Kepler Fusion Technologies Inc.

The Texatron™ Fusion Energy Platform - White Paper

A High-Level Technical Overview of a Pulsed Toroidal Aneutronic Fusion System

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Executive Summary

Kepler Fusion Technologies Inc. is developing the Texatron™, a compact fusion energy platform designed for scalable, distributed power generation. The Texatron™ combines established principles of toroidal magnetic confinement with pulsed magneto-inertial plasma compression to enable fusion-relevant plasma conditions within a simplified and modular architecture.

The system is engineered to support aneutronic fusion fuel cycles, particularly deuterium–helium-3 (D–He^3), with the objective of enabling direct electrical energy conversion from charged fusion products. This approach avoids many of the material degradation, radioactive waste, and balance-of-plant challenges associated with conventional deuterium–tritium fusion systems.

This white paper provides a non-enabling, high-level technical description of the Texatron™ concept, its underlying physical principles, and its developmental progress. Proprietary implementation details, operating parameters, and control methodologies are intentionally excluded and protected under Kepler's intellectual property and trade secret programs.

1. Technology Overview

The Texatron™ is a pulsed fusion system that forms and confines plasma within a toroidal geometry using a combination of magnetic fields and rapid plasma compression. Unlike large steady-state fusion reactors, the Texatron™ operates in a cyclic manner, with each pulse consisting of plasma formation, compression, confinement, energy release, and controlled dissipation.

The system leverages:

- Toroidal plasma confinement geometries
- Helical magnetic field topologies
- Magnetohydrodynamic (MHD) stabilization mechanisms
- Pulsed energy delivery and recovery

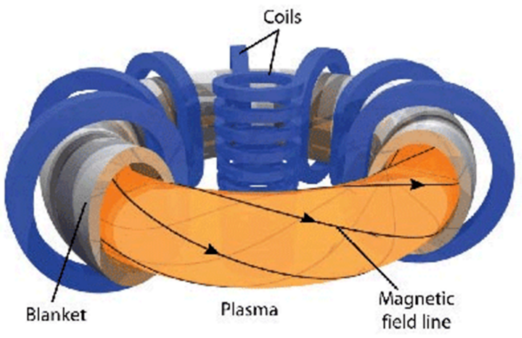
This architecture is designed to reduce system complexity, enhance stability, and support modular scaling across a range of power outputs.

2. Toroidal Plasma Formation and Magnetic Topology

In the Texatron™ system, plasma is formed within a closed toroidal chamber that induces helical magnetic field structures during operation. These twisted magnetic field lines contribute to plasma stability by mitigating common MHD instabilities that arise in purely axisymmetric systems.

The magnetic topology shares certain characteristics with tokamak-type confinement, including finite plasma beta and force-balanced equilibria, while differing fundamentally in its pulsed operational mode and chamber geometry.

Following plasma formation, the system allows the plasma to relax toward a lower-energy equilibrium state governed by well-established plasma physics relationships, including formulations related to the Grad–Shafranov equilibrium condition. These equilibria are associated with conserved global magnetic flux properties that enhance confinement during the energy-producing phase of each pulse.



The Toroidal Vortex Magnetic field in a Tokamak
- *demonstrated to be stable.*

Fig 1. The helical Magnetic field and plasma configuration in the well demonstrated Tokamak toroidal fusion device.

3. Pulsed Magneto-Inertial Operation

The Texatron™ employs a pulsed magneto-inertial fusion approach, wherein plasma heating is achieved through rapid compression rather than continuous steady-state heating. This method allows fusion-relevant temperatures and densities to be achieved transiently, reducing overall system stress and material exposure.

Each operational cycle may be characterized at a conceptual level by:

1. Introduction and formation of plasma within the toroidal chamber
2. Rapid compression and heating through pulsed electromagnetic forces
3. Temporary confinement during which fusion reactions may occur
4. Controlled plasma dissipation and system reset

Specific timing, energy delivery methods, and control strategies are proprietary and are not disclosed herein.

4. Aneutronic Fusion Fuel Strategy

Kepler's Texatron™ platform is optimized for aneutronic fusion reactions, with a primary focus on the deuterium–helium-3 ($D–He^3$) fuel cycle. This reaction pathway offers several potential advantages over conventional deuterium–tritium fusion, including:

- Reduced neutron flux and associated material damage
- Minimal induced radioactivity within reactor structures
- Production of energetic charged particles suitable for direct energy conversion

While aneutronic fusion requires higher plasma temperatures than DT fusion, stable confinement at such temperatures has been demonstrated in experimental plasma systems. The Texatron™ architecture is designed to operate within these regimes while maintaining system integrity and scalability.

5. Direct Energy Conversion Potential

A defining feature of the Texatron™ concept is its compatibility with direct electric power generation. Because aneutronic fusion reactions predominantly produce charged particles, a portion of the fusion energy may be converted directly into electrical power without reliance on steam turbines or thermal cycles.

This capability has the potential to:

- Improve overall system efficiency

- Reduce balance-of-plant complexity
- Enable compact, distributed power generation deployments

Details of energy conversion mechanisms, component configurations, and efficiencies remain proprietary.

6. Experimental Validation and Development Status

Kepler Fusion Technologies has conducted proof-of-principle experimental work demonstrating the formation of toroidal plasmas consistent with the Texatron™ concept. These experiments were performed at sub-fusion temperatures and were intended to validate fundamental plasma behavior, magnetic topology formation, and stability characteristics.

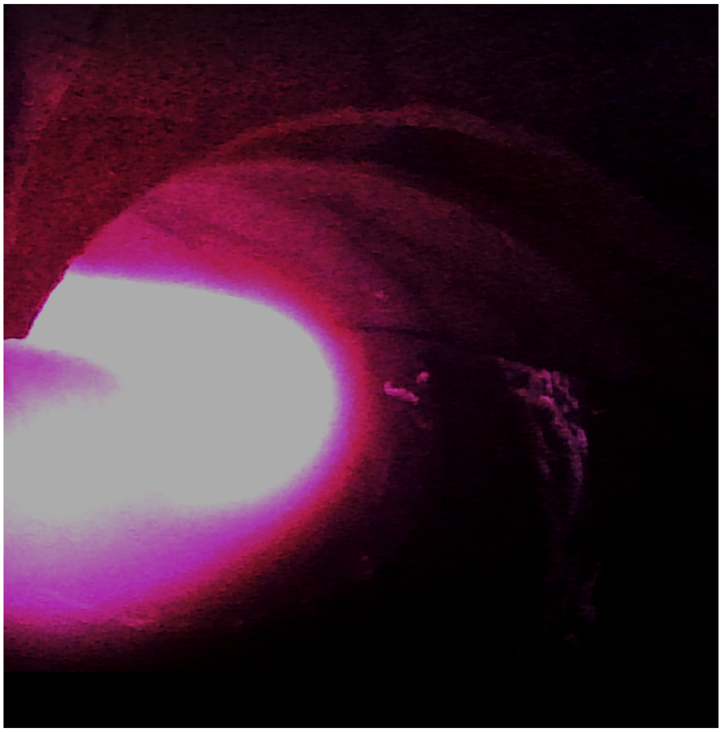


Fig. 2. Stable plasma, inside the toroidal Texatron™ fusion device inductor during a proof of principle experiment.

Observed results included:

- Repeatable toroidal plasma generation
- Formation of helical magnetic field structures
- Stable plasma behavior over relevant pulse durations

These results support continued development and scaling of the Texatron™ platform.

7. Intellectual Property and Trade Secret Protection

Kepler Fusion Technologies maintains an extensive and growing intellectual property portfolio covering aspects of fusion system architecture, plasma confinement, energy conversion, control systems, and deployment models. Additional details regarding reactor geometry, operating parameters, and control methodologies are protected under both issued and pending patents, as well as internal trade secret protections.

This document is intended to provide contextual technical understanding without enabling replication or disclosure of proprietary methods.

8. Commercialization Perspective

The Texatron™ platform is being developed as a **commercial fusion energy system** suitable for deployment across industrial, data center, utility, and infrastructure markets. The modular nature of the design supports a range of power outputs and deployment configurations, enabling phased scaling and distributed installation.

Kepler's commercialization strategy emphasizes:

- Modular deployment
- Ownership and operation of fusion assets
- Sale of electricity on a per-kilowatt-hour basis
- Long-term infrastructure-style revenue models

Conclusion

The Texatron™ represents a differentiated approach to fusion energy that integrates established plasma physics with a pulsed, modular, and commercially oriented system architecture. By focusing on aneutronic fuel cycles, direct energy conversion, and scalable deployment, Kepler Fusion Technologies is advancing toward practical fusion power applications.

Ongoing development efforts are focused on continued experimental validation, system scaling, and preparation for commercial demonstration.

References

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2. Shafranov, V.D. (1966). *Plasma Equilibrium in a Magnetic Field*. Reviews of Plasma Physics, Vol. 2.
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