

# Application Trends on HPCx

Providing a World-Class Service for  
World-Class Research

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# Aim of the talk

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- HPCx has been in operation for almost four years
- Large range of statistical data generated during this time
  - Subject areas
  - Codes
  - Length of jobs
  - Size of jobs (processors)
  - Discounts
- Aim is to review some of the more interesting observable trends

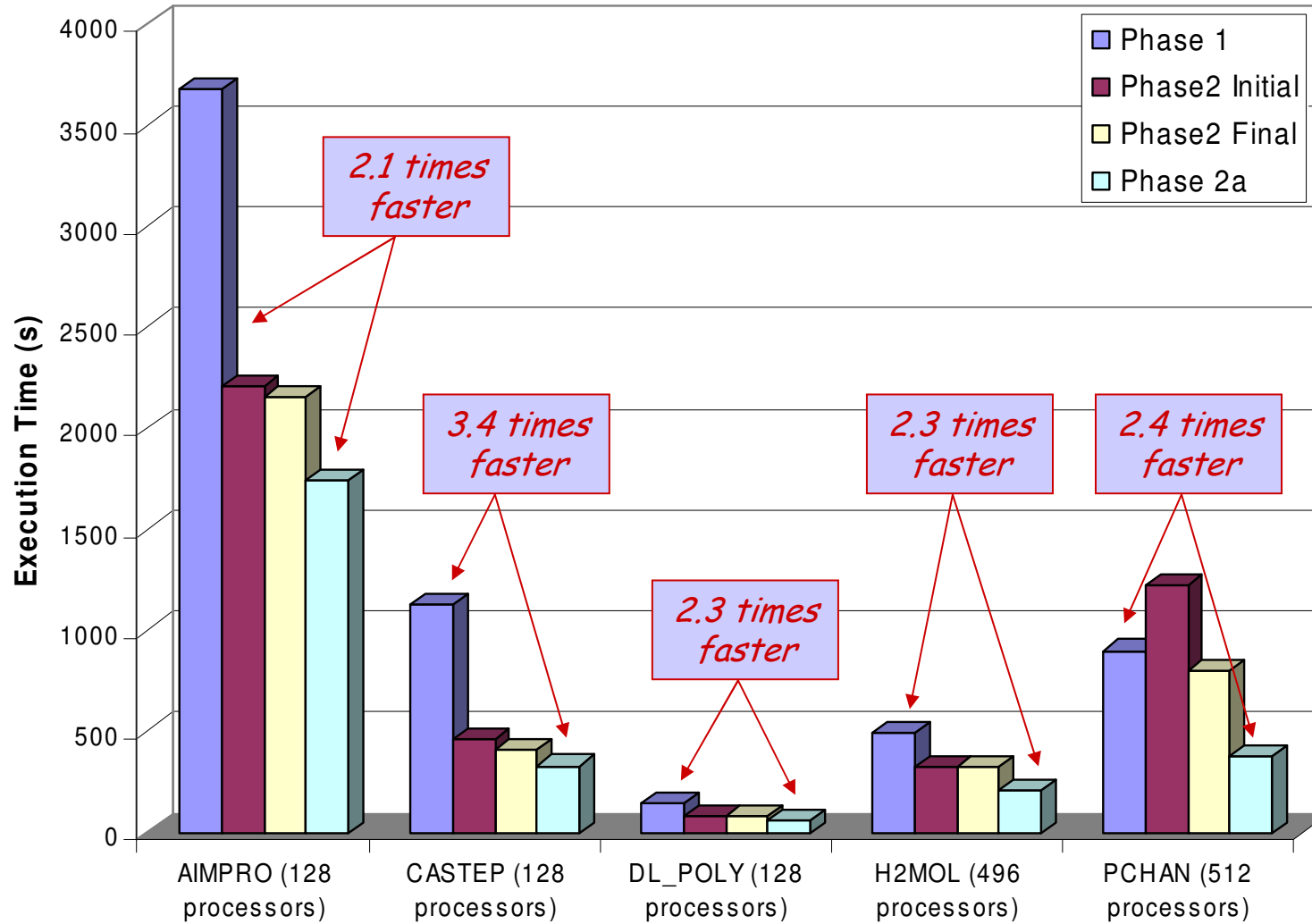
# System trends

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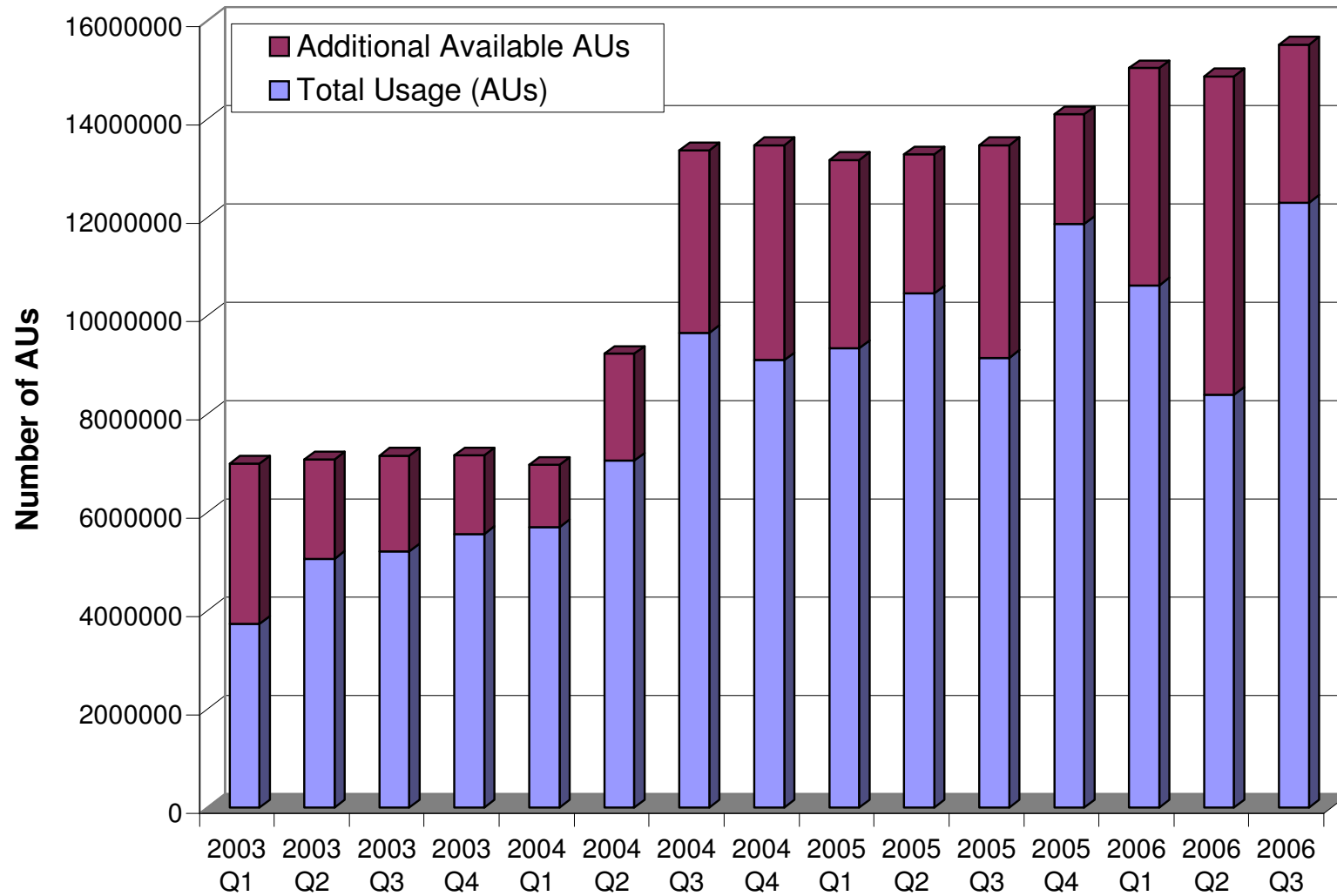
- Undergone/going four technology upgrades, three different types of system / processor
- Phase 1 (Dec 2002 - June 2004)
  - 3.4 Tflops on Linpack
  - 1280 power4 processors, 40 p690 cabinets
- Phase 2 (July 2004 - Oct 2005)
  - 6.2 Tflops on Linpack
  - 1600 power4+ processors, 50 p690+ cabinets
- Phase 2a ( Nov 2005 - Oct 2006)
  - 7.4 Tflops on Linpack
  - 1536 power5 processors, 96 p575 nodes
- Phase 3 (Nov 2006 - Dec 2008)
  - Target 12 TFlops/s on Linpack
  - XX power 5 processors



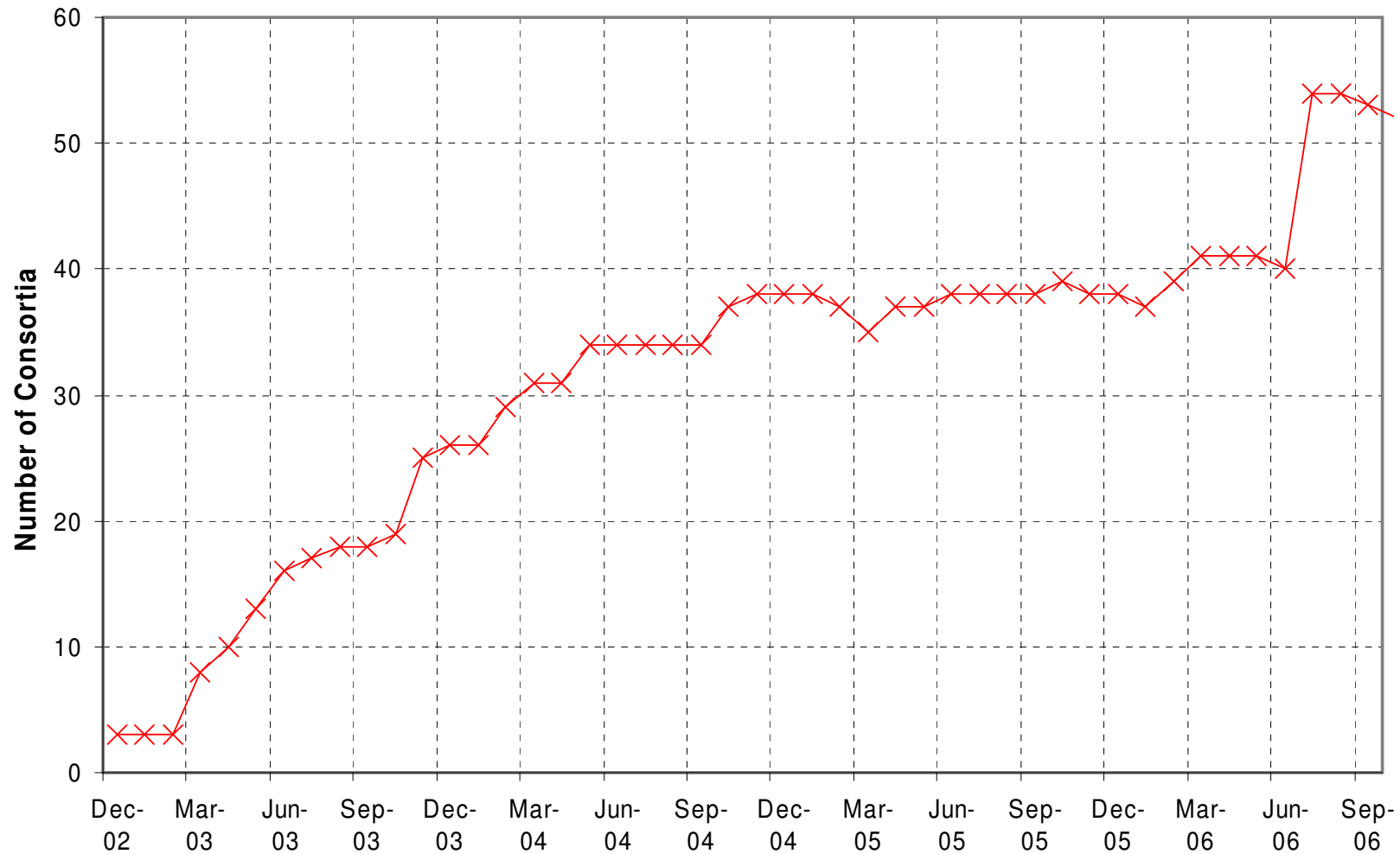
# Performance trends - acceptance tests



# Usage trends - available AUs / average usage



# Usage trends - number of consortia

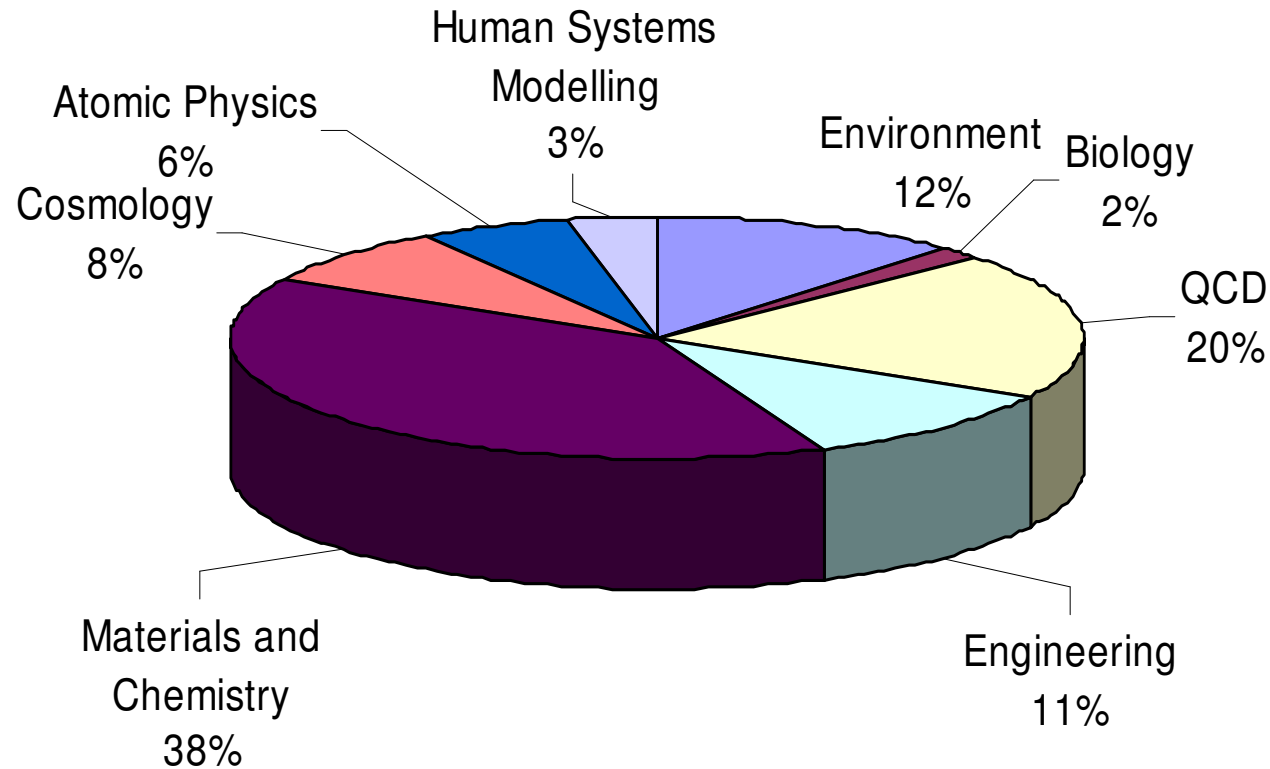


- Historically, HPC has played an important role in computational 'grand challenge' science
- Grand challenge science
  - Projects which are almost too difficult to investigate using current computer technology
- By definition, grand challenge science requires high performance computers
  - Need vast amounts of memory and / or processing power
- The UK's national HPC resources have supported this science since the early 80s

- The report *Research Requirements for High Performance Computing* identified the following grand challenge areas in 1992:
  - Climate modelling
  - Astrophysics
  - Quantum chromodynamics
  - Materials science
  - Structural engineering
  - Computational fluid dynamics
  - Human systems

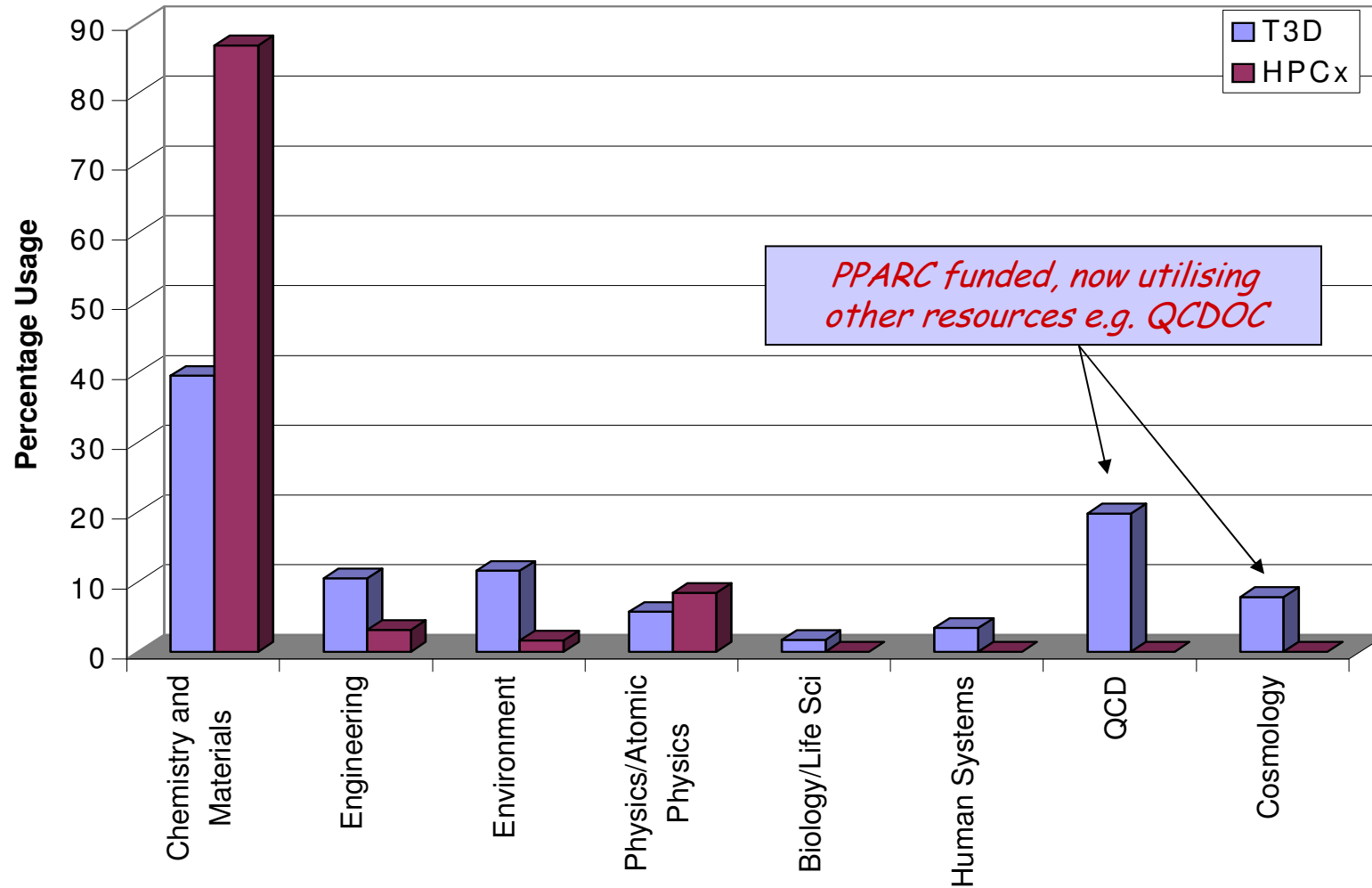
# Subject area - history

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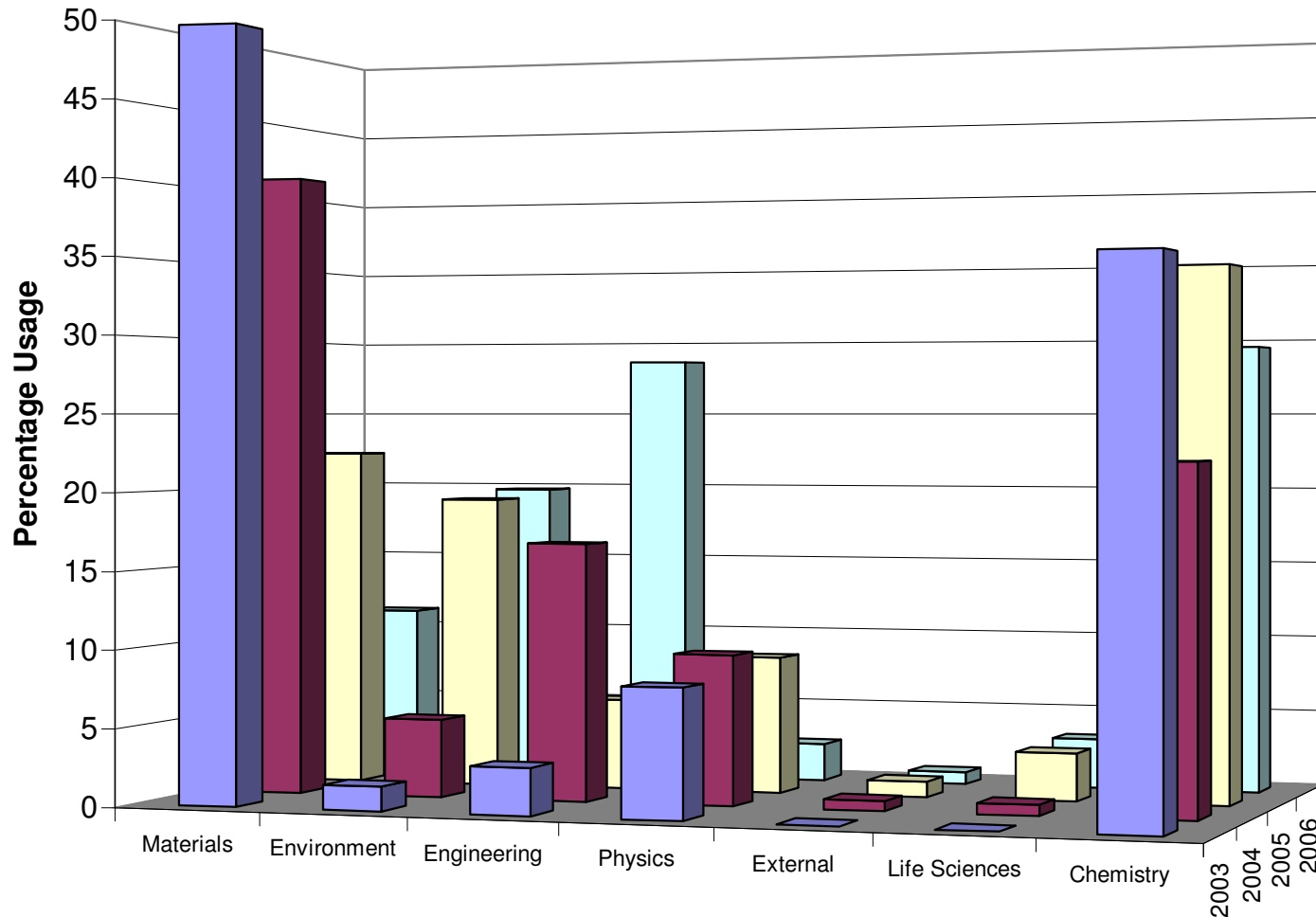


- Utilisation figures for the UK's National HPC resource in 1996 - the Cray T3D in Edinburgh

# T3D 1996 vs HPCx 2003

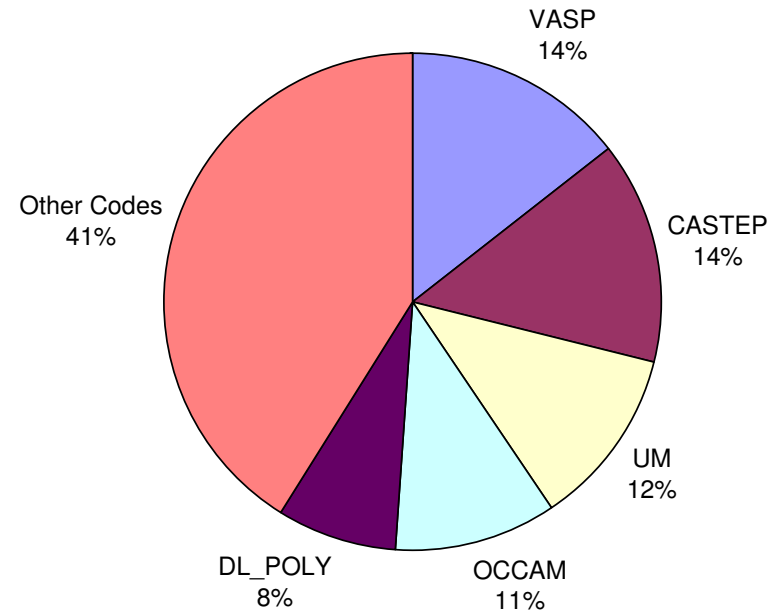
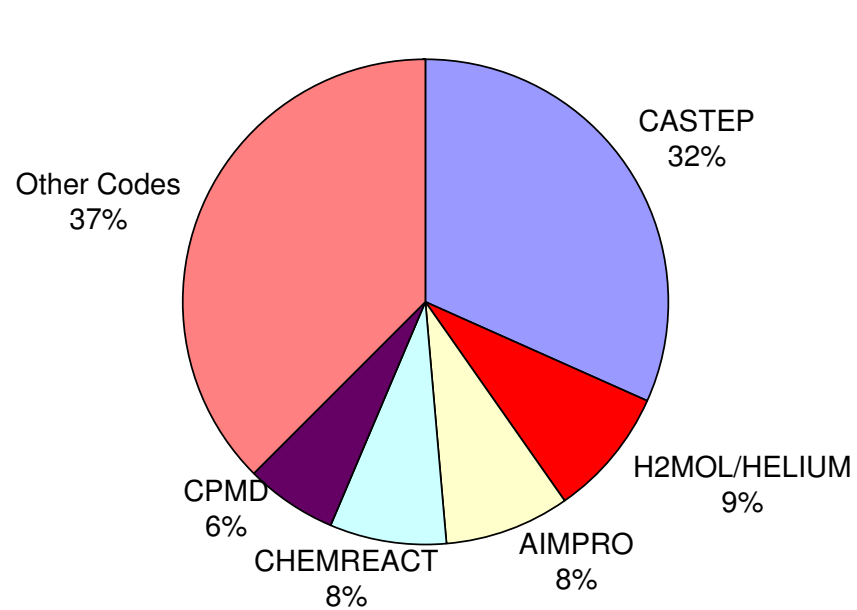


# Application area trends



- The largest users of the system are Materials and Chemistry
- However over the lifetime of the service we have seen
  - An increase in engineering
  - An increase in the environment
  - Life science projects joining the service
  - Some external industrial customers joining the service
- HPCx now supports a broader range of subject areas

# Most heavily used codes



- Start of service

- Now - 2006

## Job size trends - capability science

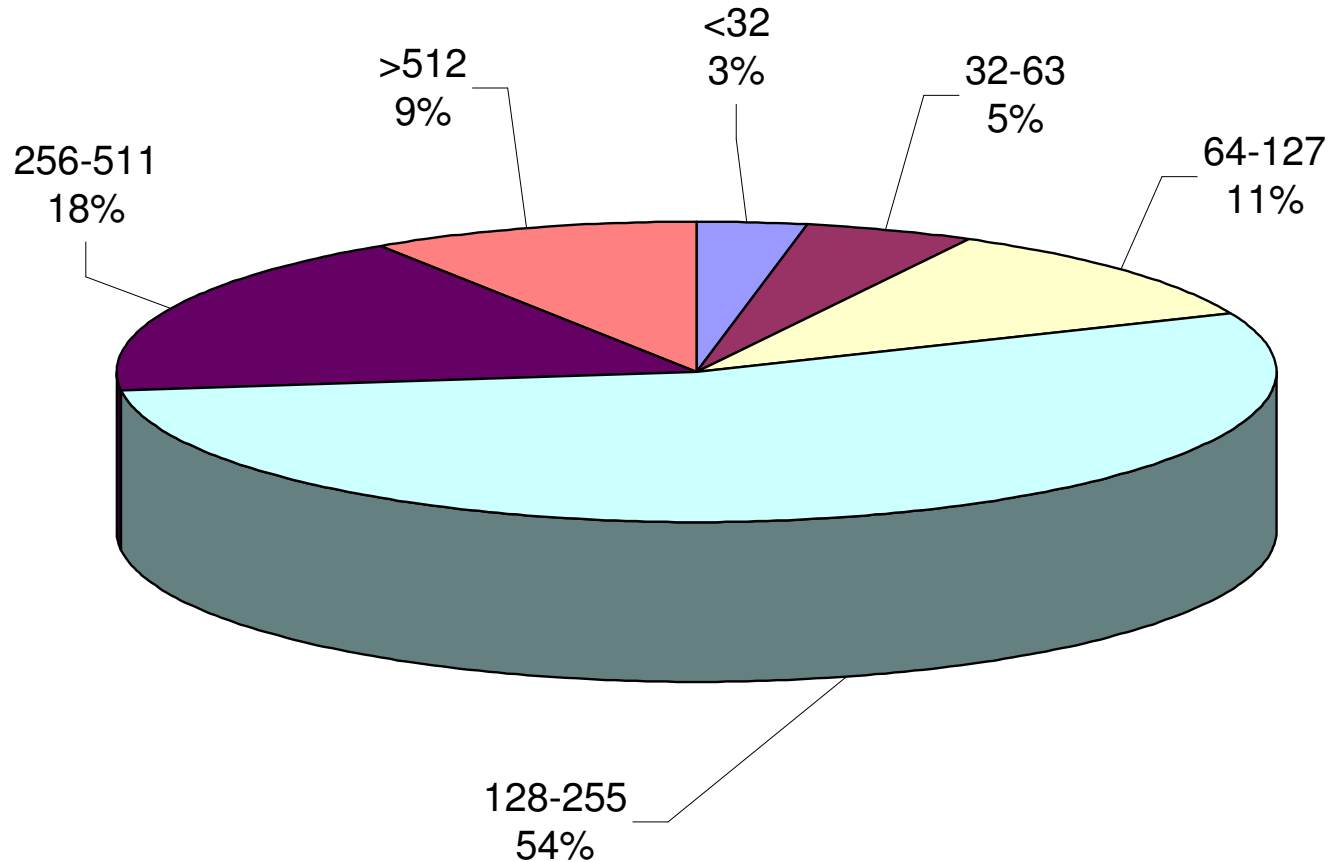
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- Science still drives HPC requirements within the UK
- Focus of current HPC resources is to facilitate world-class science
  - Through capability science
- Specifically
  - Science that uses a significant fraction of our resource, eg 512+ CPUs

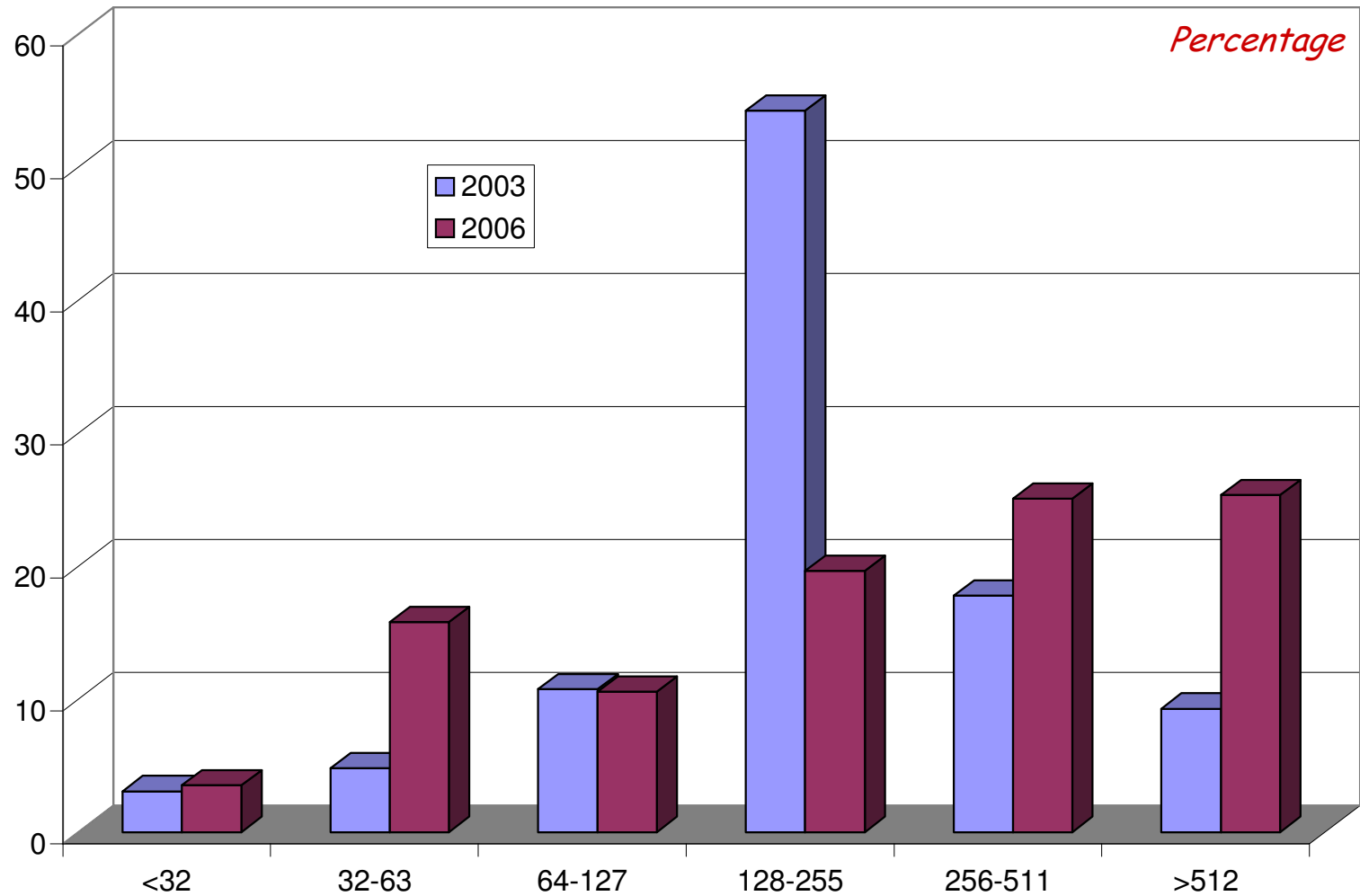
# Job sizes - start of service

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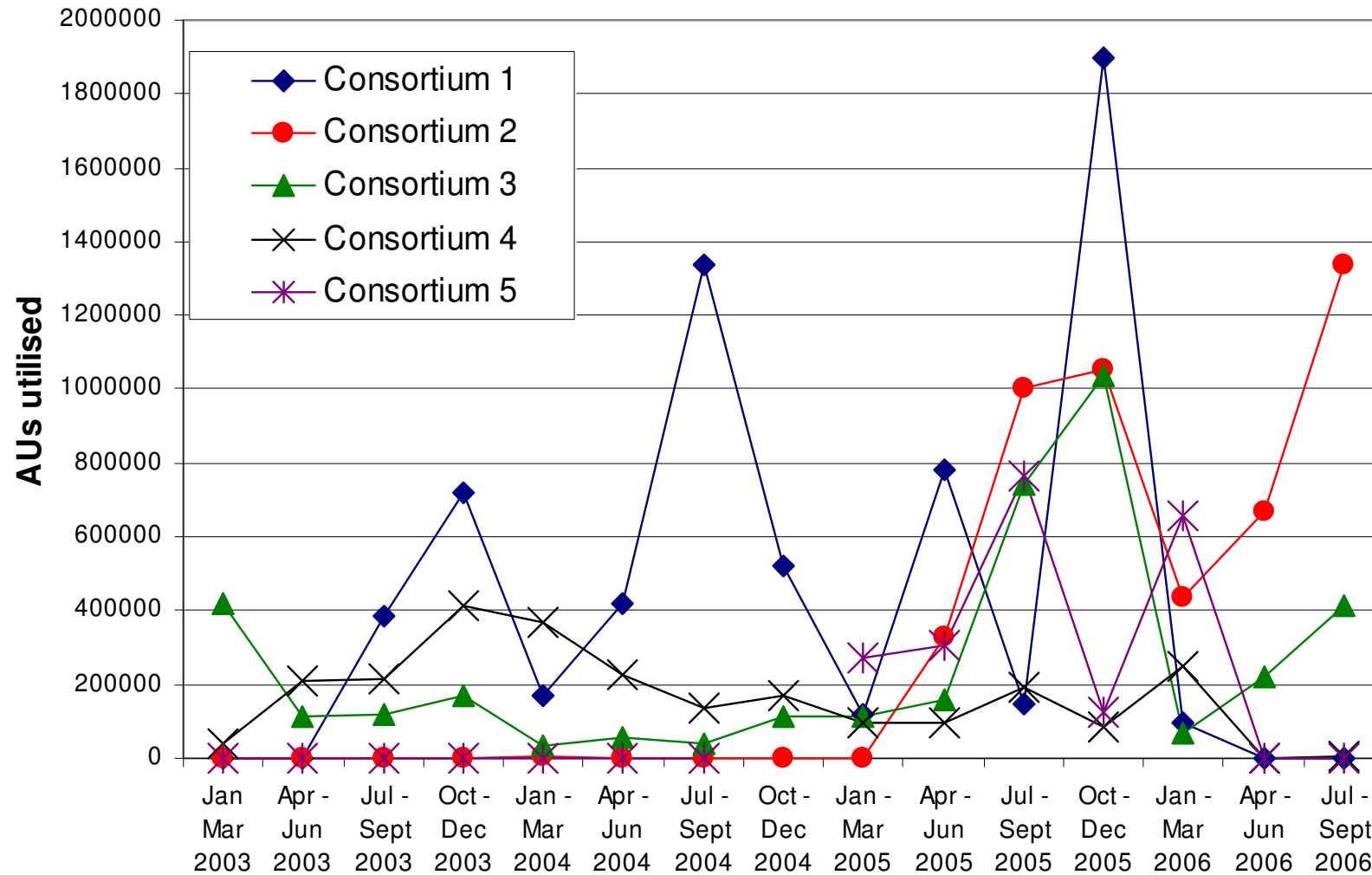


- Job sizes dominated by 128-256 jobs (mainly 128)

# Job size trends



# Capability job size trends



## Job size trends

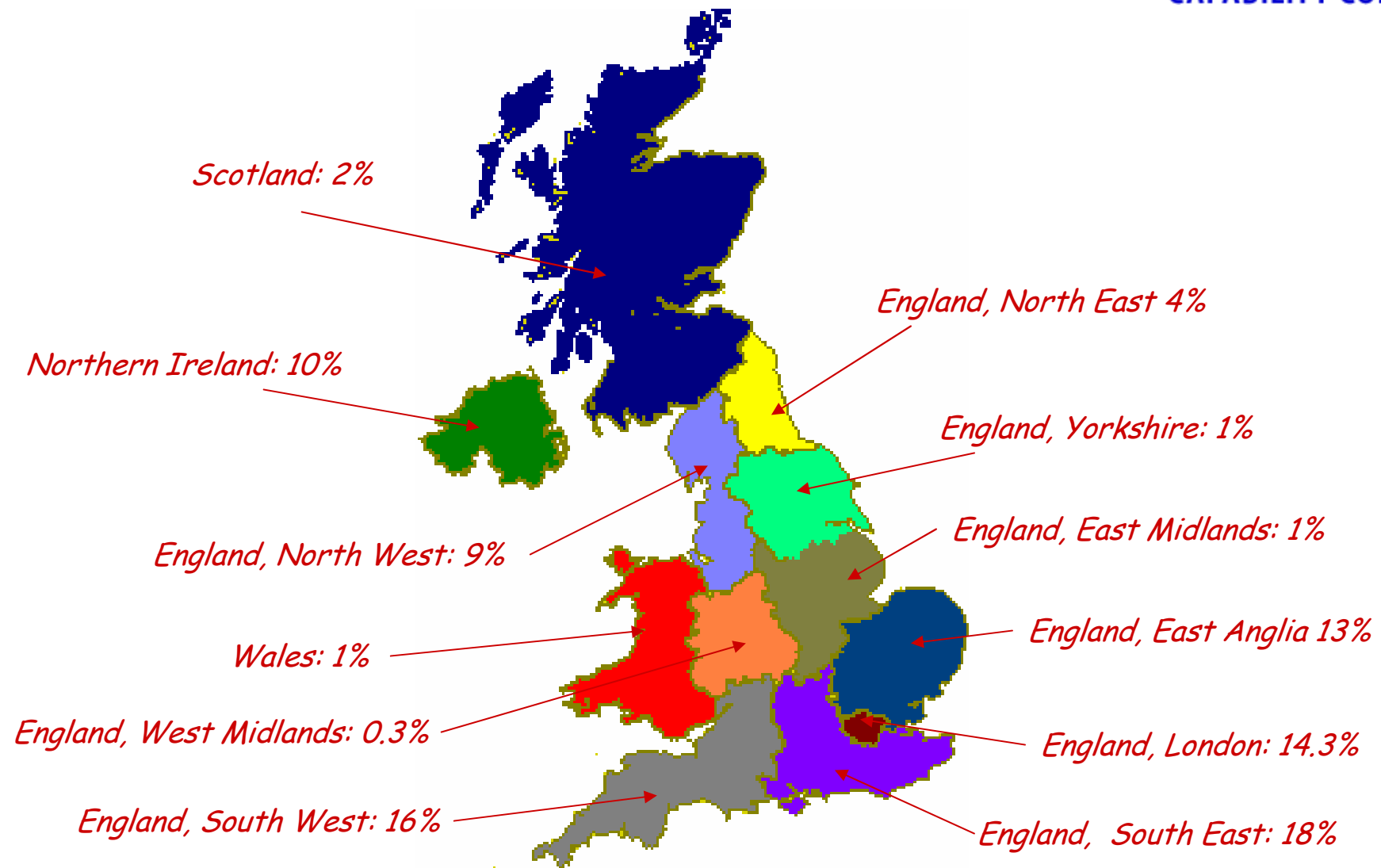
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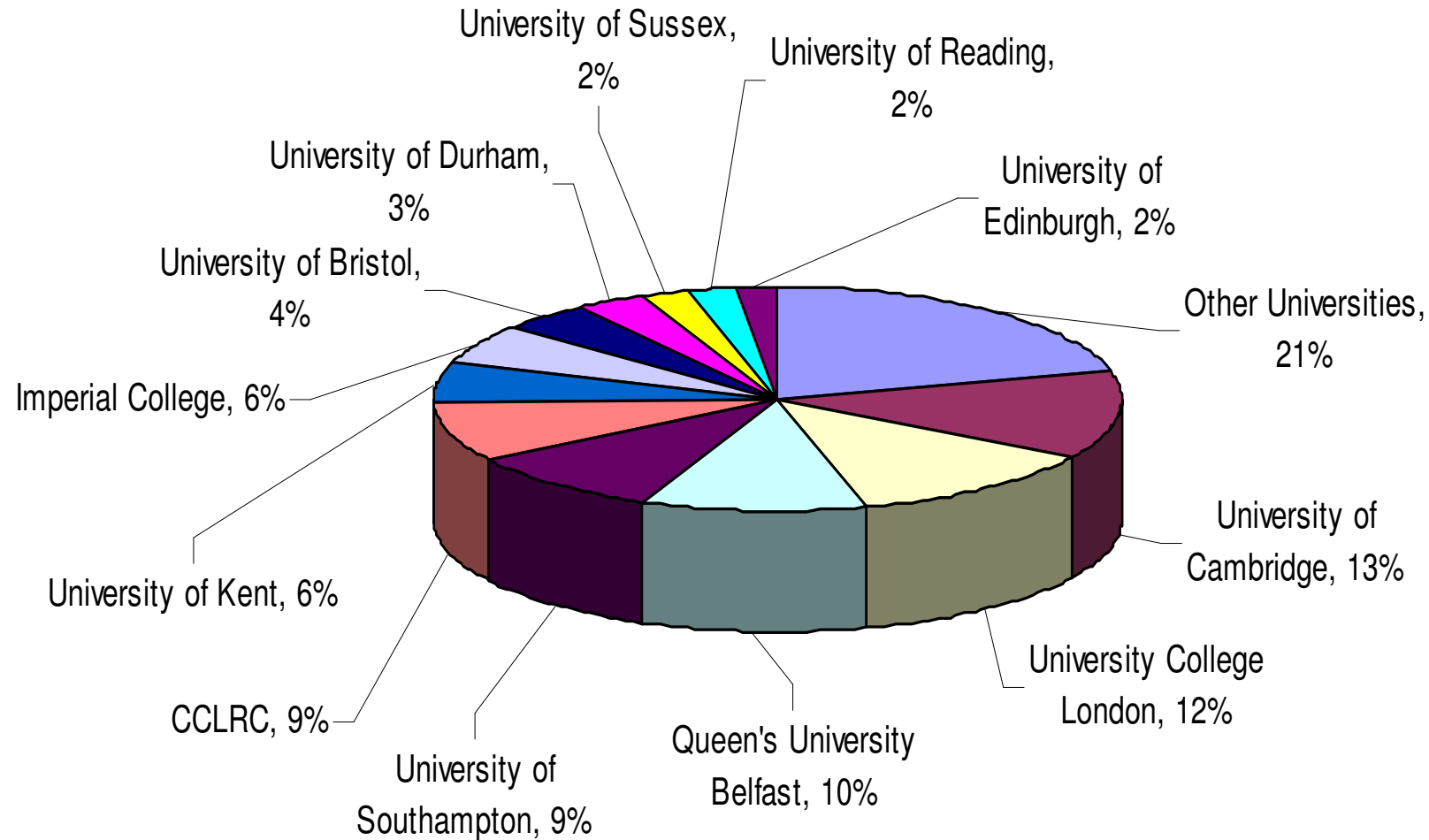
- Significant shift from 128-255 processor jobs to larger jobs
  - 256-511 and > 512
- Capability jobs
  - Usage within a consortium varies significantly across time
- 47 consortia have run capability job(s) at some time

# Usage by region

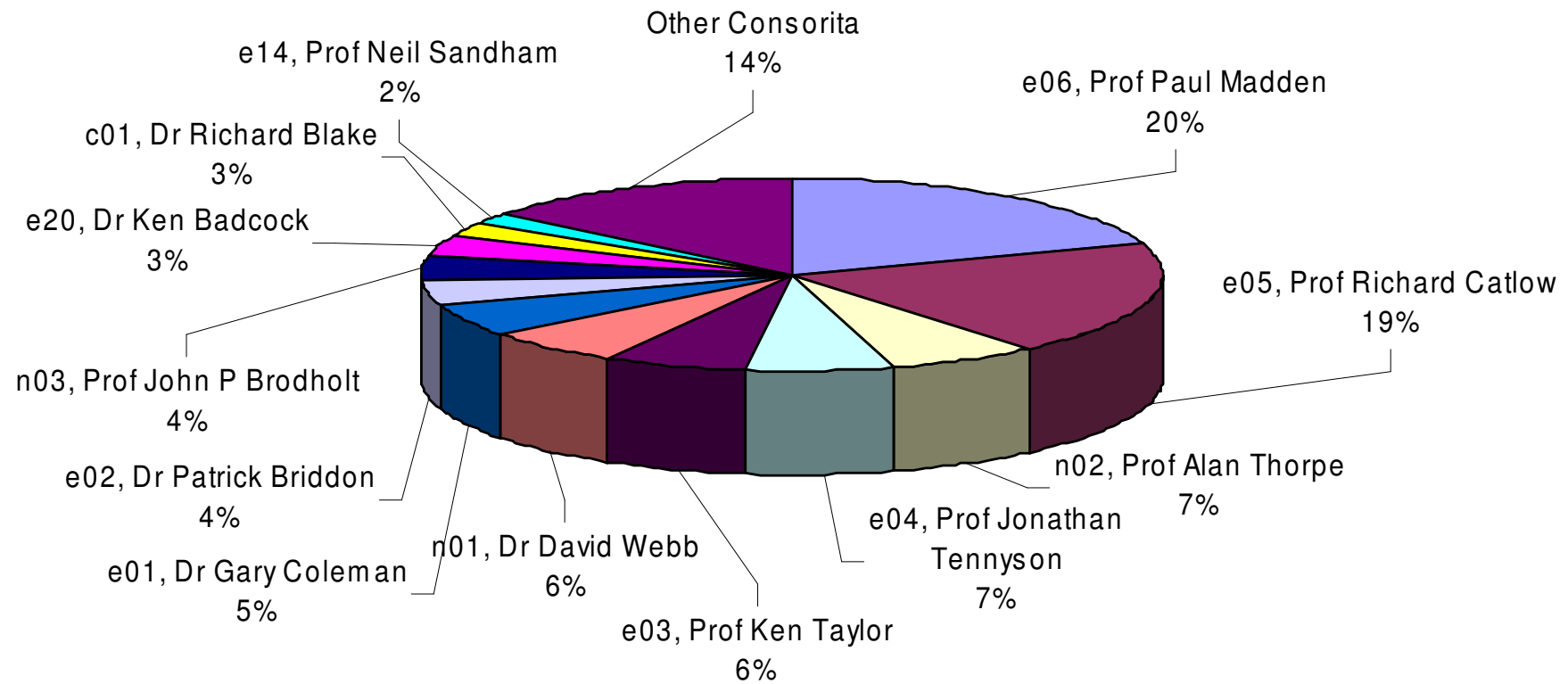
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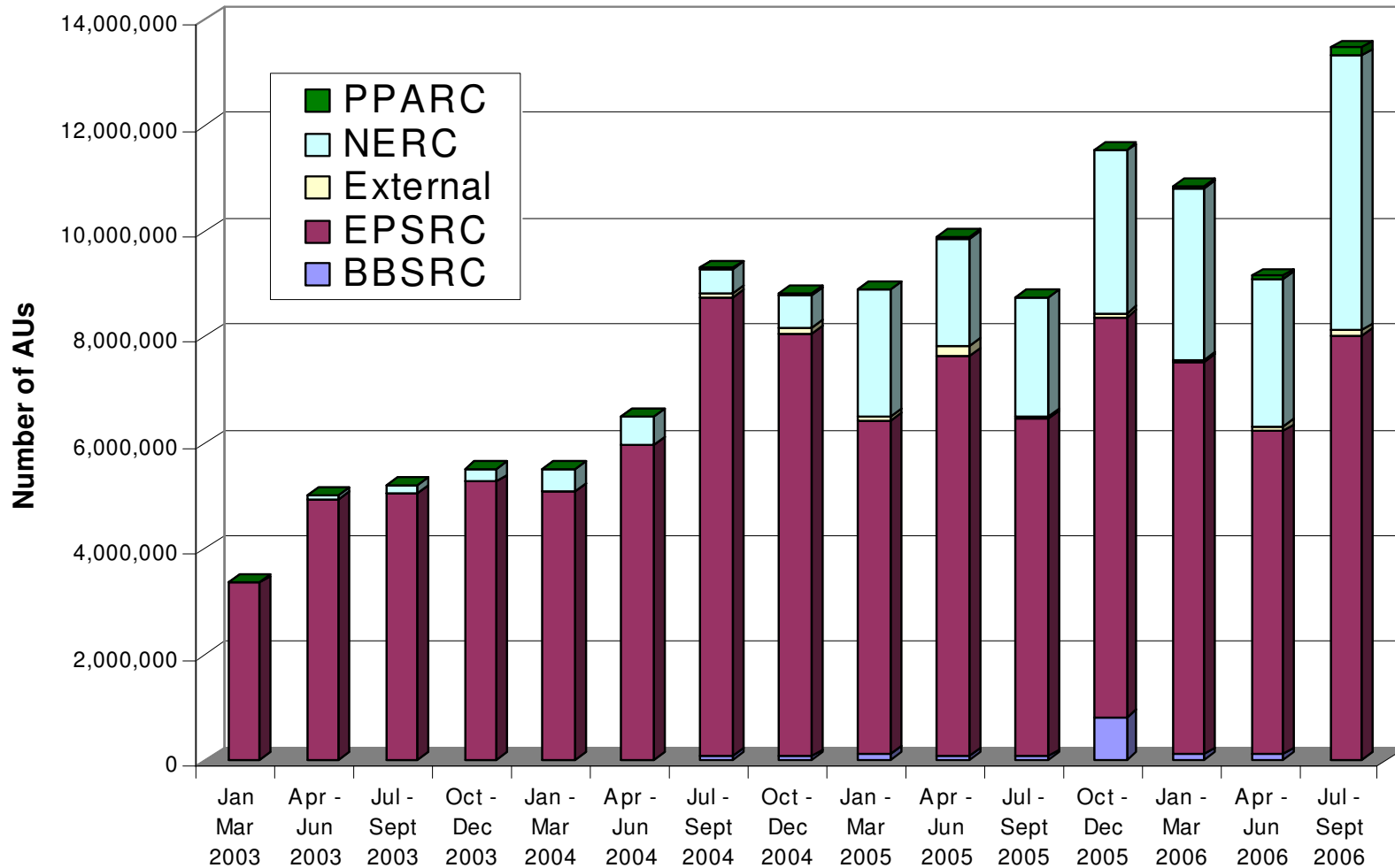
# Heaviest users (> 2%)



# Heaviest users (> 2%)



# Usage by funding body



# Conclusions

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- HPCx has been running successfully for 4 years
- Range of application areas has increased across the service
  - Increase in environment, life science and commercial usage
- Average job size has increased, as has overall capability usage
- Users are spread across the country
  - Heaviest use is from the south east of England
  - Heaviest use is from the University of Cambridge
- Acknowledgements
  - Stephen Booth for developing the software that allowed this data to be easily extracted
  - John Fisher for providing some of the data