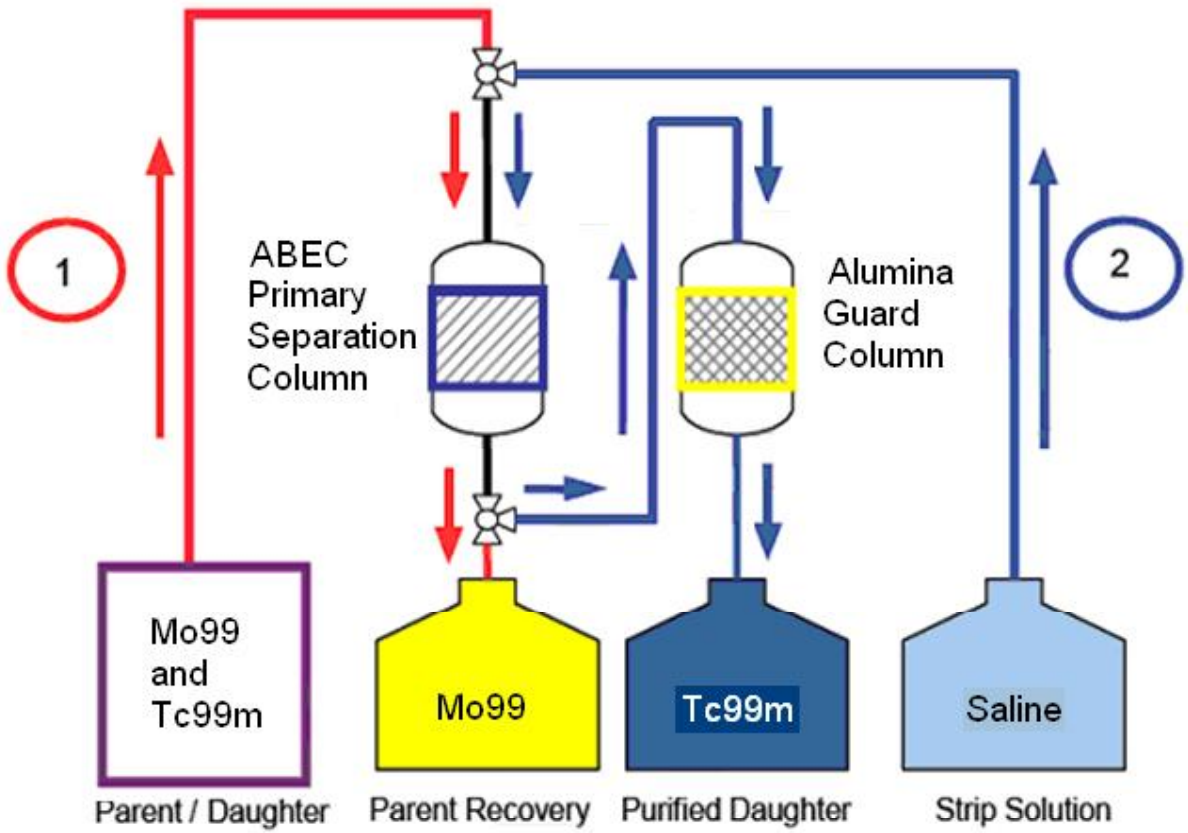


Support
Polystyrene
Divinylbenzene

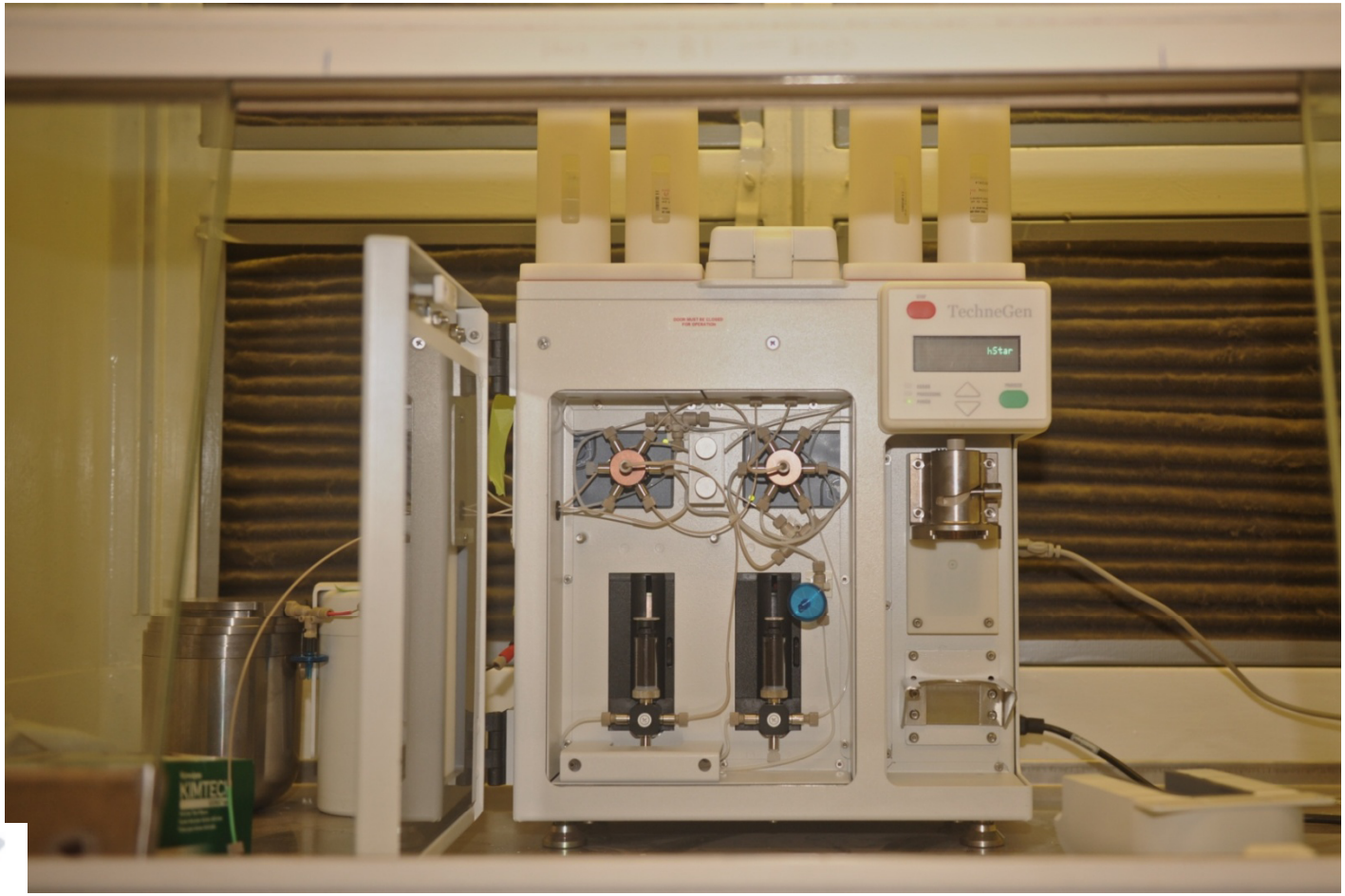
n = 50

Automated two column generator systems for medical radionuclides
Daniel R. McAlister, E. Philip Horwitz; Applied Radiation and Isotopes 67 (2009) 1985-1991

Mo99 Update: New Tc99m Generator



Mo99 Update: TechneGen™



Mo99 Update: TechneGen™

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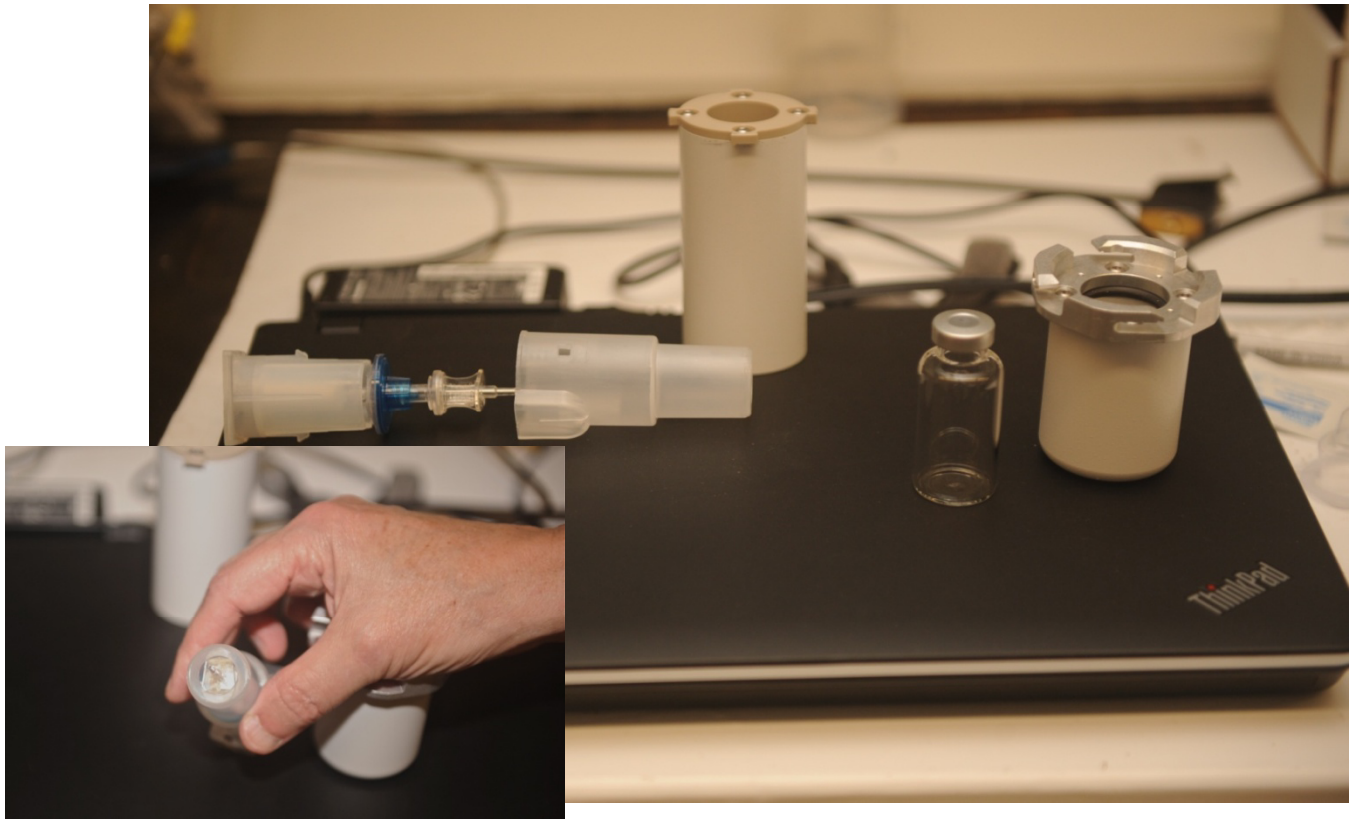
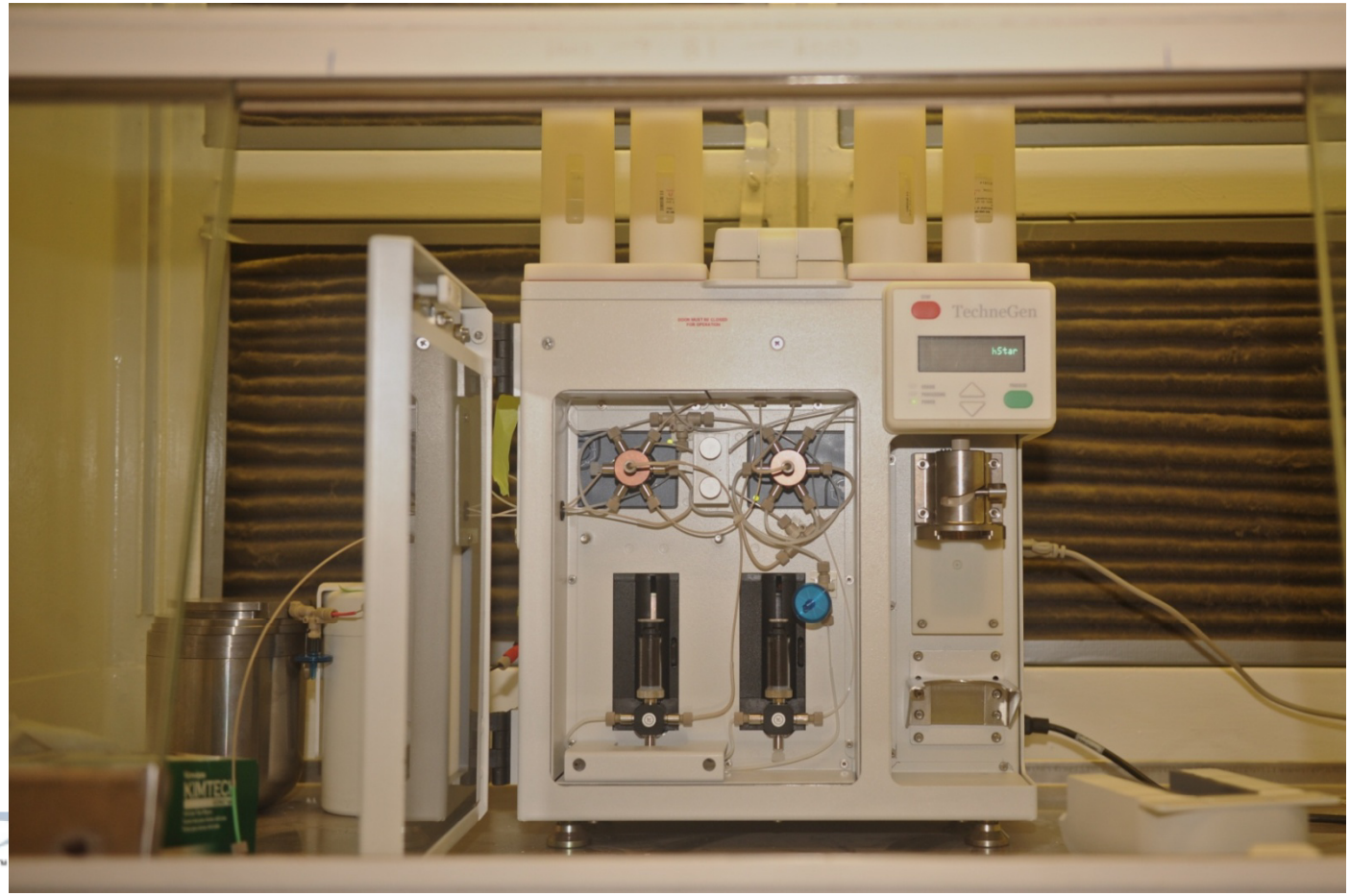


NorthStar™

Mo99 Update: TechneGen™



M099 Update: Reimbursement

Acronyms

- ABEC – Aqueous Biphasic Extraction Chromotography
- AECL – Atomic Energy of Canada
- ANSTO – Australian Nuclear Science & Technology Organisation
- BR2 – Belgian Reactor 2
- CNEA – Comisión Nacional de Energía Atómica
- HFR – High Flux Reactor
- IRE – Institute for Radio-Elements
- JHR – Jules Horowitz Reactor

Acronyms

- LEU – Low-enriched Uranium
- MIPS – Medical Isotope Production System
- Mo99 – Molybdenum-99
- NRU – National Research Universal
- NTP – Nuclear Technology Products
- RIAR – Research Institute of Atomic Reactors
- Tc99m- Technetium-99m