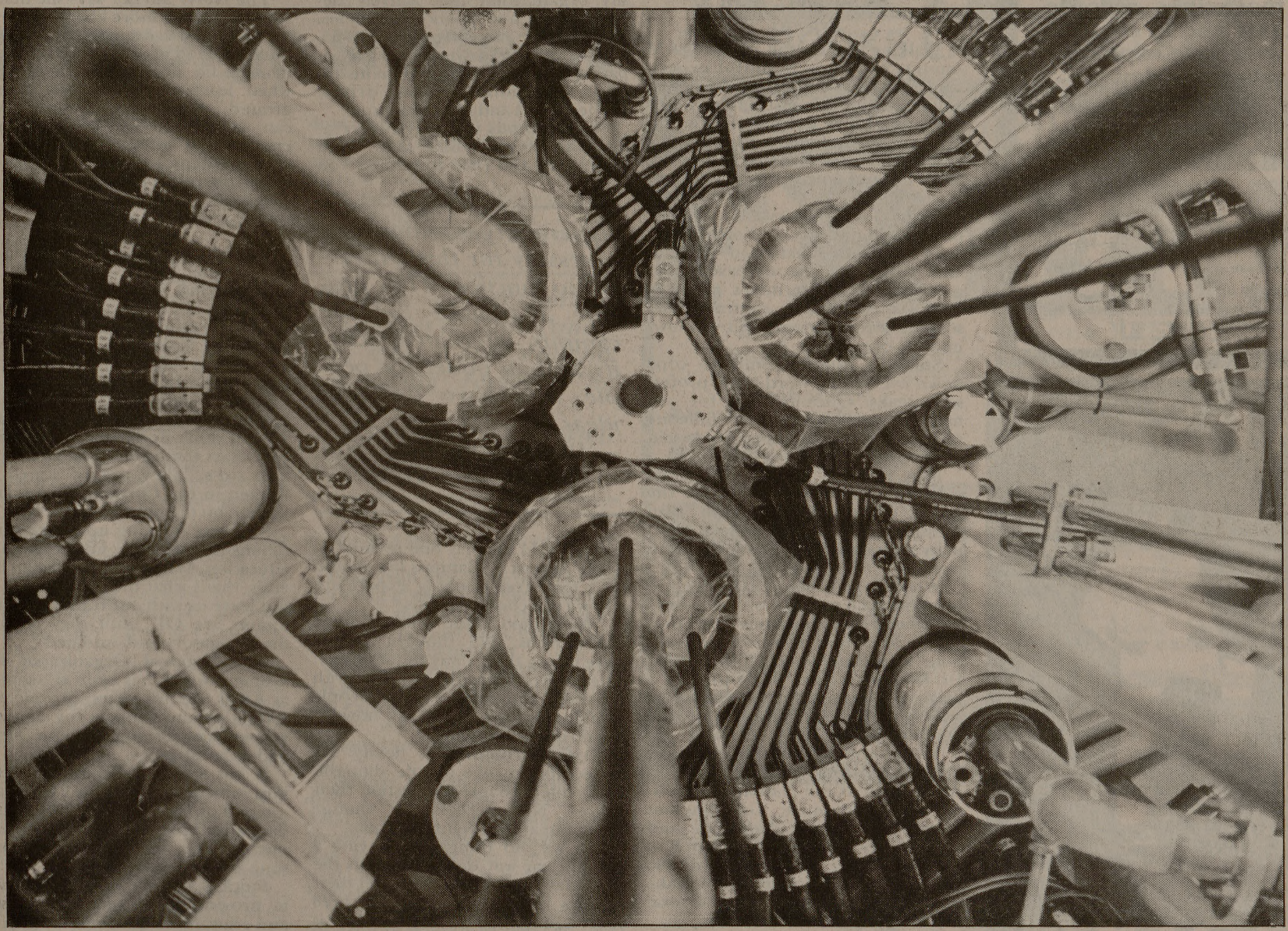
New $8 million A&M cyclotron to begin operations in October



This is an aerial view of a portion of the new cyclotron being built at Texas A&M.

Photo by Sam Meyers

By Jill Kaml
Reporter

Most students don't even know that it exists at Texas A&M — or what it is, for that matter.

But a building called The Cyclotron Institute, located next to the new Engineering Physics Building on campus, houses a rather large machine called a cyclotron, which smashes atoms.

It is used to help scientists discover how the nucleus of an atom works and why it behaves the way it does, said Dave Youngblood, the director of the Cyclotron Institute.

"We try to understand the forces that hold the nucleus together," he said.

Although it is often called an "atom smasher," Youngblood said the cyclotron actually accelerates the nuclei of atoms at very high speeds — nearly the speed of light — and then "smashes" them into a target.

Several atoms are accelerated in a stream, called a beam, to hit a target, he said. The target is a very thin foil of matter, which can be anything from carbon to gold.

As this high speed stream of particles passes through the target, occasionally one will hit the nucleus of an atom in the foil. When the particle hits it, the nucleus is broken up — thus the name "atom smasher."

A new cyclotron currently is being built by the Institute at a cost of about $8 million. It will have several advantages over the old one, Youngblood said.

For example, the new cyclotron will be able to accelerate particles much faster than the old one, he said.

"Now we will be able to accelerate a uranium nucleus, whereas with the present cyclotron we really can't do that," he said.

Also, the cost of operating the new cyclotron will be less.

Youngblood expanded on this by explaining how each cyclotron works. A cyclotron consists of three major components: a magnet, a radio frequency system and an ion source, he said.

"The magnet bends the particles in a circular path so that you keep accelerating them again and again," he said. "To get up to the speed you want, you kick them a lot of times just a little bit. You don't hit them once at a very high speed. The limit of how fast you can get the particles to go depends on how big the magnet is that you've got."

A magnet is very expensive to operate, he said, because it is run by an electric current.

"It's an electromagnet," he said. "The old cyclotron uses a megawatt of electricity, which is a million watts. This is very expensive to run. The new cyclotron has nine times the magnetic field of the old one, but by using superconducting coils — coils that have exactly zero resistance to electric flow — its total power use is 20,000 watts compared to 1 million watts."

Pete Smelser, a cryogenics engineer at the institute, says the coil is really the heart of the machine, consisting of 117,000 feet of superconducting wire.

"The only reason the new machine uses 20,000 watts of electricity is because the coils have to be refrigerated to a temperature of zero degrees Kelvin, or minus 460 degrees Fahrenheit, in order for superconductivity to occur," Smelser said.

Youngblood said the new cyclotron is almost finished and that it probably will be in operation sometime in October.

The first cyclotron at A&M was built in 1967. There was only one other comparable cyclotron at that time, and up through 1980, only two others could compare, Youngblood said.

Only one other cyclotron will compete with A&M's new one, that being at Michigan State University, he said.

A&M also coordinates facilities with the Japanese and the Europeans.

Youngblood said students at A&M are trained in research and the use of technology.

"This research is basic," he said. "It is not directed at helping anybody live better or at improving anybody's standard of living."

He said the research is 20 or 30 years in front of helping people.

"We are tying to figure out how it works," he said, "and then maybe we can do something with it."

But not all research is pure research. There are also some practical uses for present research.

The most famous of these programs was run seven years ago.

"The program involved the treatment of human cancer with neutrons using our cyclotron," Youngblood said. "It started in 1972 and was very successful."

"They actually had their patients here," said Bob Rogers, chief engineer of the Cyclotron Institute. "We changed one of our radiation areas so it was made a little more compatable for human beings."

The patients were given two to five eight-hour radiation treatments per week.

"It was different for us," Rogers said. "It was much more demanding, but still, it was interesting."

Youngblood said the patients were brought to the institute to see if this type of treatment might be effective. This program was purely research, which implies learning, in order to solve the practical problem which exists, he said.

"When the first patients were brought up here, clearly the researchers wanted to treat them and cure them of their cancer," Youngblood said. "However, these were patients who were terminal. There was no known way to cure them.

"This is a research cyclotron, which is a versatile device. Using its versatilities, as well as the knowledge of the scientists here, the researchers were able to fine-tune a program to treat cancer with neutrons."

In 1979, a cyclotron was designed specifically for the purpose of treating cancer.

"The machine is much smaller and much cheaper," Youngblood said. "It is sitting in Houston at M.D. Anderson Hospital."

Another example of applied research was in a nuclear science program conducted at the institute.

"In this program, the scientists discovered a technique in which they could measure the masses of live biological molecules in a unique way in which nobody else could," Youngblood said. "They could measure these molecules very accurately."

He said the program has now spun off and is no longer at the institute. There is now an instrument, based on the one built at The Cyclotron, that is commercially marketed for nuclear science.

In another direct applied program, Youngblood said moon rocks were brought to the institute so their compound content could be analyzed.

"We used the beams from the accelerator to analyze the compounds in the moon rocks," he said. "Some of our groups here look for trace elements in various things.

"We can also detect very small amounts of contaminants in materials. This is important to semiconductor manufactors in metals. Small contaminants in metal can make them either brittle or not brittle.

"These are the kinds of programs which go on here, along with the basic research."

The cyclotron normally runs 24 hours a day, seven days a week.