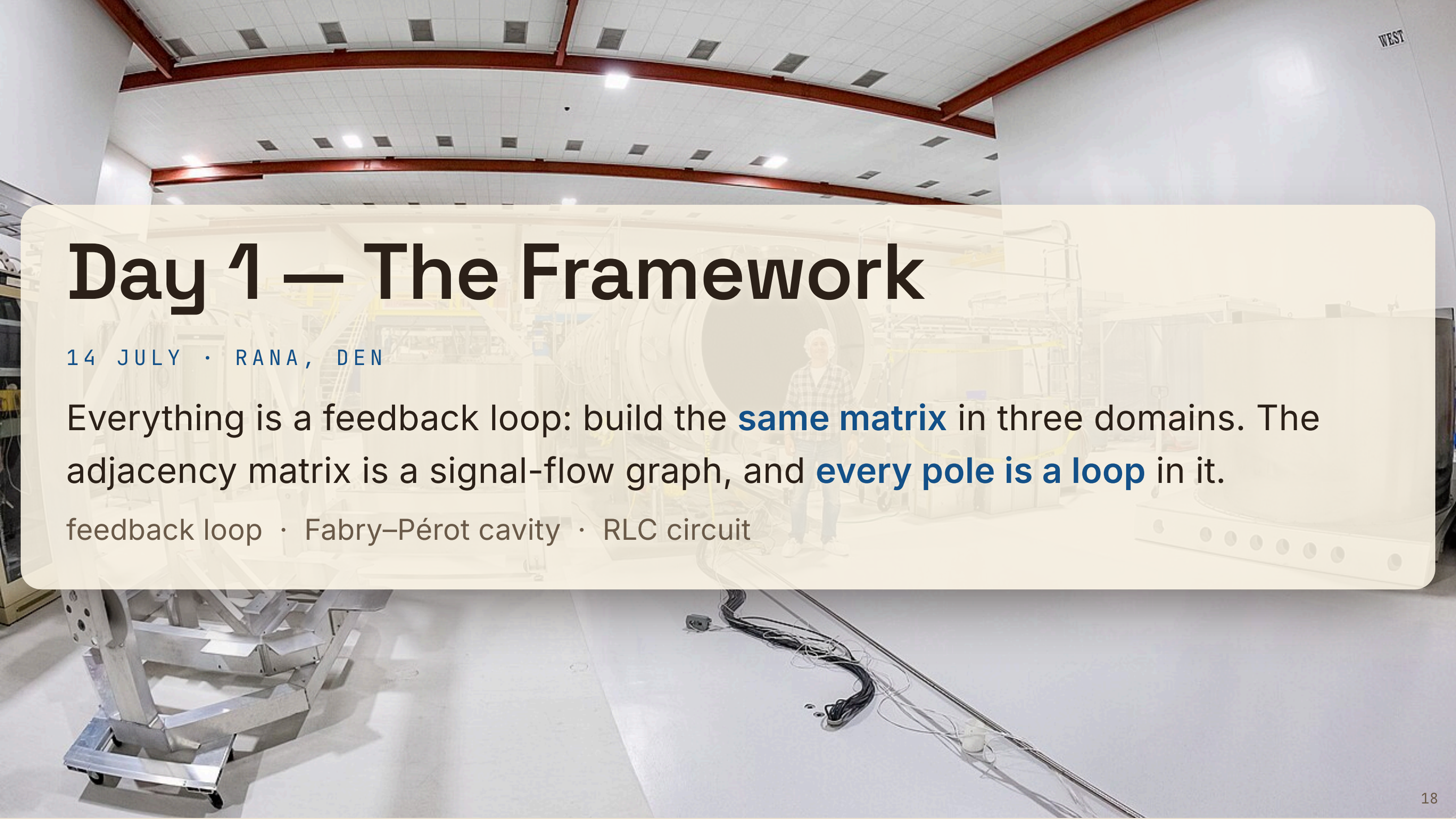


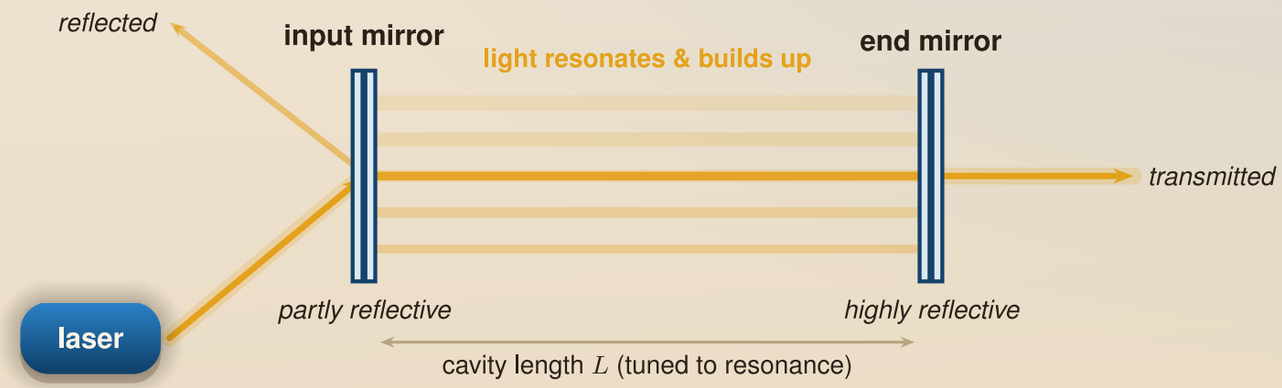
Day 1 — The Framework

14 JULY · RANA, DEN

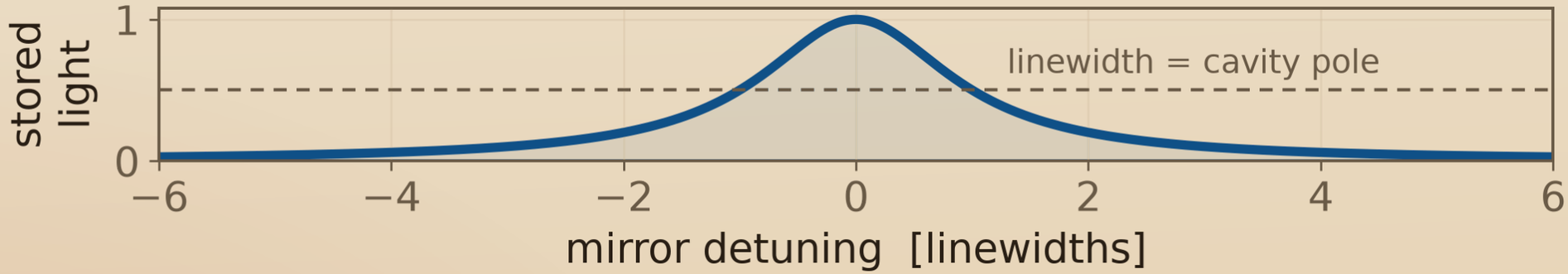
Everything is a feedback loop: build the **same matrix** in three domains. The adjacency matrix is a signal-flow graph, and **every pole is a loop** in it.

feedback loop · Fabry–Pérot cavity · RLC circuit

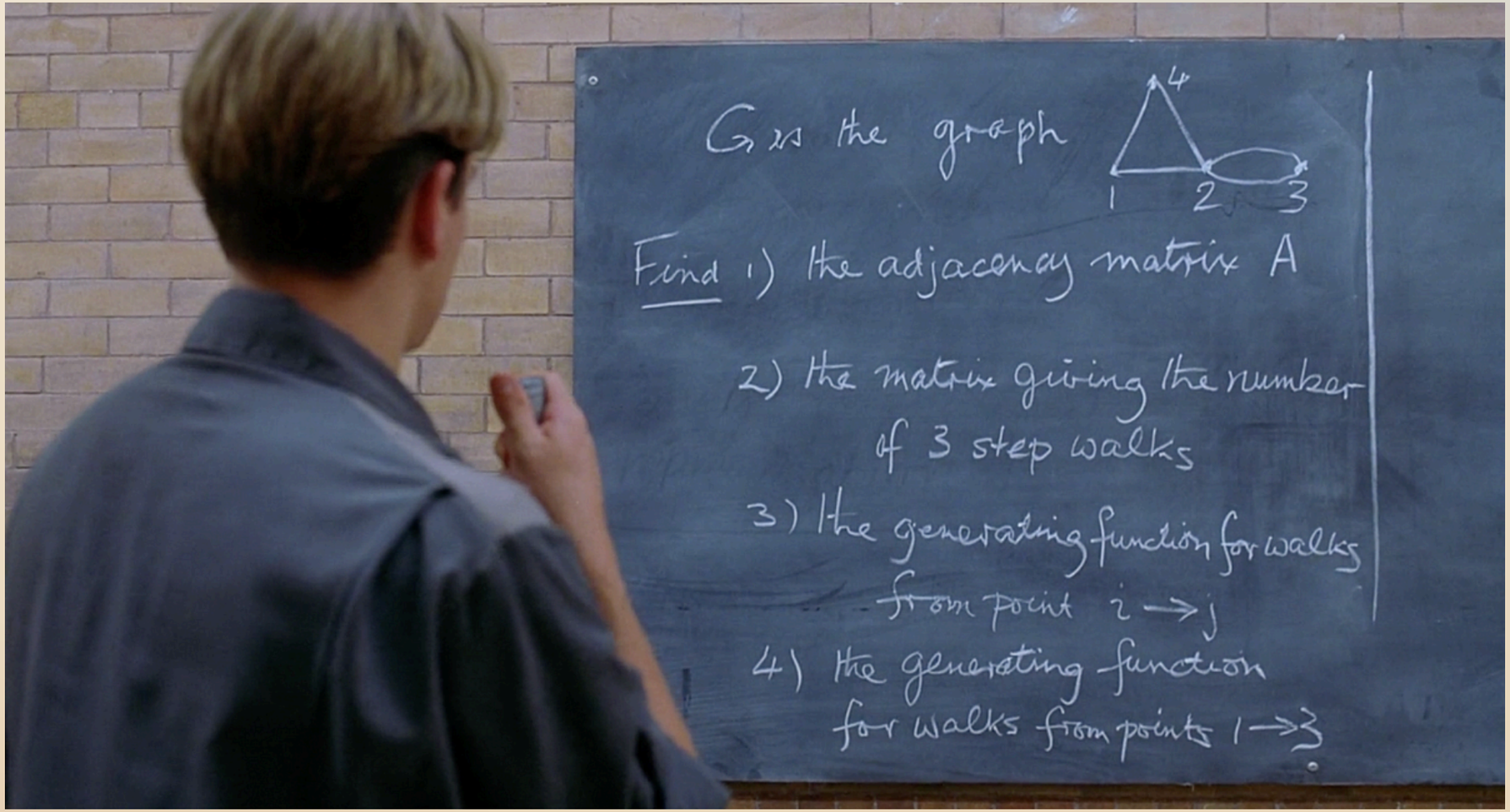
Light in a cavity — one pole (Den)



Light builds up on resonance: the cavity turns length into an optical signal. Sweep the mirror and the stored light traces **one resonance** — the cavity pole.



The adjacency matrix



“Given the graph, find the adjacency matrix A.” Number the nodes, write down which node drives which, and A is just that table. Solving $(I - A)\,x = B\,u$ then closes every loop in the graph at once — which is the whole of this morning.

Day 1 · morning

“Three loops, one formalism” `all teams` — intro → optics → the adjacency matrix.

Build all three adjacency matrices in the JupyterHub and show they are the *same feedback system* in three physical systems:

`python-control ↗`

Feedback loop

one pole, one gain; the loop moves the pole

`finesse ↗`

Fabry–Pérot cavity

one optical pole

`ohmega ↗`

RLC circuit

poles = loops in the matrix

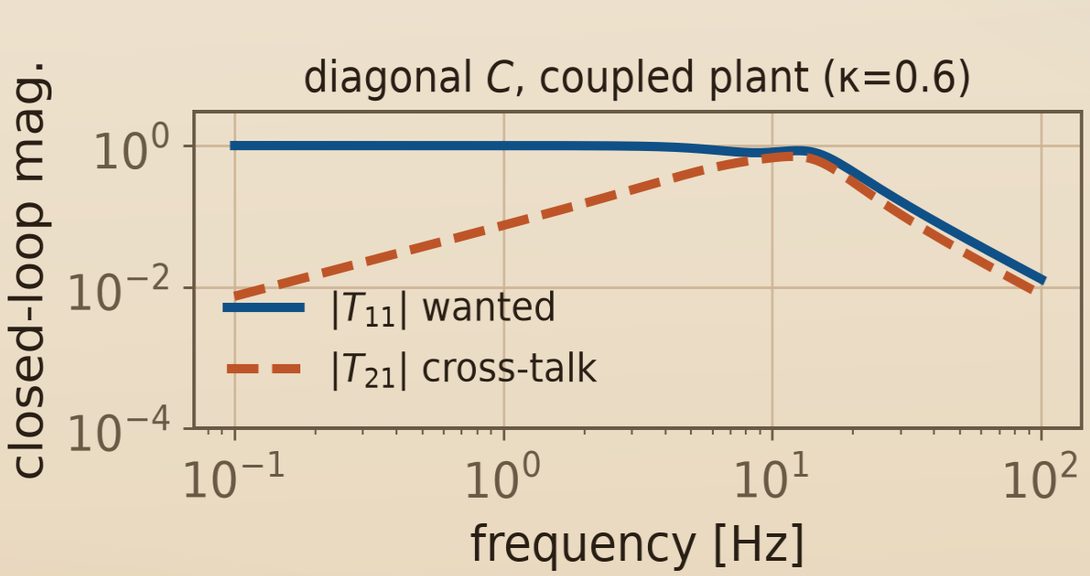
`Deliverable · three validated matrices + one-line “why it’s a loop”`

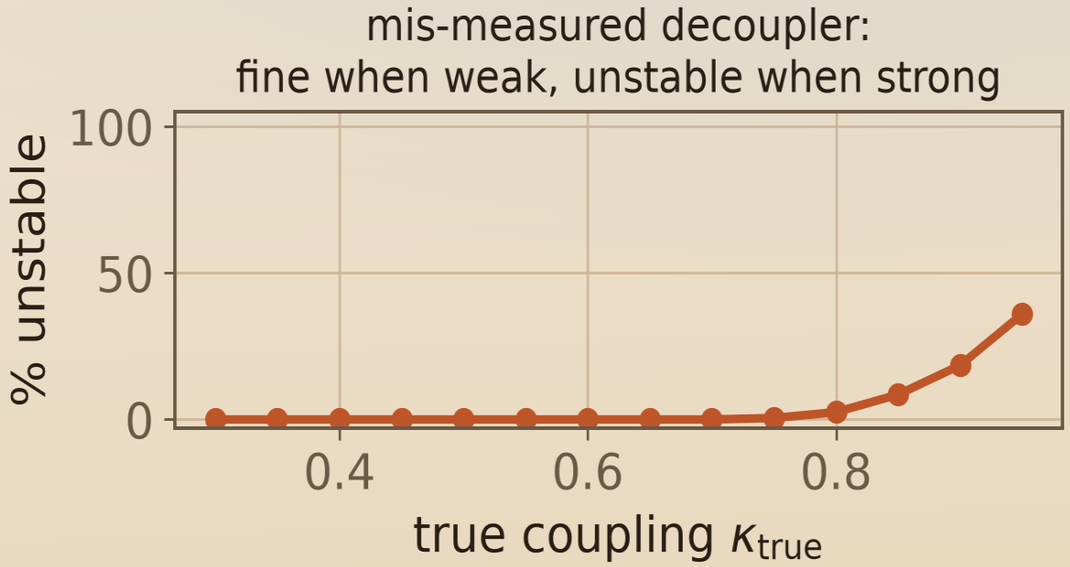
NAME THE MOVE

Everything is a feedback loop; commissioning is populating, composing, and closing it.

Day 1 · afternoon — the coupled loop & the decoupler

SISO → 2×2 coupled → decoupler robust to a ±20% sensing matrix.





A diagonal controller leaks drive between channels (cross-talk) — and a decoupler built from a ±20% sensing matrix **destabilises** a strongly-coupled plant.