AI Compute is Moving to the Distribution Grid

Micro Data Centers and Distribution Strategy

Ben Sooter

November 18, 2026

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THE SHIFT

AI's second wave lands on the distribution grid

Inference is moving closer to users, into sites of 1 to 20 MW that connect at distribution voltage. They complement hyperscale campuses, and they arrive below the thresholds written for large loads.

~55,000
substations across the U.S. electric grid

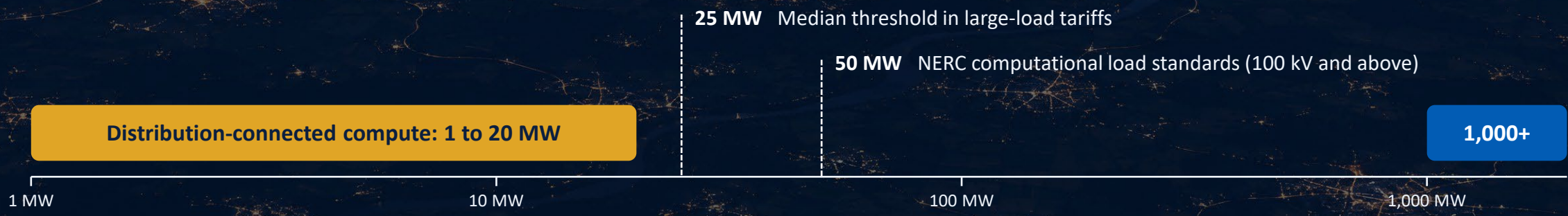
156 GW
estimated available substation capacity across the U.S.

250+ GW
estimated U.S. capacity if compute loads operate flexibly

5 to 20 MW
typical micro data center site, sized to the headroom at one substation

WHERE THE SECOND WAVE LANDS

Site size in MW, log scale



A 5 MW site at an 85% load factor uses about 37 GWh a year and fills about half of a typical 12.47 kV feeder.

Hyperscale campus: 1,000 MW and up

Sources: EPRI Micro Data Center project; LBNL, Electricity Rate Designs for Large Loads (2026 update); NERC (October 2026).

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THE PRACTICE

One practice, three ways to engage

Hosting capacity studies show where compute can connect. Strategy engagements help utilities and grid-edge companies decide what to do about it.

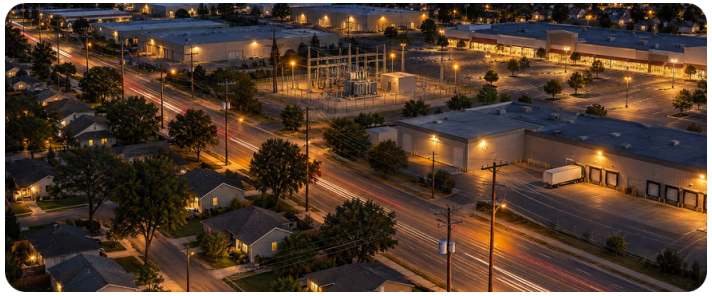


FOR UTILITIES | MICRO DATA CENTERS

Hosting capacity study

Where can 5 to 20 MW of compute connect today, and what would it take?

- Up to five candidate substations
- Power, land, and fiber screened together
- About four months



FOR UTILITIES | DISTRIBUTION

Distribution strategy study

How much distributed compute is coming, and are we ready to connect it on our terms?

- Five phases, ten deliverables
- From demand outlook to demonstration design
- About 20 weeks



FOR GRID-EDGE COMPANIES

Grid-edge strategy

Where do we play as compute moves to the distribution edge, and what do we offer?

- Executive strategy session first
- Solution definition, validation, pilot plans
- About six months

EVIDENCE BASE **DCFlex:** more than 80 companies **Flex MOSAIC:** 65+ adopters **Nature Energy:** 25% for three hours **Collaborators:** NVIDIA, Prologis, InfraPartners

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Hosting Capacity Studies Rurn Headroom into Ranked Sites

A four-month screen of up to five candidate substations for 5 to 20 MW of modular compute: power, land, and fiber together.

HOW A SITE SCREEN NARROWS

- Rank substation areas for a 5 to 10 MW target
- 16,000+ parcels within 2 miles
- About 200 plausible parcels
- Top 20 parcels
- Top 3 sites

From one EPRI feasibility study: every parcel near one substation, narrowed to three.



24
substations screened in three U.S. utility territories

~60%
cleared the capacity screen; about 40% did not

133+ MW
of capacity identified in the screen

FOUR TASKS, ABOUT FOUR MONTHS

1. **Site selection**
   Up to five substations; target size set at kickoff
2. **Electrical screening**
   Headroom, transformer ratings, feeder constraints
3. **Site and communications**
   Parcels, zoning, and fiber redundancy
4. **Business case and roadmap**
   Partner landscape, gating decisions, cost, timeline

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Micro Data Centers as a Resilience Play

Many smaller sites, alongside large campuses, keep AI capacity running when one site, route, or area is lost.



1 March 2026: strikes took two of a UAE cloud region's three zones offline.

ONE CAMPUS OR MANY SITES (ILLUSTRATIVE)

Concentrated

One site, one shared fate

Distributed

Lose one of 20 equal sites: 95% remains

Harden a few
Core sites for sensitive workloads

Distribute many
Smaller sites for inference

A RESILIENCE LENS ON EVERY SITE

Target exposure
Distance from sites in national threat scenarios

Hardening potential
Standoff, terrain, and equipment protection

Fiber and communications
Diverse routes; satellite backup for management

Power and water
Dual feeds, battery ride-through, waterless cooling

Natural hazards
Flood, heat, dust, and coastal surge

Recovery
Spares, module swap time, and access routes

TEST THE NETWORK, NOT JUST THE SITE

N-1 for compute | **Lose the worst site** | **Lose a shared route** | **Lose a whole area**

How much capacity survives, and how fast does it return?

START SMALL, PROVE IT, THEN SCALE

Screen and test → **Pilot with failover drills** → **Scale the network**

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Distribution Strategy

An executive engagement for utility and distribution leadership on how to see, set terms for, use, and shape distributed AI load.

FOUR POSTURES FRAME THE STRATEGY

DEFEND THE SYSTEM

See it

Know where compute load is and how it behaves.

Set terms

Connect on terms that protect other customers.

CREATE VALUE

Use it

Turn compute flexibility into a grid resource.

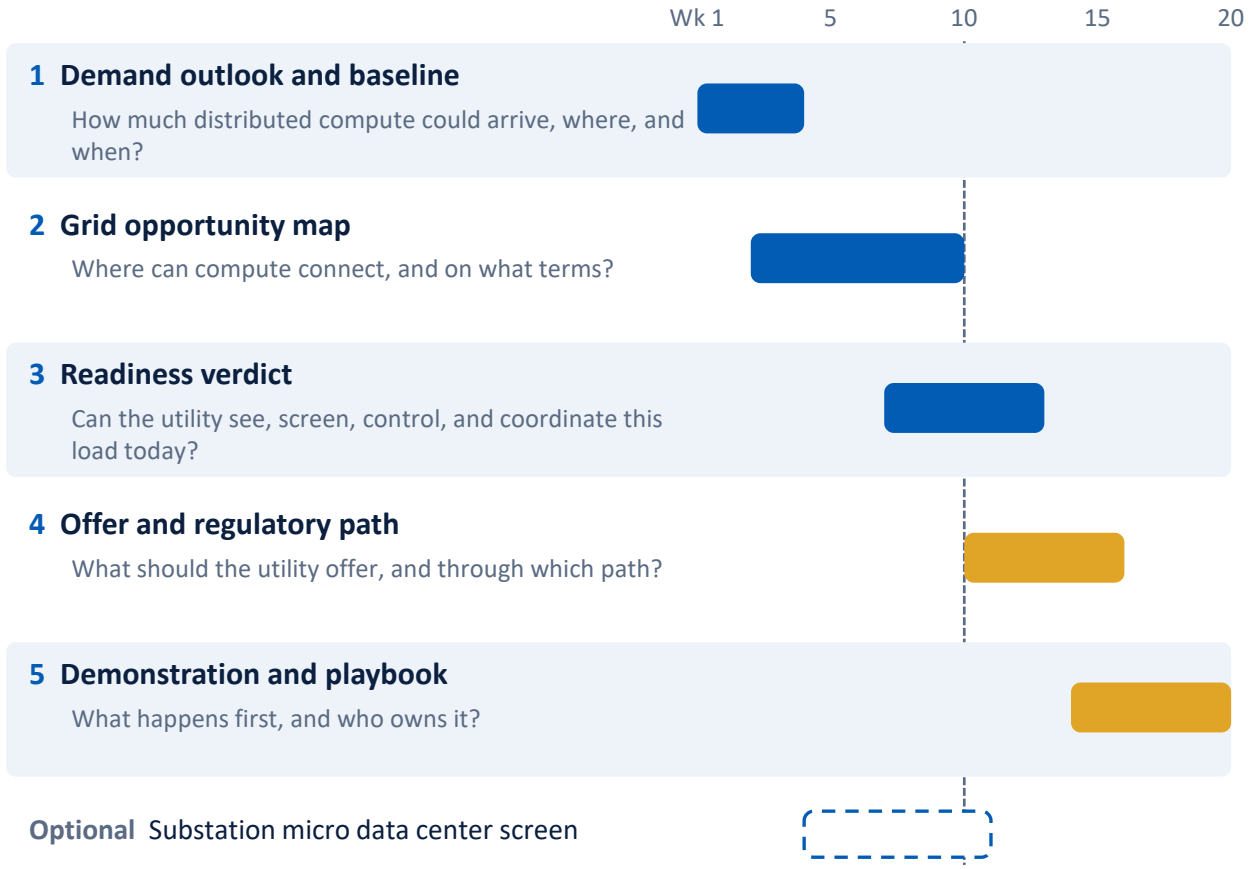
Shape it

Help set the rules for the band below the thresholds.



FIVE PHASES, ONE QUESTION EACH

Gold phases proceed on notice after the week 10 review



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Grid-Edge Strategy

For grid-edge technology companies: where to play, what to offer, what to build, buy, or partner for, and how to validate and size it.

PART A | ABOUT 4 TO 6 WEEKS PART B | ABOUT 6 MONTHS, PHASES SEPARABLE

Executive strategy session	Landscape and portfolio	Solution families	Validation	Strategy and roadmap
A half-day to one-day session with EPRI executive leadership, and a board-usable memo within days	Where compute lands, a reference architecture, and how the company's portfolio maps to it	Two or three solution families carried end to end, from utility need to offering	Evidence before offering: laboratory testing, hardware assessment, and utility pilot plans	Partnership map, build, buy, or partner gaps, and a 12-to-24-month roadmap

ILLUSTRATIVE SOLUTION FAMILIES, BY WHERE A COMPANY SITS

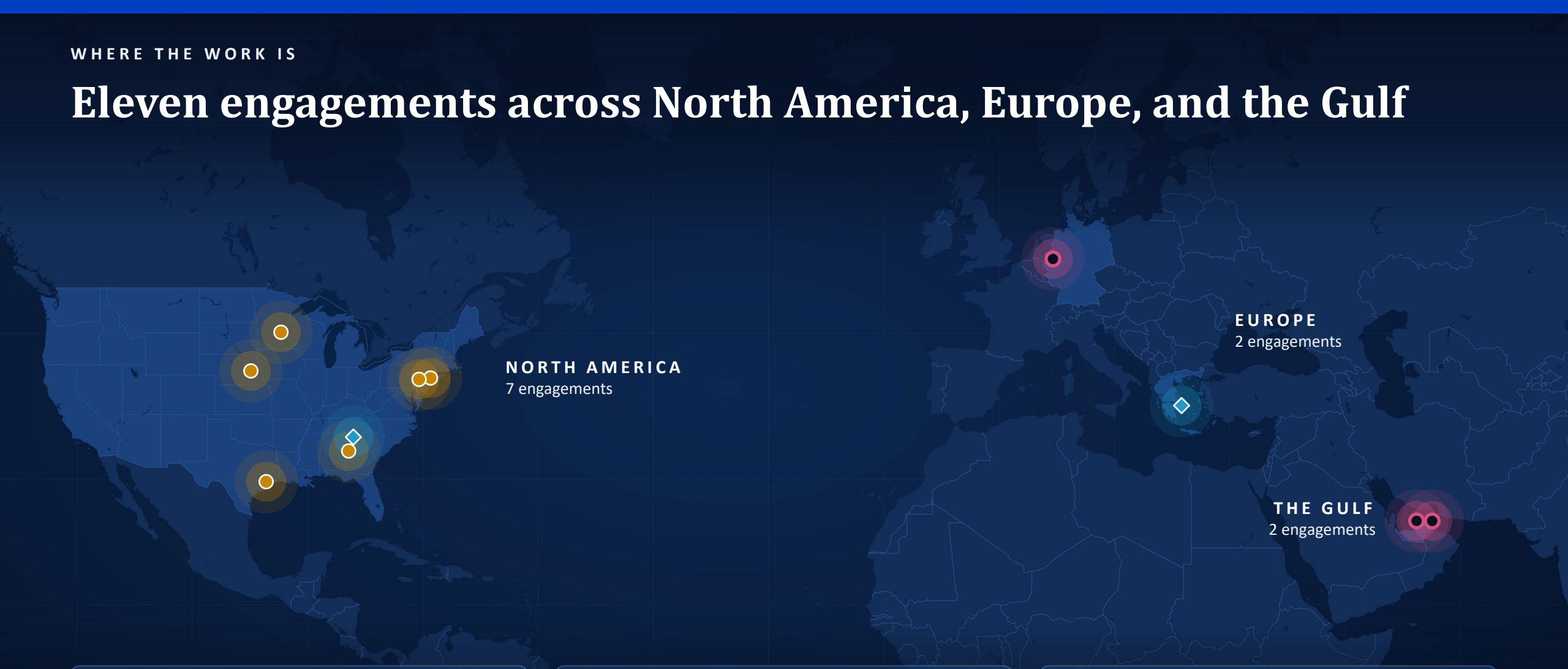
- **Power equipment and storage** → Grid-admissible power block for 1 to 20 MW sites
- **Metering, sensing, and analytics** → Headroom discovery and speed to power
- **Metering and platform software** → Measurement, verification, and settlement for flexible compute
- **Controls and orchestration** → Verifiable flexibility envelope



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WHERE THE WORK IS

Eleven engagements across North America, Europe, and the Gulf



6 **Active contracts**
Five hosting capacity studies and one distribution strategy study

2 **Contracts in process**
One grid-edge strategy engagement and one hosting capacity study

3 **Opportunities in exploration**
In Europe and the Gulf

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L I L A

Lila is the leading scientific reasoning model connected to autonomous labs that run experiments 24/7

OUR MISSION

Scientific Superintelligence to solve humankind's greatest challenges

SCALE & PRESENCE

Employees
500+

HQ
Boston

Offices
San Francisco
London

FUNDING

Total
$550M

Investors
General Catalyst
Nvidia
Collective Global
Braidwell
Flagship

MARKET SEGMENTS

Oil, Gas, and Refining
coatings, catalysts, lubricants

Energy Transition
batteries, hydrogen, minerals

Chemicals
catalysts, polymers, coatings

Semiconductors
magnetics, quantum, packaging

Pharmaceuticals
genetic medicines, antibodies, cell therapy

Consumer
formulations, sustainable materials

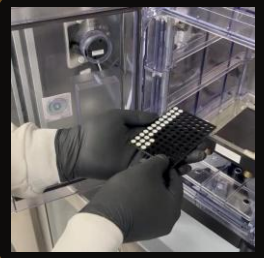
12 programs across physical sciences. Every one with measured results.



< 1 mo

PFAS-free coolant

beats best alternative



18 days

Latex-free adhesive

all specs vs ~6 months



2×

Wind-turbine coatings

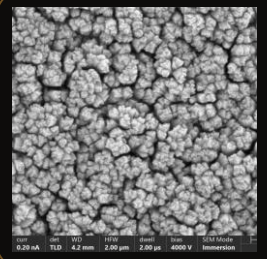
hardness gain



31

New metallic coatings

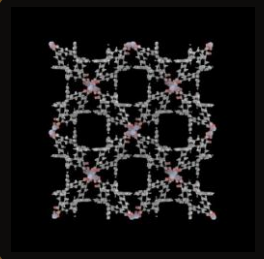
discovered in 6 weeks



4,000+

Green-H_2 catalysts

Ir/Ru-free alloys tested



70+

CO_2 sorbents

new capture materials



3 rounds

Copper electrorefining

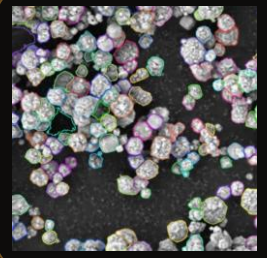
faster than experts



< 3 nm

Quantum dots

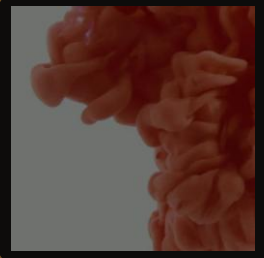
emission accuracy, no humans



Sub-µm

Zeolite synthesis

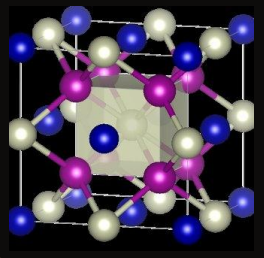
particle-size control



20 / 20

Paint formulation AI

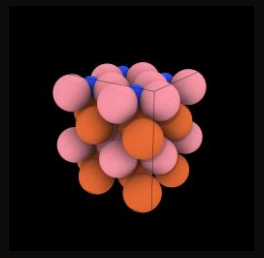
beats every published baseline



300+

Satellite alloys

screened fully agentically

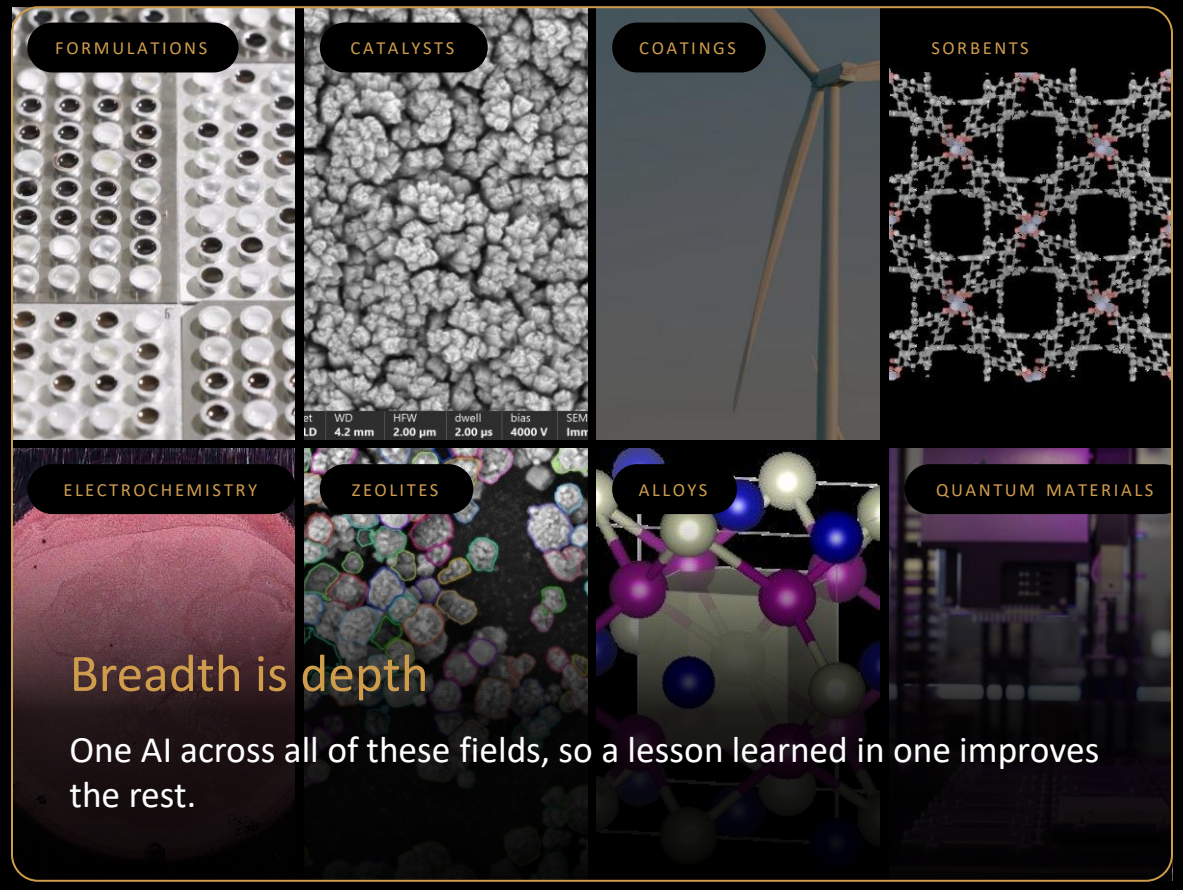


20 min

Thin-film process fix

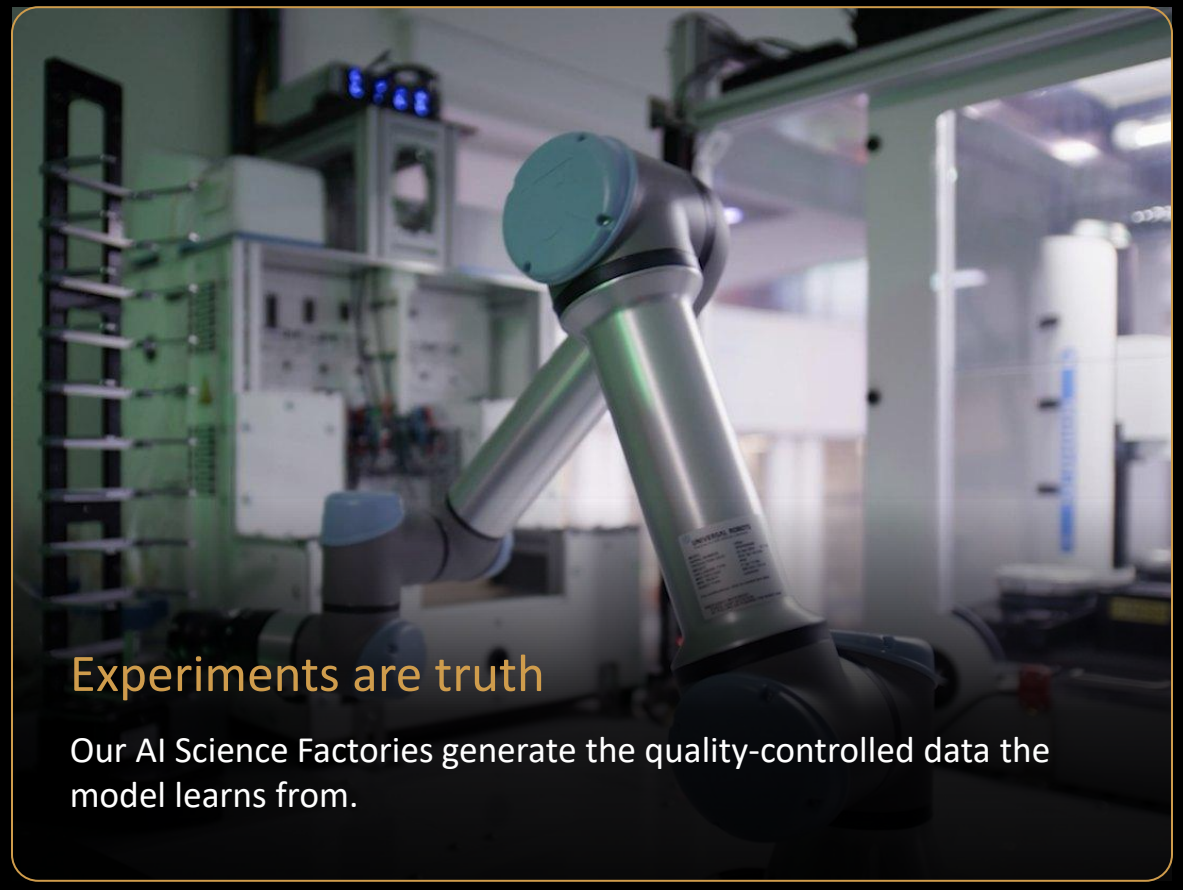
dopant found in one agent run

Lila is the only AI-science company that trains on real experimental data and applies learning across domains of science



Breadth is depth

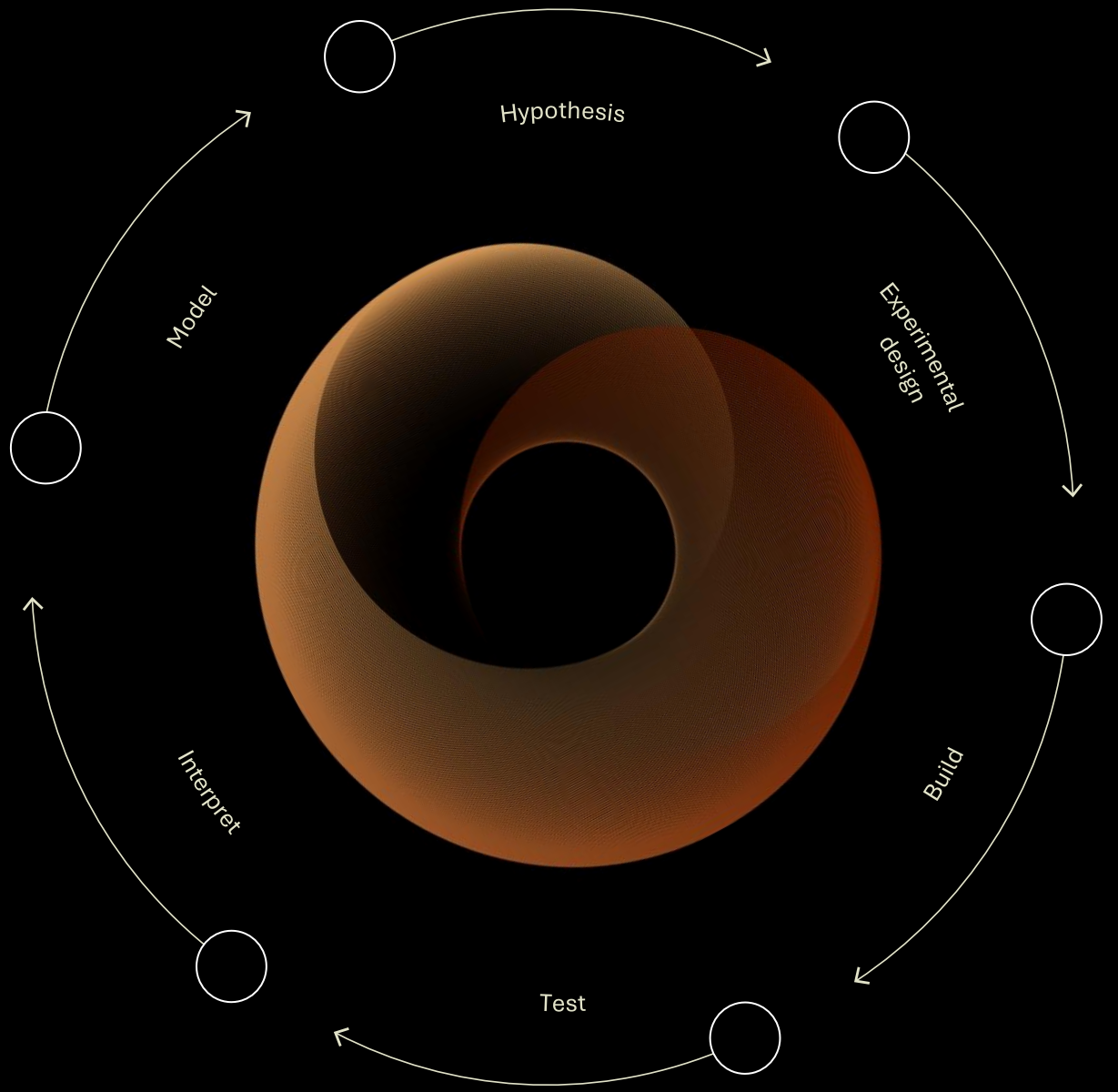
One AI across all of these fields, so a lesson learned in one improves the rest.



Experiments are truth

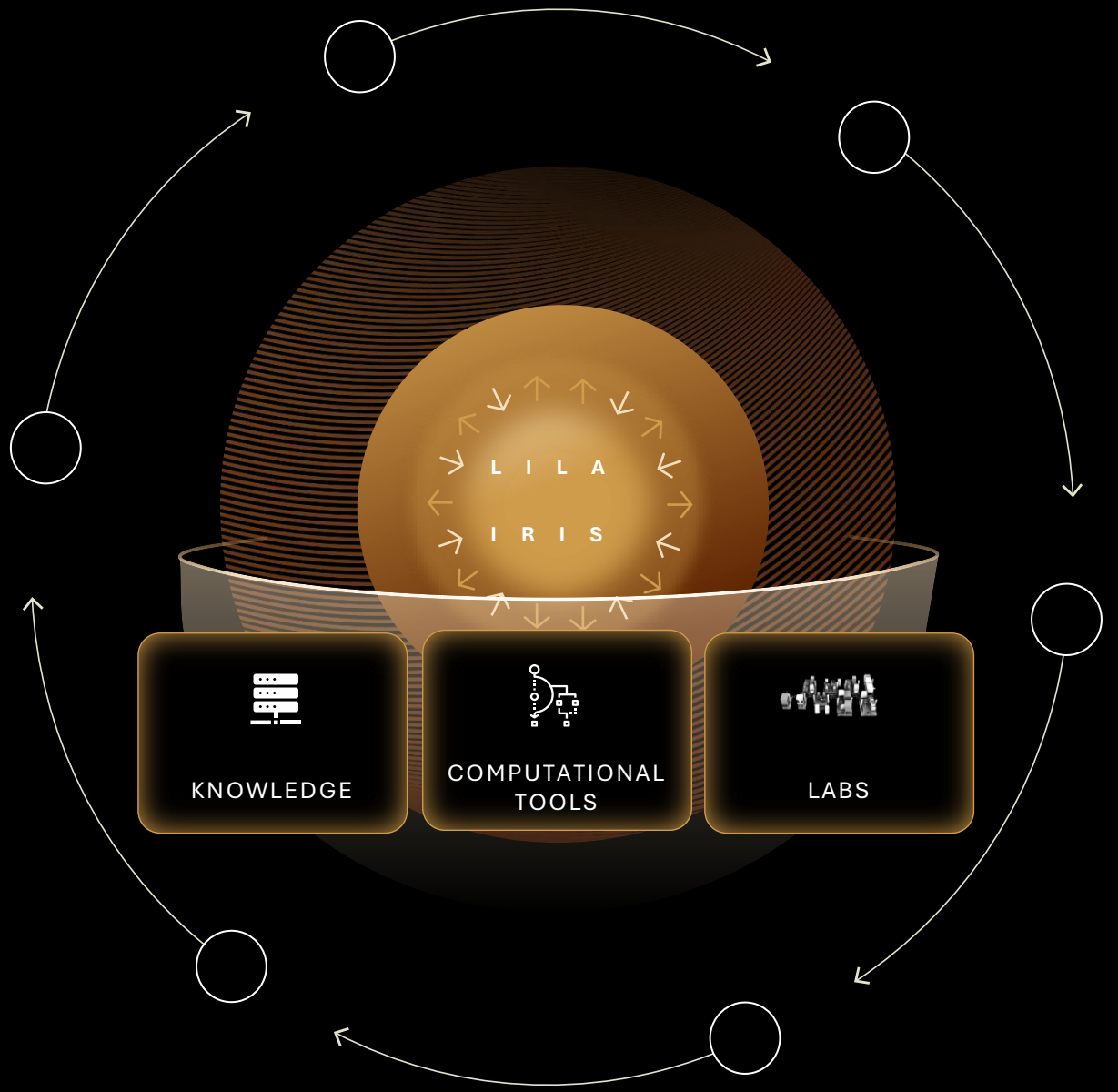
Our AI Science Factories generate the quality-controlled data the model learns from.

Lila is re-inventing the most valuable wheel in existence: The scientific method




Hypothesis
Experimental design
Build
Test
Interpret
Model
Intelligence
Execution

Lila connects proprietary scientific reasoning AI to data, software, and the lab



My AI conversations with industry scientists...



LILA SCIENCES

Case Studies

November 2026

CASE STUDY · MAGNETS

Earth-Abundant Magnets

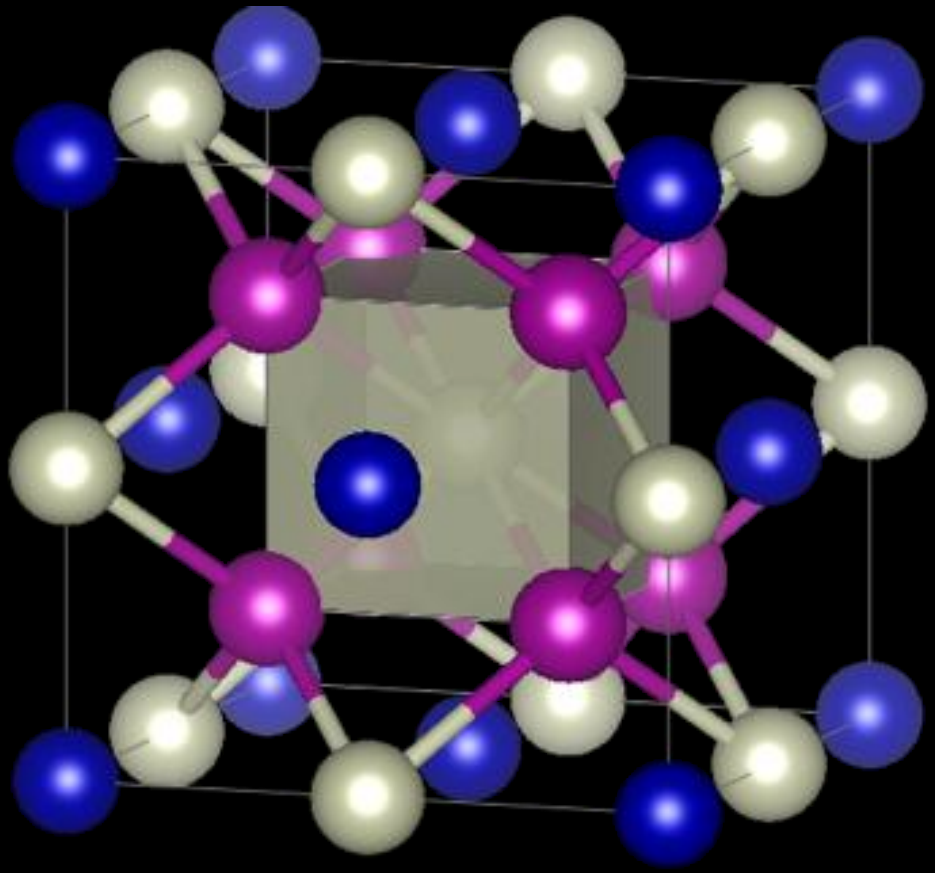
Strong magnets, less rare-earth risk

THE CHALLENGE

Wind generators and electric motors depend on rare-earth magnets, whose supply chains are concentrated and fragile.

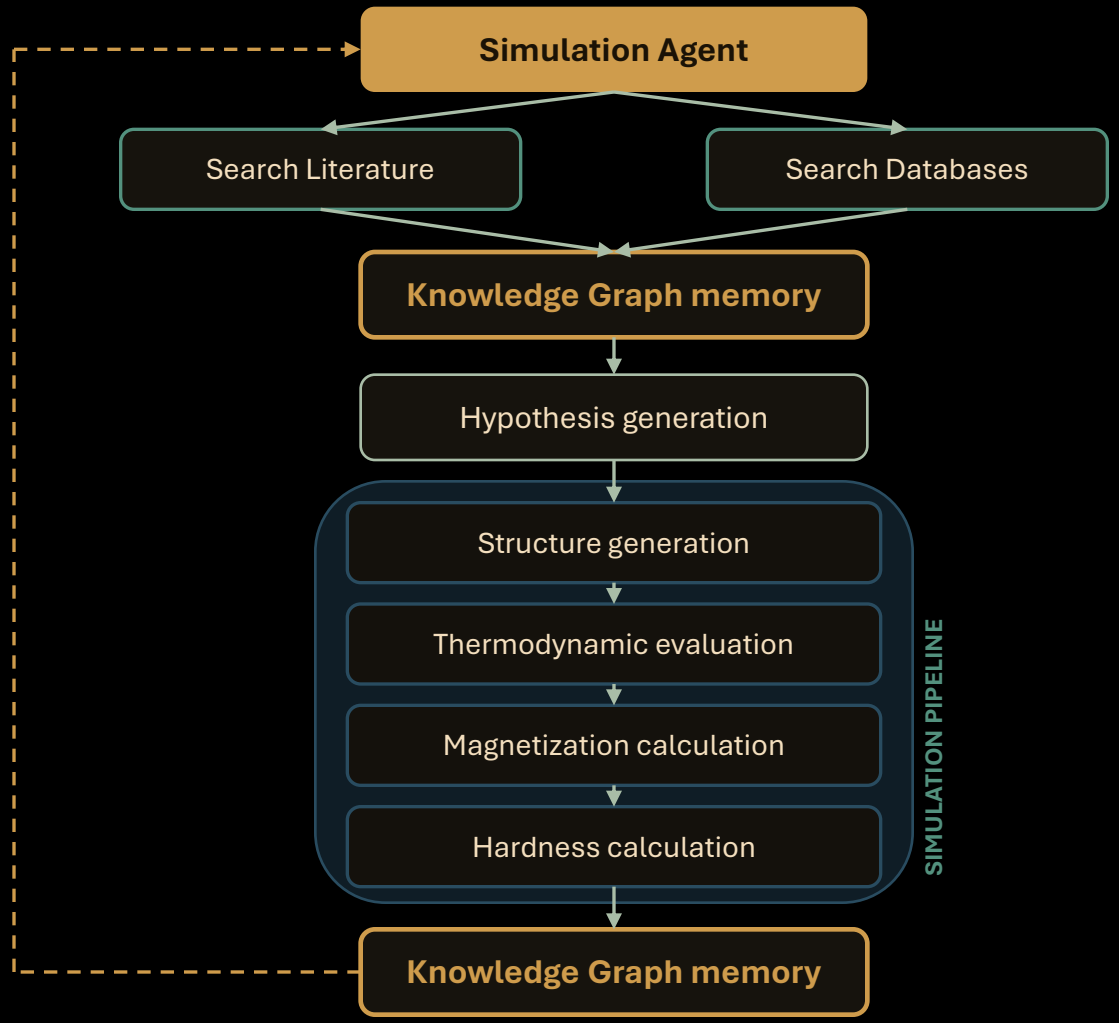
HOW AI AND THE LAB TACKLED IT

AI agents planned and ran their own simulation campaigns, learning each round, to search for strong, stable candidates for future lab testing.



Example crystal structure explored by the agent campaign

Simulation-Intelligence Campaigns



A closed loop that turns each campaign into shared, compounding knowledge.

Agent plans each round

Picks the next chemistry to probe and orchestrates the campaign.

Grounded in prior work

Searches literature and past results before proposing candidates.

Simulated end to end

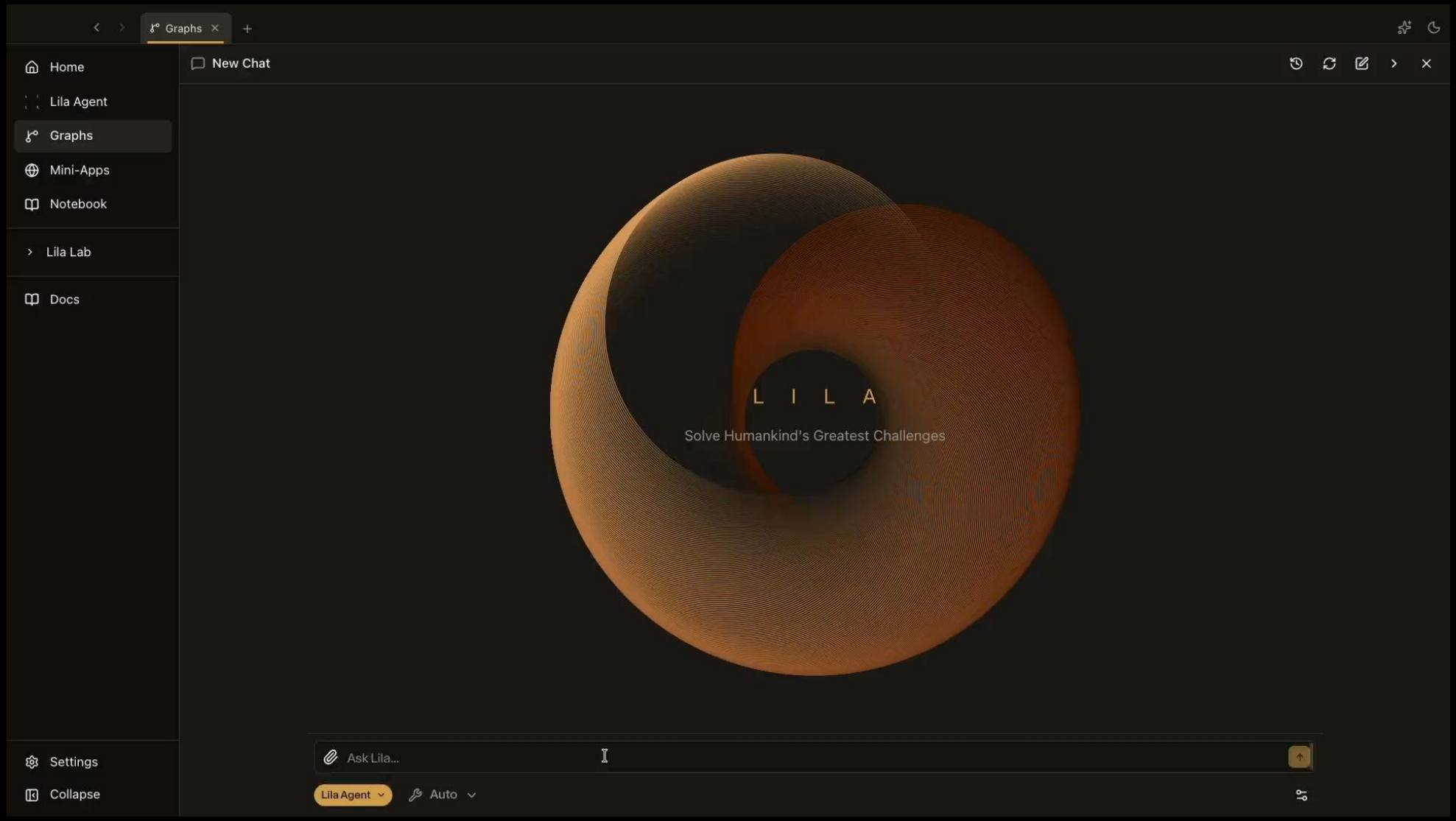
Structure, thermodynamics, magnetization and hardness for every candidate.

Compounding memory

Every finding is distilled into the KG and feeds the next round.

Earth-Abundant Magnets

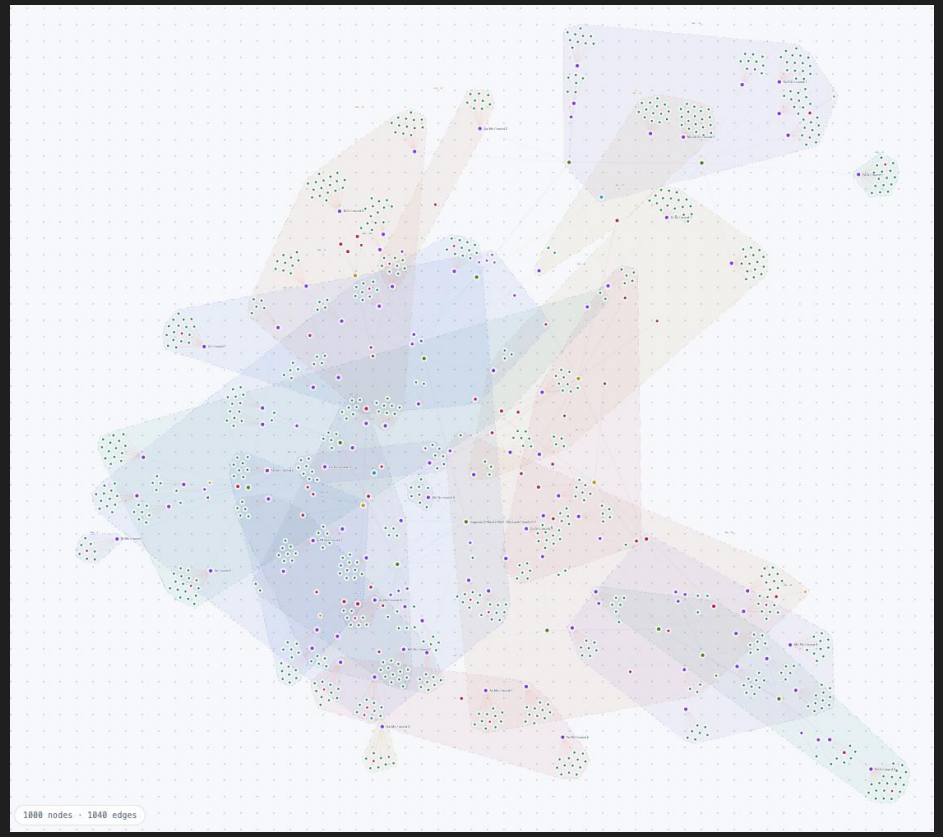
Hypothesis Generation • Agent Swarms • Molecular Dynamics



L I
L A

Magnetics Discovery — Run Artifacts

Knowledge Graph



Lemma Example · Confidence Over Iterations

rh_optimal_spacer 0.75
Lemma · active

Rh may be optimal 4d spacer due to partial spin polarization

Rhodium (4d8 configuration) as a spacer element in transition metal ternaries achieves higher magnetization than fully-filled d10 elements (Pd, Pt, Au) because Rh can acquire induced spin polarization from neighboring magnetic atoms while still having sufficiently filled d-states to avoid strong hybridization. This makes Rh the preferred spacer choice for high-moment applications. However, Mn2CoPd (d10) achieved 2.06 μB/atom, slightly above Mn2CoRh (2.03 μB/atom), suggesting that with optimal magnetic base choice the d8 vs d10 gap can narrow.

HISTORY

exp_7 · created	0.60
exp_8 · strengthened	0.70
exp_19 · strengthened	0.80
exp_20 · strengthened	0.85
exp_20 · weakened	0.75

EVIDENCE (4)

- supports exp_6
- supports exp_7
- supports exp_18
- contradicts exp_19

co_3d_moment_filling 0.65
Lemma · active

Co 3d band filling magnetization

Cobalt's magnetic moment arises from partially filled 3d orbitals with approximately 7.2 d-electrons, yielding ~1.7 μB/atom in hcp Co. Alloying with Fe (fewer d-electrons, ferromagnetic coupling tendency) enhances net magnetization. However, elements with half-filled d-shells like Mn may exhibit strong antiferromagnetic tendencies that quench net magnetization despite favorable band filling, indicating that d-filling alone is insufficient - exchange coupling sign also matters.

HISTORY

exp_1 · created	0.60
exp_2 · strengthened	0.75
exp_3 · weakened	0.65

EVIDENCE (2)

- supports exp_1
- contradicts exp_2

Coolant Formulation

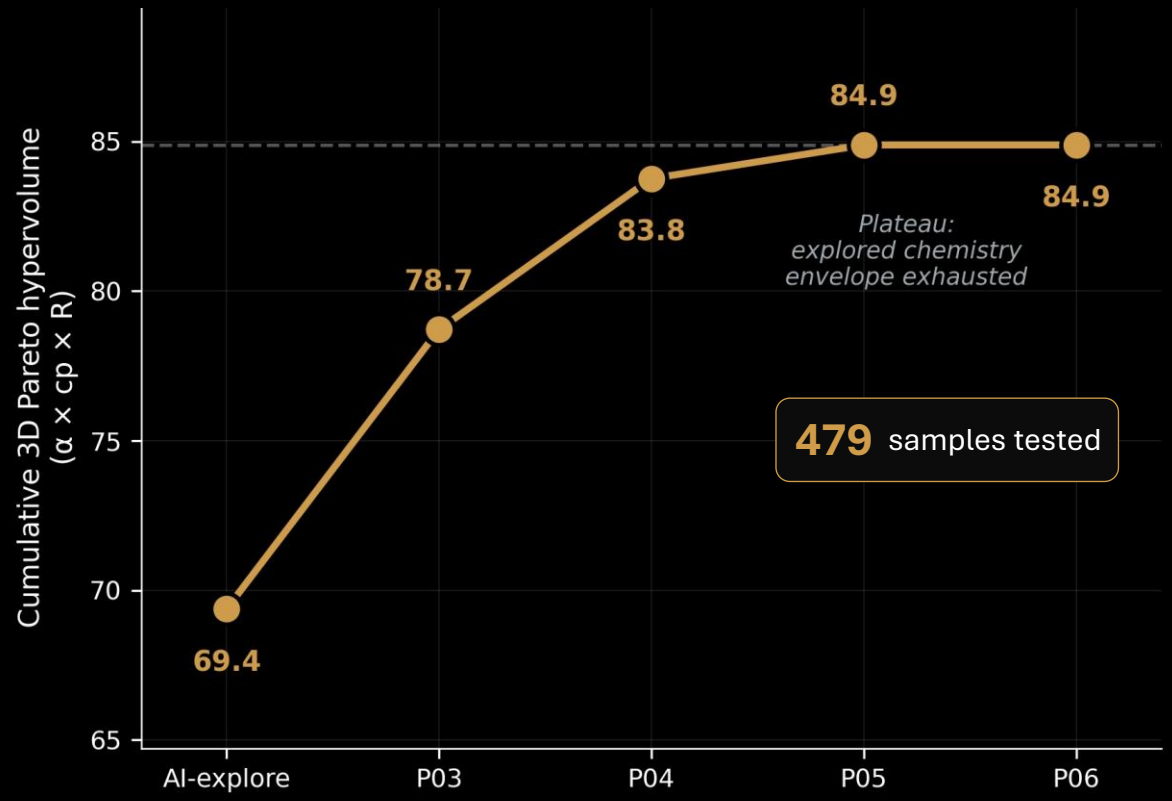
Coolant Formulation

GOAL

- Identify a PFAS-free single-phase dielectric coolant meeting performance of aqueous coolants
- Demonstrate closed-loop multi-property optimization

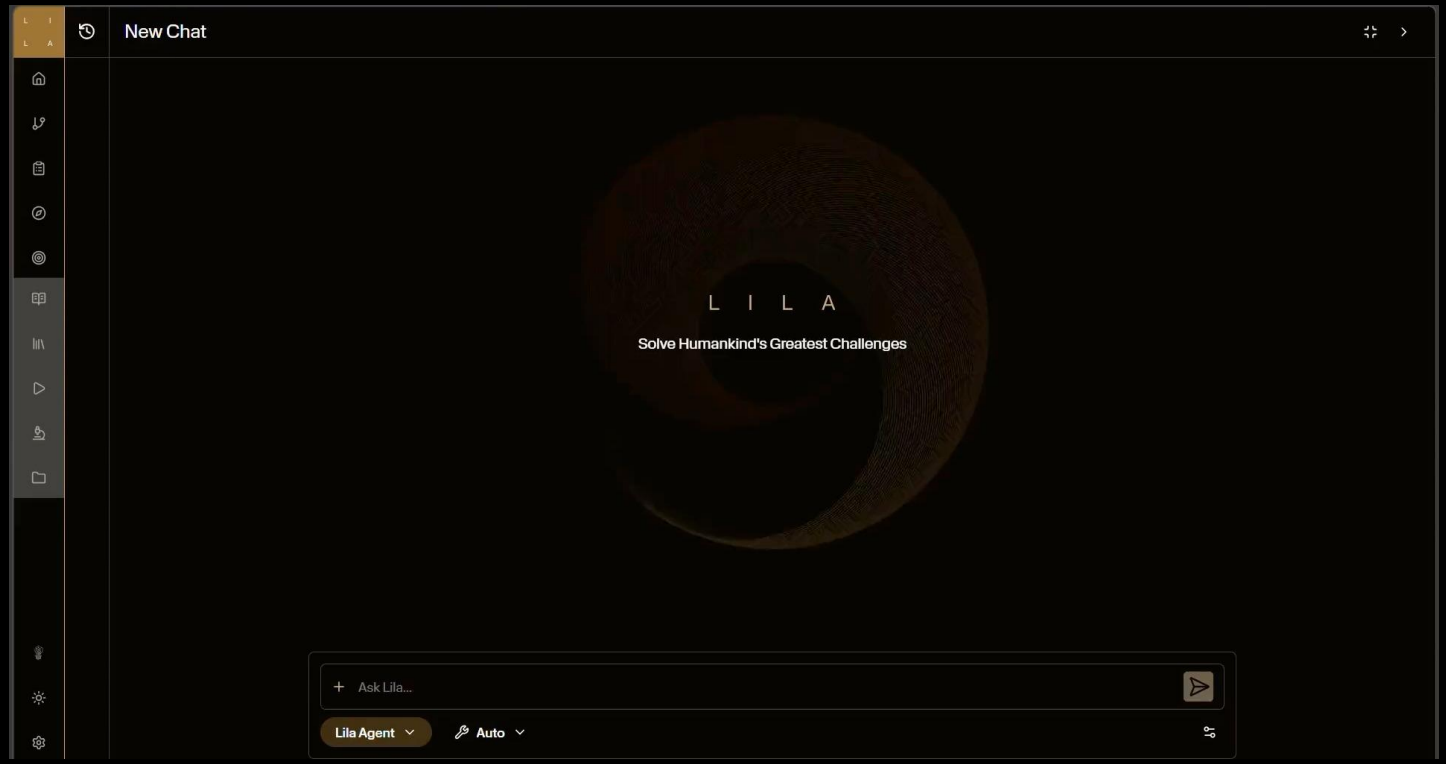
WHY IT MATTERS

- Aqueous coolants are performant, but carry excessive operational and safety risks
- All non-PFAS alternatives compromise key technical properties



Coolant Formulation

Literature Extraction • Hypothesis Generation



Lila Agent **creates a formulation space** via literature review, selecting oil, particulate, and surfactant combinations from published research

Lila Agent creates a **design of experiments** across available formulations, cross-referencing experiment ideas with component availability and lab capability

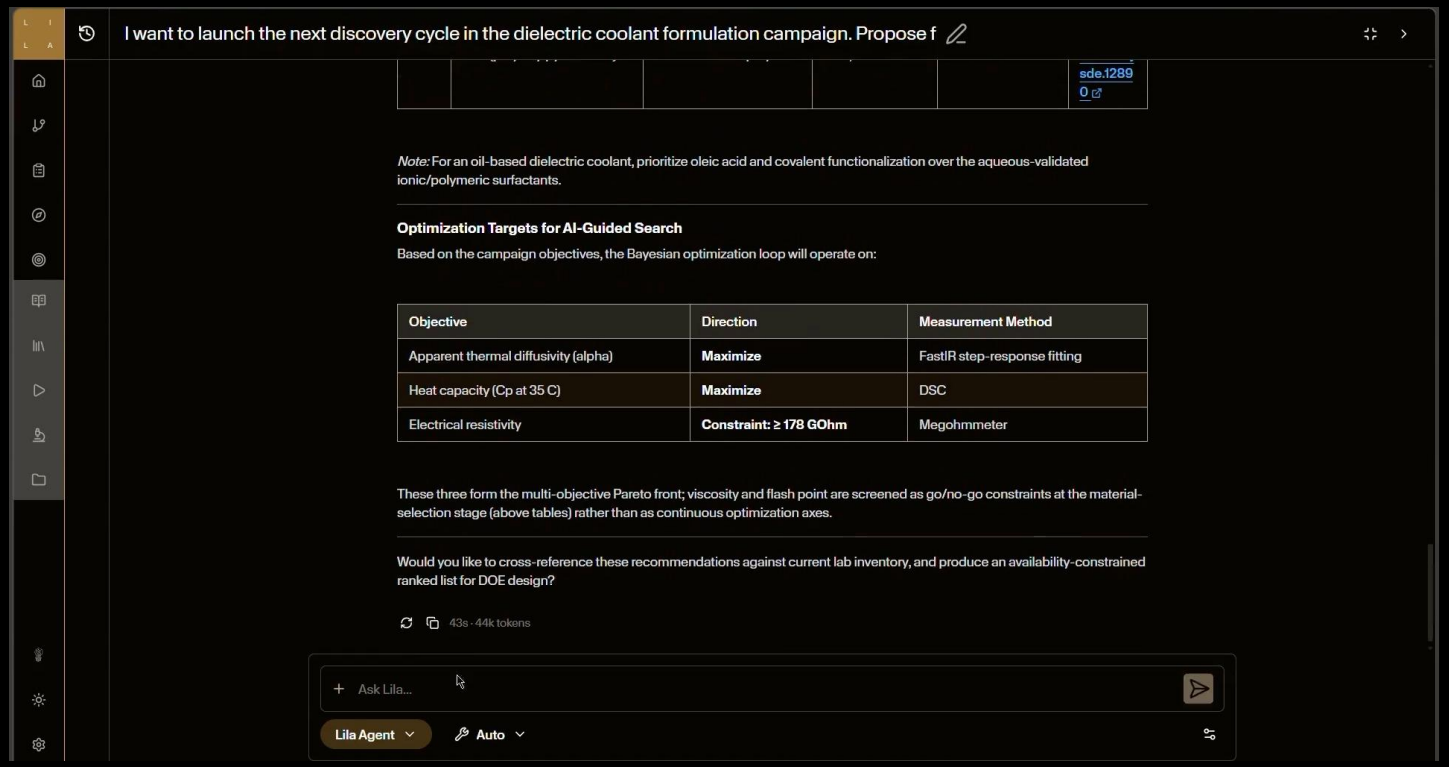
Lila Agent **communicates with laboratory instruments** to kick off experimentation

Lila Agent **continues lab communication** for characterization and thermal imaging

Lila Agent automatically **analyzes and visualizes experimental results**, returning human-readable recommendations

Coolant Formulation

Autonomous Experiment Design



Lila Agent **creates a formulation space** via literature review, selecting oil, particulate, and surfactant combinations from published research

Lila Agent creates a **design of experiments** across available formulations, cross-referencing experiment ideas with component availability and lab capability

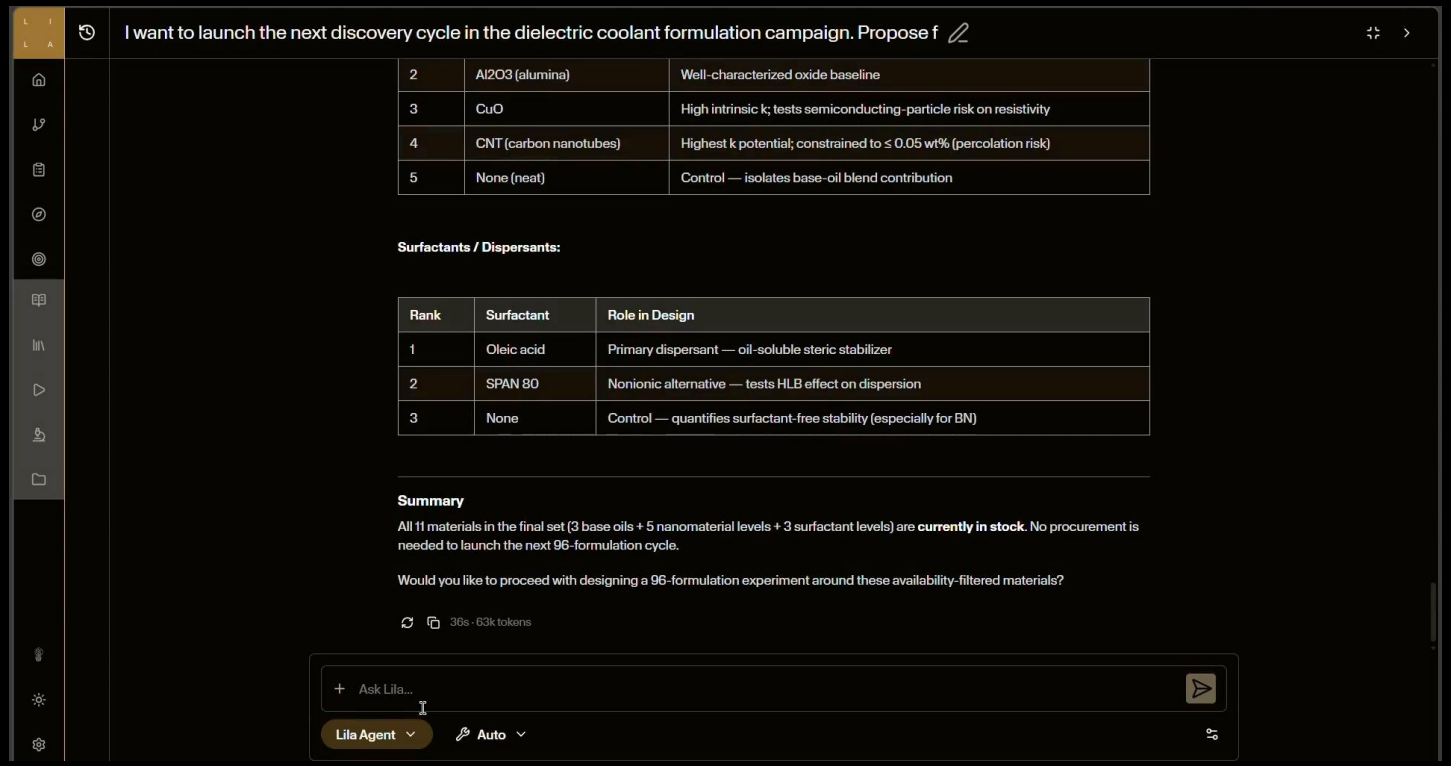
Lila Agent **communicates with laboratory instruments** to kick off experimentation

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Coolant Formulation

Lab Equipment Integration



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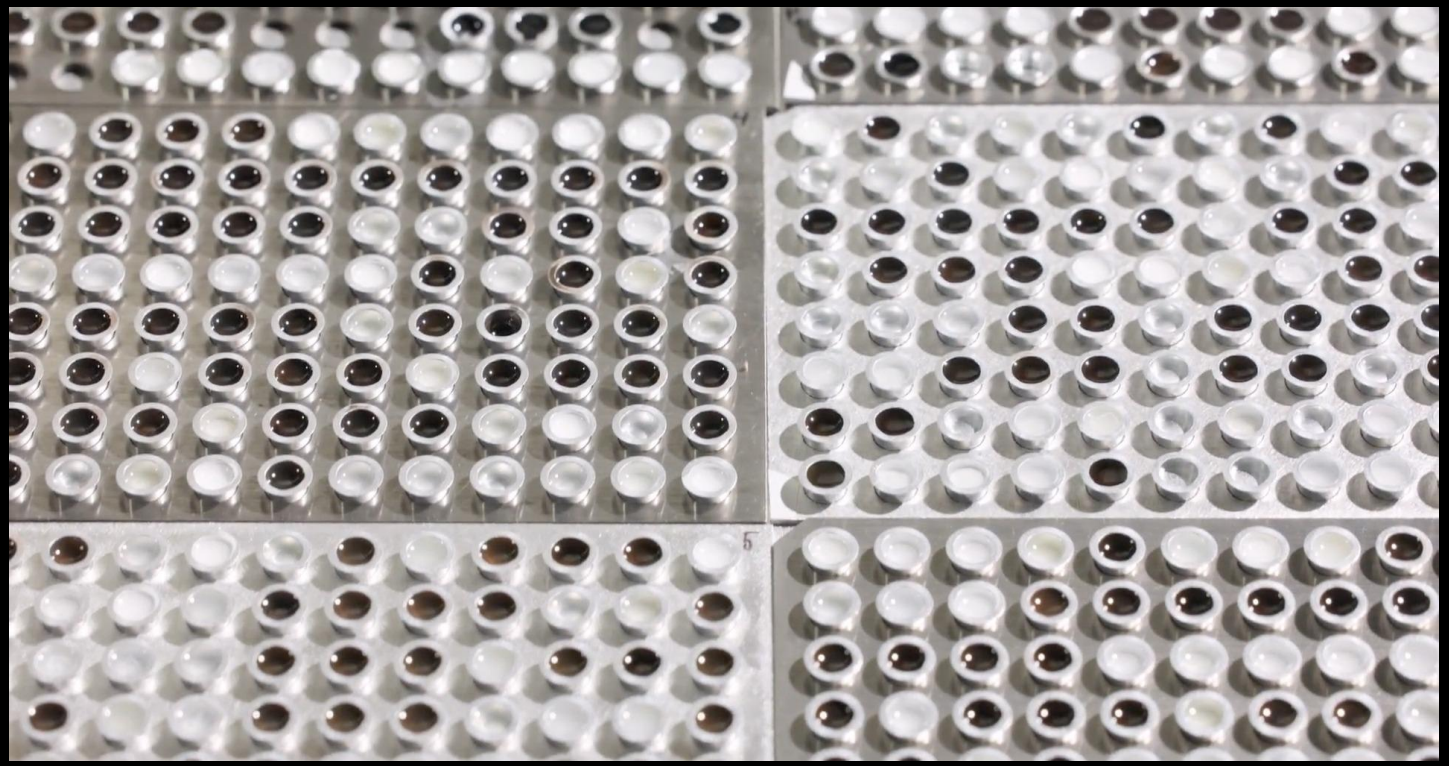
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Coolant Formulation

Data Analysis



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L I L A

Thank you. Questions?

Brandon Waye Azuero | bazuero@lila.ai
Pat Fuller | pfuller@lila.ai

lila.ai

AI Application Development supporting the U.S. Department of Energy's CESER Program Office

Ongoing and Upcoming Research

CYPHY: *Lab Testing and Utility Deployment of Digital Twins for Real-Time Cyber Attack Identification, Evaluation, and Mitigation*

This work was sponsored by the U.S. Department of Energy under Contract DE-CR0000048

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What is a Digital Twin?

Visual Digital Twin

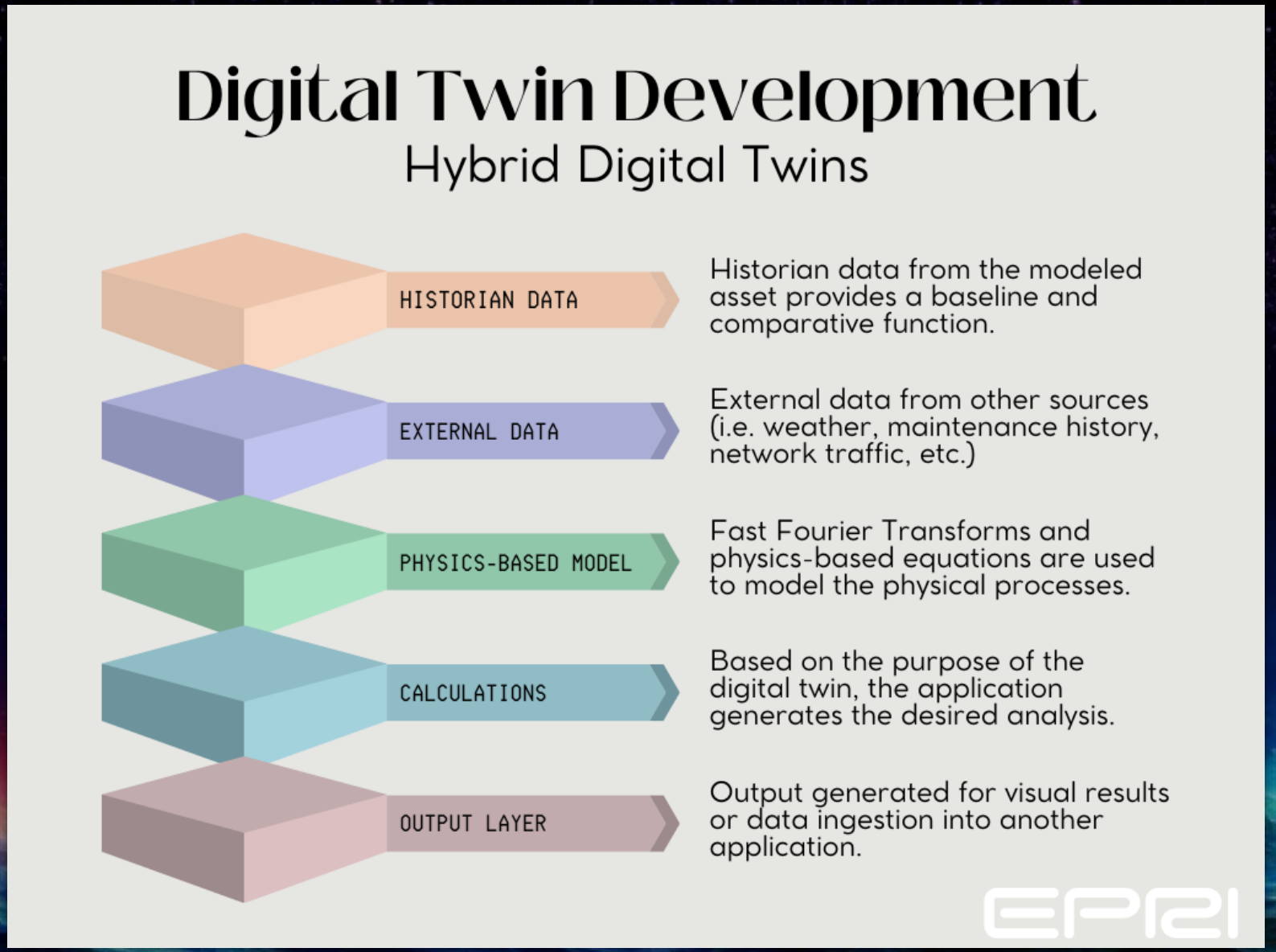
- Typically a 3D visualization
- Enables user interaction
- Very limited functional simulation capabilities
- May incorporate data integration
- Use-Cases:
  - Training and familiarization,
  - Design reviews,
  - Maintenance prep,
  - Remote inspections,
  - Presentations.
- Limitations: lacks the ability to simulate complex operational scenarios.

First Principles Digital Twin

- Physics-based modeling
- Predictive capabilities
- Data integration from various sources
- Complex calculations and simulation
- Use-Cases:
  - Predictive maintenance,
  - Smart dispatch
  - Multi-fuel characterization
  - Emissions predictions
  - Thermal performance optimization
  - Scenario analysis (what-if analysis)
  - Cyber security
- Limitations: development costs and SME requirements

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EPRI's Hybrid Digital Twin Approach



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CYPHY Project Goals

Identify and Prioritize OT Vulnerabilities	• Conduct expert workshops and create a threat database to document and rank OT system vulnerabilities specific to power plants
Develop Advanced Detection Models	• Design real-time detection models using CP-DT to identify and respond to cyber threats
Simulate and Evaluate Cyberattacks in a Lab Environment	• Create a lab-based CP-DT system to simulate cyberattacks and validate detection models
Customize and Execute Test Plans in Real Power Plants	• Adapt CP-DT models for specific plants and execute full-scale tests to assess model performance in real-world scenarios

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Developing a Digital Twin for Cyber Security

Concept

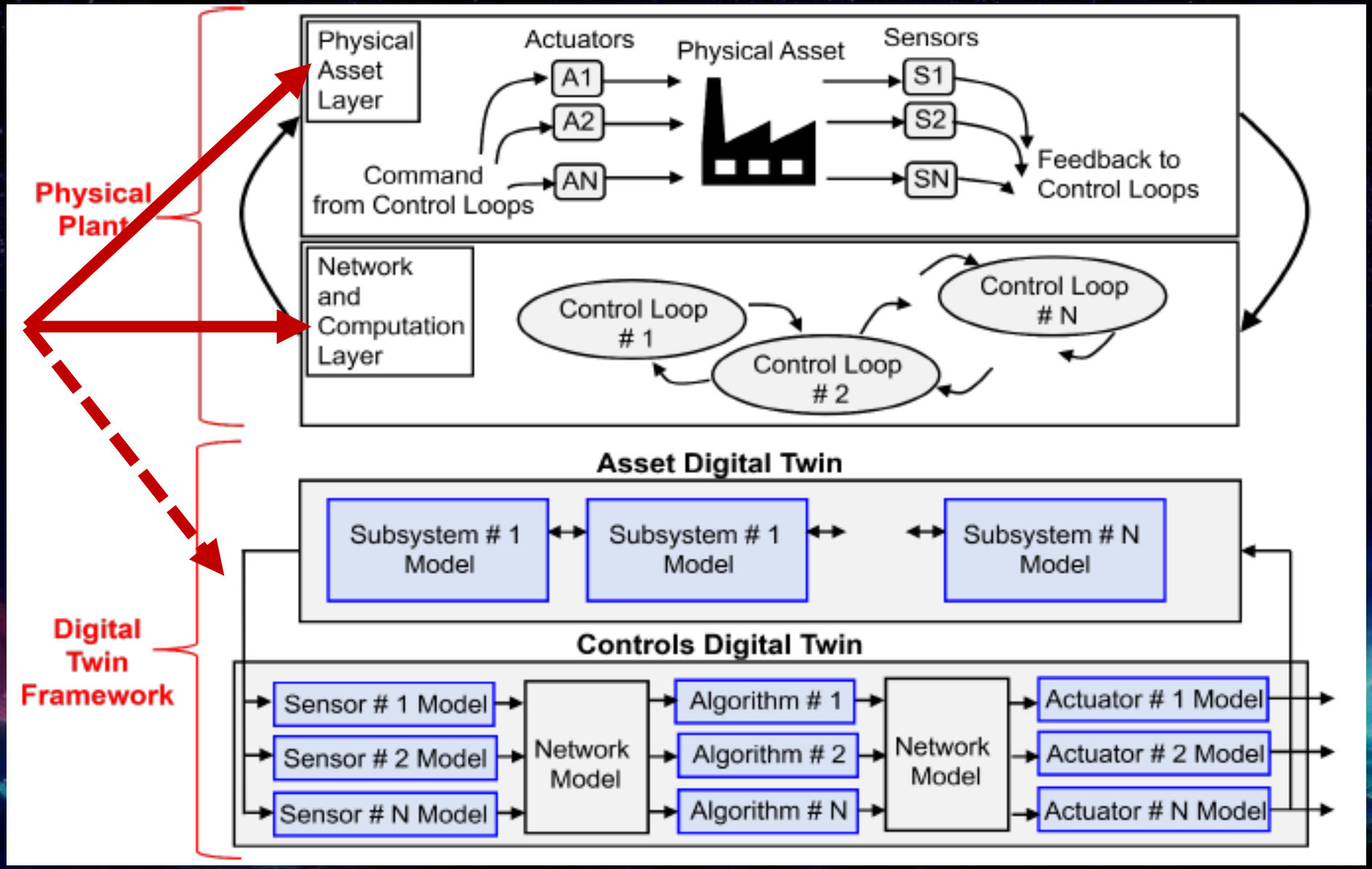
- Develop a hybrid DT to compare the expected physical system response to the actual physical response.
- Start with a standard FP DT – identify the data needed to accurately model control system components.
- Compare communications, equipment behaviors, and physical impacts.
- Compare impacts and behaviors to known states.
- Flag on known state mismatches and correlate to other operational and security data sources.

Data Layers

- Standard data for a FP DT for equipment health and performance monitoring
  - Historian
  - Weather
  - Equipment health/diagnostics/FMEA
- Cyber security-related data
  - DCS/SCADA network communications
  - Legitimate operational input from operations staff (control room)
  - Actual HMI views being presented
  - **Other data as attacks and impacts are categorized

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Add Controls and Communication Layers in the Digital Twin



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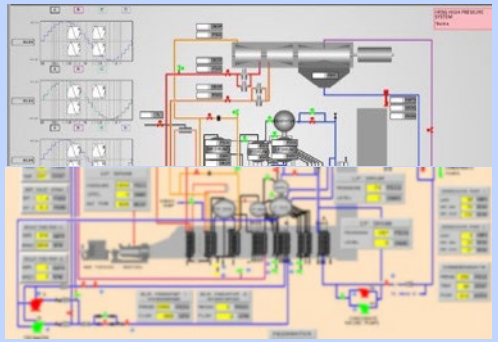
Demonstration and Transfer to Industry

Derisk development for industry by using non-production systems and lab resources

Fine-tune on plant systems without impacting operations – demonstrate technology

Accelerate technology transfer and adoption in industry – provide a method for continuous development

EPRI Development

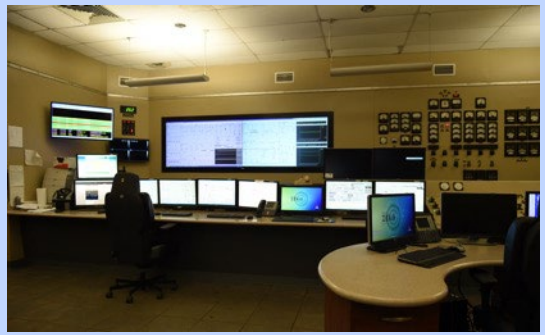


High-Fidelity Simulator



Plant Implementation and Evaluation





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Strengthening Cyber Resilience through AI

What it takes to make plant control systems resilient

- Hybrid digital twins combine first-principles physics with controls and network layers to expose what conventional monitoring misses
- Small control changes carry outsized risk: a biased signal or shifted constant can raise firing temperature while appearing to improve performance
- Detection comes from comparing expected against actual behavior in real time, then correlating mismatches with operational and security data
- 92 documented attack vectors across fuel control sub-loops were ranked with an FMEA framework for severity, detectability, and difficulty to exploit
- Temperature and speed loops cause the most damage fastest, making them the priority for flow-loop and lab validation
- Non-production simulators and lab resources derisk deployment and accelerate transfer of these defenses into industry

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CLOAK: Collaborative Learning with Obfuscation Assurances for grid Knowledge

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CLOAK enables collaborative grid AI without pooling sensitive utility data

PROJECT OVERVIEW

A 24-month research program to define, build, and evaluate privacy-preserving federated learning for power-system applications.

THE OPPORTUNITY

Learn across utilities.

Keep data under utility control.

CLOAK will test whether multiple owners can improve grid-focused models while limiting what leaves each participant site and measuring the tradeoff between privacy and model performance.

Primary focus: *distribution systems*

Period of performance

Jan. 2027 – Sept. 2028

RESEARCH APPROACH

1	**Specify the problem**	Select utility use cases, define measurable performance and privacy requirements, and establish the threat model.
2	**Build two independent model tracks**	Evaluate ANL's LUMINA/APPFL track and a Cornell-led model under one common benchmark protocol.
3	**Add privacy protections**	Integrate differential privacy and compare private approaches against non-private federated baselines.
4	**Demonstrate and govern release**	Deliver quantitative privacy–utility results plus practical guidance for utility leaders and data stewards.

Desired outcome: *defensible evidence for when and how sensitive grid-derived artifacts can support shared AI development.*

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From utility-defined requirements to an end-to-end private federated learning demonstration

PROJECT PATHWAY AND TEAM

The program moves through staged specification, baseline development, privacy integration, benchmarking, and industry outreach.

M0–6
DEFINE
Use cases • metrics • threat model • federation specification

M4–15
BUILD BASELINES
Common benchmark • two non-private tracks • multi-site deployment

M13–22
INTEGRATE + TEST
Differential privacy • attacks • privacy–utility evaluation

M19–24
DEMONSTRATE
Capstone execution • governance package • industry outreach

GATE G1 • Month 6

RESEARCH PARTNERS AND PRIMARY CONTRIBUTIONS

BERKELEY LAB	Project lead; specification, governance framework, integrated evaluation
Argonne NATIONAL LABORATORY	APPFL + LUMINA model track; federation architecture and deployment
Cornell University	Differential privacy methods; second model track; theory and integration
Lawrence Livermore National Laboratory	Threat modeling, attack demonstrations, benchmarking, deployment
Univ. of Central Florida	Contributes to the Cornell-led model track and integrated evaluation
EPRI	Utility recruitment, requirements, governance review, demonstration and outreach

Common evaluation across both model tracks preserves background IP while producing comparable evidence.

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Seeking U.S. utility partners to shape, test, and validate privacy-preserving grid AI

EPRI ROLE AND UTILITY CALL TO ACTION

Participation is intended for EPRI members in OPAI that can contribute operational perspective, privacy requirements, and selected data under agreed protections.

EPRI WILL

1. **Recruit and onboard**
   Develop the value proposition, answer utility concerns, and support NDAs/data-use agreements.
2. **Elicit requirements**
   Translate privacy concerns and operational constraints into measurable project requirements.
3. **Lead industry review**
   Convene a technical advisory group to review the governance framework and findings.
4. **Connect research to practice**
   Support benchmarking, capstone demonstration, stakeholder distribution, and outreach.

WHAT PARTICIPATING UTILITIES WILL BE ASKED TO PROVIDE

Operational use case	Identify a high-value distribution or transmission prediction, estimation, or control problem.
Data availability	Describe datasets, labels, formats, quality, history, and conditions for use; contribute selected data when agreements permit.
Privacy + risk thresholds	Define what must be protected, what may leave the site, acceptable exposure, and measurable attack-success limits.
Technical participation	Provide data/OT/analytics subject-matter experts for requirements sessions, reviews, and interpretation of results.
Validation and feedback	Review findings, assess practical usability, and help shape the final governance guidance and demonstration.

CALL TO ACTION — *Nominate a lead and schedule a 60-minute scoping discussion to confirm use case, data pathway, and participation opportunity.*

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