LPP Focus Fusion Report

October 17, 2014

Summary:

- **ARPA-E allows aneutronic fusion applications**
- **Tungsten anode installed in FF-1; aluminum cathode model checked out**
- **Crowdfunding rewards shipped out**

ARPA-E Alters Requirements To Allow Aneutronic Fusion Applications And LPPFusion Applies For Grant

ARPA-E, responding to a question from LPPFusion, has altered its requirements for its new ALPHA Funding Opportunity Announcement so as to allow aneutronic fusion concepts to compete for grants in the we $30 million program. This is the first time, to our knowledge, that a US Department of Energy program has considered aneutronic fusion proposals. In light of these new requirements, LPPFusion has submitted a proposal to ARPA-E for a $2 million, two-year grant.

The ALPHA (Accelerating Low Cost Plasma Heating and Assembly) funding program was announced by ARPA-E (Advanced Research Projects Agency-Energy) in late August, aimed at funding alternative fusion ideas. However, in the original call for applications, ARPA-E had set a requirement that fusion yield be 5 times input energy—a requirement that was unnecessary for pB11 (hydrogen –boron) aneutronic fuel and probably impossible to meet. LPPFusion sent a question to ARPA-E, asking that the requirement be changed to take into account the much higher efficiency of energy conversion (and much more economical energy conversion) possible with aneutronic fuels. Such fuels produce energy in the form of charged particles, allowing a direct conversion into electricity without use of an expensive and inefficient steam cycle.

ARPA-E responded to our question on the "FAQ" section of their website that applicants could instead use a requirement that the electricity recycled back to the next pulse be no more than half

the total electricity generated. (This is the same as requiring that net power be more than half of total electric power). They specifically mentioned higher efficiency with direct conversion of charged particles, typical of aneutronic fuels (although they did not mention the fuels themselves). They then incorporated this change into a revised announcement. This revised requirement is one that a Focus Fusion generator could meet—although such a generator would still be highly economical even if net power were only 30% of generated electricity.

ARPA-E will first decide on the basis of 4-page concept papers which applicants will be asked for full detailed applications. Then 12-15 grants will be awarded on the basis of these applications.

Tungsten Anode Goes Into FF-1; Aluminum Cathode Model Is checked

On October 10, LPPFusion team members Eric Lerner, Hamid Yousefi and Tony Ellis lifted the tungsten anode into place on top of the FF-1 dense plasma focus experimental device (figure 1). The anode had previously been attached to its steel connecting plate (see September report) and was temporarily attached to a metal carrying rod for insertion through the Mylar insulating layers. It was then unbolted form the rod and the steel connecting plate was carefully aligned and bolted to the upper outer byssus plate, connecting it into the FF-1 main circuit.

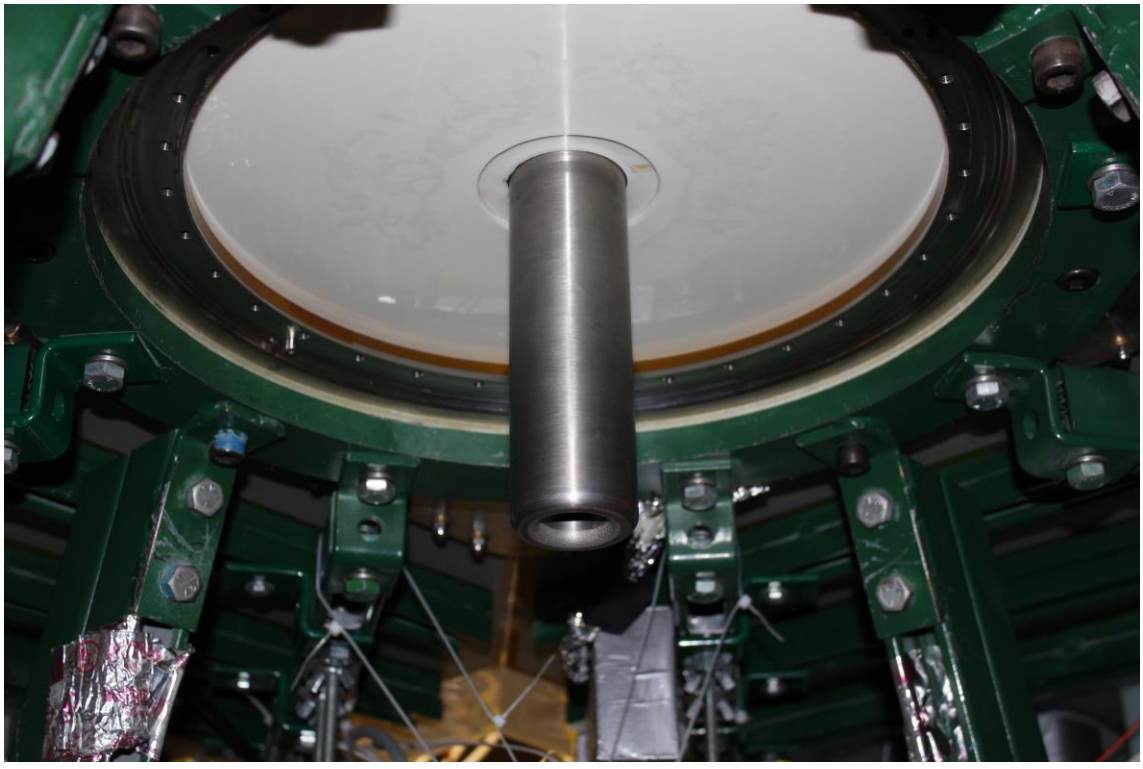

Figure 1. The new monolithic tungsten anode rests inside FF-1.Its base is surrounded by the insulating layers of Mylar that will keep the current from shorting out to the cathode, to be mounted below it.

The same week, Lerner and Yousefi carefully measured an aluminum model (Figure 2) shipped to us by Tungsten Heavy Powder, the firm producing the tungsten cathode. Due to the cathode's complexity, THP wanted us to check the aluminum model before cutting the tungsten piece. Sure enough, a few errors were found, including excessive variation in the distance between the vanes that will carry the current filaments. THP has estimated that higher accuracy will be obtained only with slower cutting of the tungsten. This will unfortunately lead to a further two- or three-month delay in our long-delayed tungsten cathode. However, it will be worth the wait to ensure the symmetry needed for good compression of the plasma and the high density we are aiming for.

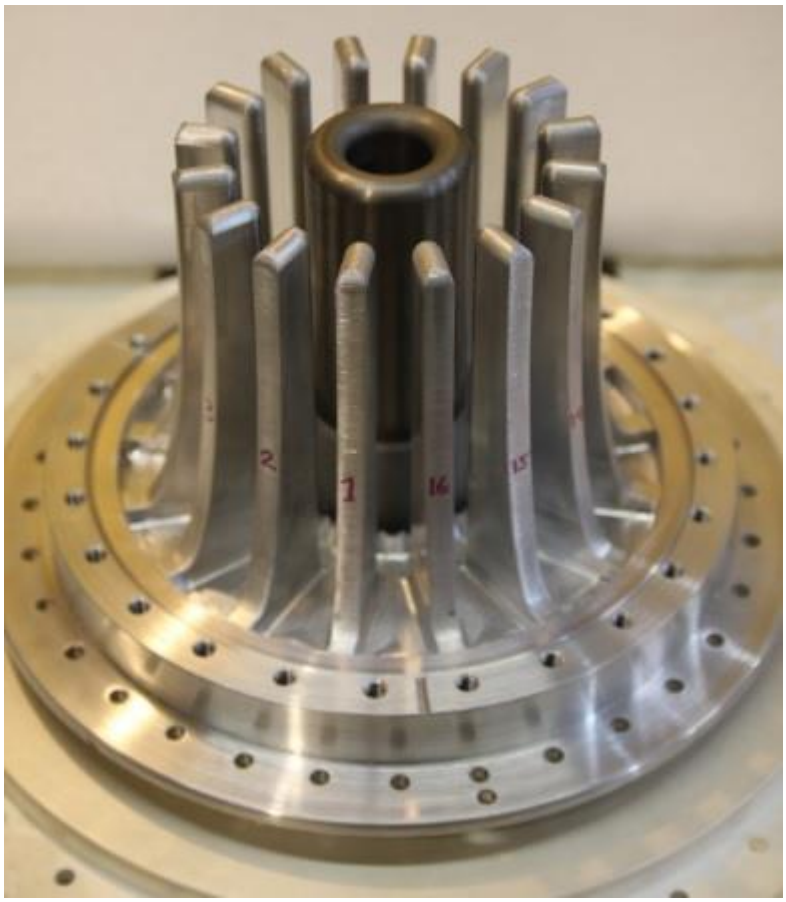

Figure 2. ***The shape of things to come****: the aluminum model of the monolithic cathode (silvery object with numbered vanes) surrounds that actual tungsten monolithic anode before it is mounted on FF-1. Aside from the silvery color of the aluminum, this is what the finished electrodes will look like. The inner ring of holes is part of the vacuum flange that will form part of the vacuum chamber wall. The outer ring of holes is for the bolts that will connect the cathode into the FF-1 circuit. Since both electrodes will be connected outside the chamber, no arcing can contaminate the plasma.*

Crowdfunding Rewards Are Shipped

After some delays due to under-staffing and summer doldrums, which LPP Fusion apologizes for, the rewards to our almost 2,000 Indiegogo crowdfunding supporters have finally been shipped, or will be by the end of next week. Thanks to LPP Administrative Assistant John Harhai for a lot of work and to LPP Chief Information Officer Ivy Karamitsos for some vital organizing.

We are currently postponing video and in-person tours of the LPPFusion lab until we have re-assembled and are operating FF_1. However, if you are due a tour as a reward and want one earlier, while we are still assembling, please contact us to request it at lpp@lppfusion.com. If we have a few requests we will schedule some early tours.

As of today, all donors should be receiving this newsletter.
Shout-outs—completed
Stickers--shipped
Plasma Portraits—emails will be completed early next week
Posters--shipped
T-shirts—shipping next week
Books—shipped
Ferrofluids (all colors)—shipped
Gaskets—shipping next week
Lightning sculptures—shipped

All $1,000 and up donors have been thanked in our monthly reports. We expect to order a plaque honoring the $2500 and $5000 donors next week. We will be thanking our $5,000 donors again by name when we publish our results based on their funding.

If you do not have your rewards in the next two weeks (for those in the US, where we are shipping from) or in the next 4 weeks (for those elsewhere) please notify us.

Note On Press Coverage Of Lockheed Martin Fusion Research

A number of supporters have asked us about the widespread press reports on a Lockheed Martin fusion advance. We want to point out that Lockheed's team has published no experimental results so far in any way. Until they do, this remains just a concept, not a "breakthrough". In contrast, LPP Fusion has consistently reported its results immediately on its website, presented them at scientific conferences and published them in peer-reviewed journals.