

C-AD

Issued: June 2, 2015

Radiation

Safety

Minutes of BLIP RSC Target Review Subcommittee

May 18 and May 29, 2015

Committee

Subject: Th Target Thermal Analysis

A group as assembled to discuss the engineering details of the thermal analysis of the Th foils that are planned for exposure in early June. The same setup was reviewed and had a successful run earlier in the year. After the Sc target failure, all research targets are being examined for any potential weaknesses not detected in the previous reviews.

The conclusion on May 29 by the group present was that the Th target design was safe to operate and the analysis was reasonable and conservative. The target was approved for irradiation.

Several important changes were made to the thermal analysis. Helium was added to all gaps between foils and the heat transfer through He was by conduction. The overlap of the Al wrapping was taken into account and the water flow was reduced by 20%. The beam size during the previous exposure was found to be smaller than expected. This was uncertain at the time of exposure although suspected. The group asked that before the present target is irradiated that a measure of the beam profile be made and it must be as large as the beam sized used in the analysis. The analysis used a beam size with FWHM of 10mm. The center of the copper target surface (back-side) has a maximum temperature of 214° C.

The conservative case of cooling the copper with “free” water convection would allow a heat flux to 132 W/cm² before boiling would begin. The copper is operating with the highest heat flux of 123 W/cm². Although this margin appears small, the actual water cooling is by forced flow of the water and will be able to allow substantially larger heat fluxes. The forced convection calculations will be available soon, but are not expected before the irradiation.

The water flow was examined over the surface of the target to see if any eddy currents existed. The analysis presented demonstrates that there are no circulation cells caused by the surface changes in the copper holder.

The analysis was conducted with a 20% lower water flow based on the discussion in the meeting of May 18 where substantial amounts of water can flow around the box lowering the flow between the targets in the box. Mass flow measurements will be conducted during the summer shutdown.

The Al foils are placed on the targets to reduce the potential spread of contamination due to atomic recoils from alpha decays. The Al foils reduce risk of contamination (mainly in the hot cell at Building 801). However, these layers of Al foils make the targets more complex and interfere with heat transfer. The use of the Al foils may need to be reconsidered for the Th targets planned for the future.

The beam size on the BLIP targets can be smaller. It appears that during the last Th exposure that the beam was smaller than expected when the Linac was retuned from lower energy to 200 MeV. The same process is being repeated this time so there is the expectation that the beam size will be close to that during the previous Th exposure. The LP for the Linac should provide beam optics details on the range of beam sizes achievable at the BLIP targets and ensure that there are appropriate controls to prevent beams that are too small for future operations on BLIP targets. Operations of the beam raster system will have beam sizes without induced movement smaller than the spot size presently used.

**Provide BLIP target group with beam size expectations on BLIP Targets.
ATS-Raparia&Beavis-LINAC-August 1, 2015**

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