AI Challenge for Feedback

OPAI + IEL

March 18, 2026

ACCELERATING AI SOLUTIONS FOR THE POWER SECTOR

What is Incubatenergy Labs® (IEL)?

- Incubatenergy Labs® (IEL) is EPRI's **open innovation platform** designed to identify, test, and implement innovative solutions in a rapid annual cycle.
- Through a **collaborative** model, IEL offers a **cost-effective way to identify, test and validate new technologies with potential to address industry-prioritized innovation challenges.**
- By leveraging shared demonstrations and peer insights, companies can avoid redundant pilots, **saving 10x in demonstration costs.**
- Connecting utilities, innovators, and EPRI experts **reduces** technology evaluation and onboarding **time by 6-12 Months.**

Proven impact and track record:

- 8 years running
- ~100 demo projects completed
- $10+ million in project funding
- 1,000+ startups evaluated

Examples:

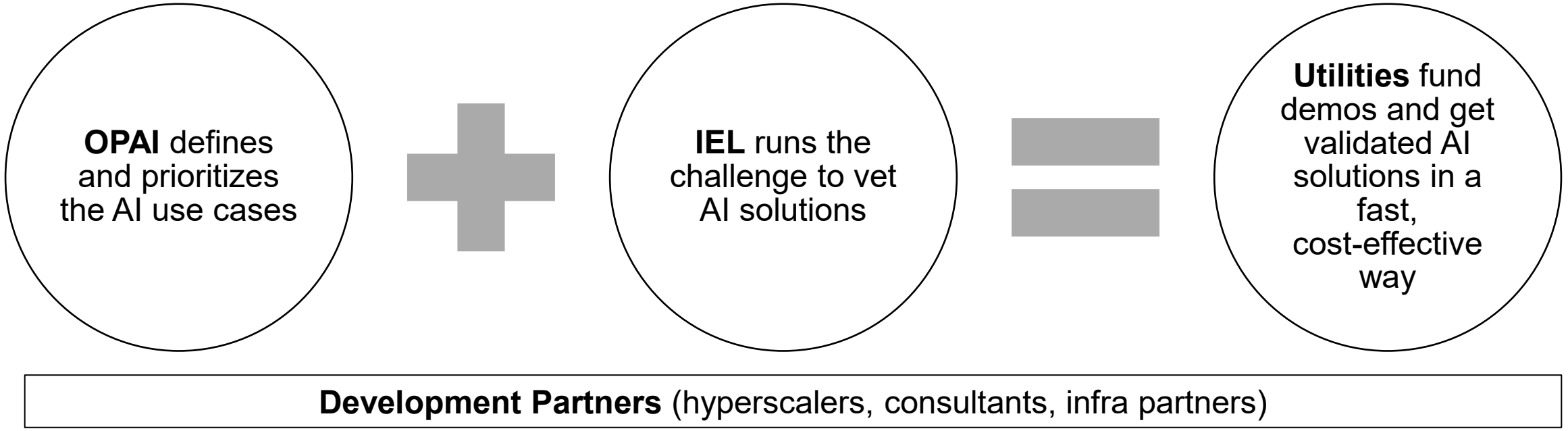
LINEVISION Utilidata square ROBOT

Learn more: https://epri.brightidea.com/community/iel

AI Challenge leveraging OPAI and IEL

- **What?** Facilitate AI demonstrations for prioritized AI use cases.

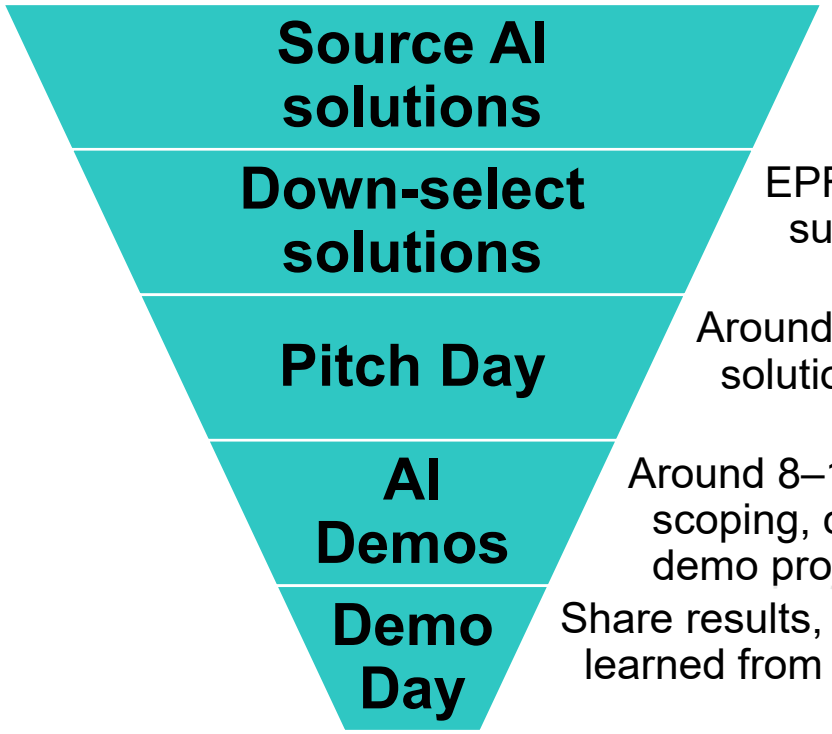
- **How?** Use IEL's proven rapid-demonstration framework to source, evaluate, and fund AI solutions against the 50+ priority use cases identified and prioritized by OPAI's 100+ utility consortium members



How the IEL AI Challenge could work? [Draft]

We're exploring how to adapt IEL's collaborative model to accelerate AI validation and are looking for thought partners to help shape it.

12 months



Open call for applications, OPAI and IEL amplify AI technology providers and development partners can apply

EPRI experts help vet and review submissions

Around 20 finalists pitch their AI solutions directly to utilities

Around 8–12 weeks. EPRI facilitates scoping, contracting, and coordination of demo projects

Share results, insights, and lessons learned from the demonstrations

Adapt IEL's collaborative model to rapidly validate AI solutions for priority use cases from OPAI

Let’s design this AI challenge together!

We’re looking for thought partners. Interested in learning more, reach out:

- Sandra Chavez, IEL Program Lead (schavez@epri.com)
- Jeremy Renshaw, Executive Director AI & Quantum (jrenshaw@epri.com)

Utilities	**Development Partners** (hyperscalers, consultants, infra partners, etc)	**AI Technology Providers**
• What are your next steps for exploring priority AI use cases in 2026? What barriers are you facing?	• How would you like to engage and where can your resources add the most value?	• Do you have a solution ready to validate with a utility, and what has your experience been so far?

Questions

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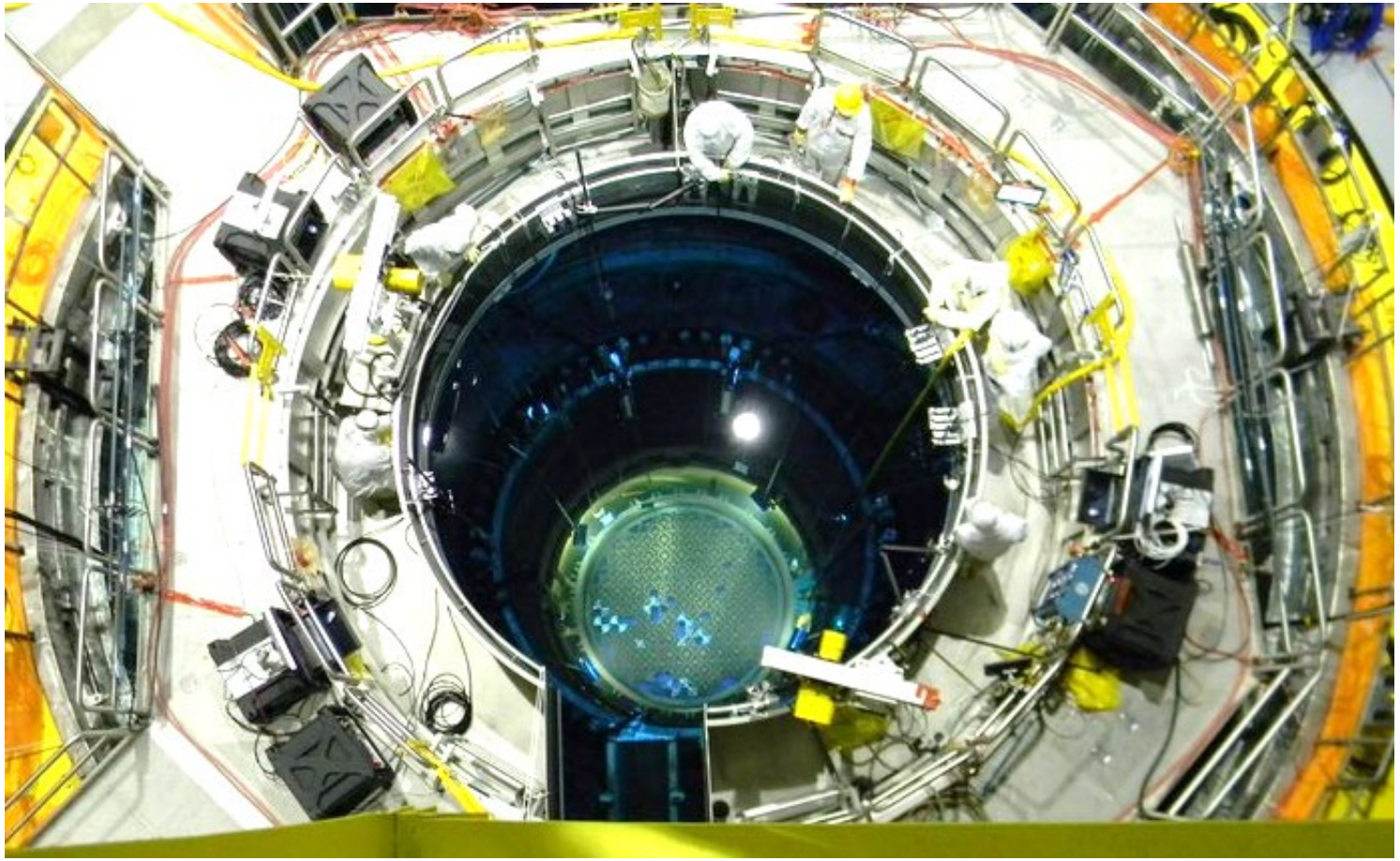
AI/ML for In-Vessel Visual Analysis

Chris Joffe
Principal Technical Leader

Open Power AI Consortium MRC Meeting
March 18, 2026

Remote Visual Inspection of Reactor Internals



fatigue

Missed flaws

distraction

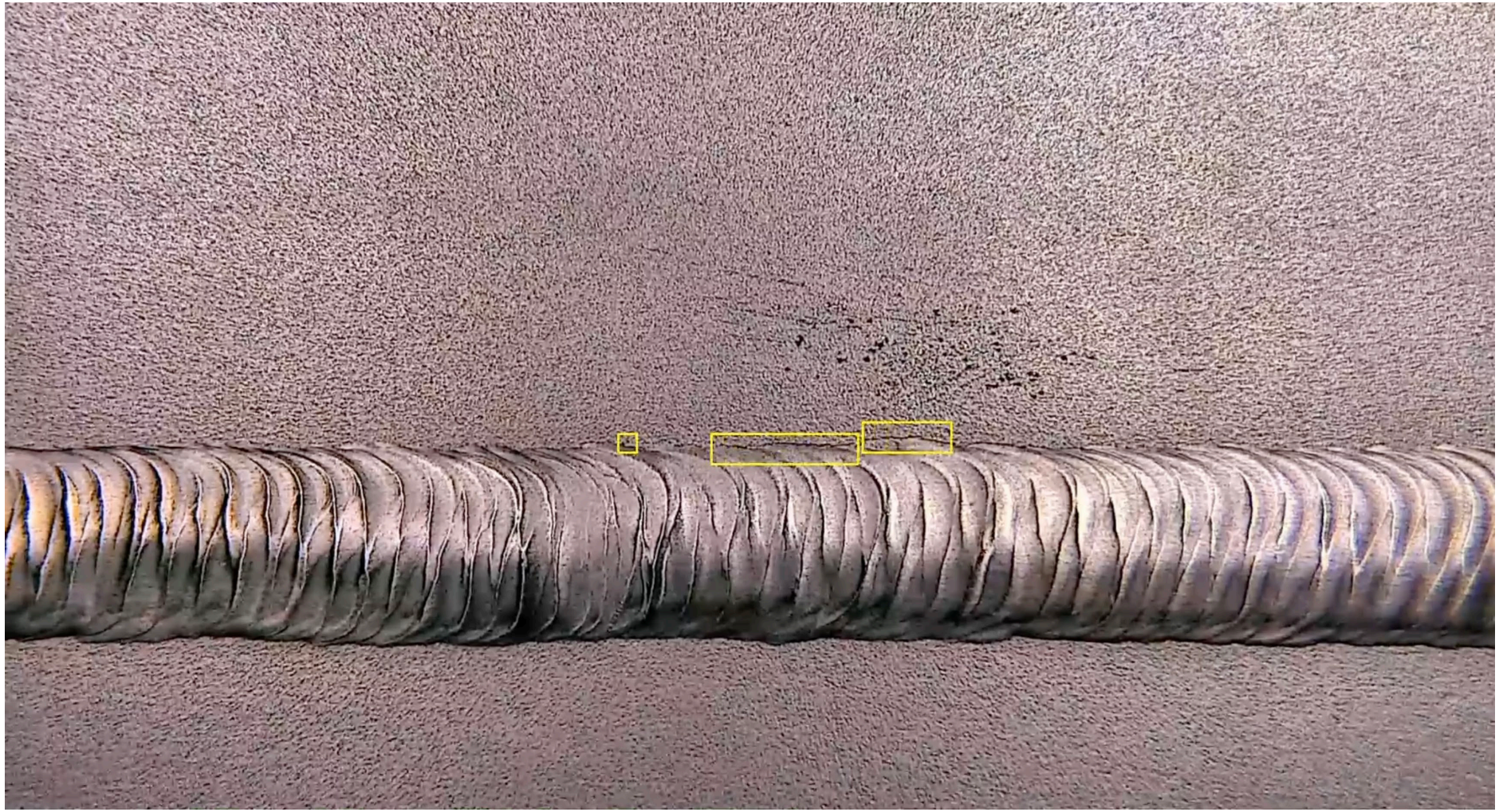
Preliminary analysis in **real time** *followed by* Post-inspection review

Goal: Develop a tool that can assist examiners in both activities

EPRI VT Test Plate

What do you see?

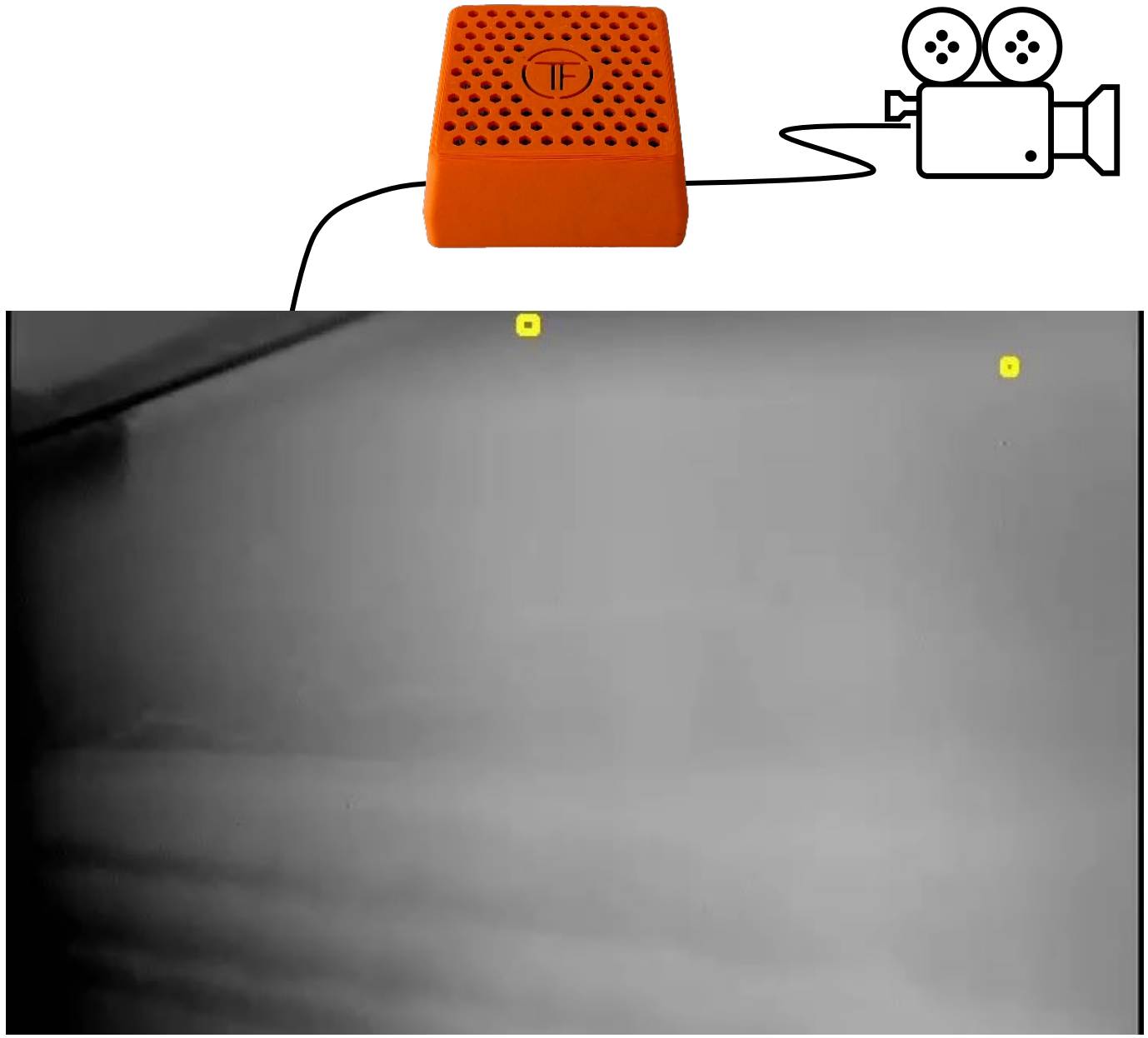
With AI



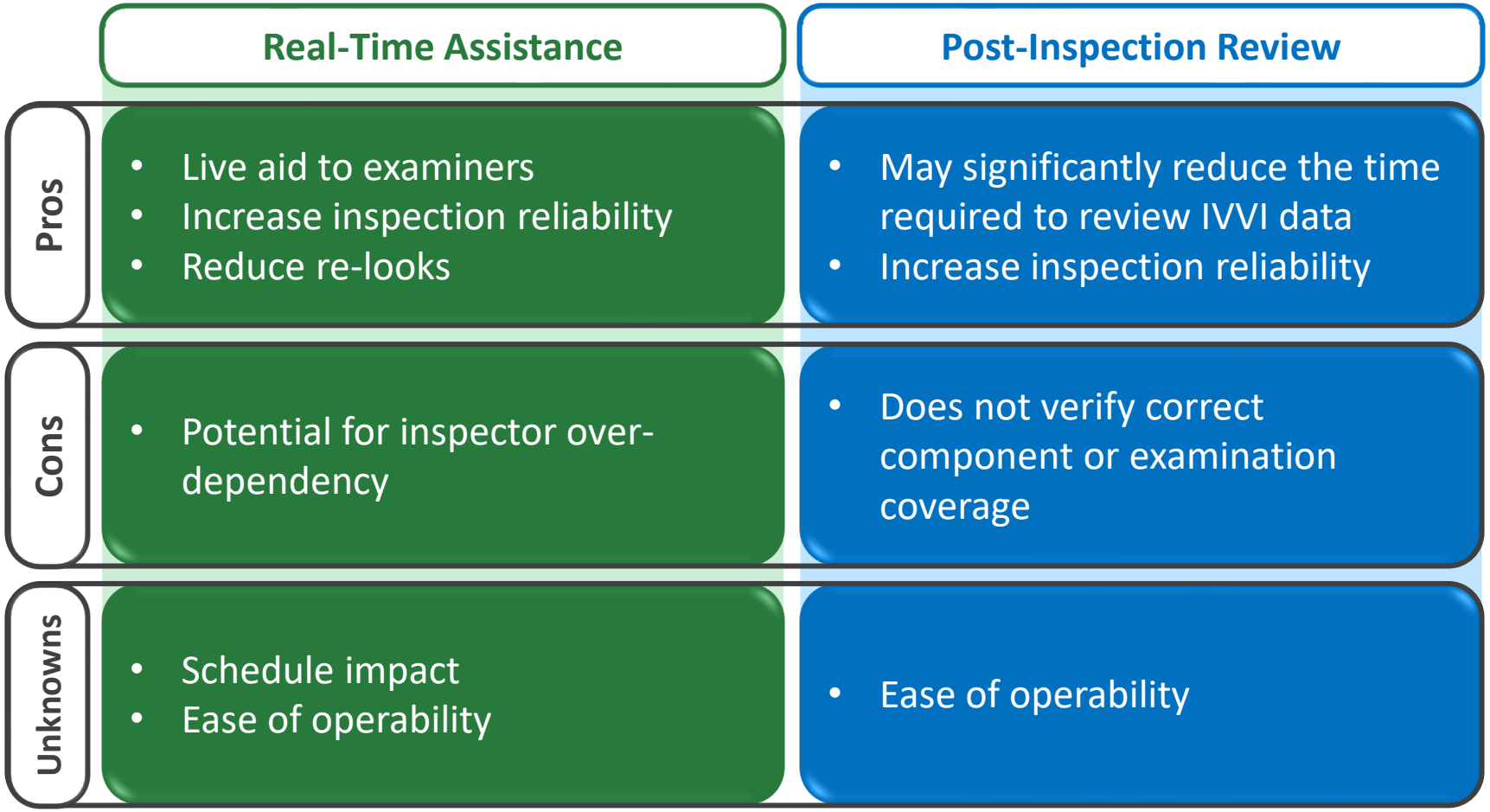
Would this be helpful?

AI Basic Details

- Objective is to **ASSIST** examiners and reviewers to increase inspection reliability
- Trained to detect Cracking
  - EVT-1 and VT-1 inspections
- One AI model for BWRs and PWRs
  - Also, works with all camera types (HD, SD, Color, B&W)
- AI does NOT actively learn
- Model developed between EPRI & AI Vendor (TrueFlaw)



Implementation Modes



Field Trials to Provide Insight

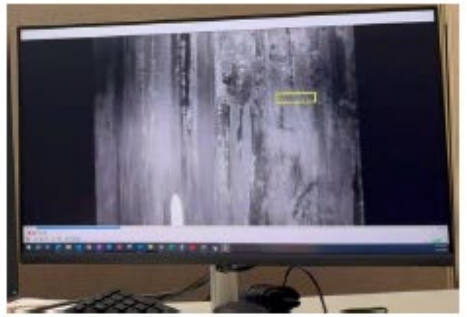
Real Time AI Set-Up

…As simple as “plug and play”

Camera CCU

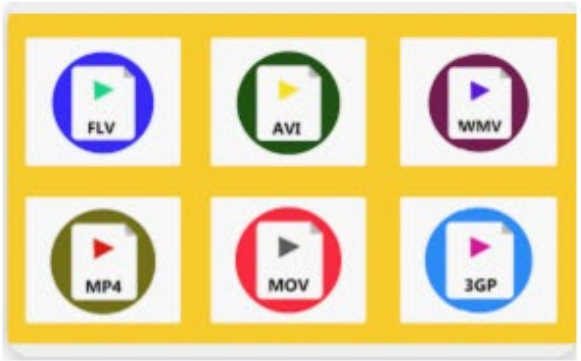
AI Box

…not set up to record any data to box



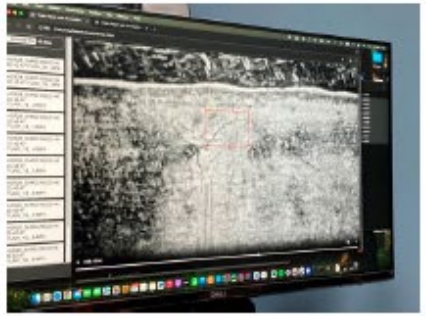
Monitor

AI Set-Up for Recorded Videos



Vendor Video File

AI Box
(Creates AI Video File)



HTML Viewer
(Plays AI Video Files)
*No software required to download

VT AI Field Trials

Field Trial Support

- 1st Field Trial in Fall 2024
  - BWR
- 4 Field Trials in 2025
  - 3 BWRs & 1 PWR
  - Includes 1 International Utility
- Potential for 5 Field Trials in 2026
  - 1 PWR already completed

Field Trial Summary

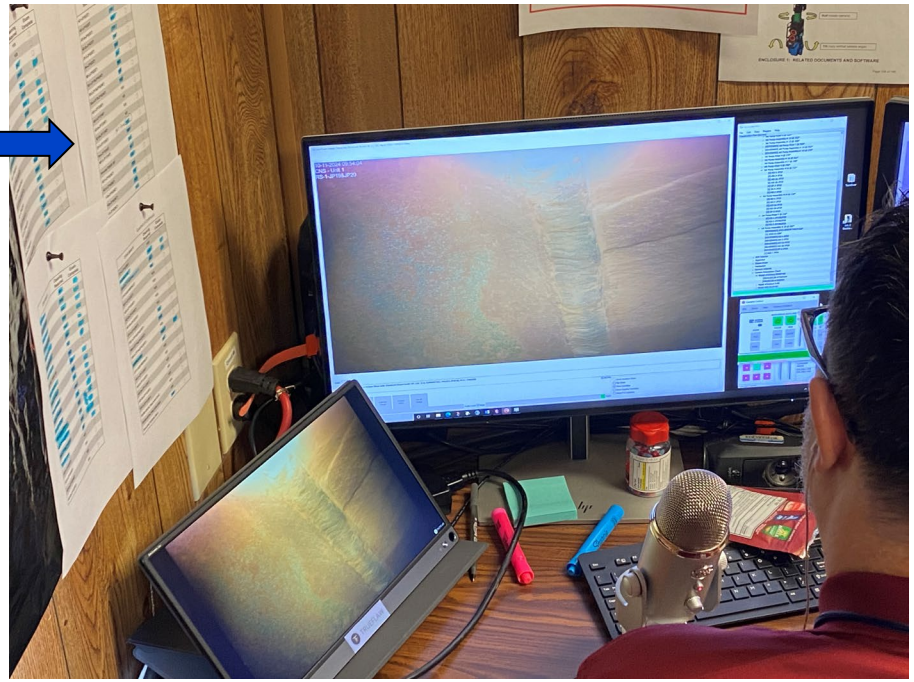
Positives:

- Positive feedback from examiners, utility personnel, and NRC
- Success in real-time implementation on refuel floor
  - No noticeable delay between inspection monitor and AI monitor
  - Success in integrating with GE & Framatome camera systems
- Minimal false calls, seem appropriate when present
- No significant difference in performance between various components, cameras, real-time vs recorded, etc.
- Separate HTML viewer that plays .json data was easy to use

AI Monitor positioned next to Primary Inspection Monitor

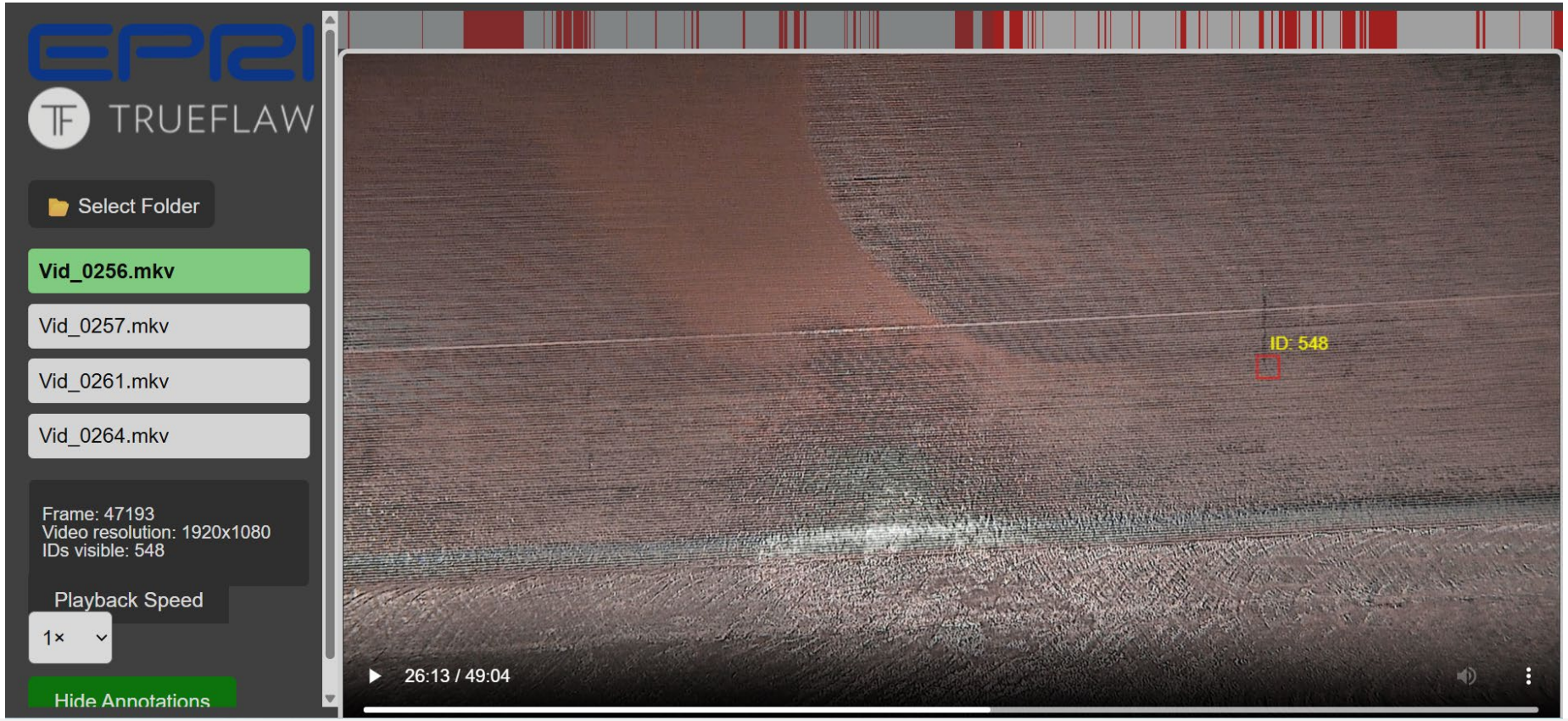
Examiner & Reviewer Feedback

- 2 monitor approach can be distracting
- Real-time AI can improve the quality of inspections by recommending Level IIs to provide audio to areas containing boxes
- Very helpful for tracking positioning while performing indication evaluations focused on one singular flaw
- Useful as a “second set of eyes” for identifying flaws that weren’t initially detected by the examiner
- Model sensitivity seems appropriate. However, lots of boxes when not performing EVT-1/VT-1
  - Sometimes struggles inside of weld and weld toes
- Model only boxed a portion of the flaw
- Emphasized significance of focus on AI performance
- Model included boxes outside the exam volume
- Expand model to detect wear



Areas for Improvement

- Efficiency gains
- Eliminate boxes that flash on screen
- Expand boxes to cover entire flaw length
- Continue to add to training library
- Improve post-processing speeds
- Avoiding contamination to boxes and cables on refuel floor
- Option to detect Wear
- Image Stitching
- Length Sizing



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MARCH 18, 2026

What We are Building in GridAI: GridMind, LUMINA, and APPFL

KIBAEK KIM
Computational Mathematician
Mathematics and Computer Science Division

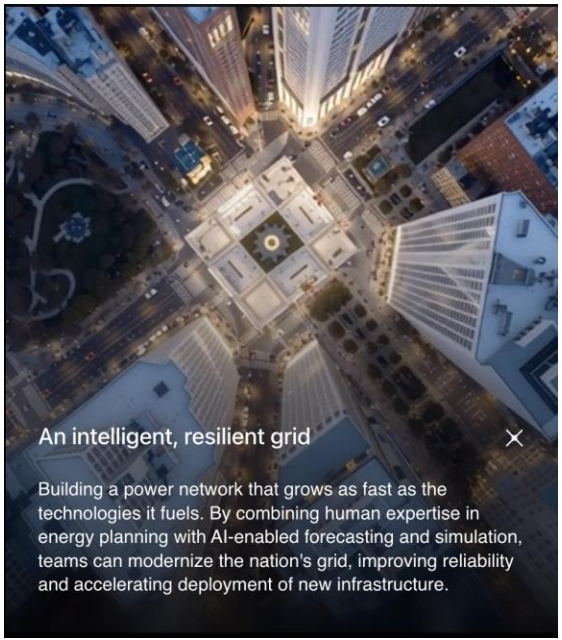
U.S. DEPARTMENT OF ENERGY
Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

Argonne NATIONAL LABORATORY

What is GridAI?

GridAI is one of the DOE Genesis Mission seed Model Team projects.

- **Focus**: Advancing and **building** AI capabilities for the grid operations and planning.
- **Team**: ANL, LANL, NLR, ORNL, PNNL, BNL, LLNL, SNL
- **Cross-divisional team at Argonne**
  - **MCS**: Kibaek Kim, Emil Constantinescu, Adrian Maldonado, Hongwei Jin, Yijiang Li, Zeeshan Memon, Keunju Song
  - **ESIA**: Jonghwan Kwon, Stefano Fenu, Sunash Shama, Henry Huang
  - **DIS**: Duane Verner, David Sehloff, Parfait Gasana, Monica Neukomm



GridAI Project Scope

Goal: Enable decisions up to **20-100 times** faster that help improve electricity costs and reliability by up to **10 percent**.

GridAI Platform

Agentic Grid Workflows

Federated Foundation Models

Interoperable Grid Data & Tools

Synergistic combination will deliver capabilities

Operational Intelligence for Future Grid
Proactive, Secure, Reliable, and Affordable

Operations
Agentic Ops at 100x Speed

Turning live grid data into actionable control recommendation

Planning
1000x Scenario Exploration

Rapid co-optimization across thousands of scenarios for resilient infrastructure

Security
100x fewer incidents

Fusing IT/OT signals to proactively detect anomalies early

Industry Partnership

- Partnership activities span – AI FM, utility data, applications, validation, PPFL
- Examples:
  - **Google EarthAI** for agentic response operations
  - **ComEd**, **EPRI Open Power AI Consortium**, and **EEI** on federated learning
  - **IBM** on grid/geospatial/weather foundation models, optimization solver (CPLEX)
  - **TVA** on data, use cases, and requirements
- Future partnership focus
  - Computational backend needed for national-scale operational deployment of GridAI
  - User-centric planning tools using GridAI

Progress: Agentic Grid Workflows

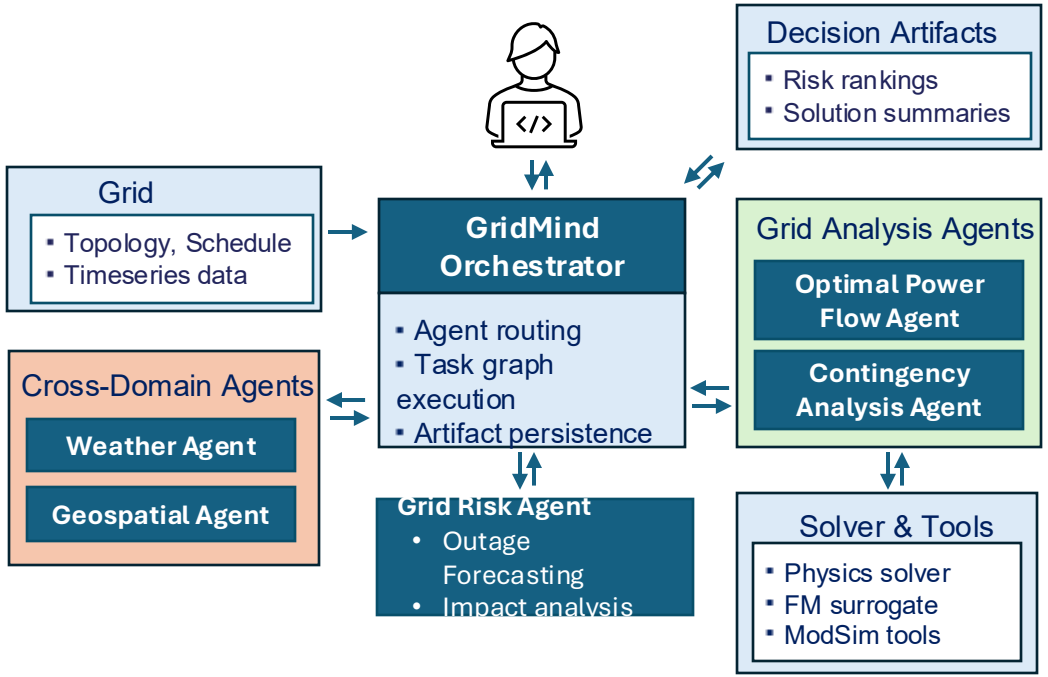
Agentic Grid Workflows at Scale

“Data comes in, multiple tools, limited time..”

GridMind is a LangGraph-based orchestration workflow agent for power system analysis

Core Capabilities:

- **LLM-Powered Routing**: Multi-agent workflow coordinating solvers, surrogates, and queries via Argo-API
- **Cross-domain Integration**: AERIS Weather Agent connected via MCP, Google Earth AI Geospatial Agent forthcoming
- **Physics + ML Execution**: Physics solvers and FM surrogates
- **Deterministic Query Layer**: Structured queries over persisted results



Progress: Federated Learning

Federated Foundation Models for the Grid

APPFL: Leveraging AI4S-funded open-source package for privacy-preserving federated learning.

CITADEL: scalable protected infrastructure for proprietary/protected data and compute.

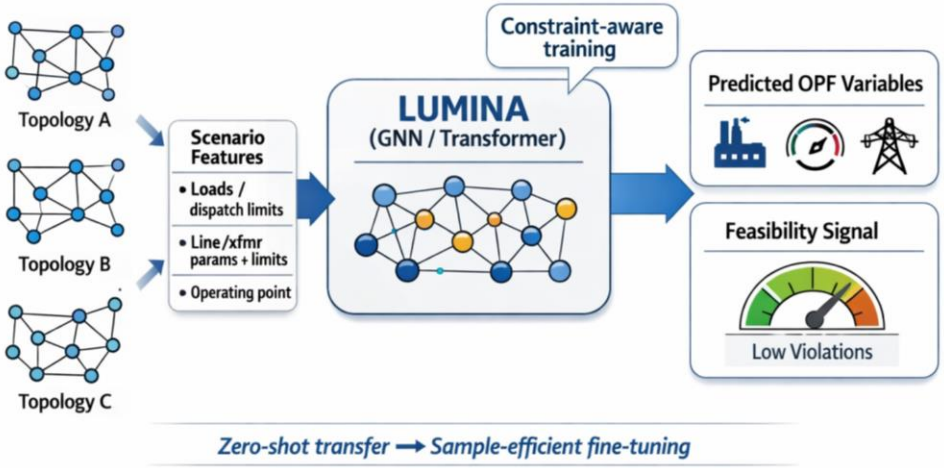
Capabilities:

- Deployed to ALCF, OLCF, NERSC, SNL, NLR, and commercial clouds (AWS, Google)
- Privacy-preserving training
- Enabled via Globus Endpoints

globus

Progress: Grid Foundation Model

LUMINA: Grid Foundation Model



- **Physics-aware:** Complex operational and physical constraints.
- **Topology-transferable:** Pre-trained model is generalized to **unseen** grid topologies.
- **Training at scale:** Portable training pipeline and **FL-ready on AmSC** infrastructure at scale.

Ensuring Lumina is performant, portable, and scalable across LCFs

Progress: Grid Foundation Model

LUMINA Lifecycle + Risk-Screening Impact

Pretraining:

- Federated Learning on **AmSC at scale**
  - Aurora, Frontier, Perlmutter, and cloud.
- Multi-topology synthetic datasets

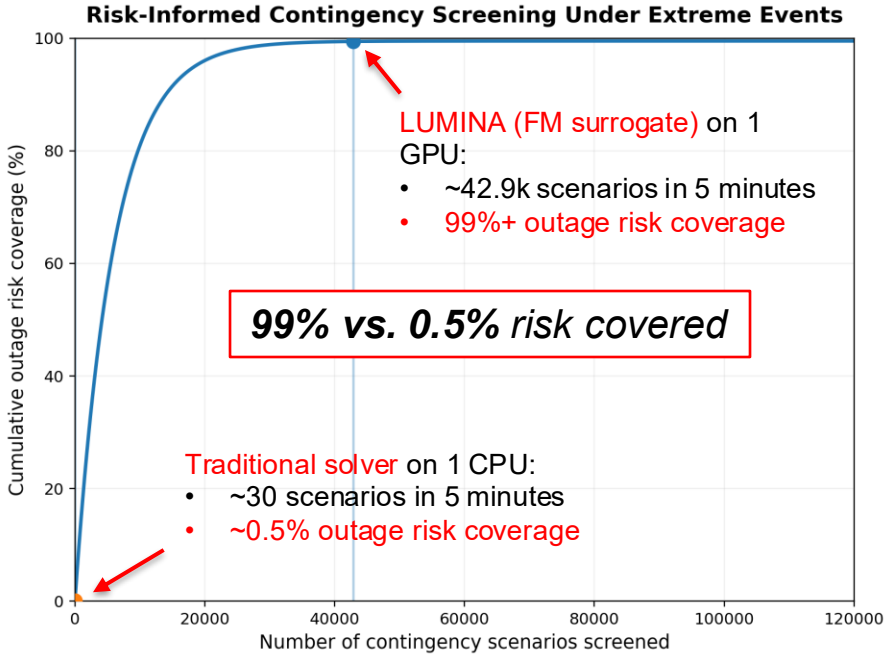
Fine-tuning:

- Faster adaptation with better performance
- Synthetic Texas system

Inference:

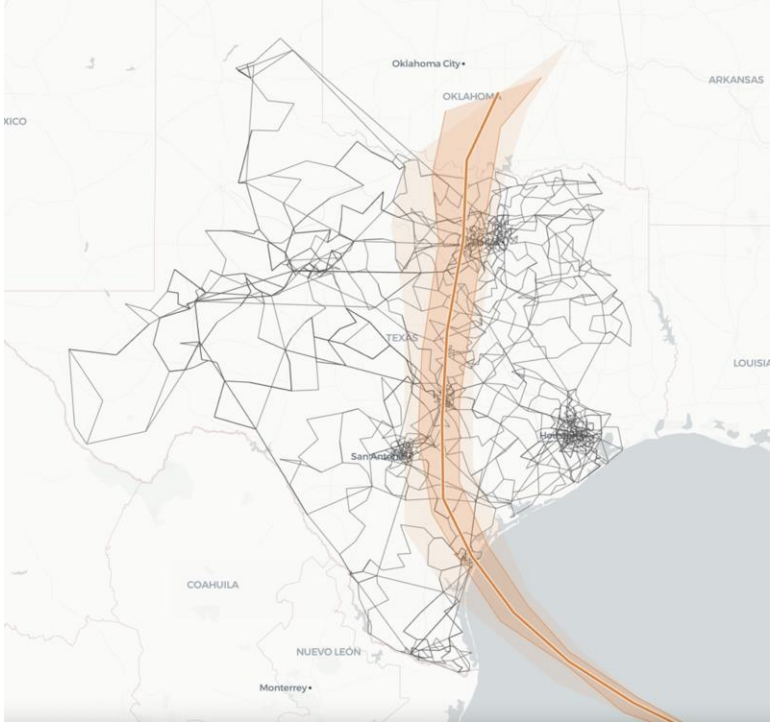
- **1000x faster** contingency screening
- Integration to GridMind Workflow

```
GridMind> Train LUMINA-v0 on new data ingest.
Starting federated learning...
```



Use Case: Hurricane Contingency on Synthetic Texas Grid

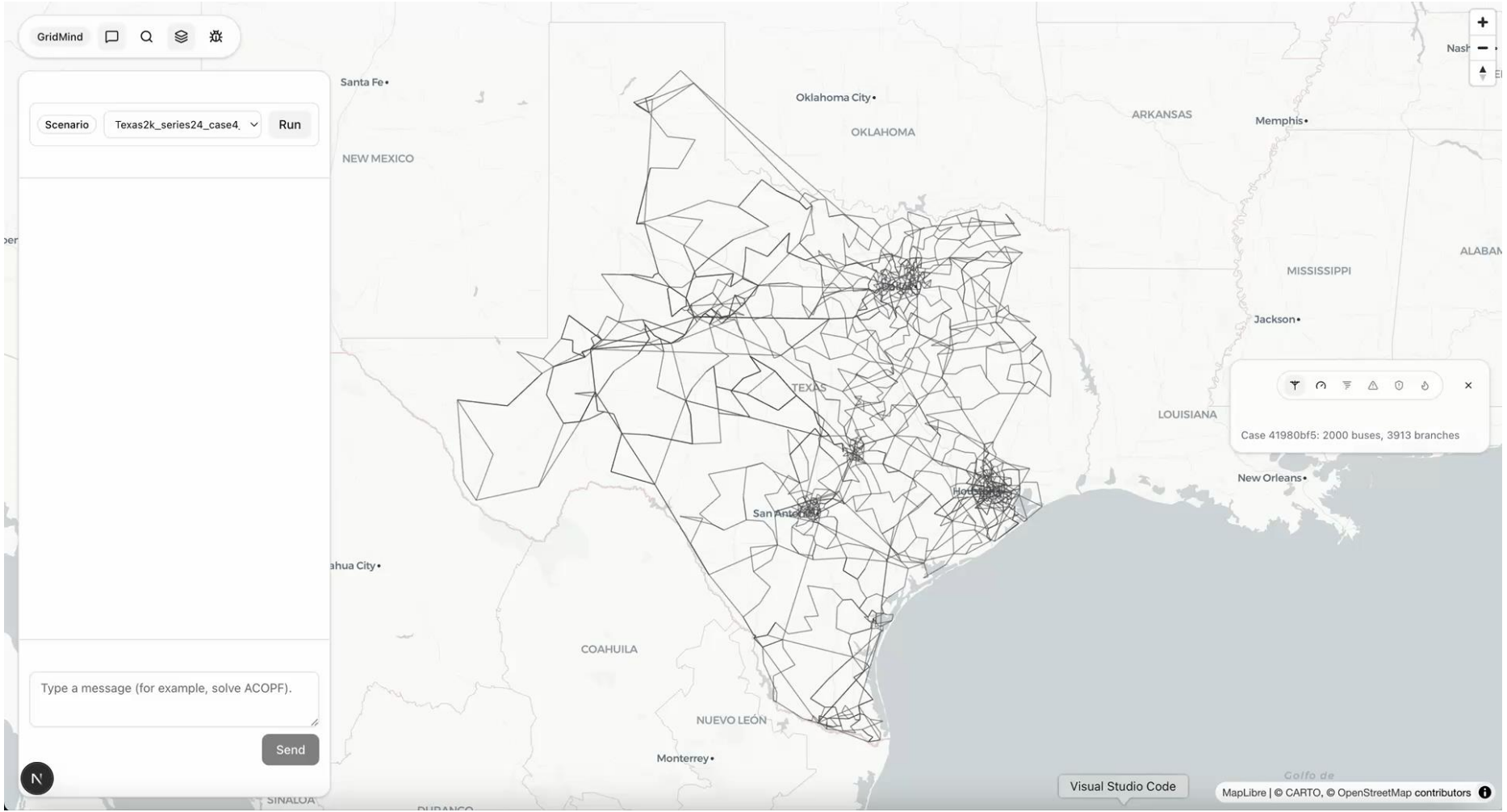
GridAI-Enabled Proactive Decision Support



Agentic GridAI Workflow Orchestrated by GridMind
From forecast-driven reasoning to forward-looking situational awareness

Weather Agent	Analyzes storm track, intensity, and timing to identify exposed grid regions
Grid Risk Agent	Samples correlated plausible asset outages driven by the forecasted hurricane event
Grid Analysis Agents	Rapidly evaluates system impacts and mitigation actions to identify high-risk cases
Certification	Validate feasibility of mitigation actions

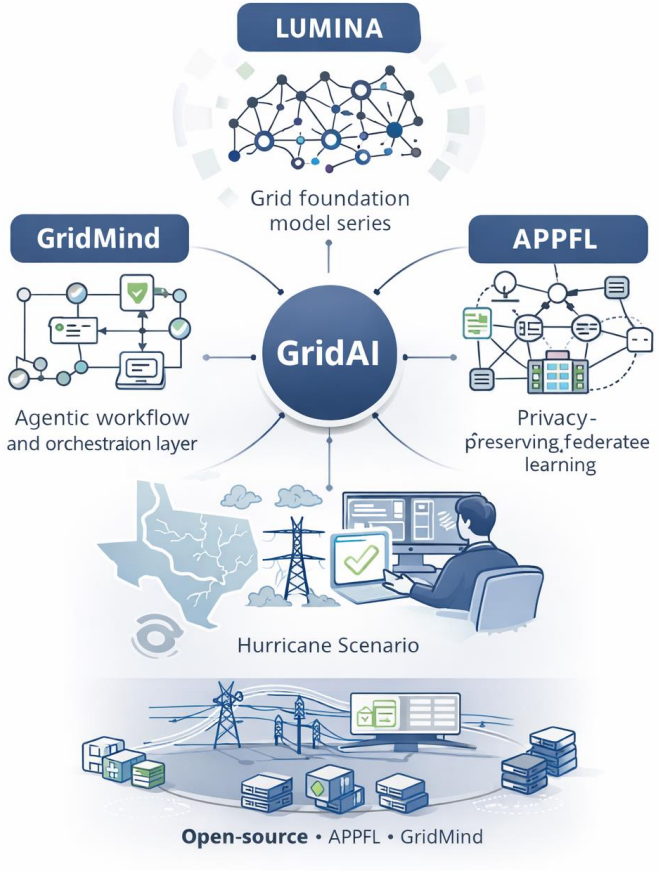
Decision Readiness Output: Prioritized, operator-ready recommendations for forward-looking situational awareness

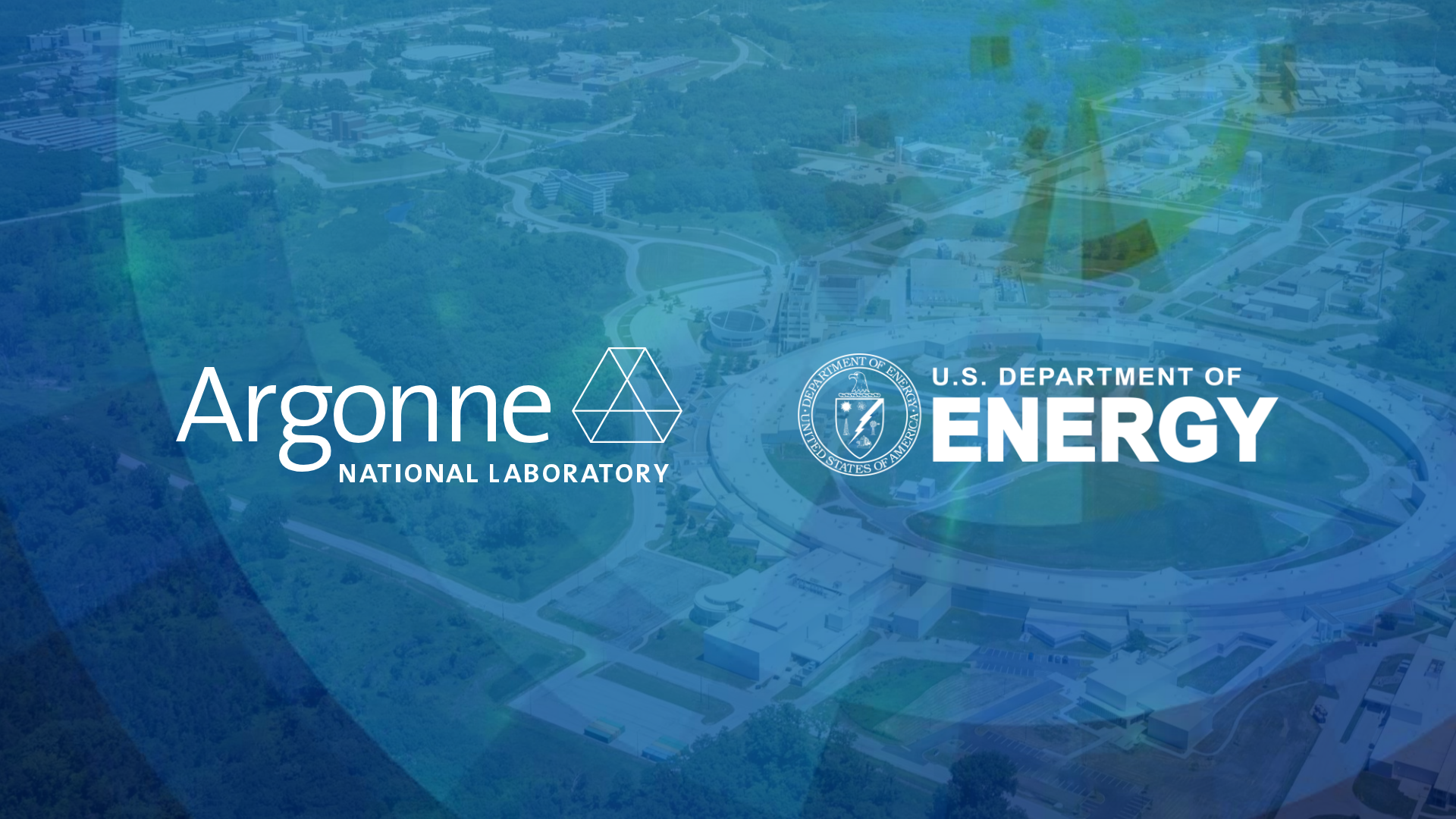

GridMind
Scenario
Texas2k_series24_case4
Run
Type a message (for example, solve ACOPF).
Send
Case 41980bf5: 2000 buses, 3913 branches
Visual Studio Code
MapLibre | © CARTO, © OpenStreetMap contributors
Santa Fe
Oklahoma City
OKLAHOMA
ARKANSAS
Memphis
NEW MEXICO
MISSISSIPPI
Jackson
TEXAS
LOUISIANA
New Orleans
San Antonio
COAHUILA
NUEVO LEÓN
Monterrey

Concluding Remarks

GridAI: a unified AI platform for proactive grid operations and planning

- **GridMind: agentic workflow layer**
  - LangGraph-based orchestration connecting weather, risk, OPF, contingency, and surrogate tools
  - Natural language interface preserving numerical rigor through structured function calls
- **LUMINA: grid foundation model series**
  - HGT + augmented Lagrangian yield best accuracy-feasibility trade-offs
  - Multi-topology pretraining: zero-shot transfer and 83% reduction in fine-tuning steps
  - Design principles for constrained scientific FMs (ICLR 2026)
- **APPFL: privacy-preserving federated learning**
  - Enables collaborative training across utilities/labs without centralizing sensitive grid data
- **Integration: demonstrated on synthetic Texas grid under hurricane event**
  - 1000x faster contingency screening; 99%+ risk coverage; operator-ready decision support
- **Open-source(-ing): lumina-core, APPFL, GridMind available for community use**

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