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University of California Ernest O. Lawrence Radiation Laboratory

ACCELERATOR NEUTRON SPECTRA
AND SPECTRA TO DOSE CONVERSION

W. S. Gilbert, H. W. Patterson and A. R. Smith

February 7, 1968

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UCRL-18076 Summary
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UCRL-18076
Summary

UNIVERSITY OF CALIFORNIA
Lawrence Radiation Laboratory
Berkeley, California

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SUMMARY

In late 1966 an extensive series of radiation shielding measurements were made at the CERN Proton Synchrotron by experimenters from Lawrence Radiation Laboratory-Berkeley, Rutherford High Energy Laboratory, and CERN. Preliminary results from this experimental program have been presented elsewhere and a comprehensive report is in preparation.^{1,2,3}

Through the use of detectors with different neutron energy thresholds and spectral responses, we were able to deduce the neutron flux spectrum above the shielding at the CPS. A knowledge of the neutron spectrum allows one to calculate the dose for any particular weighting function he chooses, viz., the ICRP values that we used. A computer program, TELLY, was used to compute the flux and dose from the activation detector data. A major innovation was the use of a light pen and CRT for both trial input spectra and intermediate output spectra. In effect a continuous feedback loop existed with the health physicist as the human interface.

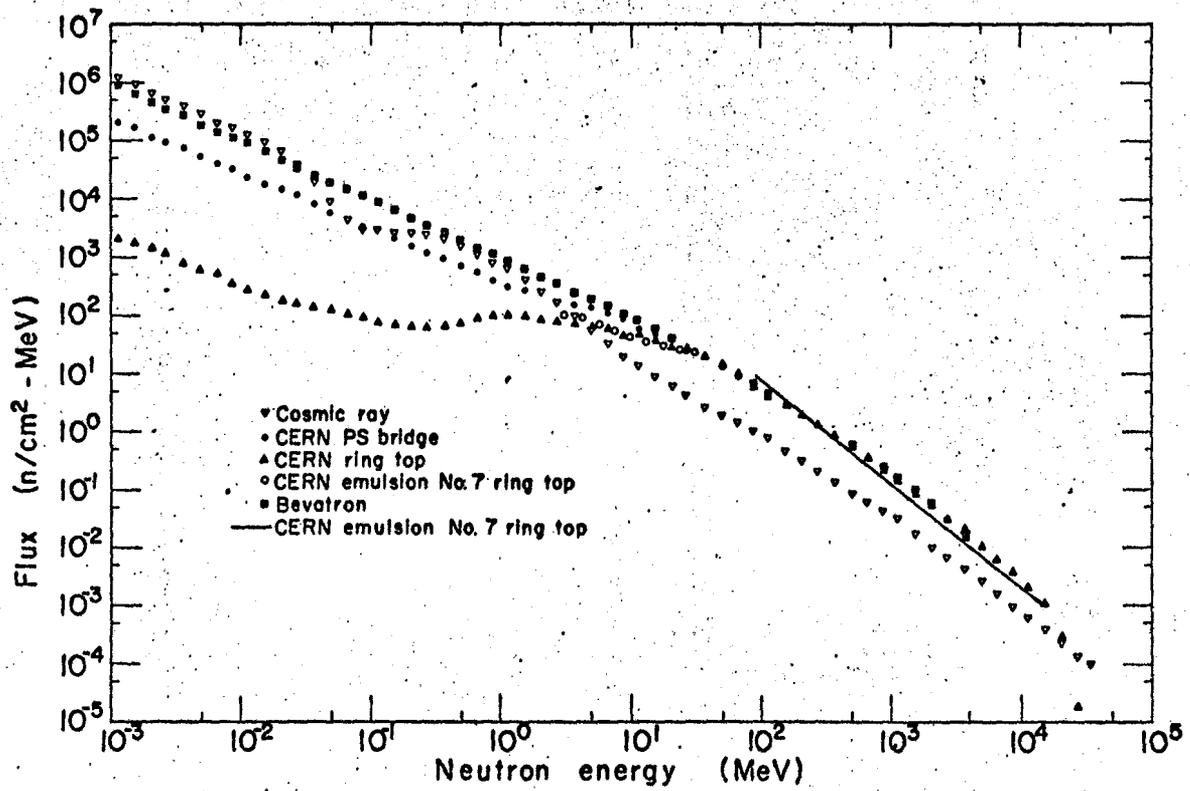
*This work was done under auspices of the U. S. Atomic Energy Commission.

The results of these procedures are shown for various locations. The shielding at the P.S. bridge is concrete, and under the ring top is earth with a high water content. The spectral difference is primarily due to this difference in hydrogen.

1. W. S. Gilbert, Radiation Problems with High-Energy Proton Accelerators, UCRL-17141, February 21, 1967.
2. R. D. Fortune, W. S. Gilbert and R. H. Thomas, Shielding Experiment at the CERN-PS, CERN/LRL/RHEL Collaboration 1966, UCID-10199, April 28, 1967.
3. W. S. Gilbert, Beam Loss and Shielding Experiments Relevant to High Energy Proton Synchrotrons, UCRL-17797, September 7, 1967, paper presented at the Sixth International Conference on High Energy Accelerators, Cambridge, Mass., September 1967.

Table I. Percentage Distribution of Neutron Dose; TELLY Program Results

Neutron Energy in MeV	Percentage of Dose from Neutrons Below Listed Energy				
	Ring Top	P.S. Bridge	Bevatron	Cosmic Rays	1/E
6×10^{-5}	—	1.2	0.9	1.2	1.1
6×10^{-4}	—	7.6	7.0	7.9	6.9
6×10^{-3}	0.2	14	15	16	13
6×10^{-2}	0.4	22	25	29	19
6×10^{-1}	1.4	30	39	52	24
6×10^0	11	44	58	82	30
6×10^1	45	66	77	89	38
6×10^2	80	88	93	95	49
6×10^3	97	97	100	99	74
3.4×10^3	100	100	—	100	100
rem/neutron	6.53×10^{-8}	5.17×10^{-8}	4.68×10^{-8}	4.21×10^{-8}	7.44×10^{-8}



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Fig. 1. Various neutron-FLUX spectra.

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