KRONOS FUSION ENERGY · PHASE 2 COMPLETE · 2026-09-11

De-Risked · Benchmarked · Published

THE FULL COMPUTATIONAL PROGRAM — OPEN, PERMANENT, CITABLE

35	115	8	7
KODEX CODES	PAPERS · DOIS	BOOKS + AUDIOBOOKS	OPEN HOMES EACH

KODEX — the family of codes
35 benchmarked AI/ML surrogates, all live on 7 open homes

De-Risking Register
245 evidence gates across the breeder & both burners

Open to verify
physics, data and code open for anyone to reproduce

Papers
8 holistic foundation papers + 107 component-level — 115 with DOIs

Books, 3D model & toolkit
8 volumes + audiobooks · the public 3D model · KRONOS Toolkit

Intellectual property
filed & secured — confidential strategy held separately

◆ All intellectual property filed & secured · a family-owned American company · kronosfusionenergy.com

WHAT'S INSIDE

Contents

EVERYTHING WE PUBLISHED & PRODUCED

35 KODEX CODES

KHALO · UQ
KGATE · SAFE
KOIL · MAGNET
KFLOW · STATE
KMAT · MATERIALS
KYRO · TRANSPORT
KWARD · DISRUPT
KORE · EQUIL
KAIROS · CONTROL
KQUBIT · QML
KBREED · BREEDER
KBURN · BURNER
KISO · ISOTOPES
KFLUX · NEUTRONICS
KPATH · OPERATIONAL
KEYE · DIAG
KQROSS · QRE
KSENSE · QSENSE
KFUSE · MULTI-FIDELITY
KFORGE · INVERSE DESIGN
KFUEL · FUEL CYCLE
KDRIVE · RL CONTROL
KLAW · EQN DISCOVERY
KGEN · GENERATIVE
KPILOT · AGENTIC COPILOT
KECON · TECHNO-ECONOMICS
KHEAT · HEATING & CD
KTENSOR · TENSOR NETWORK
KEDGE · EDGE TRANSPORT
KRAD · RADIATION CONTROL
KQERN · QUANTUM KERNEL
KQOPT · QUANTUM OPTIMIZER
KDYN · QUANTUM DYNAMICS
KSEEK · ACTIVE LEARNING
KBENCH · BENCHMARK SUITE

115 PAPERS

8 foundation papers — the whole program, rewritten holistically (breeder, both burners, magnets, DEC, AI/quantum, the register).

107 component-level papers — the deep, gate-by-gate results behind them.

8 BOOKS + AUDIOBOOKS

The Fusion Energy Equations (2nd Ed.)
The Isotope Economy
To the Moon for Fuel
The Machine That Controls the Machine
Energy Is Water
The Forty-Dollar Electron
The Long Night
Energy Sovereignty and the End of Resource War

ALSO PUBLISHED

The Physics **De-Risking Register** — 245 evidence gates across the breeder & both burners · the public **3D machine model** · the **KRONOS Toolkit** physics engine · intellectual property **filed & secured**.

OPEN, MIRRORED, PERMANENT

Eight homes — nothing depends on a single platform

Zenodo
Permanent citable DOIs — codes + papers

Figshare
DOI mirror

PyPI
pip install kronos-fusion-ml

Internet Archive
Permanent public mirror

OSF
Open-science project (osf.io/bkcmy)

GitHub
KronosFE — source of record

Hugging Face
KrononosFE — models + datasets

Website
kronosfusionenergy.com/publications · /kodex

SECTION

KODEX — the Kronos Family of Codes

35 benchmarked AI/ML surrogates — package kronos-fusion-ml (import kronos_ml; K.get("NAME")). All 35 published with live DOIs across Zenodo · OSF · Figshare · GitHub · PyPI · Hugging Face · Internet Archive. Each honest about its limits.

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KHALO · UQ

Calibrated uncertainty on every prediction (GP + deep-ensemble)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694309

OSF https://osf.io/ne89y/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559447

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-khalo-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KGATE · SAFE

Trust-boundary / abstention gate — 0 escapes / 150k steps

Zenodo · DOI https://doi.org/10.5281/zenodo.22694297

OSF https://osf.io/mbu37/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559423

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kgate-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KOIL · MAGNET

Magnet-twin stress + quench precursor — flagship

Zenodo · DOI https://doi.org/10.5281/zenodo.22694323

OSF https://osf.io/2rb68/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559492

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-koil-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KFLOW · STATE

Twin full-state estimation (message-passing GNN)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694283

OSF https://osf.io/hjrzb/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559369

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kflow-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KMAT · MATERIALS

ML + DFT alloy / high-entropy-alloy screen (CHGNet)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694319

OSF https://osf.io/y4j2p/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559480

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kmat-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KYRO · TRANSPORT

CGYRO turbulence-transport surrogate (μ=400)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694348

OSF https://osf.io/5m6vu/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559582

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kyro-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KWARD · DISRUPT

Disruption early-warning — real MAST + twin, AUC .98

Zenodo · DOI https://doi.org/10.5281/zenodo.22694342

OSF https://osf.io/ugfpr/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559570

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kward-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KORE · EQUIL

Fast MHD-equilibrium accelerator (FNO / DeepONet)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694327

OSF https://osf.io/sxm5v/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559504

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kore-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KAIROS · CONTROL

Real-time closed-loop control (MPC) + safety clamp

Zenodo · DOI https://doi.org/10.5281/zenodo.22694265

OSF https://osf.io/db6uh/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33553966

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kairos-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KQUBIT · QML

Quantum-ML — honest, validated no-advantage this decade

Zenodo · DOI https://doi.org/10.5281/zenodo.22694336

OSF https://osf.io/eqr9z/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559546

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kqubit-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KBREED · BREEDER

Tritium breeding ratio / neutronics / isotope yield

Zenodo · DOI https://doi.org/10.5281/zenodo.22694267

OSF https://osf.io/2m3ce/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559312

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kbreed-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KBURN · BURNER

Net-power balance / dispatch / plant surrogate

Zenodo · DOI https://doi.org/10.5281/zenodo.22694269

OSF https://osf.io/8e6fn/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559324

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kburn-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KISO · ISOTOPES

Medical-isotope yields — Mo-99 / Tc-99m flagship

Zenodo · DOI https://doi.org/10.5281/zenodo.22694311

OSF https://osf.io/hjqek/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559459

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kiso-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KFLUX · NEUTRONICS

Shielding / activation / neutron-flux maps

Zenodo · DOI https://doi.org/10.5281/zenodo.22694287

OSF https://osf.io/fmjc2/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559378

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kflux-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KPATH · OPERATIONAL

Pulse-trajectory optimizer (ramp → flat-top → ramp)

Zenodo · DOI https://doi.org/10.5281/zenodo.22694329

OSF https://osf.io/fbcyw/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559513

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kpath-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KEYE · DIAG

Diagnostics / virtual-sensor / signal-validation observer

Zenodo · DOI https://doi.org/10.5281/zenodo.22694279

OSF https://osf.io/5qzp4/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559357

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-keye-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KQROSS · QRE

Fault-tolerant quantum resource estimator + crossover

Zenodo · DOI https://doi.org/10.5281/zenodo.22694333

OSF https://osf.io/zp82a/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559537

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kqross-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KSENSE · QSENSE

Quantum-sensor diagnostic — honest null gain

Zenodo · DOI https://doi.org/10.5281/zenodo.22694338

OSF https://osf.io/psr8h/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559558

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-ksense-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KFUSE · MULTI-FIDELITY

Fuses reduced twin + μ=400 CGYRO with fidelity-aware UQ

Zenodo · DOI https://doi.org/10.5281/zenodo.22694294

OSF https://osf.io/exhkc/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559414

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kfuse-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KFORGE · INVERSE DESIGN

Capstone optimizer — chains the whole fleet

Zenodo · DOI https://doi.org/10.5281/zenodo.22694289

OSF https://osf.io/5zg6j/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559390

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kforge-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KFUEL · FUEL CYCLE

Tritium fuel-cycle & inventory surrogate

Zenodo · DOI https://doi.org/10.5281/zenodo.22694291

OSF https://osf.io/xuz8a/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559402

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kfuel-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KDRIVE · RL CONTROL

Reinforcement-learning plasma controller

Zenodo · DOI https://doi.org/10.5281/zenodo.22694271

OSF https://osf.io/xhkuy/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559333

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kdrive-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KLAW · EQN DISCOVERY

Symbolic regression (SINDy-class) closures

Zenodo · DOI https://doi.org/10.5281/zenodo.22694315

OSF https://osf.io/kfp4t/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559468

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-klaw-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KGEN · GENERATIVE

Generative sampling of plausible states / fields

Zenodo · DOI https://doi.org/10.5281/zenodo.22694307

OSF https://osf.io/svbwq/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559435

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kgen-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KPILOT · AGENTIC COPILOT

Natural-language interface orchestrating the fleet

Zenodo · DOI https://doi.org/10.5281/zenodo.22694331

OSF https://osf.io/aqxe8/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559525

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kpilot-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KECON · TECHNO-ECONOMICS

Generic open LCOE — financial firewall, no Kronos numbers

Zenodo · DOI https://doi.org/10.5281/zenodo.22694273

OSF https://osf.io/b5qmx/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33559345

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kecon-v0.1.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KHEAT · HEATING & CD

RF/NBI current-drive actuator surrogate — driven current I_cd, R^2=0.949

Zenodo · DOI https://doi.org/10.5281/zenodo.22713395

OSF https://osf.io/9wu4t/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634294

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kheat-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KTENSOR · TENSOR NETWORK

Low-rank MPS ROM of the CGYRO flux — honest: only modestly compressible (rank ~2.93/4)

Zenodo · DOI https://doi.org/10.5281/zenodo.22713405

OSF https://osf.io/zfk6t/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634351

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-ktensor-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KEDGE · EDGE TRANSPORT

Divertor heat-flux → target temperature (q→T_surf R^2=1.0; CuCrZr ~13.5 MW / m^2)

Zenodo · DOI https://doi.org/10.5281/zenodo.22713393

OSF https://osf.io/s6cbz/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634282

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kedge-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KRAD · RADIATION CONTROL

Impurity-seeding radiation evaluator — Ar gives least core dilution at f_rad 0.58

Zenodo · DOI https://doi.org/10.5281/zenodo.22713401

OSF https://osf.io/5hfxr/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634330

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-krad-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KQERN · QUANTUM KERNEL

Real quantum kernel on MAST disruption — AUC 0.919 vs classical 0.929 (honest tie)

Zenodo · DOI https://doi.org/10.5281/zenodo.22713397

OSF https://osf.io/fj4cm/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634306

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kqern-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KQOPT · QUANTUM OPTIMIZER

Real QAOA design-QUBO — 100% of brute-force optimum (no speedup yet, ~8–10 yr out)

Zenodo · DOI https://doi.org/10.5281/zenodo.22713399

OSF https://osf.io/gae73/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634318

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kqopt-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KDYN · QUANTUM DYNAMICS

Real Trotterized TFIM dynamics — error 1.35→0.034 over 1→32 steps

Zenodo · DOI https://doi.org/10.5281/zenodo.22713391

OSF https://osf.io/8yhba/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634270

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kdyn-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KSEEK · ACTIVE LEARNING

Acquisition on KYRO's GP — proposes the next most-informative CGYRO run

Zenodo · DOI https://doi.org/10.5281/zenodo.22713403

OSF https://osf.io/5czek/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634342

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kseek-v0.2.0

PUBLISHED SURROGATE · LIVE ON 7 HOMES

KBENCH · BENCHMARK SUITE

Open citable fusion-ML benchmark — 3 tasks, real data + KODEX baselines

Zenodo · DOI https://doi.org/10.5281/zenodo.22713389

OSF https://osf.io/kdb7a/

Figshare · DOI https://doi.org/10.6084/m9.figshare.33634261

GitHub · kronos-ml https://github.com/KronosFE/kronos-ml

PyPI https://pypi.org/project/kronos-fusion-ml/

Hugging Face https://huggingface.co/KrononosFE/kronos-ml

Internet Archive https://archive.org/details/kronos-ml-kodex-kbench-v0.2.0

OPEN REPOSITORIES & PERMANENT HOMES

Every asset is mirrored and permanently archived

Zenodo — community
Archival records + permanent DOIs
https://zenodo.org/communities/kronos_fusion_energy

GitHub — organization
KronosFE — Publications, kronos-toolkit, kronos-ml
https://github.com/KronosFE

Hugging Face — datasets
KrononosFE — publications + books
https://huggingface.co/KrononosFE

Website — Publications
115 pages + live validators + audio
https://www.kronosfusionenergy.com/publications

OSF — project
Open-science project (papers + books)
https://osf.io/bkcmy/

PyPI — kronos-toolkit
pip install kronos-toolkit (Apache-2.0)
https://pypi.org/project/kronos-toolkit/

Software Heritage
Permanent source archive
https://archive.softwareheritage.org/browse/origin/?origin_url=https://github.com/KronosFE/kronos-toolkit

Website — Physics Validation
Live physics validation simulation
https://www.kronosfusionenergy.com/Physics_Validation_Simulation/

SECTION

Papers & Research

115 published papers — the full open scientific record. Each has its own page and permanent DOI.

PAPER 1.0 · OPEN ACCESS · PEER-REVIEWABLE

The Physics De-Risking Register: Gate-by-Gate Evidence, Independently Re-Run and Stamped, Across a Compact Spherical-Tokamak Breeder and Its D–^{3}He Tandem-Mirror Burners

The public physics de-risking paper: every design gate re-run and stamped across the breeder and burner (KRONOS Register v8, ~575 pp). The first Kronos publication and the evidence base the whole series references (R0). The 150 individual-analysis Zenodo deposits are its supporting-deposit set (o…

Zenodo · DOI https://doi.org/10.5281/zenodo.22645689

Web page https://www.kronosfusionenergy.com/publications/de-risking-register

Internet Archive https://archive.org/details/kronos-2026-de-risking-register

Narrated audio version available on the paper's web page.

PAPER 1.1 · OPEN ACCESS · PEER-REVIEWABLE

Hyperion as a Strategic-Materials Platform: Gain, Tritium Breeding, He-3 Co-Production, and 14 MeV Neutron Output from a Compact Spherical-Tokamak

The spherical-tokamak breeder as a strategic-materials platform: gain, tritium breeding, He-3 co-production, 14 MeV neutrons. Never framed via net electric power.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645691

Zenodo · v1 https://doi.org/10.5281/zenodo.21746157

Web page https://www.kronosfusionenergy.com/publications/breeder.html

Internet Archive https://archive.org/details/kronos-2026-breeder

Narrated audio version available on the paper's web page.

PAPER 1.2A · OPEN ACCESS · PEER-REVIEWABLE

The Aegis Forward-Base Burner: Q_E Closure, Plug Requirement, and Mirror Confinement in an Islanded Low-Neutron D–^{3}He Tandem Mirror

The Aegis defense burner: the low-neutron D–^{3}He tandem mirror as an islanded, forward-base power source — Q_E closing point, plug requirement, mirror confinement, and the defense product-fit.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645693

Zenodo · v1 https://doi.org/10.5281/zenodo.21746479

Web page https://www.kronosfusionenergy.com/publications/aegis-burner.html

Internet Archive https://archive.org/details/kronos-2026-aegis-burner

Narrated audio version available on the paper's web page.

PAPER 1.2B · OPEN ACCESS · PEER-REVIEWABLE

The MetroVolt Data-Center Burner: Direct-DC Campus Power, Q_E Closure, and the Plug Requirement in a Low-Neutron D–^{3}He Tandem Mirror

The MetroVolt data-center burner: the same low-neutron D–^{3}He tandem mirror delivered as direct-DC campus power — Q_E closing point, plug requirement, mirror confinement, and the data-center product-fit.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645695
Zenodo · v1 https://doi.org/10.5281/zenodo.21746479
Web page https://www.kronosfusionenergy.com/publications/metrovolt-burner.html
Internet Archive https://archive.org/details/kronos-2026-metrovolt-burner

Narrated audio version available on the paper's web page.

PAPER 1.3 · OPEN ACCESS · PEER-REVIEWABLE

The REBCO High-Field Superconductor Basis: Conductor, Winding, and the Field Envelope for the Breeder Centrepost and Burner Plug

The high-field superconductor basis: conductor, winding, the field envelope.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645697 **Zenodo · v1** https://doi.org/10.5281/zenodo.21842514

Web page https://www.kronosfusionenergy.com/publications/magnets.html **Internet Archive** https://archive.org/details/kronos-2026-magnets

Narrated audio version available on the paper's web page.

PAPER 1.4 · OPEN ACCESS · PEER-REVIEWABLE

Direct Energy Conversion for a D–^{3}He Tandem-Mirror Burner: Recovering Charged-Particle Power Directly Without a Thermal Cycle

Recovering charged-particle power directly — the converter class the burner needs.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645700

Zenodo · v1 https://doi.org/10.5281/zenodo.21842864

Web page https://www.kronosfusionenergy.com/publications/direct-energy-conversion.html

Internet Archive https://archive.org/details/kronos-2026-direct-energy-conversion

Narrated audio version available on the paper's web page.

PAPER 1.5 · OPEN ACCESS · PEER-REVIEWABLE

AI and Quantum Computing for Fusion: ML Surrogates, Real-Time Control, and a Resource-Honest Quantum Frontier

The computational methods layer: ML surrogates, control, quantum frontier — resource-honest.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645702

Zenodo · v1 https://doi.org/10.5281/zenodo.21842371

Web page https://www.kronosfusionenergy.com/publications/ai-quantum-control.html

Internet Archive https://archive.org/details/kronos-2026-ai-quantum-control

Narrated audio version available on the paper's web page.

PAPER 2.1 · OPEN ACCESS · PEER-REVIEWABLE

The Kronos Strategic-Materials Platform: An Integrated Spherical-Tokamak Breeder and D-3He Tandem-Mirror Burner Architecture with a Helium-3 Flywheel

The one robust package: breeder + Aegis + MetroVolt architecture, He-3 flywheel, and every honest gate, citing all companion papers.
Nuclear Fusion / IAEA-FEC flagship.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645764

Web page https://www.kronosfusionenergy.com/publications/integrated-platform-overview.html

Internet Archive https://archive.org/details/kronos-2026-integrated-platform-overview

Narrated audio version available on the paper's web page.

PAPER 2.2 · OPEN ACCESS · PEER-REVIEWABLE

An Advanced-Fuel Scorecard for D-T, D-D, D-3He and p-11B: Reactivity, Neutron Fraction and Direct-Conversion Trades Behind the Breeder and Burner Fuel Choices

A rigorous, honest cross-fuel comparison — reactivity, radiation, neutron fraction, and conversion — placing the breeder and burner fuels against the field.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645766

Web page https://www.kronosfusionenergy.com/publications/advanced-fuel-scorecard.html

Figshare https://doi.org/10.6084/m9.figshare.33471814

Internet Archive https://archive.org/details/kronos-2026-advanced-fuel-scorecard

Narrated audio version available on the paper's web page.

PAPER 2.3 · OPEN ACCESS · PEER-REVIEWABLE

The Medical-Isotope Mission of a Compact Spherical-Tokamak Breeder: Mo-99, Targeted-Alpha Emitters, and Byproduct Isotope Co-Production on a 14 MeV Neutron Source

What a high-flux 14 MeV platform enables — a fusion-materials-qualification facility, Mo-99 and targeted-alpha medical isotopes, He-3 for quantum and neutron detection (physics/throughput, no economics).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645762

Web page https://www.kronosfusionenergy.com/publications/isotopes-and-14-mev-applications.html

Internet Archive https://archive.org/details/kronos-2026-isotopes-and-14-mev-applications

Narrated audio version available on the paper's web page.

PAPER 2.4 · OPEN ACCESS · PEER-REVIEWABLE

Negative-Triangularity Turbulence Suppression in a Compact Spherical-Tokamak Breeder: Nonlinear Gyrokinetics of Ion- and Electron-Scale Quiescence at the Operating Point

Nonlinear CGYRO: negative triangularity suppresses ion-scale turbulence 40–45% and electron-scale (ETG) 79–80% vs positive triangularity; quiet, subcritical core; corroborated on TCV and DIII-D.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645722

Web page https://www.kronosfusionenergy.com/publications/negative-triangularity-confinement.html

Internet Archive https://archive.org/details/kronos-2026-negative-triangularity-confinement

Narrated audio version available on the paper's web page.

PAPER 2.5 · OPEN ACCESS · PEER-REVIEWABLE

Neoclassical Transport, Poloidal Flows, and Impurity Screening in a Compact Spherical-Tokamak Breeder: The Collisional Baseline Beneath Turbulent Transport

NEO neoclassical fluxes, poloidal rotation, and impurity screening at config 22021 — the collisional baseline beneath the turbulent transport.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645832

Web page https://www.kronosfusionenergy.com/publications/neoclassical-transport-poloidal-flows-and-impurity-scre.html

Internet Archive https://archive.org/details/kronos-2026-neoclassical-transport-poloidal-flows-and-impurity-scre

Narrated audio version available on the paper's web page.

PAPER 2.6 · OPEN ACCESS · PEER-REVIEWABLE

The Negative-Triangularity Edge: Heat-Flux Width, the ELM-Free Pedestal, and the Scrape-Off-Layer Boundary Condition for Power Handling in a Compact Spherical-Tokamak Breeder

The NT edge: λ_q heat-flux width, the no-ELM pedestal, and the SOL width that feeds the divertor exhaust (2.16) — the edge boundary condition for the whole power-handling chain.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645830

Web page https://www.kronosfusionenergy.com/publications/the-negative-triangularity-edge-heat-flux-width-the-elm.html

Internet Archive https://archive.org/details/kronos-2026-the-negative-triangularity-edge-heat-flux-width-the-elm

Narrated audio version available on the paper's web page.

PAPER 2.7 · OPEN ACCESS · PEER-REVIEWABLE

Free-Boundary Equilibrium and Ideal-MHD Stability of a Compact Spherical-Tokamak Breeder: Troyon, Mercier, Ballooning and External-Kink Margins with a Vertical-Stability Flag

β_N 2.13 with a 1.64× Troyon margin; Mercier- and ballooning-stable; external-kink margin 1.15–1.31×; κ=2.47 flagged for vertical-stability coupling.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645740

Web page https://www.kronosfusionenergy.com/publications/ideal-mhd-stability.html

Internet Archive https://archive.org/details/kronos-2026-ideal-mhd-stability

Narrated audio version available on the paper's web page.

PAPER 2.8 · OPEN ACCESS · PEER-REVIEWABLE

Vertical Stability at High Elongation: Displacement Growth Rates, Control-Coil Authority, and VDE Avoidance for a Compact Spherical-Tokamak Breeder

Vertical-displacement growth rate at κ=2.0, control-coil authority, and VDE avoidance — closing the vertical-stability coupling flagged in the equilibrium paper (2.15).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645834

Web page https://www.kronosfusionenergy.com/publications/vertical-stability-at-high-elongation-displacement-grow.html

Internet Archive https://archive.org/details/kronos-2026-vertical-stability-at-high-elongation-displacement-grow

Narrated audio version available on the paper's web page.

PAPER 2.9 · OPEN ACCESS · PEER-REVIEWABLE

Disruptions, Runaway-Electron Avalanche and Electromagnetic Loads in a Compact Spherical-Tokamak Breeder: The Design Case for Shattered-Pellet Mitigation

τ_CQ 7–19 ms, a SEVERE runaway-electron avalanche (E/E_c ~1128, ~70% Ip beam), halo current 35% of Ip → shattered-pellet mitigation is a hard design requirement.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645724

Web page https://www.kronosfusionenergy.com/publications/disruptions-and-runaway-electrons.html

Internet Archive https://archive.org/details/kronos-2026-disruptions-and-runaway-electrons

Narrated audio version available on the paper's web page.

PAPER 2.10 · OPEN ACCESS · PEER-REVIEWABLE

Fast-Ion and Alpha-Particle Confinement in a Compact Spherical-Tokamak Breeder: Sub-Percent Ripple Losses and First-Wall Loading from Orbit-Following Simulation

99.98% alpha confinement (ASCOT5, 10^5 markers); first-wall load 0.083 kW/m²; finite toroidal-field ripple keeps the loss sub-percent.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645729

Web page https://www.kronosfusionenergy.com/publications/alpha-fast-product-confinement.html

Internet Archive https://archive.org/details/kronos-2026-alpha-fast-product-confinement

Narrated audio version available on the paper's web page.

PAPER 2.11 · OPEN ACCESS · PEER-REVIEWABLE

Bootstrap-Aligned Steady-State Current Sustainment Without a Central Solenoid: NBCD, ECCD and LHCD for a Compact Spherical-Tokamak Breeder

How the breeder holds 9.66 MA (driven + bootstrap f_bs 0.155) without a solenoid; NBCD/ECCD/LHCD options and bootstrap alignment.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645758

Web page https://www.kronosfusionenergy.com/publications/current-drive-and-bootstrap.html

Figshare https://doi.org/10.6084/m9.figshare.33471733

Internet Archive https://archive.org/details/kronos-2026-current-drive-and-bootstrap

Narrated audio version available on the paper's web page.

PAPER 2.12 · OPEN ACCESS · PEER-REVIEWABLE

From Breakdown to Flat-Top: Solenoid-Free Startup and Disruption-Free Ramp Access for a Negative-Triangularity Spherical-Tokamak Breeder

The path from breakdown to the 9.66 MA operating point under negative triangularity; disruption-free ramp access.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645760

Web page https://www.kronosfusionenergy.com/publications/solenoid-free-startup.html

Internet Archive https://archive.org/details/kronos-2026-solenoid-free-startup

Narrated audio version available on the paper's web page.

PAPER 2.13 · OPEN ACCESS · PEER-REVIEWABLE

Toroidal Rotation, Flow-Shear Stabilization and Error-Field Correction in a Compact Spherical-Tokamak Breeder: Residual Transport and Locked-Mode Avoidance

Toroidal rotation, flow-shear stabilization and error-field / resonant-perturbation correction at config 22021 — the residual-transport and locked-mode-avoidance layer.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645907

Web page https://www.kronosfusionenergy.com/publications/toroidal-rotation-flow-shear-stabilization-and-error-fi.html

Internet Archive https://archive.org/details/kronos-2026-toroidal-rotation-flow-shear-stabilization-and-error-fi

Narrated audio version available on the paper's web page.

PAPER 2.14 · OPEN ACCESS · PEER-REVIEWABLE

The Greenwald-Fraction Density Limit and the Radiative Boundary: Mapping the Safe Operating Envelope of a Compact Spherical-Tokamak Breeder

Where the operating window ends: the Greenwald-fraction density limit, the radiative boundary and the safe-operating envelope around the config-22021 point.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645947

Web page https://www.kronosfusionenergy.com/publications/the-greenwald-fraction-density-limit-and-the-radiative-.html

Figshare https://doi.org/10.6084/m9.figshare.33471745

Internet Archive https://archive.org/details/kronos-2026-the-greenwald-fraction-density-limit-and-the-radiative

Narrated audio version available on the paper's web page.

PAPER 2.15 · OPEN ACCESS · PEER-REVIEWABLE

Peeling-Ballooning Access to the ELM-Free Pedestal at δ = −0.30: How Negative Triangularity Averts Transient Edge Loads in a Compact Spherical-Tokamak Breeder

Negative triangularity's structural advantage: an inherently ELM-free edge that removes the transient heat-pulse threat to the first wall, quantified for the δ = −0.30 breeder.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645949

Web page https://www.kronosfusionenergy.com/publications/peeling-ballooning-access-to-the-elm-free-pedestal-at-0.html

Internet Archive https://archive.org/details/kronos-2026-peeling-ballooning-access-to-the-elm-free-pedestal-at-0

Narrated audio version available on the paper's web page.

PAPER 2.16 · OPEN ACCESS · PEER-REVIEWABLE

The Consumable Centrepost: Coverage-versus-Protection Neutronics, Coil Integrity, and Fused Quench Detection for a Compact Spherical-Tokamak Breeder

Binding constraint is centrepost life, not breeding; TBR-vs-life trade curve (1.196→1.097 / 0.005→0.194 fpy); FEA within −4.75% of Lamé; fused quench detector fires +2.94 s ahead of voltage; RAMI availability 0.58–0.65 (honest).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645704

Web page https://www.kronosfusionenergy.com/publications/centrepost-and-magnet-integrity.html

Figshare https://doi.org/10.6084/m9.figshare.33471751

Internet Archive https://archive.org/details/kronos-2026-centrepost-and-magnet-integrity

Narrated audio version available on the paper's web page.

PAPER 2.17 · OPEN ACCESS · PEER-REVIEWABLE

REBCO Conductor and Stabilizer Materials Under Neutron Irradiation: The Un-Doped-Tape Rule, Graphene-Reinforced Stabilizers and V2O3 Self-Protection for a Spherical-Tokamak Breeder

HTS conductor materials-under-neutron-fluence: the un-doped-tape rule (beats APC/doped for fast-fluence life) + Jc-onset-knee screening; graphene-reinforced aluminum stabilizer; delamination-arresting graphene interlayer; V2O3 self-protecting quench interlayer. Distinct from the REBCO-design (1.3…

Zenodo · DOI https://doi.org/10.5281/zenodo.22645779

Web page https://www.kronosfusionenergy.com/publications/rebco-conductor-materials-under-irradiation.html

Figshare https://doi.org/10.6084/m9.figshare.33471757

Internet Archive https://archive.org/details/kronos-2026-rebco-conductor-materials-under-irradiation

Narrated audio version available on the paper's web page.

PAPER 2.18 · OPEN ACCESS · PEER-REVIEWABLE

First-Principles Radiation Tolerance of Centrepost REBCO in a Compact Spherical-Tokamak Breeder: Chain-Oxygen-Vacancy Formation by DFT+U and YBCO Displacement-Cascade Molecular Dynamics

First-principles radiation tolerance of the centrepost REBCO: chain-oxygen-vacancy formation by DFT+U and YBCO displacement-cascade molecular dynamics — the mechanism behind the tape's irradiation lifetime.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645923

Web page https://www.kronosfusionenergy.com/publications/first-principles-radiation-tolerance-of-centrepost-rebc.html

Figshare https://doi.org/10.6084/m9.figshare.33471760

Internet Archive https://archive.org/details/kronos-2026-first-principles-radiation-tolerance-of-centrepost-rebc

Narrated audio version available on the paper's web page.

PAPER 2.19 · OPEN ACCESS · PEER-REVIEWABLE

Fused Strain-Rate and Magnetization Quench Detection with In-Winding NV-Diamond Sensing for No-Insulation REBCO Breeder Magnets

The fused strain-rate + magnetization quench detector (+2.94 s lead) and the in-winding NV-diamond sensor as a standalone magnet-diagnostics paper; patents IP-L2/L3.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645752

Web page https://www.kronosfusionenergy.com/publications/quench-detection-and-nv-sensing.html

Internet Archive https://archive.org/details/kronos-2026-quench-detection-and-nv-sensing

Narrated audio version available on the paper's web page.

PAPER 2.20 · OPEN ACCESS · PEER-REVIEWABLE

Poloidal-Field Coil Set and Equilibrium-Current Optimization for a Compact Spherical-Tokamak Breeder: Shaping the Negative-Triangularity, Solenoid-Free Equilibrium with Vertical-Stability Authority

The breeder's poloidal-field coil set: coil-current optimization for the $\delta = -0.30$ shape at Ip 9.66 MA, vertical-stability authority at $\kappa = 2.0$, and the solenoid-free equilibrium.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645945

Web page https://www.kronosfusionenergy.com/publications/poloidal-field-coil-set-and-equilibrium-current-optimiz.html

Internet Archive https://archive.org/details/kronos-2026-poloidal-field-coil-set-and-equilibrium-current-optimiz

Narrated audio version available on the paper's web page.

PAPER 2.21 · OPEN ACCESS · PEER-REVIEWABLE

Engineering the 26.49 T Plug Coil of a D–^{3}He Tandem-Mirror Burner: Three-Dimensional Structural FEA, No-Insulation REBCO Quench Margin and Throat-Conductor Stress

The burner plug coil at 26.49 T: thick-wall → 3-D structural FEA, no-insulation REBCO quench margin, and throat-conductor stress — the magnet that sets the mirror ratio.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645915

Web page https://www.kronosfusionenergy.com/publications/engineering-the-26-49-t-plug-coil-of-a-d-he-tandem-mirr.html

Figshare https://doi.org/10.6084/m9.figshare.33471778

Internet Archive https://archive.org/details/kronos-2026-engineering-the-26-49-t-plug-coil-of-a-d-he-tandem-mirr

Narrated audio version available on the paper's web page.

PAPER 2.22 · OPEN ACCESS · PEER-REVIEWABLE

Vacuum-Vessel and Support Structural Mechanics Under Electromagnetic, Halo-Current, and Seismic Loads for a Compact Spherical-Tokamak Breeder

Vessel stress under electromagnetic and halo-current loads (halo ~35% of Ip), plus seismic — the structure that houses config 22021.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645838

Web page https://www.kronosfusionenergy.com/publications/vacuum-vessel-and-support-structural-mechanics-under-el.html

Figshare https://doi.org/10.6084/m9.figshare.33471781

Internet Archive https://archive.org/details/kronos-2026-vacuum-vessel-and-support-structural-mechanics-under-el

Narrated audio version available on the paper's web page.

PAPER 2.23 · OPEN ACCESS · PEER-REVIEWABLE

Cryogenics and the Cold-Mass Thermal Budget of a High-Field Spherical-Tokamak Breeder: Centrepost Heat Loads, Current Leads, and the 4.5 K Refrigeration Plant

The cryogenic load of the 16.84 T breeder centrepost and coil set, current leads, and the 4.5 K plant — the refrigeration backbone (shared with the He-3 cold-trap train).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645840

Web page https://www.kronosfusionenergy.com/publications/cryogenics-and-the-cold-mass-thermal-budget-of-a-high-f.html

Figshare https://doi.org/10.6084/m9.figshare.33471787

Internet Archive https://archive.org/details/kronos-2026-cryogenics-and-the-cold-mass-thermal-budget-of-a-high-f

Narrated audio version available on the paper's web page.

PAPER 2.24 · OPEN ACCESS · PEER-REVIEWABLE

From Tritium Consumer to Breeding Fleet: Net Blanket TBR and the Cross-Library Case for Multi-Unit Tritium Export from a Compact Spherical-Tokamak Breeder

Single unit is a tritium consumer (3-D net TBR 0.79); PbLi buys only +0.004 — export is a fleet story (~5–6 units for 3–4 kg/fpy). Cross-library 3-D TBR 1.18 reproduced (ENDF vs FENDL <0.3%).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645706

Web page https://www.kronosfusionenergy.com/publications/blanket-tritium-breeding-lever.html

Internet Archive https://archive.org/details/kronos-2026-blanket-tritium-breeding-lever

Narrated audio version available on the paper's web page.

PAPER 2.25 · OPEN ACCESS · PEER-REVIEWABLE

CAD-Faithful Neutronics for a Compact Spherical-Tokamak Breeder: STEP-to-DAGMC Monte-Carlo Transport Reproducing the 3-D Net Tritium-Breeding Ratio

Monte-Carlo neutron transport on the as-built CAD (STEP → DAGMC), reproducing the 3-D net TBR (1.12 single-null / 1.07 double-null) at fabrication fidelity.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645881

Web page https://www.kronosfusionenergy.com/publications/cad-faithful-neutronics-for-a-compact-spherical-tokamak.html

Internet Archive https://archive.org/details/kronos-2026-cad-faithful-neutronics-for-a-compact-spherical-tokamak

Narrated audio version available on the paper's web page.

PAPER 2.26 · OPEN ACCESS · PEER-REVIEWABLE

The Centrepost Life-Limiter: Fast-Fluence, dpa, and Shielding Setting the Cartridge-Replacement Cadence for a Compact Spherical-Tokamak Breeder

Fast-fluence + dpa scan and the cartridge cadence table; the life-limiter quantified. Burner-plug companion follows.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645708

Web page https://www.kronosfusionenergy.com/publications/centrepost-fluence-and-shielding.html

Figshare https://doi.org/10.6084/m9.figshare.33471796

Internet Archive https://archive.org/details/kronos-2026-centrepost-fluence-and-shielding

Narrated audio version available on the paper's web page.

PAPER 2.27 · OPEN ACCESS · PEER-REVIEWABLE

Nuclear-Data Uncertainty Quantification for Tritium Breeding: Which 14 MeV Cross-Section Channels Set the Error Bar on the Breeding Ratio

The credible error bar on the TBR: TALYS-vs-ENDF/B-VIII.0 at 14 MeV (NJOY21), 55–66% model spread on the load-bearing light channels vs ~15% on heavy structural — which channels must come from evaluated covariances.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645777

Web page https://www.kronosfusionenergy.com/publications/nuclear-data-uq-for-the-tbr.html

Internet Archive https://archive.org/details/kronos-2026-nuclear-data-uq-for-the-tbr

Narrated audio version available on the paper's web page.

PAPER 2.28 · OPEN ACCESS · PEER-REVIEWABLE

Neutron Streaming, Duct and Port Penetrations, and Occupational Dose Around a 14 MeV Compact Spherical-Tokamak Breeder

Duct and port streaming, shielding-dose maps, and occupational / emergency-planning-zone dose — the penetration problem around a 14 MeV source.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645842

Web page https://www.kronosfusionenergy.com/publications/neutron-streaming-duct-and-port-penetrations-and-occupa.html

Internet Archive https://archive.org/details/kronos-2026-neutron-streaming-duct-and-port-penetrations-and-occupa

Narrated audio version available on the paper's web page.

PAPER 2.29 · OPEN ACCESS · PEER-REVIEWABLE

Component Activation, Waste-Class Routing, and Decommissioning of a Low-Activation Compact Spherical-Tokamak Breeder: No Isotope Beyond a Century's Half-Life

Component activation inventory on the low-activation palette (no isotope with half-life > 100 yr), waste-class routing, and the decommissioning path — distinct from the accident case (2.21).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645846

Web page https://www.kronosfusionenergy.com/publications/component-activation-waste-class-routing-and-decommissi.html

Internet Archive https://archive.org/details/kronos-2026-component-activation-waste-class-routing-and-decommissi

Narrated audio version available on the paper's web page.

PAPER 2.30 · OPEN ACCESS · PEER-REVIEWABLE

First-Wall and Plasma-Facing-Component Lifetime Under 14 MeV Loading: Displacement Damage, Bubble Swelling and Erosion in a Compact Spherical-Tokamak Breeder

Displacement damage (~9.78 dpa/fpy), He/H bubble swelling, plasma-material sputtering/erosion, and hydrogenic permeation under 14 MeV loading — the "how long does the wall survive" question, on an independent SPECTRA-PKA / LAMMPS / Xolotl / RustBCA / FESTIM stack. Distinct from the activation/was…

Zenodo · DOI https://doi.org/10.5281/zenodo.22645774

Web page https://www.kronosfusionenergy.com/publications/first-wall-neutron-damage-lifetime.html

Internet Archive https://archive.org/details/kronos-2026-first-wall-neutron-damage-lifetime

Narrated audio version available on the paper's web page.

PAPER 2.31 · OPEN ACCESS · PEER-REVIEWABLE

Beryllium and $Be_{12}Ti$ Neutron Multipliers for a Compact Spherical-Tokamak Breeder: Pebble Performance, Activation, and Closing Net TBR ≥ 1.05

The neutron multiplier that lifts the TBR ladder (0.742 → 1.42): Be / $Be_{12}Ti$ pebble performance, activation and the multiplier's role in reaching net TBR ≥ 1.05.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645889

Web page https://www.kronosfusionenergy.com/publications/beryllium-and-be-ti-neutron-multipliers-for-a-compact-s.html

Internet Archive https://archive.org/details/kronos-2026-beryllium-and-be-ti-neutron-multipliers-for-a-compact-s

Narrated audio version available on the paper's web page.

PAPER 2.32 · OPEN ACCESS · PEER-REVIEWABLE

Breeding-Blanket and Neutron-Multiplier Concept Down-Select for a Compact Spherical-Tokamak Breeder: Ceramic versus Liquid-Metal Options Walking the TBR Ladder to Self-Sufficiency

The blanket concept selection: ceramic-breeder vs liquid-metal options and the beryllium / $Be_{12}Ti$ multiplier, walking the TBR ladder to net TBR ≥ 1.05 — the alternatives behind the chosen design.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645937

Web page https://www.kronosfusionenergy.com/publications/breeding-blanket-and-neutron-multiplier-concept-down-se.html

Internet Archive https://archive.org/details/kronos-2026-breeding-blanket-and-neutron-multiplier-concept-down-se

Narrated audio version available on the paper's web page.

PAPER 2.33 · OPEN ACCESS · PEER-REVIEWABLE

The Tritium Breeding Ladder for a Compact Spherical-Tokamak Breeder: Per-Unit Inventory, Doubling Time and the Fleet Path to Tritium Self-Sufficiency

The confirmed per-unit ladder 0.29 → 0.9 → ~2.0 kg-T/yr (net TBR 1.42 ceiling across 12 blanket configs); startup/equilibrium inventory, DIR loop, doubling time, fleet 3.6–4.5 kg/yr.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645746

Web page https://www.kronosfusionenergy.com/publications/tritium-fuel-cycle-and-breeding-ladder.html

Figshare https://doi.org/10.6084/m9.figshare.33471838

Internet Archive https://archive.org/details/kronos-2026-tritium-fuel-cycle-and-breeding-ladder

Narrated audio version available on the paper's web page.

PAPER 2.34 · OPEN ACCESS · PEER-REVIEWABLE

A Real-Time Tritium-Accountancy Twin for a Compact Spherical-Tokamak Breeder: In-Vessel Inventory, Retention, and Self-Sufficiency Bookkeeping

A live tritium-accountancy twin tracking in-vessel inventory, retention, and the Li-6 enrichment inventory — the bookkeeping behind self-sufficiency (net TBR ≥ 1.05, resolved in 3-D CAD).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645876

Web page https://www.kronosfusionenergy.com/publications/a-real-time-tritium-accountancy-twin-for-a-compact-sphe.html

Internet Archive https://archive.org/details/kronos-2026-a-real-time-tritium-accountancy-twin-for-a-compact-sphe

Narrated audio version available on the paper's web page.

PAPER 2.35 · OPEN ACCESS · PEER-REVIEWABLE

The D-3He Fuel Cycle Does Not Close Indigenously: Helium-3 Supply, the Lunar Gate on Burner-Scale Fuel, and the Breeder's Strategic Co-Product

The D–³He loop does not close indigenously (~192/105/45 breeders per burner); burner-scale He-3 is lunar-gated; the breeder's He-3 is a strategic co-product.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645734

Web page https://www.kronosfusionenergy.com/publications/helium-3-fuel-cycle.html

Internet Archive https://archive.org/details/kronos-2026-helium-3-fuel-cycle

Narrated audio version available on the paper's web page.

PAPER 2.36 · OPEN ACCESS · PEER-REVIEWABLE

A Neutronics and Activation Digital Twin with Rigorous-Two-Step Shutdown-Dose Mapping for a Compact Spherical-Tokamak Breeder

A neutronics / activation twin with rigorous-two-step shutdown-dose mapping — component activation and contact dose on the low-activation palette (no isotope with half-life > 100 yr).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645878

Web page https://www.kronosfusionenergy.com/publications/a-neutronics-and-activation-digital-twin-with-rigorous-.html

Internet Archive https://archive.org/details/kronos-2026-a-neutronics-and-activation-digital-twin-with-rigorous

Narrated audio version available on the paper's web page.

PAPER 2.37 · OPEN ACCESS · PEER-REVIEWABLE

A Stacked Detachment Portfolio for a Compact Spherical-Tokamak Breeder: Super-X, Double-Null and Snowflake Geometries that Cut the Required Argon Seed Fraction

Stacked Super-X × double-null × snowflake narrows the required argon seed from ~6.4% to a tolerable ~0.5% (1-D screening); the 2-D confirmation is the named next step.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645742

Web page https://www.kronosfusionenergy.com/publications/divertor-portfolio.html

Internet Archive https://archive.org/details/kronos-2026-divertor-portfolio

Narrated audio version available on the paper's web page.

PAPER 2.38 · OPEN ACCESS · PEER-REVIEWABLE

A Divertor-Exhaust Concept Down-Select for a Compact Spherical-Tokamak Breeder: Super-X, Snowflake, X-Point-Target, and Liquid-Metal Geometries Ranked by Peak Heat Flux and Detachment Window

Every divertor-exhaust option tested side by side: standard, Super-X, snowflake and X-point-target geometries plus the stacked / liquid-metal closure — peak heat flux, detachment window and the down-select, with all tested numbers.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645933

Web page https://www.kronosfusionenergy.com/publications/a-divertor-exhaust-concept-down-select-for-a-compact-sp.html

Internet Archive https://archive.org/details/kronos-2026-a-divertor-exhaust-concept-down-select-for-a-compact-sp

Narrated audio version available on the paper's web page.

PAPER 2.39 · OPEN ACCESS · PEER-REVIEWABLE

A Flowing-Lithium Vapor-Box Divertor with Molten-Salt In-Loop Tritium Extraction for a Compact Spherical-Tokamak Breeder

The flagship divertor invention (IP-L1): a flowing-Li vapor box with molten-salt in-loop tritium recovery; the top patent candidate to counsel.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645750

Web page https://www.kronosfusionenergy.com/publications/flowing-lithium-vapor-box-divertor.html

Internet Archive https://archive.org/details/kronos-2026-flowing-lithium-vapor-box-divertor

Narrated audio version available on the paper's web page.

PAPER 2.40 · OPEN ACCESS · PEER-REVIEWABLE

Real-Time Detachment Control for a Super-X Divertor in a Compact Spherical-Tokamak Breeder: Radiated-Power-Fraction Regulation with a Radiative-Collapse Guard

Real-time detachment control for the Super-X exhaust: strike-point sweeping, radiated-power-fraction regulation, and a radiative-collapse guard — the ~0.8% N-seed detachment point held under feedback.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645874

Web page https://www.kronosfusionenergy.com/publications/real-time-detachment-control-for-a-super-x-divertor-in-.html

Internet Archive https://archive.org/details/kronos-2026-real-time-detachment-control-for-a-super-x-divertor-in

Narrated audio version available on the paper's web page.

PAPER 2.41 · OPEN ACCESS · PEER-REVIEWABLE

Collisional-Radiative Impurity-Radiation Modeling for a Compact Spherical-Tokamak Breeder: Closing the Core and Edge Radiated-Power Budget

Collisional-radiative impurity radiation and the core / edge radiated-power budget — the radiation bookkeeping that closes the power balance.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645883

Web page https://www.kronosfusionenergy.com/publications/collisional-radiative-impurity-radiation-modeling-for-a.html

Internet Archive https://archive.org/details/kronos-2026-collisional-radiative-impurity-radiation-modeling-for-a

Narrated audio version available on the paper's web page.

PAPER 2.42 · OPEN ACCESS · PEER-REVIEWABLE

Plasma-Material Interaction in a Compact Spherical-Tokamak Breeder: Sputtering, Net Erosion, and Redeposition Setting the Plasma-Facing-Surface Lifetime

Sputtering, net erosion and redeposition on the plasma-facing surfaces under the config-22021 loads — the surface-lifetime companion to the neutron-damage (2.30) and thermomechanics (2.62) papers.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645885

Web page https://www.kronosfusionenergy.com/publications/plasma-material-interaction-in-a-compact-spherical-toka.html

Figshare https://doi.org/10.6084/m9.figshare.33471883

Internet Archive https://archive.org/details/kronos-2026-plasma-material-interaction-in-a-compact-spherical-toka

Narrated audio version available on the paper's web page.

PAPER 2.43 · OPEN ACCESS · PEER-REVIEWABLE

First-Wall Thermomechanics and Fatigue Life of Plasma-Facing Components Under Combined Surface and Volumetric Loading in a Compact Spherical-Tokamak Breeder

Cyclic thermal-stress and fatigue of the plasma-facing components under combined surface and volumetric loading — the mechanical-lifetime companion to the neutron-damage paper (2.30).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645850

Web page https://www.kronosfusionenergy.com/publications/first-wall-thermomechanics-and-fatigue-life-of-plasma-f.html

Figshare https://doi.org/10.6084/m9.figshare.33471889

Internet Archive https://archive.org/details/kronos-2026-first-wall-thermomechanics-and-fatigue-life-of-plasma-f

Narrated audio version available on the paper's web page.

PAPER 2.44 · OPEN ACCESS · PEER-REVIEWABLE

Blanket and Divertor Thermal-Hydraulics for a Compact Spherical-Tokamak Breeder: Coolant Heat Removal, Peak-Temperature Margins, and the Walk-Away Safety Case

Coolant heat removal, peak component temperatures, and pumping power for the breeding blanket and divertor at fabrication fidelity — the CFD behind the walk-away safety case.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645836

Web page https://www.kronosfusionenergy.com/publications/blanket-and-divertor-thermal-hydraulics-for-a-compact-s.html

Figshare https://doi.org/10.6084/m9.figshare.33471892

Internet Archive https://archive.org/details/kronos-2026-blanket-and-divertor-thermal-hydraulics-for-a-compact-s

Narrated audio version available on the paper's web page.

PAPER 2.45 · OPEN ACCESS · PEER-REVIEWABLE

Pellet Fueling, Particle Balance, and Helium-Ash Exhaust for Sustained Burn in a Compact Spherical-Tokamak Breeder

Pellet fueling to hold the operating density, helium-ash removal, and the particle balance that sustains the burn.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645848

Web page https://www.kronosfusionenergy.com/publications/pellet-fueling-particle-balance-and-helium-ash-exhaust-.html

Figshare https://doi.org/10.6084/m9.figshare.33471895

Internet Archive https://archive.org/details/kronos-2026-pellet-fueling-particle-balance-and-helium-ash-exhaust

Narrated audio version available on the paper's web page.

PAPER 2.46 · OPEN ACCESS · PEER-REVIEWABLE

First-Principles Near-Neutral Low-Activation Refractory Alloys for Fusion Plasma-Facing Components: Formation-Energy Screening and Entropy-Stabilized Composition-of-Matter Design

A first-principles family near-neutral in formation energy (+0.015 eV/atom, divergent Ta-free variants); composition-of-matter IP shifts to the design/processing method + entropy stabilization.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645744

Web page https://www.kronosfusionenergy.com/publications/low-activation-alloys.html

Internet Archive https://archive.org/details/kronos-2026-low-activation-alloys

Narrated audio version available on the paper's web page.

PAPER 2.47 · OPEN ACCESS · PEER-REVIEWABLE

A Radiation-Tolerant Refractory High-Entropy Alloy for Fusion Plasma-Facing Components: Microstructural Stability and a Scalable Processing Route

A refractory high-entropy palette (W-Ta-Mo-Nb-V-Cr) for first wall and divertor — entropy-stabilized and radiation-tolerant; the composition-of-matter and processing-method IP.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645868

Web page https://www.kronosfusionenergy.com/publications/a-radiation-tolerant-refractory-high-entropy-alloy-for-.html

Internet Archive https://archive.org/details/kronos-2026-a-radiation-tolerant-refractory-high-entropy-alloy-for

Narrated audio version available on the paper's web page.

PAPER 2.48 · OPEN ACCESS · PEER-REVIEWABLE

A Tantalum- and Rhenium-Free Low-Activation Alloy Family for First Wall, Divertor and Direct-Energy-Converter Electrodes: A First-Principles Composition-of-Matter Study

A Ta-free / Re-free low-activation alloy family for first wall, divertor and DEC electrode (DFT composition-of-matter), removing the long-lead / high-activation constituents.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645891

Web page https://www.kronosfusionenergy.com/publications/a-tantalum-and-rhenium-free-low-activation-alloy-family.html

Internet Archive https://archive.org/details/kronos-2026-a-tantalum-and-rhenium-free-low-activation-alloy-family

Narrated audio version available on the paper's web page.

PAPER 2.49 · OPEN ACCESS · PEER-REVIEWABLE

Qualifying Reduced-Activation Ferritic-Martensitic Steel for a Compact Spherical-Tokamak Breeder: Strength, DBTT Shift and Swelling under 14 MeV Neutron Loading

Reduced-activation ferritic-martensitic (EUROFER-class) steel for the structure: strength, DBTT shift and swelling under the 14 MeV load — the structural-alloy baseline.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645887

Web page https://www.kronosfusionenergy.com/publications/qualifying-reduced-activation-ferritic-martensitic-stee.html

Internet Archive https://archive.org/details/kronos-2026-qualifying-reduced-activation-ferritic-martensitic-stee

Narrated audio version available on the paper's web page.

PAPER 2.50 · OPEN ACCESS · PEER-REVIEWABLE

Tritium Permeation-Barrier Coatings for a Compact Spherical-Tokamak Breeder: The Liquid-Lithium-over-Tin Wall-Chemistry Choice

Permeation-barrier coatings for the structural wall plus the liquid-Li » Sn tritium-barrier finding, linking to the flowing-Li divertor chemistry (2.19).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645870

Web page https://www.kronosfusionenergy.com/publications/tritium-permeation-barrier-coatings-for-a-compact-spher.html

Internet Archive https://archive.org/details/kronos-2026-tritium-permeation-barrier-coatings-for-a-compact-spher

Narrated audio version available on the paper's web page.

PAPER 2.51 · OPEN ACCESS · PEER-REVIEWABLE

A Machine-Learning Interatomic-Potential to Activation-Transport Pipeline for Low-Activation Fusion Alloy Discovery: CHGNet Screening, DFT Confirmation, and OpenMC/FISPACT Down-Selection

The discovery method: universal-potential (CHGNet) relaxation screen of thousands of candidates → DFT confirmation → OpenMC / FISPACT activation down-select on a GPU fleet — the workflow that produced the low-activation alloy family (results paper stays 2.17).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645797

Web page https://www.kronosfusionenergy.com/publications/ml-potential-materials-discovery-pipeline.html

Figshare https://doi.org/10.6084/m9.figshare.33471931

Internet Archive https://archive.org/details/kronos-2026-ml-potential-materials-discovery-pipeline

Narrated audio version available on the paper's web page.

PAPER 2.52 · OPEN ACCESS · PEER-REVIEWABLE

Tandem-Mirror Design-Space Mapping for a D–^{3}He Burner: 0-D Power Balance Benchmarked against WHAM and the Pastukhov-Plug Operating Point

The burner's 0-D tandem-mirror power balance validated against the WHAM experiment and mapped across the net-gain database — the Pastukhov-plug Mode-M operating point that closes Q_E 1.318 at η_DEC 0.49.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645911

Web page https://www.kronosfusionenergy.com/publications/tandem-mirror-design-space-mapping-for-a-d-he-burner-0-.html

Figshare https://doi.org/10.6084/m9.figshare.33471934

Internet Archive https://archive.org/details/kronos-2026-tandem-mirror-design-space-mapping-for-a-d-he-burner-0

Narrated audio version available on the paper's web page.

PAPER 2.53 · OPEN ACCESS · PEER-REVIEWABLE

RF Alpha-Channeling in a D–^{3}He Tandem-Mirror Burner: Raising the Recoverable Charged-Particle Fraction from 8% Toward 80%

Raising the recoverable charged fraction with an RF scheme — the burner's efficiency lever.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645712

Web page https://www.kronosfusionenergy.com/publications/rf-alpha-channeling.html

Figshare https://doi.org/10.6084/m9.figshare.33471937

Internet Archive https://archive.org/details/kronos-2026-rf-alpha-channeling

Narrated audio version available on the paper's web page.

PAPER 2.54 · OPEN ACCESS · PEER-REVIEWABLE

Velocity-Space Microstability at the DCLC Knee: Warm-Fill Requirements and Residual AIC Activity in a D–^{3}He Tandem-Mirror Burner

The 6.25% warm fill sits on the knee — clears DCLC only if L_n/ϱ_i ≈ 25.3 (marginal, stated honestly); weak AIC residual persists in ES + EM solvers.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645714

Web page https://www.kronosfusionenergy.com/publications/dclc-loss-cone-microstability.html

Internet Archive https://archive.org/details/kronos-2026-dclc-loss-cone-microstability

Narrated audio version available on the paper's web page.

PAPER 2.55 · OPEN ACCESS · PEER-REVIEWABLE

Synchrotron Radiation Transport in a D-3He Tandem-Mirror Burner: Pinning the Electron Temperature at the Maximum-Q_E Operating Point

The radiation-dominated D–^{3}He burner: EC / synchrotron transport (AFJ vs Trubnikov vs optically-thin, ~2× model spread with wall reflection) pins Te at the maximum-QE temperature; size-dependent harmonic-cutoff design lever.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645772

Web page https://www.kronosfusionenergy.com/publications/synchrotron-radiation-transport.html

Internet Archive https://archive.org/details/kronos-2026-synchrotron-radiation-transport

Narrated audio version available on the paper's web page.

PAPER 2.56 · OPEN ACCESS · PEER-REVIEWABLE

ECH-Sustained Thermal-Barrier Decoupling in the D-3He Tandem-Mirror Plug: Hot-Electron and Sloshing-Ion Formation of the Ion-Confining Potential

The burner's cornerstone plug mechanism: electron-cyclotron-heated hot electrons + sloshing-ion depression sustain the ~249 keV ion-confining potential while decoupling recirculating-electron heating — the lever that lifts QE from ~1.3 toward 3–5. WHAM-scale retirement experiment.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645781

Web page https://www.kronosfusionenergy.com/publications/ech-thermal-barrier-decoupling.html

Figshare https://doi.org/10.6084/m9.figshare.33471952

Internet Archive https://archive.org/details/kronos-2026-ech-thermal-barrier-decoupling

Narrated audio version available on the paper's web page.

PAPER 2.57 · OPEN ACCESS · PEER-REVIEWABLE

Sloshing-Ion Ambipolar-Potential Formation in a D–^{3}He Tandem-Mirror Burner: The Density-Ratio–Potential Pareto and Non-Maxwellian Tail Control

How the tandem-mirror plug builds its confining potential: sloshing-ion distributions, the plug density-ratio↔potential Pareto at ratio 16, and non-Maxwellian tail control.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645913

Web page https://www.kronosfusionenergy.com/publications/sloshing-ion-ambipolar-potential-formation-in-a-d-he-ta.html

Internet Archive https://archive.org/details/kronos-2026-sloshing-ion-ambipolar-potential-formation-in-a-d-he-ta

Narrated audio version available on the paper's web page.

PAPER 2.58 · OPEN ACCESS · PEER-REVIEWABLE

Central-Cell Radial Transport and Interchange/Ballooning MHD Stability in a D-3He Tandem-Mirror Burner: The Sideways-Loss and Stability Gates

Central-cell radial losses and interchange / ballooning stability at f_n 5.44% — the sideways-loss and MHD gates for the burner core.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645854

Web page https://www.kronosfusionenergy.com/publications/central-cell-radial-transport-and-interchange-balloonin.html

Internet Archive https://archive.org/details/kronos-2026-central-cell-radial-transport-and-interchange-balloonin

Narrated audio version available on the paper's web page.

PAPER 2.59 · OPEN ACCESS · PEER-REVIEWABLE

End-Cell, Expander, and Halo Physics in a D-3He Tandem-Mirror Burner: The Mirror Ends That Set the Loss Budget

End-cell confinement, expander-region control, and halo-scraping for the D-^{3}He tandem mirror — the mirror ends that set the loss budget.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645852

Web page https://www.kronosfusionenergy.com/publications/end-cell-expander-and-halo-physics-in-a-d-3he-tandem-mi.html

Internet Archive https://archive.org/details/kronos-2026-end-cell-expander-and-halo-physics-in-a-d-3he-tandem-mi

Narrated audio version available on the paper's web page.

PAPER 2.60 · OPEN ACCESS · PEER-REVIEWABLE

Tandem-Mirror End-Cell and Plug Alternatives for a D–^{3}He Burner: Kinetic-Stabilizer End-Cells, the Mirror-Ratio–End-Loss Optimum, and Expander Flux-Expansion Trades

Tandem-mirror end-cell alternatives: the kinetic-stabilizer end-cell, the mirror-ratio↔end-loss optimum, and expander flux-expansion — the confinement-vs-loss trades for the burner ends.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645939

Web page https://www.kronosfusionenergy.com/publications/tandem-mirror-end-cell-and-plug-alternatives-for-a-d-he.html

Figshare https://doi.org/10.6084/m9.figshare.33471982

Internet Archive https://archive.org/details/kronos-2026-tandem-mirror-end-cell-and-plug-alternatives-for-a-d-he

Narrated audio version available on the paper's web page.

PAPER 2.61 · OPEN ACCESS · PEER-REVIEWABLE

Recirculation-Resolved Q_E Closure in a D-^{3}He Tandem-Mirror Burner: The Synchrotron-Limited Operating Point and the Carried-Open Plug Gate

The end-to-end Q_E 1.318 closure: charged-power budget, recirculation, and the maximum-Q_E operating temperature pinned by synchrotron transport (2.29); the plug gate carried open.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645860

Web page https://www.kronosfusionenergy.com/publications/recirculation-resolved-q-e-closure-in-a-d-he-tandem-mir.html

Figshare https://doi.org/10.6084/m9.figshare.33471991

Internet Archive https://archive.org/details/kronos-2026-recirculation-resolved-q-e-closure-in-a-d-he-tandem-mir

Narrated audio version available on the paper's web page.

PAPER 2.62 · OPEN ACCESS · PEER-REVIEWABLE

The Neutron-Lean Siting Case for a D–^{3}He Tandem-Mirror Burner: Parasitic D–D/D–T Neutron Budgets, Shielded Housing Dose, and Tritium-Suppressed Operation for Defense and Urban Deployment

The D–^{3}He burner's distinctive low-neutron signature: the D-D/D-T neutron split, housing dose outside a 1–3 m shield, and tritium-suppressed operation — the basis for defense and urban siting.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645917

Web page https://www.kronosfusionenergy.com/publications/the-neutron-lean-siting-case-for-a-d-he-tandem-mirror-b.html

Figshare https://doi.org/10.6084/m9.figshare.33471994

Internet Archive https://archive.org/details/kronos-2026-the-neutron-lean-siting-case-for-a-d-he-tandem-mirror-b

Narrated audio version available on the paper's web page.

PAPER 2.63 · OPEN ACCESS · PEER-REVIEWABLE

Direct-Energy-Converter Collector Physics in a D-^{3}He Tandem-Mirror Burner: Multi-Stage Deceleration, Secondary Emission, and the Space-Charge-Limited Grid Optimum

The DEC collector and decelerating grids at η 0.49: multi-stage collection, secondary-emission and space-charge limits — the converter physics behind the power story.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645858

Web page https://www.kronosfusionenergy.com/publications/direct-energy-converter-collector-physics-in-a-d-he-tan.html

Internet Archive https://archive.org/details/kronos-2026-direct-energy-converter-collector-physics-in-a-d-he-tan

Narrated audio version available on the paper's web page.

PAPER 2.64 · OPEN ACCESS · PEER-REVIEWABLE

Direct-Energy-Converter Architectures for a D–^{3}He Tandem-Mirror Burner: Venetian-Blind, Traveling-Wave, and Periodic-Electrostatic-Plug Collectors Compared on Efficiency, Grid Erosion, and Lifetime

Direct-energy-converter architectures compared: multi-stage Venetian-blind, traveling-wave and periodic-electrostatic-plug collectors — efficiency, grid erosion and lifetime, against the module-level 0.70 validation.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645935

Web page https://www.kronosfusionenergy.com/publications/direct-energy-converter-architectures-for-a-d-he-tandem.html

Internet Archive https://archive.org/details/kronos-2026-direct-energy-converter-architectures-for-a-d-he-tandem

Narrated audio version available on the paper's web page.

PAPER 2.65 · OPEN ACCESS · PEER-REVIEWABLE

Islanded Forward-Base Operation of the Aegis D-^{3}He Tandem-Mirror Burner: Black-Start, Microgrid Load-Following, and the Lunar-Gated He-3 Symbiosis

Black-start, load-following a base microgrid, and fuel autonomy for the fixed defense installation; the He-3 symbiosis carried honestly — the D-^{3}He loop does not close indigenously (fleet / lunar-gated).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645862

Web page https://www.kronosfusionenergy.com/publications/islanded-forward-base-operation-of-the-aegis-d-he-tande.html

Figshare https://doi.org/10.6084/m9.figshare.33472009

Internet Archive https://archive.org/details/kronos-2026-islanded-forward-base-operation-of-the-aegis-d-he-tande

Narrated audio version available on the paper's web page.

PAPER 2.66 · OPEN ACCESS · PEER-REVIEWABLE

Data-Center Integration of a D–^{3}He Tandem-Mirror Burner: Four-Nines Uptime Against Plasma Transients, the PUE-Reduction Pathway, and Waste-Heat Reuse for Behind-the-Meter Dispatch

MetroVolt as a data-center utility: four-nines uptime against plasma transients, the PUE 1.35→1.17 pathway, waste-heat → cooling reuse, and behind-the-meter dispatch.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645919

Web page https://www.kronosfusionenergy.com/publications/data-center-integration-of-a-d-he-tandem-mirror-burner-.html

Figshare https://doi.org/10.6084/m9.figshare.33472012

Internet Archive https://archive.org/details/kronos-2026-data-center-integration-of-a-d-he-tandem-mirror-burner

Narrated audio version available on the paper's web page.

PAPER 2.67 · OPEN ACCESS · PEER-REVIEWABLE

The Direct-Energy-Converter-to-Load Interface in a D-3He Tandem-Mirror Data-Center Burner: An HVDC-Native Power-Electronics Path with Millisecond Load-Following

The direct-energy converter as an intrinsically HVDC-native source (~54% DC at 50–250 kV, no synchronous generator) reaching an 800 VDC bus in 2–3 stages; ms-class electronic load-following vs plasma throttling (gross/net amplifier 4.14). Physics / power-electronics only; siting / PUE / SLA stay …

Zenodo · DOI https://doi.org/10.5281/zenodo.22645783

Web page https://www.kronosfusionenergy.com/publications/metrovolt-hvdc-native-power-interface.html

Figshare https://doi.org/10.6084/m9.figshare.33472015

Internet Archive https://archive.org/details/kronos-2026-metrovolt-hvdc-native-power-interface

Narrated audio version available on the paper's web page.

PAPER 2.68 · OPEN ACCESS · PEER-REVIEWABLE

Power-Delivery Topologies for a D–^{3}He Tandem-Mirror Data-Center Burner: Solid-State-Transformer versus Direct-DC Conversion, Grid-Forming Control, and DC-Bus Fault-Ride-Through

Power-delivery alternatives for the data-center burner: solid-state-transformer vs DEC-direct DC, grid-forming vs grid-following control, and DC-bus fault-ride-through — the topology down-select.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645941

Web page https://www.kronosfusionenergy.com/publications/power-delivery-topologies-for-a-d-he-tandem-mirror-data.html

Internet Archive https://archive.org/details/kronos-2026-power-delivery-topologies-for-a-d-he-tandem-mirror-data

Narrated audio version available on the paper's web page.

PAPER 2.69 · OPEN ACCESS · PEER-REVIEWABLE

A Certified Control-Barrier Safety Filter for Fusion Control: Forward-Invariance Guarantees, Calibrated Uncertainty, and an Honest PINN Negative for a Compact Spherical-Tokamak Breeder

Control-barrier safety filter: 0 / 5000 safe-set escapes vs 5000/5000 without, with an analytic forward-invariance proof; plus BO/UQ calibration, quench-RUL twin, and the honest PINN miss (kept).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645716

Web page https://www.kronosfusionenergy.com/publications/control-barrier-safety-clamp.html

Internet Archive https://archive.org/details/kronos-2026-control-barrier-safety-clamp

Narrated audio version available on the paper's web page.

PAPER 2.70 · OPEN ACCESS · PEER-REVIEWABLE

Maturity-Gated Actuation Authority: Binding PCMM Verification Credibility to Runtime Control Authority in an Autonomous Fusion Control Stack

Couples the V&V credibility score (PCMM maturity) to how much authority a controller / AI is permitted at runtime — a novel bridge between verification maturity and control authority, in neither the CBF-clamp nor the V&V paper.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645795

Web page https://www.kronosfusionenergy.com/publications/maturity-gated-actuation-authority.html

Internet Archive https://archive.org/details/kronos-2026-maturity-gated-actuation-authority

Narrated audio version available on the paper's web page.

PAPER 2.71 · OPEN ACCESS · PEER-REVIEWABLE

Sub-Millisecond Neural Equilibrium Reconstruction Robust to Sensor Dropout: A Virtual-Sensor Mesh for Radiation-Degraded Diagnostics in a Compact Spherical-Tokamak Breeder

A sub-ms neural equilibrium solver with tomographic / bolometer / Thomson / interferometer inversion and a virtual-sensor mesh that holds reconstruction through radiation-degraded or dropped diagnostics.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645801

Web page https://www.kronosfusionenergy.com/publications/sub-millisecond-neural-equilibrium-reconstruction-robus.html

Internet Archive https://archive.org/details/kronos-2026-sub-millisecond-neural-equilibrium-reconstruction-robus

Narrated audio version available on the paper's web page.

PAPER 2.72 · OPEN ACCESS · PEER-REVIEWABLE

Neural-Operator Flux Surrogates for Control-Latency Transport: Differentiable DeepONet-FNO Emulation of Nonlinear Gyrokinetics with Manifold-Abstention Monitoring

A NeuralCGYRO / DeepONet-FNO flux operator emulating nonlinear gyrokinetics at control latency, differentiable end-to-end, with a surrogate-error monitor that abstains when it leaves the trained manifold.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645803

Web page https://www.kronosfusionenergy.com/publications/neural-operator-flux-surrogates-for-control-latency-tra.html

Figshare https://doi.org/10.6084/m9.figshare.33472051

Internet Archive https://archive.org/details/kronos-2026-neural-operator-flux-surrogates-for-control-latency-tra

Narrated audio version available on the paper's web page.

PAPER 2.73 · OPEN ACCESS · PEER-REVIEWABLE

Four Coupled Digital Twins for a Compact Spherical-Tokamak Breeder: Multi-Rate Co-Simulation, Propagated Uncertainty, and a Real-Time Self-Consistency Monitor

Real-time per-subsystem twins with multi-rate co-simulation, propagated uncertainty, and a self-consistency monitor; the shadow that runs beside config 22021 (Q 3.076, 85.04 MW, 9.66 MA).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645805

Web page https://www.kronosfusionenergy.com/publications/four-coupled-digital-twins-for-a-compact-spherical-toka.html

Internet Archive https://archive.org/details/kronos-2026-four-coupled-digital-twins-for-a-compact-spherical-toka

Narrated audio version available on the paper's web page.

PAPER 2.74 · OPEN ACCESS · PEER-REVIEWABLE

Model-Predictive Burn Control Inside a Certified Safe Envelope: A Reference-Governor MPC Bounded by a Control-Barrier-Function Safety Clamp

A 50-100 ms predictive burn controller bounded by the CBF safety clamp (0/5000 safe-set escapes), with a reference governor and actuator-saturation manager; distinct from the clamp proof (2.7).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645807

Web page https://www.kronosfusionenergy.com/publications/model-predictive-burn-control-inside-a-certified-safe-e.html

Internet Archive https://archive.org/details/kronos-2026-model-predictive-burn-control-inside-a-certified-safe-e

Narrated audio version available on the paper's web page.

PAPER 2.75 · OPEN ACCESS · PEER-REVIEWABLE

A Real-Time Control Suite for a Compact Negative-Triangularity Spherical-Tokamak Breeder: Profile, Shape, Vertical-Stability, q-Profile, and Solenoid-Free Ramp Controllers

The tokamak control-feature family for a compact negative-triangularity ST holding 9.66 MA: profile / shape / vertical-stability / q-profile / ramp controllers; κ=2.0 vertical-stability coupling carried as an open flag.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645809

Web page https://www.kronosfusionenergy.com/publications/a-real-time-control-suite-for-a-compact-negative-triang.html

Internet Archive https://archive.org/details/kronos-2026-a-real-time-control-suite-for-a-compact-negative-triang

Narrated audio version available on the paper's web page.

PAPER 2.76 · OPEN ACCESS · PEER-REVIEWABLE

A Real-Time Control Suite for a D-3He Tandem-Mirror Burner: Plug-Potential, Sloshing-Ion, DCLC/AIC-Microstability, and Direct-Energy-Converter Dispatch Controllers

The tandem-mirror control family: mirror-plug-potential, sloshing-ion, DCLC / AIC-microstability and DEC-dispatch controllers plus ms-class electronic load-following for the 26.49 T-plug burner (Q_E 1.318).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645811

Web page https://www.kronosfusionenergy.com/publications/a-real-time-control-suite-for-a-d-3he-tandem-mirror-bur.html

Internet Archive https://archive.org/details/kronos-2026-a-real-time-control-suite-for-a-d-3he-tandem-mirror-bur

Narrated audio version available on the paper's web page.

PAPER 2.77 · OPEN ACCESS · PEER-REVIEWABLE

Calibrated Uncertainty, Conformal Prediction, and Abstention for Safety-Critical Fusion Control: Handing Authority Back to a Deterministic Floor Out of Distribution

Every model output carries a calibrated interval; conformal wrappers plus abstain-on-out-of-distribution hand authority back to the deterministic floor — the credibility layer under the AI.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645813

Web page https://www.kronosfusionenergy.com/publications/calibrated-uncertainty-conformal-prediction-and-abstent.html

Internet Archive https://archive.org/details/kronos-2026-calibrated-uncertainty-conformal-prediction-and-abstent

Narrated audio version available on the paper's web page.

PAPER 2.78 · OPEN ACCESS · PEER-REVIEWABLE

Runtime Assurance with Signed-Ledger Provenance for Autonomous Fusion Control: A Zero-Trust, Hardware-Failsafe Last Line of Defense Beneath the AI

A runtime-assurance monitor with a signed decision ledger and a hardware failsafe beneath the AI — the last line of defense is not AI; zero-trust boundary with a data diode.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645817

Web page https://www.kronosfusionenergy.com/publications/runtime-assurance-with-signed-ledger-provenance-for-aut.html

Internet Archive https://archive.org/details/kronos-2026-runtime-assurance-with-signed-ledger-provenance-for-aut

Narrated audio version available on the paper's web page.

PAPER 2.79 · OPEN ACCESS · PEER-REVIEWABLE

Out-of-Distribution Detection and Epistemic Gating for Autonomous Fusion Control: A Machine-Readable Extrapolation Ledger That Throttles Model Authority Beyond the Validated Envelope

OOD / regime detection plus a machine-readable extrapolation ledger that throttles model authority the moment the machine leaves the validated envelope.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645819

Web page https://www.kronosfusionenergy.com/publications/out-of-distribution-detection-and-epistemic-gating-for-.html

Internet Archive https://archive.org/details/kronos-2026-out-of-distribution-detection-and-epistemic-gating-for

Narrated audio version available on the paper's web page.

PAPER 2.80 · OPEN ACCESS · PEER-REVIEWABLE

Cross-Machine Transfer Learning for a Compact Spherical-Tokamak Breeder: A Disruption Model Pre-Trained on TCV, DIII-D, and NSTX with Honest Transfer Uncertainty

Pre-training on public-tokamak data (TCV / DIII-D / NSTX) then transferring to config 22021; a cross-machine disruption model that carries its own transfer-uncertainty honestly.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645821

Web page https://www.kronosfusionenergy.com/publications/cross-machine-transfer-learning-for-a-compact-spherical.html

Internet Archive https://archive.org/details/kronos-2026-cross-machine-transfer-learning-for-a-compact-spherical

Narrated audio version available on the paper's web page.

PAPER 2.81 · OPEN ACCESS · PEER-REVIEWABLE

Safe Reinforcement Learning from Operator Feedback for Fusion Control: Imitation and Policy Exploration Confined to a Control-Barrier-Certified Safe Set

Imitation / RL from the digital operator logbook, explored only inside the CBF-certified safe set — no exploration outside the proven envelope.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645823

Web page https://www.kronosfusionenergy.com/publications/safe-reinforcement-learning-from-operator-feedback-for-.html

Internet Archive https://archive.org/details/kronos-2026-safe-reinforcement-learning-from-operator-feedback-for

Narrated audio version available on the paper's web page.

PAPER 2.82 · OPEN ACCESS · PEER-REVIEWABLE

Causal Intervention Models for Regulator-Facing Plasma Control: Do-Calculus Prediction and Per-Decision Explainability in a Compact Spherical-Tokamak Breeder

do-calculus models that predict interventions rather than correlations, with per-decision explainability for a regulator-facing control stack.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645825

Web page https://www.kronosfusionenergy.com/publications/causal-intervention-models-for-regulator-facing-plasma-.html

Internet Archive https://archive.org/details/kronos-2026-causal-intervention-models-for-regulator-facing-plasma

Narrated audio version available on the paper's web page.

PAPER 2.83 · OPEN ACCESS · PEER-REVIEWABLE

MLOps for a Safety-Critical Fusion Control Stack: Versioned Lineage, Gated Model Promotion, and Physics-Balanced Multi-GPU Training for a Compact Spherical-Tokamak Breeder

The reproducibility backbone: data-versioning and lineage, gated model promotion, canary deployment, and multi-GPU training orchestration on the NVIDIA GPU HPC campaign, with physics-loss balancing.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645827

Web page https://www.kronosfusionenergy.com/publications/mlops-for-a-safety-critical-fusion-control-stack-versio.html

Internet Archive https://archive.org/details/kronos-2026-mlops-for-a-safety-critical-fusion-control-stack-versio

Narrated audio version available on the paper's web page.

PAPER 2.84 · OPEN ACCESS · PEER-REVIEWABLE

The Plasma Diagnostic Suite and Real-Time State Estimation for a Compact Spherical-Tokamak Breeder: Magnetics, Thomson, Interferometry, and Bolometry Fused by a Graph-Neural-Network Reconstructor

The sensor set behind autonomous control: magnetics, Thomson scattering, interferometry and bolometry, fused by a GNN state reconstructor into the real-time equilibrium and profile estimate.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645943

Web page https://www.kronosfusionenergy.com/publications/the-plasma-diagnostic-suite-and-real-time-state-estimat.html

Figshare https://doi.org/10.6084/m9.figshare.33472129

Internet Archive https://archive.org/details/kronos-2026-the-plasma-diagnostic-suite-and-real-time-state-estimat

Narrated audio version available on the paper's web page.

PAPER 2.85 · OPEN ACCESS · PEER-REVIEWABLE

Prognostics and Remaining-Useful-Life Estimation for the Consumable Centrepost: A Dual-Channel Fluence-Driven Framework Scheduling Cartridge Replacement in a Spherical-Tokamak Breeder

A prognostics-and-health-management framework: a dual-channel fluence-driven remaining-useful-life estimator with an out-of-distribution backstop, driving scheduled cartridge replacement — distinct from structural integrity (2.1) and quench detection (2.20).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645788

Web page https://www.kronosfusionenergy.com/publications/centrepost-prognostics-and-rul-control.html

Internet Archive https://archive.org/details/kronos-2026-centrepost-prognostics-and-rul-control

Narrated audio version available on the paper's web page.

PAPER 2.86 · OPEN ACCESS · PEER-REVIEWABLE

The Human-Machine Layer for Autonomous Fusion Operation: Natural-Language-Supervised Control, Autonomous Root-Cause Analysis and a Digital Operator Logbook

The human-machine layer for autonomous operation: natural-language-supervised control, autonomous root-cause analysis and the digital operator logbook — the operator stays in command.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645909

Web page https://www.kronosfusionenergy.com/publications/the-human-machine-layer-for-autonomous-fusion-operation.html

Internet Archive https://archive.org/details/kronos-2026-the-human-machine-layer-for-autonomous-fusion-operation

Narrated audio version available on the paper's web page.

PAPER 2.87 · OPEN ACCESS · PEER-REVIEWABLE

A Real-Time Optimization Backbone for Fusion Plasma Control: Quadratic-Programming, Reduced-Basis and Adjoint-Sensitivity Engines at Control Latency

The solver layer beneath the controllers: real-time QP, reduced-basis and adjoint-sensitivity engines that let MPC and setpoint optimization run at control latency.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645899

Web page https://www.kronosfusionenergy.com/publications/a-real-time-optimization-backbone-for-fusion-plasma-con.html

Internet Archive https://archive.org/details/kronos-2026-a-real-time-optimization-backbone-for-fusion-plasma-con

Narrated audio version available on the paper's web page.

PAPER 2.88 · OPEN ACCESS · PEER-REVIEWABLE

Global Sensitivity and Uncertainty Quantification across the Breeder and Burner Design Planes: A 40,000-Sample Monte-Carlo Ranking of the Frozen Anchors

A 40,000-sample Monte-Carlo sensitivity / UQ across the breeder and burner design planes — which inputs move the frozen anchors, quantified.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645893

Web page https://www.kronosfusionenergy.com/publications/global-sensitivity-and-uncertainty-quantification-acros.html

Internet Archive https://archive.org/details/kronos-2026-global-sensitivity-and-uncertainty-quantification-acros

Narrated audio version available on the paper's web page.

PAPER 2.89 · OPEN ACCESS · PEER-REVIEWABLE

Bayesian Optimal Experimental Design and Multi-Fidelity Data Fusion: Prioritizing the Next Experiment across Reduced-Order, GPU-HPC and Hardware Data

Where to spend the next experiment: Bayesian optimal design plus multi-fidelity fusion of reduced-order, GPU-HPC and (later) hardware data.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645895

Web page https://www.kronosfusionenergy.com/publications/bayesian-optimal-experimental-design-and-multi-fidelity.html

Figshare https://doi.org/10.6084/m9.figshare.33472153

Internet Archive https://archive.org/details/kronos-2026-bayesian-optimal-experimental-design-and-multi-fidelity

Narrated audio version available on the paper's web page.

PAPER 2.90 · OPEN ACCESS · PEER-REVIEWABLE

Resource-Honest Quantum Computing for Fusion: Variational Landau-Damping Emulation and ADAPT-VQE Low-Activation Alloy Chemistry Against the Classical Frontier

5-qubit Landau damping reproduced to 1–7%; ADAPT-VQE at chemical accuracy on the alloy fragments; the resource frontier + where classical still wins — no overclaim.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645718

Web page https://www.kronosfusionenergy.com/publications/quantum-computing-for-fusion.html

Figshare https://doi.org/10.6084/m9.figshare.33472171

Internet Archive https://archive.org/details/kronos-2026-quantum-computing-for-fusion

Narrated audio version available on the paper's web page.

PAPER 2.91 · OPEN ACCESS · PEER-REVIEWABLE

Quantum Optimization and Reinforcement Learning for Real-Time Plasma Control: QUBO/QAOA Actuator Scheduling and Quantum RL for Shape Control, without Claimed Advantage

QUBO / QAOA encodings of coil-current and actuator scheduling, and quantum reinforcement learning for shape / position — with the honest gate: no measured quantum advantage on these problems today.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645903

Web page https://www.kronosfusionenergy.com/publications/quantum-optimization-and-reinforcement-learning-for-rea.html

Internet Archive https://archive.org/details/kronos-2026-quantum-optimization-and-reinforcement-learning-for-rea

Narrated audio version available on the paper's web page.

PAPER 2.92 · OPEN ACCESS · PEER-REVIEWABLE

Quantum Machine-Learning Surrogates, Entanglement-Enhanced Magnetometry and Fault-Tolerant Resource Estimates for Fusion: A Resource-Honest Roadmap

Quantum-ML transport surrogates, entanglement-enhanced magnetometry, and fault-tolerant resource estimates with the dated technology roadmap — resource-honest, no overclaim.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645905

Web page https://www.kronosfusionenergy.com/publications/quantum-machine-learning-surrogates-entanglement-enhanc.html

Figshare https://doi.org/10.6084/m9.figshare.33472186

Internet Archive https://archive.org/details/kronos-2026-quantum-machine-learning-surrogates-entanglement-enhanc

Narrated audio version available on the paper's web page.

PAPER 2.93 · OPEN ACCESS · PEER-REVIEWABLE

Quantum Algorithms for the Real-Time Control Loop: HHL Equilibrium Reconstruction, Disruption State-Estimation, and Edge-Turbulence Simulation with Resource-Honest Advantage Accounting

Quantum-algorithm designs for the control loop: an HHL linear-solver equilibrium reconstruction, quantum state-estimation for disruption prediction, and quantum simulation of edge turbulence — resource-honest, with no claimed advantage today.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645925

Web page https://www.kronosfusionenergy.com/publications/quantum-algorithms-for-the-real-time-control-loop-hhl-e.html

Internet Archive https://archive.org/details/kronos-2026-quantum-algorithms-for-the-real-time-control-loop-hhl-e

Narrated audio version available on the paper's web page.

PAPER 2.94 · OPEN ACCESS · PEER-REVIEWABLE

The Burner Quantum Stack: Entanglement-Enhanced Plug-Field Magnetometry and a Quantum Kinetic Solver for D–^{3}He Tandem-Mirror Burn Control

Quantum sensing and simulation for the burner: entanglement-enhanced live plug-field magnetometry and a quantum kinetic solver for D–^{3}He burn control — resource-honest, gated once.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645927

Web page https://www.kronosfusionenergy.com/publications/the-burner-quantum-stack-entanglement-enhanced-plug-fie.html

Figshare https://doi.org/10.6084/m9.figshare.33472198

Internet Archive https://archive.org/details/kronos-2026-the-burner-quantum-stack-entanglement-enhanced-plug-fie

Narrated audio version available on the paper's web page.

PAPER 2.95 · OPEN ACCESS · PEER-REVIEWABLE

Quantum Chemistry Beyond DFT for Low-Activation Fusion Alloys: ADAPT-VQE Correlation Energies for Composition-of-Matter Screening with Fault-Tolerant Resource Estimates

ADAPT-VQE electronic structure for the low-activation alloy family: correlation energies beyond DFT for composition-of-matter screening, with fault-tolerant resource estimates on a dated roadmap.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645929

Web page https://www.kronosfusionenergy.com/publications/quantum-chemistry-beyond-dft-for-low-activation-fusion-.html

Internet Archive https://archive.org/details/kronos-2026-quantum-chemistry-beyond-dft-for-low-activation-fusion

Narrated audio version available on the paper's web page.

PAPER 2.96 · OPEN ACCESS · PEER-REVIEWABLE

A Tensor-Network Kinetic Solver for Fusion Transport: Matrix-Product-State Compression of the Distribution Function with Exponential Error Decay

Classical low-rank (matrix-product-state / SVD) compression of the kinetic distribution function — rank-8 ≈ 0.19× dense storage with exponential error decay on a 1D1V BGK problem. A deployable-today classical solver, distinct from the quantum-computing paper.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645768

Web page https://www.kronosfusionenergy.com/publications/tensor-network-kinetic-solver.html

Figshare https://doi.org/10.6084/m9.figshare.33472207

Internet Archive https://archive.org/details/kronos-2026-tensor-network-kinetic-solver

Narrated audio version available on the paper's web page.

PAPER 2.97 · OPEN ACCESS · PEER-REVIEWABLE

Verification-First Fusion Modeling: Frozen Anchors, Independent-Library Gate Reproduction, and a Byte-for-Byte Computational-Provenance Catalog for a Breeder-and-Burner Design Register

19/19 frozen anchors PASS + 12 register gates independently re-run locally on an independent nuclear-data library, 13 reproduced / 0 flags. Now also claims the full 47-code computational-provenance catalog and the byte-for-byte frozen-anchor reproducibility suite (MMS / GCI / Sobol / PCMM spine +…

Zenodo · DOI https://doi.org/10.5281/zenodo.22645710

Web page https://www.kronosfusionenergy.com/publications/verification-and-validation-47-code-provenance.html

Internet Archive https://archive.org/details/kronos-2026-verification-and-validation-47-code-provenance

Narrated audio version available on the paper's web page.

PAPER 2.98 · OPEN ACCESS · PEER-REVIEWABLE

Two-Code Cross-Validation of Negative-Triangularity Turbulence Suppression in a Compact Spherical-Tokamak Breeder: Quasilinear TGLF Confirms Nonlinear CGYRO

Independent quasilinear TGLF confirms the nonlinear CGYRO NT suppression — two codes now agree on the confinement bet — with a formal grid-convergence index below 0.4%.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645864

Web page https://www.kronosfusionenergy.com/publications/two-code-cross-validation-of-negative-triangularity-tur.html

Internet Archive https://archive.org/details/kronos-2026-two-code-cross-validation-of-negative-triangularity-tur

Narrated audio version available on the paper's web page.

PAPER 2.99 · OPEN ACCESS · PEER-REVIEWABLE

The Code-by-Code Verification Backbone: Role, Version, and Reference-Benchmark Provenance for Every Solver in a Multi-Product Fusion Design Campaign

Every code in the campaign — its role, version, and reference benchmark — across the NVIDIA GPU HPC campaign; the provenance backbone distinct from the frozen-anchor V&V spine (2.4).

Zenodo · DOI https://doi.org/10.5281/zenodo.22645866

Web page https://www.kronosfusionenergy.com/publications/the-code-by-code-verification-backbone-role-version-and.html

Internet Archive https://archive.org/details/kronos-2026-the-code-by-code-verification-backbone-role-version-and

Narrated audio version available on the paper's web page.

PAPER 2.100 · OPEN ACCESS · PEER-REVIEWABLE

Lifetime-Constrained Operating-Window Synthesis for a Compact Spherical-Tokamak Breeder: The Source-Strength-Centrepost-Life Trade and the Admissible Current Window

How competing mission / lifetime constraints jointly define the operating box: the strict 1:1 source-strength↔centrepost-life trade (Sn invariant across the fG–Ti plane) and the admissible-Ip window as a coupled floor (q95 / MHD-edge) / ceiling (centrepost fluence) problem.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645799

Web page https://www.kronosfusionenergy.com/publications/admissible-operating-window-synthesis.html

Internet Archive https://archive.org/details/kronos-2026-admissible-operating-window-synthesis

Narrated audio version available on the paper's web page.

PAPER 2.101 · OPEN ACCESS · PEER-REVIEWABLE

Red-Teaming the Frozen Design Point: Current-Drive and beta-Headroom Margins for a Spherical-Tokamak Breeder and Thermal-Barrier versus Centrifugal Plug Alternatives for the Mirror Burner

P_CD −58% at ×1.68 source (breeder); the plug gate 16→3.5 (thermal barrier) / →1.0 (centrifugal); ruled-out levers kept as negatives.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645720

Web page https://www.kronosfusionenergy.com/publications/red-team-of-the-binding-gates.html

Internet Archive https://archive.org/details/kronos-2026-red-team-of-the-binding-gates

Narrated audio version available on the paper's web page.

PAPER 2.102 · OPEN ACCESS · PEER-REVIEWABLE

Balance of Plant for a Compact Spherical-Tokamak Breeder: Heat Rejection, Cryoplant Load-Balancing, and Vacuum Scheduling for the 16.84 T Cold Mass

The plant systems: power conversion, the cryoplant load-balancer and refrigeration-COP optimizer, and vacuum-pumping scheduling for the 16.84 T cold mass.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645901

Web page https://www.kronosfusionenergy.com/publications/balance-of-plant-for-a-compact-spherical-tokamak-breede.html

Figshare https://doi.org/10.6084/m9.figshare.33471700

Internet Archive https://archive.org/details/kronos-2026-balance-of-plant-for-a-compact-spherical-tokamak-breede

Narrated audio version available on the paper's web page.

PAPER 2.103 · OPEN ACCESS · PEER-REVIEWABLE

Heating and Current-Drive Actuator Systems for a Compact Spherical-Tokamak Breeder: An NBI/ECH/ICRF/LHCD Mix Optimized for Solenoid-Free Sustainment

The auxiliary-power actuator mix that reaches and holds 9.66 MA at Q 3.076: NBI / ECH / ICRF / LHCD power, coupling and wall loads, with a heating-mix and current-drive-efficiency optimizer.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645872

Web page https://www.kronosfusionenergy.com/publications/heating-and-current-drive-actuator-systems-for-a-compac.html

Figshare https://doi.org/10.6084/m9.figshare.33471706

Internet Archive https://archive.org/details/kronos-2026-heating-and-current-drive-actuator-systems-for-a-compac

Narrated audio version available on the paper's web page.

PAPER 2.104 · OPEN ACCESS · PEER-REVIEWABLE

Operating the Consumable Centrepost of a Compact Spherical-Tokamak Breeder: Demountable-Cartridge Swap Logistics, Fleet RAMI, and Centrepost Radial-Budget Reconciliation

The consumable-centrepost operations case: demountable-cartridge swap logistics, fleet RAMI, and the resolved ~2 cm centrepost radial-budget reconciliation.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645931

Web page https://www.kronosfusionenergy.com/publications/operating-the-consumable-centrepost-of-a-compact-spheri.html

Internet Archive https://archive.org/details/kronos-2026-operating-the-consumable-centrepost-of-a-compact-spheri

Narrated audio version available on the paper's web page.

PAPER 2.105 · OPEN ACCESS · PEER-REVIEWABLE

Fleet Availability under Consumable-Centrepost Swap Cadence: A Time-Domain Monte-Carlo of Capacity Factor and RAMI across a Four-Unit Spherical-Tokamak Breeder Fleet

The fleet-level availability case: a time-domain Monte-Carlo of capacity factor and RAMI across a four-breeder fleet, including consumable-centrepost swap cadence.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645951

Web page https://www.kronosfusionenergy.com/publications/fleet-availability-under-consumable-centrepost-swap-cad.html

Figshare https://doi.org/10.6084/m9.figshare.33471715

Internet Archive https://archive.org/details/kronos-2026-fleet-availability-under-consumable-centrepost-swap-cad

Narrated audio version available on the paper's web page.

PAPER 2.106 · OPEN ACCESS · PEER-REVIEWABLE

Critical-Materials Buildability for a Spherical-Tokamak Breeder Fleet: Bottleneck Ranking of Li-6 Enrichment, Beryllium Fabrication and REBCO Tape Supply

Non-economic buildability: bill of materials + bottleneck ranking (90%-enriched Li-6 = #1 long-lead, relaxable to 30–60 at%), nuclear-grade Be pebble fab, REBCO tape length, and the centrepost as a scheduled consumable-cartridge line (~10–15 units/yr). Dollar content stays internal.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645786

Web page https://www.kronosfusionenergy.com/publications/supply-chain-and-fleet-buildability.html

Internet Archive https://archive.org/details/kronos-2026-supply-chain-and-fleet-buildability

Narrated audio version available on the paper's web page.

PAPER 2.107 · OPEN ACCESS · PEER-REVIEWABLE

Environmental Profile, Accident Analysis and the Tritium Safety Case for a Multi-Kilogram Breeder Plant: Source Terms, Dispersion and Emergency-Planning-Zone Sizing

Source terms, χ/Q dispersion, detritiation-factor closure, emergency-planning-zone sizing, and tritiated-waste routes for a multi-kg tritium plant.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645754

Web page https://www.kronosfusionenergy.com/publications/inherent-safety-and-environmental-case.html

Internet Archive https://archive.org/details/kronos-2026-inherent-safety-and-environmental-case

Narrated audio version available on the paper's web page.

PAPER 2.108 · OPEN ACCESS · PEER-REVIEWABLE

The Sub-100 MW Byproduct-Material Thesis: Why a Compact Spherical-Tokamak Breeder Licenses Under NRC 10 CFR Part 30 Rather Than Part 50

The NRC 10 CFR Part 30 byproduct-material regulatory thesis for a sub-100 MW breeder; why the framework fits the platform.

Zenodo · DOI https://doi.org/10.5281/zenodo.22645756

Web page https://www.kronosfusionenergy.com/publications/licensing-byproduct-material-part-30.html

Internet Archive https://archive.org/details/kronos-2026-licensing-byproduct-material-part-30

Narrated audio version available on the paper's web page.

SECTION

Books & Audiobooks

Eight volumes — each an interior edition, a chaptered audiobook, and an open physics & math package.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

The Fusion Energy Equations (2nd Ed.)

The core physics equations of the program — a working technical reference.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

The Isotope Economy

The mission & economics of fusion-made isotopes — He-3, tritium, medical isotopes.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

To the Moon for Fuel

Lunar He-3 and the Earth-Moon fuel architecture.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

The Machine That Controls the Machine

Real-time AI control of a fusion plant.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

Energy Is Water

Fusion, desalination, and the water-energy nexus.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

The Forty-Dollar Electron

The economics of fusion electricity and isotopes.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

The Long Night

A history of the long road to fusion.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

P. I. FORD · INTERIOR + AUDIOBOOK + OPEN PHYSICS PACKAGE

Energy Sovereignty and the End of Resource War

The geopolitics of abundant energy.

Read on site https://www.kronosfusionenergy.com/books

Audiobook https://www.kronosfusionenergy.com/audiobooks

Hugging Face https://huggingface.co/datasets/KrononosFE/kronos-2026-books

Per-book archival DOIs (Zenodo) minting draft-first — added on release.

THE PRIVATE PROGRAM

What stays confidential

The record above is deliberately open. The following remain private — named so the shape is clear, with no specifics.

- **Intellectual property**
  Provisional patents filed and secured — the invention portfolio.
- **Detailed engineering & blueprints**
  Full CAD, the build-bible, and bill of materials.
- **Investor & board materials**
  Diligence volumes, cap table, deal materials.
- **30-year commercialization strategy**
  The staged build & product roadmap (2027 → 2056).
- **Economics, cost models & valuation**
  Unit economics, FOAK/NOAK cost, funding — held per the financial firewall.

KRONOS FUSION ENERGY

Open science, secured IP.

Every code, paper, and book above is public and permanently archived — the physics open for anyone to verify. The invention portfolio is filed and protected.