

RECONSIDERATION OF REQUIRED DEPTH FOR A DUMAND ARRAY.

A. Roberts, Hawaii DUMAND Center

Since the earliest days of DUMAND, when we were thinking in terms of arrays of a square kilometer or more, the site requirements have included the need to find clear water a depth of at least 4 to 5 km., in order to reduce the background rate of cosmic-ray muons to a tolerable level; such a level was thought to be 20-40 counts/sec. It was this requirement that essentially dictated the choice of the Hawaiian islands as the best available DUMAND site. Recently much thought has gone into the design of considerably smaller arrays, and accordingly, it is desirable to reexamine the siting problem, to see how much this broadens the available choice of sites. A shallower depth might be advantageous in several ways: it might be closer to shore, it might be in a more advantageous location, it might make the array cheaper to install, and it would certainly improve the accuracy with which sea-level muon energy is derived from DUMAND measurements. In the extreme case of very small arrays, it might even make possible an installation in a fresh-water lake, thus removing the pernicious K^{40} background.

Fig. 1 shows the background rate as a function of depth¹ for arrays of three different sizes. It is assumed that the effective solid angle for cosmic-ray muons is 2 steradians. We note that the drop from 1. km² to 1/16 km² (DUMAND G to Phase I) is equivalent to reducing the depth 2 km. Our view of what background rate is tolerable is also undergoing revision; we may be able to tolerate higher rates than the 20-40 counts/sec originally considered a limit. A factor of 10 in allowable rate is worth a kilometer of depth.

On the other hand, the initial commitment to a site involves a considerable investment in cable laying, cable, and shore facilities. These remain available if the original array is replaced by a larger one. Investment in a shallower site may not be recoverable if a later array requires a greater depth.

References

1. R.K. Adair and H. Kasha, Muon Physics, V.W. Hughes and C.S. Wu, eds., Vol. 1, p.324. Academic Press, New York, 1977.

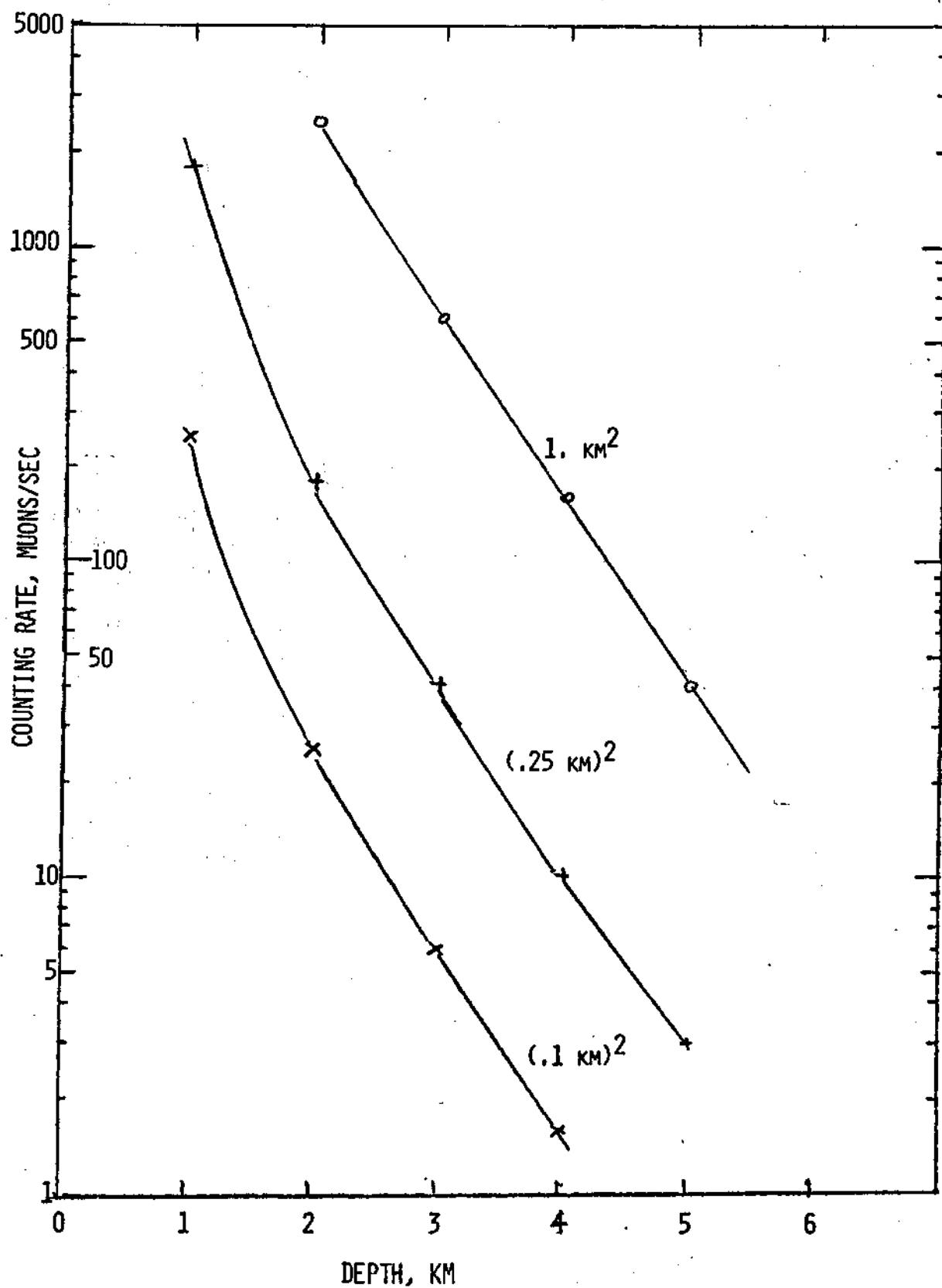


Fig. 1. Expected cosmic-ray muon counting rate in several arrays as a function of depth in the ocean. The middle curve is DUMAND Phase I, the lower a 100m x 100m array. (as proposed by Cline.)