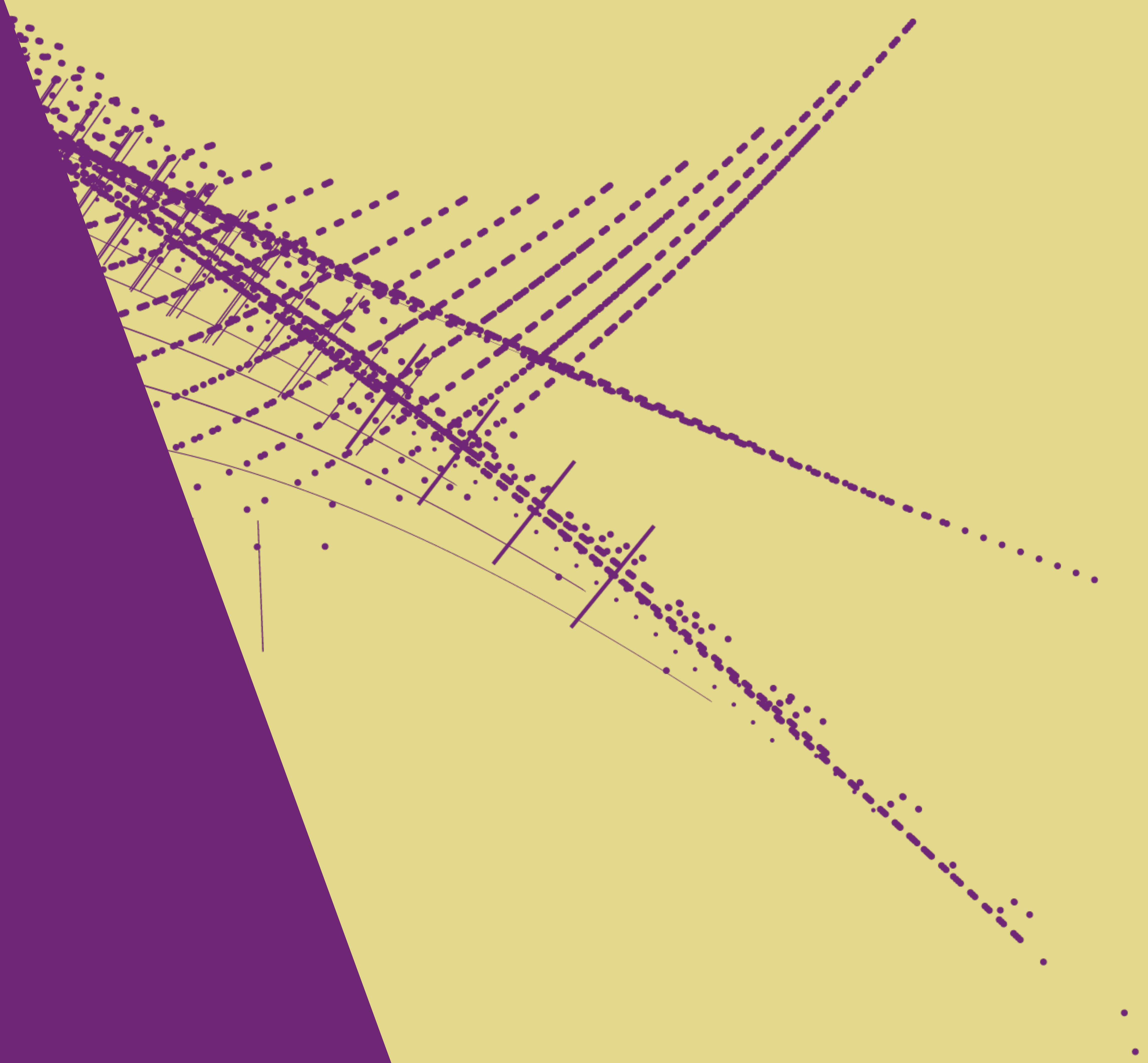
Nikhef

VISTA 2030 PDP



PDP PROGRAM MISSION

Ensure that physics reach of Nikhef experiments is never limited by computing, through R&D on scientific computing, R&D on collaborative computing, operation of / contribution to local, national, and international computing infrastructures for science.

10 YEARS OF COMPUTING

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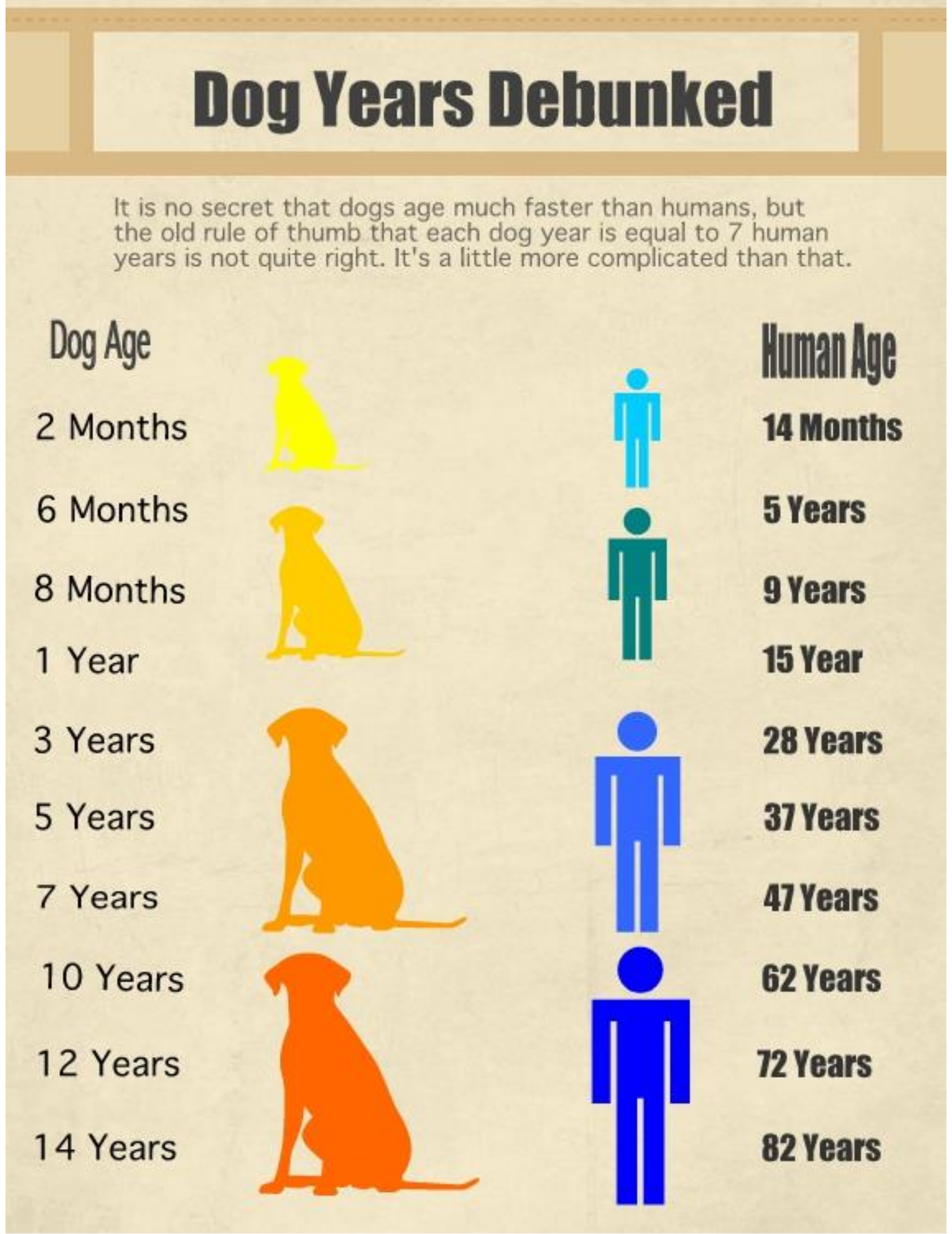
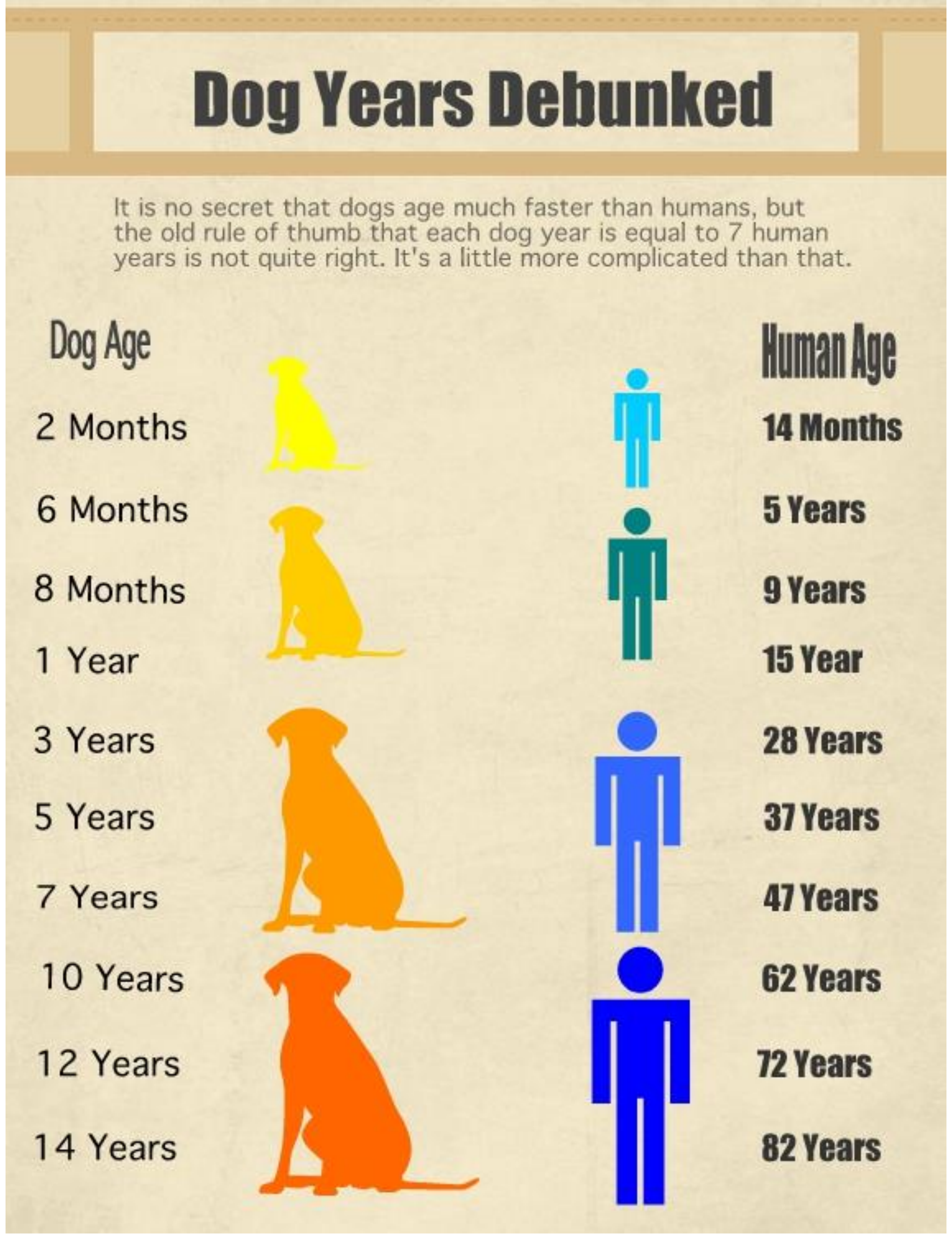


10 YEARS OF COMPUTING

Jamboree 2010: no mention of

- *death of serial power increases*
- *Machine learning*
- *GPUs or Tensor cores*

Data management is still a hot topic



NOT TECHNOLOGY BUT THEMES

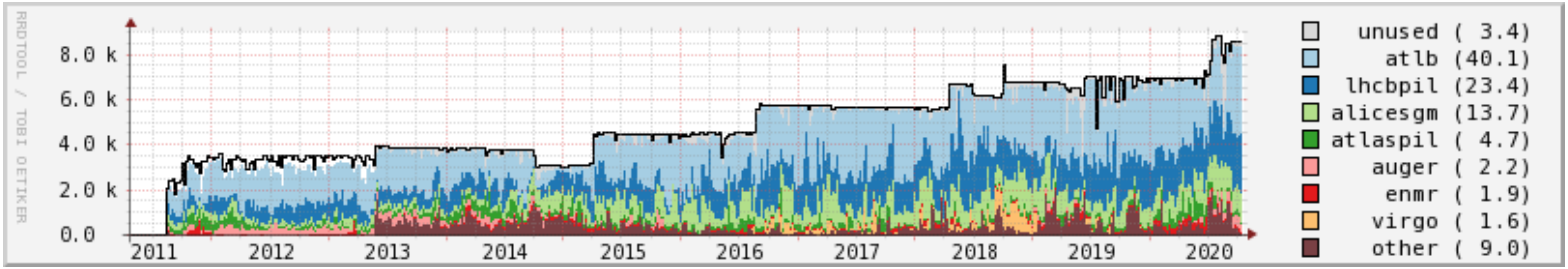
Scaling “how much”

Balancing infrastructure

Collaboration

SCALING

Jobs running on Nikhef Grid Cluster, 2011 - present



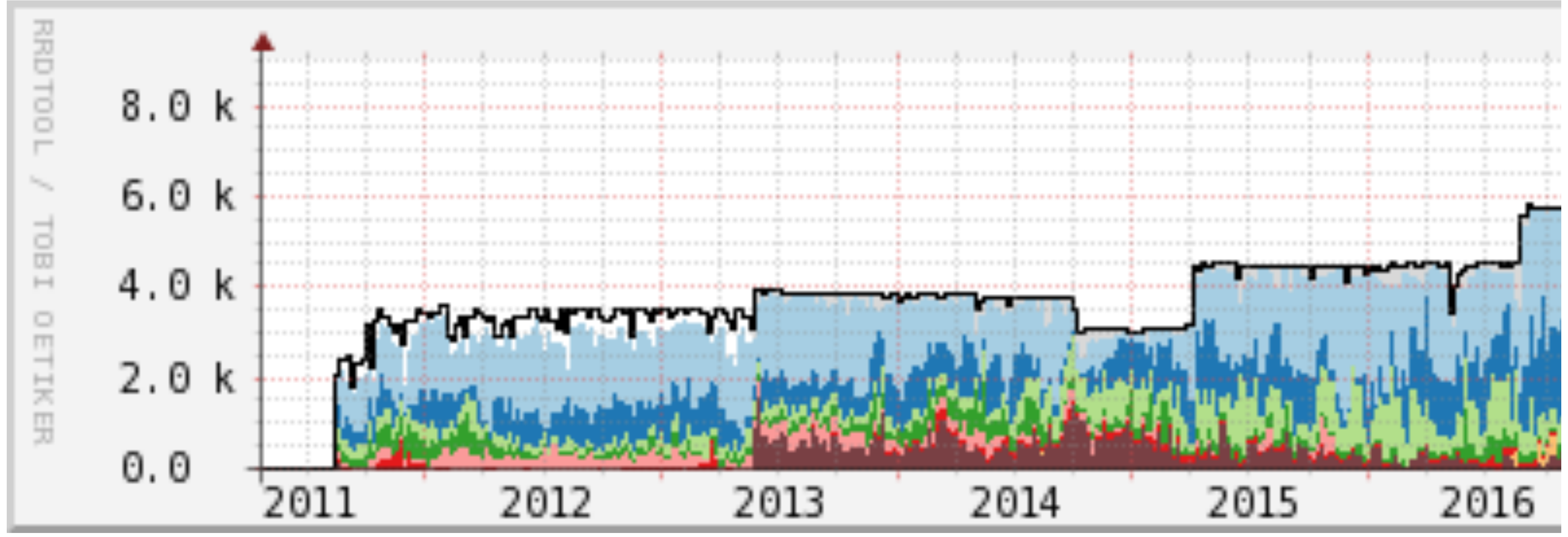
Doesn't matter too much which dimension

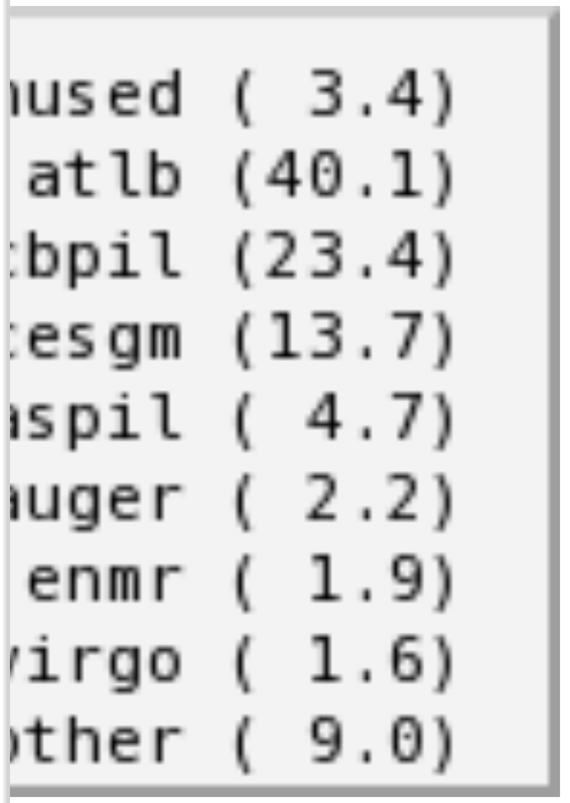
10 years = roughly 10 times

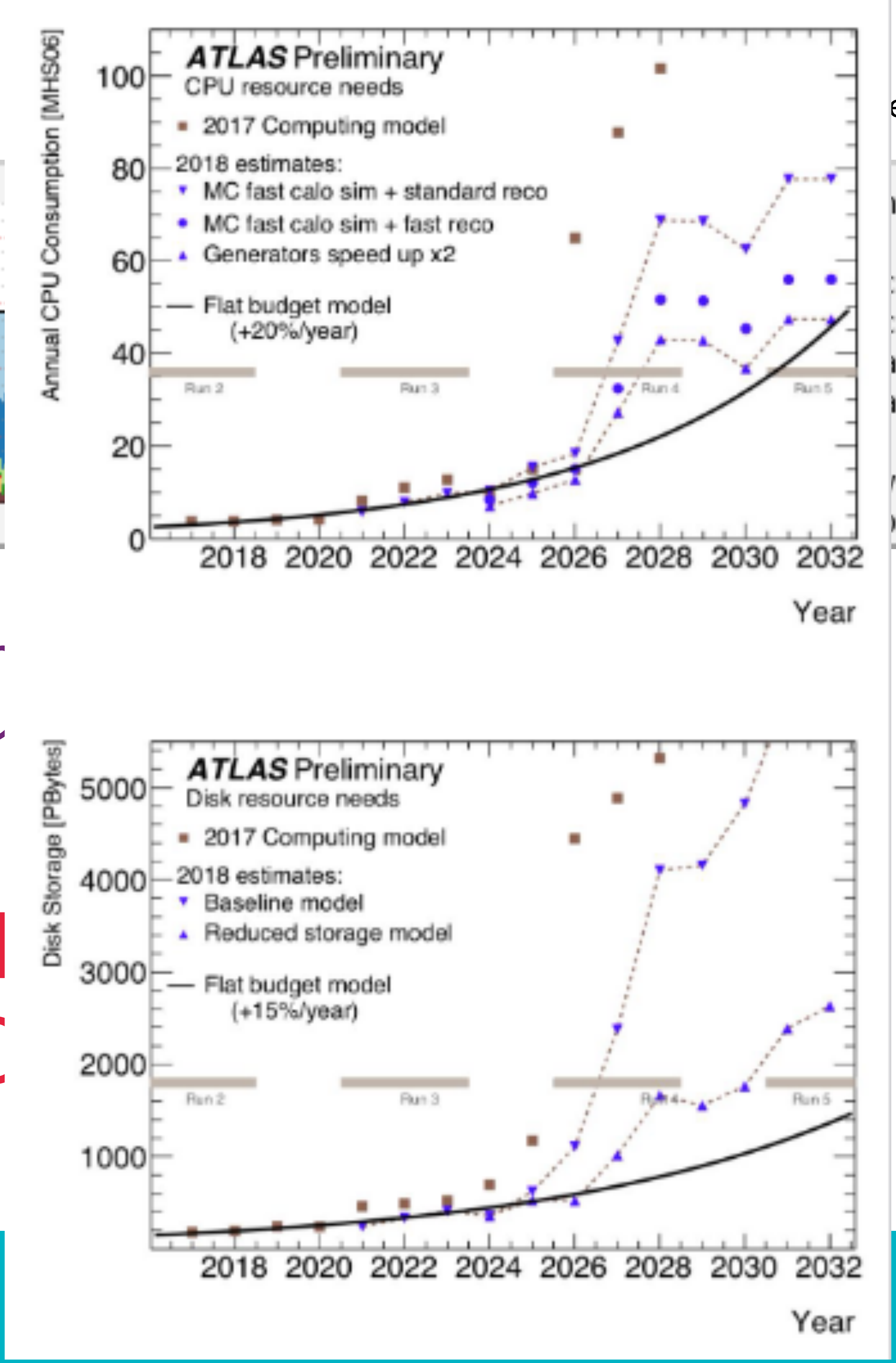
LHC TIER-1, VIRGO, DUNE, XENON, LATER ET … STOOMBOOT

SCALING

er, 2011 - present







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LHC TIER-1, VIRGO, DUN
LATER ET … STOOMBOC

Nikhef

BALANCED INFRASTRUCTURE

Do computing, storage, and network work together as a system? Find the limitation and solve it.

2010’s were first network and later storage

Computing moving to new arch: add software

GPUs, tensor cores don’t help if software is serial

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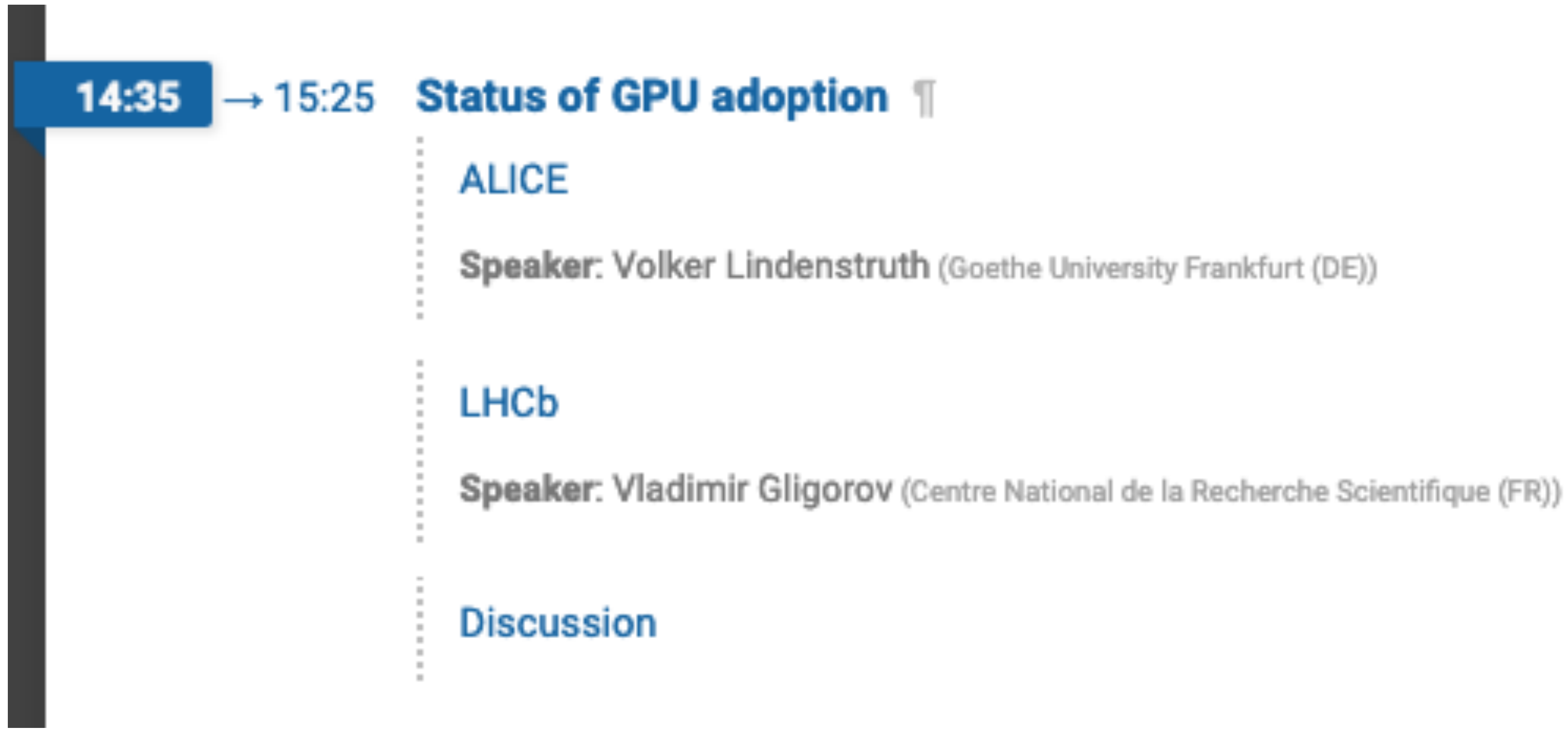

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COLLABORATION

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- Integration of services

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- Integration of services

› Now adding standardized token support
  - SciTokens (http://scitokens.org) for HTCondor-CE, data
  - OAuth 2.0 Workflow → Box, Google Drive, AWS S3, …

COLLABORATION

- Integration of services

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- Common infrastructure

COLLABORATION

- Integration of services
- Common infrastructure
  - LVC, DUNE, LHC

COLLABORATION

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  - How to prevent breaches AND remain usable
  - Protect you guys from bureaucracy!

COLLABORATION

	Low Security	High Security
Good Usability	What users default to. Security incident likely.	**The sweet spot.** **Live here.**
Bad Usability	Everyone suffers. Pain. Followed by more pain.	What bad security professionals default to. User circumvention (and resulting incident) likely.

- Integration of services
- Common infrastructure
  - LVC, DUNE, LHC
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WILD CARD : QUANTUM COMPUTING

Maastricht starts work (LHCb and ET)

ET seems promising;

New ideas in particle physics!

Long shot & high payoff!!

8.2. Post-Moore computing

Quantum algorithms

Since the idea of a quantum computer was conceived, only a hand full of classes of quantum algorithms have been discovered. These can be summarised as:

1. using Fourier Transforms to find periodicity, Shor's algorithm [142] being the prime example.
2. Grover's search algorithm [73] and its generalisations.
3. algorithms for simulating or solving problems in quantum physics, exemplified by Feynman's initial ideas [64].
4. quantum walks, quantum analogues to classic random walks, first proposed by Childs [45].

While for a small set of problems quantum computers seem to offer tremendous advantages over conventional computers, as typified by these classes of algorithms, this set has not grown significantly in years. Some research has been done into the reasons for this [143], which concludes that either these systems are so different from normal computers that our techniques for designing algorithms are unsuitable, or there are only a handful of problems that actually benefit significantly from quantum computers. Com-

C. Broekema PhD Thesis (VU/ASTRON) 2020

NOT TECHNOLOGY BUT THEMES

Scaling “how much” 10 times

Balancing infrastructure add software and UX

Collaboration

Follow quantum computing closely