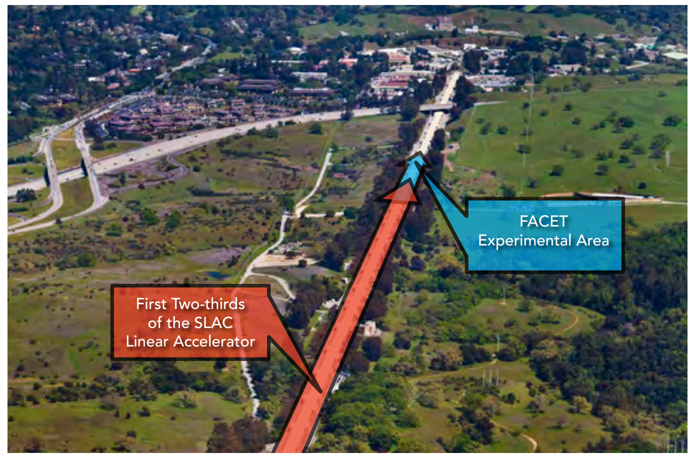
SLAC NATIONAL ACCELERATOR LABORATORY

FACET
Facility for Advanced Accelerator Experimental Tests

Scientists from all over the world come to FACET to do experiments aimed at improving the power and efficiency of particle accelerators used in basic research, medicine, industry and other areas important to society.



A Unique Facility
FACET uses part of SLAC's two-mile-long linear accelerator to generate high-density beams of electrons and their antimatter counterparts, positrons. These beams are so intense, it's as if they were focusing all the power of the sun on a surface 10 meters square. This produces large electric and magnetic fields in a very short time – ideal for creating exotic states of matter and researching advanced accelerator technologies.

World-Leading Research
FACET is open to researchers from all over the world, who submit proposals for experiments at the facility. These proposals are reviewed by an independent panel of experts. The first round of user experiments began in spring 2012.

Plasma Wakefield Acceleration
Electrons can "surf" on waves of plasma – a hot gas of charged particles – gaining very high energies in very short distances. This approach, called plasma wakefield acceleration, has the potential to dramatically shrink the size and cost of particle accelerators. Research at SLAC has demonstrated that a plasma can accelerate electrons to 1,000 times greater energies over a given distance than current technologies can manage. FACET continues this world-leading research.

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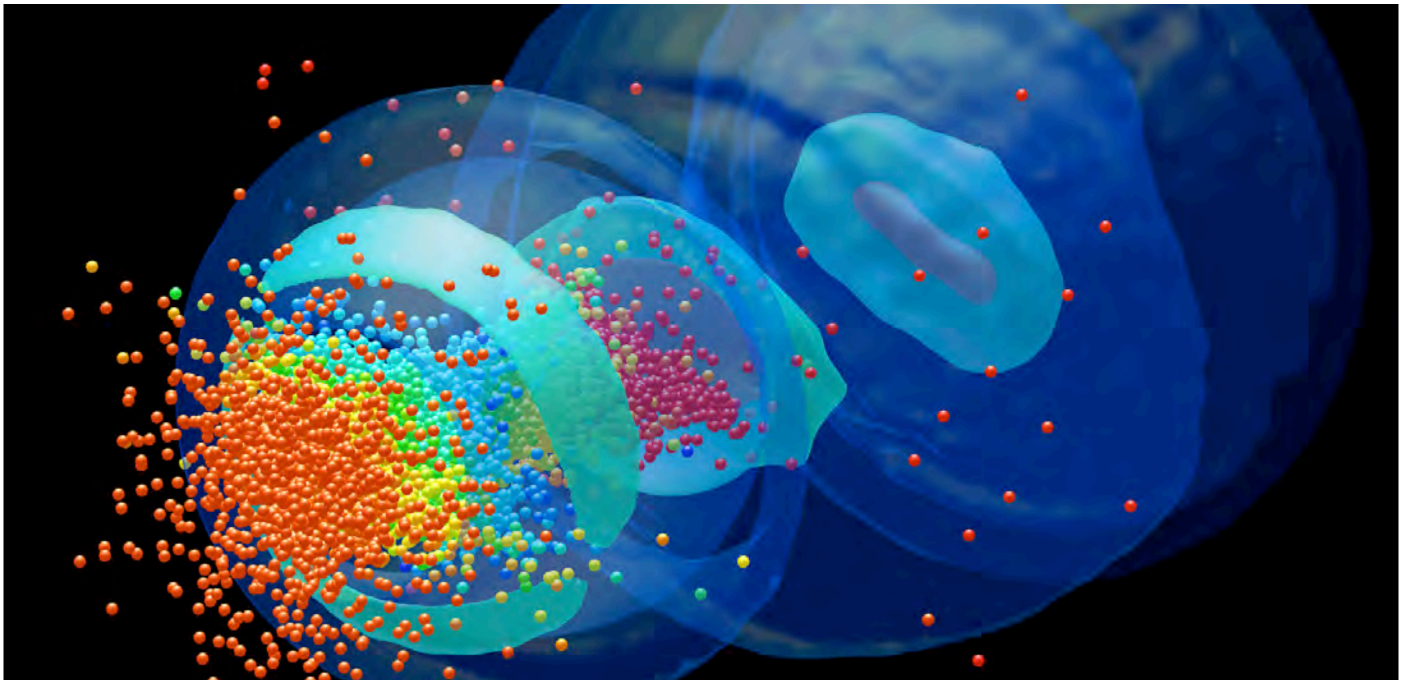
Office of Science



In this image from a simulation of a SLAC experiment, electrons (dots) drive and "surf" on waves of plasma (blue surfaces), accelerating very quickly over a very short distance. The colors of electrons represent their energies, from blue (low) to red (high). The experiment doubled the energies of electrons in less than one meter.
Image: Miaomiao Zhou (UCLA) and C.K. Huang (Los Alamos National Lab) with visualizations created by F. S. Tsung (UCLA)

Dielectric Wakefield Acceleration

Plasma isn't the only way to accelerate electrons in a short distance. When two well-spaced bunches of particles pass through a dielectric material such as silica or diamond, their interaction with the material causes the first bunch to lose energy and the second to gain energy. FACET is the only facility that provides the high peak fields needed to test the highest possible acceleration with this technology.

Materials Studies

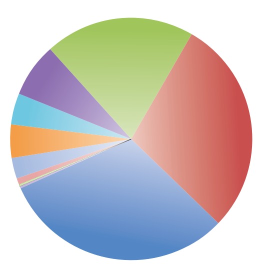
Scientists are using FACET to explore the fastest and most efficient way to switch magnetization in magnetic data storage media, unearthing new phenomena. FACET also produces terahertz or "sub-millimeter" electromagnetic radiation, which has many applications in material science, semiconductor research, chemical imaging and more.

Diagnostic Devices

In running any accelerator it's important to know exactly what is going on inside so you can correctly interpret the results of your experiment or project. FACET's unique qualities allow it to develop equally unique diagnostics. Non-invasive and inexpensive techniques for measuring the profiles of ultra-short bunches of electrons have already been demonstrated at FACET.

Societal Impact

Experiments at FACET aim to make accelerators for research, industry and medicine smaller, more powerful and more efficient. About 30,000 particle accelerators are in operation throughout the world today.



Industrial Accelerators and their Applications, *Robert W. Hamm & Marianne E. Hamm, World Scientific Publishing (2012)*

FACET is a user facility for experimental beam physics at SLAC National Accelerator Laboratory, which is operated for the Department of Energy by Stanford University.

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