AbstractID: 12147 Title: Challenges for Next-Generation Accelerators

Particle accelerators, once the exclusive playthings of high-energy physicists, have become an essential technology for modern medicine, materials science, and molecular biology. The world's 7000 operating medical linacs have already enabled treatment of 30,000,000 patients, and new developments such as advanced proton therapies imply a growing demand for accelerators in the decades ahead.

To serve the broadest possible patient population worldwide, medical accelerators need to become smaller, cheaper, and easier to operate. At first glance these needs appear orthogonal to those of particle physics, where the push has always been for larger more complex accelerators capable of reaching ever-higher energies. However particle physicists have realized for some time that the 27 kilometer Large Hadron Collider, beginning operation this year, represents the last hurrah of conventional accelerator technology. The future lies with fundamentally new approaches that promise much stronger accelerating gradients. The same breakthroughs needed to make large high-energy accelerators affordable will also make medical linacs smaller and cheaper.

Fermilab and other national laboratories have taken the lead in developing new accelerator technologies with revolutionary potential. These include superconducting accelerating cavities, plasma wakefields, and laser acceleration. This lecture will provide a non-technical overview of the prospects for next-generation accelerators.

Learning Objectives:

1. Understand the increasing importance of particle accelerators across many disciplines.
2. Understand the needs driving research into new accelerator technologies.
3. Gain a working idea of the most promising avenues for next-generation accelerators.