

GFA and SwissFEL Accelerator Seminar

New Frontiers in Compact Superconducting Cyclotrons

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Superconducting compact cyclotrons offer new opportunities for applications of particle accelerators. Modern analytic modeling methods and developments in superconducting systems have resulted in substantial reductions in machine size and cost and thus in application space. One example is a 250 MeV proton synchrocyclotron design, recently commissioned, and currently entering commercial production as a single room proton radiotherapy system. At 11T peak field, it is the highest field circular particle accelerator ever operated, and has a mass $1/20^{\text{th}}$ of a conventional cyclotron of the same energy.

Machines under design at MIT include a 250 MeV, 1 mA proton machine (diameter 2.2m, height 1.2m, mass 30 tonnes, 400 kW) which is intended to explore the performance limits of compact, high power cyclotrons. In addition, we are starting the construction of a 10 MeV ultra-compact machine [diameter 0.25m, height .5m, mass 0.5tonnes, 3 kW] for security applications. We will describe the design process for these machines, expected performance and some examples of applications in security, medicine and fundamental science made possible by these developments.

