12 GeV Upgrade

At Jefferson Lab

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Like a giant, powerful microscope, Jefferson Lab's CEBAF accelerator and its experimental halls allow scientists to peer into matter to study the tiniest particles that comprise it. Doubling the maximum energy of the lab's electron beam to 12 billion electron-Volts (Giga electron-Volts or GeV), building a new experimental research building and upgrading equipment in the three existing experimental areas will effectively increase the resolution of this "microscope," allowing scientists to probe quarks, gluons and other particles with improved precision. The upgrade will provide a cutting-edge research facility for the international community for decades to come and make it possible for Jefferson Lab to continue to contribute to the economic vitality of the region.

Quick Facts

• Roughly 400 jobs will be created over the course of construction, of which ~40-50 will be permanent.

• As excitement about the project grows, the lab's community of user scientists has also grown to more than 1,300.

• The number of visiting scientists onsite is expected to increase by about one-third once the project is completed, from about 200 to 260 a day.

• The U.S. Department of Energy's Office of Nuclear Physics within the Office of Science provides primary funding for the project. The Commonwealth of Virginia, the National Science Foundation and the international scientific community also are contributing critical support.

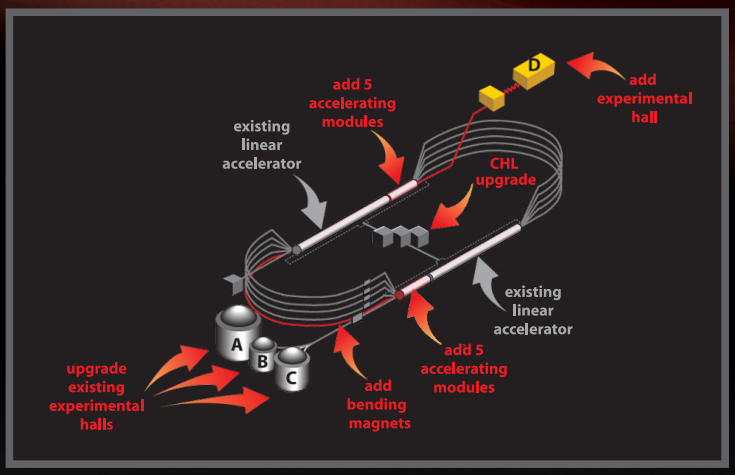
Project Costs

• Total Project Cost (design/construction/commissioning): $310 million

• Construction Costs: $267 million, including:

  • Construction Labor Costs: $100 million

  • Construction Procurement Costs: $167 million, including $28 million for civil construction contracts at the site.



Timeline

2004 Critical Decision Zero (CD-0) approval from the DOE, recognizing the "mission need" for the upgrade and allowing the lab to develop conceptual, acquisition and project execution plans

2006 CD-1 approval from the DOE, allowing for project engineering and design efforts to begin

2007 CD-2 approval from the DOE, finalizing the project definition as well as allowing a request for the project's construction funding to be included in the federal budget

2008 CD-3 approval from the DOE, clearing the way for start of construction

2009 Civil construction groundbreaking takes place

2012 Accelerator shutdown for the main installation phase of the construction project (Projected)

2013 Accelerator startup for commissioning (Projected)

2014 Equipment commissioning for experiments (Projected)

2015 Nuclear physics research starts (Projected)

What We Will Study

The upgrade will enable scientists to study the nucleus of the atom with unprecedented precision. Scientists aim to study the protons and neutrons in the nucleus and the quarks and gluons that make up protons and neutrons.

The upgrade will allow four main areas of research:

• Study the mechanism that confines quarks and seek an answer to one of the great mysteries of physics: Why is one quark never found alone?

• Research the fundamental structure of neutrons and protons.

• Seek an answer to how protons and neutrons bind together to form the nucleus.

• Study the limits of the Standard Model, the theory that describes the fundamental particles and their interactions.

New and Upgraded Facilities

• A new experimental facility (Hall D) and accompanying work space and control room totaling 10,000 square feet, contributing to a total of 28,000 new square feet for the entire Hall D Complex.

• Extending the accelerator tunnel by 250 feet.

• Adding 10 new cryomodules (or accelerating units) to the accelerator linacs, bringing the total to 50 cryomodules. The advanced design of the new modules will allow researchers to double the electron beam's maximum energy from 6 GeV to 12 GeV.

• An additional arc of magnets to transport the 12 GeV electron beam to the new experiment facility (Hall D), expanding the existing 5-pass machine to a 5.5-pass machine.

• Physical additions to the refrigeration plant or Central Helium Liquefier (CHL) and other accelerator facilities totaling 8,400 square feet and doubling the refrigeration plant's capacity.

• Utility upgrades, including water, sewer, electrical, cryogenics distribution, and telecommunications.

• New or upgraded equipment in the experimental halls, including massive magnets and detectors necessary for analyzing particle trajectories, momenta and energy after the electron beam collides with the target particles.

Benefit to Local Universities

Approved research grants totaling approximately $1.5 million have already been awarded through the National Science Foundation to build critical detector components for 12 GeV physics experiments.

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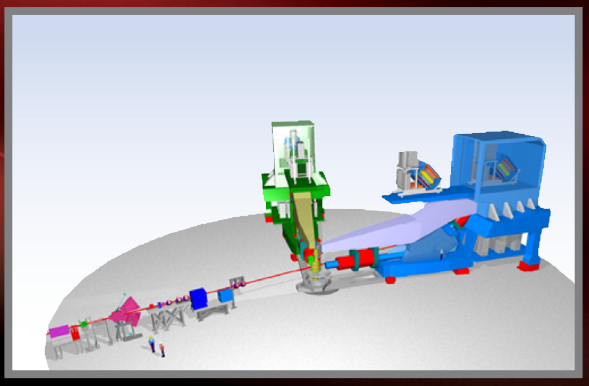
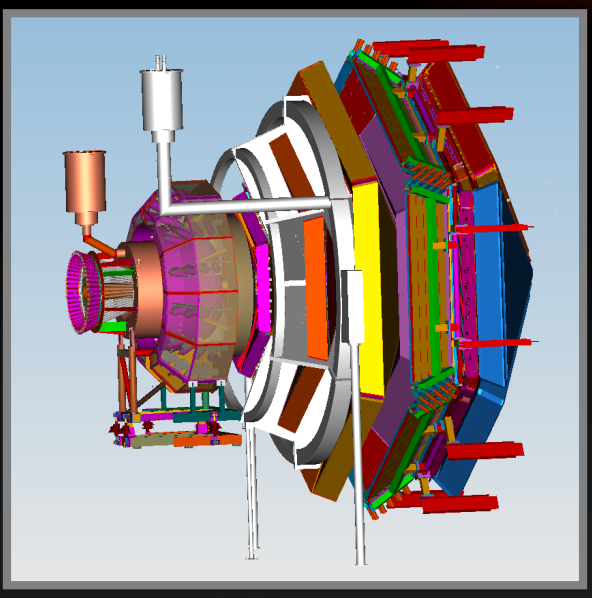
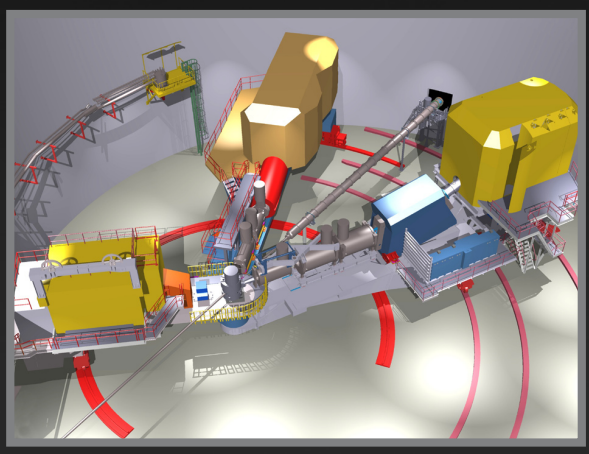


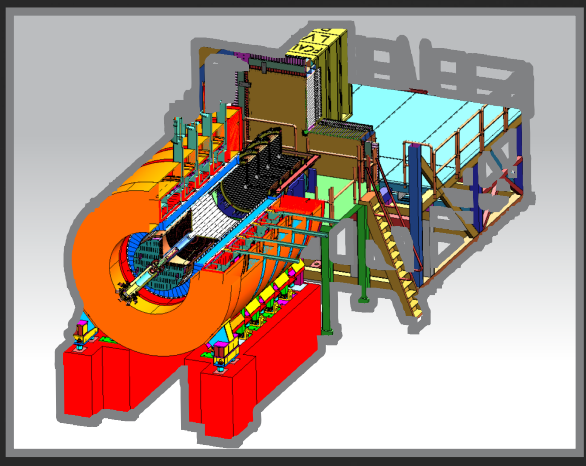
Hall A - Large Installations, Standard Model Tests



Hall B - Generalized Parton Distributions



Hall C - Valence Quark Properties



Hall D - Quark Confinement