

87TH GLASS PROBLEMS CONFERENCE · AI AND PROCESS CONTROL

From PID to AI

Autonomous Process Control in Glass Manufacturing

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30-minute session · 3:30 p.m.

Where I'm standing, in thirty seconds

1

Process innovation at O-I

Led process innovation and digital transformation for O-I Glass — a decade-plus in R&D at a glass manufacturer, taking work out of development and onto real furnaces and real machines across melting and forming.

2

An industry first

Led the industry's first deep-reinforcement-learning autonomous process-control deployment — operator-certified, running in advisor mode.

3

Advising the frontier

Strategic Advisor to a regional glass process-AI program (NOIC) building toward the autonomous furnace.

4

And where I sit now

Customer Solutions Architect for the glass industry at Siemens, still working on industrial AI. This talk is technical and vendor-neutral — not a pitch for anyone's product.

What you'll walk out with

1

The vision

What an autonomous furnace actually is — defined concretely, not as a buzzword.

2

Why it's hard here

Why the AI-success playbook breaks against glass physics, sensing, and risk.

3

What it takes

The required stack, and two principles the industry is learning the hard way.

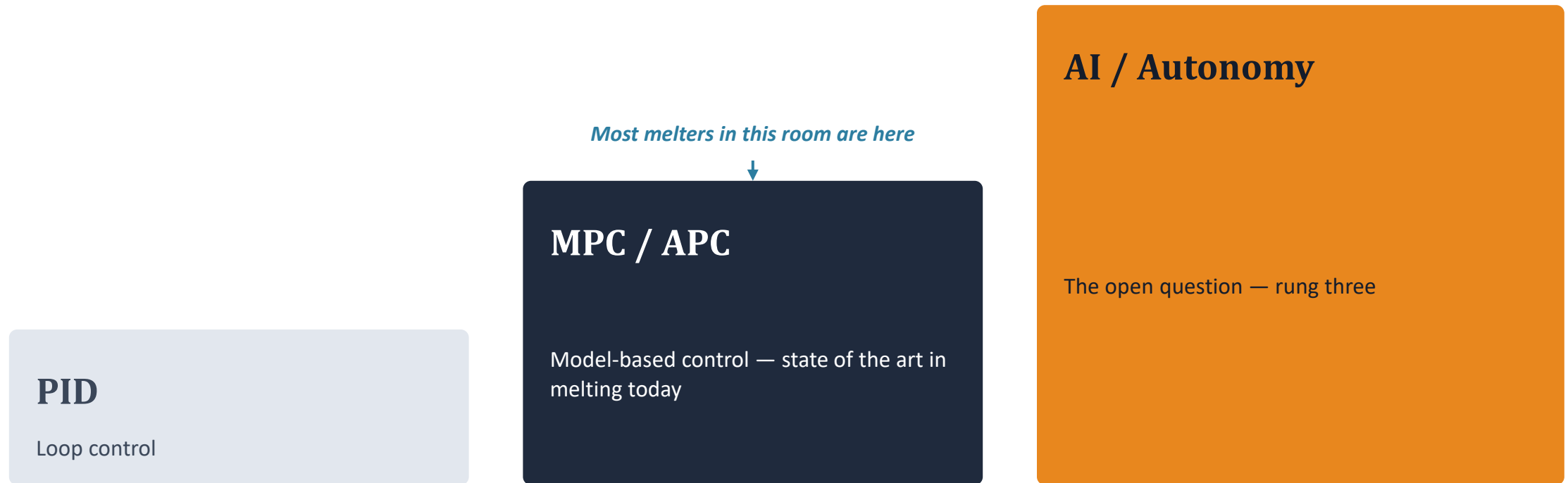
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Proof the pieces work

Two deployments from my own history — prediction on the melt, control on the machine.

WHERE WE ACTUALLY ARE

The control ladder — and the open question



“Beyond PID” is the arc of this talk, not the news. The news is what rung three takes.

What an autonomous furnace actually is

Senses its own state → decides → acts, within safe operating bounds.

The shift: operator-in-the-loop → operator-on-the-loop → supervised autonomy.

Not a bigger MPC. A furnace that holds its own targets through disturbances a human would otherwise chase by hand.

WHAT IT BUYS

- **Energy** — Hold the true optimum, not the safe-but-costly setpoint.
- **Stability** — Reject disturbances before they propagate through hours of thermal lag.
- **Quality consistency** — Fewer excursions; less crew-to-crew variance.
- **Knowledge capture** — The expertise walking out the door — encoded before it leaves.

The end state you're being invited to build toward.

Why rung three is genuinely hard — in glass

1 Thermal inertia

Long time constants and enormous stored energy — the furnace answers slowly, and remembers.

2 Sparse, costly sensing

Few measurements, in a hostile environment, each one expensive to add and to keep alive.

3 Asymmetric risk

Campaign life means an experiment can cost you a furnace. Downside dwarfs upside.

4 Safety & uptime

Non-negotiable. The control layer earns trust before it earns authority.

5 Mixed control estates

Legacy assets and heterogeneous controls — no clean, uniform platform to build on.

6 Small, slow data

Nothing like the volumes the AI success stories assume. Thin, hard-won, and precious.

PART TWO

What it takes to get there

The required stack, the hard-won principles, and what “autonomous” honestly means.

The required stack

- 1 Sensing that closes the gaps** — Measure what actually drives the process — not just what's easy to instrument.
- 2 A data foundation** — Historian and contextualization: data that's trustworthy, aligned, and queryable.
- 3 A model** — Physics, data-driven, or hybrid — whatever earns predictive grip on the process.
- 4 A supervisory control layer** — Where decisions become actions, within bounds, above the base controls.
- 5 Validation & operator-trust gates** — The graduated proof that lets an operating company actually act on it.

Where capability lands

These are engineering requirements, not a product list. Every one is real work. Who supplies which layer is a choice you make — this talk names no one.

Two principles, learned the hard way



Time-to-deploy is a design constraint

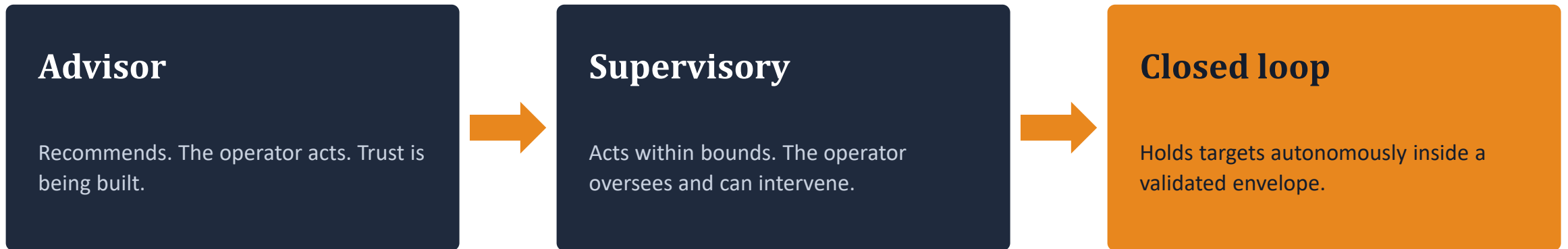
A model that takes a year to stand up is a study, not a control strategy. If it can't be deployed on the timescale the plant operates, it doesn't count as control — treat speed-to-value as a first-class requirement from day one, not an afterthought.



A claimed number is not a result

The validation path has to be defined before the work starts. An operating company can't act on a headline figure it can't reproduce — decide up front how you'll prove it, in whose eyes, against what baseline. Validation is the deliverable, not the number.

What “autonomous” honestly means



Operator certification is the gate between every rung.

Specialized, deterministic control — not a chatbot bolted to a furnace. Bounded, verifiable, purpose-built. That distinction is the whole point.

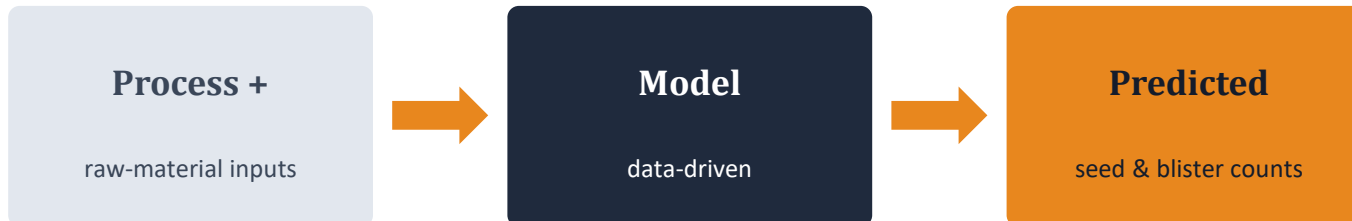
Prediction on a demanding melting application

2023: a model that predicted glass quality from process data.

Seed and blister counts, from process parameters and raw-material inputs — on a demanding melting application.

No new instrumentation: the historian, the QC lab's own counts, and raw-material records the plant already kept.

The hard part was time — the defect is counted at the cold end, hours after the melter condition that caused it.



The point for this talk

The model layer is real — even when cause and effect are separated by hours of thermal lag.

The algorithm was never the hard part. Time-alignment and agreeing on what counts as truth — that was the work.

Prediction, not control. Rung one — and it still changed what the plant watched.

Decomposing expert judgment — on the machine

~50

variables streaming in real time

~30

interdependent real-time actions

1

new sensor type: gob cameras,
proven industry hardware

12

months to production readiness —
most of it acquiring data

6

real-world validation trials

1

master operator's certification

The DRL gob-forming deployment

Gob forming at O-I — never successfully automated by anyone.

Nobody here needs convincing that feeder setup and control is expert work. That's the problem, not the news: judgment doesn't scale across shifts, and it walks out the door at retirement.

Which is why rules-based attempts always failed. DRL captures judgment instead of encoding rules — trained against a simulator built from the plant's own historian.

Advisor mode on an O-I pilot line in 2023 — capable of full autonomy, running beside the operator by choice.

It surfaced a control strategy the expert had never considered.

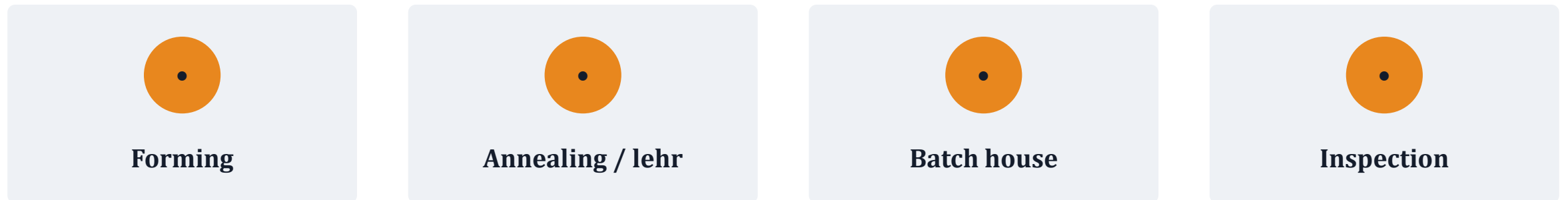
It generalizes beyond melting

THE PATTERN



...with a validation gate at each step.

TRANSFERS TO



Same pattern, different unit operation. That's the scope the broadened title is promising.

No one company can do this alone

The sensing, the data, the modeling, the validation, and the cross-plant learning an autonomous furnace needs **exceed what any single manufacturer will build solo** — especially against campaign-life risk and thin data.

This is the problem that needs a different model to solve.

→ The path forward is collaborative — the industry has to build this together.

What we're building toward

- **The vision** — A furnace that senses, decides, and acts within safe bounds — operator on the loop, not in it.
- **What it takes** — Sensing, data, model, supervisory control, validation gates — deployed fast, proven honestly.
- **It's real** — Prediction on a hard melt; certified autonomous control on the machine. The pieces work.

“That's what we're building toward, and what it requires. The question is **how you organize to actually do it** — collaboratively, as an industry. That's the consortium model NOIC is proving out, and where this conversation goes next.”

END

Thank You!

My contact information is in this QR code.



BACKUP

Q&A ammunition

Held in reserve — pulled up only if the question comes.

Why sensing is the binding constraint

- What drives the process is often not what's easy to measure — the informative variable lives in a hostile, hard-to-instrument location.
- Adding a sensor is a capital and maintenance commitment, not a software change; each one has to earn its place.
- Soft sensing and inference help, but they inherit the model's blind spots — you can't infer what the data never saw.
- Closing the sensing gap is usually the first real cost of autonomy, and the one people underestimate.

How trust is actually earned

- Define the validation path before the work starts — baseline, metric, and who signs off, agreed up front.
- Graduated trials: shadow → advisor → bounded supervisory, with a go/no-go at each gate.
- Operator certification is a real gate, not a formality — the people accountable for the furnace hold the pen.
- A result that can't be reproduced in the operator's eyes can't be acted on, whatever the number says.

The unglamorous foundation

- Historian and contextualization: aligned, trustworthy, queryable data is the substrate everything else stands on.
- Edge compute where latency and reliability demand it; the control loop can't wait on a round trip to a cloud.
- A supervisory platform that can act within bounds and be overridden instantly by the operator.
- None of this is exciting, and all of it is load-bearing — skip it and the model has nothing to stand on.

Why not just a big model

- Furnace control is bounded, deterministic, and safety-critical — the opposite of open-ended generation.
- Specialized models are verifiable against physics and process limits; a general chatbot is not.
- The failure modes have to be understood and bounded before the system gets any authority.
- General-purpose AI has a role in tooling and knowledge work — but the control layer is purpose-built.

The honest ledger

- Models that were technically impressive but took too long to stand up to matter as control.
- Numbers claimed before a validation path existed — impossible for an operating company to act on.
- Sensing gaps discovered late, after the modeling assumed data that wasn't really there.
- Every one of these is a process failure, not a math failure — which is why the principles slide exists.

What it actually takes to stand up

- Sensing is usually the first hard cost — capital, install, and ongoing maintenance in a hostile environment.
- The data foundation is a sustained effort, not a one-time project; it decays without ownership.
- Validation consumes real furnace time and operator attention — plan for it, don't bolt it on.
- Speed-to-value is the discipline that keeps all of this honest: if it can't deploy, it doesn't count.