

The Waferstepper Challenge: Innovation and Reliability despite Complexity

by *Gerrit Muller* Buskerud University College

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

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.

Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

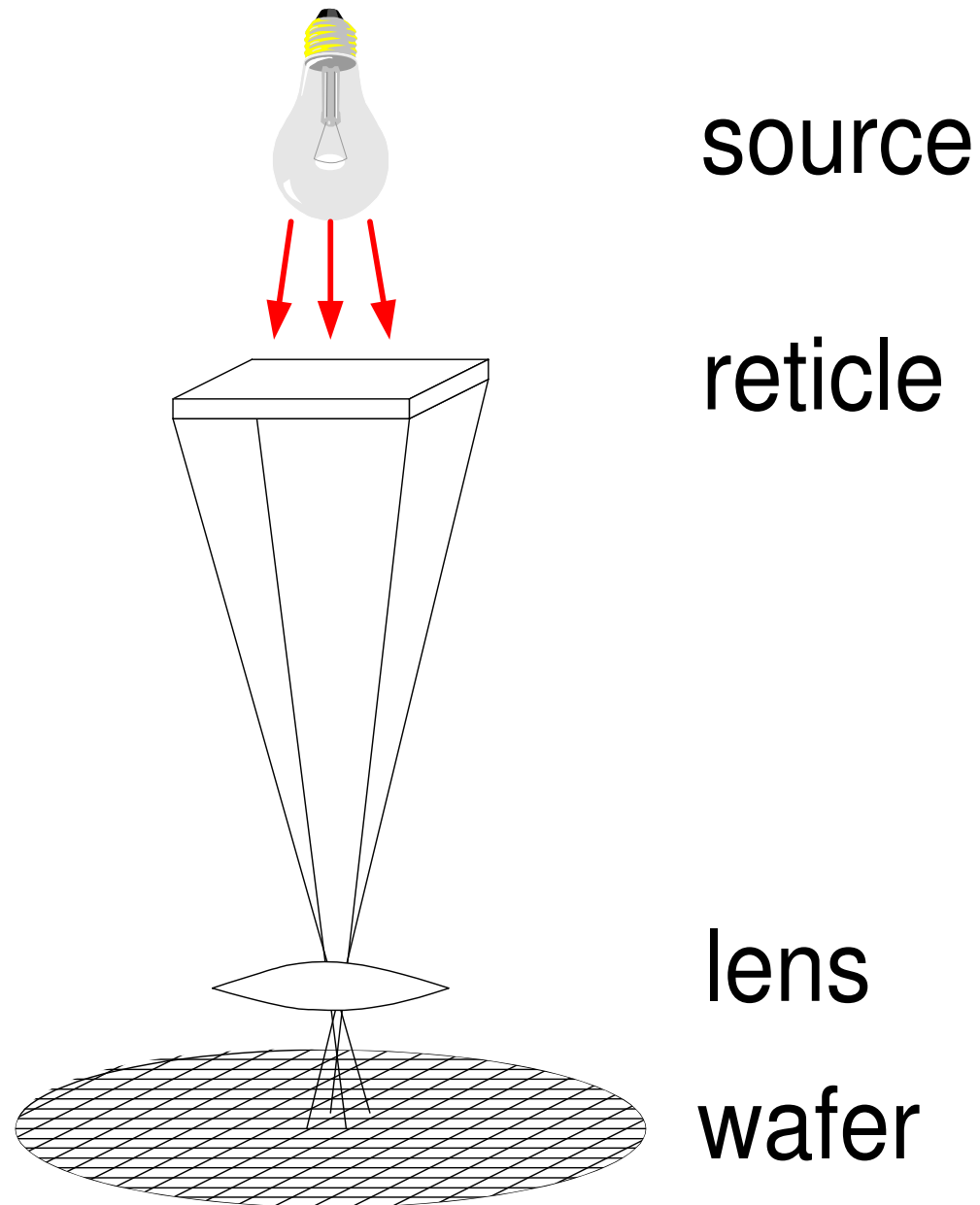
October 20, 2017
status: finished
version: 1.0



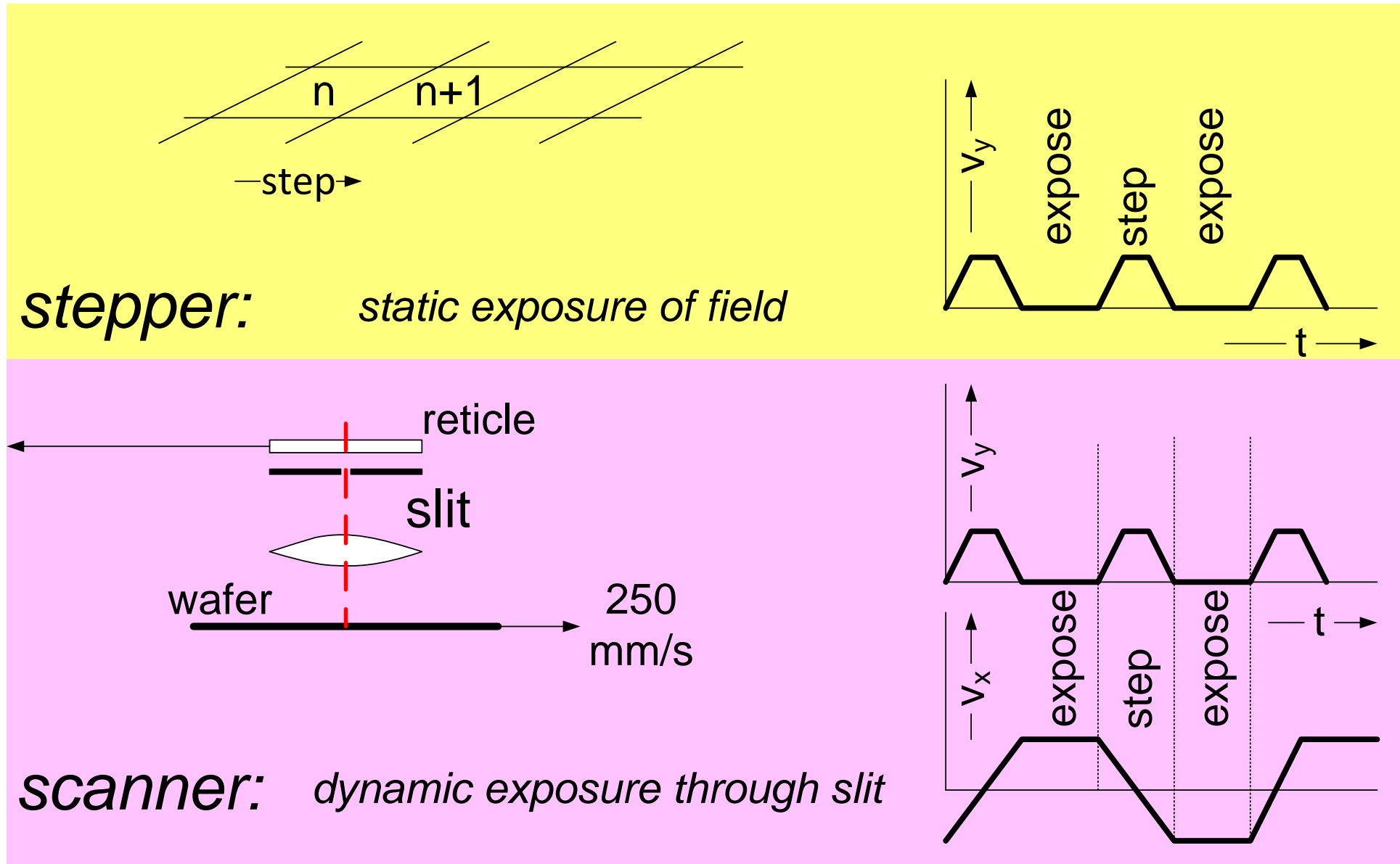
Twinscan AT1100



What is a waferstepper

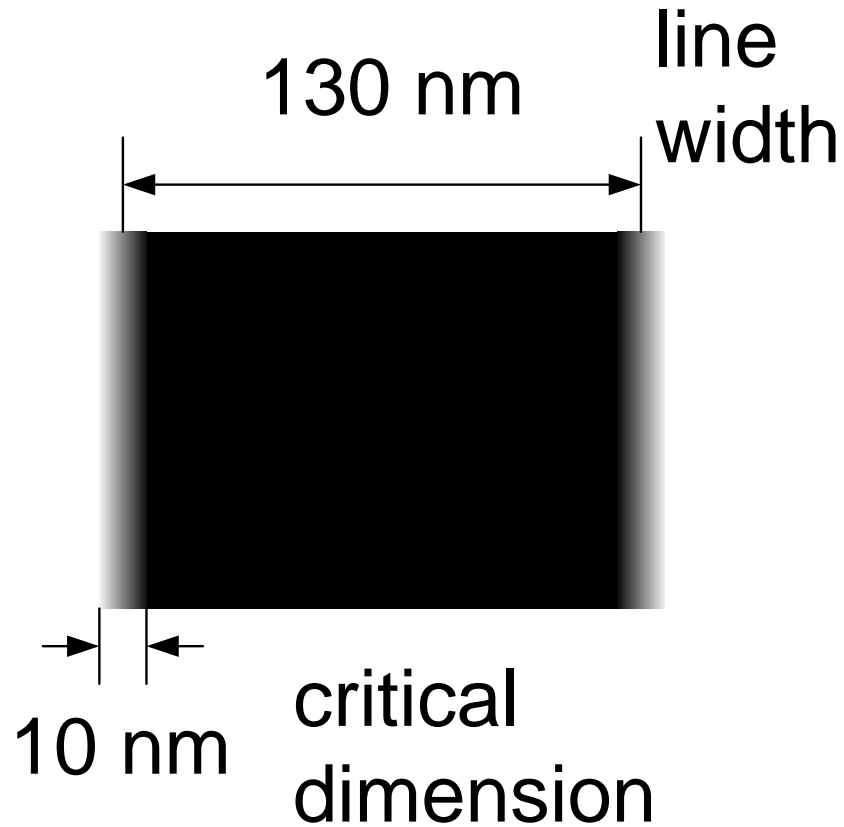


From stepping to scanning

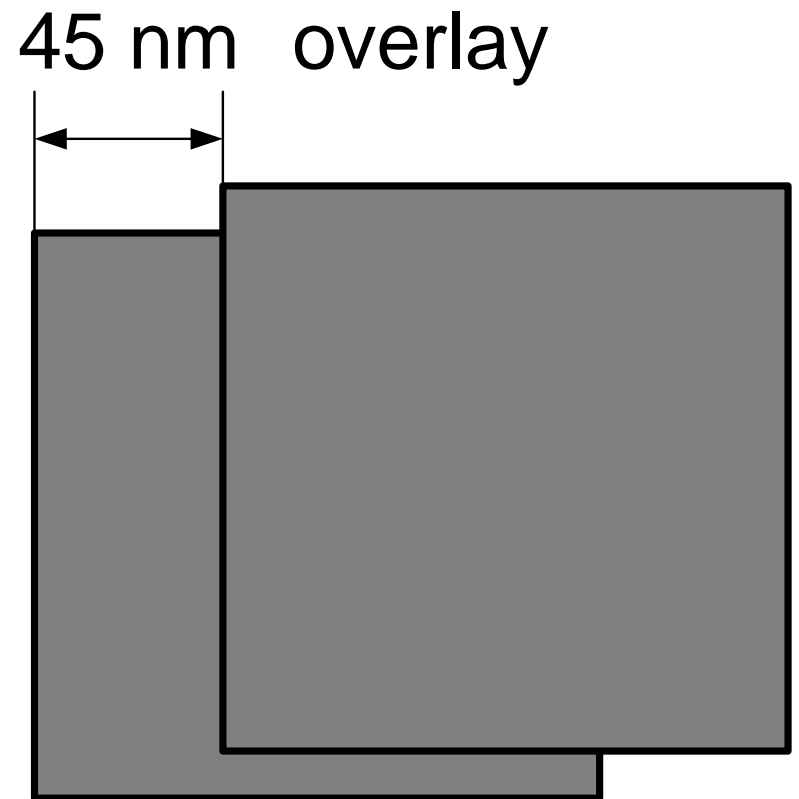


Key specifications waferstepper

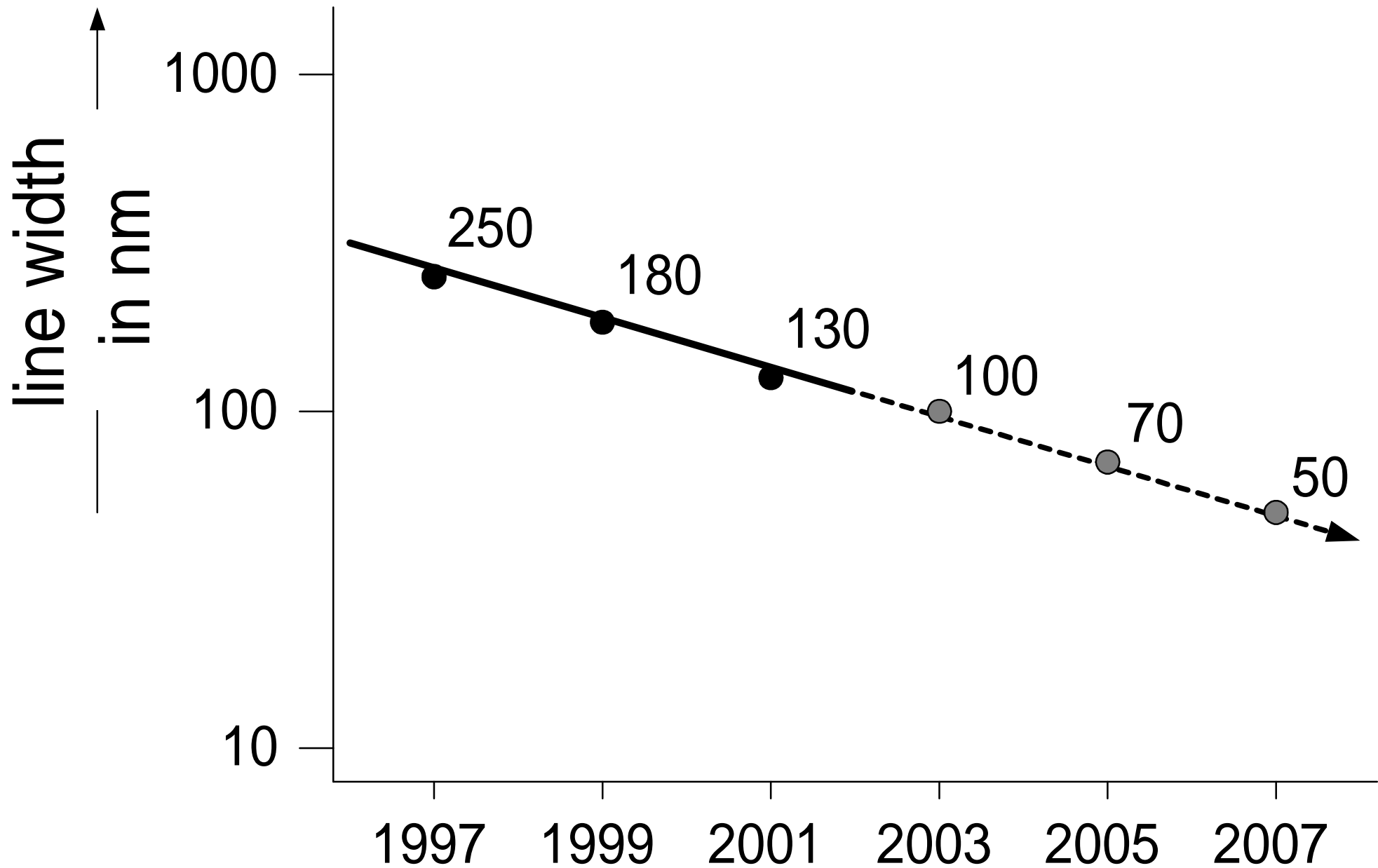
imaging



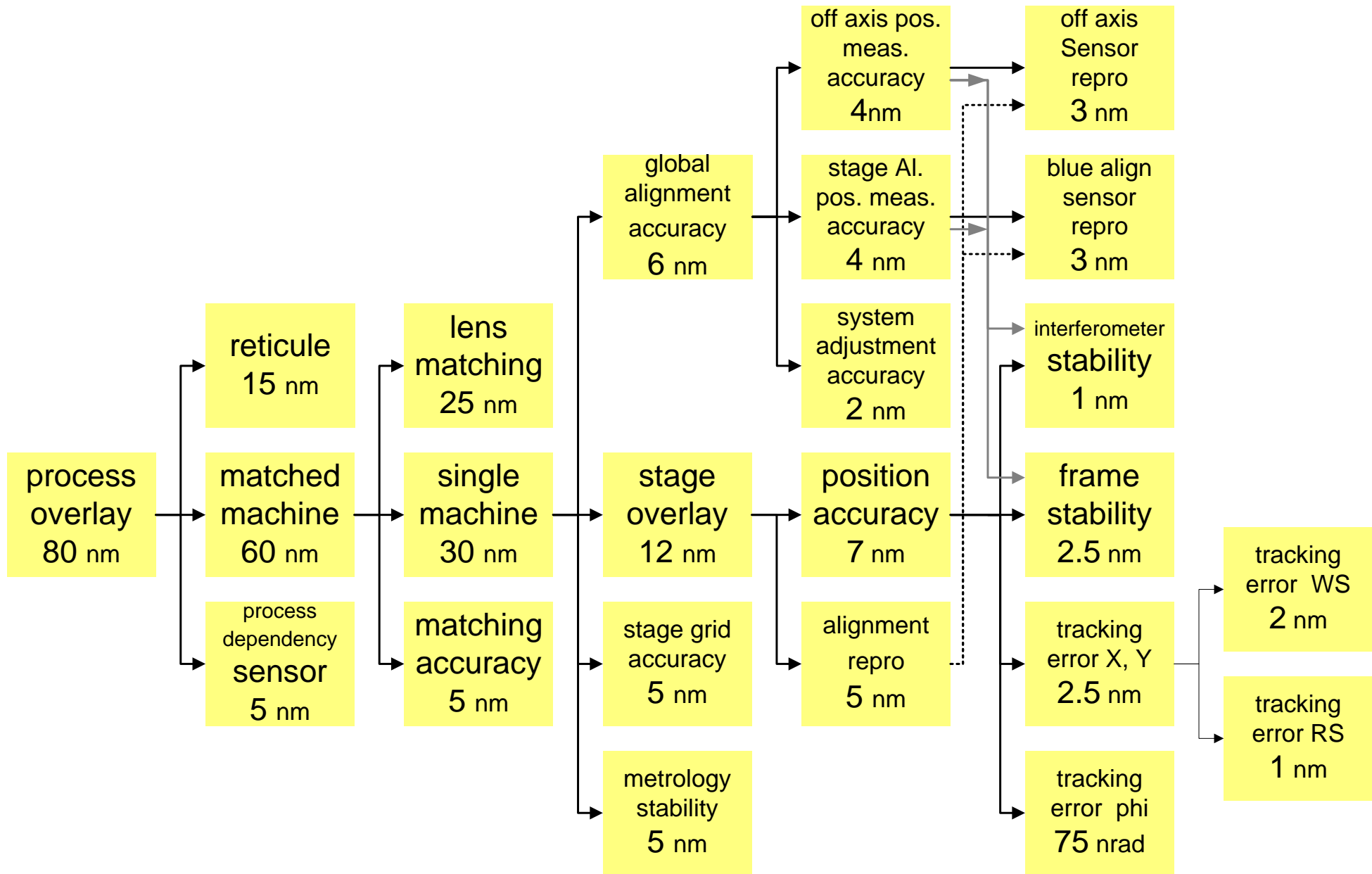
alignment



Moore's law




Overlay budget (1999)

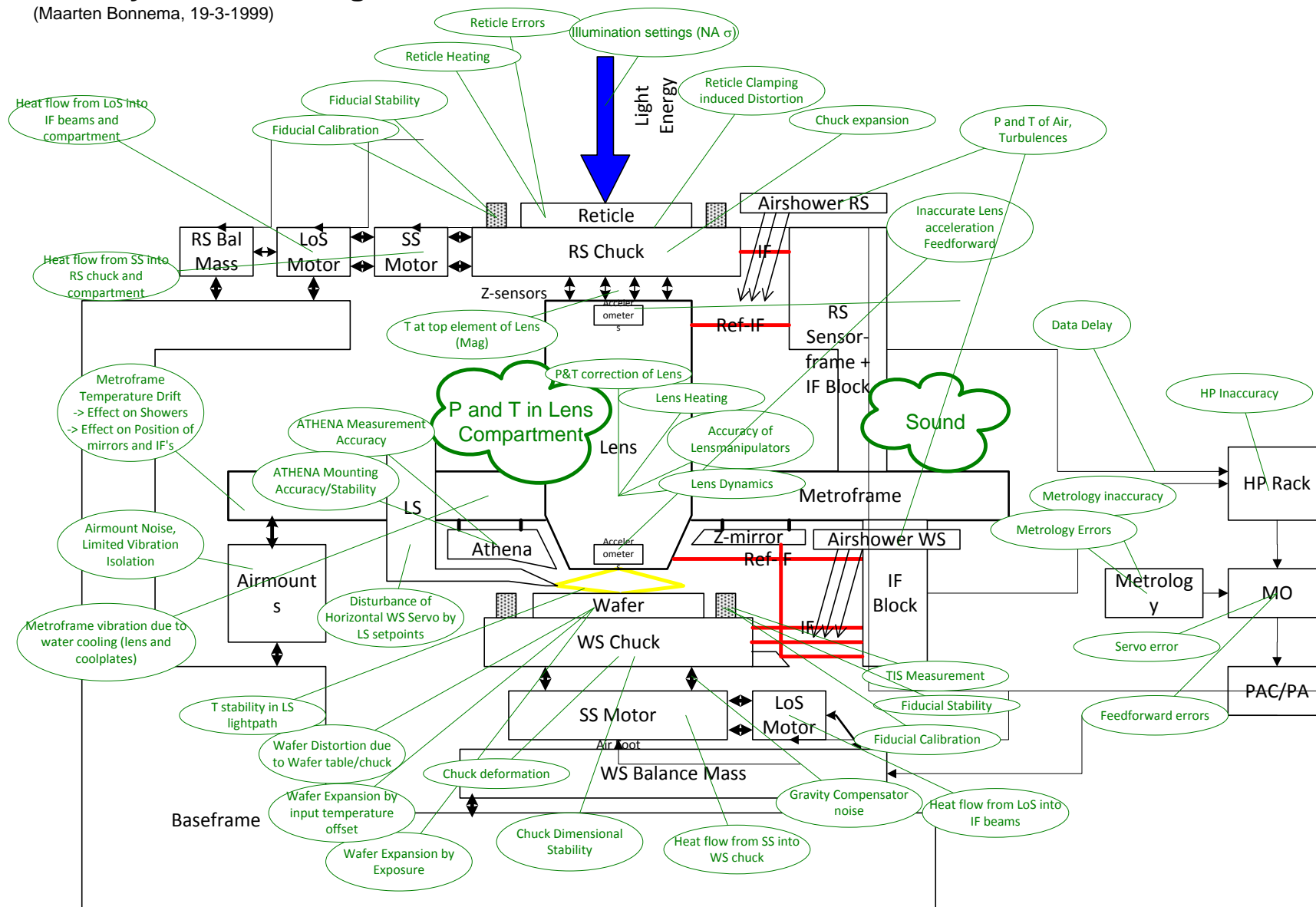


Everything influences overlay

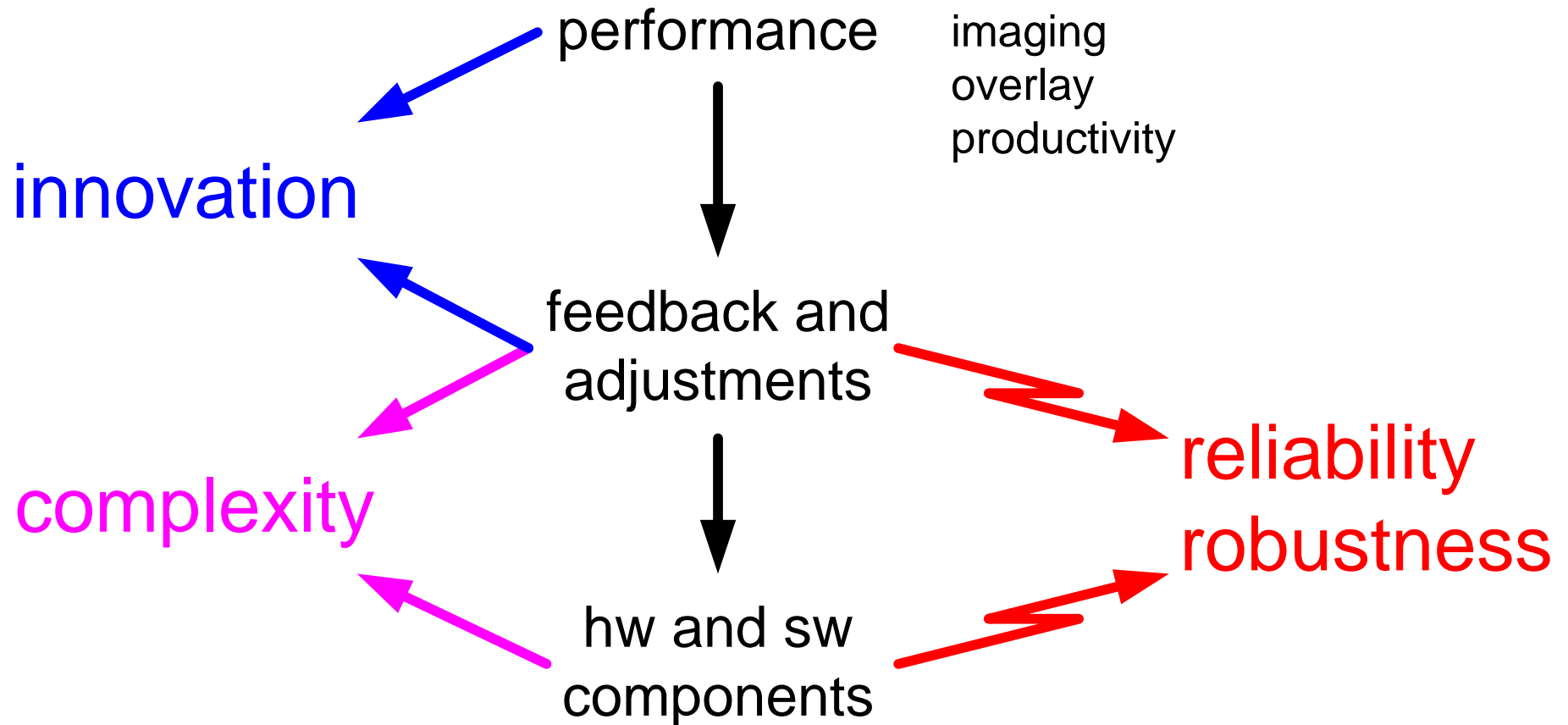
Overlay Influence Diagram.

(Maarten Bonnema, 19-3-1999)

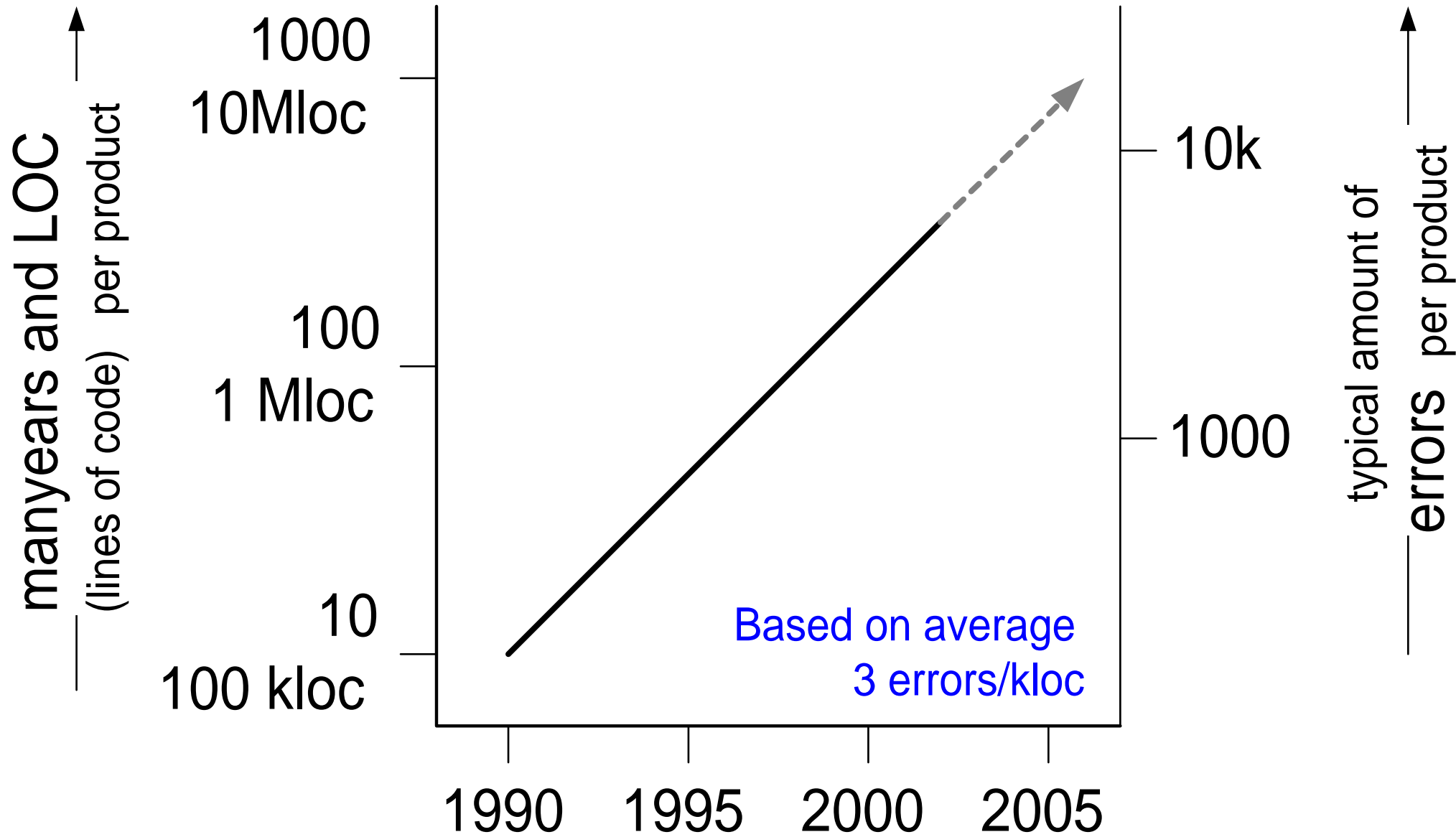
 : Fiducial



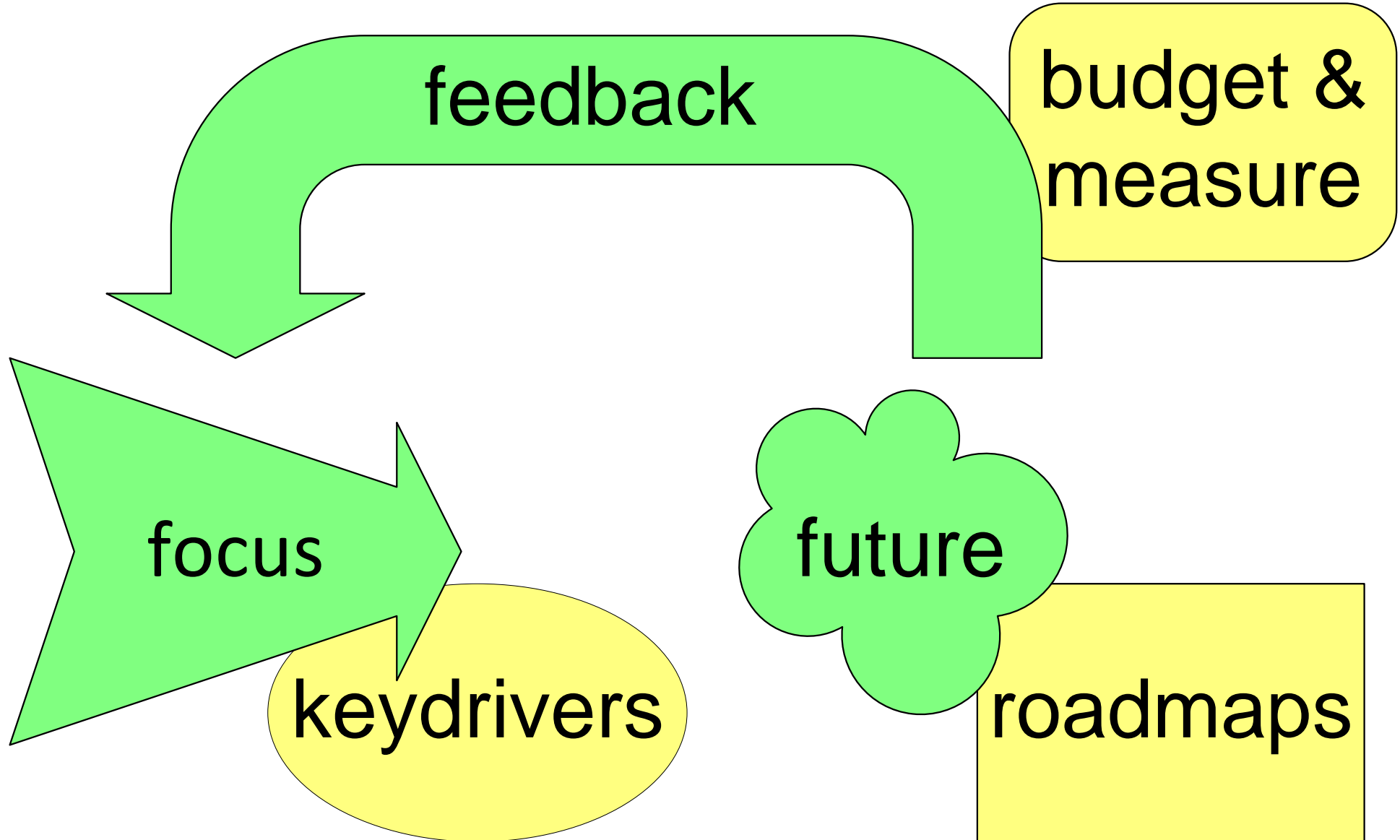
Challenge: Exponential Increase



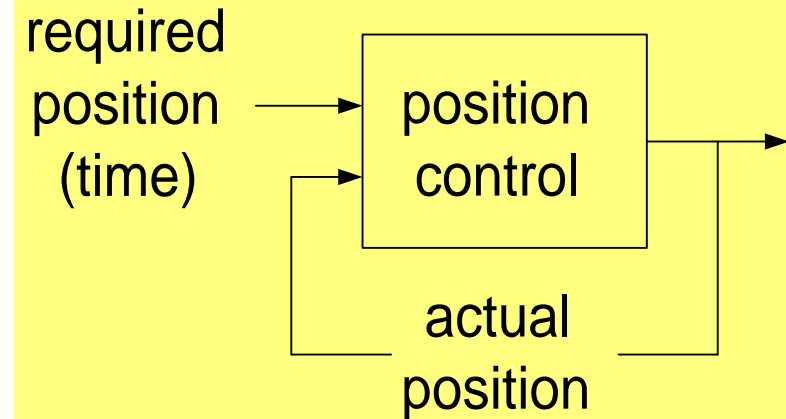
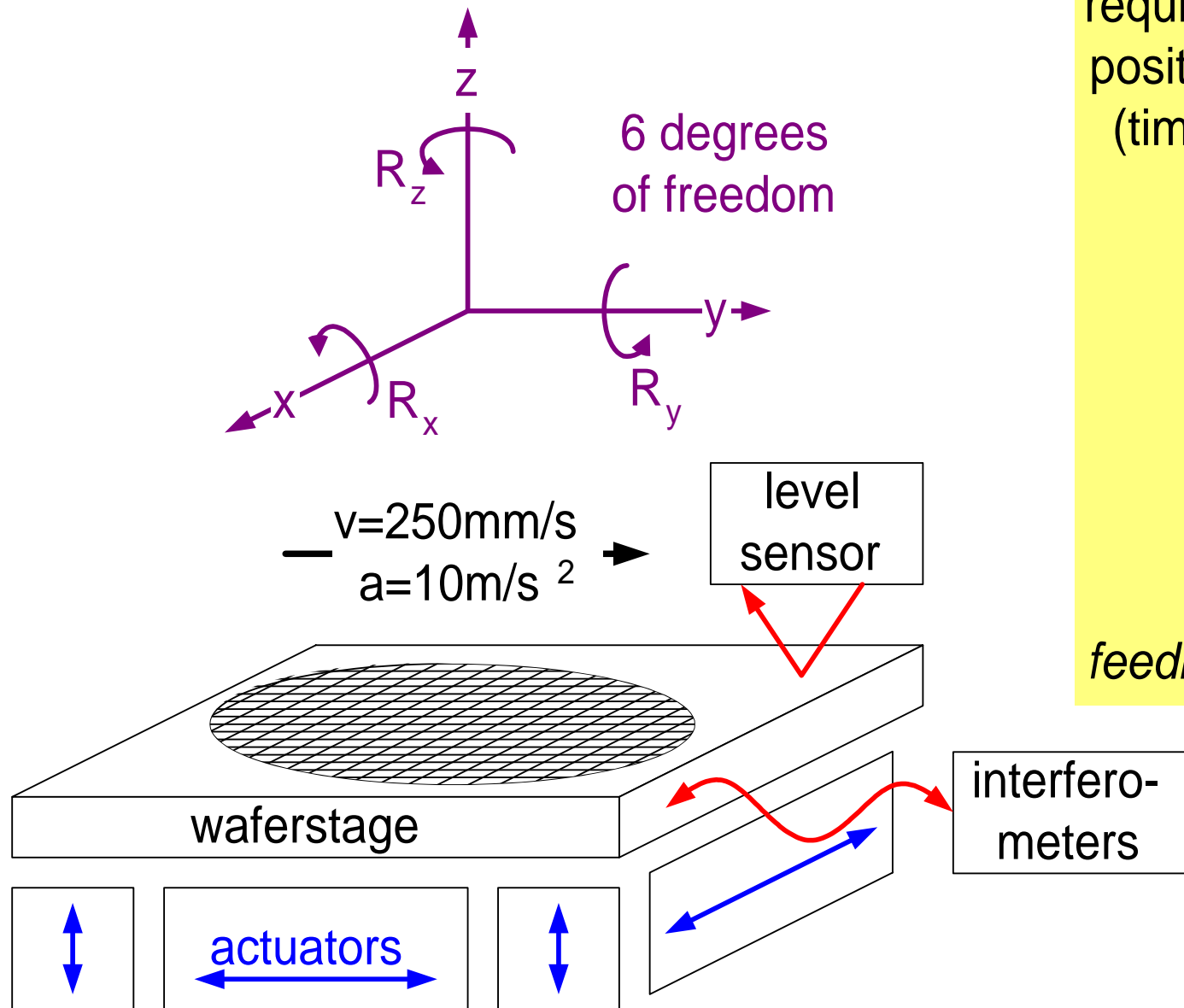
The Software Reliability Threat



Success factor: ASML system engineering style



Feedback as technical design pattern

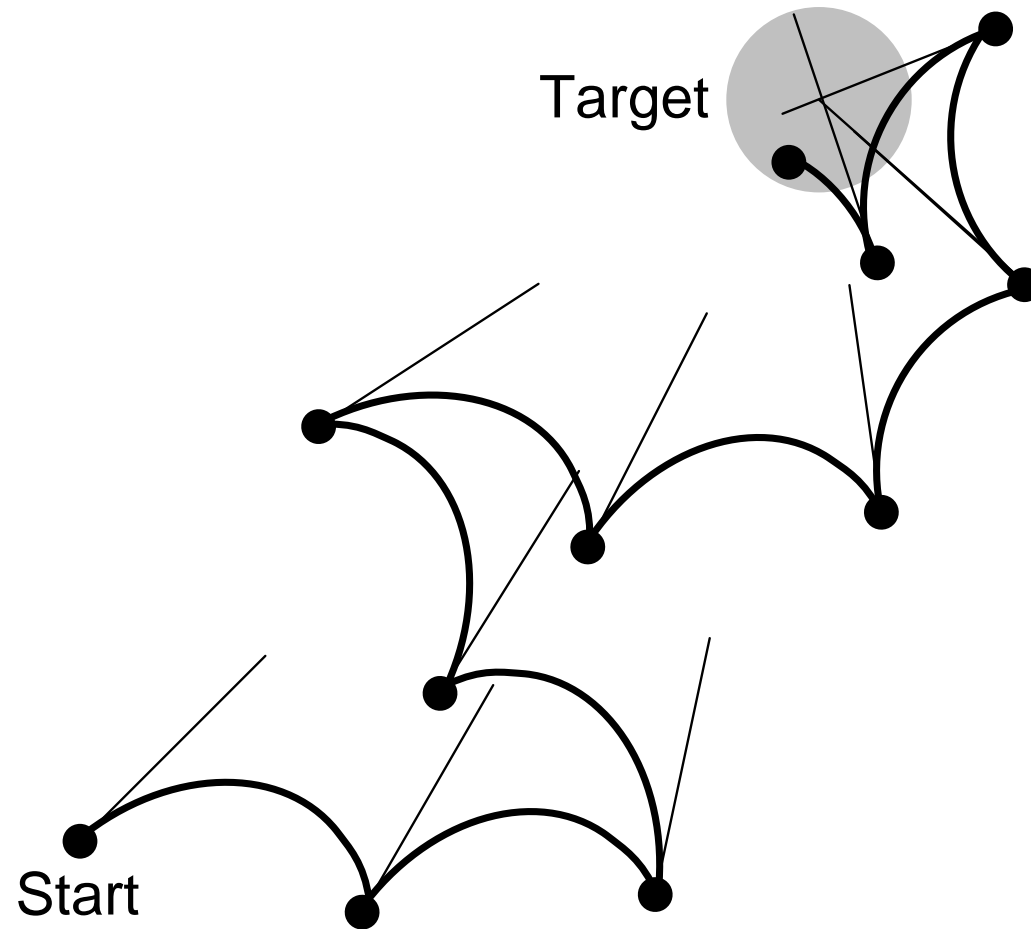


feedback frequency:
4 kHz (250 usec)

feedback: fast and accurate

Feedback as development process pattern

stepsize: 3 months
elapsed time: 25 months

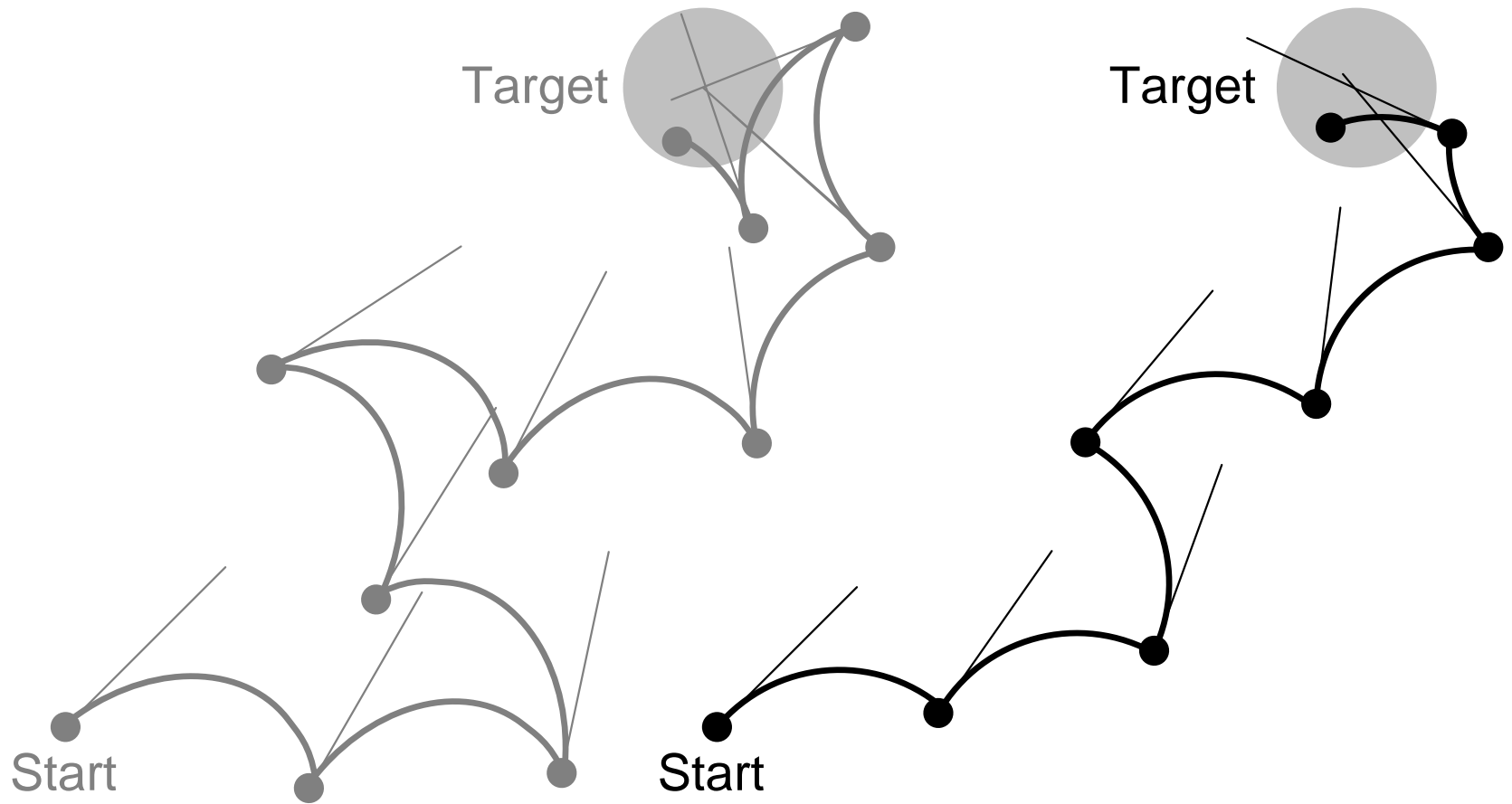


Feedback (2)

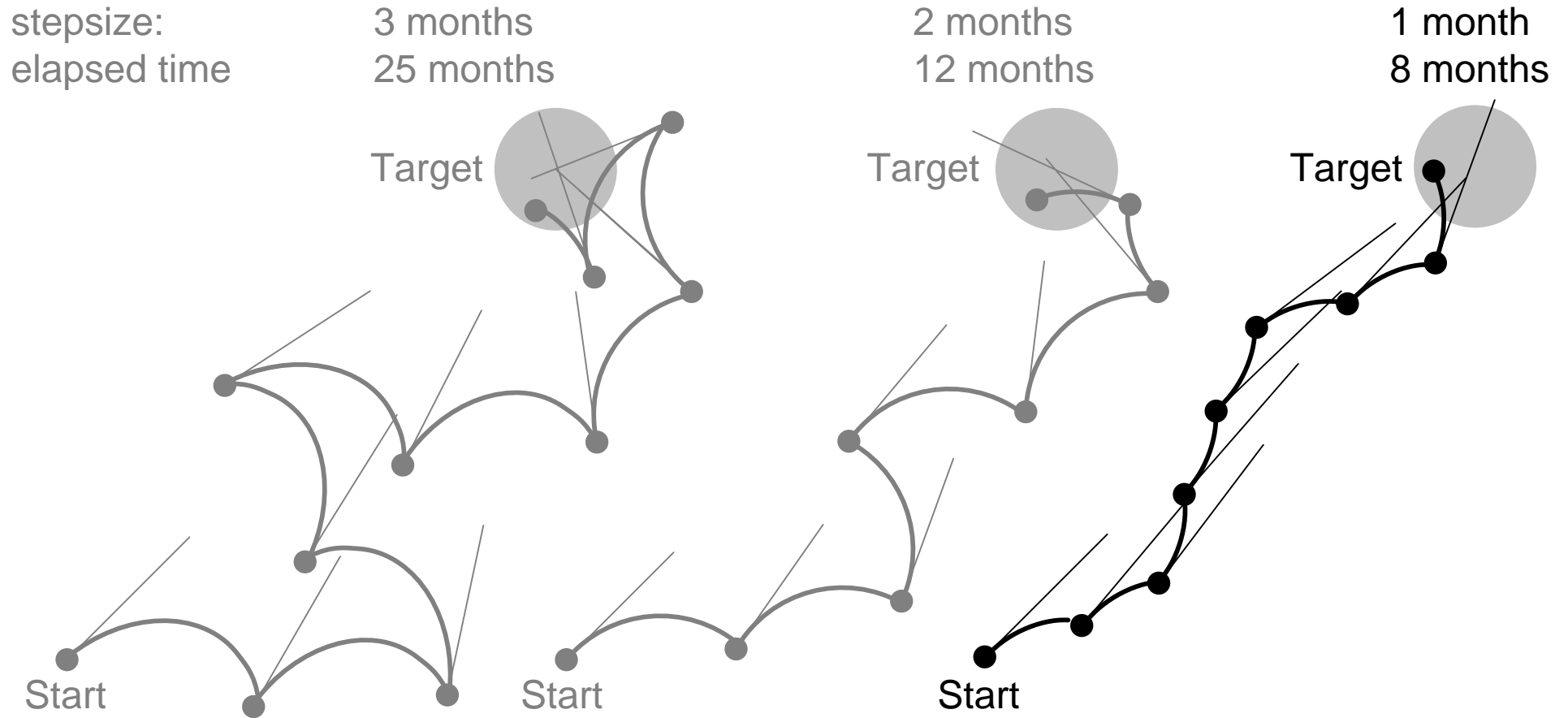
stepsize:
elapsed time

3 months
25 months

2 months
12 months

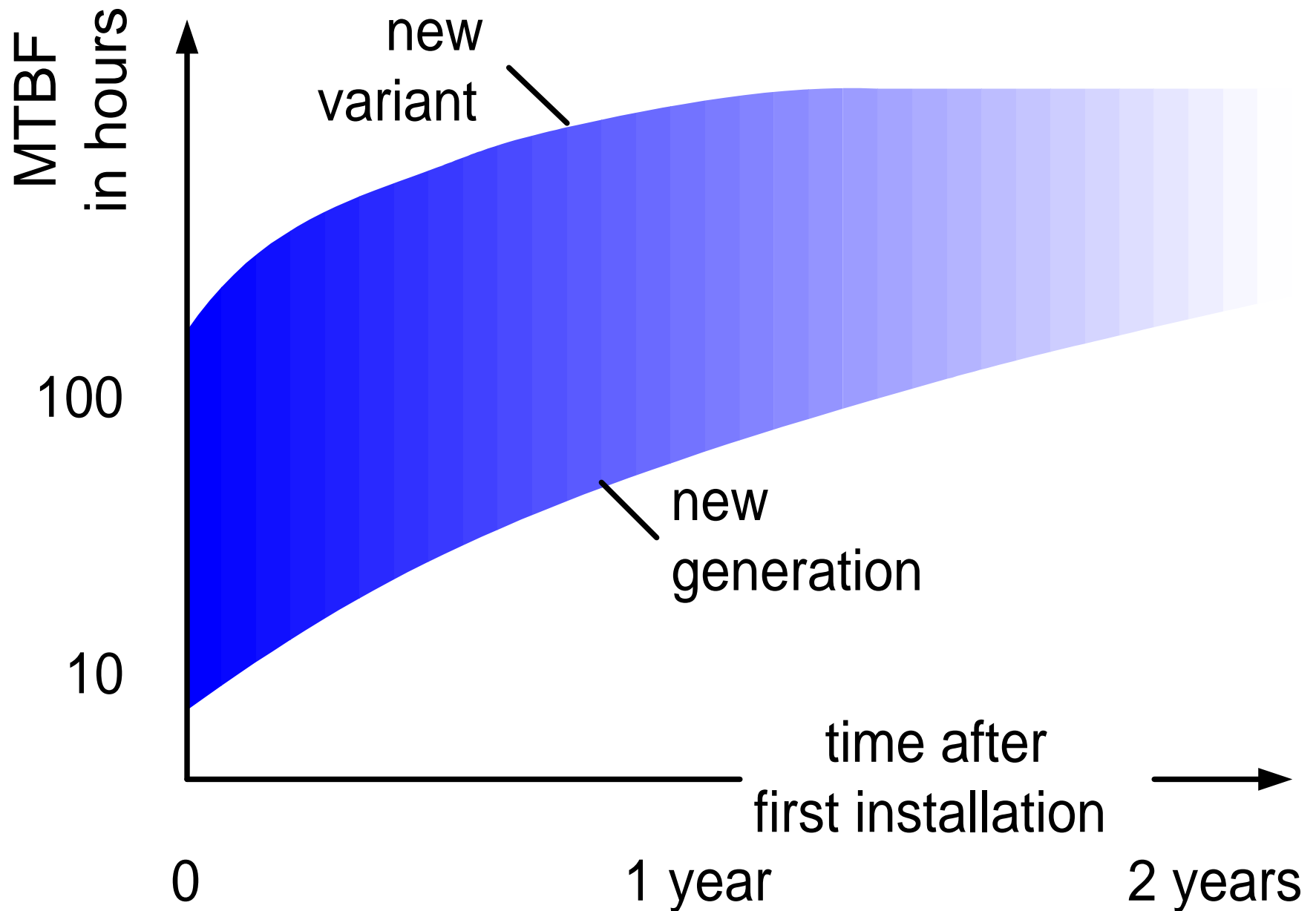


Feedback (3)

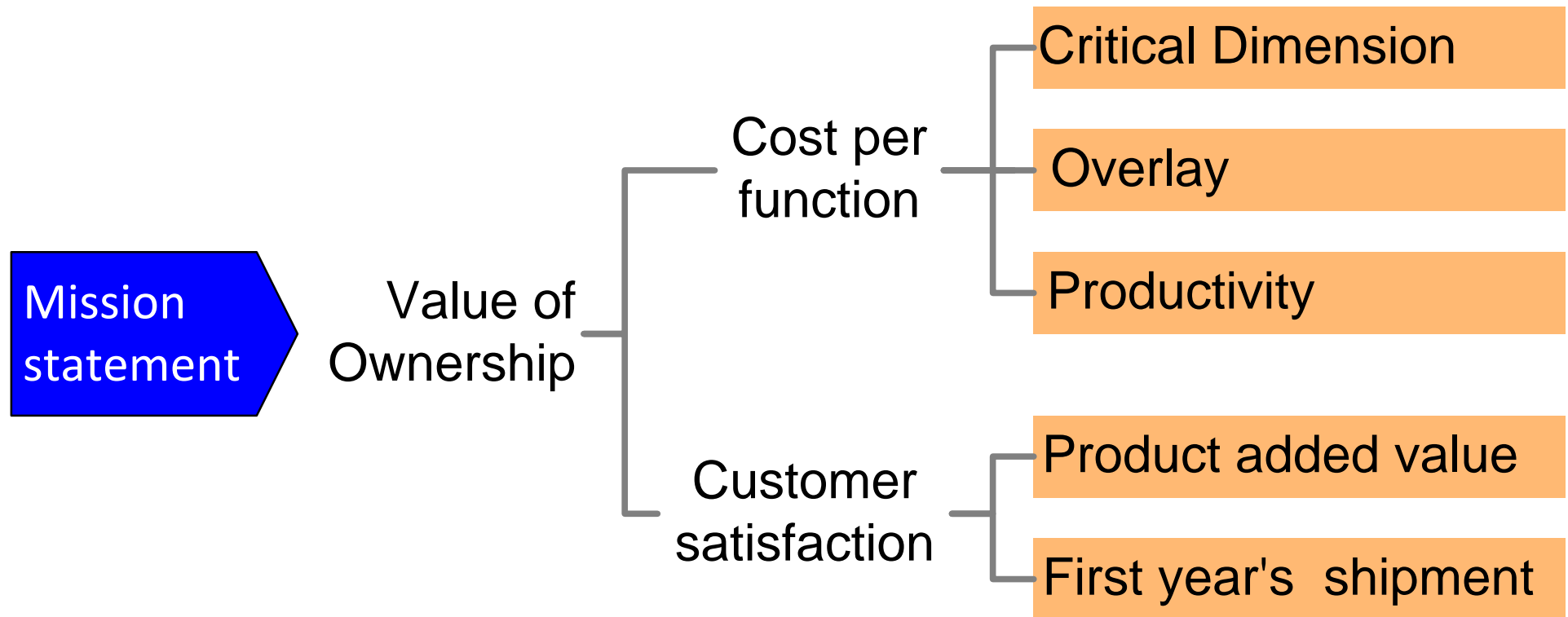


Small feedback cycles result in Faster Time to Market

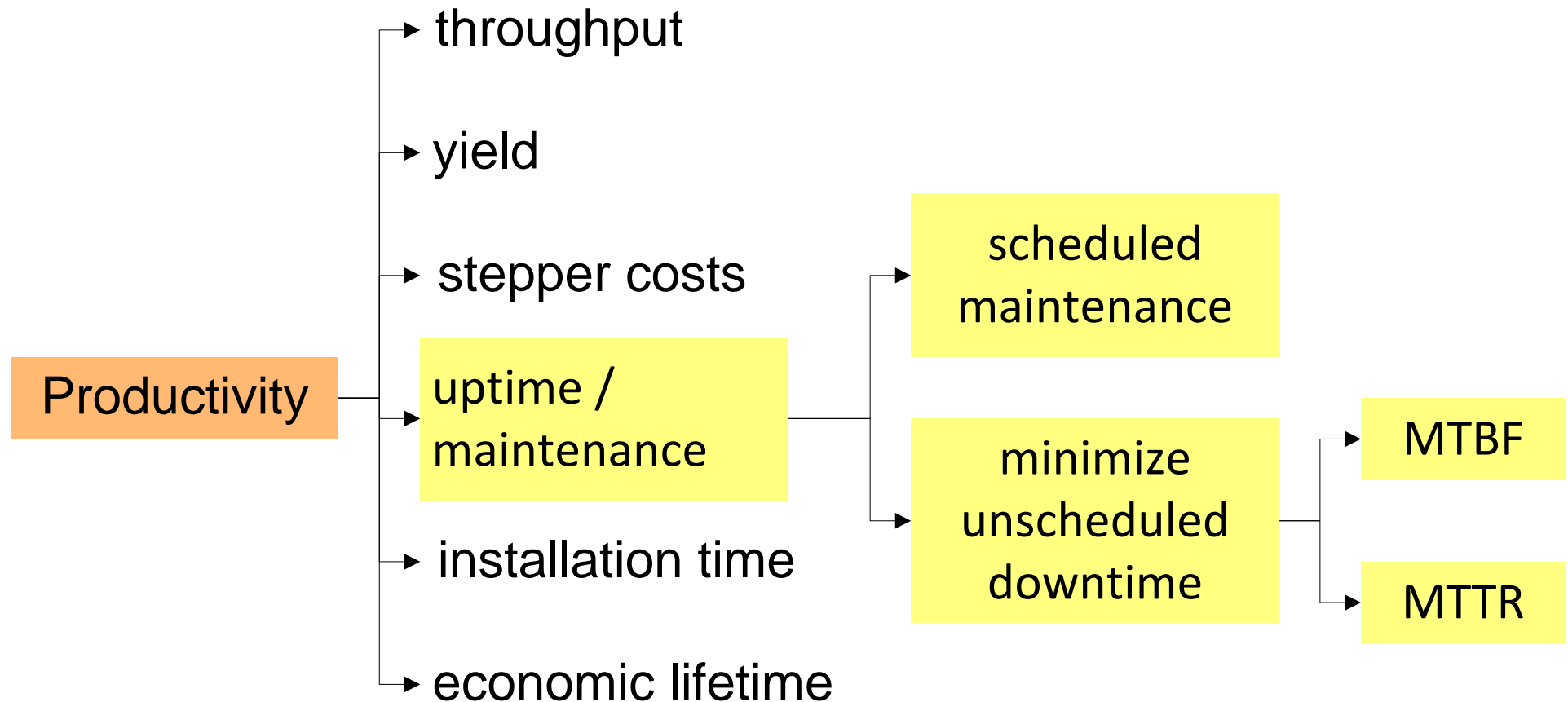
MTBF as function of time

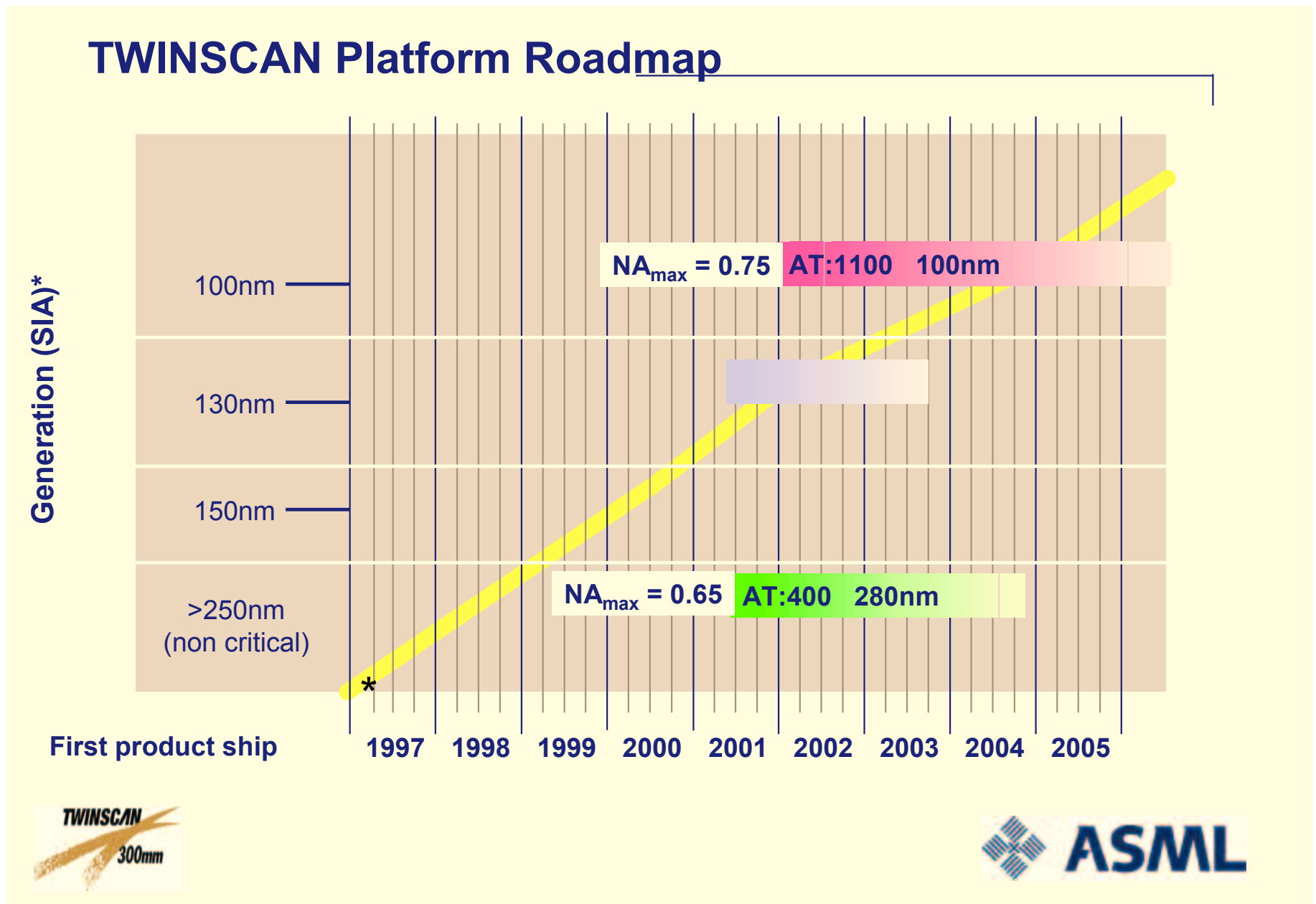


Focus via key drivers

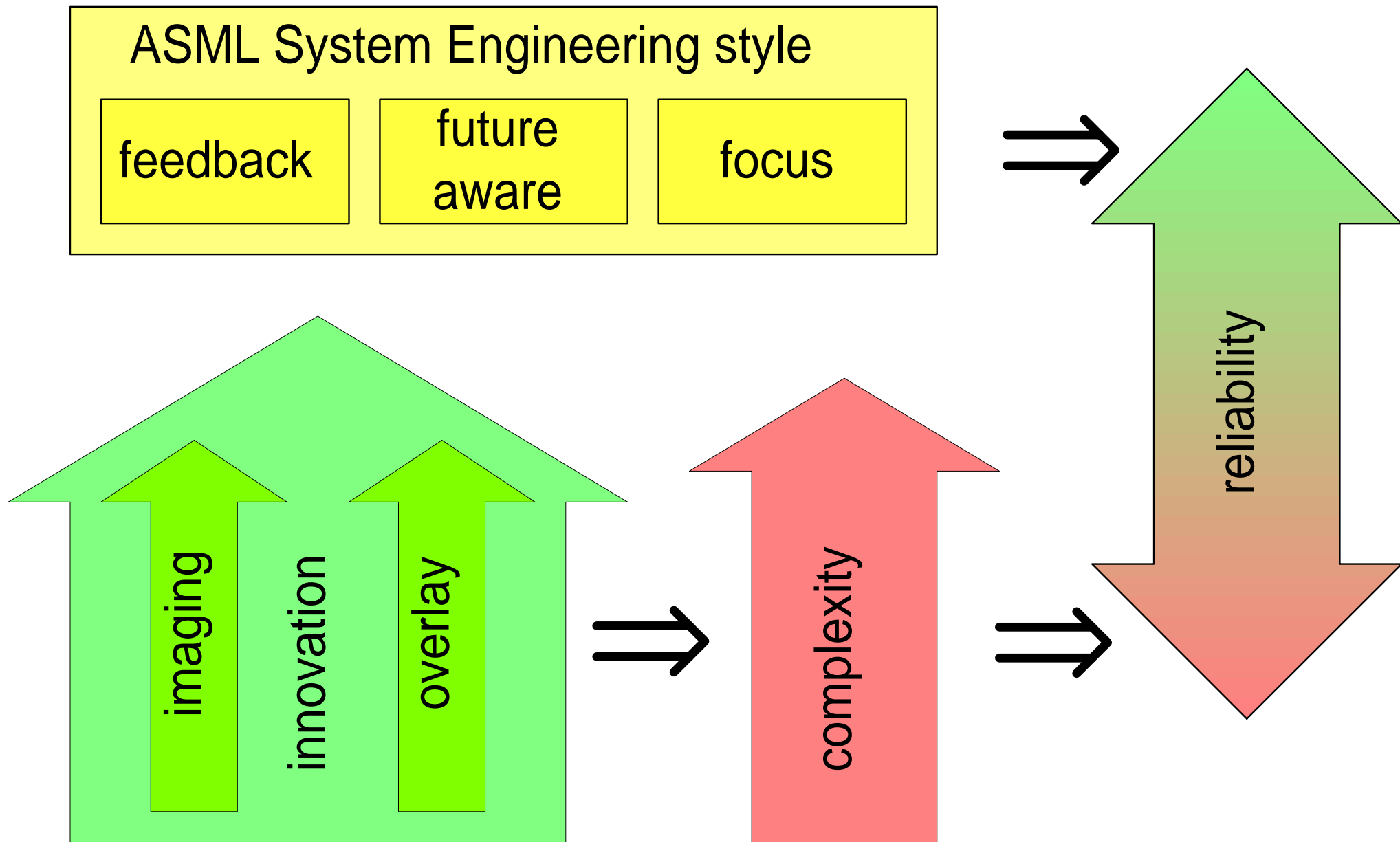


Productivity decomposed





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