Fermilab

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Minimization of surface fields.

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2nd Harmonic cavity meeting

July 28, 2016

Kilpatrick limit

$f\,(\mathrm{MHz}) = 1.64 \cdot E_k^2 \cdot e^{-8.5/E_k}$, E_k - Kilpatrick limit in MV/m

$f\,(\mathrm{MHz}) = (62/E) \cdot e^{17/E}$, criterion from PAC83, W. Peter et al

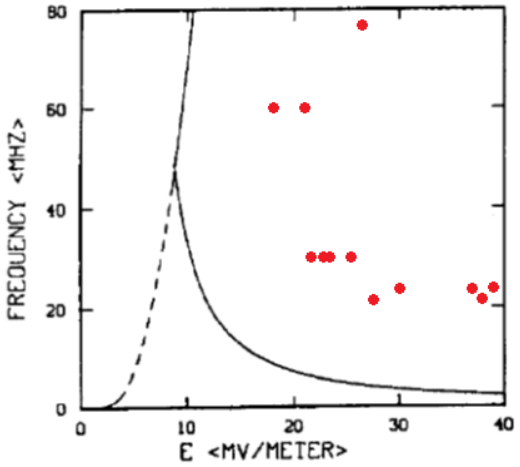
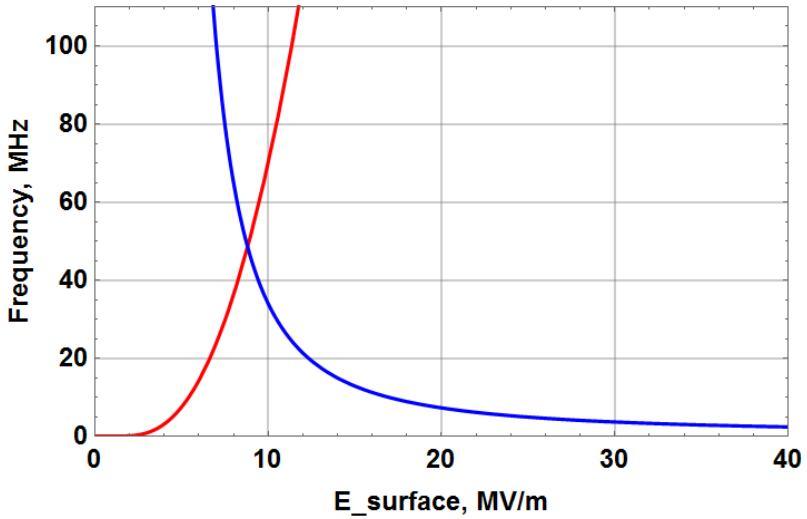


Fig. 1. Breakdown thresholds predicted by Kilpatrick (dashed curve) and by this study (solid curve) with experimental data points.

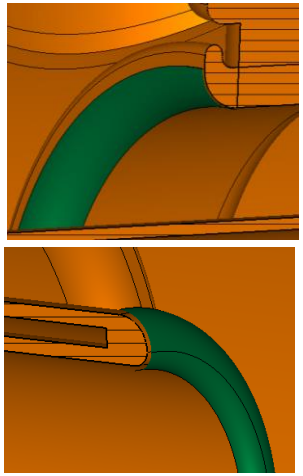


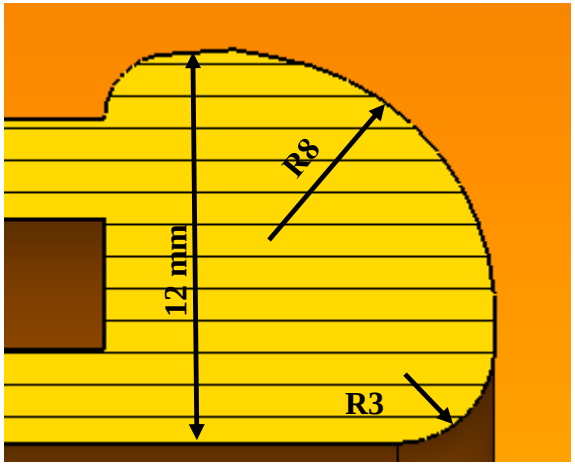
For our 70-110 MHz the limit is 10-12 MV/m

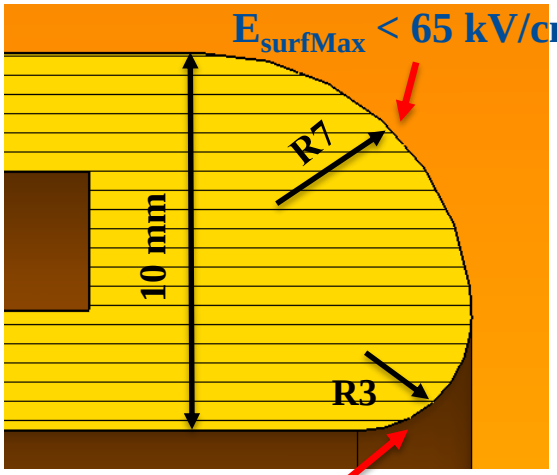
Or 100-120 kV/cm

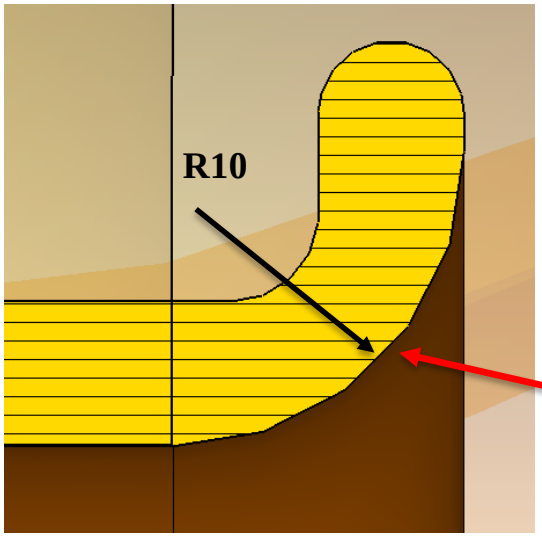
With modern surface treatment technique both formulas overestimate a danger of electrical breakdown. Typically field up to two Kilpatrick limits is considered safe.

Drift tube tip. Corona ring of the coupler.



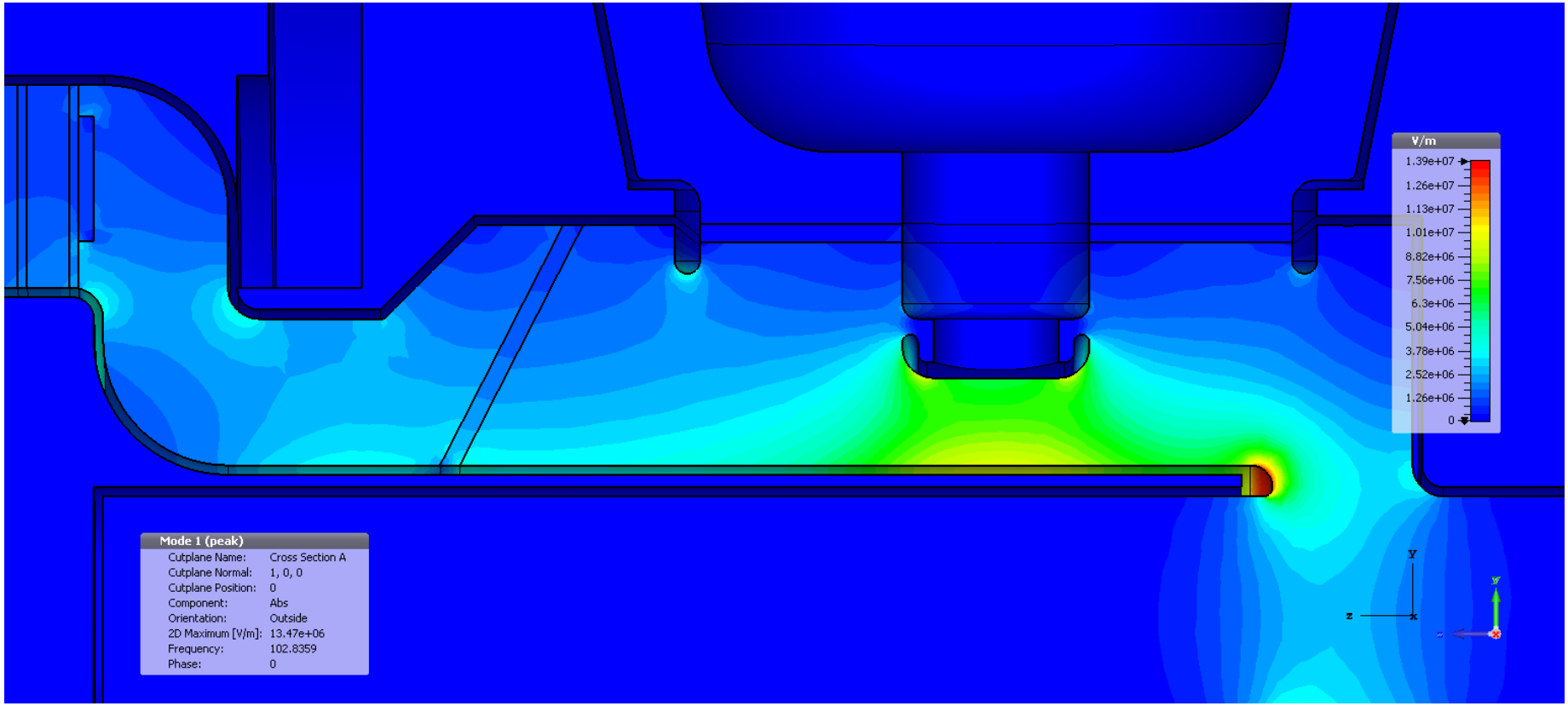






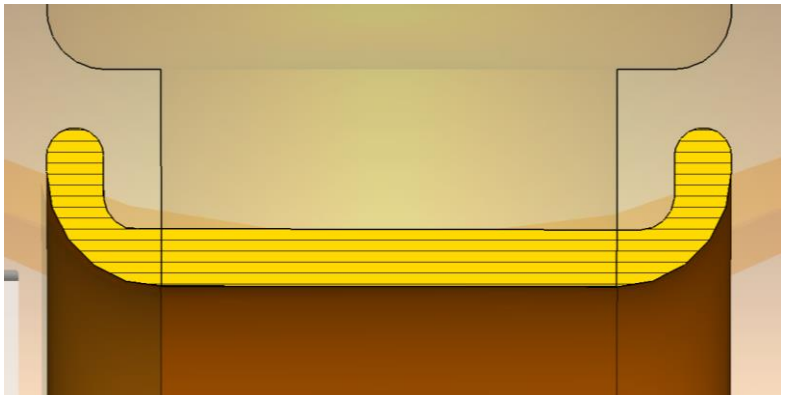
E_surface is well below Kilpatrick level (100-120 kV/cm) for both the corona ring and the drift tube tip.

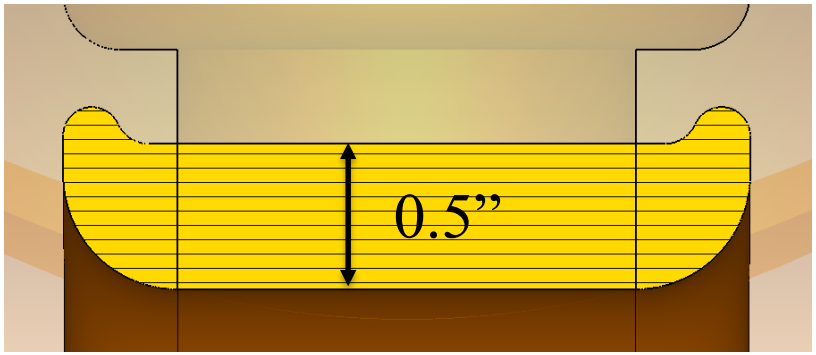
Current electric field distribution.

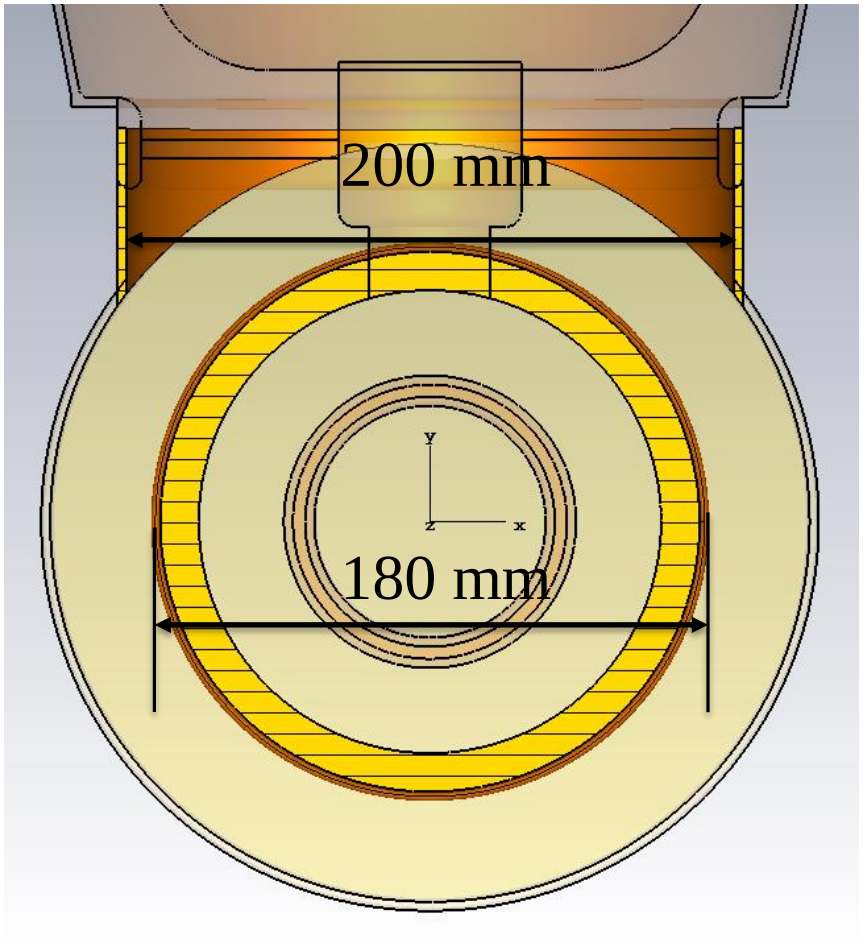


Ding: "By the way, I saw the E field at conical window is almost as high as the tip of the beam pipe (gap)." - ???

Thicker corona ring







Parameters are practically unchanged. But…

Next

- Set solid model exchange between CST and NX (*.prt -> *.stp -> *.sat and back)
- The windows with real mechanical features.
- Losses and thermo-analyses.