

## Photoneutron (PN) simulations.

A study of PN dose resulting from gas bremsstrahlung (GB) striking thick targets of various materials was conducted by Pisharody et al.[1,2]. Solid cylinders of Cu, Fe, W, and Pb were irradiated with a GB beam generated in an ID straight section of the APS. The GB itself is characterized by a Pb-glass calorimeter[3]. A comparison of this data with MARS simulations is presented in order to evaluate the program's predictive capability for simulating PN dosages. In the case of Ref. 1 and 2, an Andersson-Braun (AB) remmeter was used to measure the PN dose.

The plan geometry of the MARS simulation is presented in Figure 1; in this case, an iron target receives the GB beam. In Figure 2, the PN dose predicted by MARS is shown for the geometry given in Figure 1. The simulation results presented in Fig. 2 must be normalized for the actual pressure and current as mentioned above. Performing this normalization, PN dose results from Ref. 1 and scaled MARS simulations are presented in Table 3. The simulations starts with  $10^8$  primary electrons striking an air target 31 m upstream of the GB target. The PN measurements presented in Table One are obtained from beamline 6 ID which has the lowest GB power of all beamlines (BL) examined (a factor of 4 with respect to the average BL and a factor of 10 lower than the highest BL); however, it still does not explain the large difference between measurement and simulation. Also, the targets change in absolute dimensions to maintain a length of  $20 X_0$  and  $6 X_0$  in width. In the conclusion of Ref. 2, it is stated that a detector should be built to measure the high energy PN spectrum; however, this suggestion does not appear in the refereed publication, Ref. 1.

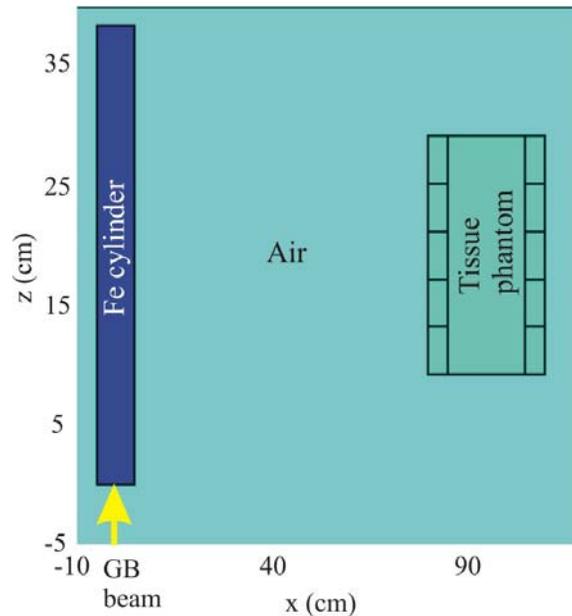


Figure 1: Plan geometry of the MARS PN measurement simulation.

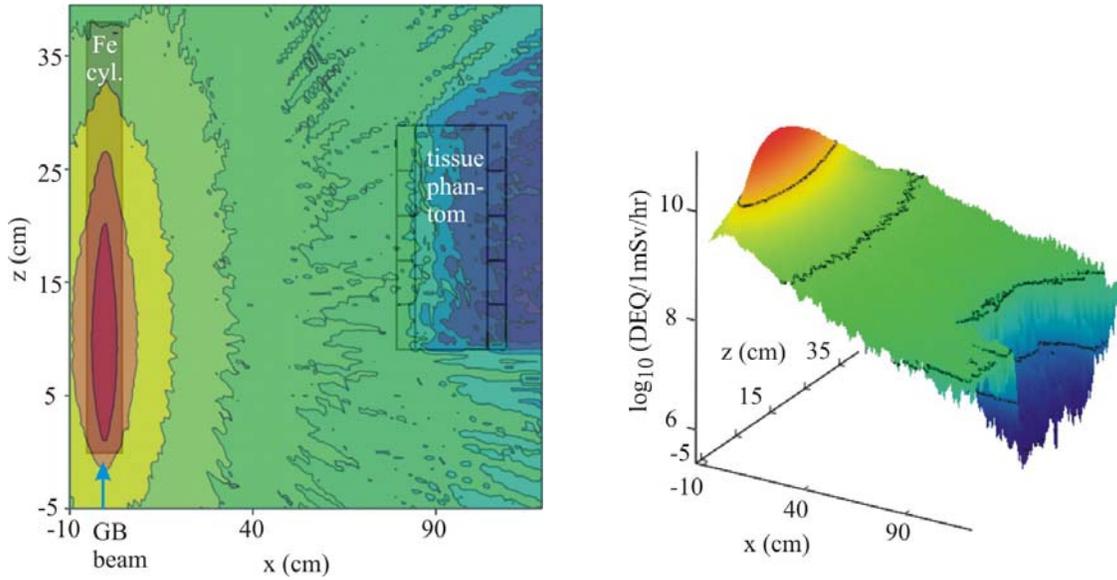


Figure 2: MARS simulation of unnormalized PN dose from an APS GB beam striking a cylindrical metal target for comparison with measurements given in Ref. 1 and 2. Each contour represents a factor of  $10^{0.45}$  or 2.82.

Table One: Comparison of PN Dose measurements in References 1 and 2 with MARS simulations.

Case\Material	Fe	Cu	Pb	W
I (mA)	93.1	90.1	76.1	88.5
p (nT)	9.69	9.41	8.22	9.29
AB Remmeter ( $\mu$ Sv/hr)	0.150	0.130	0.177	0.186
MARS ( $\mu$ Sv/hr)	10.42	9.87	8.62	7.88

## References

1. M. Pisharody, E. Semones, and P.K. Job, NIM-A, **430**, (1999), pp. 542-558.
2. M. Pisharody, E. Semones, and P. K. Job, "Dose Measurements of Bremsstrahlung-Produced Neutrons at the Advance Photon Source," ANL/APS/LS-269 (1998).
3. M. Pisharody, P. K. Job, S. Magill, J. Proudfoot, and R. Stanek, "Measurement of Gas Bremsstrahlung from the Insertion Device Beamlines of the Advanced Photon Source," ANL/APS/LS-260 (1997).