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Lawrenceville Plasma Physics, Inc

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

LPP Focus Fusion Report
May 21, 2015

Summary:

- **Abell Foundation invests additional $200,000 in LPPFusion**
- **Fiber-epoxy winding, steel brace added to tungsten cathode**
- **Beryllium import permission obtained**
- **Dr. Hamid Yousefi returns to Iran, frustrated by immigration rejections**

Abell Foundation Invests Additional $200,000 in LPPFusion

Showing confidence in the outcome of LPPFusion's new experiments, The Abell Foundation has invested an additional $200,000 in LPPFusion. The Foundation, based in Baltimore Maryland, is LPPFusion's sole institutional investor and in 2008 made a $500,000 investment that was critical to the construction of the FF-1 plasma focus device that we are now using. The Financial Committee of the Foundation, chaired by Foundation President Robert Embry, made the decision after thorough discussions between Embry and LPPFusion's President Eric Lerner to clarify the goals of the coming experiments. As Figure 1 (prepared for Abell by LPPFusion) shows, that the goal is to demonstrate that greatly reducing impurities in the plasma will boost fusion yield back onto the scaling line that leads to the condition needed for net energy production.

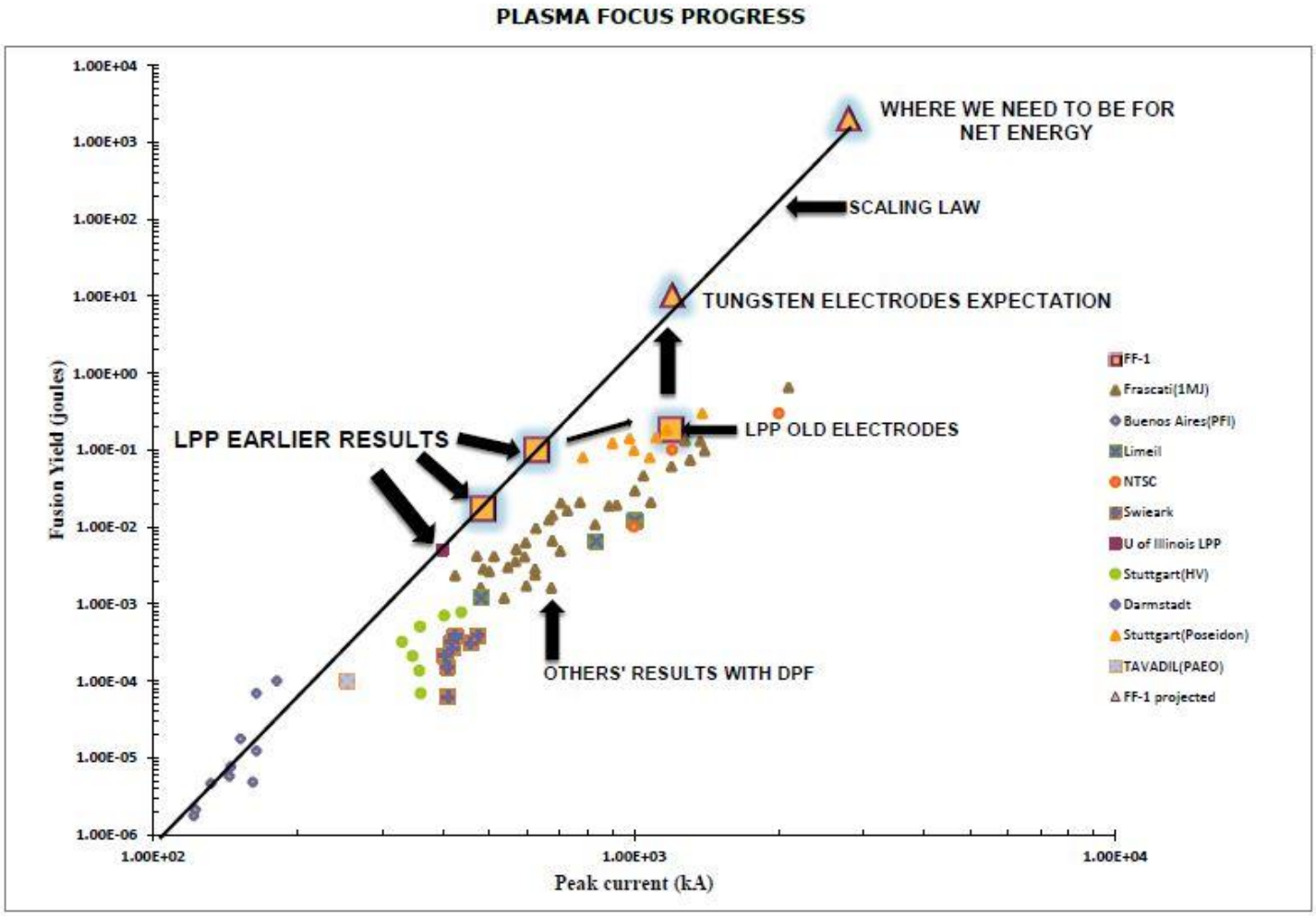

Figure 1- Plasma Focus Progress graph prepared for The Abell Foundation shows that by greatly reducing impurities in the plasma it will boost fusion yield back onto the scaling line that leads to the condition needed for net energy production.

LPPFusion has agreed that The Abell Foundation will have a representative on the LPPFusion Board of Advisors. The representative chosen is David Wise, President and Chief Executive Officer of Genetics and IVF Institute, who brings deep business experience, to complement that of our existing Board members.

The Board is consulted on all LPPFusion business and financial decisions. In addition to meeting by conference call when needed the Board will also be meeting semiannually to review LPPFusion's overall business and technical situation.

The new investment, combined with other investments recently received, has come close to selling out LPFusion's current stock offering, begun in 2011, which is now 95% complete.

At the moment, LLPFusion relies on new investments, as we have not yet been successful in obtaining new government funding. Unfortunately ARPA-E has declined to fund our work. They say that they require more evidence of the feasibility of our approach. We intend to apply again after the next set of experiments.

Fiber-epoxy Winding, Steel Brace Added to Tungsten Cathode, Completing Mechanical Repair

LPPFusion's lab team has completed the mechanical repair and reinforcement of the tungsten cathode. The first and most difficult step was to apply the fiber-epoxy composite around the broken rim of the cathode. (See April LPP Focus fusion Report for a description of how this damage occurred.) The purpose of applying the composite was to provide strong inward pressure on the cathode to close up micro-cracks that could impede the flow of current during FF-1 shots. The fiber, a thick nylon thread, was stretched to provide the inward force, while the epoxy adhesive fixed the fiber in place. The problem was the irregular broken surface that we were repairing produced forces that pushed the thread up or down as we were winding it around the rim. In a painstaking task, LPPFusion CIO Ivy Karamtisos guided the thread during many hours of winding to maximize the number of windings and to prevent the fiber form slipping off. (see video)

To maintain a constant tension but to avoid breaking the thread, LPPFusion Chief Scientist Eric Lerner monitored the tension with a torque meter (a mechanical device that measures the torque or twisting force on an axel or spool). We checked the torque meter by monitoring how much the fiber was stretching and by noting when the pull was enough to overcome the friction in the turntable that the cathode was resting on. Since we had to let the epoxy dry for a day between each layer of fiber, this critical step was quite time consuming.

As a result of this effort, we were able to stretch the fiber by an average of 18% in length so that with 34 windings round the cathode, in seven layers of fiber, we generated 350 psi of inward pressure. The micro cracks visibly closed up and 80% of the length of cracks ceased to be a significant obstacle to the current—something that we checked with a micro-ohmmeter, an instrument that can measure extremely small resistance to electric current.

The second step was to attach with more epoxy a steel brace to the outside of the cathode. The brace will serve to attach the cathode to a steel plate that will carry current from the rest of the machine. The brace replaces the function of the broken tungsten rim. With the help of our new temporary Research Associate, Mark Kalpheke (see note below), we carefully machined and ground the brace to closely fit the surface of the fiber-epoxy composite. A closer fit minimizes outward tension produced as the epoxy shrinks and dries which would counter the inward tension generated by the fibers. (see Figure. 2)

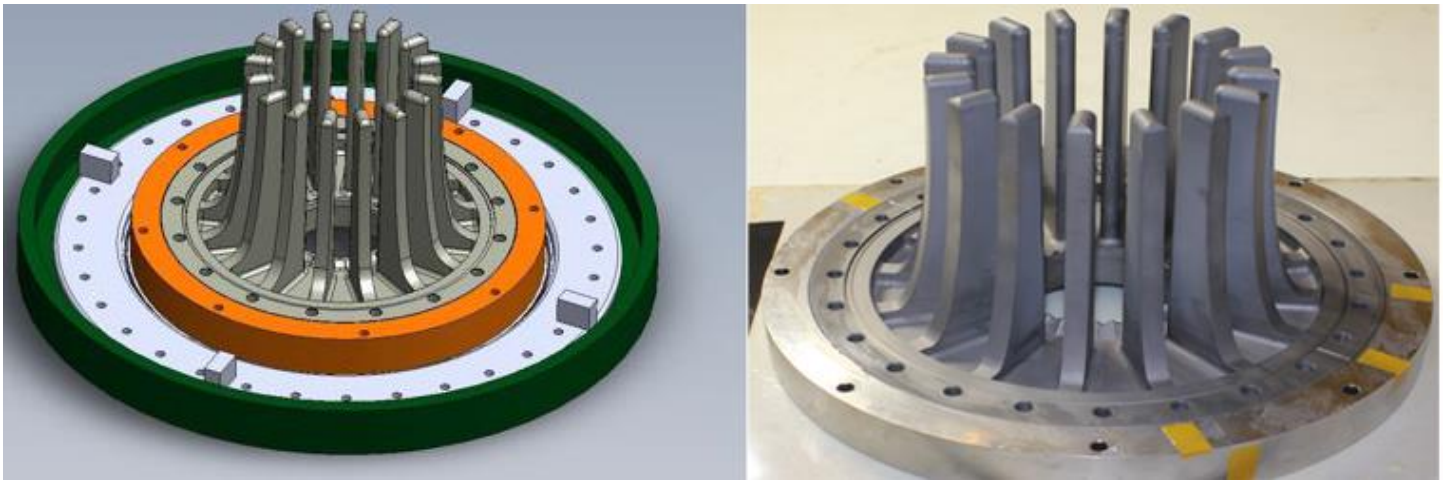

Figure 2- Photo of brace attached to the tungsten cathode(right) . Drawing(left) shows how the brace attaches the cathode to the rest of the device, replacing the function of the tungsten rim.

The next step will be to apply indium to bridge over the remaining 3 cm of micro-cracks, thus providing a safe path for the current in this region. Then the brace and cathode will be bolted onto the steel connection plate. At that point we will be able to proceed to the final reassembly of FF-1 and continue our important set of experiments.

Permission Obtained for Beryllium Electrodes Import

We have now obtained US Department of Commerce permission to import the cylindrical beryllium billets we will need for our next set of electrodes. The beryllium electrodes will be needed in later stages of our experimental program, as the x-ray flux from our plasmoid becomes too intense for the tungsten electrodes. Beryllium is far more transparent to x-rays and the x-rays that are absorbed will be spread out harmlessly in the bulk of the material.

With the import permission in hand, we expect to get the billets from Kazakhstan by the end of summer and have the machined electrodes by the end of 2015.

Dr. Hamid Yousefi Returns To Iran, Frustrated by Immigration Rejections

Frustrated by repeated rejections by US immigration authorities, Dr. Hamid Yousefi has returned to Iran and resigned as LPPFusion's Chief Research Officer. Last year, Dr. Yousefi's wife Sarah was rejected for a visa by the US State Department and had to stay in Iran with their son. As a result, Dr. Yousefi applied to change his visa to an O-1 Immigrant visa, which would allow another application for his wife. However, as we reported last month, after granting the visa, the USCIS then gave notice that they would revoke it. Although LPPFusion was in the process of appealing this revocation, Dr. Yousefi and his wife felt there was no real chance of getting the immigration situation resolved in the near future. Given his wife's health problems, they decided that he should return to Iran and resume his position at the Plasma Physics Research Center.

"Dr. Yousefi's departure is yet another unfortunate result of misguided immigration policies that make it difficult or impossible for the US to attract and keep the immigrants who, in the past have helped to build this country," commented LPPFusion's Lerner. "We wish Dr. Yousefi well in his work at PPRC."

LPPFusion is in the process of hiring additional researchers to help with our project. In the interim, to assist in our upcoming experiments, we have hired temporarily Mark Klapheke, an electrical engineer with experience working with plasma and vacuum systems and a longtime supporter of Focus Fusion Society.