

Memo

date: September 13, 2012
Updated: September 26, 2012
to: RSC
from: D. Beavis 
subject: Simple X-ray Estimate for the ATF Gun

I will use curves in NCRP Report no. 144 to estimate the potential dose for x-rays from the ATF gun.

Assume :

60 nano-Coulombs
5 MeV beam energy
0.3 W is the total beam power

At 90 degrees the dose rate for a thick high Z target is:

$$10^4 \text{ rads/hr} * 3.28 * 3.28 * 3 * 10^{-4} = 32.3 \text{ rad/hr at a foot for .3 Watts.}$$

Using a TVL for lead of 5.29 cm (rounded to 5) I get that 4 inches of lead gives a reduction of 10^{-2} .

I will assume a factor of .1 for low z, non-thick target and sideways shielding ie this is a fudge factor to make things closer to reality.

The estimate is then 32 mrad of x-rays for .3 W of 5 MeV beam for a full beam fault. Clearly this can happen on the valve.

If the gun is limited in current to 2nC per with 1.5 Hz operation then the result for a full beam loss is 1.6 mrad/hr. Routine losses depend on how much of the beam is lost and what the dark current is. I doubt it causes any more dose then a full beam fault. I assume that only a very small amount of beam can be accelerated backwards as discussed in the SAD.

The 1.6 mrad/hr is a fault condition. The routine levels should be substantially lower.

The gun area is a Controlled Area with TLD required, which is appropriate.

Pre-start Recommendations:

- Establish a limit on gun current to be administratively maintained until confirmation of dose rates.

Post Start Recommendations:

- Immediately on restart conduct and document a survey and fault study in a deliberate and controlled fashion.
- Generate a USI on SAD description of gun. I do not see an impact on ASE. This appears to be an editorial type USI if necessary. I hear indirectly that the description in the SAD does not impact the safety analysis.
- Document and Configure Control the Pb shielding for the gun. The Configuration process in place may already be sufficient.
- Allow increased gun current as details are confirmed and processes improved.

Note the forward number is about 20-40 times higher when crudely estimated. It would be interesting to know if the lead wall in the laser room was placed there due to scrapping in the gun area.