Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Effects of external magnetic fields on the operation of rf accelerating structures[1] DIKTYS STRATAKIS, JUAN GALLARDO, ROBERT PALMER, Brookhaven National Laboratory — Recent experiments on rf cavity breakdown have shown severe surface damage and a reduction of the maximum accelerating gradient when an external magnetic field is applied. This finding implies serious problems for cooling lattices in which rf cavities and external magnetic fields coexist, such as those of the proposed neutrino factory and muon collider. While existing data suggest that such operational problems were associated with the unwanted emission of electrons from locally enhanced field regions, the mechanism that drives the breakdown is poorly understood. We show that field-emitted electrons from one wall of a cavity are accelerated by the rf fields, and in the presence of a external magnetic field are focused into small spots at another location in the cavity where they heat the surface. We construct a simple model to analyze the dependence of wall temperature on emission current and external magnetic fields. We show that if the magnetic field strength is on the order of 1 T, the surface can suffer significant thermally-induced deformation that eventually limits the cavity's accelerating gradient. We compare the results from our model to existing experimental data from an 805-MHz cavity. Possible solutions and suggestions for future experiments to study those problems are offered.

[1]This work supported by the U.S. Department of Energy, contract no. DE-AC02-98CH10886.

Diktys Stratakis
Brookhaven National Laboratory

Date submitted: 18 Jul 2009 Electronic form version 1.4