

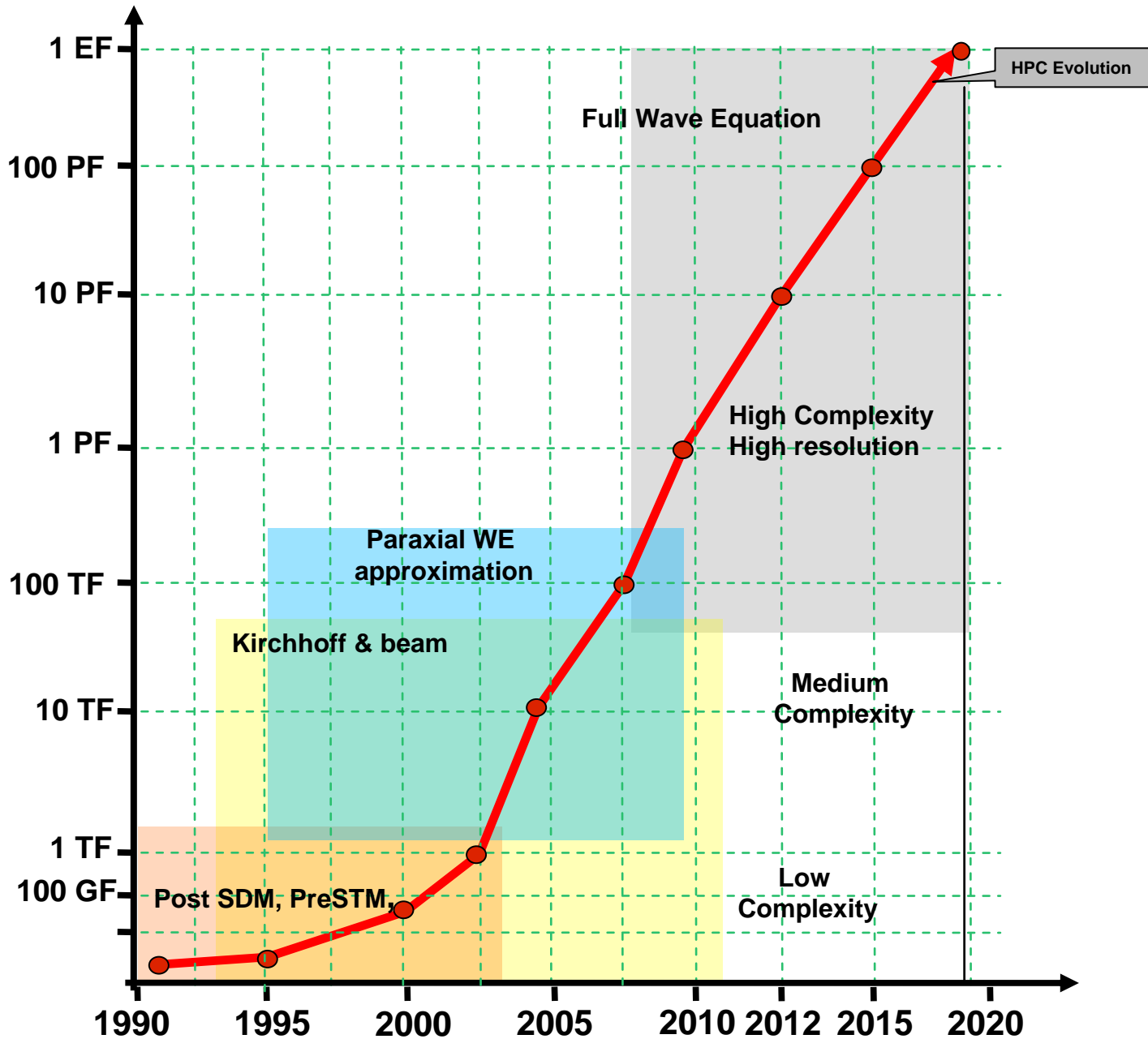
What We Can Do With & What We Need to Use an Exaflop System

Henri Calandra

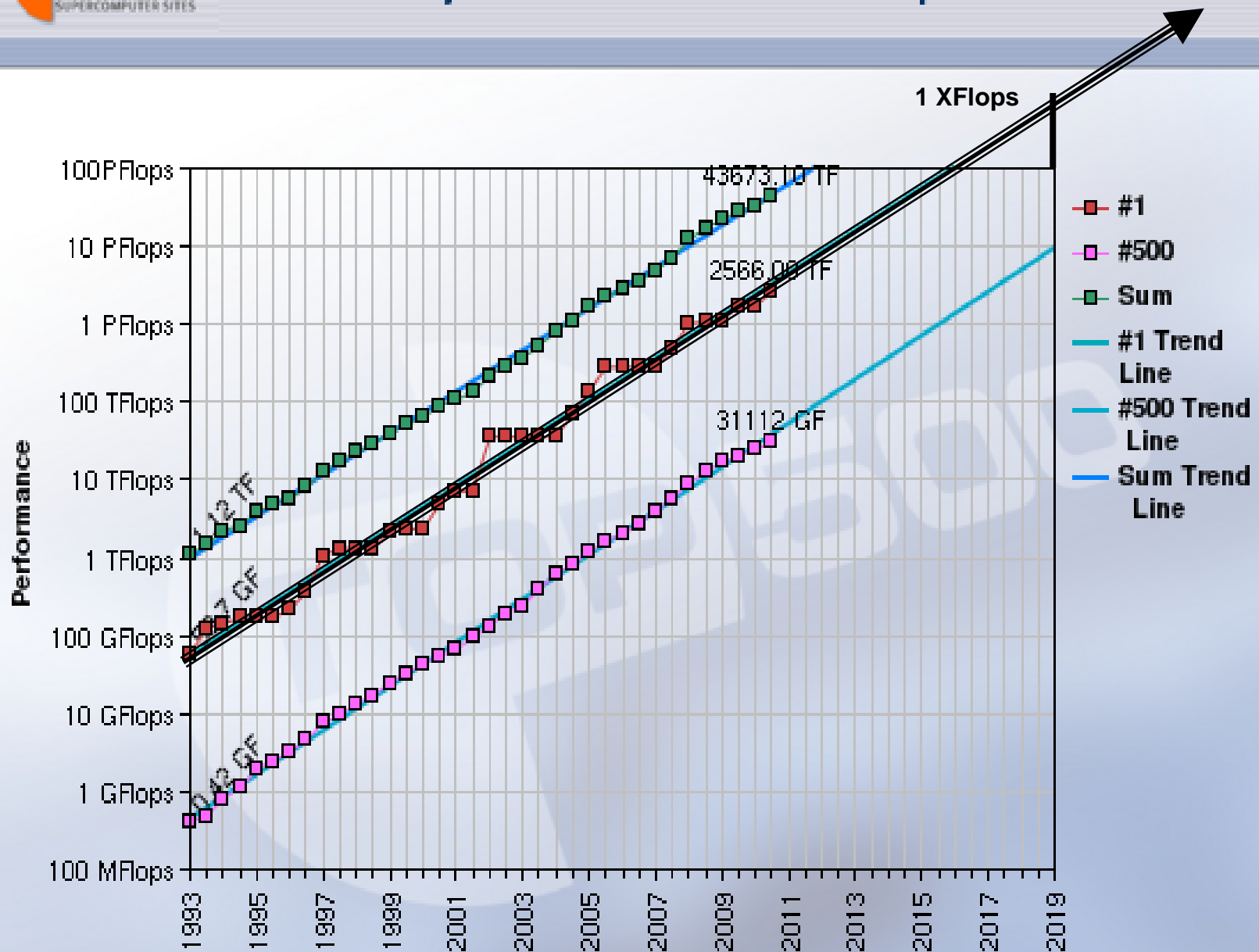
John Etgen

Scott Morton

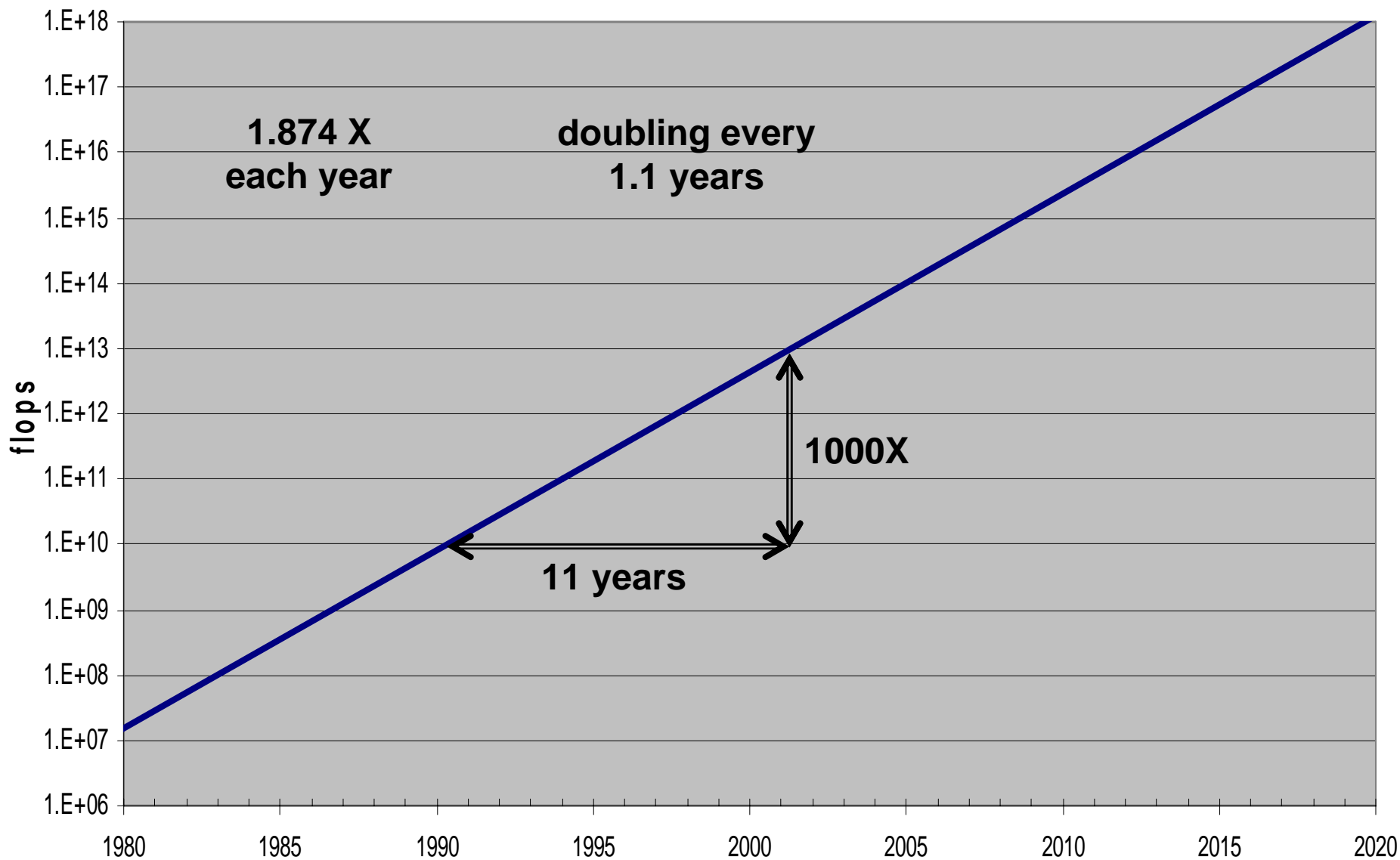
Seismic Depth Imaging Methods & HPC evolution



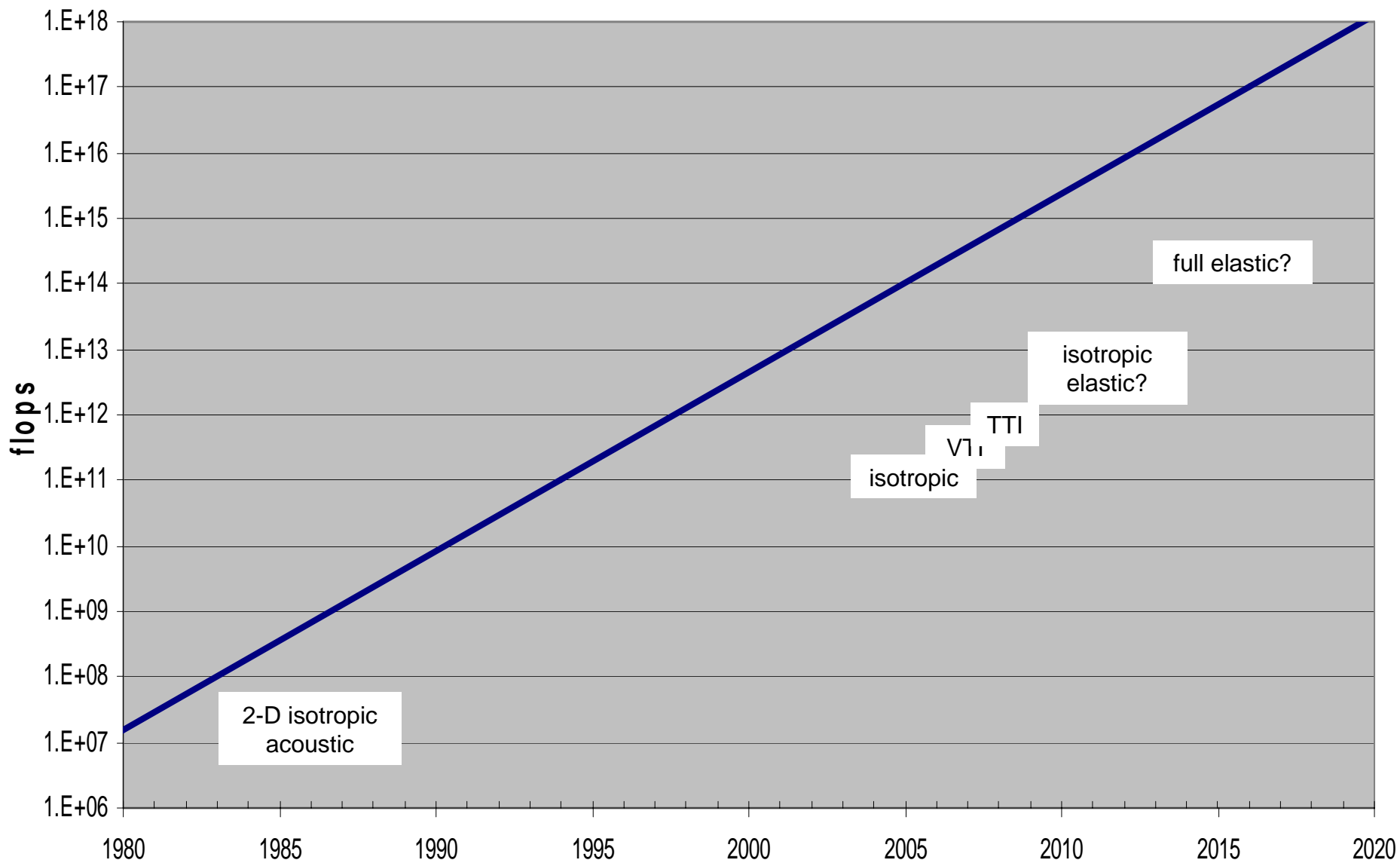
Projected Performance Development



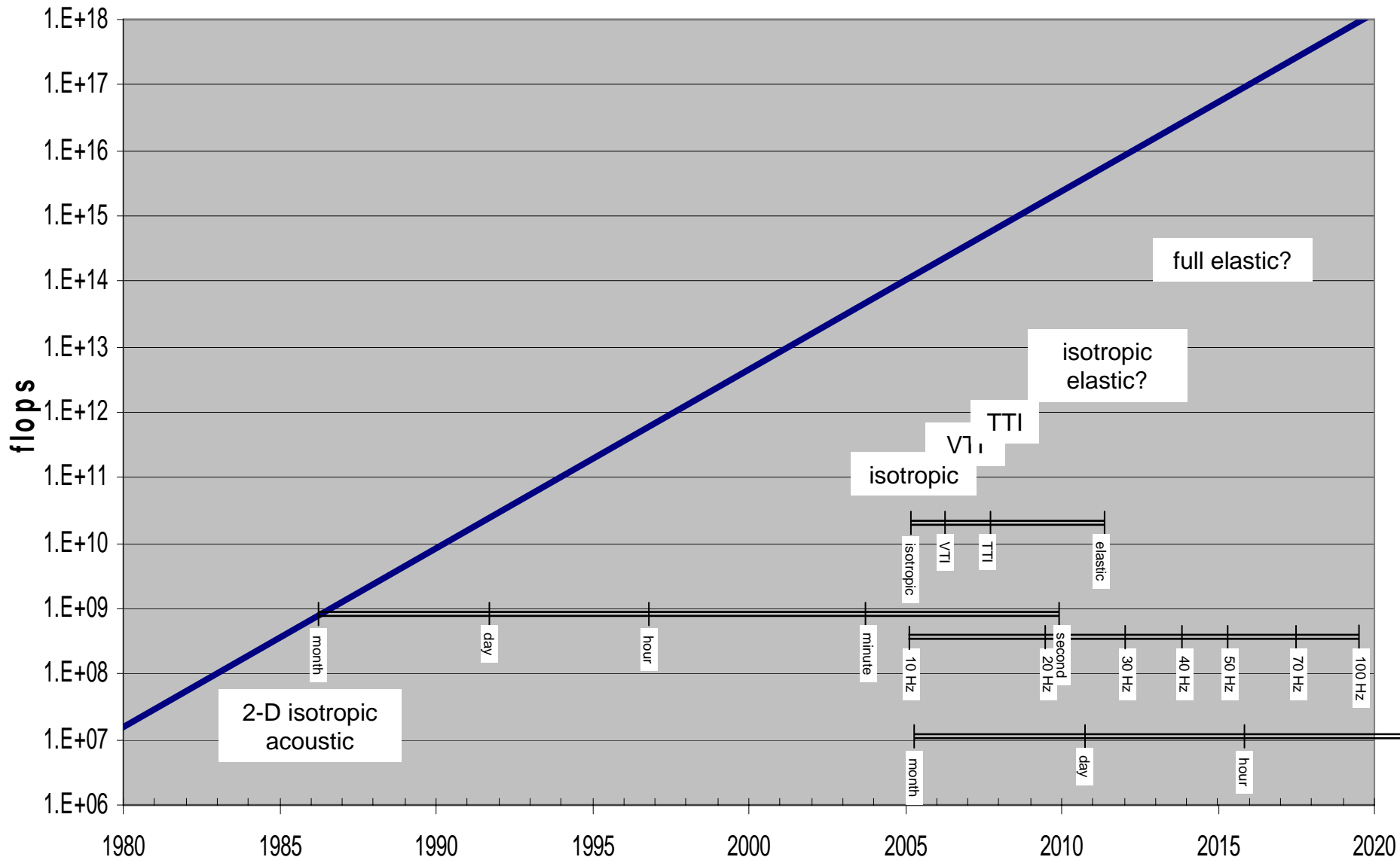
top 500 #1 Computer Extrapolation



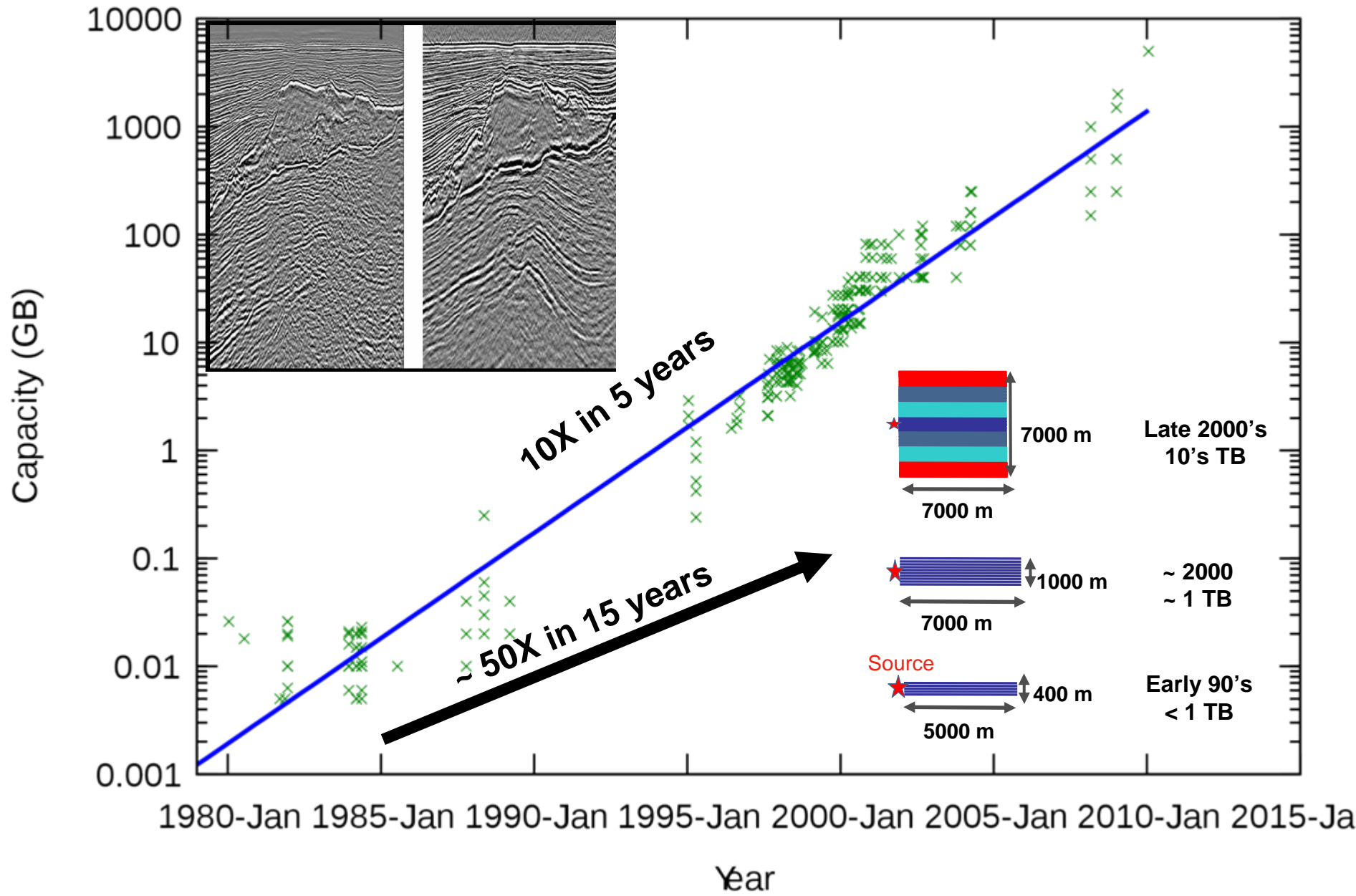
Prestack Reverse-time Migration Evolution



Prestack Reverse-time Migration Evolution

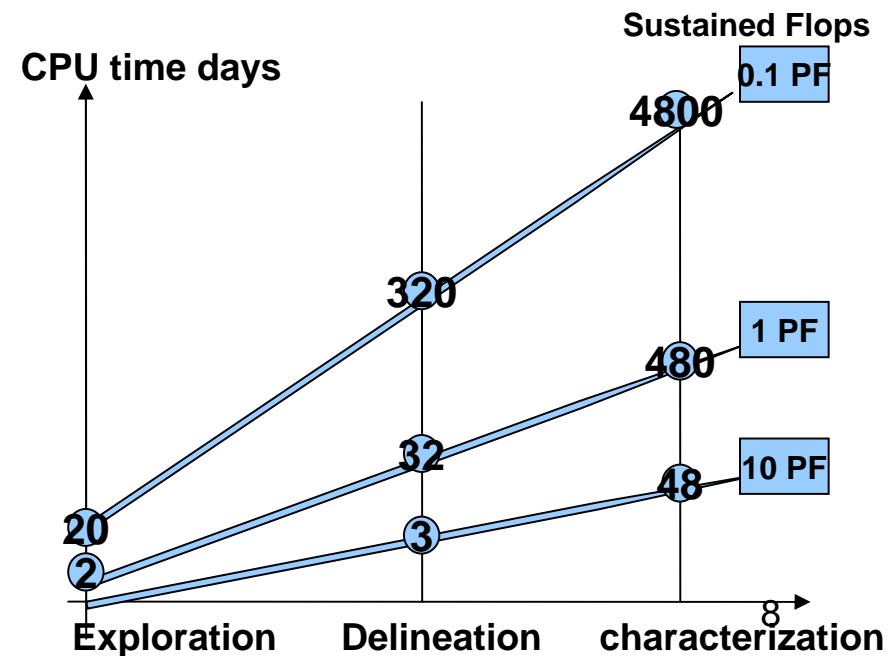
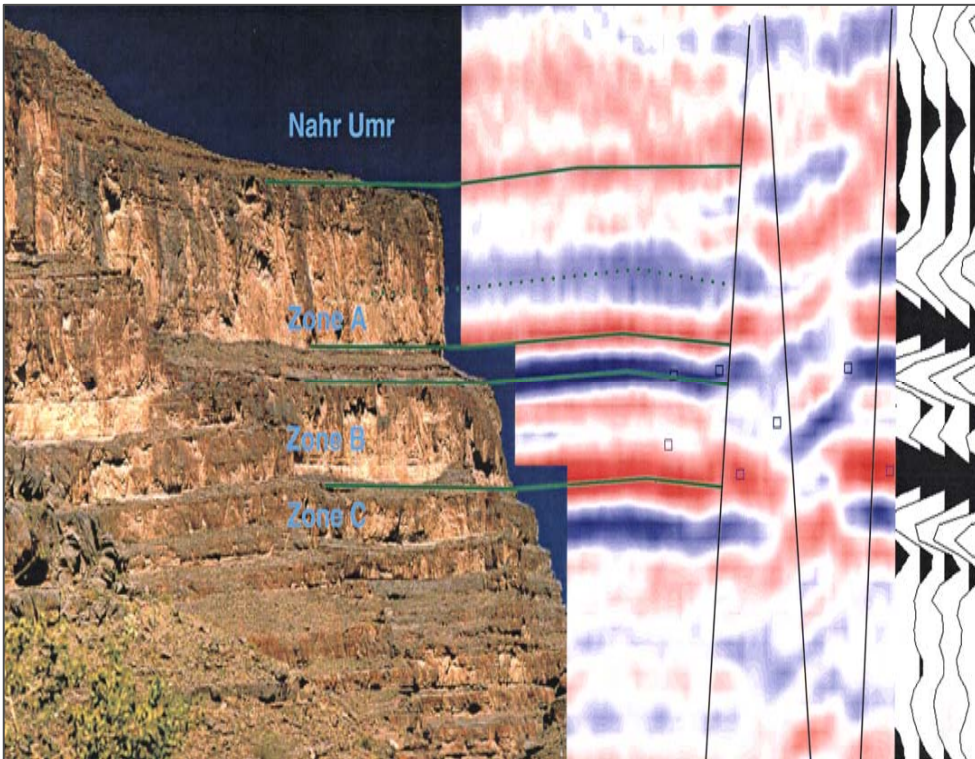


Disk Capacity Trend



From PetaFlops to ExaFlops

From Seismic to the Rocks



We're easy

- Algorithms based on physics (and physics is naturally parallel)
 - Convolutions
 - FFT's
 - Indirect addressing with low Flops per memory access
 - Iterative linear (non-linear) Gradient Descent
 - Generally no large linear problems needing exact solves (a few potential exceptions)
 - Optimization is either quasi-linear or so non-linear we don't know how to do it yet

Time to Speculate

- Many-simulations technologies
 - Uncertainty analysis
 - Global optimization
- Integration of disciplines
 - Bridge between physical scales
 - Geological scenario exploration
 - Interactivity
- Expansion of domains
 - Phase space
 - Path integration
- ...

What Do We Need To Use An Exaflop System?

- We have it easy
 - We need to replicate a “node” that can do 1 shot
 - DOE’s problems need much higher scalability
 - And of course we need
 - Programmability
 - Reliability / fault-tolerance
 - ...

What Do We Need To Use An Exaflop System?

- Given
 - Commodity components
 - Consumer market
- We'll be able to make such systems
- But what will we actually *want* to do?
- What will have *value* to our industry?

Only time will answer these
questions!