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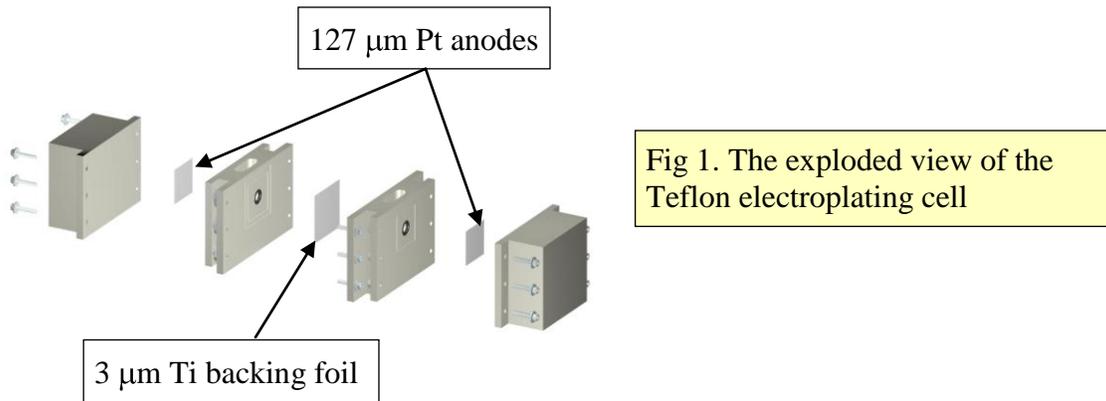
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Fabrication of a ^{238}Pu target

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Precision neutron-induced reaction data are important for modeling the network of isotope production and destruction within a given diagnostic chain. This network modeling has many applications such as the design of advanced fuel cycle for reactors and the interpretation of radiochemical data related to the stockpile stewardship and nuclear forensics projects. Our current funded effort is to improve the neutron-induced reaction data on the short-lived actinides and the specific goal is to improve the neutron capture data on ^{238}Pu with a half-life of 87.7 years. In this report, the fabrication of a ^{238}Pu target for the proposed measurement using the DANCE array at LANL is described.

The ^{238}Pu target was fabricated from a sample enriched to 99.35 %, acquired from ORNL. A total of 395 μg was electroplated onto both sides of a 3 μm thick Ti foil using a custom-made plating cell, shown in Fig 1.



The target-material loaded Ti foil is sandwiched between two double-side aluminized mylar foils with a thickness of 1.4 μm . The mylar foil is glued to a polyimide ring. This arrangement is shown partially in Fig. 2. The assembled target is then inserted into an aluminum container with a wall thickness of 0.76 mm, shown in Fig. 3. A derlin ring is used to keep the target assembly in place. The ends of this cylindrical container are vacuum-sealed by two covers with thin Kapton foils as windows for the beam entrance and exit. Shown in Fig. 4 is details of the arrangement.

This target is used for phase I of the proposed measurement on ^{238}Pu scheduled for Nov 2010 together with the DANCE array to address the safety issues raised by LANL. Shown in Fig. 5 is the preliminary results on the yield spectrum as a function of neutron incident energy with a gate on the total γ -ray energy of equivalent Q value. Since no

fission PPAC is employed, the distinction between the capture and fission events cannot be made, which is important for the higher neutron incident energy. However, it indicates that a cross section of less than one barn can be measured.

The second phase of this experiment will be carried out in 2011 by assembling a PPAC with the ^{238}Pu target to extend the measurement to higher neutron incident energies by distinguishing the capture from fission events. The fission cross section becomes dominant for neutron incident energies above 30 keV. This PPAC was developed in FY2010 under the NA22 funding and performed very well for the ^{239}Pu and ^{241}Pu measurements [1]. A new ^{238}Pu target will be fabricated for the phase II measurement using the same electroplating technique.



Fig 2. The target loaded Ti foil placed on top of the aluminized mylar, which is glued to the polyimide ring

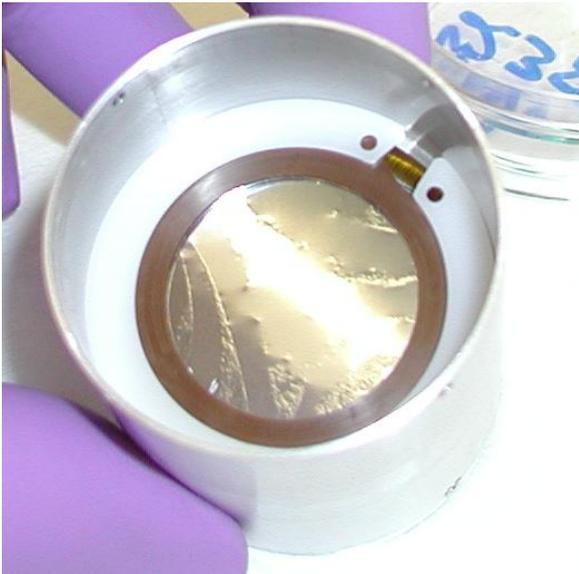


Fig 3. The target assembly, where the 3 μm thick Ti is sandwiched between two aluminized mylars, is kept in place by a derlin retaining ring of 1 mm.

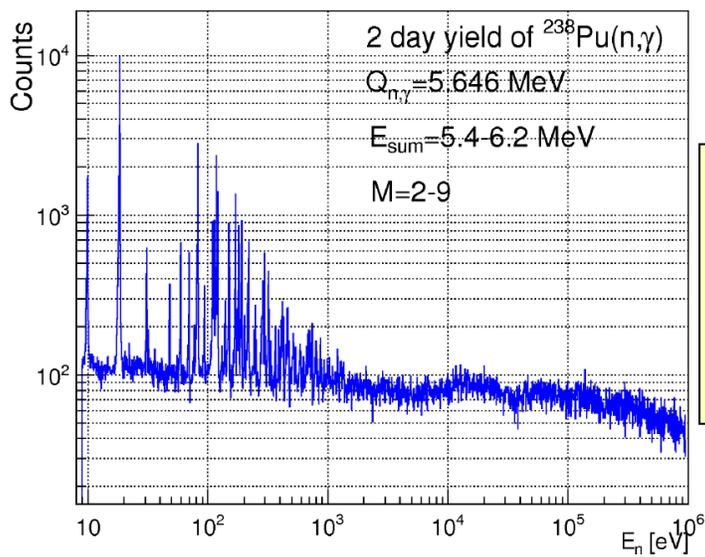
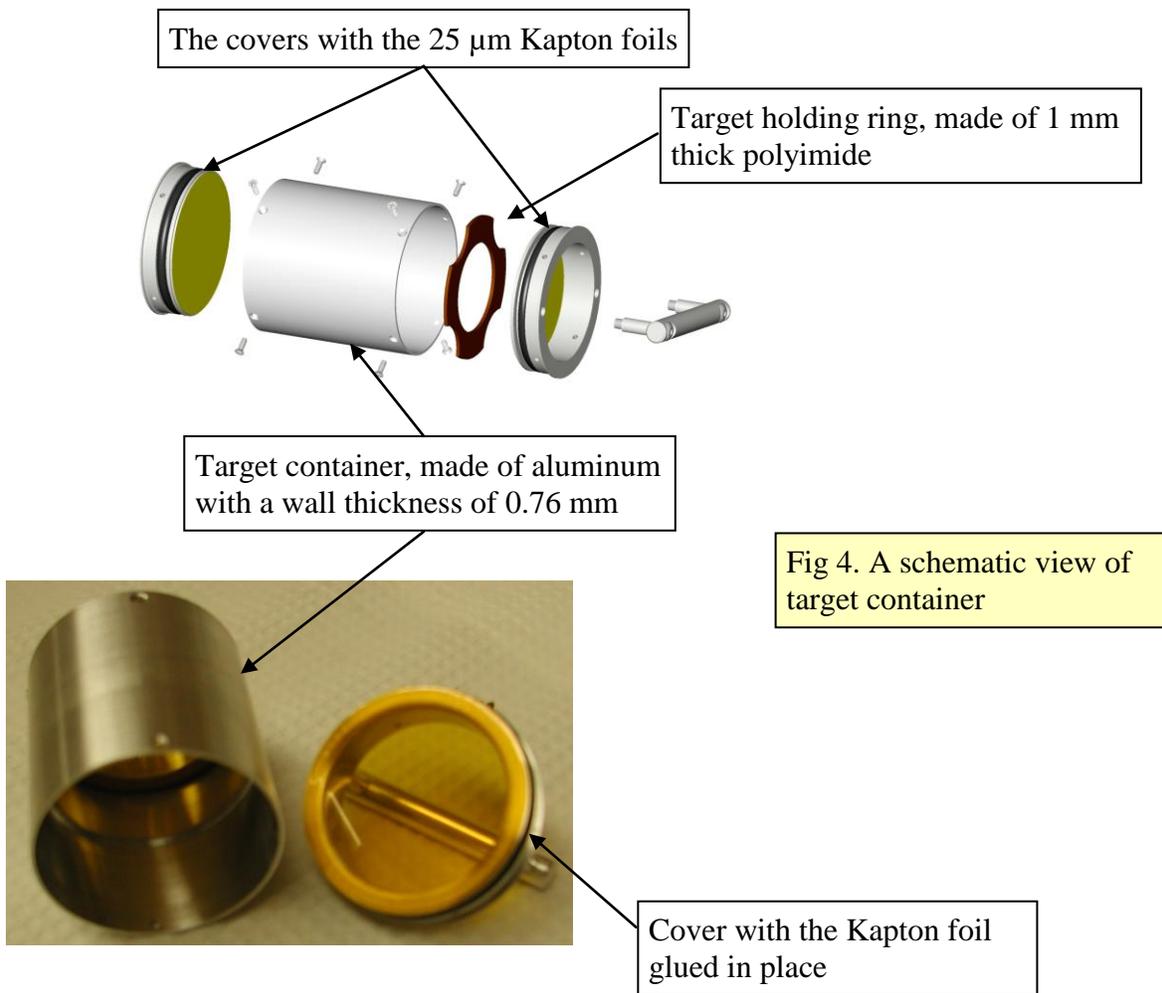


Fig 5. The raw yield spectrum for the ^{238}Pu experiment with DANCE obtained by gating on the total γ -ray energy of equivalent Q value. The distinction between the capture and fission events cannot be made within the given gate.

[1] C.Y. Wu, A. Chyzh, E. Kwan, R. Henderson, J. Gostic, D. Carter, T. Bredeweg, A. Coutuer, M. Jandel, and J. Ullmann, "Compact fission counter for DANCE", LLNL-TR-462118, Nov 2010.

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