Spherical-Symmetry Options in the General Fusion Approach

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https://youtu.be/23W0t5-LlV0&lc=UgymqdN3U8vB6_LbRy14AaABAg

A Comment on the Sabine Hossenfelder post:
Nuclear Fusion Energy: Who'll Be First To Make It Work? (Mar 18, 2023)
https://youtu.be/23W0t5-LlV0?t=23m58s

28:14 *"I haven't been able to make up my mind which one's the most promising. What do you think?"* General Fusion, due to its clever cavitation-like lead-lithium fluid compression cycle's novelty, damage resistance, and long-term sustainability.

General Fusion's current cylindrical symmetry design could be more optimal since it becomes exponentially unstable along its vertical axis as pressures increase.

However, this also means that General Fusion has one of the most persuasive long-term performance improvement paths available for any device in the video. By asymptotically approaching a perfectly spherical inbound cavitation wall in the lead-lithium fluid, the symmetry of the compression cycle could, in principle, persist down to near-atomic flow-cell granularity scales. Deep (on a log scale) preservation of this spherical symmetry phase produces exceptionally rapid plasma pressure and temperature increases.

(To get a quick idea of the limiting granularity issue, think of the graininess of the flow cells at the surface of the sun's photosphere. Put those cells on the *inside* of a hollow sun, then shrink this hollow sun until there is room for only a handful of cells, ending with just two. These final cells determine the theoretical limits for the compression cycle's depth. For small cavities in clean, dense, high-surface tension fluids, the last pair of flow cells — a double-hammer configuration — could reach atomic scales.)

The robust surface tension of liquid metal alloys can help create and maintain the high spherical symmetry needed. Using the negative-pressure phases of synchronized spherical-symmetry sound would assist this process by briefly creating a near-vacuum at the cavity wall. This phase gives the liquid metal surface tension sufficient time to align the wall into a maximally spherical state. The wall encounters the plasma only after this self-aligning phase finishes, presumably during a positive-pressure phase of the sound waves. Finally, the high density and small scale of lead-lithium flow cells on the imploding cavity face means they can dampen out minute plasma instabilities that would grow exponentially in any plasma-only design. Magnetic fields alone cannot provide the resolution, power levels, or fast responses needed to dampen such emerging plasma instabilities, so designs that rely solely on magnetic fields tend to become chaotic quickly.

In summary, General Fusion strikes me as the most open-ended option for improvement.

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PDF: https://sarxiv.org/apa.2023-03-19.0055.pdf