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Shielded Cold Cathode Magnetron (SCCM)

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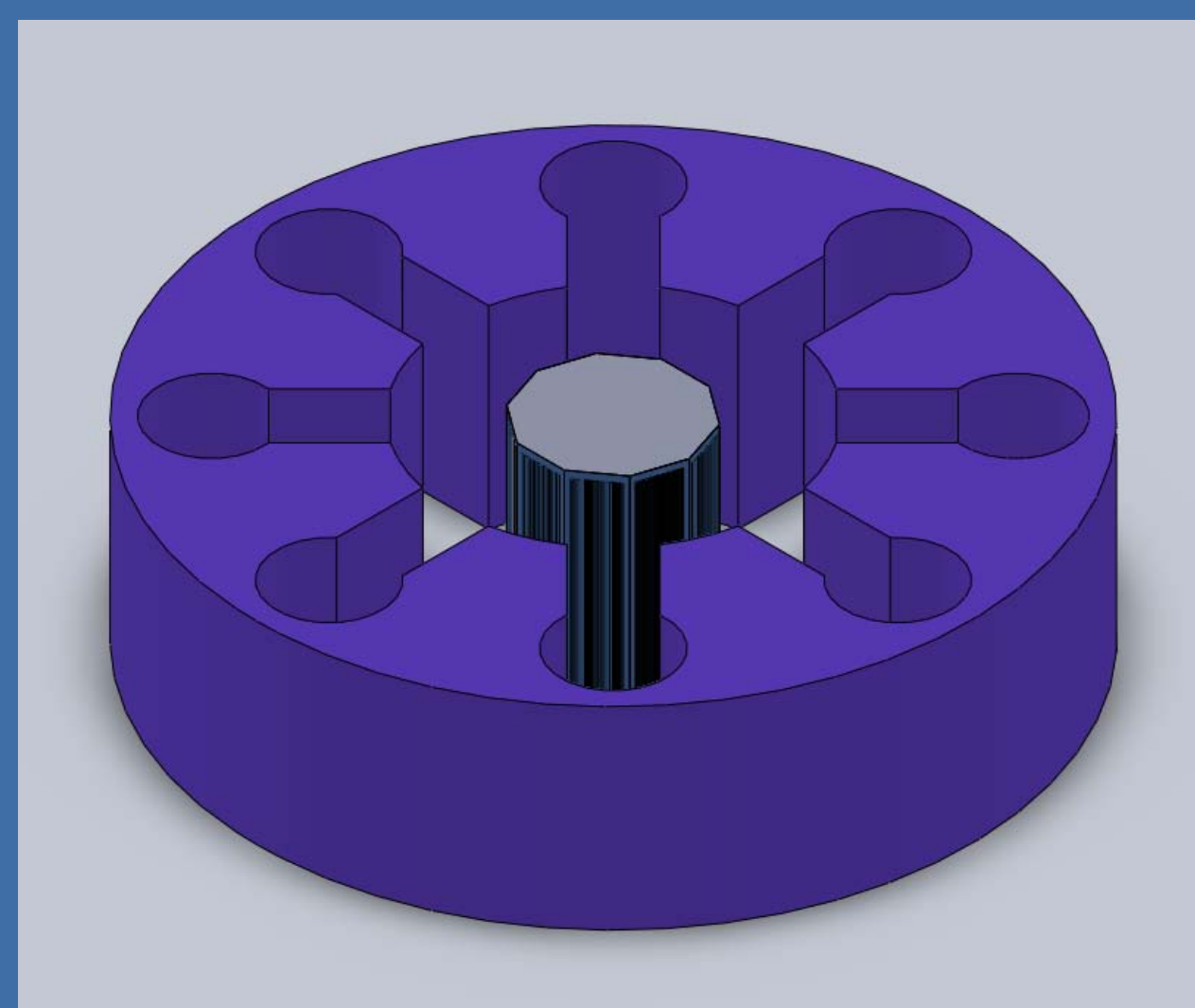
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Objective:

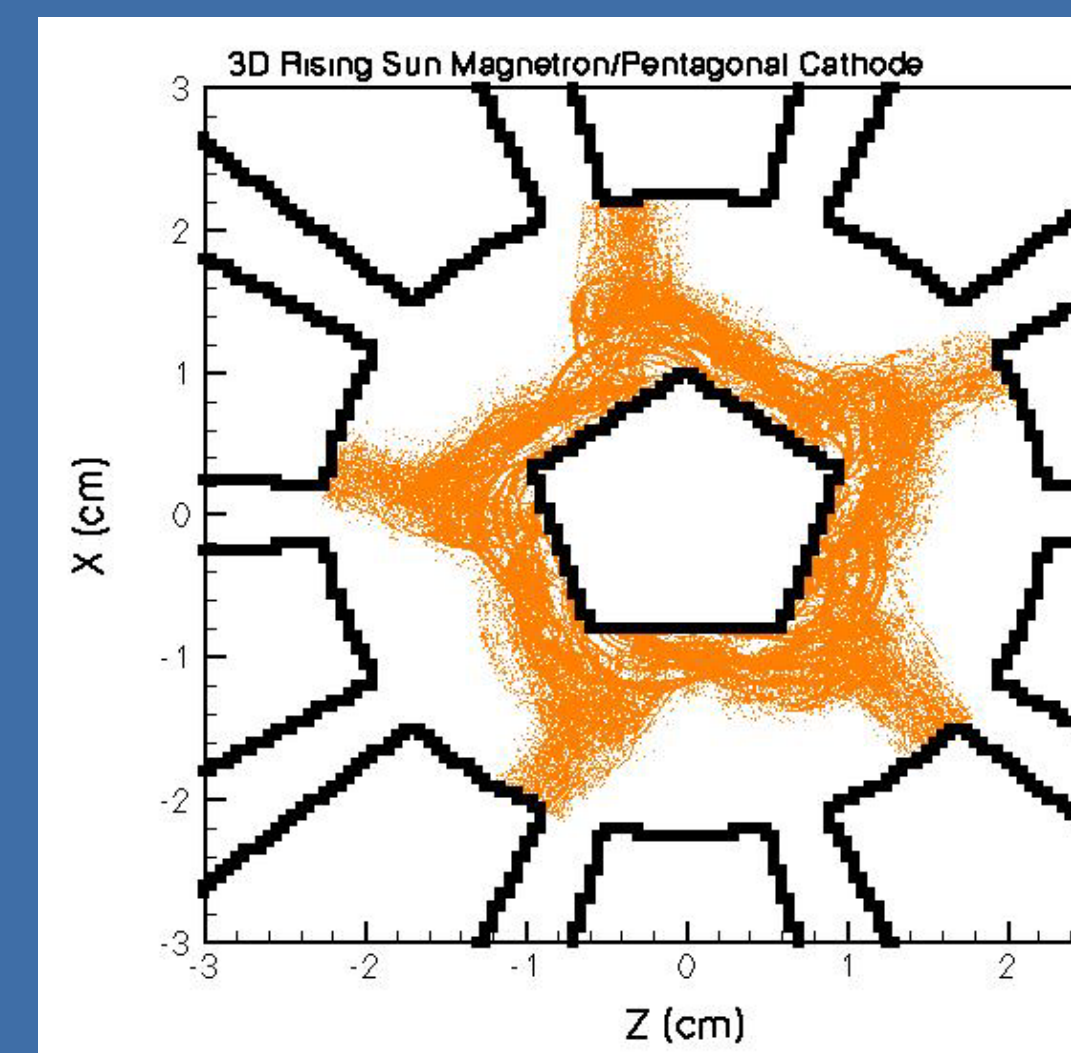
Test an experimental shield structure to allow use of field emitters in radar system magnetrons.

SCCM Design:

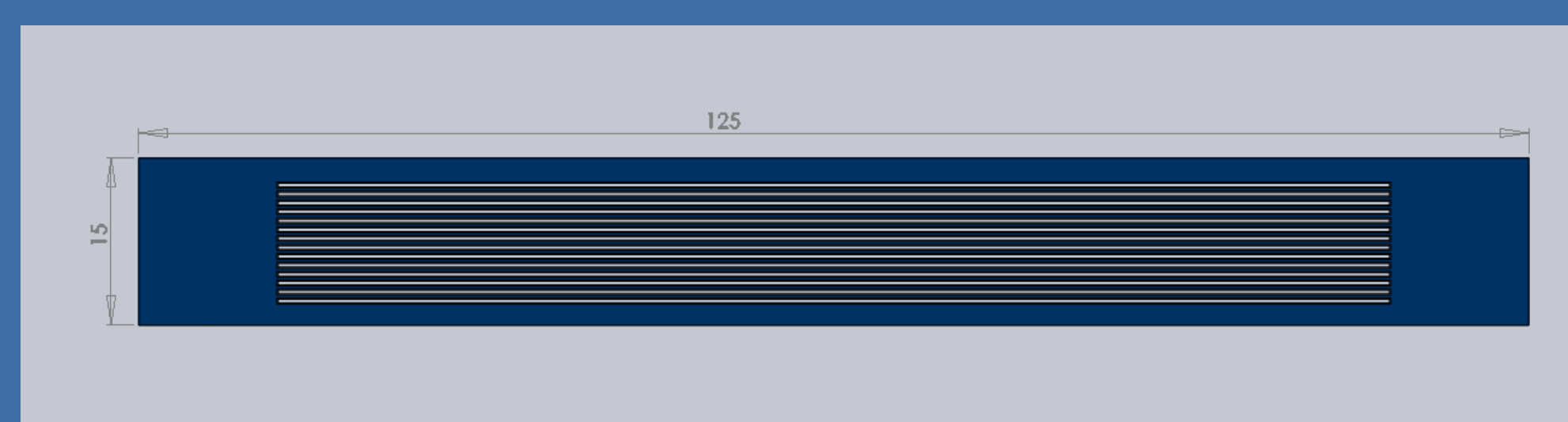
- Current Magnetron designs implement cylindrical slow wave anodes and thermionic cathodes to generate microwaves.
- A shielded cold cathode magnetron uses shielded emitters to inject electrons into the interaction space.
- A SCCM magnetron uses faceted plates with slits
- An example implementation shown below has ten facets each containing as many slits as possible



Faceted cathode design



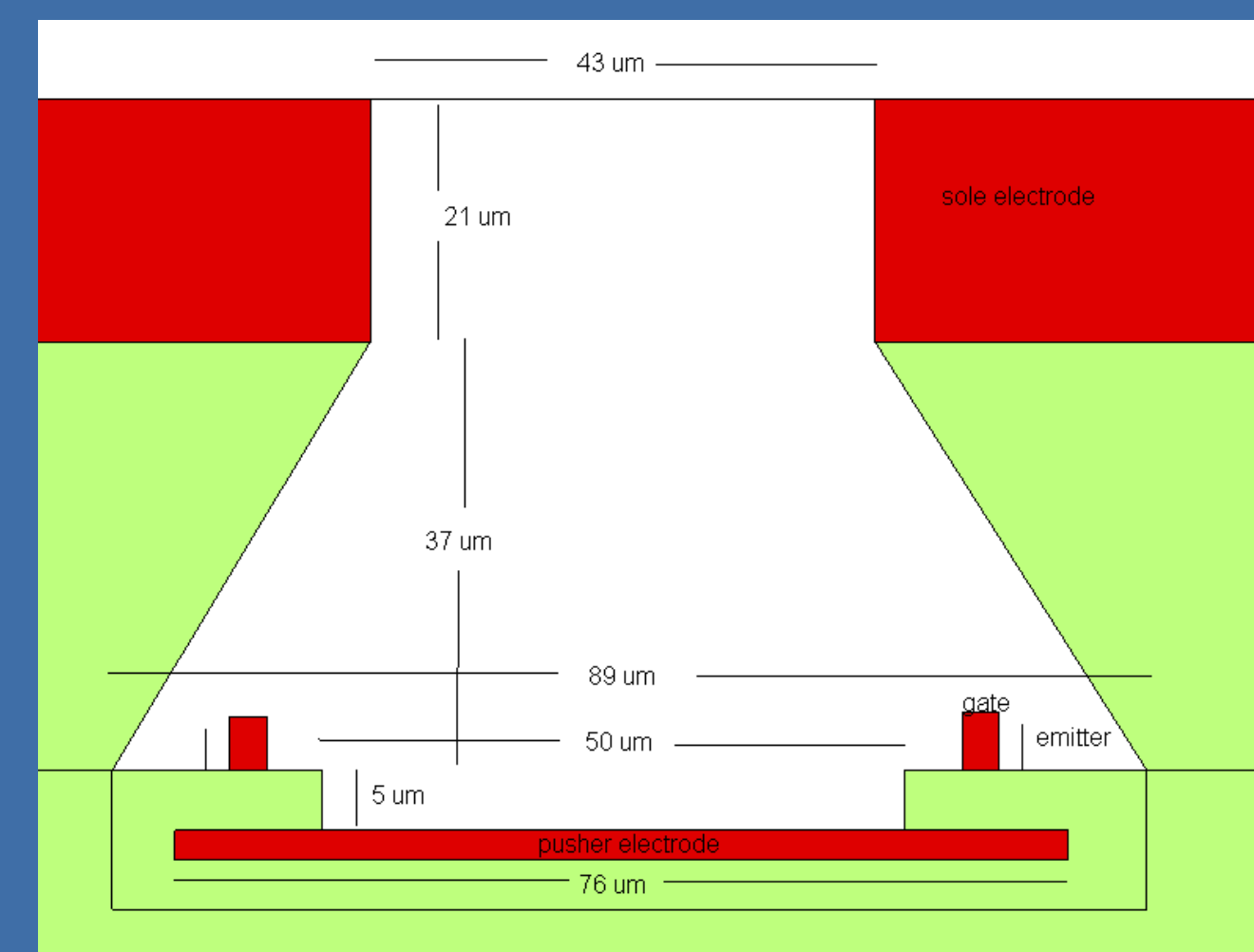
ICEPIC simulation using 5 facets (J. Watrous, NumerEx)



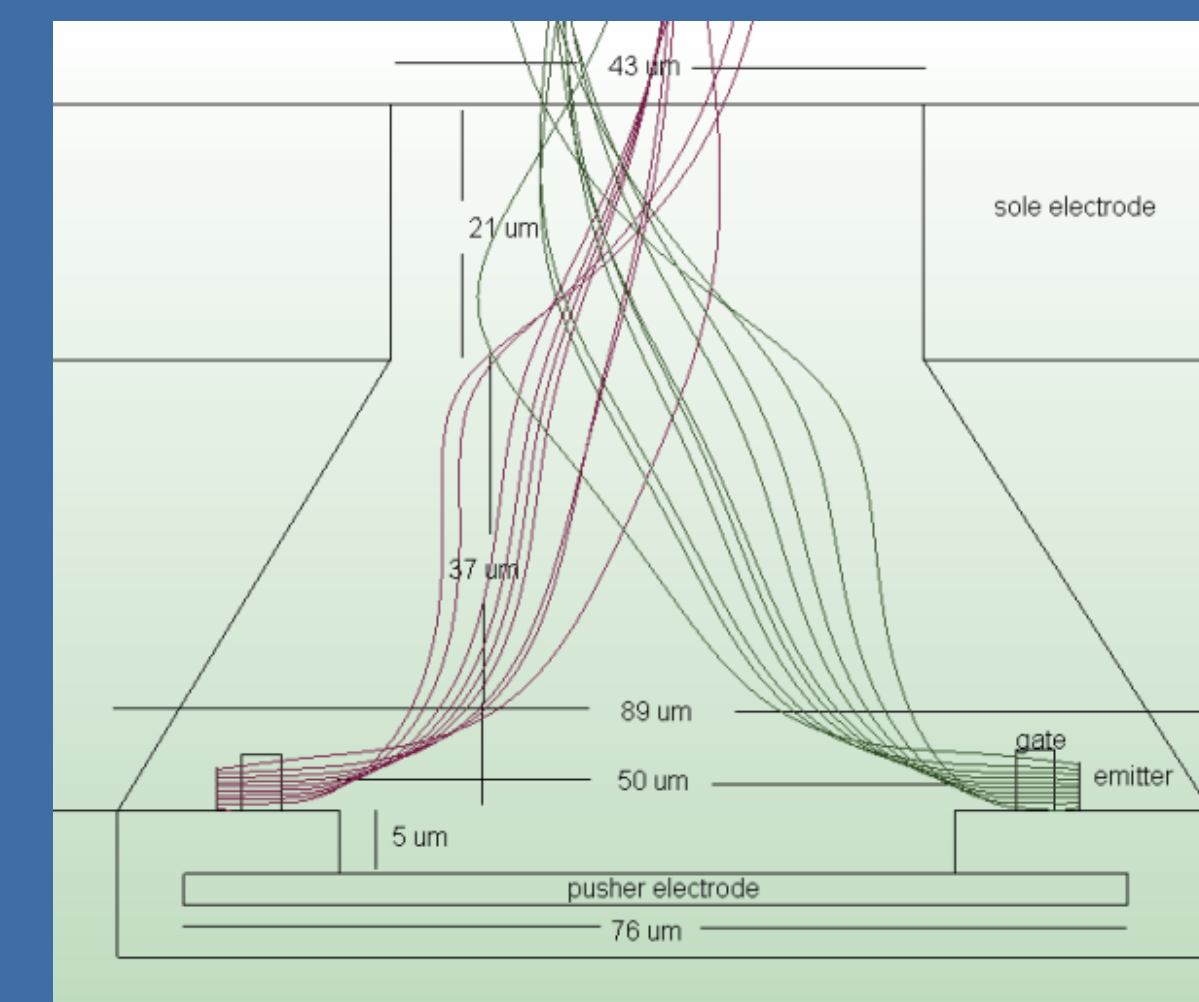
Single facet slit structure design

Shielded Structure:

- Field emitters must be protected from electron and ion bombardment
- A sloped slit structure is used
- The slope of the slit wall must be steep enough to avoid electron hopping, but shallow enough to ensure emitter protection
- Each emitter tip is paired with a gate and the electron motion is controlled by a pusher electrode
- These emitter gate pairs can be individually addressed, thereby allowing control of electron injection



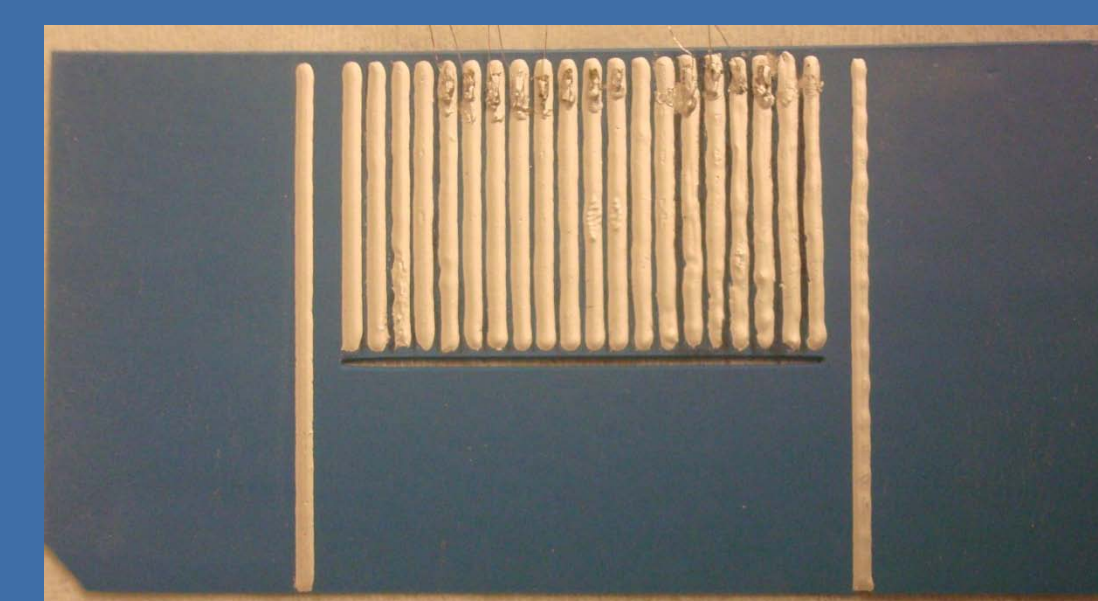
Shielded structure design



Lorentz simulation showing electron emission from slit.

Test Structure:

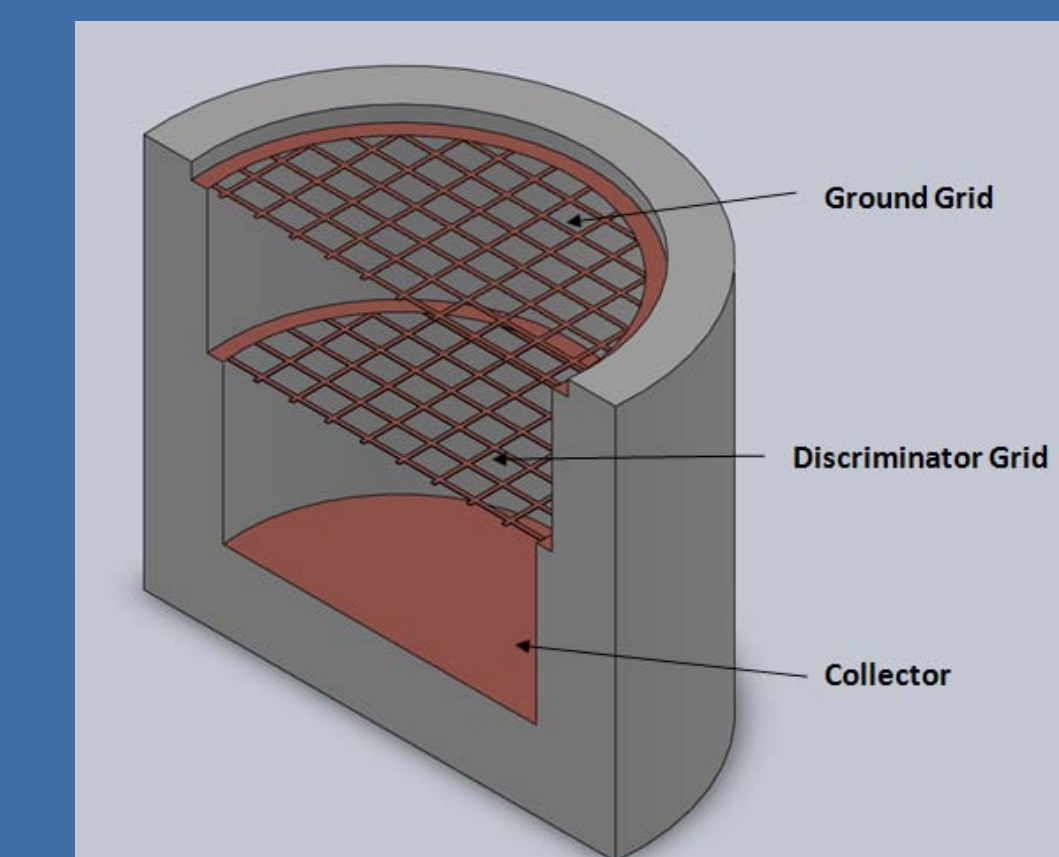
- Fabricated at Boise State University using a Low Temperature Co-Fired Ceramic and thick film metal electrodes
- This test structure has one slit and was used to measure electron emission



Test Structure fabricated from LTCC

Data:

- An energy analyzer was used to measure the energy of the electrons exiting the slit
- Energy measurements determine whether electrons strike the slit walls
- For magnetron performance, electrons should exit at energy of emitter



Energy analyzer design



Energy analyzer fabricated using Teflon tubing

Measurements from Energy Analyzer:

