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.

February 10, 2011
status: finished
version: 1.0

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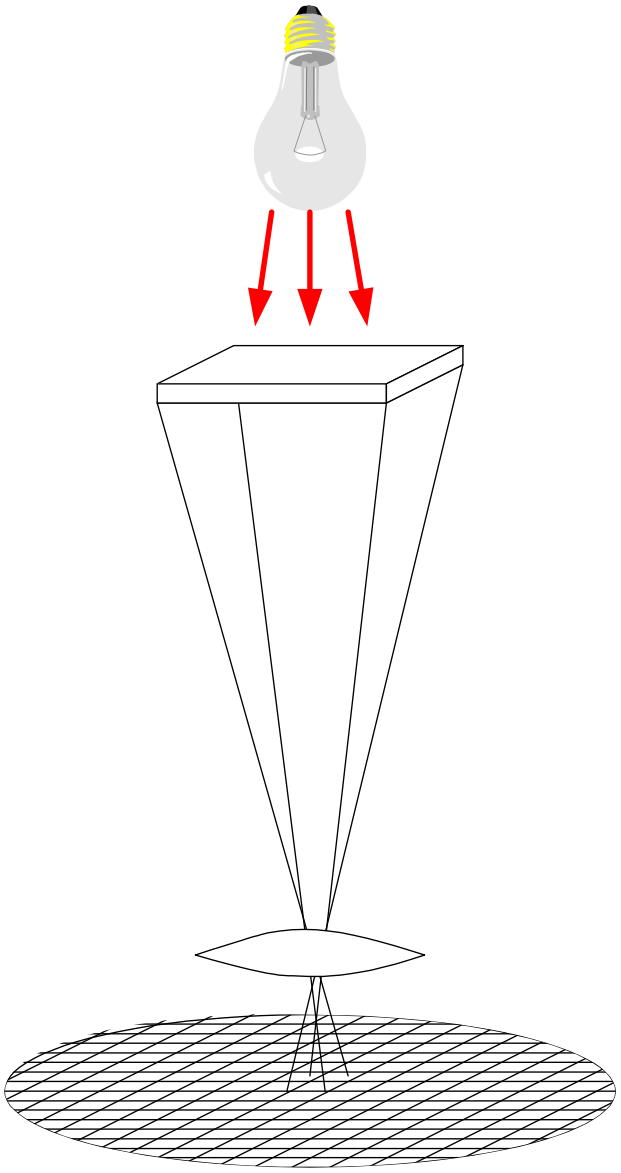
What is a waferstepper



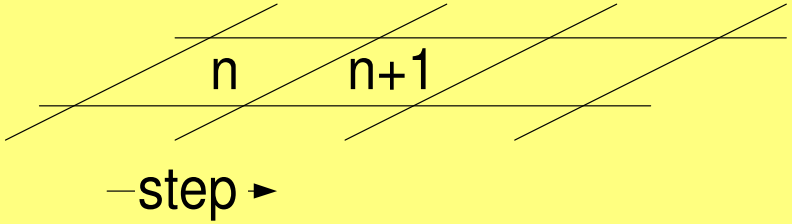
source

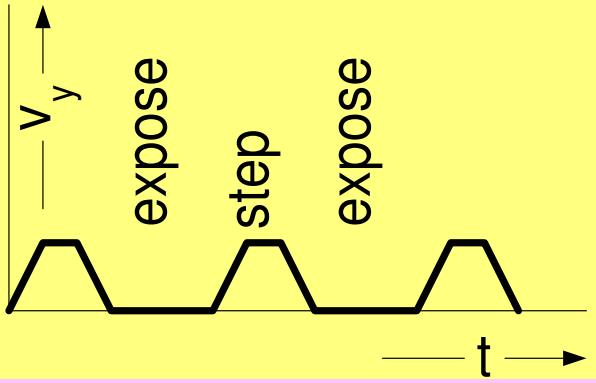
reticle

lens

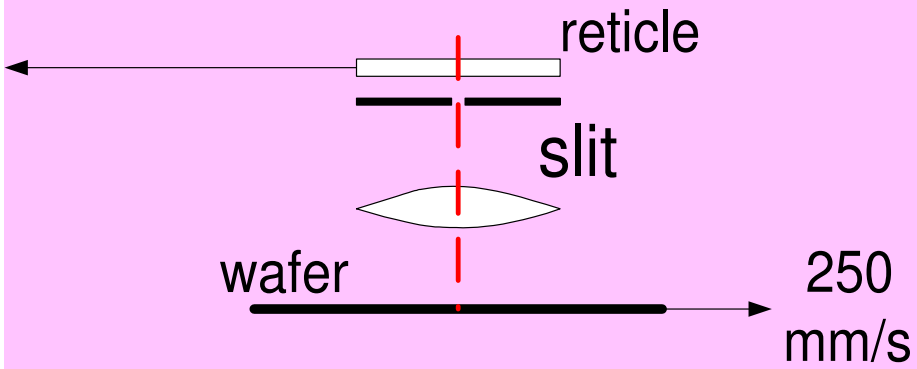
wafer

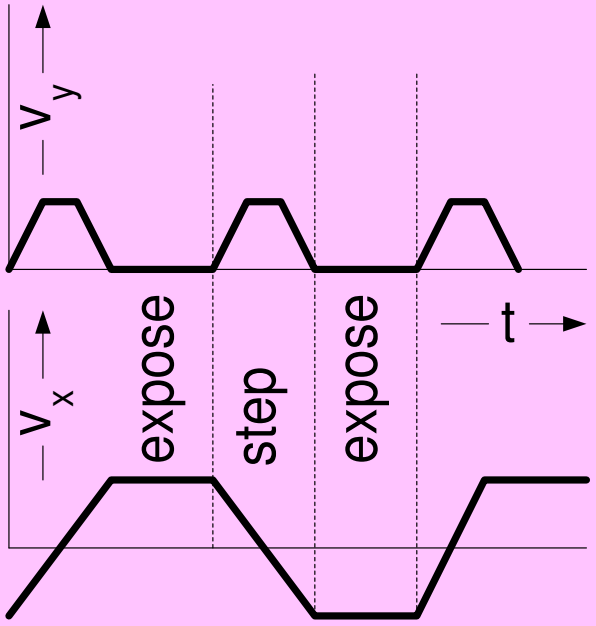
From stepping to scanning





stepper: *static exposure of field*

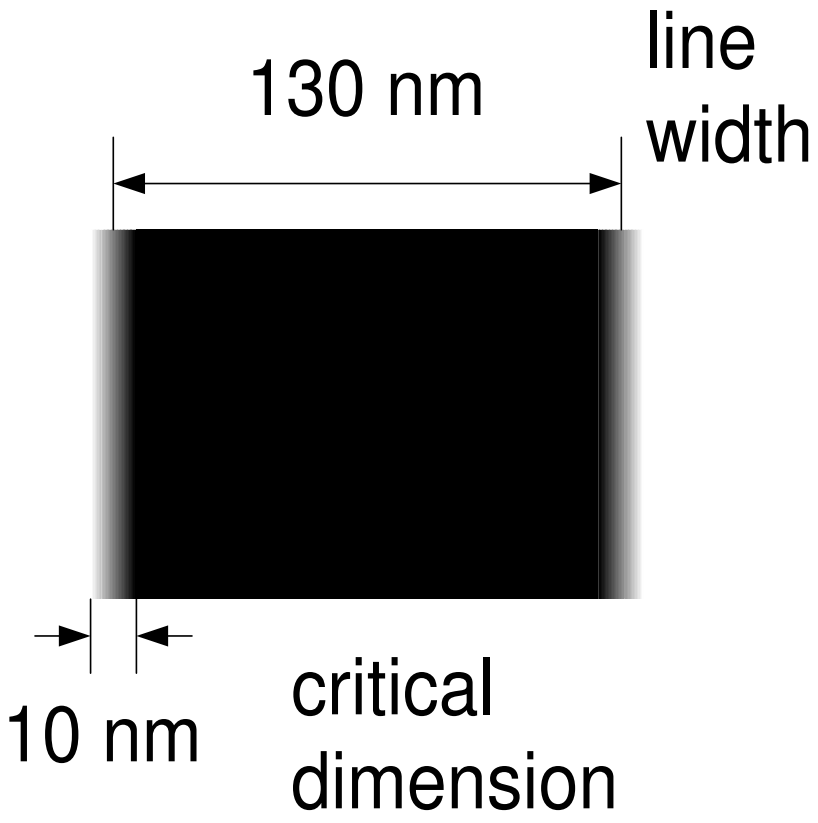




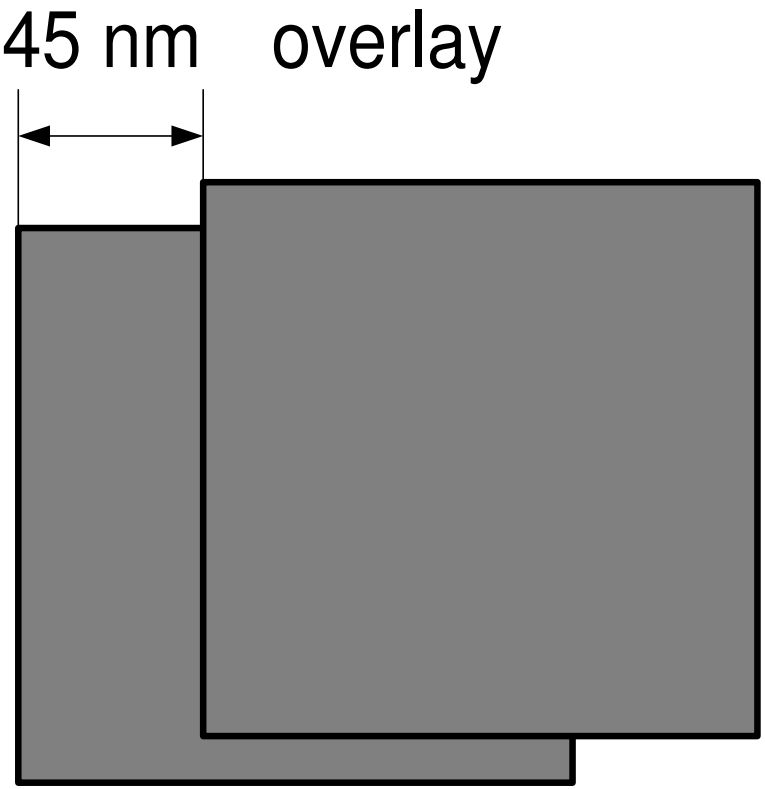
scanner: *dynamic exposure through slit*

Key specifications waferstepper

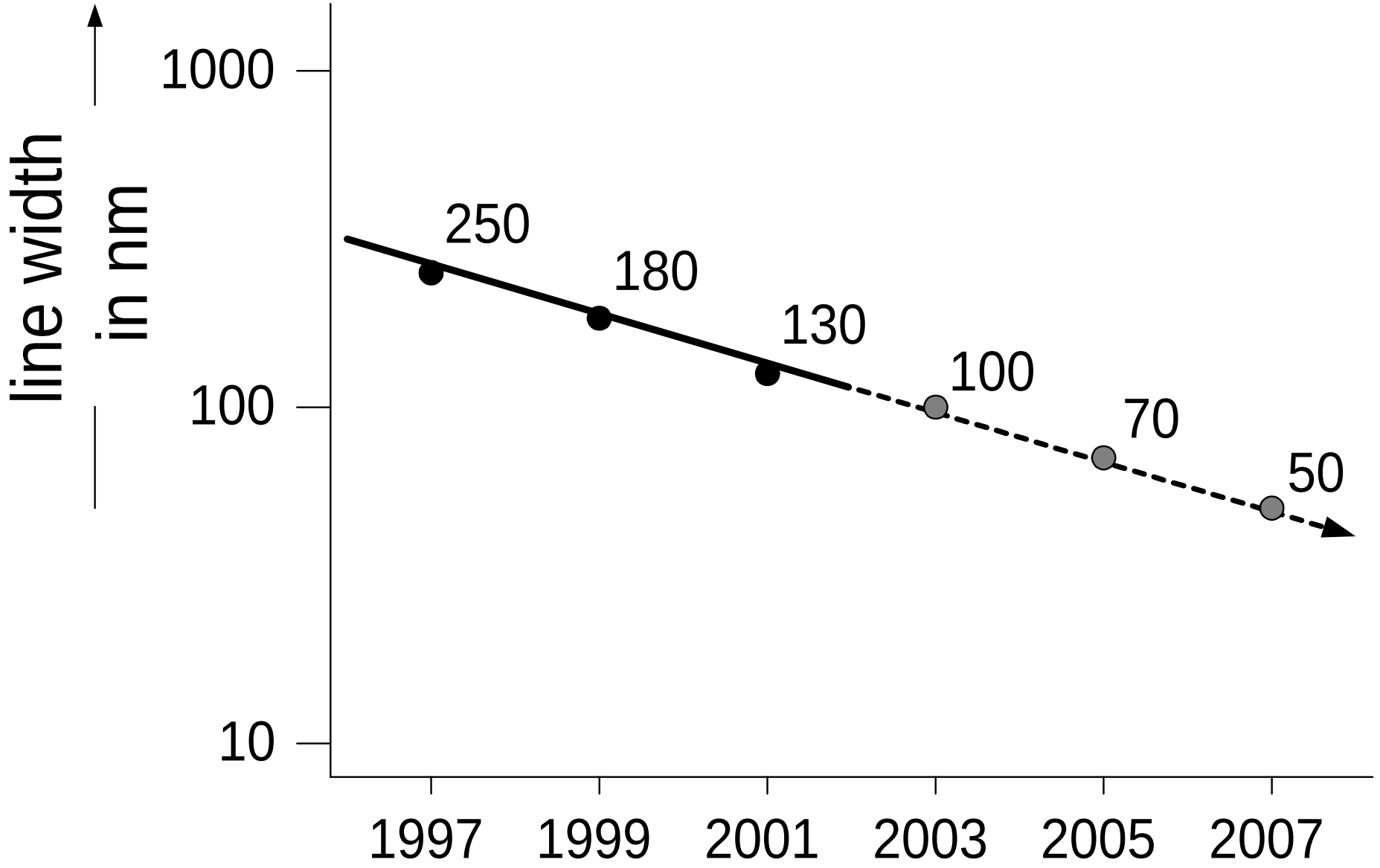
imaging



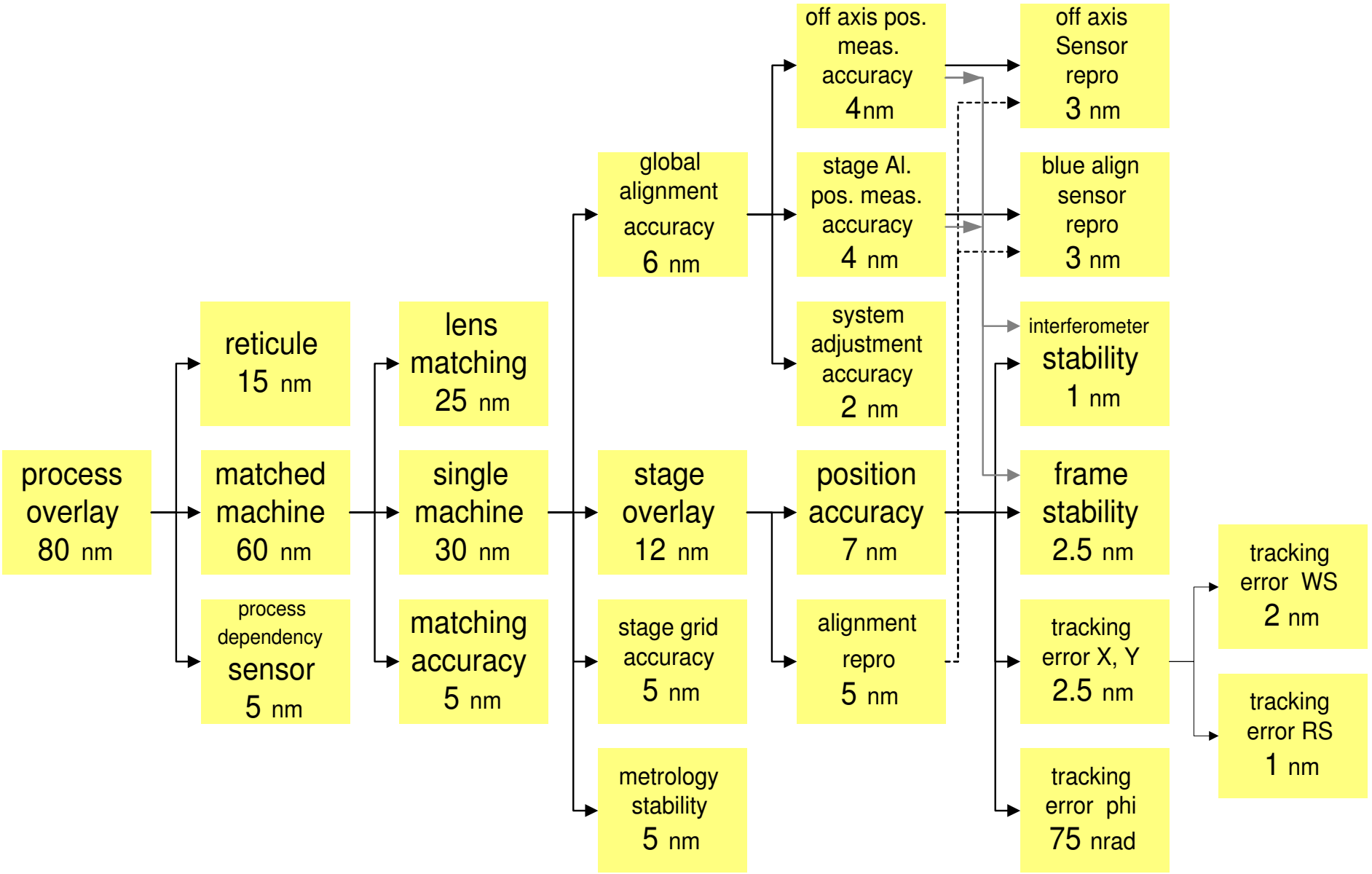
alignment



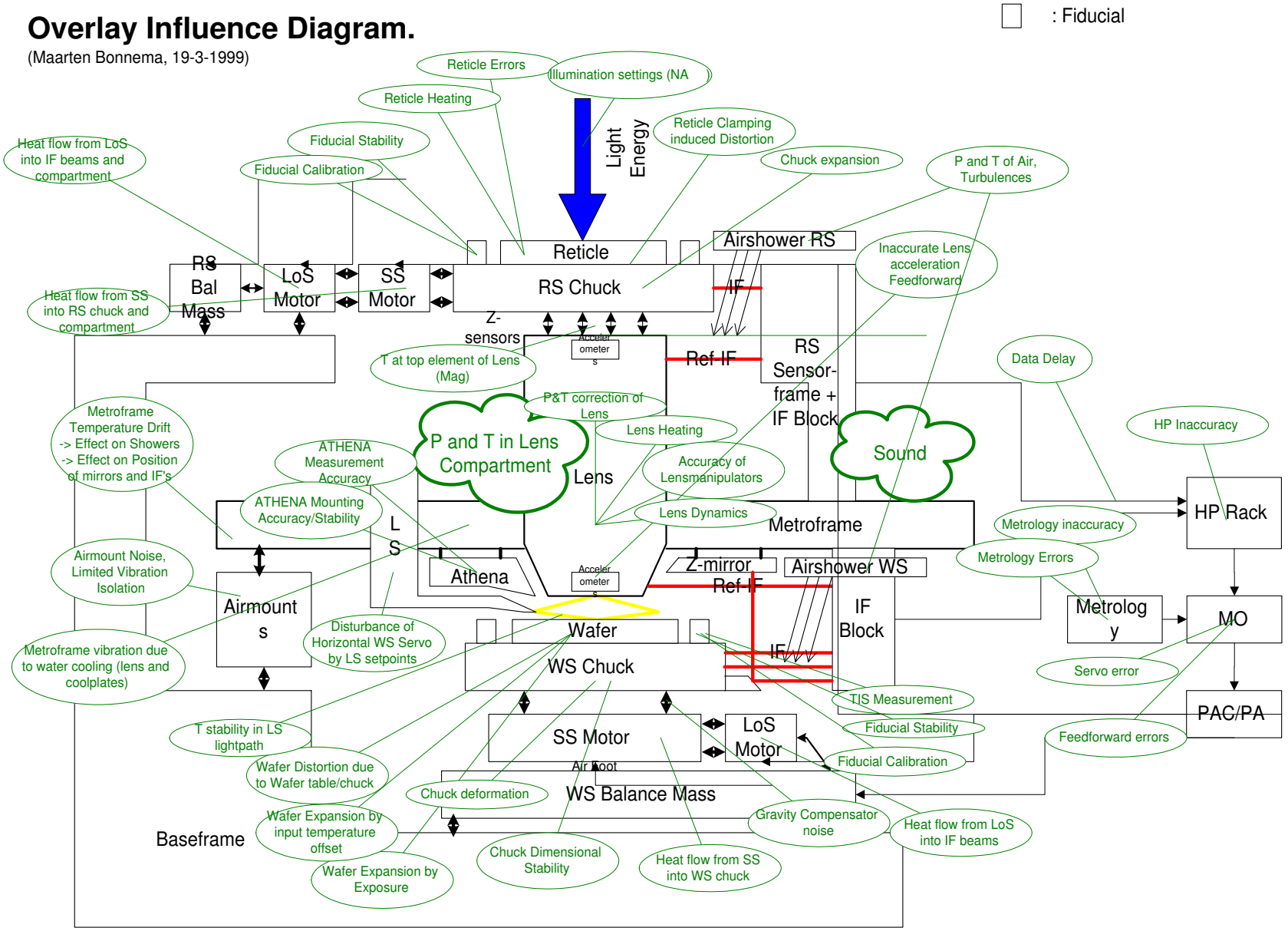
Moore's law


line width
in nm
1000
100
10
250
180
130
100
70
50
1997
1999
2001
2003
2005
2007

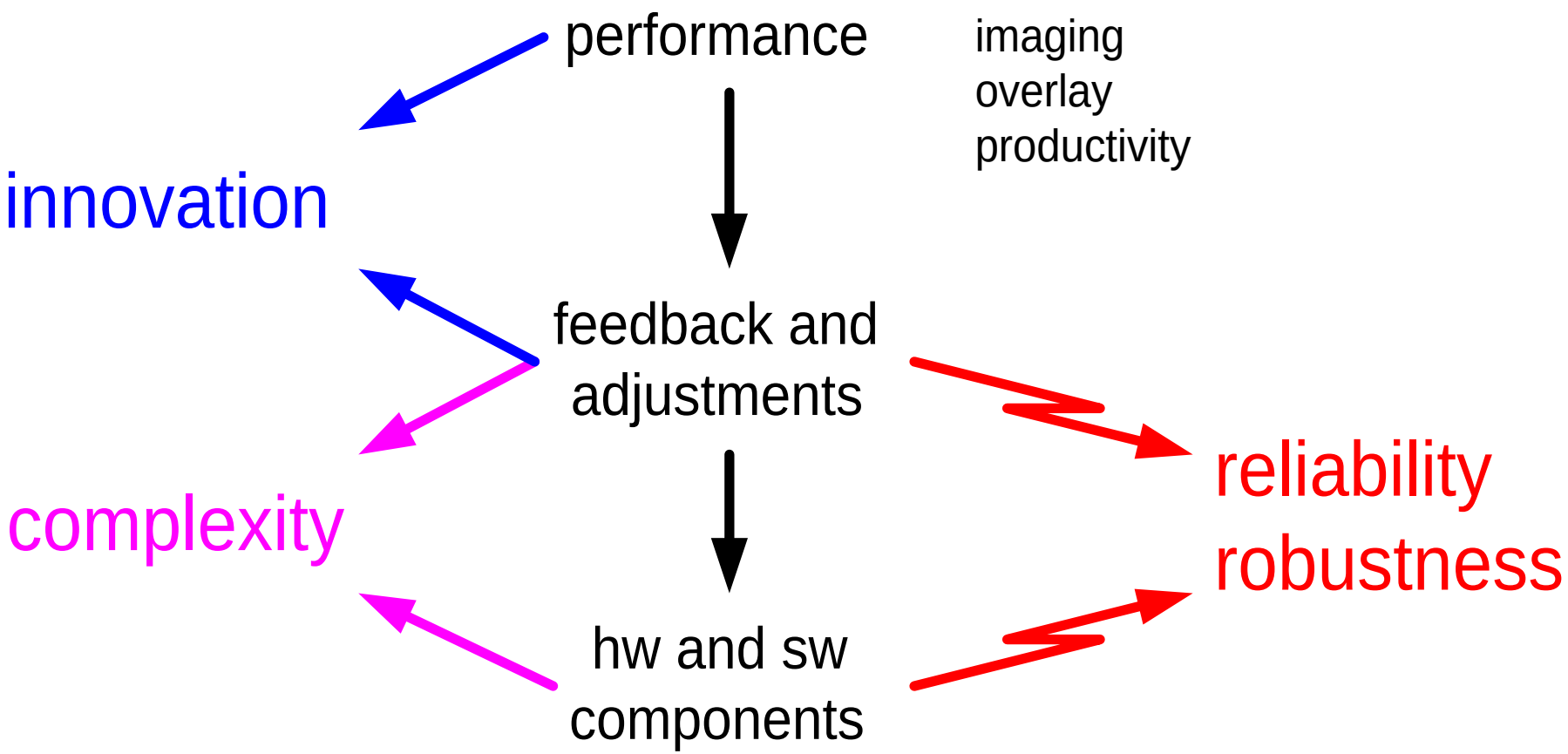
Overlay budget (1999)



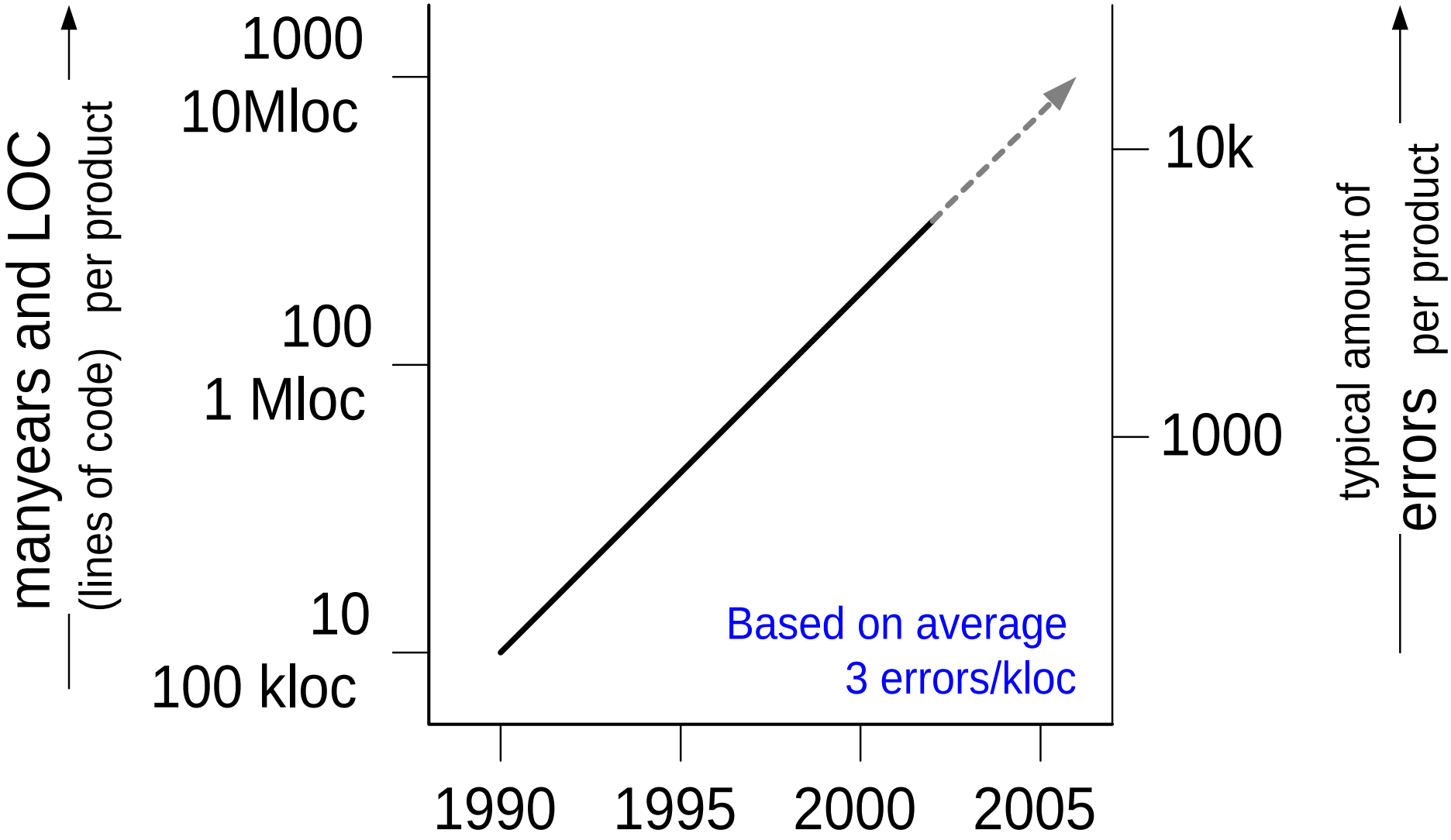
Everything influences overlay



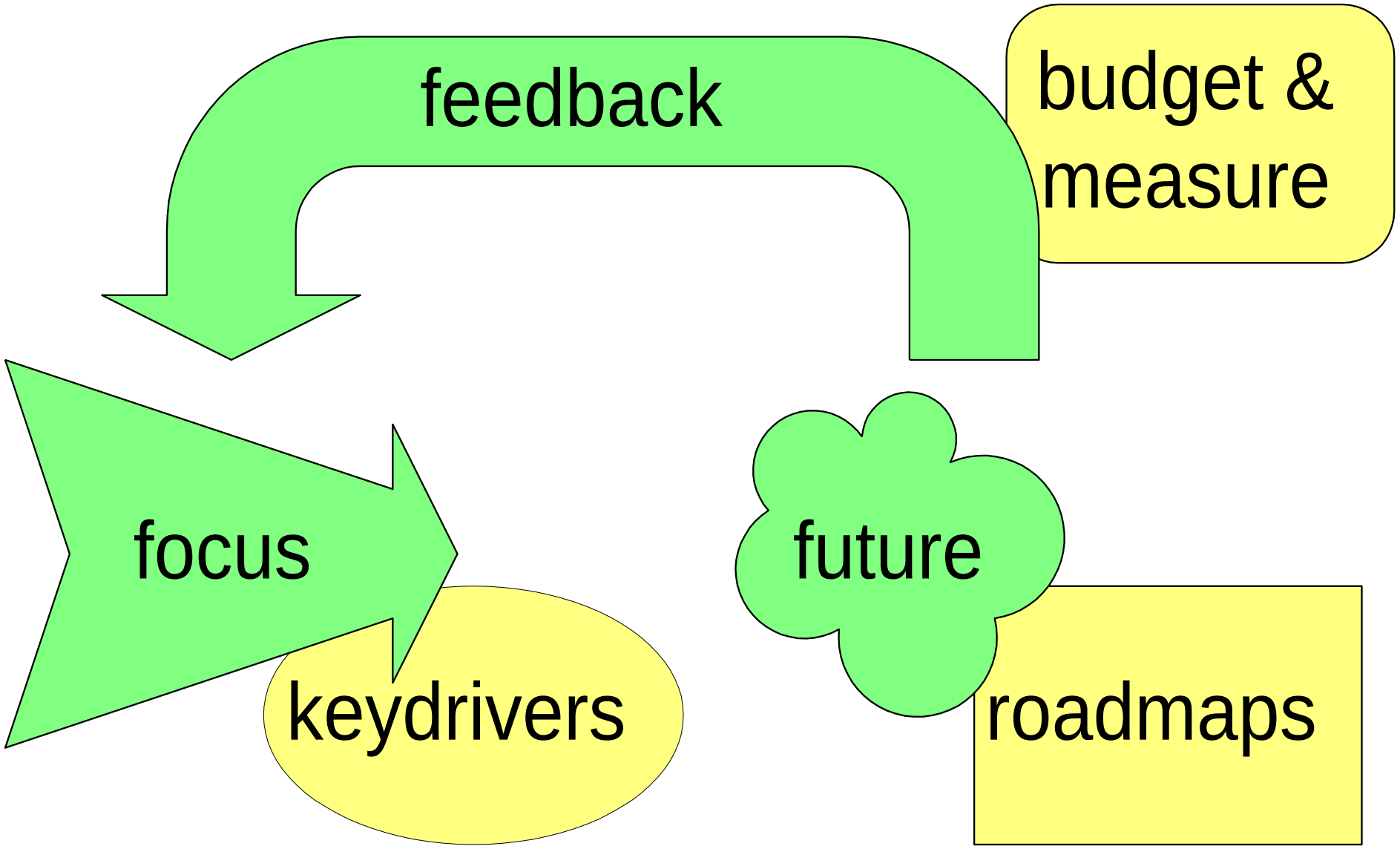
Challenge: Exponential Increase



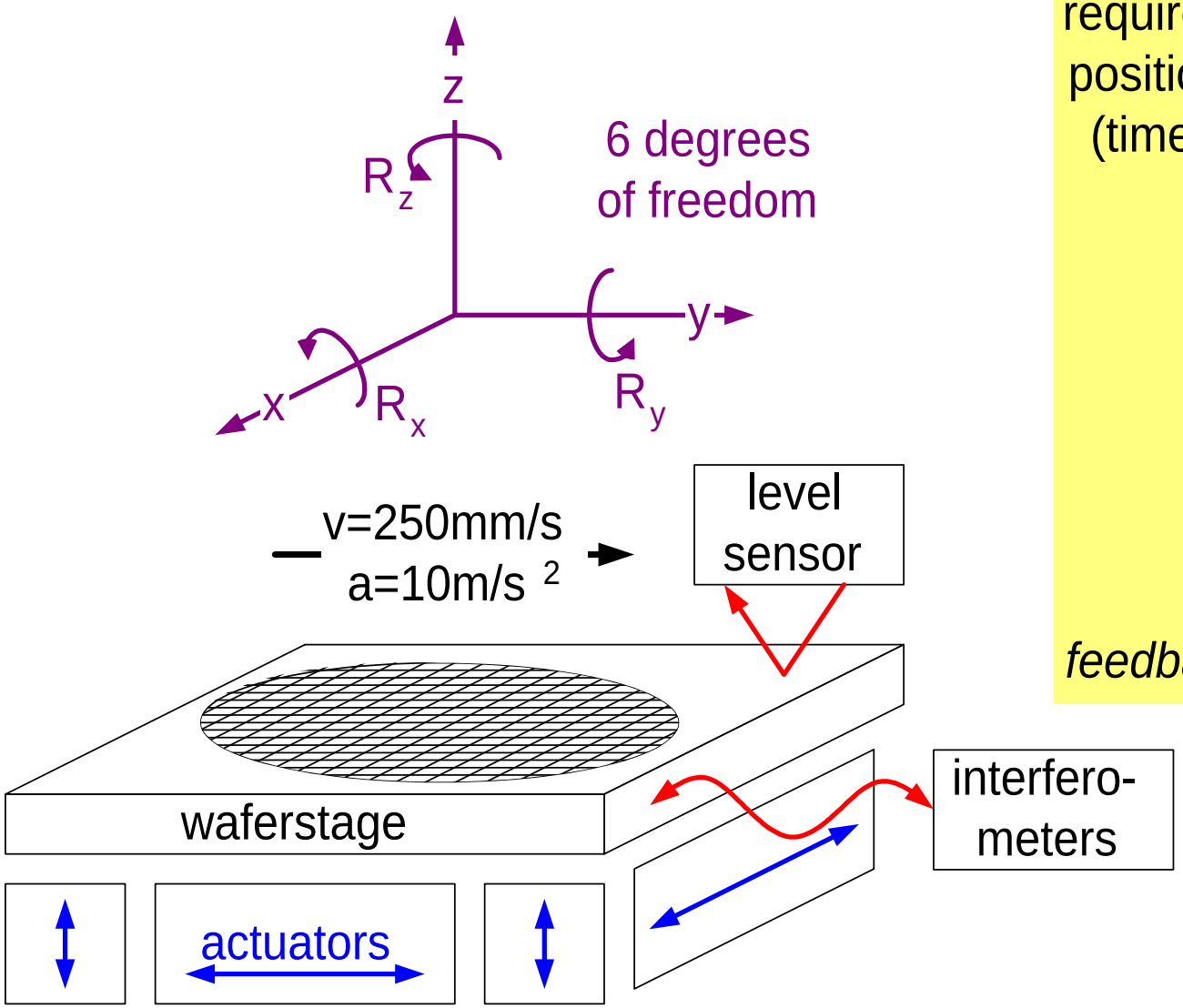
The Software Reliability Threat

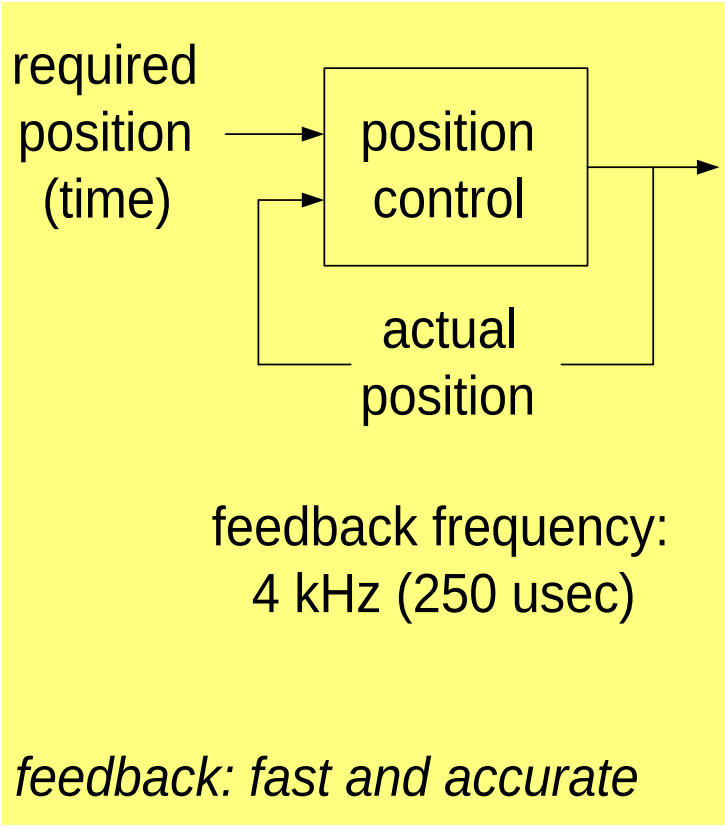


Success factor: ASML system engineering style



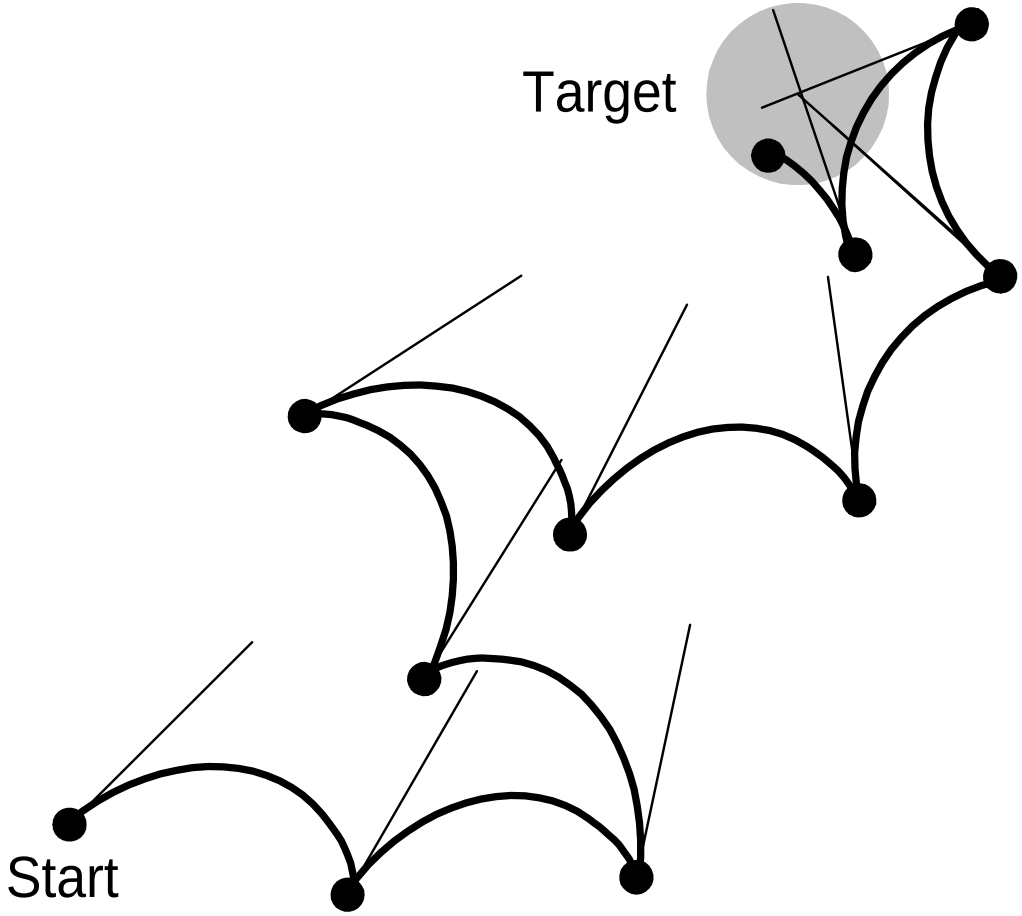
Feedback as technical design pattern





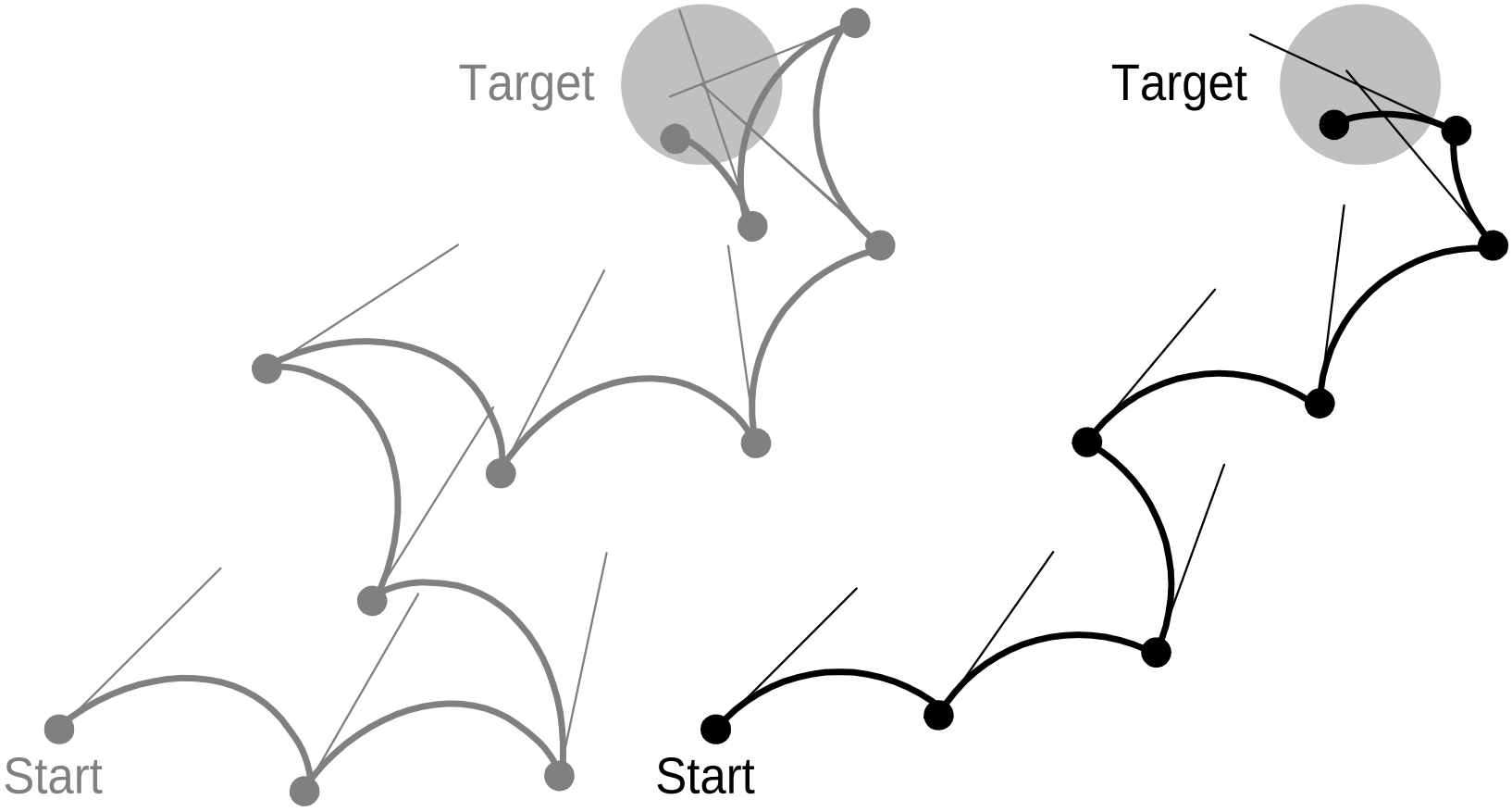
Feedback as development process pattern

stepsize: 3 months
elapsed time: 25 months

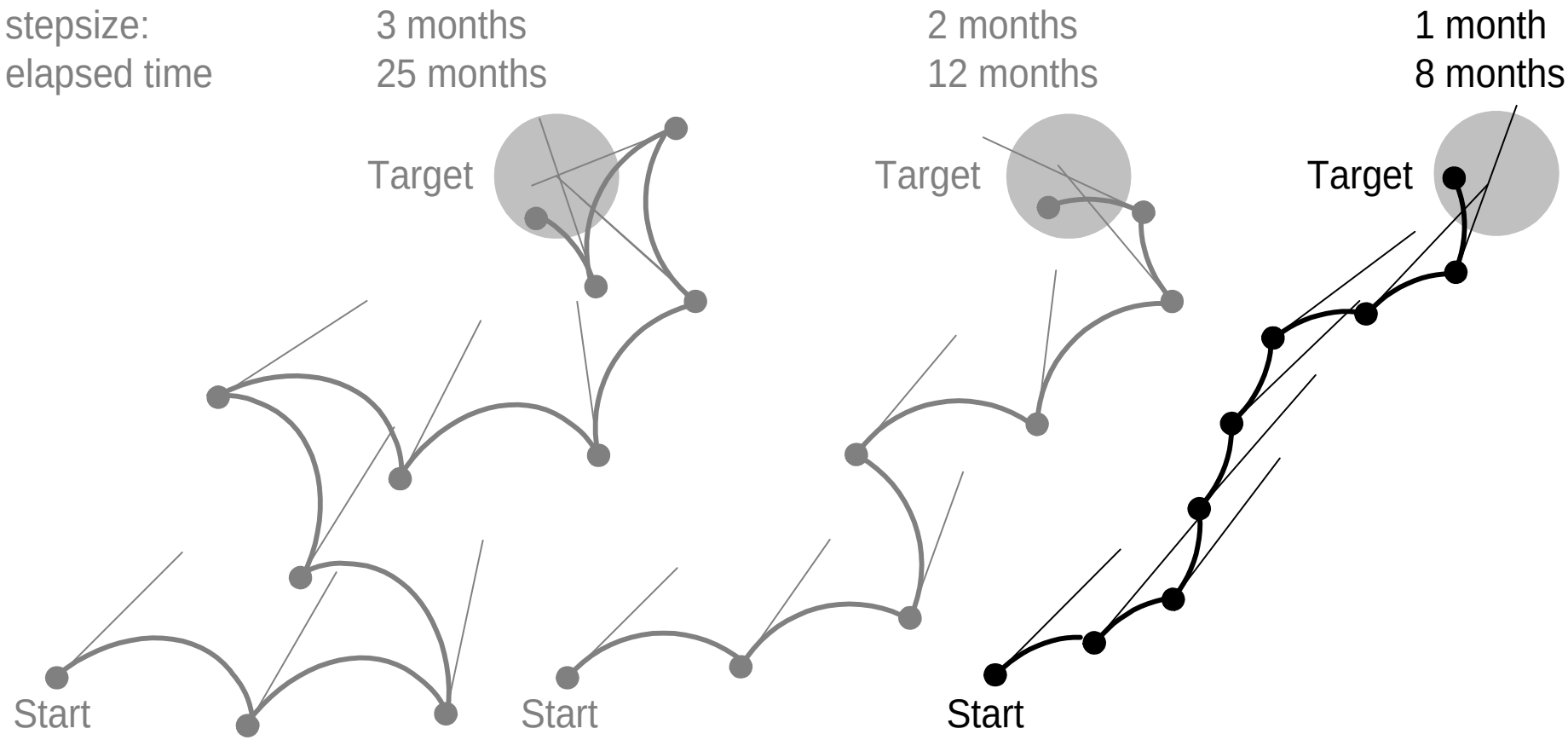


Feedback (2)

stepsize: 3 months 2 months
elapsed time 25 months 12 months

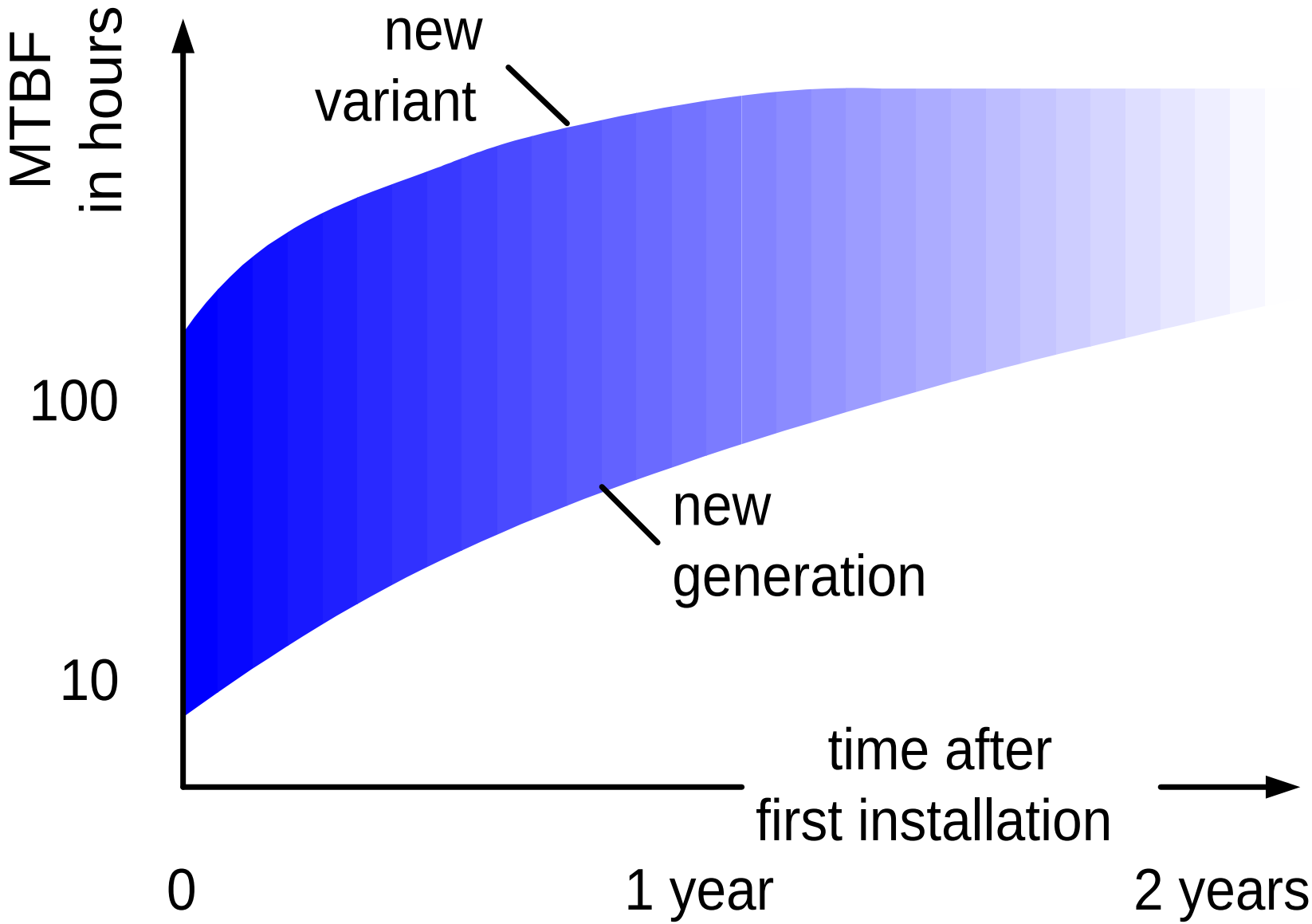


Feedback (3)

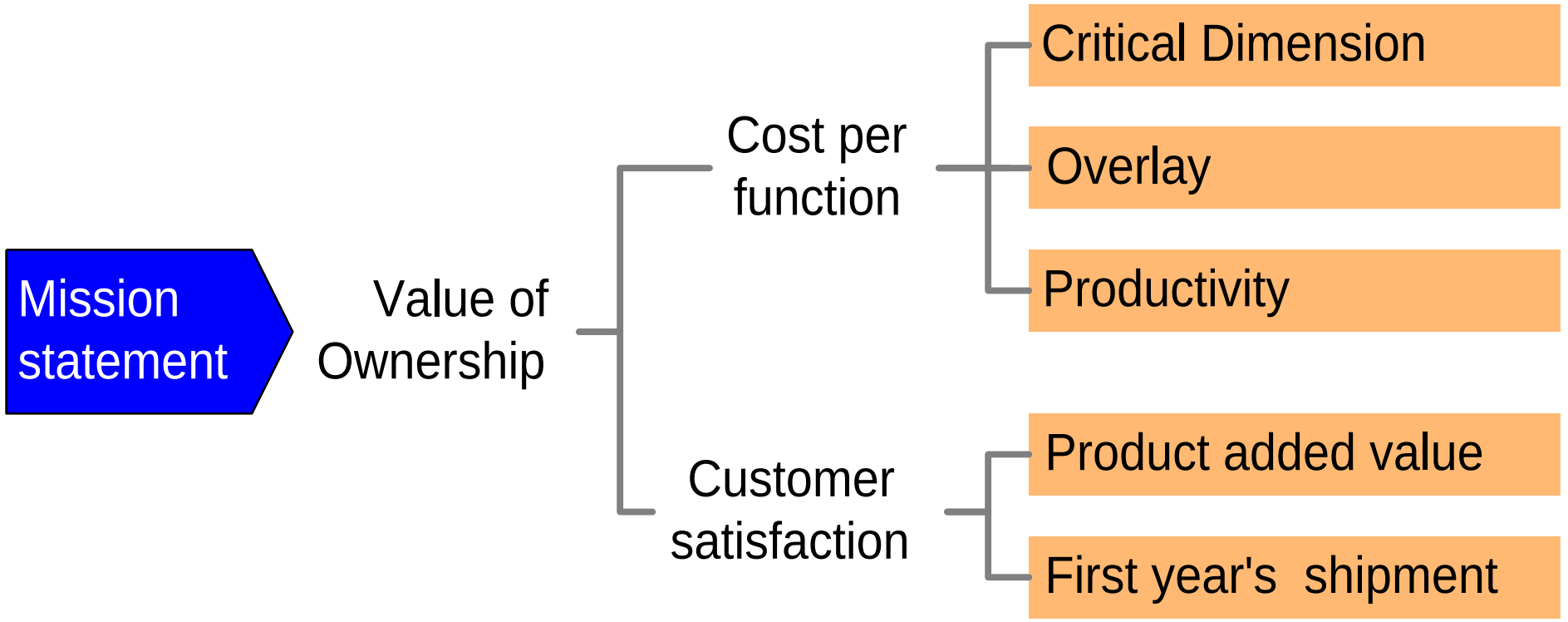


Small feedback cycles result in Faster Time to Market

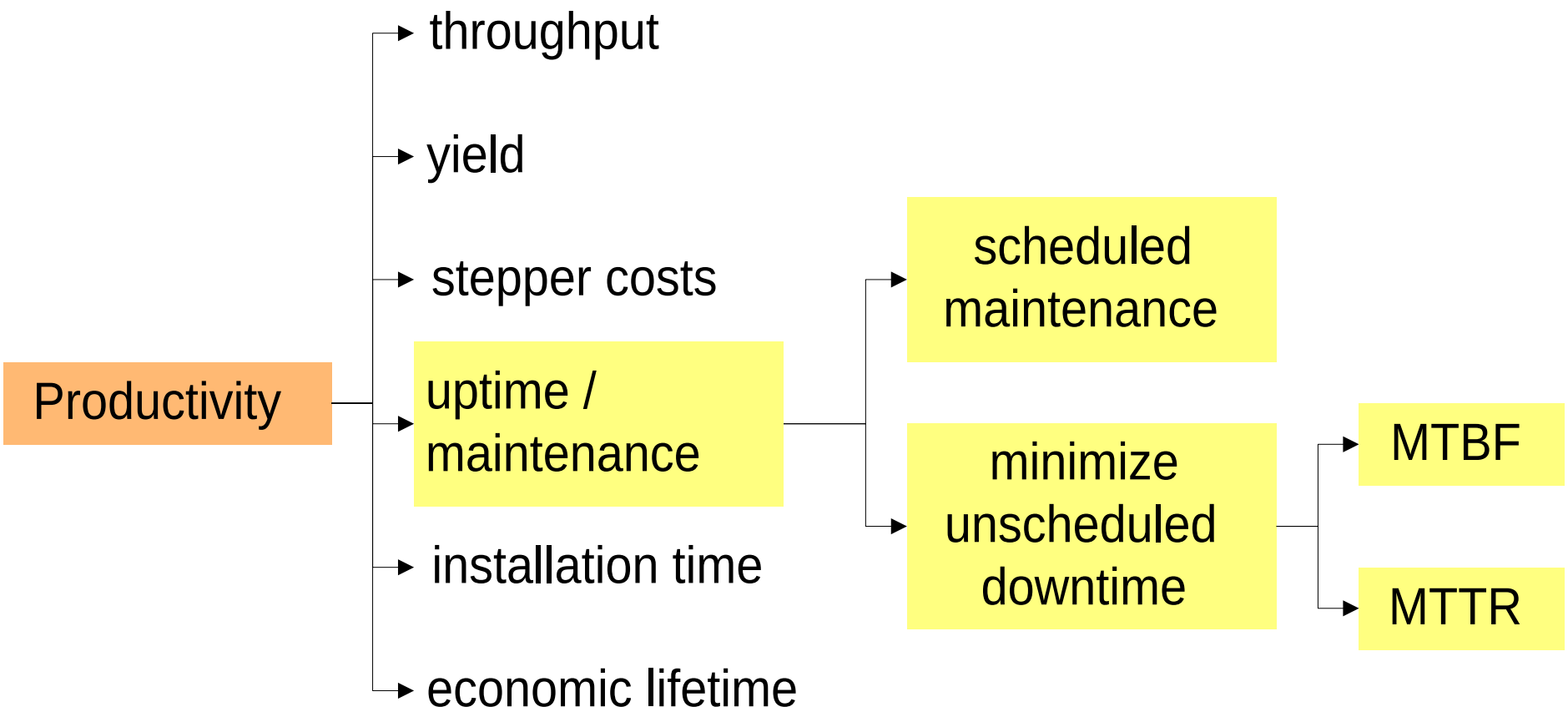
MTBF as function of time



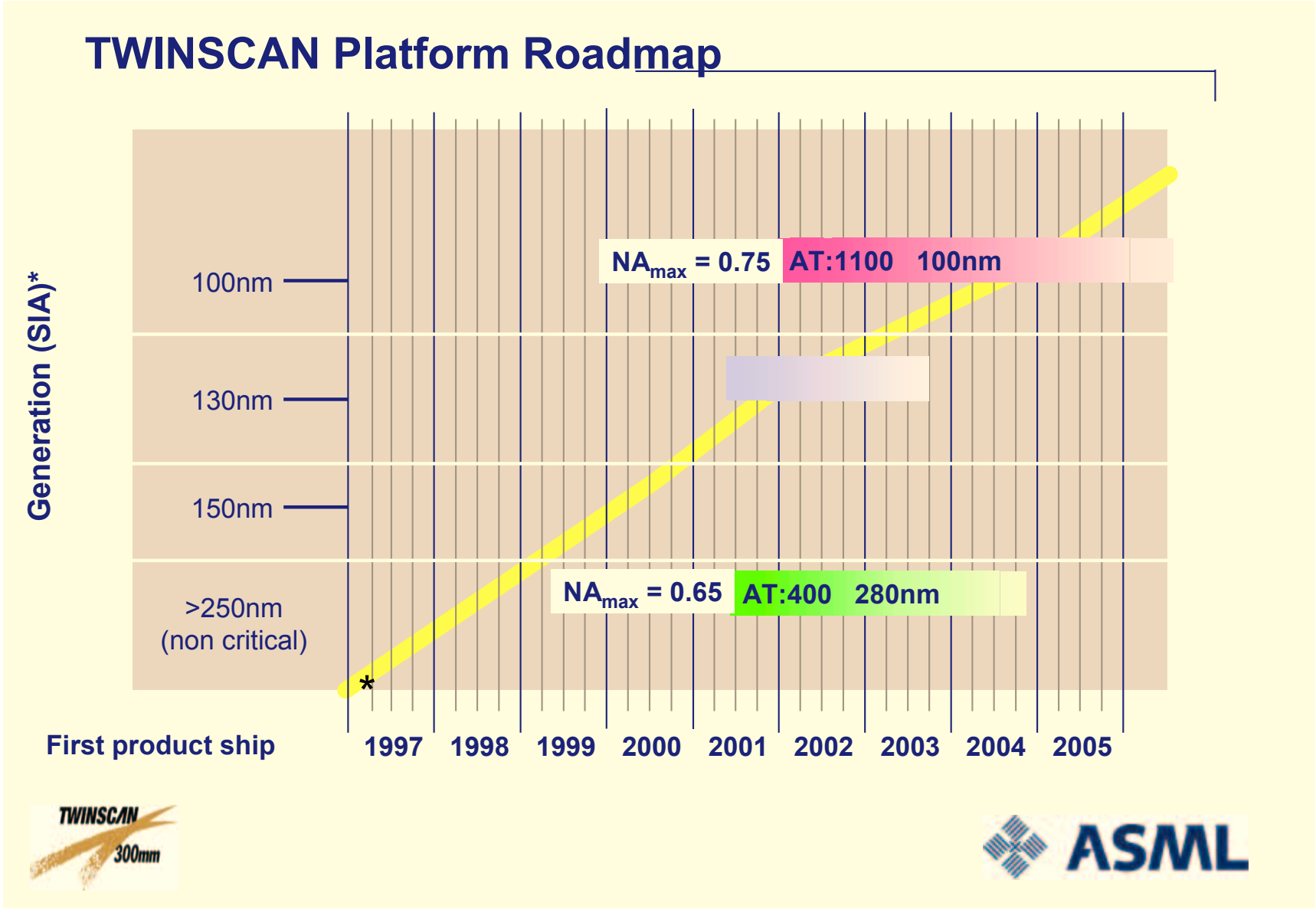
Focus via key drivers



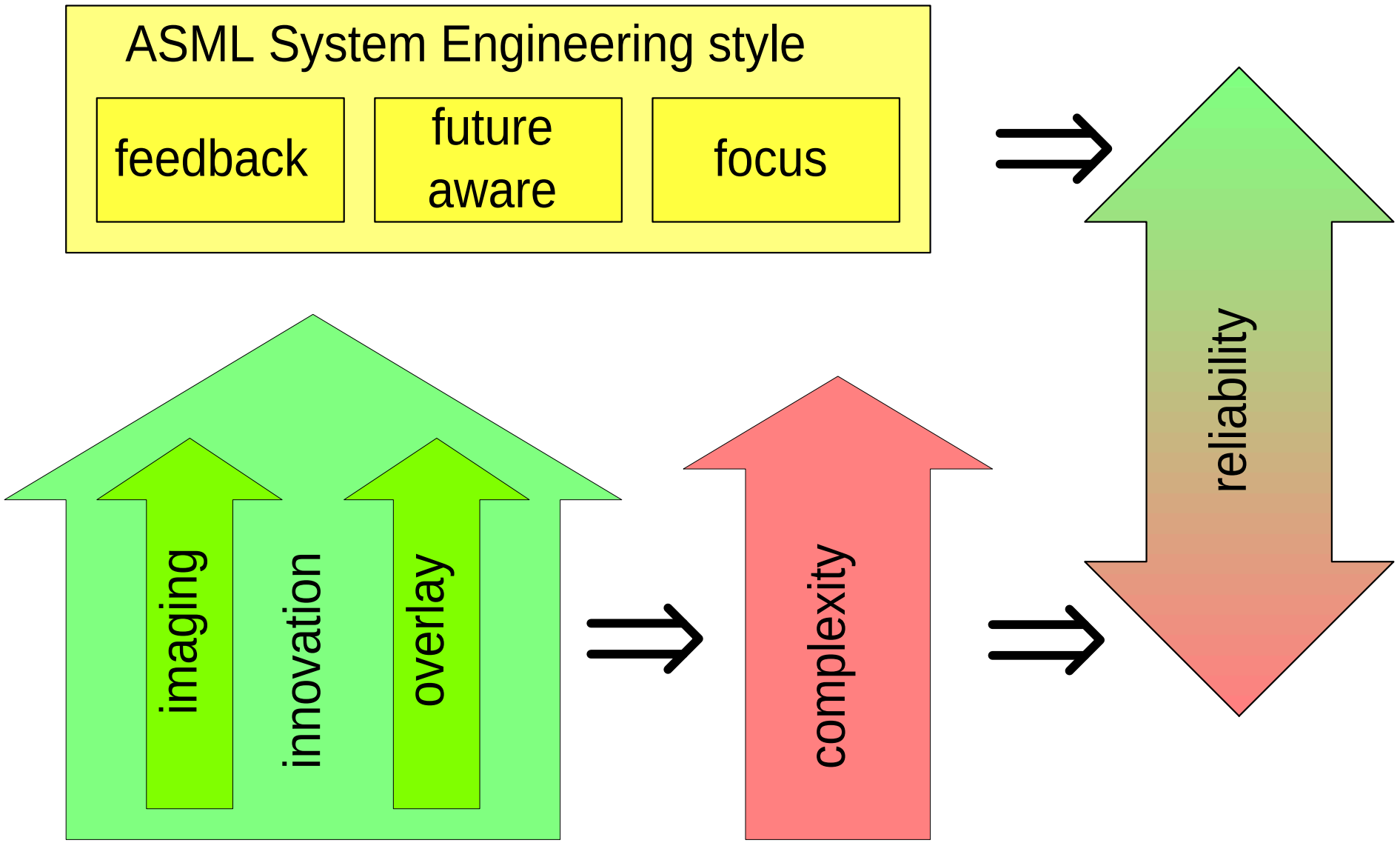
Productivity decomposed



Future aware



Conclusion


ASML System Engineering style
feedback
future aware
focus
imaging
innovation
overlay
complexity
reliability

Nota Bene

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