Investigation of Removal of $^3$He from Liquid $^4$He Solution for the Neutron Electric Dipole Moment Measurement$^1$ DAVID G. HAASE, ROBERT GOLUB, PAUL R. HUFFMAN, North Carolina State University and Triangle Universities Nuclear Laboratory — The measurement cycle for the proposed experiment to measure the neutron electric dipole moment at the SNS includes the injection and removal of polarized $^3$He, which is used as a comagnetometer in the same 15 liters of superfluid $^4$He which trap the ultracold neutrons. A critical part of the process is the removal of $^3$He atoms at the end of data collection, reducing the $^3$He concentration from $10^{-10}$ to $10^{-12}$ in a period of 100-200 seconds. It is proposed to accomplish the task via diffusion of the $^3$He from the target cell to an evaporator which preferentially removes $^3$He vapor. The efficiency of the process is strongly sensitive to the temperature dependent diffusion rate and vapor pressure of $^3$He as well as the superfluid film flow in $^4$He. We describe the design of this process and initial results from a prototype evaporator implemented at NC State University.

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