

# Electron Beam for Oncology and Industrial Applications



John Noonan, Argonne National Laboratory  
John Lewellen, Naval Postgraduate School



## Technology

An electron beam source has been designed that has very low beam emittance (emittance is how large the beam becomes as it is transported in free space). The electron beam is sub-millimeter in diameter and stays small over meters of transport.

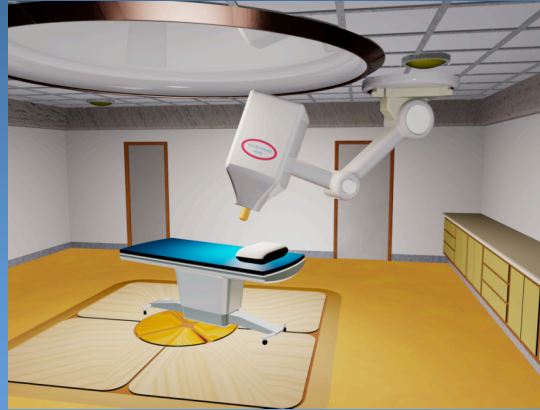
### Oncology:

An electron beam delivered directly to a tumor is absorbed by the tumor only. Healthy tissue is not exposed to the radiation. Enormous dosages can be delivered to the tumor without worrying about total dose exposures. The electron beam can be tailored to irradiate a very precise volume.

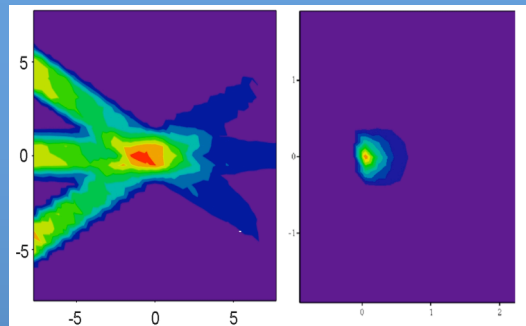
The electron beam system is compact, it would fit in an operating room—probably even under the operating table. Except for the electron source, the system uses conventional accelerator technology.

### Welding:

A new electron beam welding technology is also possible with the low emittance electron beam. The electron source and the parts can be stationary. The electron beam is transported to a small dipole magnet which can position the e-beam onto the weld joint. Internal welds and even atmospheric e-beam welding are possible with this new technology.



Rendering of laparoscopic e-beam system



This figure shows a comparison of X-ray radiation treatment and electron beam treatment. At left, a false color map displays energy deposited into tissue as a function of distance for three 250kV X-ray beams. At right, the map displays energy deposited into tissue for a 3 MeV electron beam as a function of distance, with the zero point starting at the end of the laparoscopic tube (note length scale change).

## Markets

### Potential Commercial Markets:

Radiation oncology, especially inoperable cancer, brain tumors, and cancer near sensitive organs and body parts, such as the spine.

### Technology Readiness:

This is a concept, a prototype needs to be demonstrated.

Since electron beam treatment of cancer is already demonstrated, the FDA approval should be able to be fast-tracked.

### Intellectual Property:

U.S. Patents for the low emittance electron source, the laparoscopic e-beam therapy, and e-beam welding have been awarded to UChicago-Argonne, LLC.

Licensing is available.

## Contacts

Business: Paul Betten  
Technology Development and  
Commercialization  
Argonne National Laboratory  
9700 S. Cass Ave.  
Lemont, IL 60439  
(630) 252-4962  
[betten@anl.gov](mailto:betten@anl.gov)

Technical Contact: John Noonan,  
[noonan@anl.gov](mailto:noonan@anl.gov)