High Electric Fields in rf Cavities

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The Model

A model of breakdown triggers
Fields tear rf fragment or clutter
PE breaks land line fragment
Loopy plasma produced near wall
EM energy heats wall

Frequency dependence

$10^{-11}$ - $10^5$ Torr

Materials

Temperature

Secondary Emitters

Strong Magnetic fields

Cavity Conditioning

Rapid evolution of spark

Atom Probe data

Superconducting rf

Light and power switching

Future R&D

Field Evaporation at ~30 GY/m

Stable operation

Voltage

Patches of ~5 GY/m

Coating facility

X-rays from cavities imply E fields that can damage surfaces.

Little is known about these processes.
No systematic data on high fields and surfaces.
No detailed model of breakdown.

We have a program to try to understand them.
RF experiments in warm cavities.
Modeling of high field effects.
Atom Probe Tomography.

Atom Probe Tomography is an excellent technique.
Straightforward, systematic studies are possible.
Completely covers required experimental range.
However...
There is much less experience with surface studies.