High-Power X-Ray Sources

Portable High Power X-ray Scanning

Cargo scanning using either radiographic imaging or active interrogation for Special Nuclear Material (SNM) requires high energy and high intensity x-rays. The most common source of such x-rays is an electron accelerator. Existing pulsed copper accelerators have low duty cycle beams and correspondingly low average current, which limit the quality of x-ray images and SNM detection sensitivity. Furthermore, inspection systems based on copper accelerators typically weigh several tons, have a large footprint, and consume hundreds of kilowatts of electric power. As a result, these machines require a large, fixed site to operate. To overcome these limitations we are developing a compact, portable, high-efficiency 10 MeV superconducting electron linac.

Our 10 MeV superconducting, continuous wave (CW) linac with electron beam power of 10 kW will operate at 4 Kelvin and will require a cryomodule. The accelerator will be cooled with insulated liquid nitrogen and helium dewars, so no on site refrigeration system is required. The entire system (linac and cryomodule) can be powered by a compact portable generator. A liquid metal x-ray converter, capable of dissipating hundreds of kilowatts of electron beam power, will provide the high photon flux density necessary for cargo scanning. A collimator to limit the x-ray cone will be placed after the converter. Finally, the whole setup will be properly shielded. The system will have a small footprint and could be placed in a small truck or van (see Figure 1).

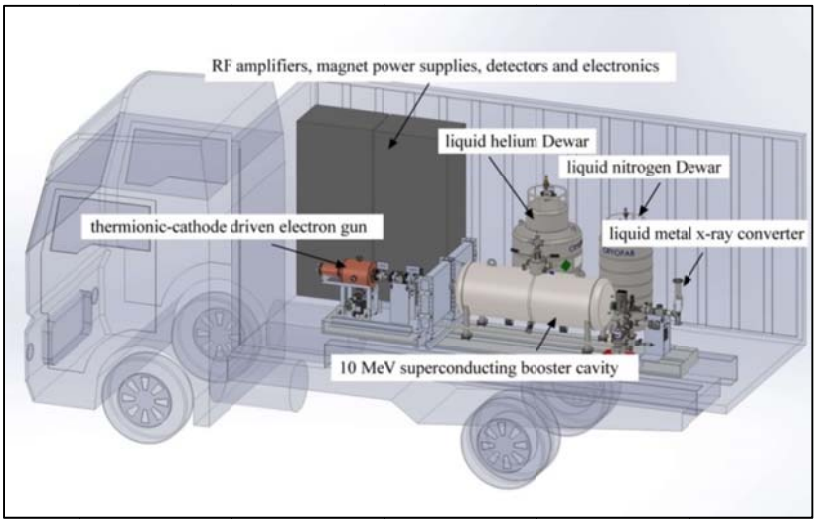

Figure 1. Compact portable scanning system based on a superconducting CW electron linac.

X-ray Sterilization to Eliminate High Activity Radioactive Sources

Highly radioactive sources such as Cobalt-60 and Cesium-137 with weaponization potential as "dirty bombs" are commonly used for medical sterilization. Accelerator based sterilization offers many advantages over radioactive sources. First, accelerators cannot be used as a dirty bomb and produce little radioactive waste (see Figure 2). Second, they can produce high energy x-rays on demand and can easily be turned on and off. Third, accelerators can produce radiation of varying intensity, photon energy and power, offering greater throughput. These advantages offer new and cost effective solutions for medical, industrial and municipal waste sterilization techniques. Our sterilization machines are customizable with energies from 2 MeV to greater than 10 MeV, offering high fluxes of up to 10^{17} photons/cm^2 per second.

Figure 2. X-ray sterilization can eliminate the need for dangerous radioactive sources