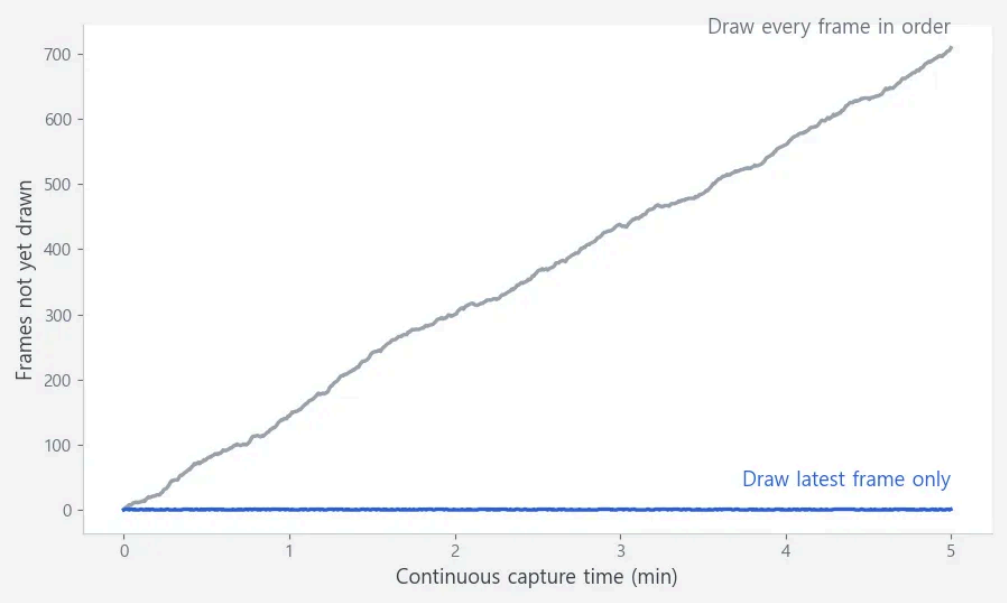
# Stabilizing a new particle-removal tool



Recorded **0 failures** in 11 days (264 h). Vision uptime was **98.86%**, including 3 h of planned downtime.



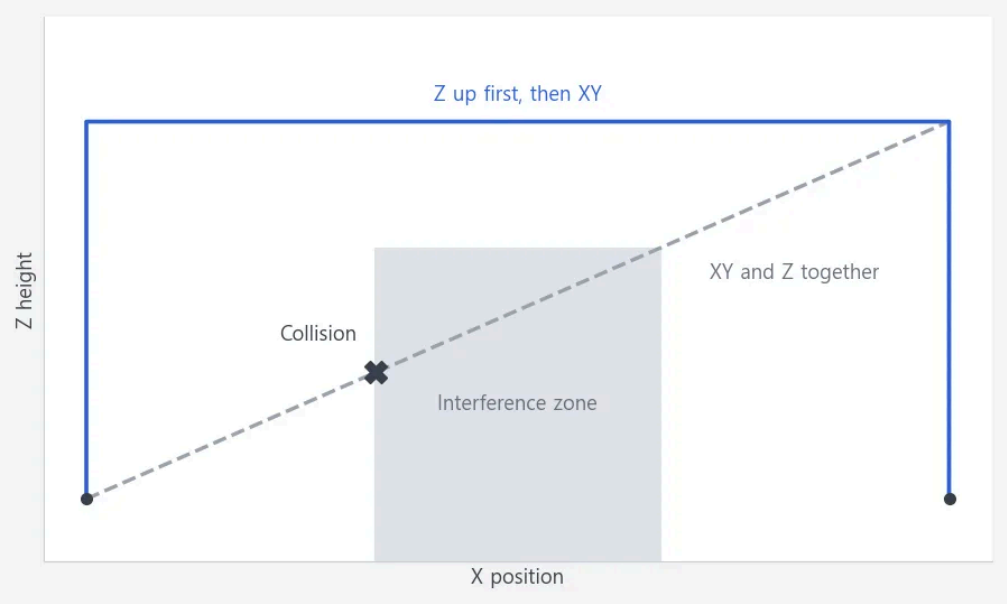

If drawing is even slightly slower than capture, drawing every frame in order makes the queue grow without end. Synthetic simulation

| | |
|---|---|
| **Problem** | This new tool turned a manual machine into a semi-automatic one, so there was no reference code and the delivery date was fixed. After it entered production the program kept halting within 48 hours, so I stayed on site for 25 days, repeating reproduction, log analysis, fixes, and revalidation. |
| **Implementation** | During continuous capture the display fell behind and frames piled up. Drawing only the latest frame and limiting concurrent processing to one removed it. I also moved to 64-bit and added camera reconnection. |
| **Evaluation** | Failure counts use deduplicated events classified as failures in the operating record. Planned software patches were logged separately. |
| **Status** | Spent 25 days on site reproducing and fixing freezes. The tool is in production and has passed third-party certification. |

**Evidence** · internal evaluation records (H2 2025), field setup records

# Motion interlock for tip protection

Recorded **0 repeat tip breakages** after rollout. Production lots ran normally.



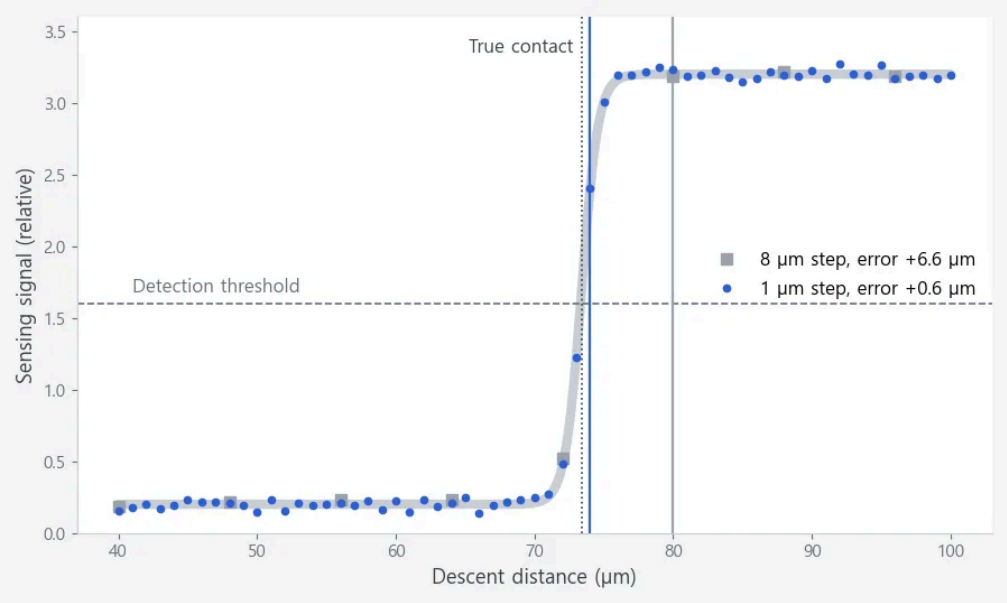

Moving XY and Z together passes through the interference zone. The interlock forces Z up first, then XY. Concept diagram

| | |
|---|---|
| **Problem** | When XY motion is requested, check clearance using Z position. The previous logic used XY position. |
| **Implementation** | Allow XY travel once Z clears the interference zone and its stop is confirmed. |
| **Evaluation** | In a separate 1,000-cycle lifter test, I recorded commanded and actual positions at the home and both limit switches and checked stop-position repeatability (3σ). |
| **Status** | In production |

**Evidence** · internal evaluation records (H1 2026), servo repeat-run records

# Particle-height measurement by contact sensing

Image autofocus fell from **90 to 25 s**. Contact sensing gave **±2 µm** repeatability over 20 measurements on particles ≥300 µm.




The finer the descent step, the closer the threshold crossing is to the real contact. Synthetic signal

**Problem** Checking the floor one direction at a time became a simultaneous check of all directions, cutting AF time from 90 s to 25 s (−72%). But with a weakly textured floor, or no image change after a shear, the height could not be told apart.

**Implementation** I measured particle height from the difference between the Z positions where the voltage crossed the contact threshold at the floor and the particle top. A finer descent step localized each contact more precisely.

**Evaluation** With no independently measured reference sample on site, I measured the same particle repeatedly. Height repeatability was ±2 µm over 20 runs on particles of 300 µm or larger. Consecutive and multiple shears on production material also ran normally.

**Status** Verified consecutive and multiple shears on production material in the field.

**Evidence** · internal evaluation records (H2 2025)