Sandia researchers recently demonstrated that if the electron beam is enclosed in a separately produced plasma, the electron beam can be transported over several meters (up to 10) and be kept stable and focused.

These developments, together with utilization of disposable plasma anodes in the electron beam diode, brings the technology needed for power reactors within the existing state of the art. A similar situation does not presently exist for laser fusion since the only existing high power laser systems are very inefficient. High power laser systems convert less than one percent of their input energy into the actual laser beam output, while electron beams convert up to 50 percent of the input energy into the output beam. Therefore much lower pellet gains can produce net energy output with e-beam systems.

At the present time inertial confinement research in general and e-beam work in particular is being hampered by top secret government classification of the research. This was most clearly demonstrated by the Rudakov success and the hysterical reaction on the part of Rockefeller agents in ERDA to its unilateral disclosure last July. The most significant recent development, which is intimated in the Stickley testimony — especially by his emphasis on the short term weapons applications of inertial confinement for simulation of H-bombs — is the fact that the recent success at Livermore Lab in obtaining isentropic compression obviates the need for more underground H-bomb tests to check new weapon designs. This is why Carter has offered to unilaterally halt these costly underground tests — they can now be done in the laboratory. The object obviously is to get the Soviets to go along with the charade and thereby fall behind U.S. weapons development.

Ironically, the e-beam research, which lends itself to more rapid development of peaceful applications and reactor development, is being cut back, but at the same time provides the means for much better weapons simulation.

First CO_2 Laser Fusion Achieved At Los Alamos

Researchers at the U.S. Los Alamos Scientific Laboratory reported yesterday that they have obtained laser pellet fusion utilizing a carbon dioxide gas laser. The scientists stated that these experimental results indicate that as much as "ten to twenty years could be lopped off" previous projections for the time it would take to develop commercial laser fusion power plants. It is now expected that a proto-type fusion generator could be operating by the early 1980s. This significant breakthrough in harnessing the virtually infinite energy of nuclear fusion reactions is based both on major technological and frontier scientific advances. Like the hydrogen bomb, laser pellet fusion is based on inertial confinement. Laser beams can only compress and heat very small quantities of fusion fuel and therefore only produce microexplosions like those in a gasoline engine.

Until now the only high energy laser system capable of producing the conditions for inertial confinement fusion have been solid glass lasers. But these glass lasers do not appear to meet the minimal technological needs of actual power plants. First of all they are very inefficient. Furthermore, they must be cooled down after each "shot." For a power reactor the laser must be shot at least once a second. Also glass lasers, while developing sufficient power levels and total energy outputs for demonstrating the scientific feasibility of laser pellet fusion, cannot be straight-forwardly scaled up to the sizes needed for power plants.

Carbon dioxide gas lasers, on the other hand, have efficiencies of up to 5 percent, and very high repetition rates. According to scientists at Los Alamos, scaling carbon dioxide lasers up to the sizes and shot rates needed for power plants is within existing "state of the art" technology. The main problem has been that carbon dioxide laser light has a wavelength (10 microns) 10 times that of glass lasers (1 micron). From the initial linear physics analysis it appeared that the long wavelength carbon dioxide could not be efficiently coupled into the pellet. But, more recent theoretical and experimental work had pointed to the fact that non-linear laser-plasma interaction led to efficient coupling of the laser beam into the pellet regardless of the wavelength.

In experiments beginning in Oct. 1976, scientists at Los Alamos demonstrated that these new non-linear theories were indeed correct. A two-beam, carbon dioxide laser system with a total energy of 200 joules delivered to the pellet in less than a billionth of a second produced up to 100,000 thermonuclear neutrons. This is 10,000 times less than the billion neutrons produced with glass laser systems at Lawrence Livermore Lab late last year, but these Los Alamos experiments do demonstrate efficient coupling of carbon dioxide lasers.

An eight-beam carbon dioxide laser system will begin operation at Los Alamos in 1978. With the recent Carter Administration cuts in the fusion research budget, the High Energy Laser System at Los Alamos — an upgrade of the eight-beam system which will reach break-even — has been set back several years beyond its originally scheduled start-up date of 1981, if it is authorized at all. With an expansion of the existing program demonstration commercial prototype laser fusion power reactors could be brought on line by the early 1980s.