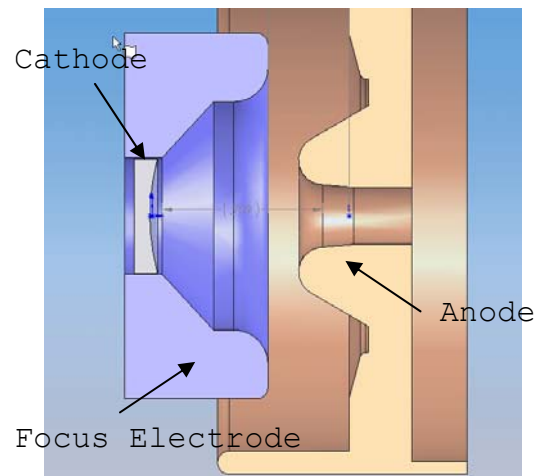


Improved Electron Gun Design

Electron beams are employed in vacuum devices to generate very high power microwaves for many critical applications, including amplifiers in communications, television, radar guns and computer monitors, and high energy accelerators. The quality of these electron beams directly impacts the output power and efficiency that can be achieved. In a SAMSI workshop, a group of graduate students was given the challenge of developing a new technique to design electron guns that produce these beams. The students were provided the required specifications for a device to drive the TEVATRON accelerator at Fermi National Laboratory.



Applying their knowledge of basic physics principles and advanced mathematical techniques, and unrestrained by existing paradigms, the students embarked on a different path toward achieving the specifications. In the process, they developed a new way of generating high power electron beams with improved performance.

In particular, their design called for an electron gun with a cathode shape that is concave (instead of convex) where the radius of the cathode is larger than the radius of the beam tunnel. In this case, the students chose the value and a design that differed from that historically used by engineers. For this application, the resulting design provided significantly improved operating parameters and a unique, lower cost, mechanical configuration. The U.S. Patent Office is currently reviewing this new design for a patent award. It is likely that the students will be recognized as 'inventors' through the work performed in this SAMSI workshop.

