C-AD

Radiation

Safety

Committee

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Minutes of BLIP RSC Target Review Subcommittee July 16, 2015

Subject: Thorium Targets for Next year

Present: D. Medvedev, L. Mausner, C. Cutler, E. Lessard, P. Pile, C. Schaefer, D. Beavis, and C. Cullen

The committee was asked to consider changes to the Thorium (Th) target designs for next year to accommodate changes in the program. Most importantly, the raster system is expected to be operational. This will lower the beam power density deposited in the targets but requires that the targets have a larger diameter. The beam current will be increased from 115 micro-amps to 140 micro-amps. The targets will be fabricated by LANL (Sigma group) next year and that will also introduce target changes. Decisions with LANL need to be finalized soon to enable the targets to be manufactured.

Target Changes

Th targets used in the past were typically 0.005 inches thick[1], exposed as a stack of three with individual Al wrapping (0.0005" thick). The Al wrapping was to prevent the spread of alpha emitters when the target is opened after irradiation. Each foil was shipped separately in a type A container. Shipping all three targets together would have required a type B container, which BNL does not have[2]. LANL will only be able to roll the new targets to a thickness of 0.015 inches. Therefore, to stay with a type A container LANL will precut a single Th disk into three pieces.

The geometry of the target pieces has several issues. The geometry of the cuts in the target may impact the thermal analysis. Most of the heat is transported through the top and bottom faces of the Th and the thermal analysis is not expected to be too severely affected. Unequal non-pie shaped pieces may have different levels of activation due to the sweeping of the beam by the raster magnet which would complicate shipping somewhat. The sizes will need to be selected so that a type A container can be used for each piece. The target pieces are usually folded to fit into a glass vial and the folding process will need to be tested for the new target pieces. LANL has been consulted on the type of shapes they are comfortable in cutting and they favor three equal pie slices. The thermal analysis will be conducted on the chosen geometry.

The Th targets will not be wrapped with Al. LANL will not wrap them and the wraps reduce thermal conductance to the cooling surfaces. Silver electroplating has been ruled out as a means to block release of alpha emitting nuclei recoiling from the target surface. The targets will not be coated for

[1] Purchased from a vendor.

[2] It is noted that there are plans to obtain a type B container for the future.

next year. The targets arrive at BNL sealed in a welded target can. The can is only opened after irradiation to remove the three target pieces, place each in a glass vial, and then ship them to ORNL in a type A shipping container. The opening operations take place in the building 801 Hot cell. The primary concern is the possible contamination of production targets with alpha emitters in the hot cell.

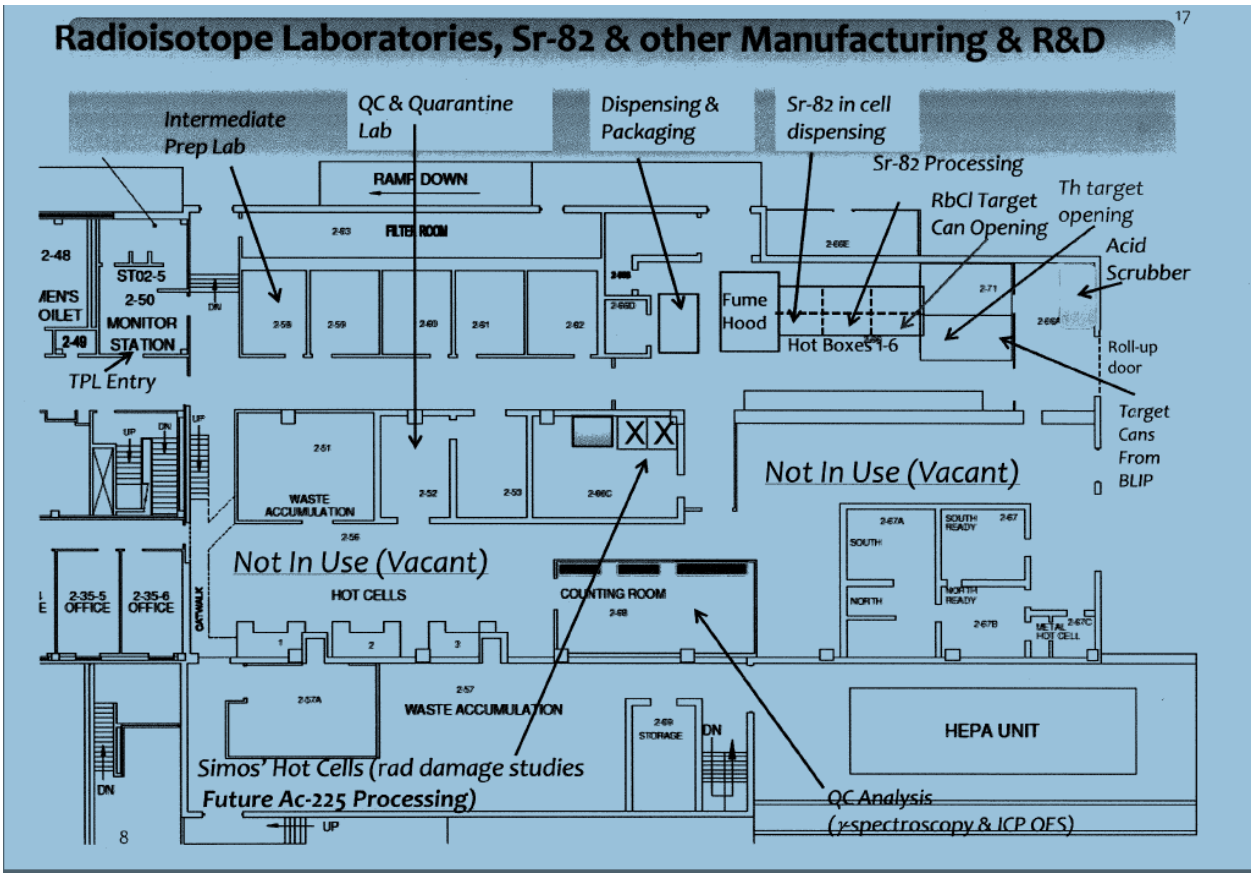
Next year the RbCl target will be moved into hot box #6 and be opened with a new separate cutter from that used for the Th targets. The RbCl targets are always washed in the hot box before they are opened and this should remove any potential contamination. An administrative control will need to be implemented to have the shutter between the hot box and the hot cell closed to avoid air intrusion from the hot cell. If possible an engineered solution to prevent air flow should be developed between the hot box and the hot cell, which does not require operator intervention.

A flexible plastic elephant trunk will be investigated for adding to the hot cell so that any recoil particles caused by alpha emitters will be carried into the acid vapor neutralization ventilation system (acid scrubber in the figure below) rather than circulate in the hot cell. Vapors are then trapped in a basic solution. Metal trunk lines tend to rust so it is important that a plastic trunk line is utilized.

Should the hot cell become contaminated from particles there are established means to remove the contamination. For the Th targets any Ac225 in the ventilation system will not require being decontaminated since the half-life is 10 days. The specific activity of long lived Ac 227 should be very low.

There are three planned irradiations next year with 10 day duration each. A Cu or Inconel target can will be used. However, in the out years involving thicker Th disks copper may need to be abandoned if the target temperature approaches 800° C.

A target documentation package will arrive with the fabricated target from LANL. This will be archived following QA practices using Windchill. To provide better thermal coupling to the can windows the feasibility of sealing the target in a He atmosphere will be investigated by LANL.



Layout of the Building 801 areas used for RbCl and Ac targets.