PointSource
Grid Alternative Energy Solutions

The PointSource Fusion Engine

A revolution in industrial power

Curt Brown

Rob Humble

August 27, 2016

Engine Technology Review

Executive Summary
PointSource Engine

- Condensed Matter Nuclear Reactions Physics Review: The physics of Palladium catalyzed Deuterium fusion have been explored and replicated by US Government labs and other major organizations.
- Fusion Engine Design: PointSource Energy has combined these research findings with an innovative scalable engine design. A small senior engineering team has obtained four US patents and have had claims allowed in a Chinese app. We are currently testing engine prototypes. Additional IP filings are ongoing.
- Business Strategy: Develop and control a substantial body of art surrounding solid state engine design and implementation. We will construct a demonstration engine and license the accumulated IP portfolio and design knowledge in vertical markets and geographic territories.

The PointSource Team

PointSource Founders are successful professionals

The PointSource Executive Team:

Curt Brown

- CTO/SVP experience in technology industry including HP, Iomega, Seagate, Lantronix, Conner Peripherals and Intelio.
- Developed a number of industry leading products; sales in millions of units and billions of dollars.
- Proven accomplishments in designing world class technology solutions, and related manufacturing facilities, aimed at high volume markets.
- Capable inventor with numerous patents; successful commercialization in technology segments; including Zip drive and XPort (world's smallest web server).
- Comfortable in leading start-ups and scaling organizations; led teams up to 350 engineers.
- MSEE MIT, BSEE University of California.

Sean Taylor

- Founder of solar photovoltaic design and installation company; key contract with state of California's SASH renewable energy program.
- Developed, owned and operated commercial real estate.
- Corporate development expertise with proven business development track record.
- Undergraduate Fellowship Scholar and Varsity athlete UC Berkeley, MBA Fellowship Scholar university of San Francisco.

Rob Humble

- Innovative world class product execution with many successful product introductions.
- Broad mechanical, electrical and software engineering skills.
- Deep knowledge of ceramic fabrication including a variety of Zirconia structures.
- Complete skills required to invent and create all tooling, test systems, prototypes, demos, electronics & software for PointSource.

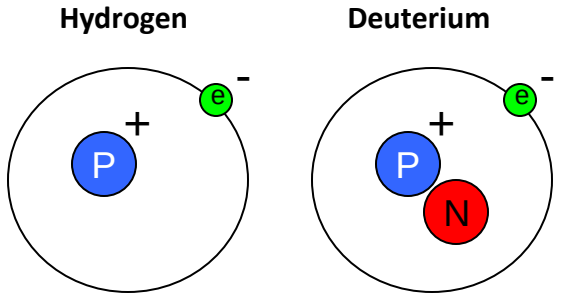
Emily Tung

- President, China Affairs
- Expert in Strategic Business Development, government relations team building, executive management.
- Proven JV Formation and Operation strengths.
- China/US/Foreign contractual agreement development.
- Complete skills required to guide PointSource expansion in Asian markets and beyond.

The Opportunity: The Physics of Nuclear Fusion

The Fuel: **Deuterium**

Fuel:	Deuterium = isotope of hydrogen
Fuel Reserves:	1 deuterium atom in every 6,500 atoms of sea water *(1/1000 of an inch of the ocean's water is equivalent to the world's oil supply)*
Fuel Refining:	Cascading Distillation *(No by-products. Distillation produces D2O or D2 gas (fuel) and distilled water)*

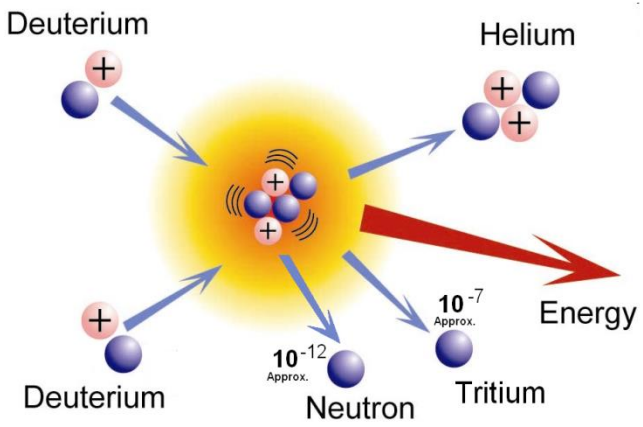


The Reaction: **D + D = He + 24,000,000 eV**

Reaction Potential:	1 gallon of deuterium = 10 million gallons of gasoline.

The Catalyst: **Metallic Dopant**

Catalyst:	*Palladium, Nickel, Thorium, Tungsten*
Catalyst Reserves:	Metallic Dopants Widely Available
Catalyst Refining:	Conventional techniques



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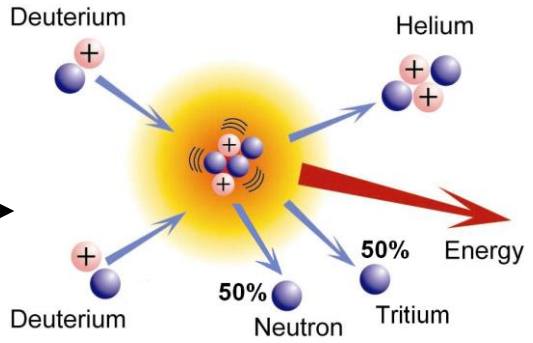
Nuclear Basics: Fusion Methods

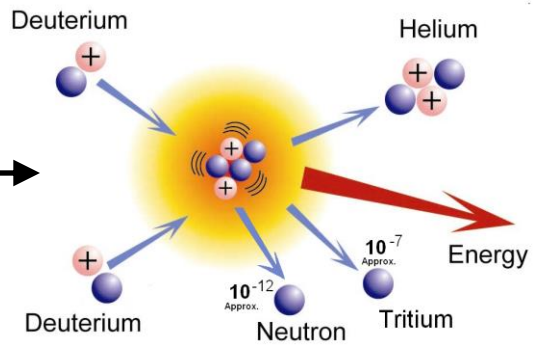
Fusion

Not Yet Commercialized
Clean - no nuclear waste
Safe - Failsafe

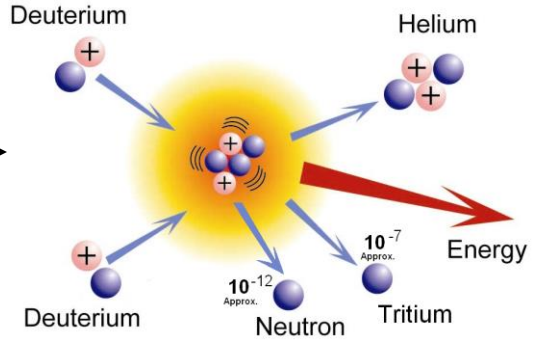
High Temperature
- Easy to Ignite
- Hard to Sustain
- Large $$ Investment



Warm Temperature
- Easy to Ignite
- Easy to Sustain
- Small $$ Investment

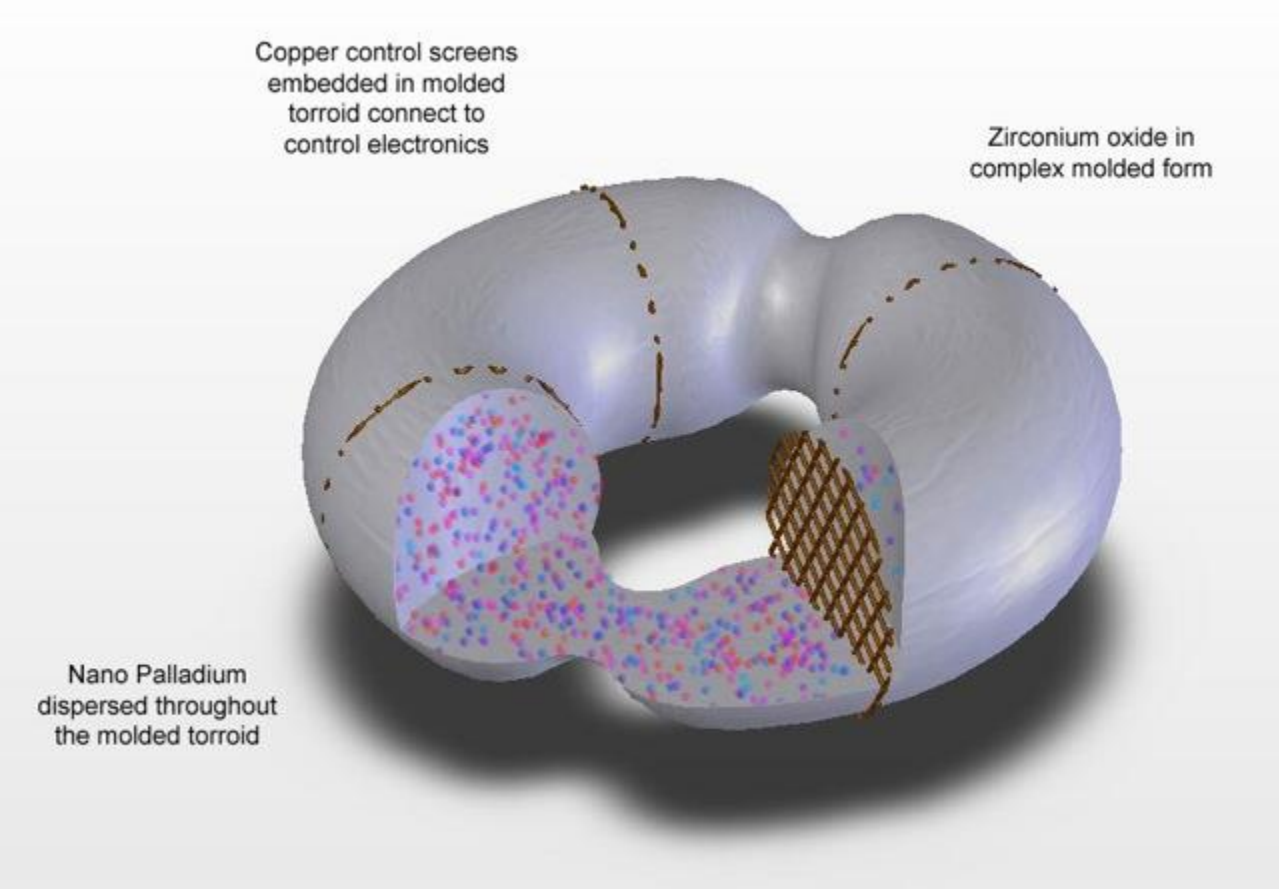


Low Temperature
- Hard to Ignite
- Easy to Sustain
- Small $$ Investment



PointSource Engine Technology

Initial Concept:
Solid State Tokamak (SST)



Gas Loading

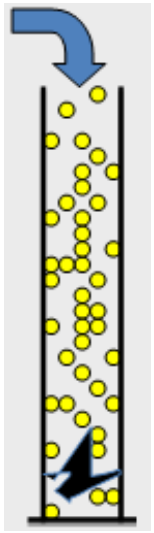
Anomalous Heat with Palladium Black

Deuterium Gas

The key “gas loading” experiment, first done by Arata and replicated many times. Also reported by the U.S. Naval Research Laboratory.

Heat appears after a “loading” phase of deuterium absorption.

Palladium Black



KEY FINDINGS: MATERIALS

Arata, Y. and Y.C. Zhang, A new energy caused by "Spillover-deuterium". Proc. Jpn. Acad., Ser. B, 1994. **70 ser. B**: p. 106
Mizuno, T., *Analysis of Elements for Solid State Electrolyte in Deuterium Atmosphere during Applied Field.* J. New Energy, 1996. **1**(1): p. 79

Flux

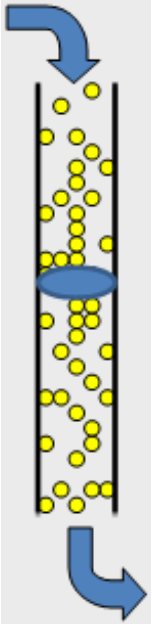
Anomalous Heat with Palladium Wafer

Deuterium Gas

Heat varies with Deuterium flux through Pd wafer

Palladium Wafer

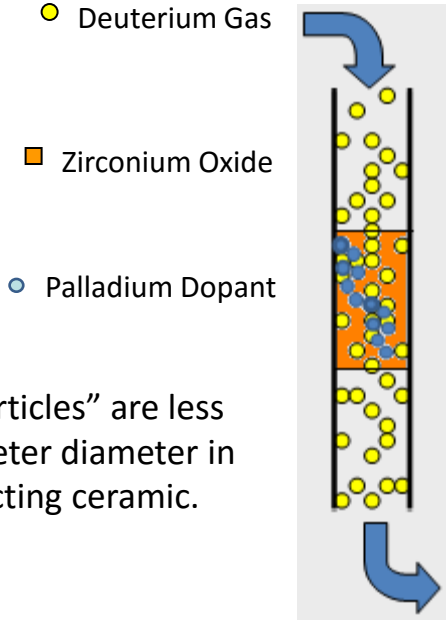
Surrounding Vacuum



KEY FINDINGS: FLUX (D LOADING)

Tian, J., 2002. Tsinghua Univ., Beijing, China: Tsinghua Univ. Press
Li, X.Z.,. 2002. Tsinghua Univ.,Beijing, China: Tsinghua Univ. Press.
Zhang, W.-S. and J. Dash. *The 13th International Conference on Condensed Matter Nuclear Science*. 2007. Sochi, Russia.

Anomalous Heat
with Deuteron Conducting Ceramics



Metal "nano particles" are less than 10 nano-meter diameter in proton conducting ceramic.

KEY FINDINGS: MATERIALS

Kidwell, D., et. Al. *Does Gas Loading Produce Anomalous Heat?* 15th International Conference on Condensed Matter Nuclear Science. 2009, Rome, Italy: ENEA

Oriani, R.A., *An investigation of anomalous thermal power generation from a proton conduction oxide.* Fusion Technol., 1996.

Mizuno, T., *Analysis of Elements for Solid State Electrolyte in Deuterium Atmosphere during Applied Field.* J. New Energy, 1996. **1**(1): p. 79.

Excitatory Fields

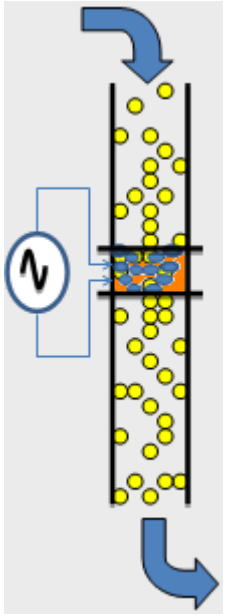
Anomalous Heat with Applied Field

Deuterium Gas

Zr.Pd ceramic with porous Pt electrodes

Palladium Dopant

Electric field further enhances anomalous heat effect



KEY FINDINGS: FIELD

Kitamura, et. al., *Anomalous effects in charging of Pd powders with high density hydrogen isotopes.* Physics Letters A, 2009.
Mizuno, T., *Analysis of Elements for Solid State Electrolyte in Deuterium Atmosphere during Applied Field.* J. New Energy, 1996.
Dardik, I., Branover, H., El-Boher, A., Gazit, D., *Intensification Of Low Energy Nuclear Reactions Using Superwave Excitation*. in *Tenth International Conference on Cold Fusion*. 2003. Cambridge, MA

- Every key PointSource engine design requirement is supported by published research, with every key design parameter demonstrated successfully in a published technical paper.
- The engine design is based around nanoparticles (of palladium) trapped in a proton conducting ceramic (zirconia). Fuel (deuterium) moves through the ceramic freely, and is taken up by the sponge-like nanoparticles. Proper operating conditions include adequate fuel concentration near the surface layers of Pd and flux generation via appropriately applied E and B fields.
- Heating of the ceramic element occurs while combustion products are contained within the ceramic. Modulation of excitatory fields controls engine power output. Heat output can be used directly or converted to electrical or mechanical power.

PointSource issued patents

- Ceramic Heating Element 9,410,721
- Enhanced alpha particle emitter 8,801,977
- Ceramic element 8,485,791
- Enhanced alpha particle emitter 8,303,865

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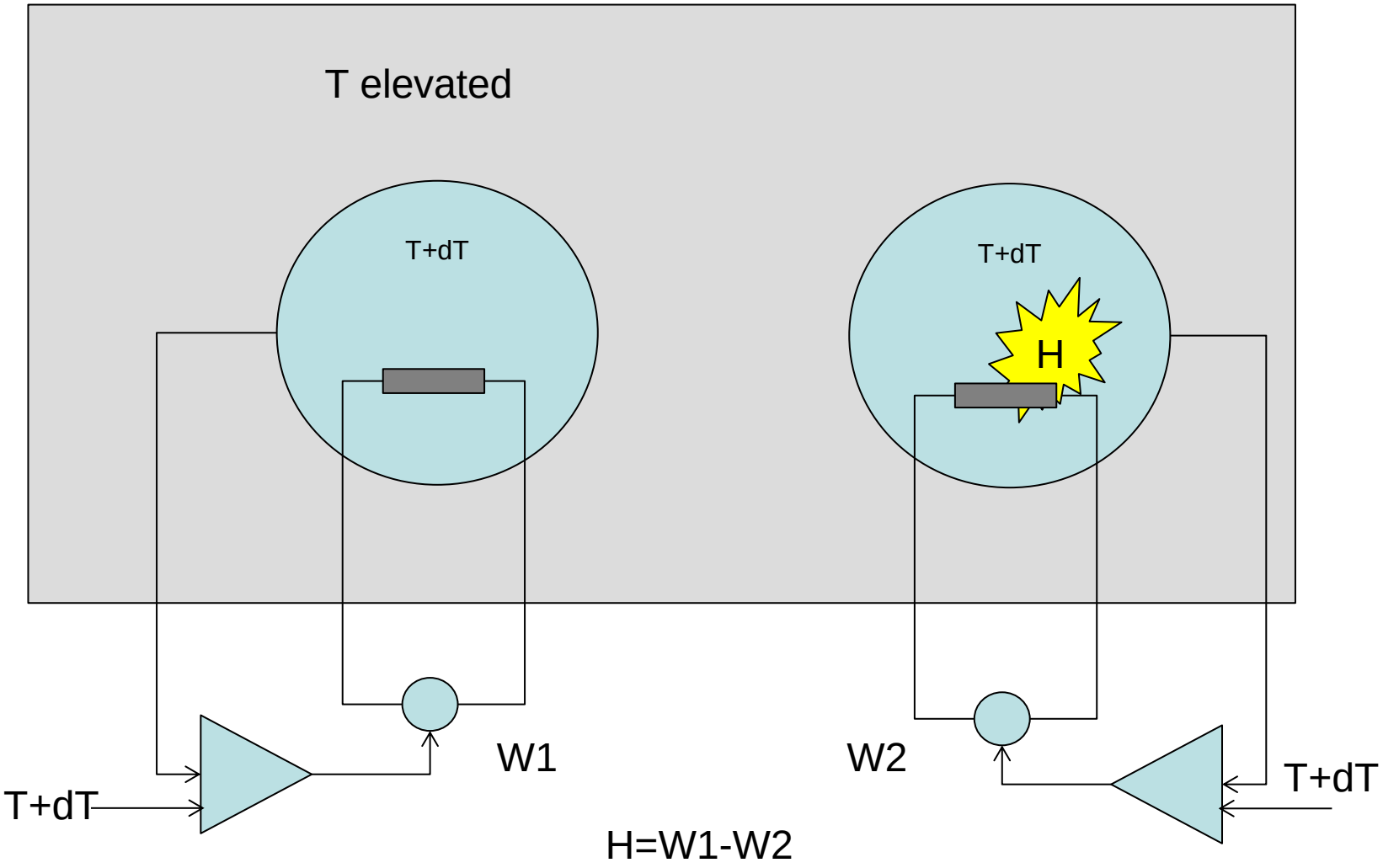
Doped ZrO2 Wafer inside D2 fueled ampoule

Servo Control

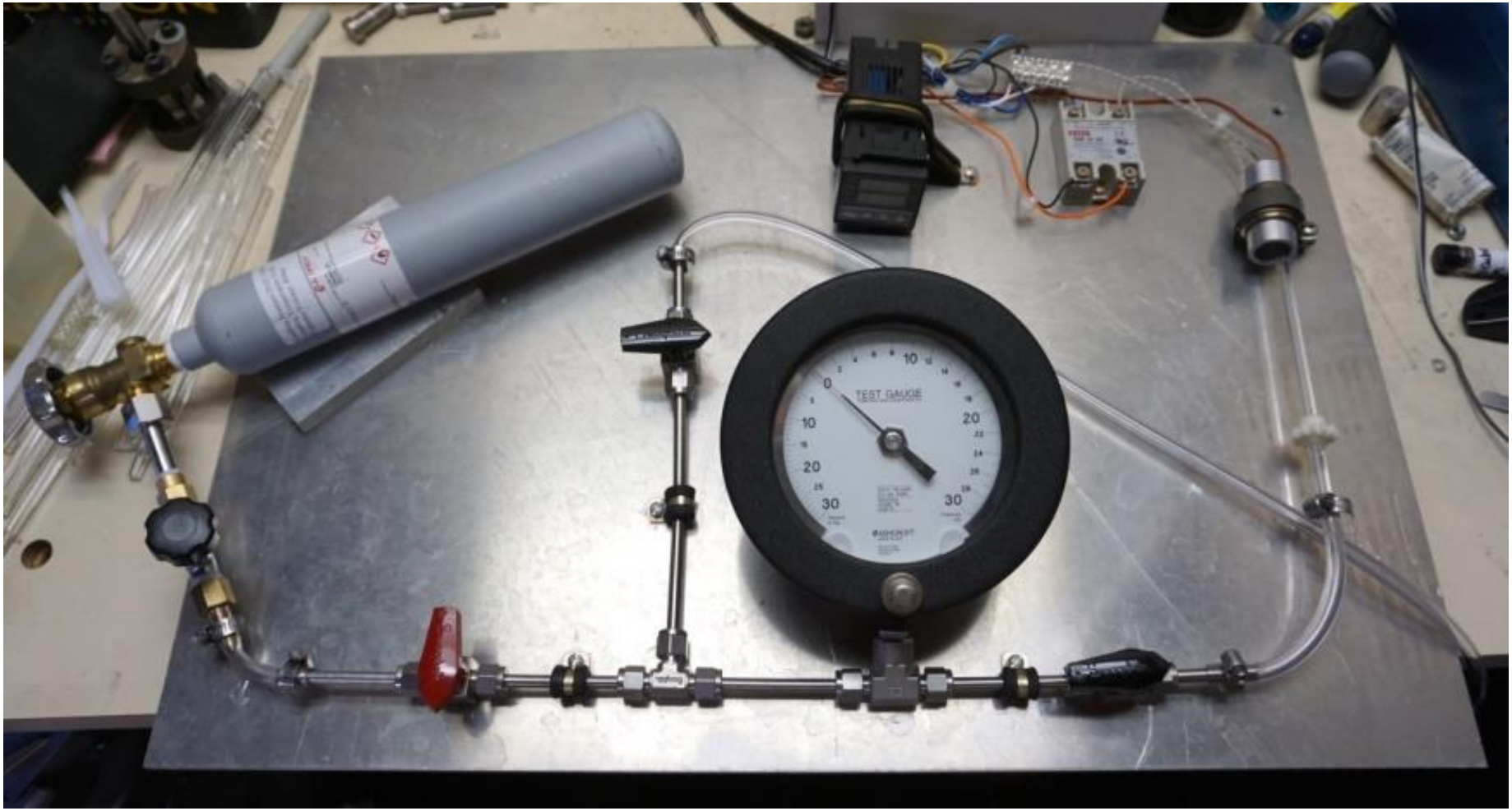
Provide stable operating condition at T+dT, servo controlling W1 and W2 to maintain that condition.



Differential Calorimeter Test System

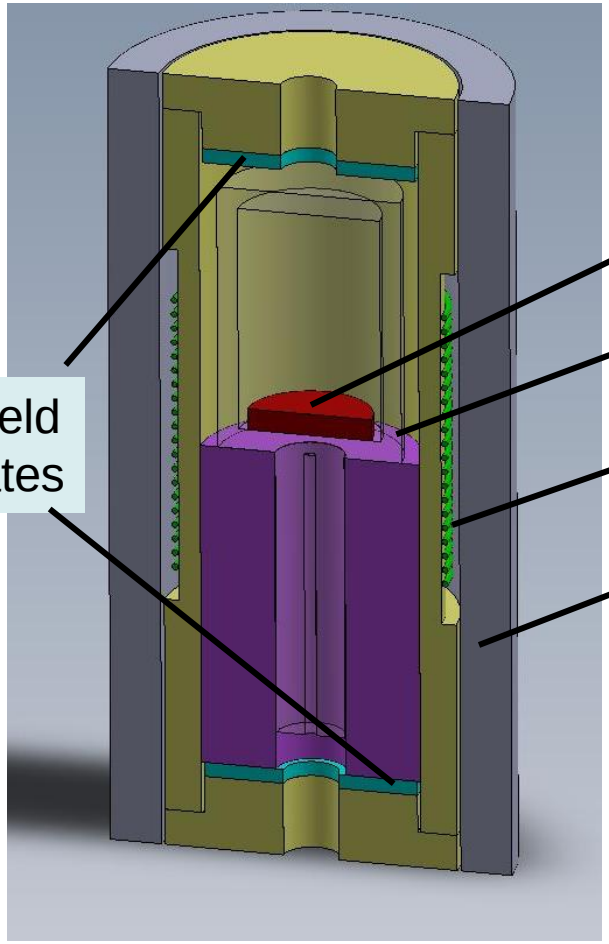
Engine test wafer enclosed in glass ampoule:

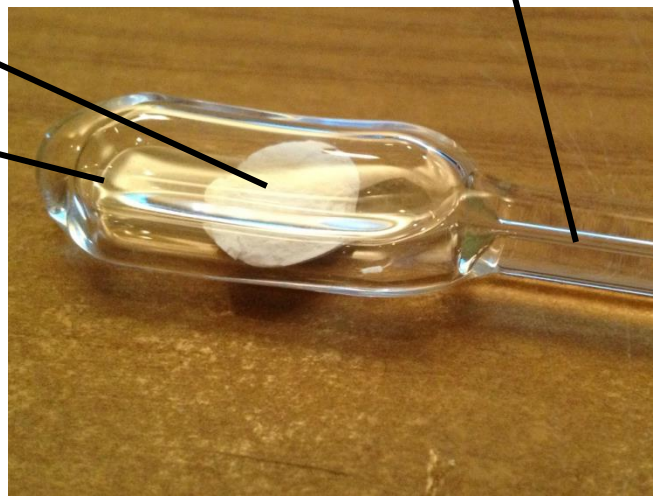
Fueling and Sealing Station



Engine ampoule in ceramic excitation holder:

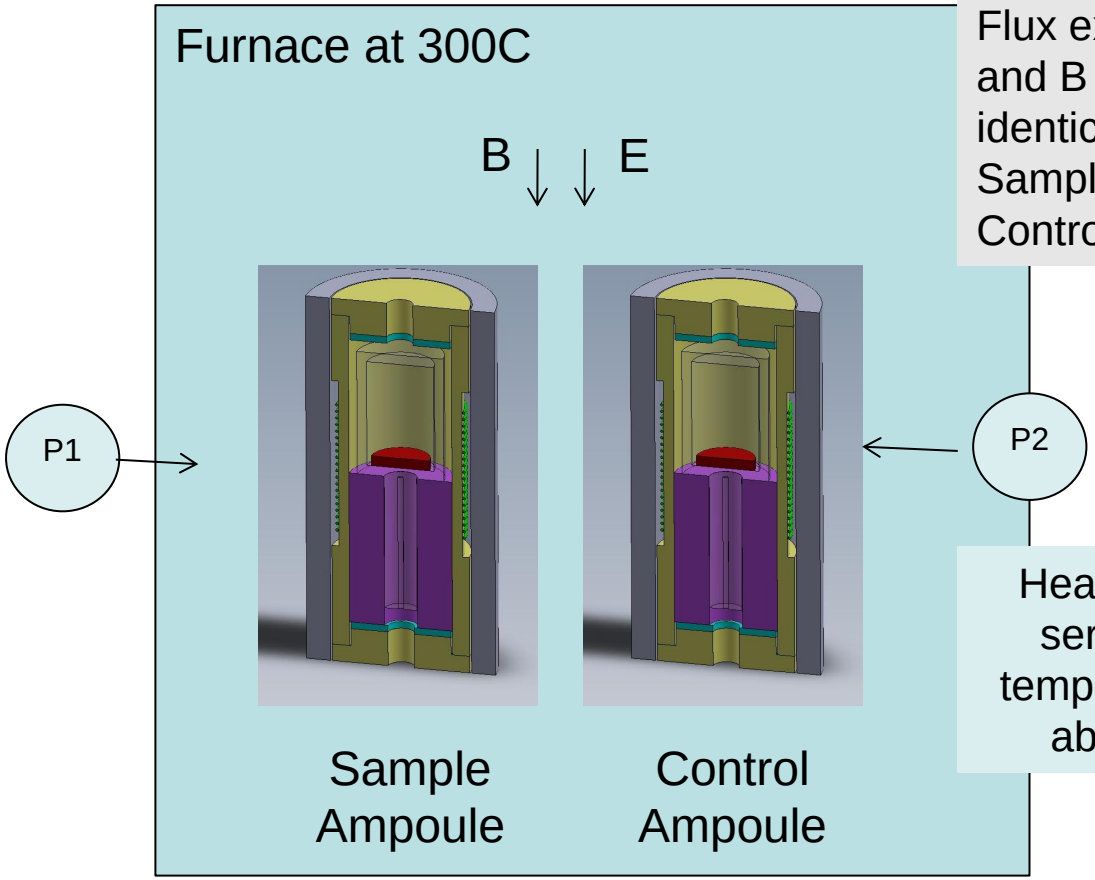
Quick Change Test Container and Sample Ampoule





The ampoule within the test container and the test container within the furnace may be swapped out quickly with minimal change to key variables.

Development Plan: Engineering Program Focus and Methodologies



Flux excitation E and B is applied identically to both Sample and Control

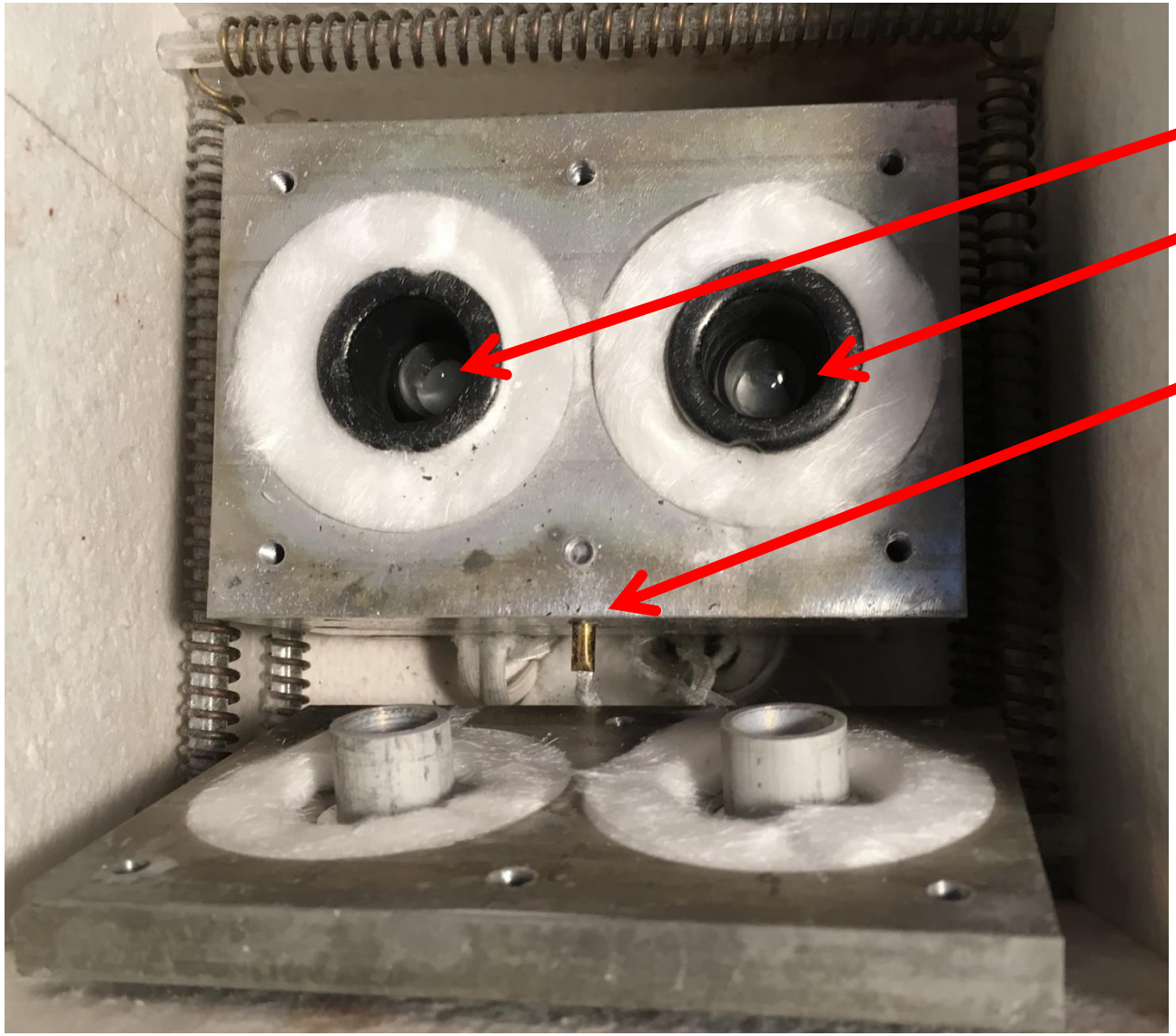
Heater power P1 and P2 is servoed to hold ampoule temperature at a constant dT above furnace ambient.

P2-P1 is a direct measure of anomalous power generated in Sample

DC Furnace

Furnace regulates to std 0.001C

Differential Calorimeter



Development Methodology

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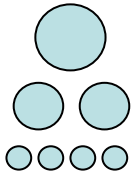
The Engine Development Program

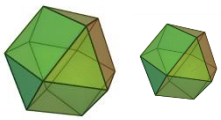
Manufacturing

Catalyst



Surface area increases as particle size decreases

Material



561 atoms 309

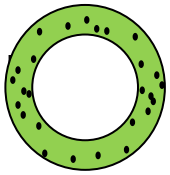
Nanoparticles are formed in preferential shapes

Mix/Mold Process

A proprietary process forms a ZrO2 slurry with isolated nanoparticles

And can be molded as a ceramic into any shape

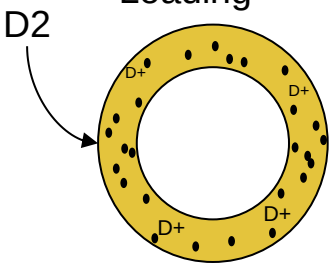
Matrix



Firing produces a hard stable engine body – toroid or wafer

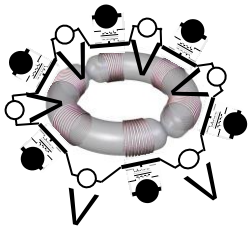
Testing

Loading



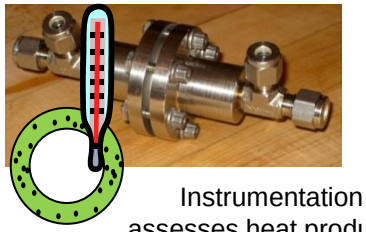
D2 ionizes to D+ as charge carrier

Flux



Impressed magnetic and electric fields induce reaction

Heat



Instrumentation assesses heat produced

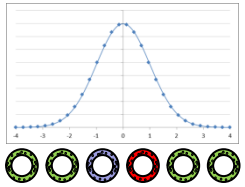
Selecting the optimal operating parameters requires over 2 million experiments

Optimizing

Fractional Factorial Analysis

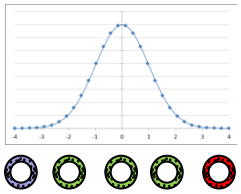
Reduces 2M experiments to less than 200

Rapid Ampoule Testing



Automated measurement and analysis for rapid cycle testing

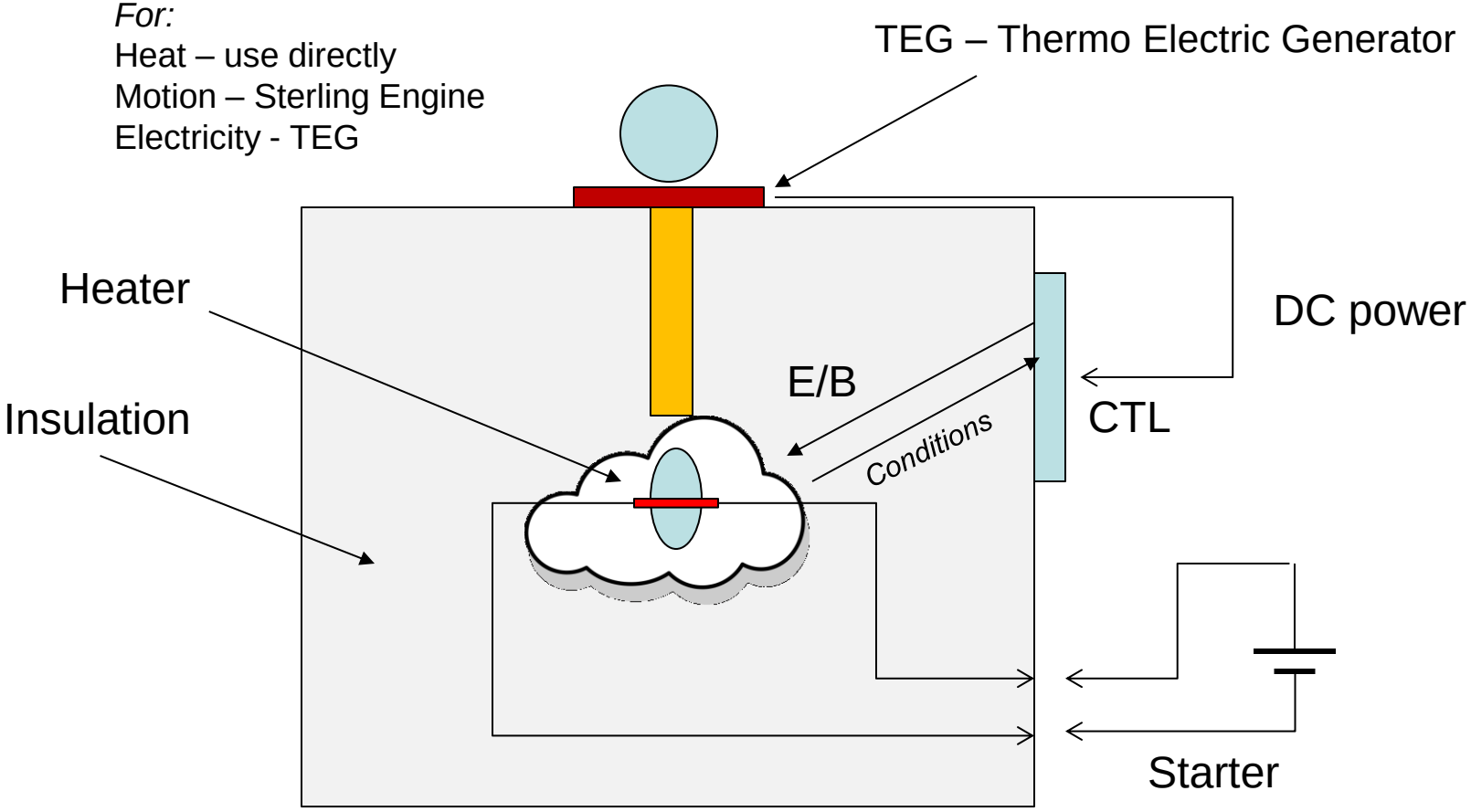
Selection



The Stand-alone Engine

Stand-alone Demo Engine Construction

For:
Heat – use directly
Motion – Sterling Engine
Electricity - TEG



End