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Compact, mega-watt superconducting electron linear accelerators for environmental and industrial applications: projects and status

Thursday, 11 May 2023 16:30 (2 hours)

In this talk, we describe the project status of a new class of simple, turn-key superconducting radio frequency (SRF) accelerators that will be used in environmental studies such as wastewater treatment, treating contaminants in municipal water, and industrial applications such as material processing, medical device sterilization, security, and other niche application. Leveraging recent R&D breakthroughs in high-temperature SRF cavities, cost-effective radio-frequency sources, modern cryo-coolers, and high-average current electron guns, Fermilab has developed a novel accelerator design for a compact SRF high-average power electron beam linear accelerator. We will describe the status of the active projects at 650 MHz and 1.3 GHz along with the results of this novel concept on conduction cooling of SRF cavities which removes the need for liquid Helium, thus making SRF technology accessible to industrial applications.

Our linac can generate electron beam energies up to 10 MeV in continuous-wave operation. We show through detailed thermal, RF and particle simulation that a single accelerator module can deliver average beam power as high as 250 kW and above. We can reach up to 1 MW by combining several modules. Compact and light enough to mount on mobile platforms, our machine will enable new in-situ environmental remediation applications, portable security applications, and novel applications for in-situ cross-linking of materials.

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Footnotes

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Yes

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