Miners-Iron Test of Optical Fibers*

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An experiment is planned in which a number of optical fibers will be exposed to nuclear radiation in the Miners-Iron event at the Nevada Test Site. The experiment matrix includes two polymer clad silica fibers which are notably radiation resistant in simulation testing,[1] Valtec PC10 and ITT T1011 (T323). Also, a borosilicate clad fiber will be fielded. Both have undoped silica cores. A set of these fibers will experience a dose of several Mrads, while a second set will see about 0.1 Mrad. Both attenuation and luminescence experiments are planned.

Cabling will also be fiber optic. The cables, either Valtec or ITT, will contain eight of either the PC10 or T1011 fibers. A set of cable attenuation measurements are included in the experiment matrix. In this set the cable will run to and from the experiment chamber without entering.

Following are three figures. Figure 1 shows the experimental matrix with fiber lengths to be exposed and the expected peak attenuations. Figure 2 shows some peak attenuation data taken from the literature[1,2,3] for the most radiation resistant fibers available to date. Clearly polymer clad silica fibers are best by this criteria. Of all the glass fibers, the borosilicate clad pure silica core fibers are the most radiation resistant. Selection of fibers for this experiment, and determination of exposure lengths and attenuations has been done using these and similar data.

Figure 3 shows the experimental chamber. It consists of a three-inch-diameter aluminum tube which mounts to a vacuum flange and extends through the main Miners-Iron experimental tank wall into the prime fluence region. The experiment fibers will be contained in this tube, those seeing the high dose being on the front side of a central partition; the low dose fibers being on the back side. The partition thus provides both support and filtering. The fibers extend out of the tank to a connector box where they interface to the cable.

LEDs and photodiodes are to be used as sources and detectors. The LEDs will be full modulated at 5 MHz and 10% modulated at 100 KHz in order to provide signals of known character at the receivers, and thus to assist in distinguishing signal from noise. Tape recording with 400 KHz band width will be used to record "long term" data, 10 sec to 300 msec. Oscilloscopes will be used to obtain sub-microsecond data.

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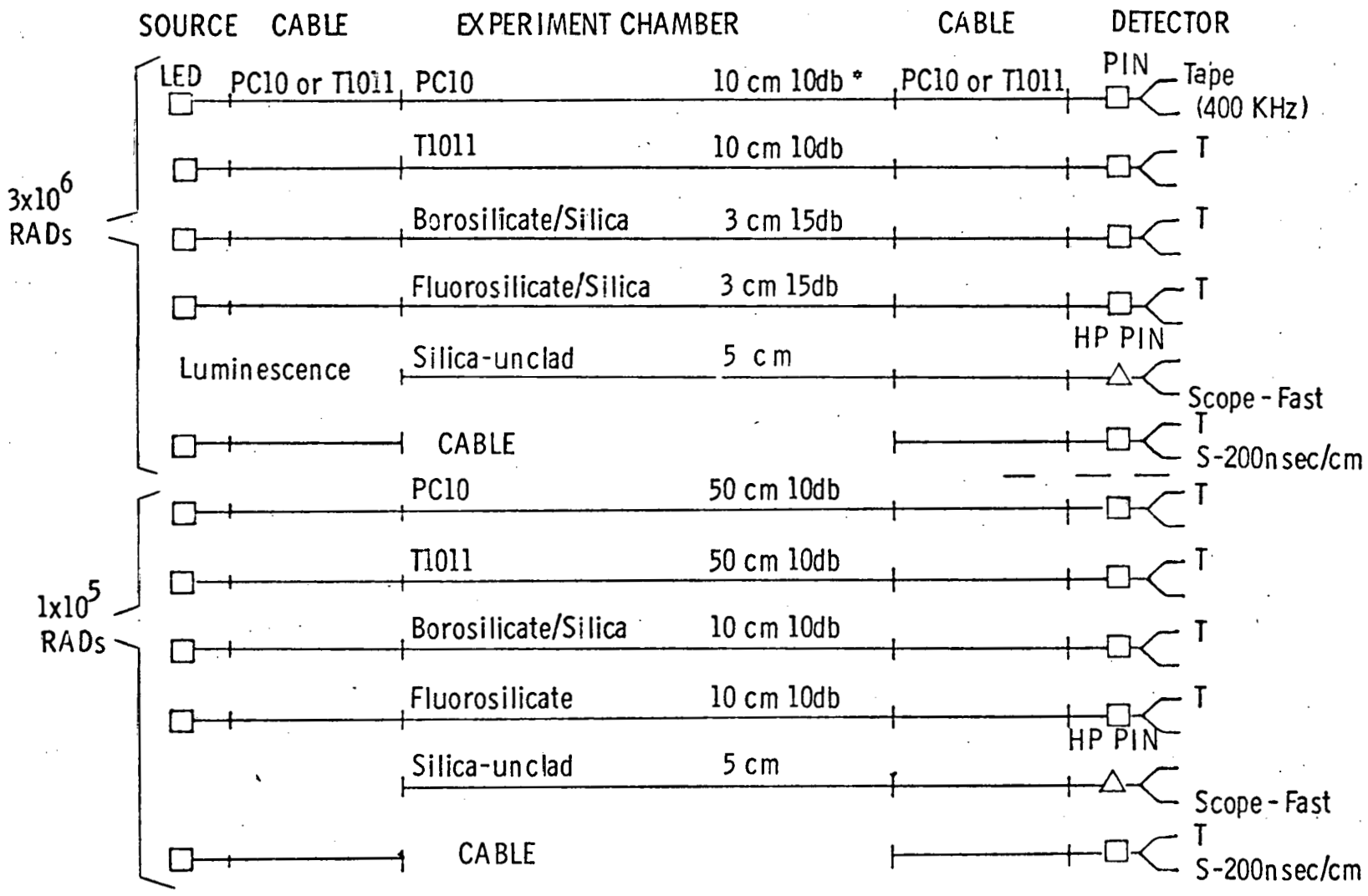
DISCLAIMER

References

1. E. J. Friebele, Opt. Eng. 18, 552 (1970), Valtec-PC 10 and ITT-T323 data.

2. C. D. Skoog, Sandia Report, SAND76-8056 (1976), Valtec and Schott PCS data.

3. J. E. Golob, P. B. Lyons and L. D. Looney, IEEE Trans. on Nucl. Sci., NS-24(6), 2164 (1977). Borosilicate clad and germanium doped Corning data.



*Attenuations are predicted radiation induced, peak values.

Figure 1. Miners-Iron fiber optics experiment.

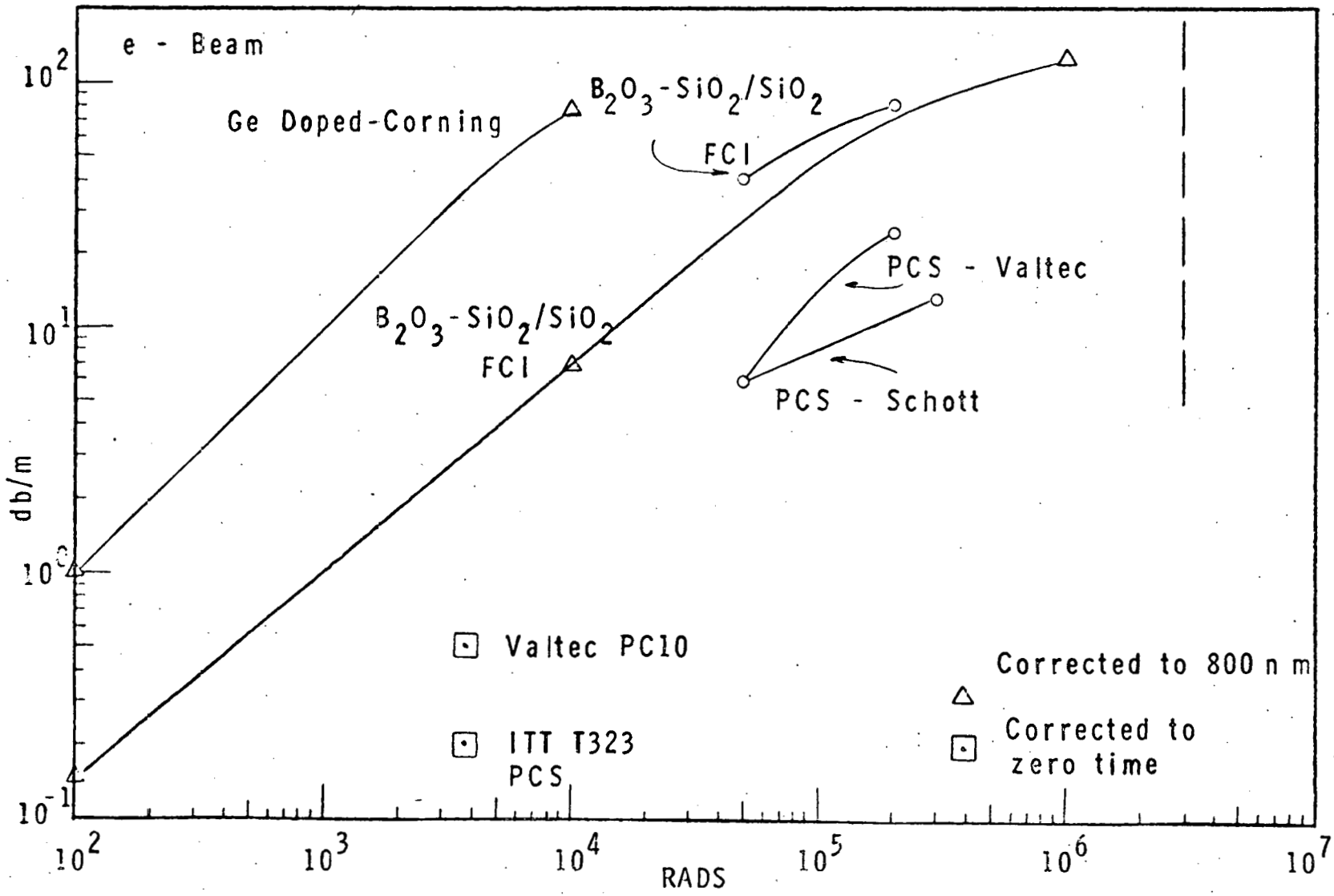


Figure 2. Peak attenuation @ 800 nm.

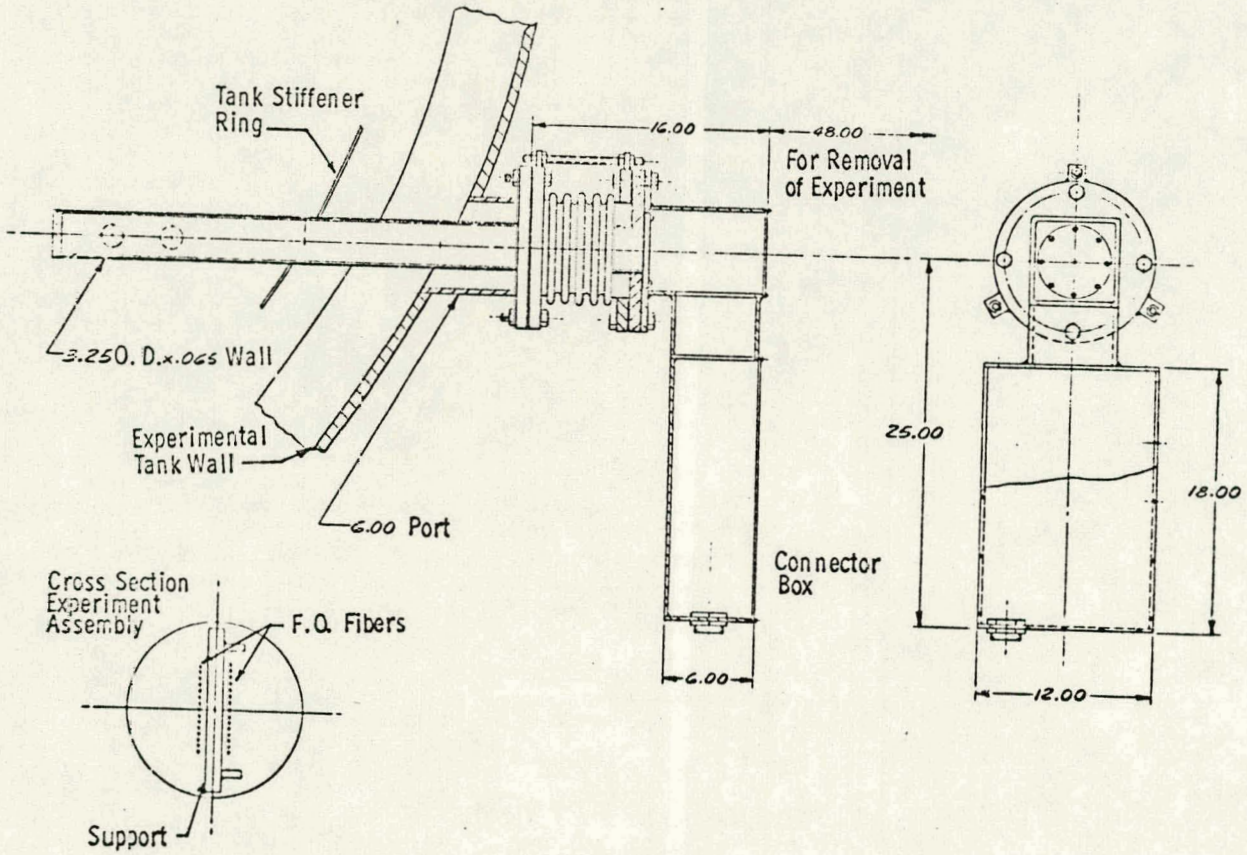


Figure 3. Fiber optic experiment fixture.