

The Waferstepper Challenge: Innovation and Reliability despite Complexity

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Abstract

The function of the waferstepper is explained and its most important characteristics. The dynamic market provides continuous technological challenges, resulting in ever increasing performance, but also complexity. Despite the exponential increase of performance and complexity, the reliability must be good. The reliability is crucial when the stepper is used in volume production.

The ASML engineering style plays a central role in tackling this challenge. Three key aspects of this style are: Feedback, Focus and Future awareness. The concurrent application of these three aspects has so far been proven to be effective.

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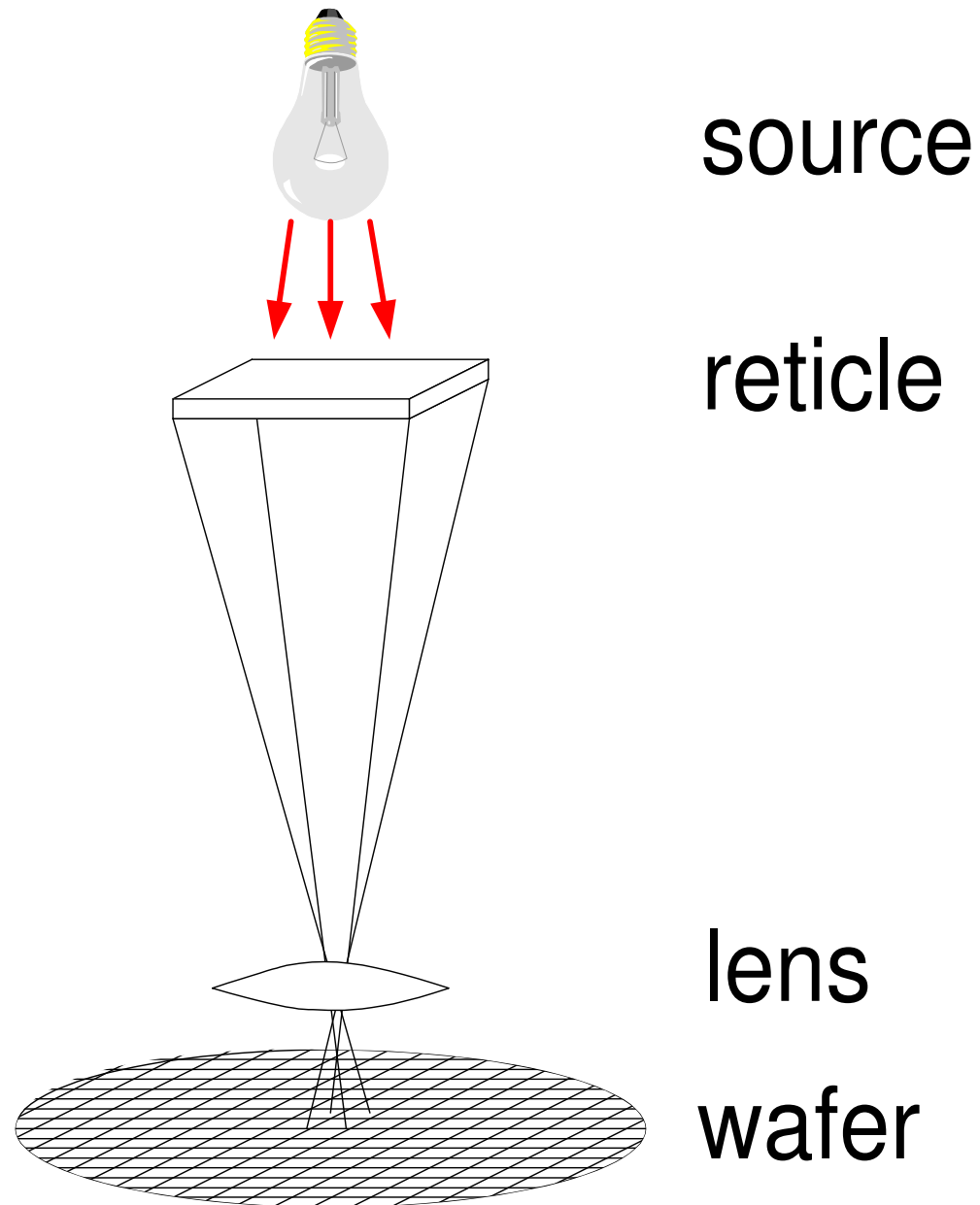
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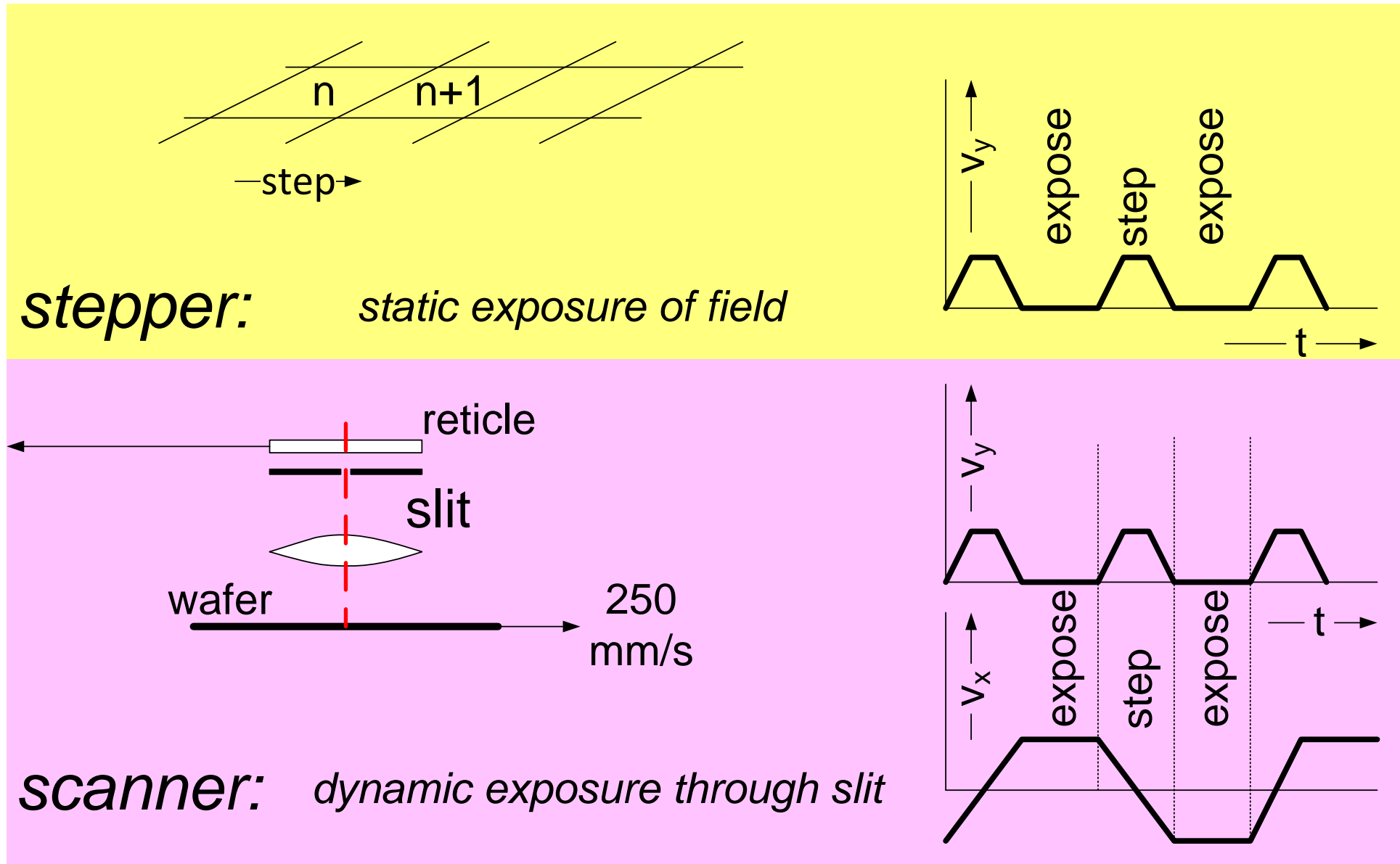
Twinscan AT1100



What is a waferstepper

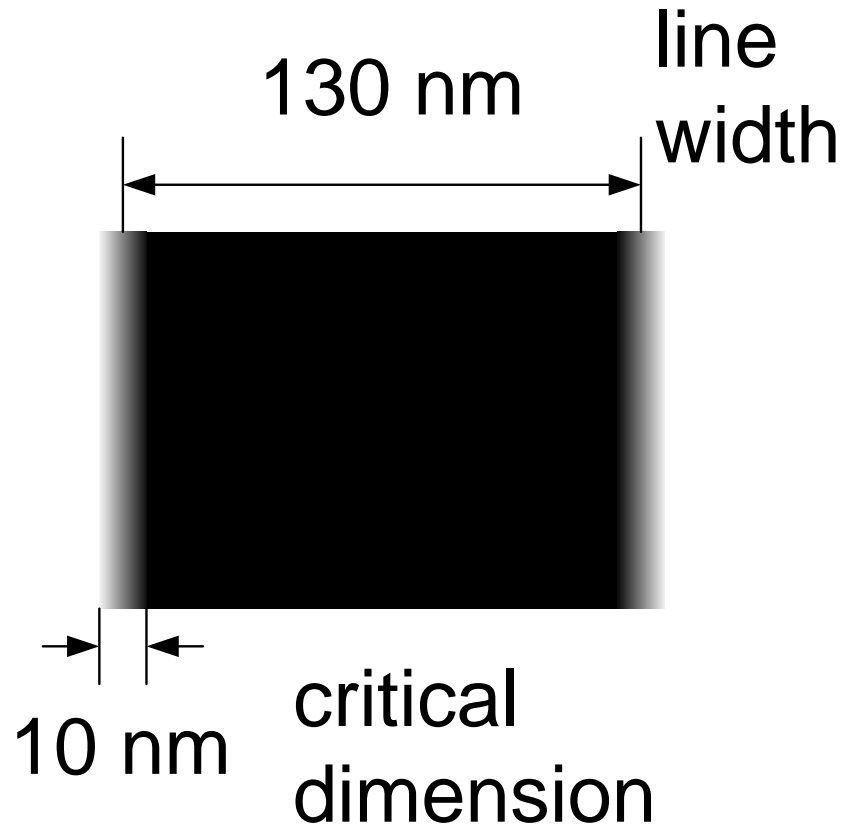


From stepping to scanning

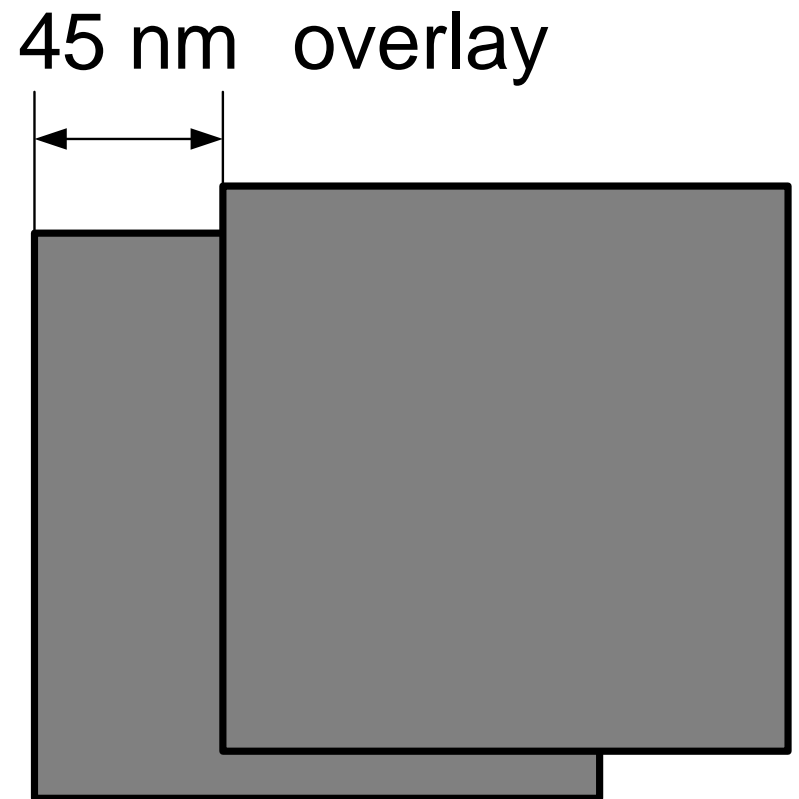


Key specifications waferstepper

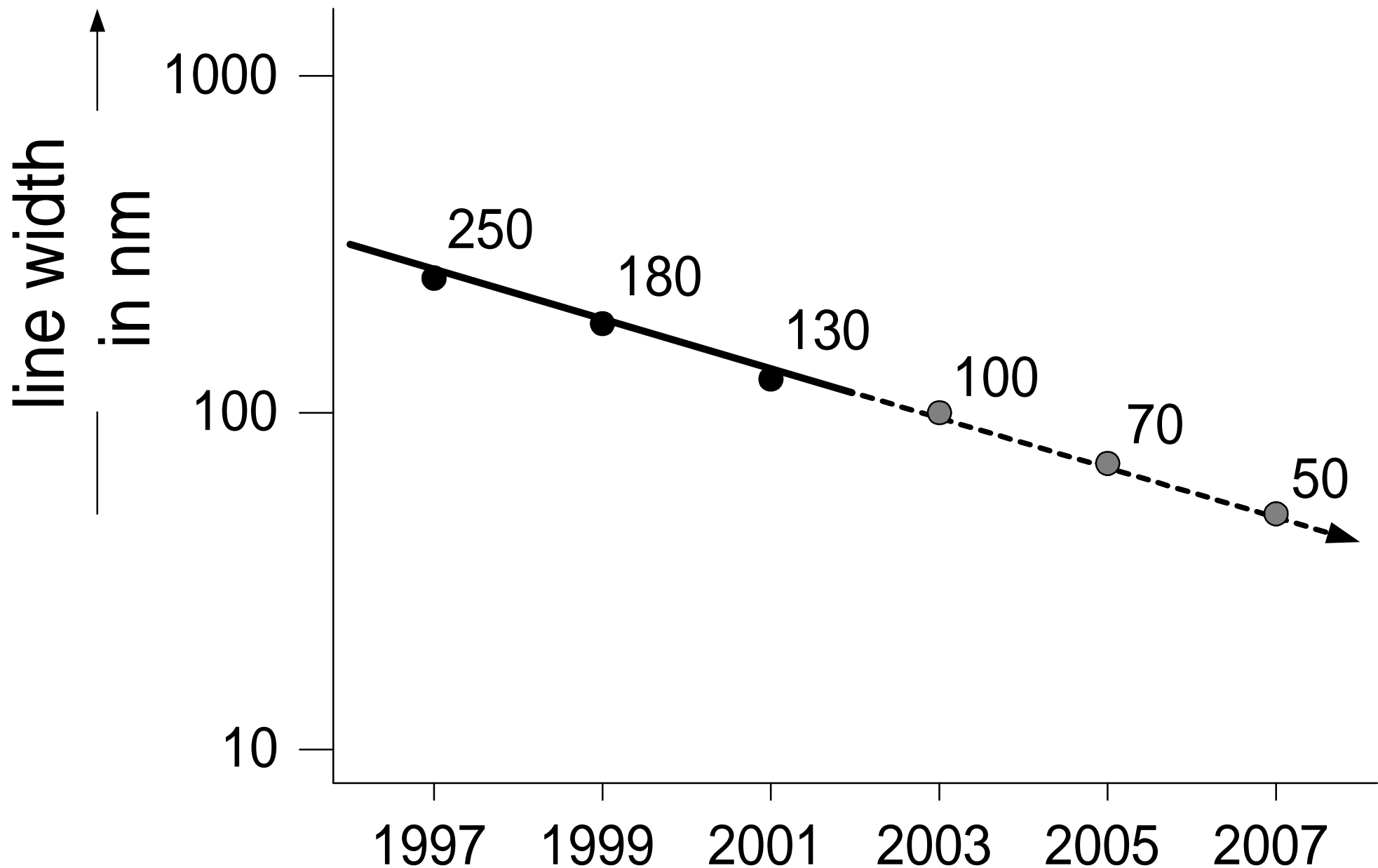
imaging



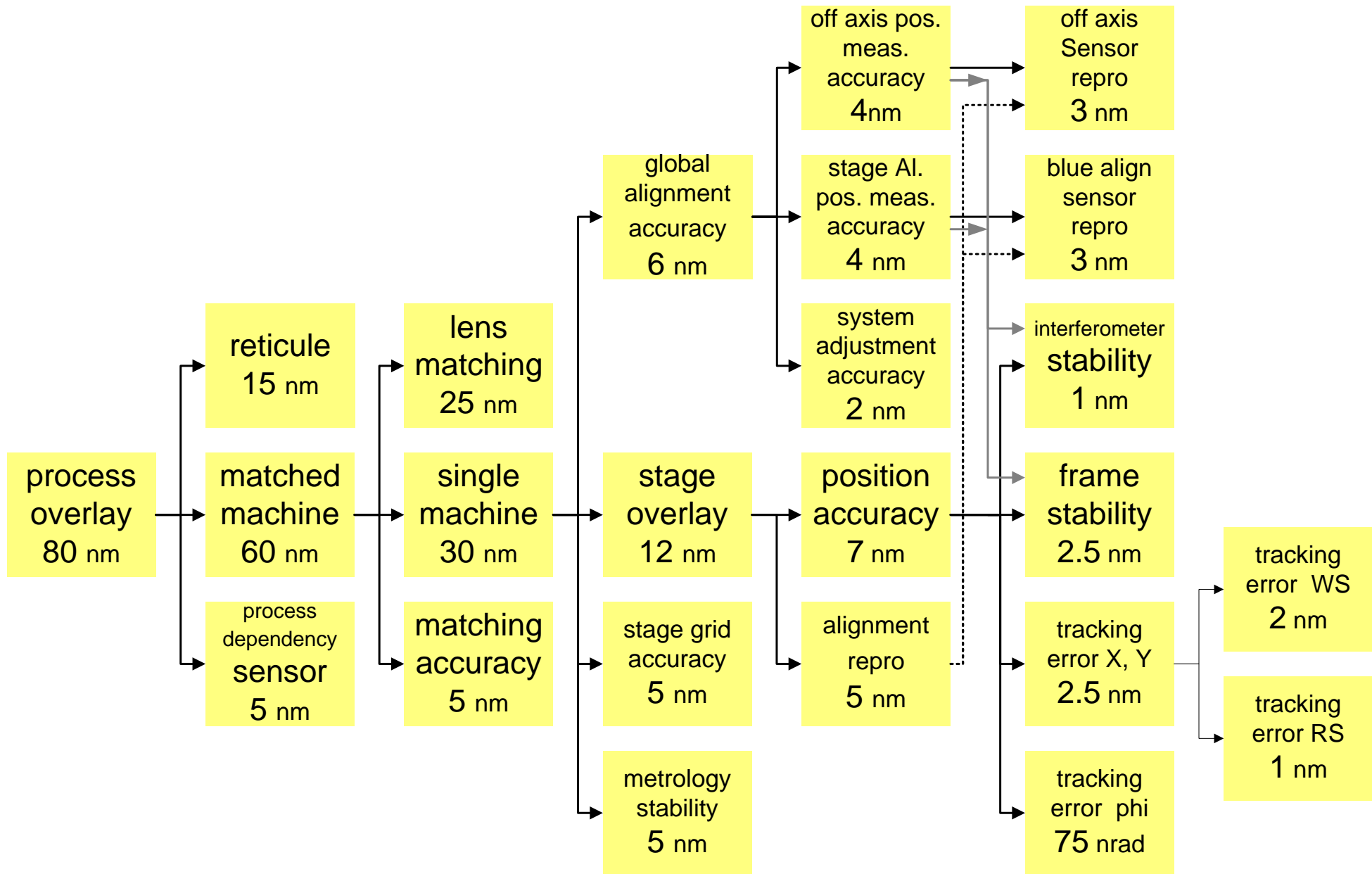
alignment



Moore's law




Overlay budget (1999)

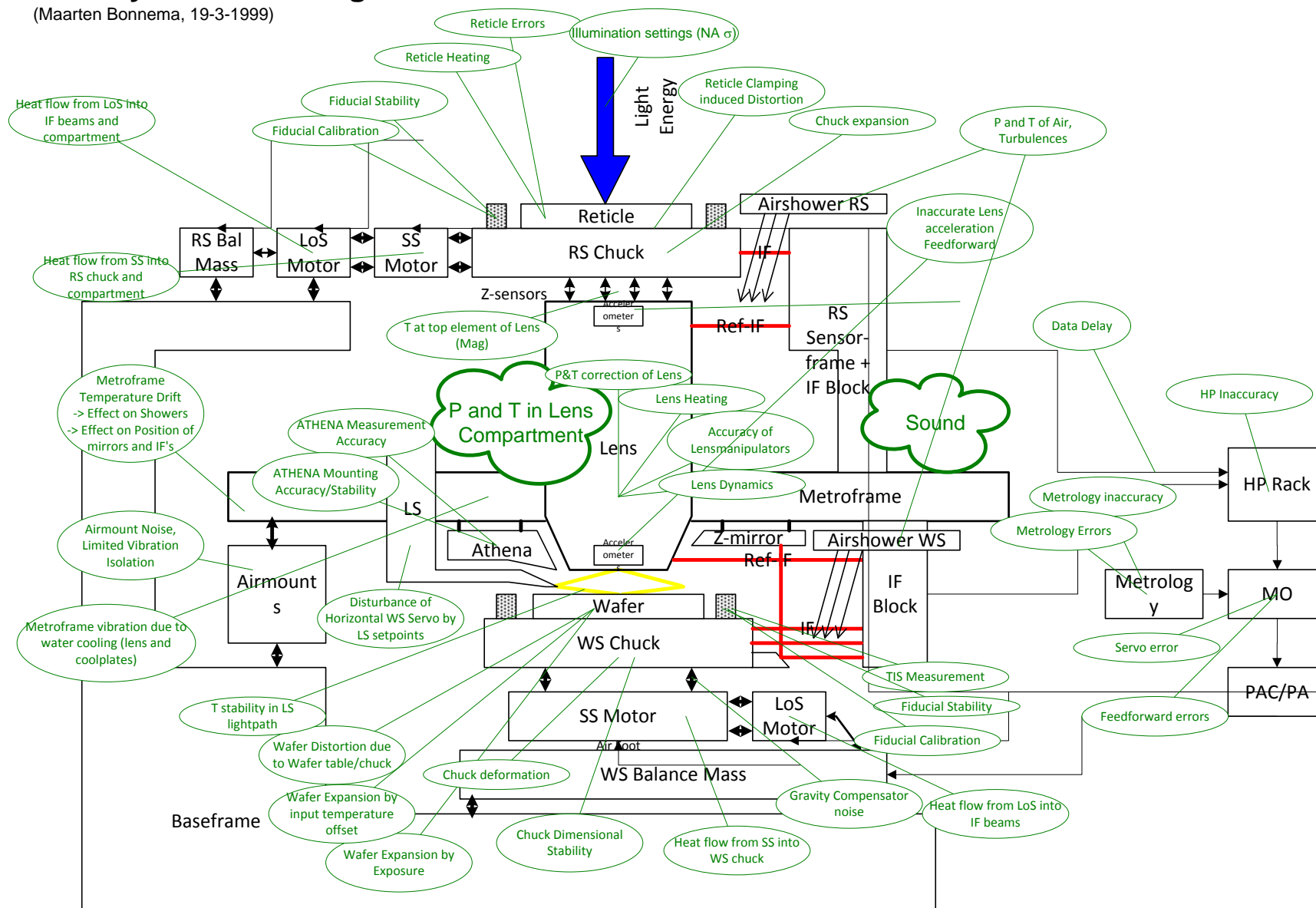


Everything influences overlay

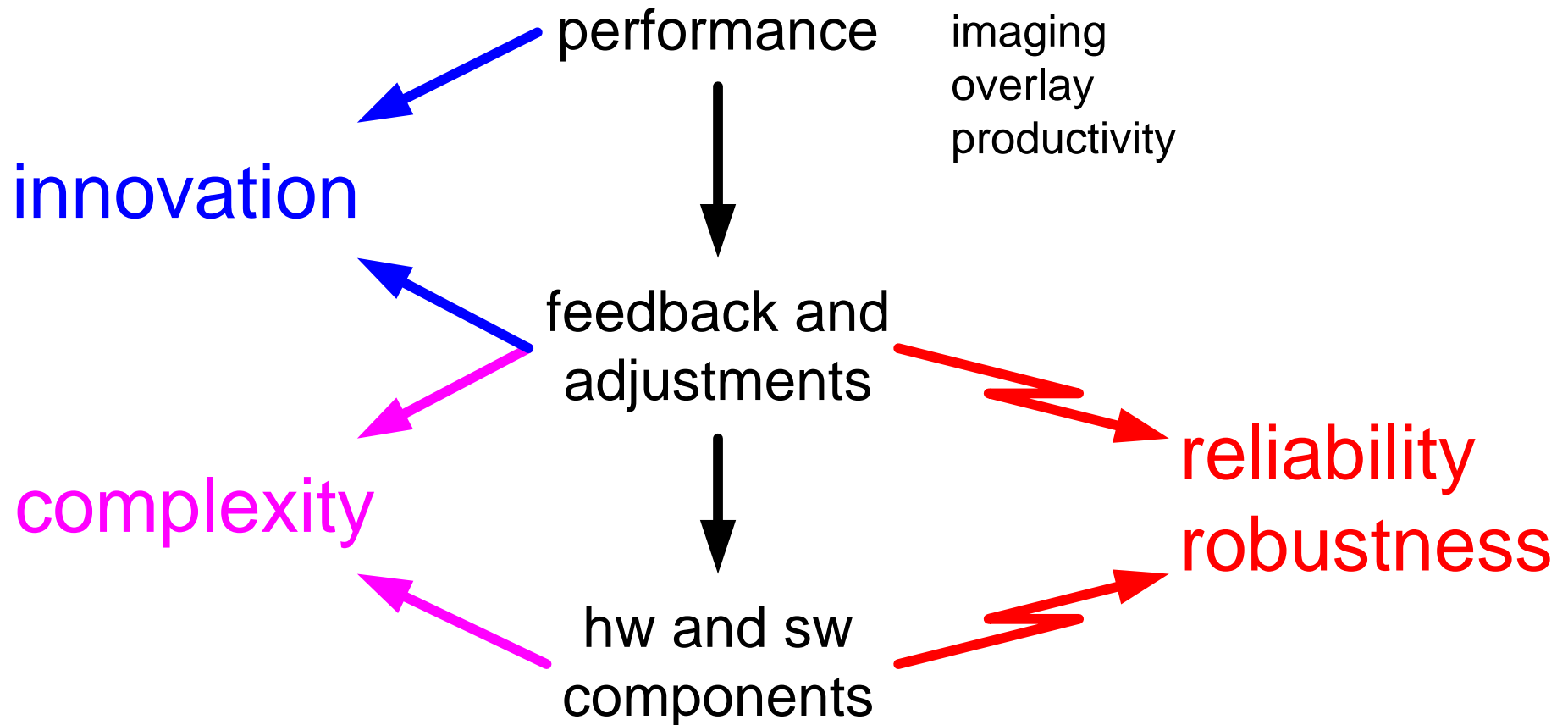
Overlay Influence Diagram.

(Maarten Bonnema, 19-3-1999)

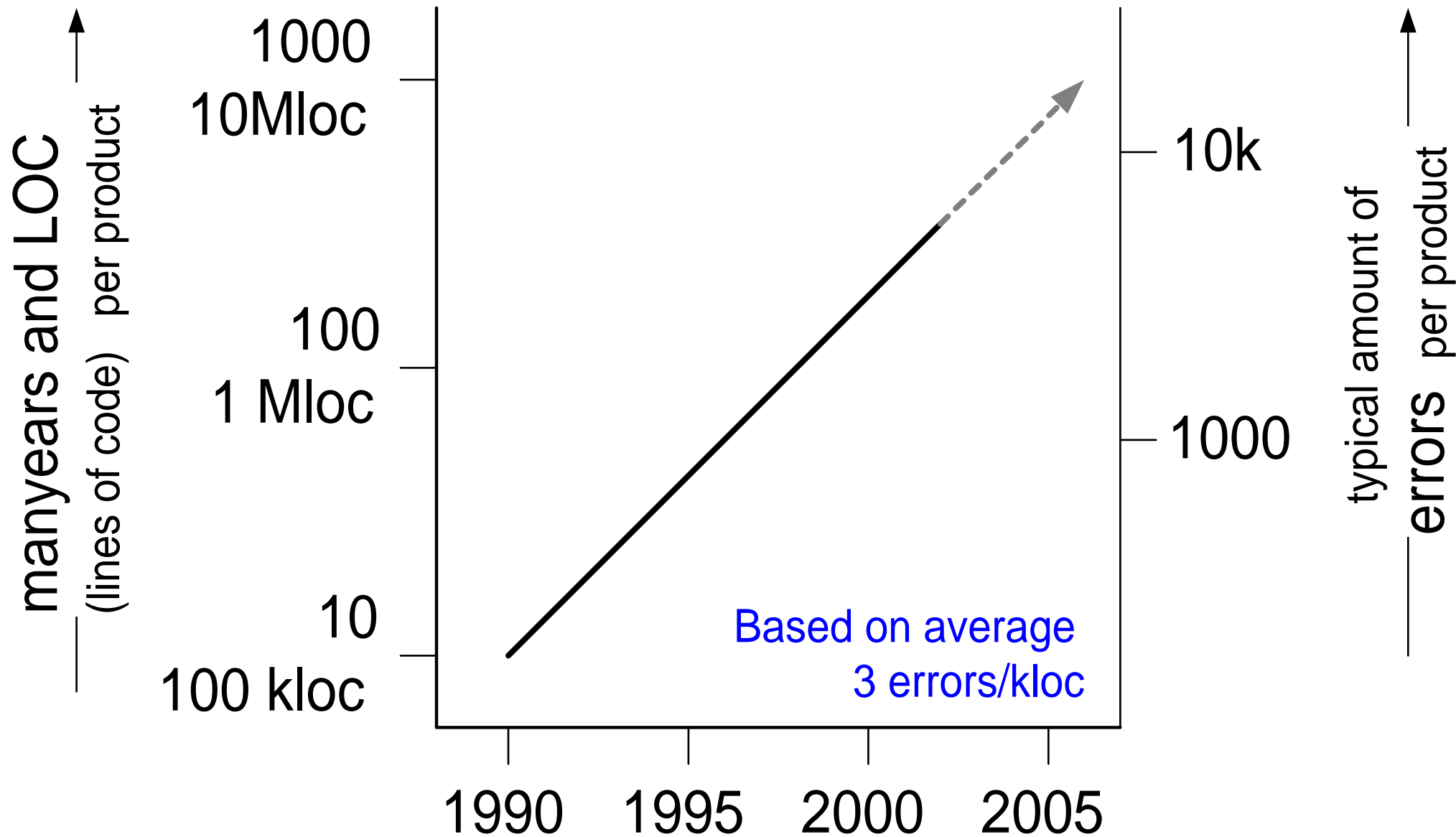
 : Fiducial



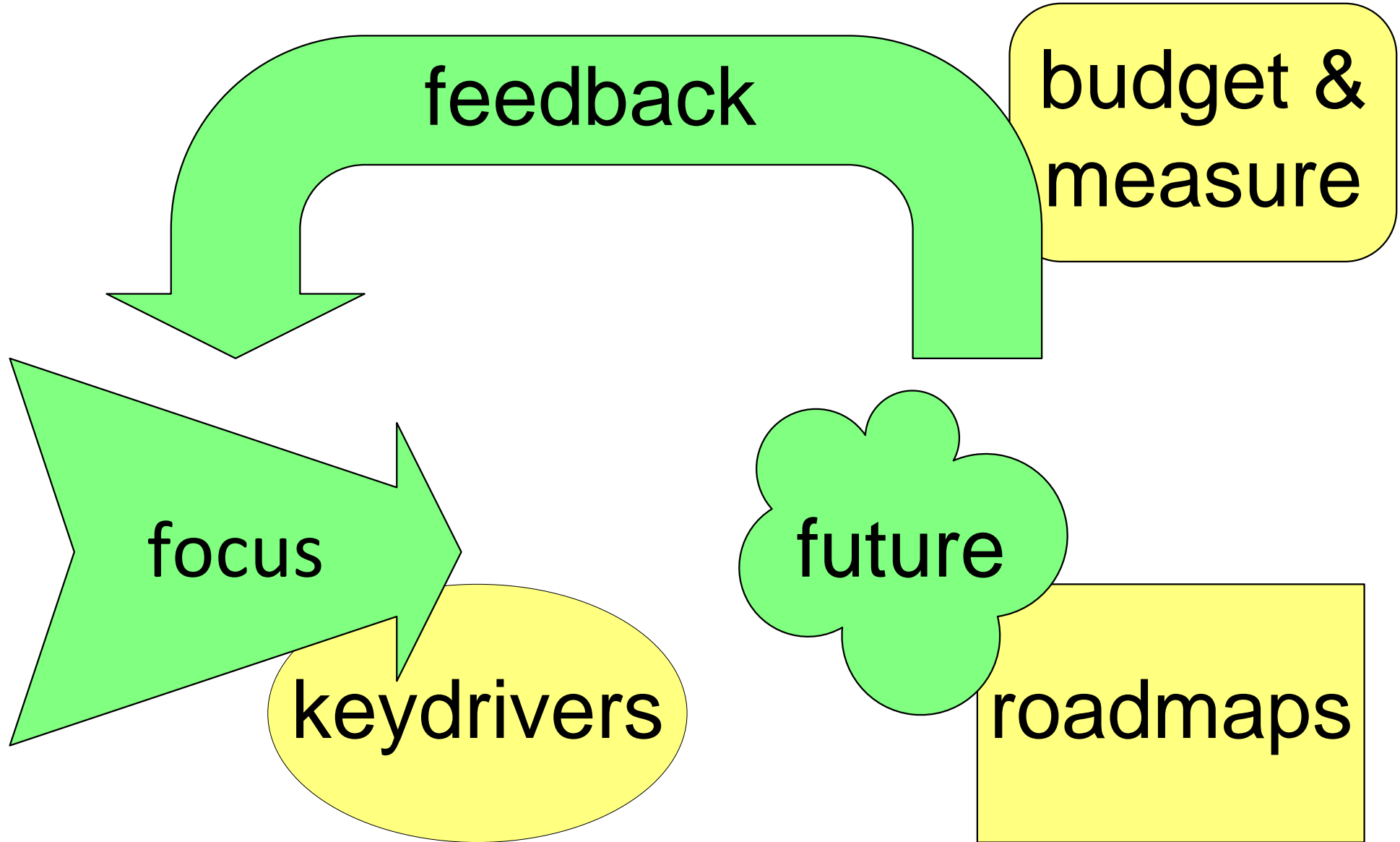
Challenge: Exponential Increase



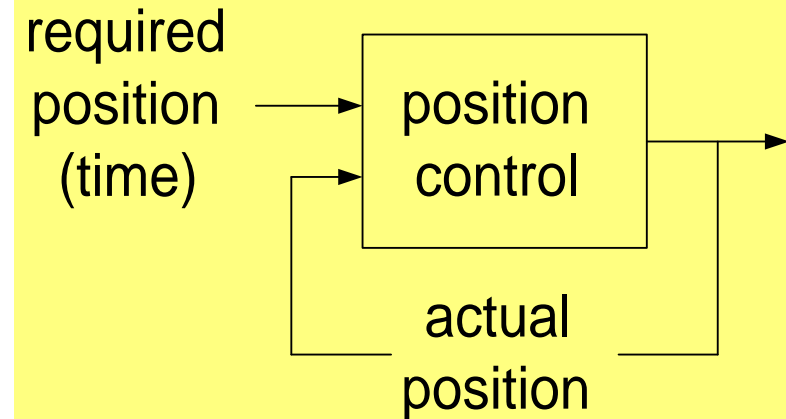
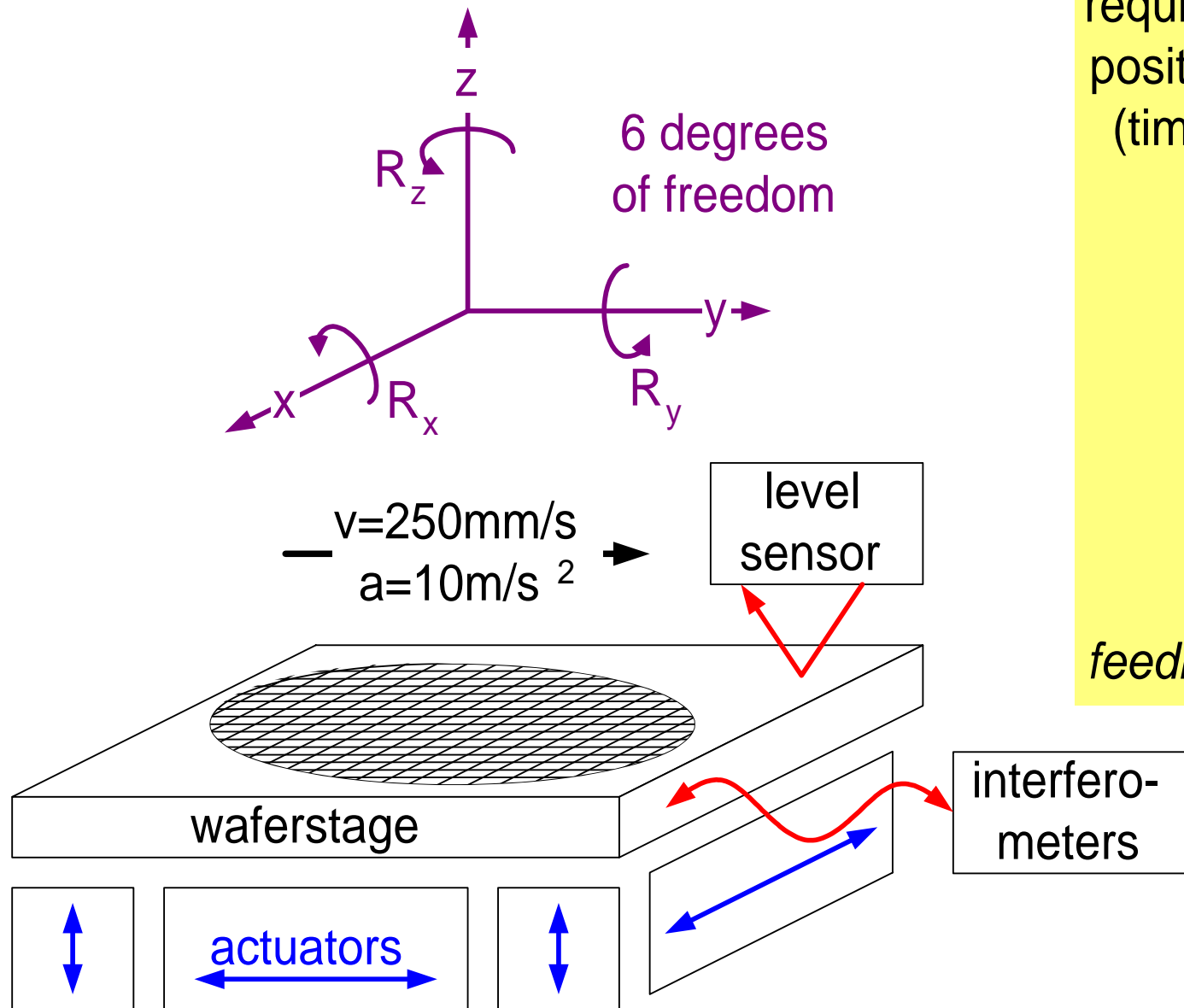
The Software Reliability Threat



Success factor: ASML system engineering style



Feedback as technical design pattern

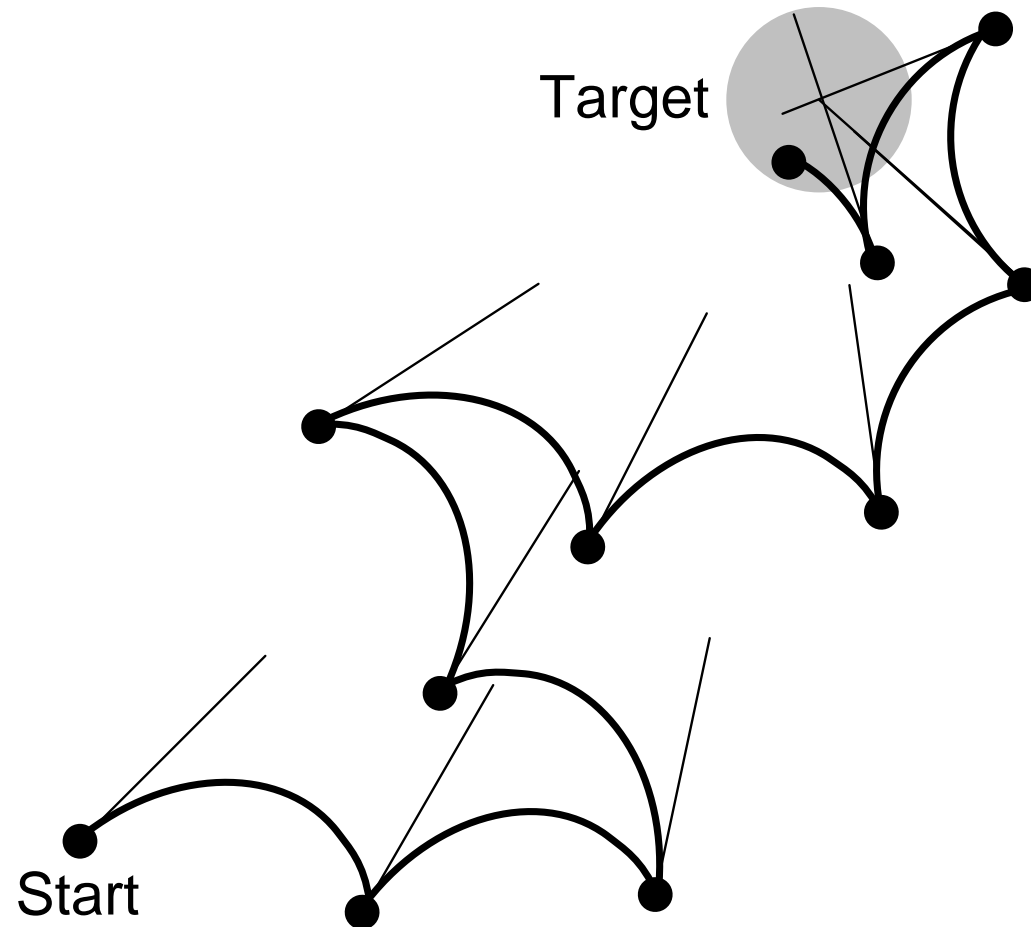


feedback frequency:
4 kHz (250 usec)

feedback: fast and accurate

Feedback as development process pattern

stepsize: 3 months
elapsed time: 25 months

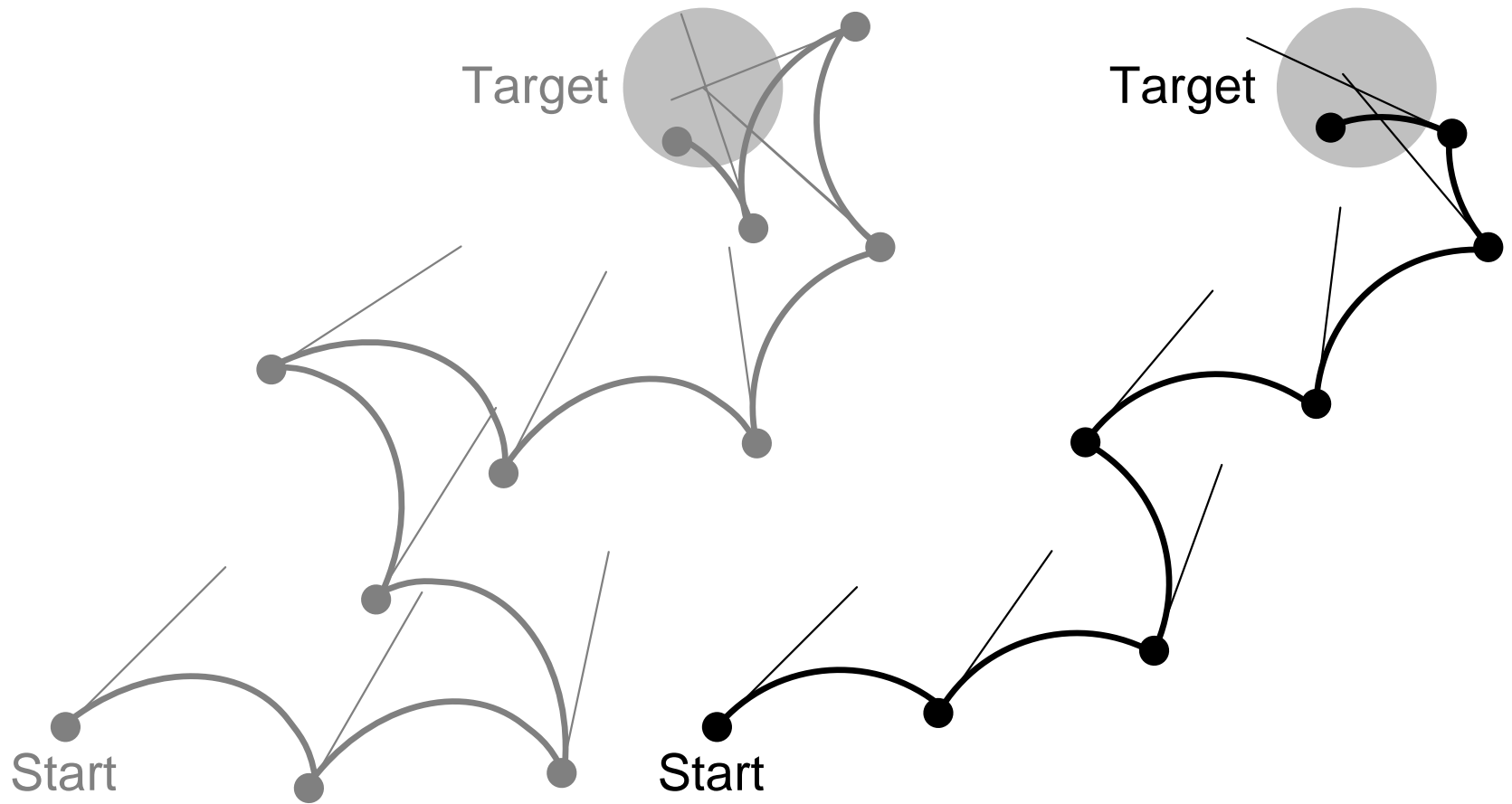


Feedback (2)

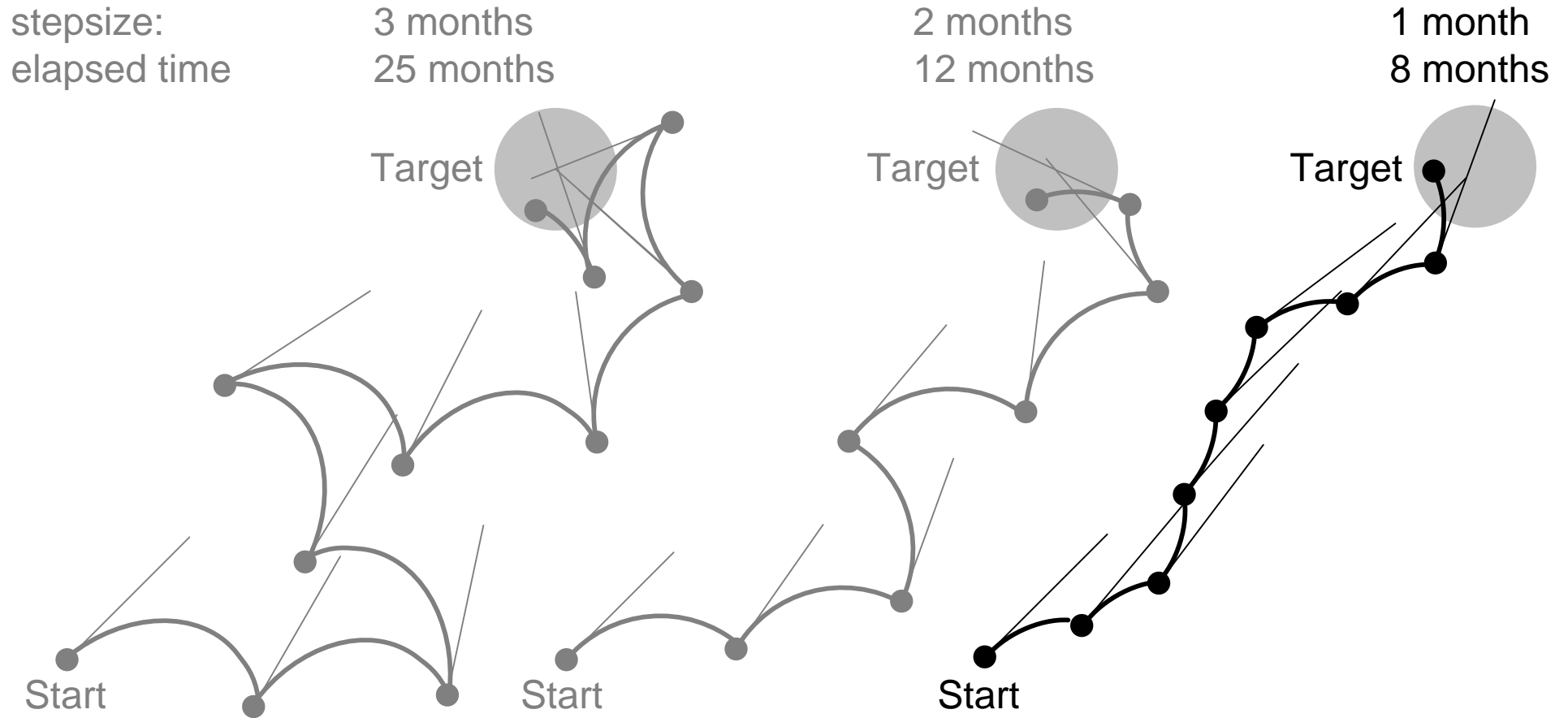
stepsize:
elapsed time

3 months
25 months

2 months
12 months

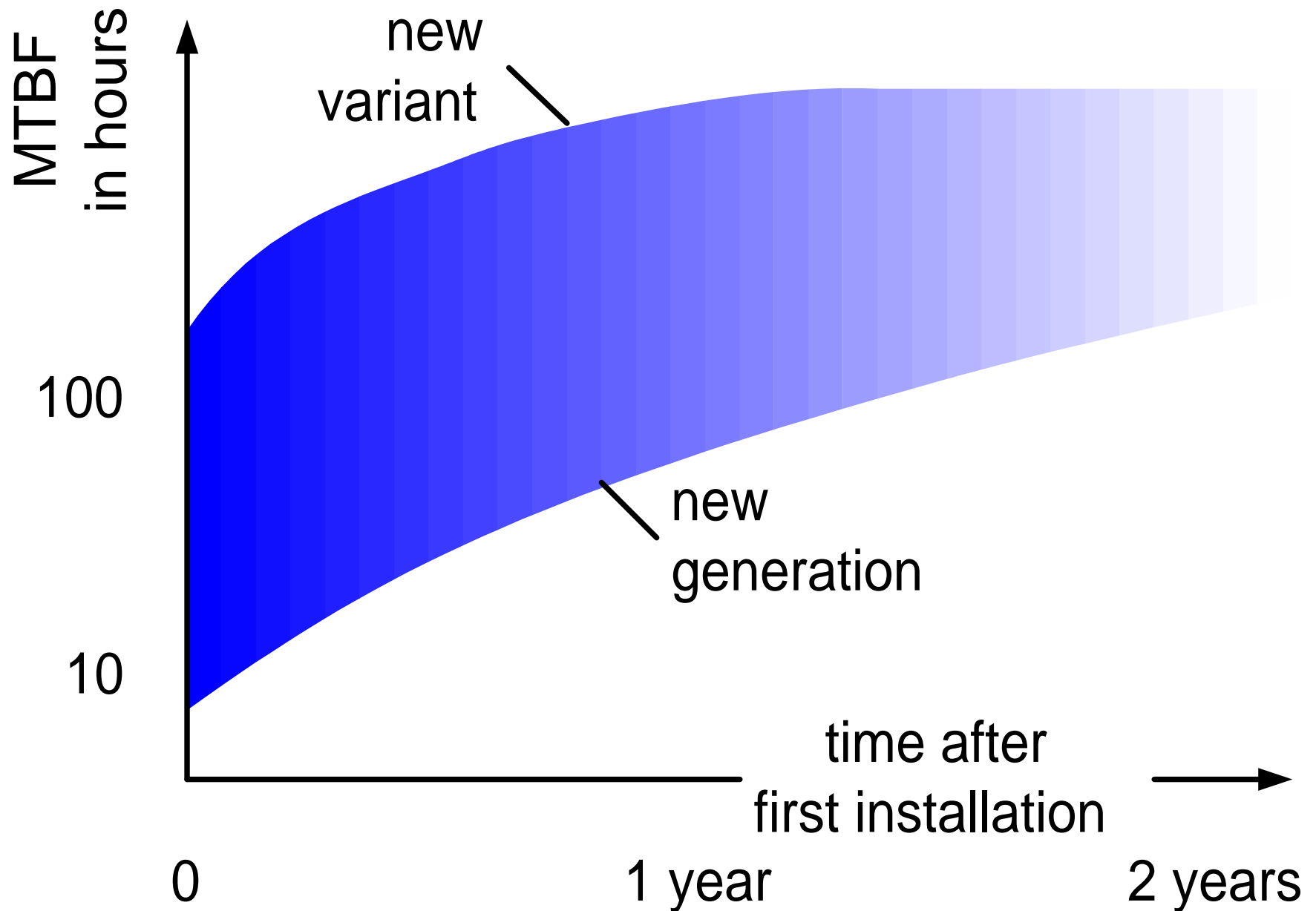


Feedback (3)

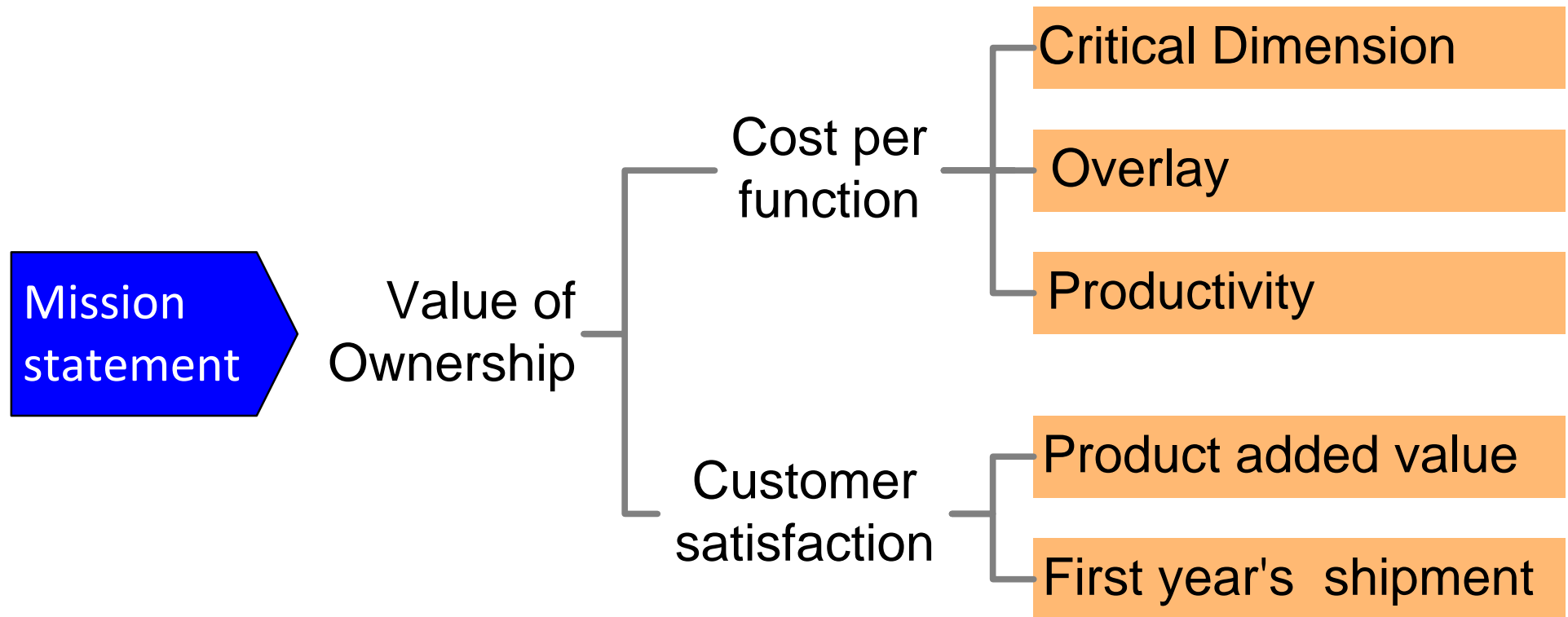


Small feedback cycles result in Faster Time to Market

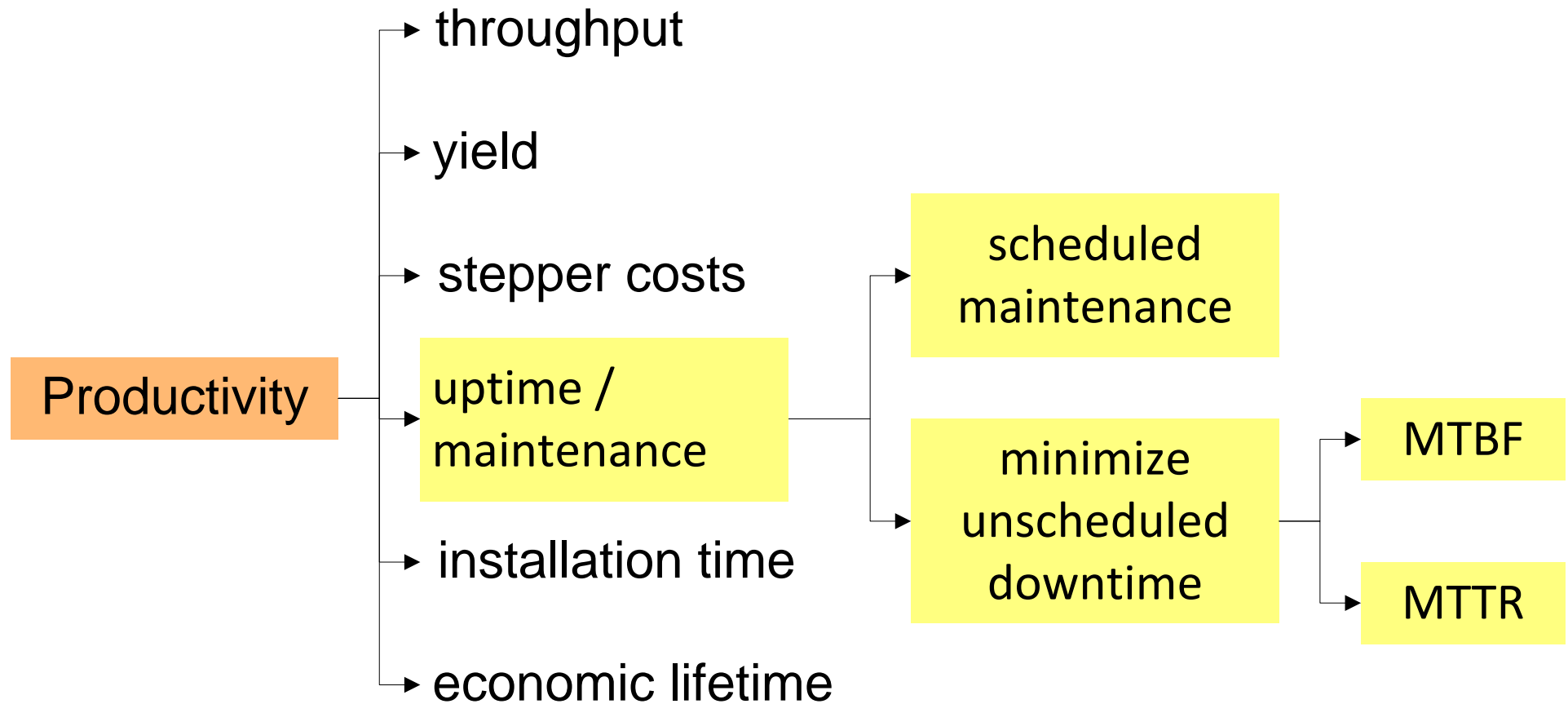
MTBF as function of time

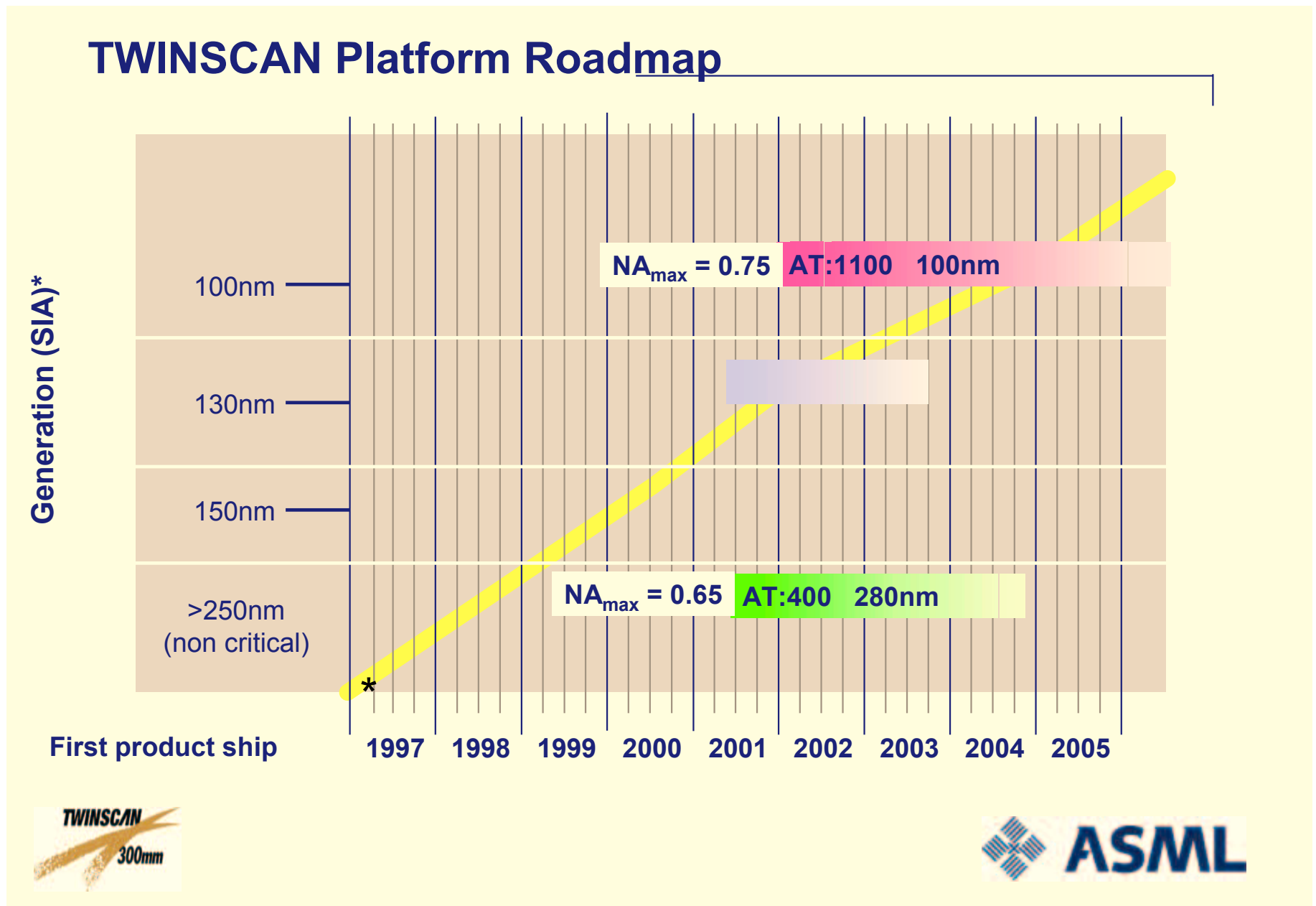


Focus via key drivers

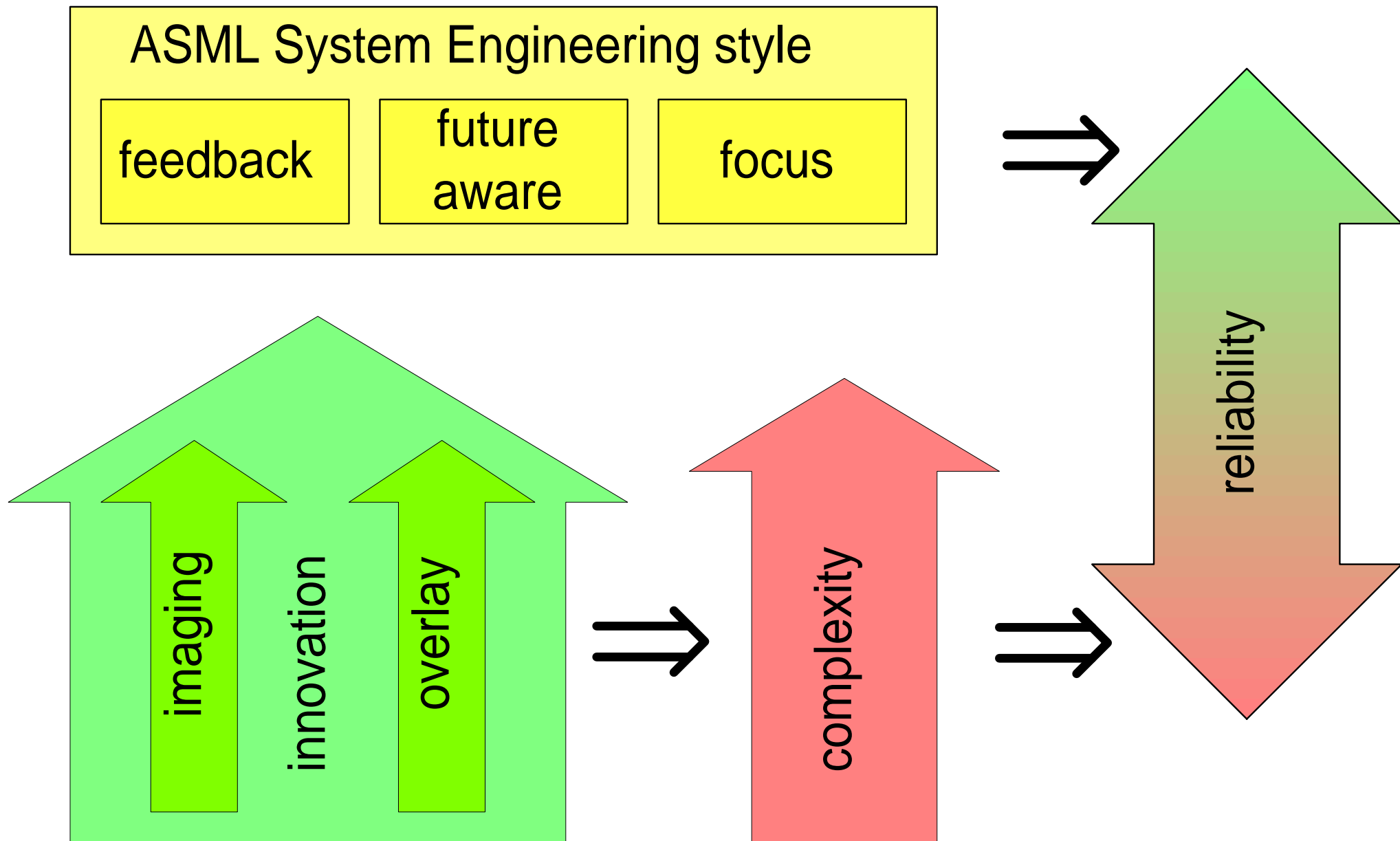


Productivity decomposed





Conclusion



disclaimer

The case material is based on actual data, from a complex context with large commercial interests. The material is **simplified** to increase the accessibility, while at the same time **small changes** have been made to remove commercial sensitivity. Commercial sensitivity is further reduced by using relatively **old** data (between 5 and 10 years in the past). Care has been taken that the illustrative value is maintained