

Guide for Conducting a Survey Following NTF Tungsten Target Irradiation

Bill Higgins 26 March 2010

Modified by Michael Vincent 26 August 2010

From time to time at the Neutron Therapy Facility, a tungsten target assembly, which is on a cart, is used to irradiate samples. Tom Kroc has supervised these tests. The cart is usually stored in the Lower Linac Gallery, in the locked cage just upstream of the NTF treatment room. This cage is a posted Radioactive Materials Area; it is also a Radiation Area when NTF is operating.

Following an irradiation, the assembly typically exhibits a dose too high to allow movement through the hallways, around 10 to 30 millirem per hour. The Linac gallery is posted as a Controlled Area, and the dose from the target assembly must drop below 5 millirem/hour before it can be moved. Typically it cools down to a tolerable level by the following day, around 0.1 to 0.5 millirem per hour.

Therefore, we survey the target assembly, padlock the rolling door to the NTF treatment room, and return a day or more later for another survey.

After the irradiation, survey the target assembly in the treatment room using a Microrem instrument.

1. Note the device number and its expiration date, along with the date and time of the survey. Check battery and high-voltage level.
2. Take a background reading outside the sliding door. Background in the room will be high.
3. Measure activity 1 foot from the front face of the target.
4. Determine that no one occupies the treatment room. ~~Close the sliding door and lock its bolt with an RSO padlock.~~ Use the following guide to secure the NTF sliding door.
-- M. Vincent 26 Aug 2010
5. Log the lockup in the Configuration Control Log under the Linac category.
6. Record the date, time, instrument number, expiration date, background dose rate, and target dose rate in the file "NTF Tungsten Activation.xls" found in the "Y:\Rad_Safety_Group\NTF Target Irradiation" folder.

(Web:

<file:///Y:/Rad_Safety_Group/NTF%20Target%20Irradiation/NTF%20Tungsten%20Activation.xls>)

Also subtract the background from the target dose rate and record the result.

7. After an overnight cooldown, unlock the rolling door.
8. Take a background reading.
9. Enter the treatment room and measure the dose rate one foot from the front face of the target.
10. If the dose exceeds 5 mrem/hour, exit and lock the door to allow further cooldown.
11. If the dose is below 5 millirem/hour, notify NTF personnel.
12. Log removal of RSO lock in Configuration Control Log.
13. Enter the post-cooldown readings in the "NTF Tungsten Activation.xls" file.

Photos:

Tungsten target assembly in NTF Treatment Room:

<http://adusers.fnal.gov/higgins/Bill%20Higgins/Forms/DispForm.aspx?ID=7>

Overview of tungsten target in NTF Cage:

<http://adusers.fnal.gov/higgins/Bill%20Higgins/Forms/DispForm.aspx?ID=6>

NTF Cage entrance showing tungsten target cart:

<http://adusers.fnal.gov/higgins/Bill%20Higgins/Forms/DispForm.aspx?ID=5>

GUIDE FOR LOCKING THE SLIDING DOOR AT NTF

M. VINCENT
25 AUG, 2010



1. Upon arrival, you should find that the switch to the left of the NTF sliding door is secured in the **UNLOCKED** (down) position with an RSO lock.



2. Remove the lock, open the NTF sliding door a few inches (to keep the lock from engaging), and turn the switch up to the **LOCKED** position.

3. Open the NTF sliding door and verify that the light on the crash button is lit.



4. Fully close the NTF sliding door. The sound of the door lock engaging should be clearly audible.

5. Verify that the NTF sliding door cannot be opened.



6. Place the RSO lock back on the switch, locking it in the **LOCKED** (up) position.

For The Curious:

From: Thomas Kroc [kroc@fnal.gov]
Sent: Wednesday, June 02, 2010 3:04 PM
To: glauten@fnal.gov
Subject: Re: NtF Tungsten Irradiation

glauten wrote:

> Hi Tom,
>
> Since I took over the duties of checking your tungsten irradiation
> table at NTF, it occurred to me that I don't know a couple of things:
>
> 1. "Why" are we irradiating the tungsten; what does doing this
> accomplish for NTF?
>
> 2. "What" happens to the tungsten irradiation table after you put it
> downstairs in the fenced area? Are any parts removed and taken offsite?
> Who handles the radioactive parts?
>
> Thanks
> Gary

The actual goal is to irradiate brain tumor cells. The tungsten is just part of the apparatus to modify the neutron energy spectrum. The tungsten covers a 5cm x 10 cm aperture that is defined by lead bricks. Behind this is a polyethylene block that represents a head. We place flasks of the brain tumor cells in the head phantom.

Surrounding this are blocks of graphite that reflect the neutrons to keep as many as possible in the area of the head. The brain tumor cells are treated with either boron or gadolinium compounds. The B or Gd have high cross sections in the thermal portion of the neutron spectrum and the apparatus is trying to enhance that component.

The whole assembly is based on thesis work by a Georgia Tech graduate student about 4 years ago. He came up with the combination of lead collimation, tungsten filtration, and graphite reflector to maximize the thermal neutron enhancement.

When we are done with these experiments (and I expect them to continue for a few more years) we will disassemble the apparatus and store the components for future use.

As for who handles the apparatus: Once the irradiation is done and you have surveyed it and said we can move it downstairs, we handle it as little as possible while moving it.

When we bring it back for the next run, we have to move the tungsten out of the way, in order to align everything, and then replace it. But by then, it has cooled for more days since you had surveyed it.

Tom