Lawrenceville Plasma Physics, Inc

High technology research, development and consulting in plasma physics, X-ray sources, and Focus Fusion

December 30, 2013

Summary:

- **Former US Fusion Energy Chief, Senior Researchers Endorse Funding Focus Fusion**
- **Independent Simulations Support LPP predictions at Singapore Conference**
- **Tungsten sample passes another test**

Former US Fusion Energy Chief, Senior Researchers Endorse Funding Focus Fusion

In a major endorsement of LPP's fusion energy research program, a committee of senior fusion researchers, led by a former head of the US fusion program, has concluded that the innovative research effort deserves "a much higher level of investment…based on their considerable progress to date." The report concludes that "In the committee's view, (LPP's) approach to fusion power…is worthy of a considerable expansion of effort."

The committee of researchers was led by Dr. Robert Hirsch, a former director of fusion research for the US Atomic Energy Commission and the Energy Research and Development Agency. Other members of the committee were: Dr. Stephen O. Dean, President of Fusion Power Associates, and former director of fusion Magnetic Confinement Systems for the Department of Energy; Professor Gerald L. Kulcinski Associate Dean for research, College of Engineering, University of Wisconsin-Madison, and Prof. Dennis Papadopoulos, Professor of Physics, University of Maryland. The committee was organized by Dr. Hirsch at the request of Mr. Alvin Samuels, an investor in LPP's effort, to give an objective assessment of the program. Neither Mr. Samuels nor LPP had any control over the committee's conclusions.

The committee's report pointed to the "innovative thinking and experimental results achieved thus far by Mr. (Eric J.) Lerner and his team at LPP." The review committee did not minimize the remaining work that needs to be done to validate the predictions of LPP's theory of the dense plasma focus (DPF) functioning. Commenting on the report, LPP's President and Chief Scientist Lerner said, "We agree with the review committee that several of our predictions still need to be proved in the laboratory, which is what we intend to do over the coming period."

LPP has stated that, given adequate funding, it can demonstrate in a year or two the scientific feasibility of fusion energy with the DPF and boron fuel. The review committee broadly supported that short-term viewpoint: "While a number of near-term physics issues remain to be resolved," the report concluded, "it is likely that with adequate financial support these matters could be addressed in a relatively short period of time, e.g. a few years. If these issues are addressed, the committee does not see any fundamental roadblock to power system viability." In other words, there doesn't appear to be any unbeatable obstacle to creating a functioning, economical and clean new source of energy.

Independent Simulations Support LPP predictions at Singapore Conference

Ion-beam generation is critical for the functioning of a plasma focus device and will be the main source of energy in a future fusion generator. LPP predicts that with a maximum design current of 2.8 MA, the FF-1 plasma focus device will produce a 66 kJ beam, exclusive of any additional energy from fusion reactions. Now, leading simulation expert Dr. Sor Hoeh Saw of the Malaysia Institute for Plasma Focus Studies has presented simulation results that match LPP's experiments and predictions.

The new results were presented on Dec. 4 at the International Conference on Plasma Science and Applications in Singapore. Dr. Saw used a somewhat different theoretical model for the plasma focus than that developed by LPP. LPP's model is derived from the overall simulation tool developed by Dr. Saw's collaborator, Dr. Sing Lee, and is the most widely used simulation tool for the plasma focus devices. For a 1 MA (million amp) peak current, the Saw simulation predicts an ion beam energy of 3.3 kJ, somewhat better than but relatively close to the observed 2 kJ beam measured at LPP's FF-1 device, when it had a 1 MA current. At a peak current of 2.8 MA, the Saw simulation predicts an ion beam of 90 kJ, again close to but somewhat larger than the LPP prediction of 66 kJ. For comparison, the FF-1 device has a maximum energy input of 100 kJ, so both models predict the conversion of most of the input energy into beam energy.

This is an important result, because if so much of the input energy is converted to beam energy, which can then be readily re-captured as electricity, an additional fusion yield of about 30-40 kJ will result in more energy out than in, not even counting the additional energy output in X-rays. At the same conference, LPP's Lerner presented the teams' latest results on the influence of impurities in the plasma and the proposed solution with a monolithic tungsten cathode. Several researchers commented favorably on the analysis and LPP's innovative proposal for a cathode connected to the electric circuit outside the vacuum chamber, to avoid arcing.

Tungsten Samples Pass Another Test

LPP's plans for greatly increasing density and cutting down impurity levels in the plasma depend on substituting tungsten electrodes for the present silver-plated copper ones. Since the tungsten electrodes are expensive and have a lead time of three months, LPP's team wanted to ensure that the prospective supplier, Tungsten Heavy Powder, could provide material that would easily withstand the conditions in the FF-1 device. In the latest tests, an independent testing company measured the impact strength of some tungsten samples from the supplier. Since tungsten is a brittle material, LPP needs to make sure that the tungsten could withstand the sudden mechanical stress from the magnetic fields in the device pushing on the electrodes.

The two samples passed the tests with flying colors, surpassing the impact energy expected in FF-1. After one further test for tensile strength, LPP expects to order the tungsten electrodes in early January, and begin experiments with them in April, 2014.