A NEW LOCAL FIELD QUANTITY DESCRIBING THE HIGH GRADIENT LIMIT OF ACCELERATING STRUCTURES

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A. Grudiev, W. Wuensch
CERN, Geneva, Switzerland

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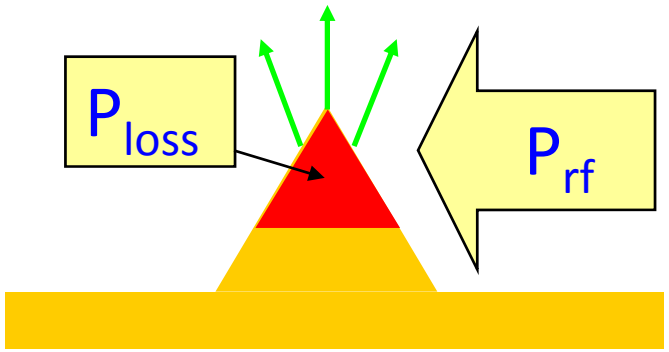
Breakdown initiation scenario

Qualitative picture

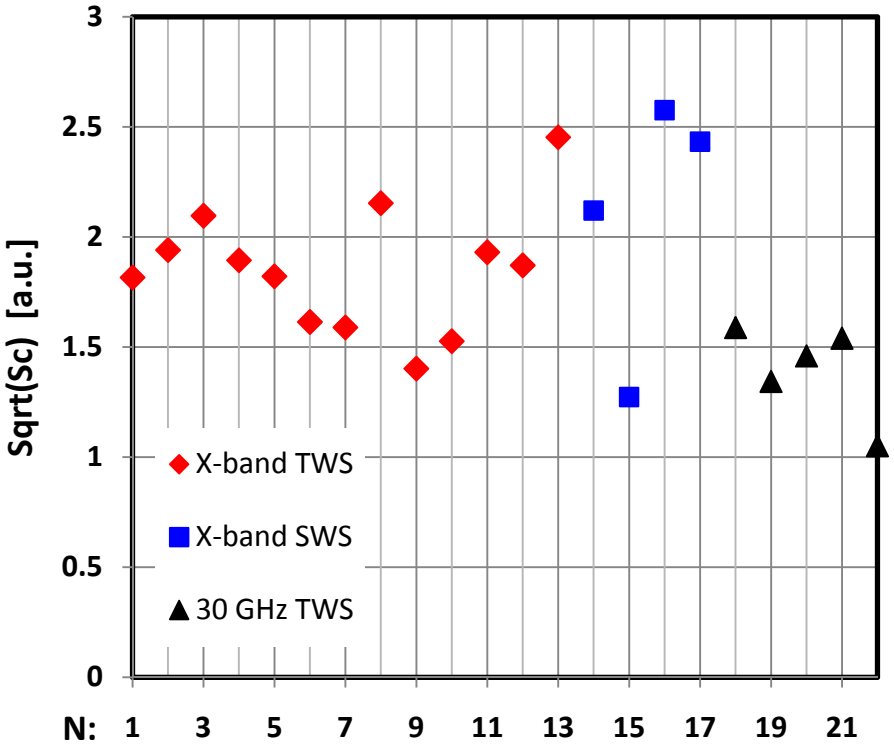
- Field emission currents J_{FN} heat a (potential) breakdown site up to a temperature rise ΔT on each pulse.
- After a number of pulses the site got modified so that J_{FN} increases so that ΔT increases above a certain threshold.
- Breakdown takes place.



This scenario can explain:

- Dependence of the breakdown rate on the gradient (Fatigue)
- Pulse length dependence of the gradient (1D÷3D heat flow from a point-like source)

New rf breakdown constraint S_c



$$S_c = \mathrm{Re}\{\mathbf{S}\} + \mathrm{Im}\{\mathbf{S}\}/6$$

S_c = 4 ÷ 5 [MW/mm^2]

at 200ns, BDR=1e-6

$S_c^{15} t_p^{5}$/BDR = const