Molybdenum converter electron linear accelerator

The Need:
The radioisotope 43-Tc-99m is by far the most important radioisotope for use in Nuclear Medicine. It is a key diagnostic in ~85% of Nuclear Medicine procedure. There are more than 40 million procedures performed worldwide per year (myocardial perfusion, bone mets, renal, infection, others...). 43-Tc-99m (6 h, 141keV) is a product of the (β-) decay of its precursor, 42-Mo-99 (66 h), which, in turn is a product of thermal neutron fission (n,f) process (F.Y.=6.161%). It is the “gold standard” for producing of Mo-99 resulting in a very high specific activity of more than 5,000 Ci/gMo. Mo-99 production from nuclear fission of U-235 requires very elaborate and very expensive “hot cell” facilities to treat highly toxic Fission products and transuranic. The production of medical radioisotope molybdenum-99 will cease at Canada, which is one of the most, which is one of the major production site in the world. Most of nuclear reactors, which produce Mo-99, are very old “geriatric” reactors with an average age of more than 50 years. As a result there are unpredicted unscheduled shutdowns sometimes for many months. All of them are close to total decommissioning.

The solution:
Utilizing Bremsstrahlung as a target/converter made from molybdenum (42—Mo) and thus maximizing the production of Mo-99 via the photo neutron reaction on Mo-100.
The use of Mo directly as a Bremsstrahlung target enables to utilize the neutrons from the reaction and for complimentary production of Mo-99 via the reaction on Mo-98.

Main advantages of the accelerator based technique:
No need for use of a nuclear reactor.
Non-fissionable material, such as Mo, can be used thus obviating the problems of security and Non-Proliferation Treaty.
Cost effective solution with minimal risks and low maintenance.
The electron accelerator based technology promises to be scalable.

Project and Patent Status
Monte Carlo simulation was carried out
Granted IP

Leading Researcher
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