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Measuring and Optimizing flows in the Madison Dynamo Experiment N.Z. TAYLOR, M. CLARK, C.B. FOREST, E.J. KAPLAN, M.D. NORNBERG, A.M. RASMUS, K. RAHBARNIA, University of Wisconsin-Madison — In the Madison Dynamo Experiment, two counter-rotating impellers drive a turbulent flow of liquid sodium in a one meter-diameter sphere. One of the goals of the experiment is to observe a magnetic field grow at the expense of kinetic energy in the flow. The enormous Reynolds number of the experiment and its two vortex geometry leads to a large turbulent EMF. This poster presents results from the MDE after several upgrades were made. First, an equatorial baffle was installed to stabilize the position of the shear layer between the two counterrotating hemispheres. This reduced the scale of the largest eddies in the experiment, lowering the effective resistivity due to turbulence. Next, a probe was used to measure both the fluctuating velocity and magnetic fields, enabling a direct measurement of the turbulent EMF. This EMF is anti-parallel to the mean current, consistent with an enhanced resistivity predicted by mean field theory. Finally, vanes with adjustable orientation were installed on the vessel wall, allowing the pitch of the helical flow to be altered. Computational fluid dynamics simulations and inversion of the measured induced magnetic field are used to determine the optimum angle of these vanes to minimize the critical velocity at which the dynamo onset occurs.

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