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Atomic collider gets OK. Now Jefferson Lab will compete for it.

By Joanne Kimberlin
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NEWPORT NEWS

And the race begins.

Thursday's green light to build a cutting-edge atomic collider means it's on between Virginia and New York - the two contenders for the $1 billion project.

Approval for the collider was announced in Washington at a meeting of the Nuclear Science Advisory Committee, which steers the nation's long-range plans through the U.S. Department of Energy.

Just who wins the project - an electron-ion collider, or EIC - won't be decided for several years, but in the meantime, Jefferson Lab in Newport News will compete with Long Island's Brookhaven Laboratory for the contract.

"We're out of the starting gate," said Bob McKeown, deputy director for science at Jefferson Lab, or more formally the Thomas Jefferson National Accelerator Facility.

Landing the collider, which could take a decade to build, would pump $708 million into the state's economy - $557 million for Hampton Roads - and create nearly 5,000 construction jobs, according to a study done by the Wessex Group.

On a larger stage: EIC could lead to all sorts of technological advances while restoring the U.S. to the forefront of nuclear research - now claimed by Europe - "for many decades into the future," McKeown said.

Even bigger: It could help mankind answer some age-old questions:

What is the universe made of? What keeps it all together?

The thirst to know already drives Jefferson Lab, where scientists do pioneering work using a hair-width tool: a particle beam that moves so fast, it could circle the globe 7-1/2 times in a single second.

The EIC wouldn't be Virginia's first scientific score. Jefferson Lab already has a one-of-a-kind machine - a Continuous Electron Beam Accelerator Facility, or CEBAF - built 20 years ago after a tough battle with other states.

Used to explore the inner workings of atoms, CEBAF takes up acres of land on the edge of the city's bustling Patrick Henry shopping area. With much of the complex

underground, most people zip by the lab's wooded campus without a glance.

And with no idea that inside, physicists are using something so big to study something so very small.

One of 17 national laboratories funded by the U.S. Department of Energy - and the only one in Virginia - Jefferson Lab is among the youngest in a chain with roots in the Manhattan Project, which produced the atomic bombs dropped to end World War II.

The atom remains full of mystery decades later. These basic building blocks of matter hold keys to a greater understanding of our world, knowledge with intriguing potential for a long list of fields, from medicine to the environment to industry.

But probing them isn't easy. Atoms hold their secrets tight, bound with forces barely understood, each so small that one sugar cube contains as many atoms as the universe has stars.

Jefferson Lab's accelerator - built for $600 million and recently upgraded for another $340 million - uses a high-velocity electron beam that cuts into atoms like a knife.

"Running beam," as the scientists call it, is meticulous, cautious work. It revolves around a seven-eighths-mile oval-shaped "track" housed inside a concrete tunnel buried 25 feet underground. Radiation is unavoidably produced. "Running beam" calls for everyone to leave the tunnel.

"If you stayed in there you might not come out," said Andrew Hutton, associate director of the accelerator division.

Scientists monitor the action from an above-ground control room while, down below, 20,000 megawatts of electricity - enough to power 16,000 homes - shoots the beam through the track's labyrinth of cylinders, pipes, modules, magnets, wires, gauges and switches.

Goosed up to greater speed with every circuit, the beam must be kept in pinpoint focus until it's fed into waiting laboratories, where it's smashed against various elements.

Sensors send status reports to the control room through banks of computers, updating 350,000 signals every second.

"Precision is the order of the day," Hutton said.

It has to be. An off-kilter beam is both useless and dangerous - able to slice its way out of the accelerator "like a James Bond laser," Hutton said.

Even the water table must be taken into consideration. Adjustments are made for fluctuations, which can cause the track to "float" the smallest bit.

Having the world's only CEBAF makes Jefferson Lab a mecca for nuclear physicists. The lab, which annually draws 13,000-plus visiting scientists from around the globe, has a 10-year backlog of experiments waiting to be performed. Funding

limits operating hours. "Running beam" costs about $25,000 an hour, money that comes from the feds.

It'll take state money to win the EIC - which propels two beams into an even more-powerful, head-on collision.

Virginia legislators have already supplied $4.7 million to create the initial site and design plans that helped Jefferson Lab make the final two. The lab plans to ask for $2.4 million more.

They're in for a fight. Brookhaven's bid appears to be in line for $25 million, pledged earlier this year by New York's governor.

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What do they do in there, anyway?

The Jefferson Lab is the scene of experiments that create technologies with practical uses - everything from improved medical diagnostics to better bulletproof uniforms.

The lab's bread and butter, though, is its CEBAF - Continuous Electron Beam Accelerator Facility. Billed as the world's most powerful "microscope," its mission is to peer into the universe's tiniest building blocks.

To understand CEBAF, here's a little refresher in middle-school science:

- Everything we can touch is made of matter...

- which is made up of the chemical elements (remember that tedious periodic table?)...

- which are made up of atoms, each with a cloud of electrons orbiting its nucleus.

- Inside that nucleus: protons and neutrons...

- which are made of quarks and gluon.

But mystery remains: What else might be in there? And what holds it all together? Well, operating under the theory that if you know how something comes apart, you might be able to figure out how it's put together, physicists at JLab go through these intricate steps:

- Create a hair-width beam made of electrons...

- shoot it through an underground, oval-shaped accelerator that's nearly a mile around...

- all the while avoiding heat build-up by cooling the accelerator with liquid helium to -456 degrees Fahrenheit...

- until that beam is zooming along at nearly the speed of light, or about 900 million feet per second...

- at which point, the beam is split and diverted into laboratories...

- where it's smashed against a variety of elements to blast apart their innards...

- which leaves a collection of atomic debris for scientists to study.