Designing DiRAC-4:
Supercomputing for computational cosmology

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DiRAC
High Performance Computing Facility

ExCALIBUR 10

DiRAC

- Distributed Research utilising Advanced Computing
  - HPC for the STFC theory community
    - Including astronomy, cosmology, astrophysics, ...
- 4 systems at 4 sites
  - And a project office at UCL
- Each designed for specific workloads
  - Durham: Memory intensive (COSMA)
    - e.g. cosmology
  - Edinburgh: Extreme scaling
    - e.g. particle physics/QCD
  - Cambridge: Data intensive
    - e.g. astronomy
  - Leicester: Data intensive
    - e.g. QCD, black holes

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Bespoke design

- Systems designed to match the science
  - Significantly more cost-effective than a single large system
  - We do co-design with hardware vendors
  - Bespoke compute allows the UK to remain at the cutting edge of science
    - For example cosmology: Some of the largest simulations worldwide have been performed on COSMA in Durham

A telescope for cosmology: COSMA

- The COSmology MAchine: 8th generation
- Similar design principles to a large telescope
  - Different risks and timescales
- Bespoke for cosmology:
  - High RAM per node
  - Fast checkpointing storage
  - Non-blocking low latency network fabric
  - Large bulk storage
  - Tape archive

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The DiRAC-4 design process

- DiRAC-3 systems are approaching end-of-life
  - Installed in 2021
  - Now is the time to plan for DiRAC-4
- Community engagement
  - Science case developed
    - Peer reviewed and accepted
  - Technical case development

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Technical case development

- Extraction of computational requirements from the Science Case
  - What type of compute? (CPU/GPU/other, RAM, storage)
  - How much?
- Community engagement
  - Consultations, workshops, summaries, clarifications
- Technical description
  - What separate systems are required
    - What are the unique points? RAM, network fabric, processor type
  - What are the likely most cost-effective system designs
    - What is the likely cost? Single system? Multiple systems?
- What other communities (beyond STFC) are relevant?

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Approval

- Technical case should be finished within the next couple of months
- Technical case approval
  - DiRAC Technical Directorate
  - DiRAC Board sign-off
  - Submission to UKRI
- Annual updates until funding arrives!

The DiRAC-4 route

- Funding arrives
- Procurement starts
- System delivery, build, integration and test
- Commissioning science projects
- Live to users
  - Start planning your science!

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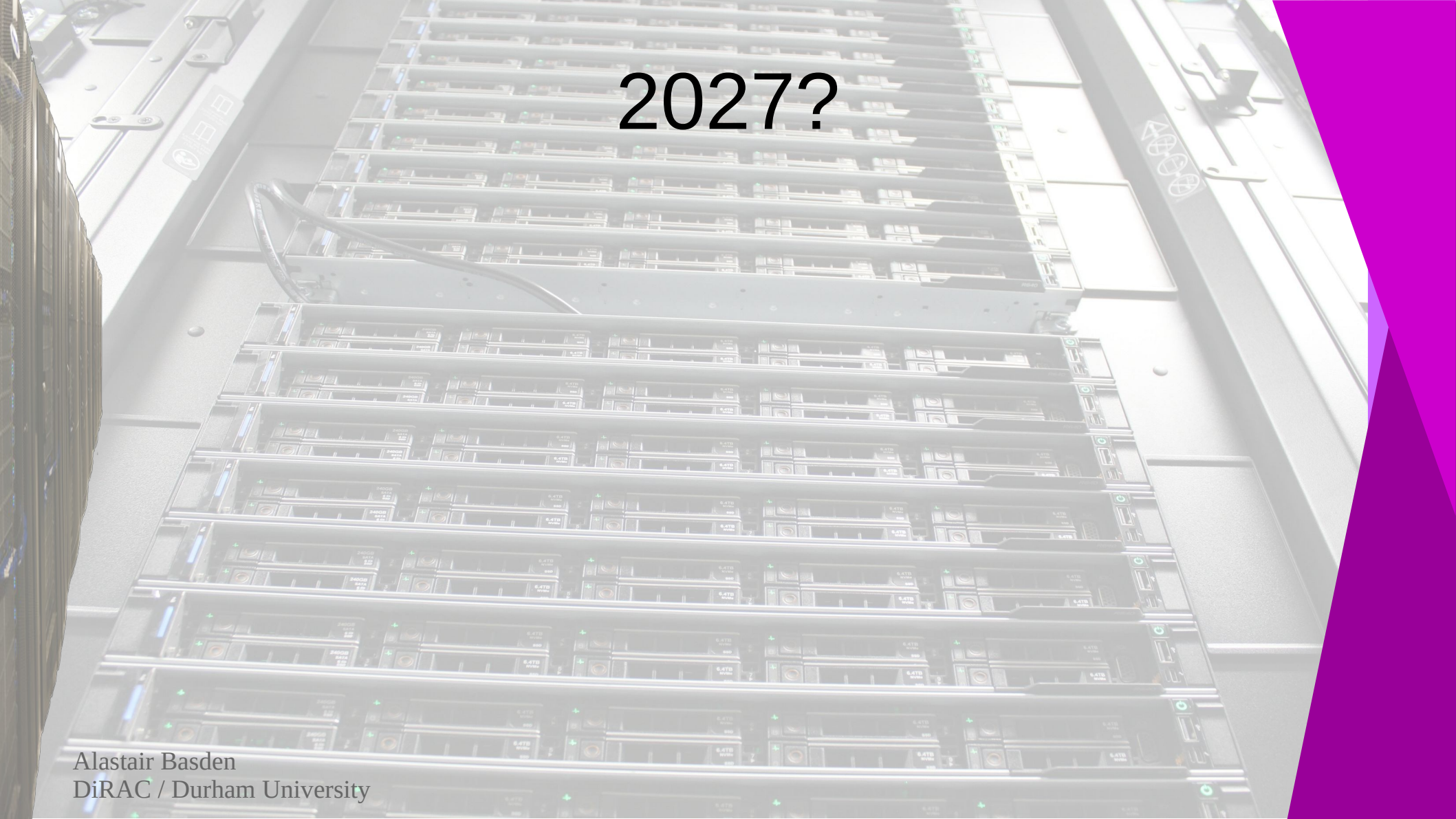

2027?

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