ADE-1
Industrial System Software

From model to fully operational production systems

We don't optimize factories.
We generate them.

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ADE-1 Autonomous Decision Engineering

ADE-1

Developed by Tocotech Group
+20 years of industrial innovation

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Introduction

Today I will introduce a new approach to industrial process optimization.
After 22 years, **we are bringing a VISION to LIFE**

ADE-1 is not a classical planning or scheduling tool.
It is a system engine that models, simulates, and runs industrial production using the same underlying structure.

It is **NOT** just a "simulation system", it is an
Autonomous Decision Engineering, a **"living organism playing chess for a better order sequence"**

We generate systems where correct decisions emerge automatically from the model.

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Introduction

From a single model, the system automatically generates:

- **production control**
- **machine control**
- **databases**
- **Visualization**

Using a 360º context, real-time feedback, and user-defined priority weights, to brute-force the optimal production sequence

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The Problem

Industrial systems are controlled by multiple disconnected layers:
ERP, MES, PLC, planning tools. They are losing efficiency every day — not because of lack of data, but because of fragmented decision systems.

Companies rely on **disconnected tools** (ERP, MES, planning, control), each operating on a partial view of reality.

These systems cannot represent the real physical process

This leads to:

- **Suboptimal production decisions**
- **High operational variability**
- **Hidden inefficiencies that scale with complexity**
- **In complex environments, human-driven planning simply does not scale**

This leads to inefficiencies that are widely accepted as unavoidable.

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Why Existing Solutions Fail

No system today provides a unified, executable model of the full production system

Current industrial software does **not model reality — it approximates it.**
Each system layer amplifies the problem:

- **Planning tools ignore execution constraints**
- **Execution systems lack global optimization**
- **Control systems operate locally**

As a result:

- **Decisions are made on incomplete models**
- **Optimization is local, not global**
- **Systems become unstable under disruption**

The core issue:
Existing systems optimize decisions. They do not model the system itself.

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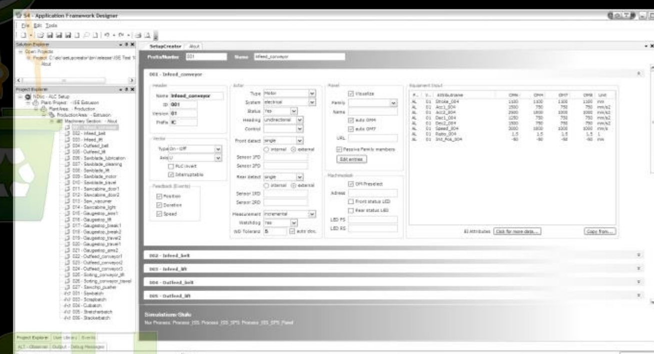
The Core Idea

We take a fundamentally different approach.
Current systems require manual programming, integration, and maintenance.
ADE-1 require NO coding. The model is not a representation. It becomes the executable system itself.

- **Materials are tracked as real identities**
- **Machines define physical constraints**
- **Processes are ruled-based transformations**



This creates a system where:
Correct decisions are not calculated → they emerge from the model

The model is not a simplification
It behaves like the real system
It is a functional representation of the process itself

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How ADE-1 Works

The same model generates both simulation and real system execution. No abstraction layers between model and execution.

Material is never abstracted away. Instead, it is tracked continuously through transformations.
Objects are tracked spatially in real-time with millimetric precision

At machine boundaries:
- **Objects are consumed**
- **New objects are created**
- **Identity and genealogy are preserved**

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How It Works

For example:
A cooling batch is incrementally transformed into a saw batch, which is then transformed into stacker batches and by-products.

During this process, source and target objects coexist until the transformation is complete.

This guarantees full consistency and traceability at all times.

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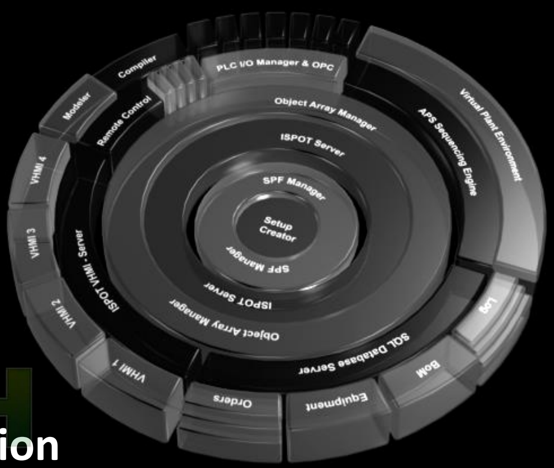
Scenario Engine

Unlike traditional APS, this system evaluates physically valid scenarios only.

On top of this model, we run a scenario-based planning engine.
The system generates and evaluates a large number
of possible production scenarios.

These scenarios vary parameters such as:

- **order sequence**
- **lot sizes**
- **batch composition**
- **machine configurations**
- **Enables real-time “rolling production” optimization**



Each scenario is simulated over a defined time horizon.

The outcome is not estimated —
It is computed through the model.

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Key Differentiator

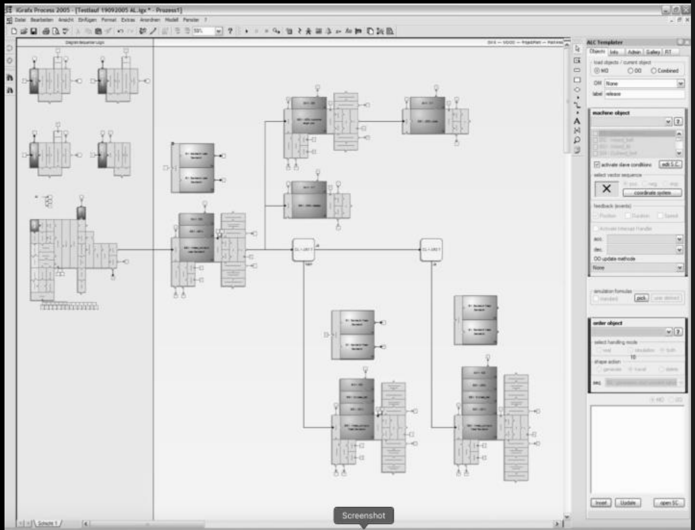
- ✓ **No heuristics**
- ✓ **No approximations**
- ✓ **No manual rule tuning**
- ✓ **No predefined rules**

It evaluates thousands of physically valid production scenarios and selects the best outcome.

<u>No need for PLC programming — system generates control logic automatically</u>

This leads to:

Higher accuracy
More stable operations
Results that outperform human planning



The intelligence is not coded
It emerges from the structure of the system

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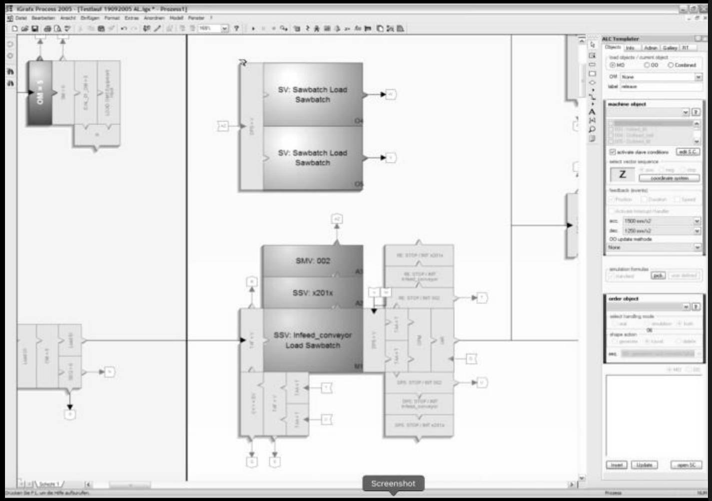
Why It Works

<u>All scenarios are physically valid by design</u>. Object-matrix architecture replaces traditional database bottlenecks → 1000x performance improvement

The effectiveness of the approach is based on constraint integrity.

The system enforces:

- **conservation of material**
- **geometric feasibility**
- **machine capabilities**
- **process timing**



This ensures that all simulated scenarios are physically valid.

As a result, the search space is significantly reduced, and brute-force evaluation becomes feasible.

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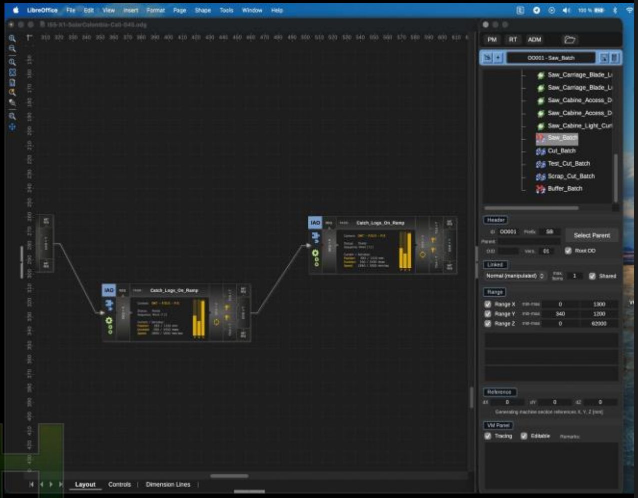
Why ADE-1 is Unique

This framework unifies multiple traditionally separate domains:

- **Automatic system generation from model**
- **Process modeling**
- **Production planning**
- **Execution logic**
- **Control System**
- **Machine logic**
- **Database**
- **Visualization**
- **Documentation**



All operate on a single, consistent representation.

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Why ADE-1 is different

In addition:

- **Every material transformation is tracked**
- **Full genealogy is preserved**
- **Dynamic batch formation is supported**

Traditional Systems	ADE-1
fragmented	unified
manual integration	automatic generation
coding required	no code
approximation	real system

This level of integration is not available in conventional systems.

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This is not a concept.
This is a running system.

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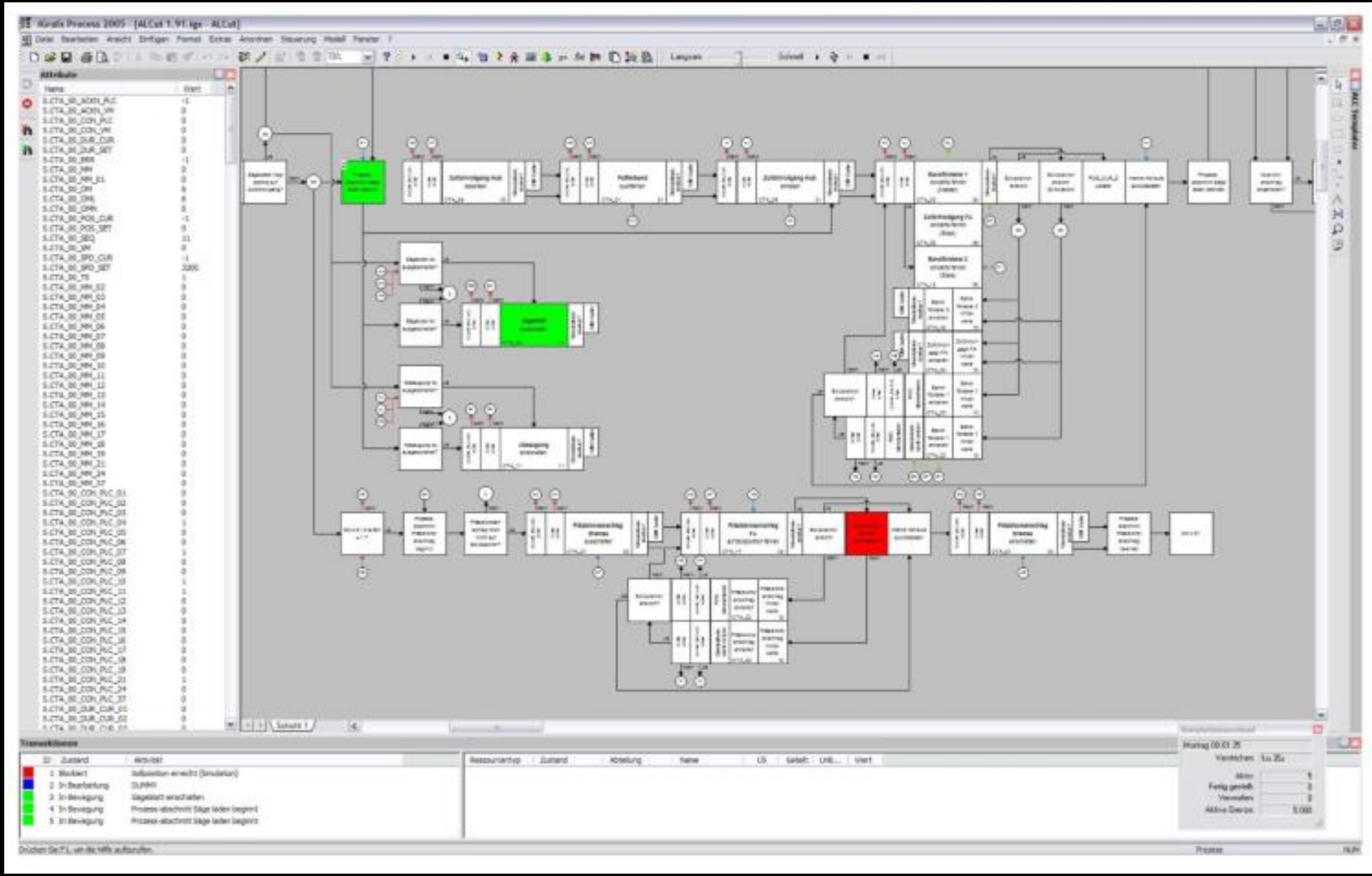

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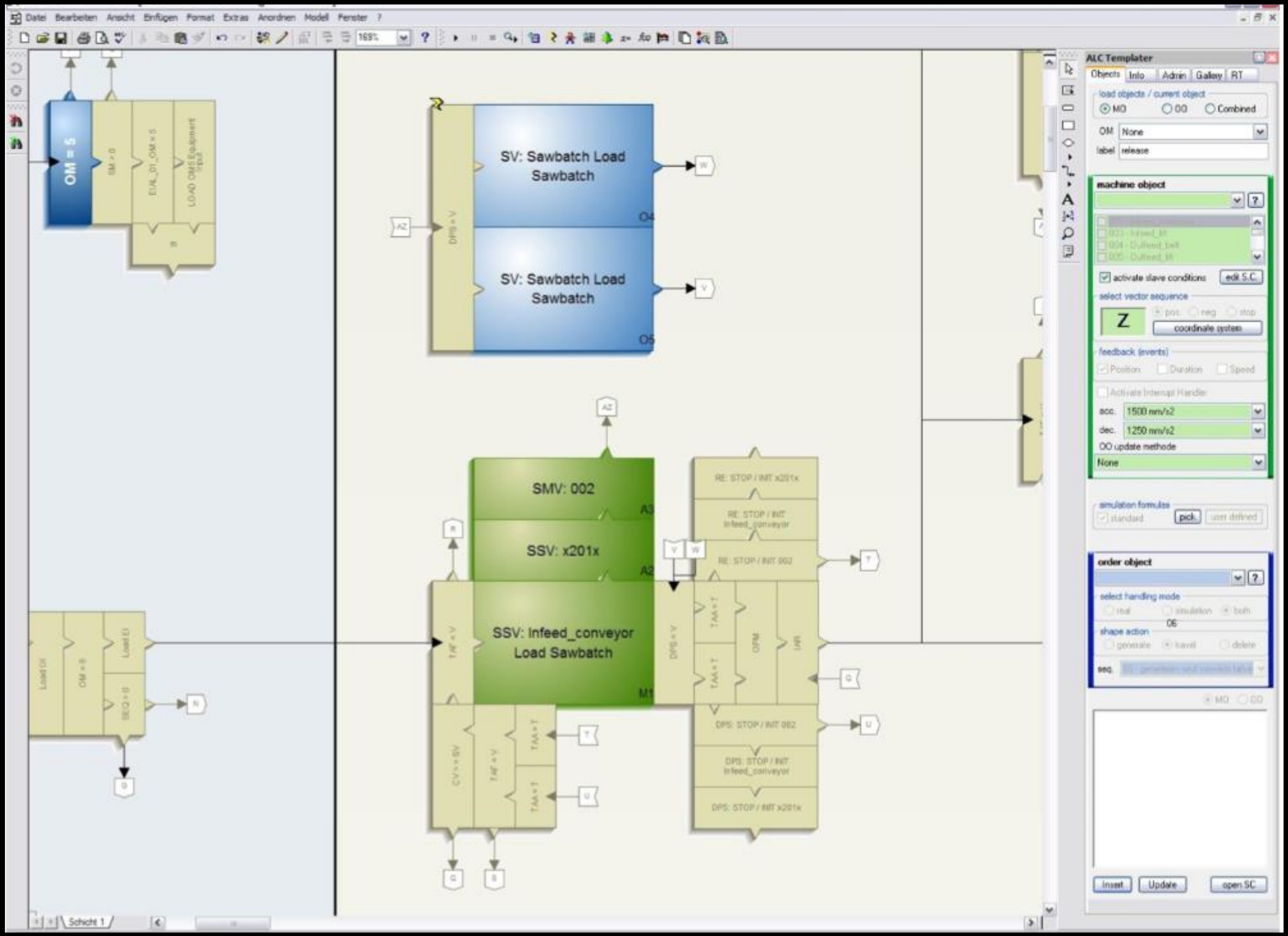

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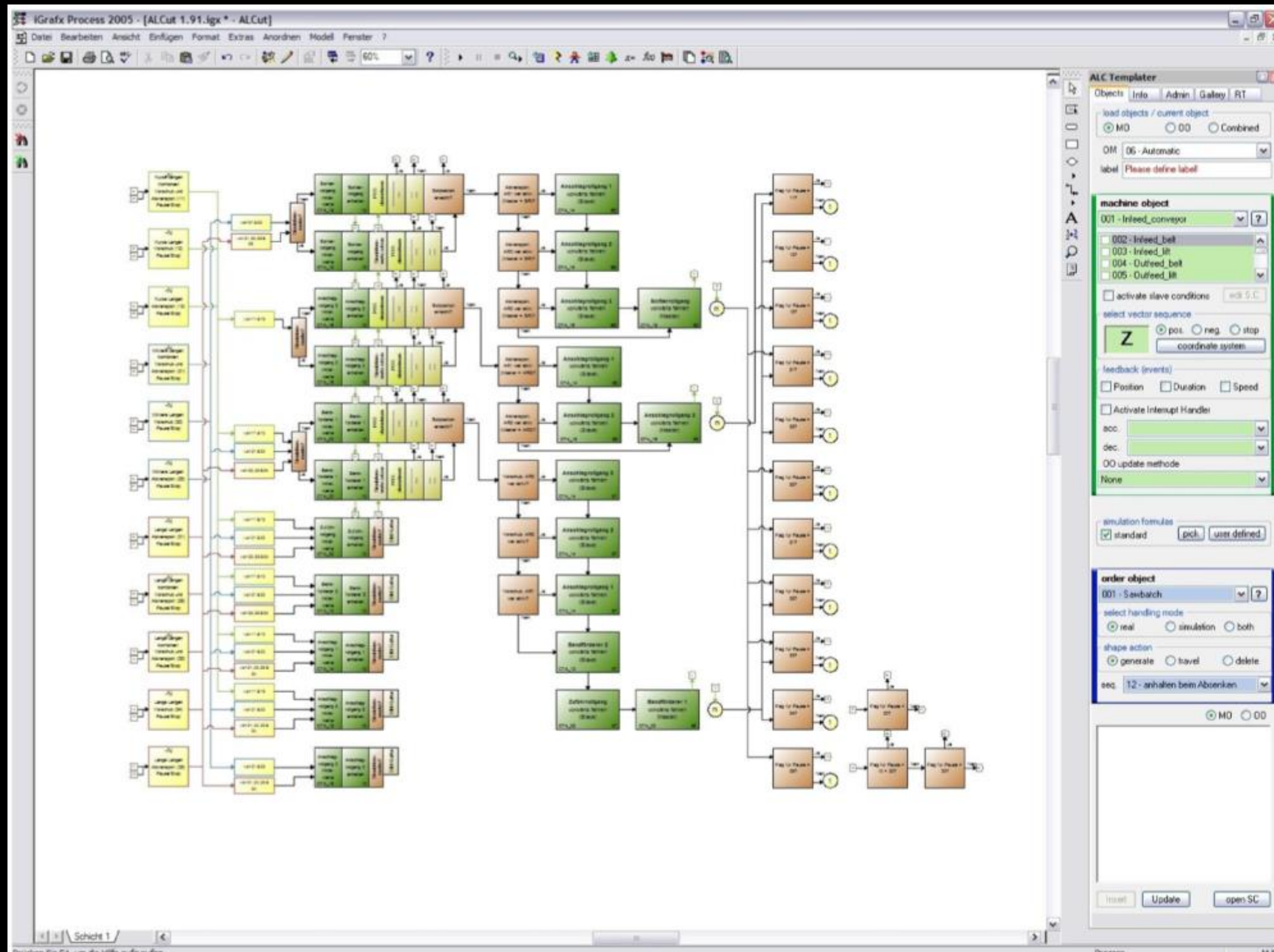

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Performance & Scalability

The system is designed for high computational throughput. Performance advantages:

- **up to 1000x faster than database-based systems**
- **millions of operations per second**
- **sub-millisecond response time**
- **scalable across hardware**
- **scenarios can be evaluated in parallel**
- **runtime instances can scale horizontally**
- **performance increases directly with available hardware**
- **Future architectures, including FPGA-based acceleration, can further increase performance.**

This opens the possibility for near real-time global optimization.

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Business Impact

Measured impact (validated environments):

- 20–40% efficiency improvement
- 10–25% throughput increase
- Significant reduction in material waste
- Improved energy efficiency

Most importantly:
Ability to handle complexity beyond human capability.

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Use Cases

While initially developed for metal processing, the underlying model is general.

It applies to any domain involving:

- **material flow**
- **transformation processes**
- **constrained systems**

Examples include:

- **Bulk materials**
- **Fluids and gases**
- **Logistics networks**
- **Energy distribution**
- **Recycling systems**
- **Including hybrid systems (solids + fluids)**

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Vision

Our long-term vision is to establish a **universal execution layer for industrial systems**

A system capable of describing:

- **material**
- **energy**
- **and process interactions in a unified, executable form.**

Effectively, a discrete physics layer for industrial systems.

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Competitive Position

ADE-1 replaces multiple systems instead of improving one

Existing solutions rely on:
- **heuristics**
- **approximations**
- **domain-specific optimizations**

Our approach is fundamentally different:
- **it is model-driven**
- **physically consistent**
- **and scenario-based**

This creates a structural advantage rather than an incremental improvement.

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Closing

To summarize:

- **From model to fully running system — automatically**
- **We are not teaching machines how to decide.**
- **We are building systems in which the correct decision is the natural outcome of the model.**

This represents a shift from decision optimization to system-level intelligence.

THANKS FOR YOUR CHOICE!

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