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Description automatically generated

**DiRAC Resource Allocation Committee**

**Technical Assessment Form**

# Instructions

1. Please see the call guidance notes for call information and guidelines. These can be found on the [UKRI Funding Finder](https://www.ukri.org/opportunity/)
2. Your completed form must be submitted directly to the DiRAC helpdesk

[dirac-support@epcc.ed.ac.uk](mailto:dirac-support@epcc.ed.ac.uk) by the **deadline of Thursday 14th September 2023, 16:00 UK time**. Any questions related directly to the filling in of this form should also be directed to the DiRAC helpdesk.

1. The DiRAC RSE team will complete Section 7 ***Technical Assessment*** and will contact you directly for more information if it is required. This may take up to 15 working days from receipt of the completed form.
2. The DiRAC RSE Team will contact applicants with feedback on the technical case by the end of November 2023.
3. The tables below may be expanded as required.

**Definition of resource hours**

The allocation on DiRAC systems is provided in resource hour units. There are different services providing different architectures and different types of resource per system. Please see the call guidance notes for a detailed description of the hardware resources available. Up to date information about the hardware resources will be available on the DiRAC website (<http://dirac.ac.uk/resources/>).

Resource hour units are defined as:

* Core hours: In one wall-clock hour one central processing unit (CPU core) will provide one core hour. A two-socket system would have 2 processors each with say 64 cores (CPUs) which would make this a 128-core system and provide 128 core hours in 1 wall clock hour.
* GPU hours: A node with 4 A100 GPUs would provide 4 GPU hours in one wall-clock hour.

Completion of this form implies permission for user details to be stored in the DiRAC service providers’[[1]](#footnote-1) and Research Councils’ databases and to be used for mailing, accounting, reporting and other administrative purposes.

**Acknowledgement:** This form was based on the ARCHER Technical Assessment form.

# Personal Details of the applicant

|  |  |
| --- | --- |
| **Name:** |  |
| **Address:** |  |
| **Affiliation:** |  |
| **Telephone number:** |  |
| **Email address:** |  |
| **Title of the project:** |  |
| **Type of project (thematic/short):** |  |

***Enter your proposed project start date:***

**Start Date**

dd/mm/yyyy

## Project duration (months):

***Enter the proposed duration of the project in months:***

**Project Duration**

# DiRAC Software and Support Requirements.

## Summary of software requirements.

Please answer the following questions and include links to any codes/software you intend to use.

### What are the main codes you will be using?

***Enter list of all codes, with links to descriptions if possible, in the following table:***

|  |  |  |
| --- | --- | --- |
| **Name of the code** | **Owner** | **Source (web address)** |
|  |  |  |

Indicate, if possible, where the codes are already established, and your own experience of running this code.

### Software requirements (e.g. compilers, libraries, tools):

***Enter list of software requirements to support your use of DiRAC in the following table:***

***Duplicate this table per system and hardware type you are applying to use.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of DiRAC Service requested:** | | | |
| **Name of software** | **Version** | **Licenced?**  **Y/N** | **Dependencies**  **(if known)** |
|  |  |  |  |
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## **Code optimisation**

How do you plan to port and optimise your code on DiRAC

***Complete the following table, deleting as appropriate:***

|  |  |
| --- | --- |
| **Expertise in your group** | Yes/No/NA |
| **DiRAC RSE Support** | Yes/No/NA |
| **Other (please specify)** |  |

We encourage applications for RSE support as optimisation and profiling can improve the effectiveness of the systems.

### **Summary of further support requirements**

***Summarise any other support requirements for this project in the box below:***

***If you are applying for RSE time (this is not mandatory) then please fill out the separate RSE application form. The box here should be used for more general system support requests.***

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# Scaling Evidence to Support Proposed Use of DiRAC

The number of resource hours requested and the job sizes specified in section 6 *[Proposed Use of DiRAC Resources](#_Proposed_Use_of)*must be backed up by quantitative evidence that the code scales efficiently to the job sizes requested.

## Weak scaling

Weak scaling: the problem size increases at the same rate as the number of processors, keeping the amount of work per processor the same.

If the DiRAC resources requested in this application are set by requirements such as memory or runtime, can the applicant please explain and show benchmarks to justify why the requested job size is appropriate. Up-to-date scaling information should be supplied, close to the job requirements detailed in section 6.

***Please give your reasoning in the box below:***

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## Strong scaling

Strong scaling: total problem size stays the same as the number of processors increases.

The evidence should include:

* A graph or table of the *speedup* for a similar problem using the code on a DiRAC or another HPC system. The speedup should be provided relative to the smallest number of cores that can be used feasibly. This is called strong-scaling.
* A profile, if possible, of a typical run. This can be achieved using tools like *oprofile* or *pmu-tools* or even the system *perf* command*.*

If the application is developing new algorithms for which scaling data is not yet available then the proposed scaling should be justified with appropriate references and descriptions.

If scaling data is available only for core numbers lower than the requested amount, please explain and justify how the full problem is expected to scale. Information gathered using information generated by the *oprofile* tools might be helpful.

If you require help in evaluating the speedup of a code on a particular problem then please contact the DiRAC Helpdesk ([dirac-support@epcc.ed.ac.uk](mailto:dirac-support@epcc.ed.ac.uk)[support@epcc.ed.ac.uk](mailto:support@DiRAC.ac.uk)).

**For a thematic project, the applicants must give performance evidence for ALL MAJOR CODES**

***Enter your Resource Justification in the box below including scaling plots and code profiles for each of the MAJOR CODES***

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# Data Production and Transfer

This section asks some basic questions about the data generated on DiRAC during the proposed calculations.

## File management during production

### How many files are typically produced by each job?

***Please enter the estimated number of files produced by each job in the box below:***

*(This does not need to be exact, order of magnitude is sufficient here. For example, 1000 files per job. You should also state how these files are organised; for example, are they all stored in one directory or is there a hierarchy of directories?)*

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***Could you please describe a possible operational plan for reducing the number of files if there are many?***

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### Data read in by each job

***Please enter the estimated total size in kB/GB/TB:***

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### Data produced by each job

***Please enter how much data is produced by each job***

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### Size of writes and reads

***Does the code execute many small writes or reads? (Delete as appropriate)***

**Yes/No**

***e.g. do you read or write many files less than a few MB in size?***

***HPC file systems generally work best with larger files.***

***If Yes, what are the plans to optimise this?***

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***Describe how your files will be effectively striped across the parallel file system.***

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***Any other comments?***

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### Data transfer plans

*The DiRAC systems are not able to store indefinitely data produced by RAC approved projects. The PI is therefore required to consider in advance what should happen to the data and how much needs to be saved, which requires data to be transferred from the DiRAC system to a more permanent location.*

***Please describe how you plan to manage your local data and give an indication of how much data you plan to transfer off the system.***

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# Proposed Use of DiRAC Resources

## Choice of DiRAC resource for your applications

*The DiRAC resources are described in detail on the DiRAC web pages:* [*http://www.dirac.ac.uk/Resources*](http://www.dirac.ac.uk/Resources)*. Please consult these pages to help you identify the system(s) you think most suitable for your applications.*

### Total amount of computational resource hours required

(*For a definition of resource hours please see discussion at the start of this document*.)

***Please give an estimate of the total amount of computational resource hours required. The final resource request must be specified in the science case.***

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | Resources Requested | | | |
| DiRAC Service | DiRAC system | CPU/GPU type | Units | Year 1(Q2 2024 - Q1 2025) | Year 2(Q2 2025 - Q1 2026) | Year 3(Q2 2026 - Q1 2027) | *TOTAL* |
| Data Intensive Service - Cambridge | CSD3\_CPU | Intel cascade lake / Intel icelake | Mcore-h |  |  |  |  |
| CSD3\_GPU | Nvidia A100 | MGPU-h |  |  |  |  |
| Data Intensive Service - Leicester | DIaL | Intel skylake | Mcore-h |  |  |  |  |
| DIaL-3 | AMD Rome | Mcore-h |  |  |  |  |
| SuperDome (6 TB RAM) | Intel skylake | Mcore-h |  |  |  |  |
| 3 Fat nodes (1.5TB RAM) | Intel skylake | Mcore-h |  |  |  |  |
| Extreme Scaling Service - Edinburgh | Tursa\_GPU | Nvidia A100 | MGPU-h |  |  |  |  |
| Tursa\_CPU | AMD Rome | Mcore-h |  |  |  |  |
| Memory Intensive Service - Durham | Cosma7 (16 GB/core) | Intel skylake | Mcore-h |  |  |  |  |
| Cosma8 (7.8 GB/core) | AMD Rome | Mcore-h |  |  |  |  |
| 2 Fat nodes (4 TB RAM) | AMD Rome | Mcore-h |  |  |  |  |

Year 1 = 1st April 2024 (Q2) – 31st March 2025 (Q1)

Year 2 = 1st April 2025 (Q2) – 31st March 2026 (Q1)

Year 3 = 1st April 2026 (Q2) – 31st March 2027 (Q1)

### Exploitation of Compute resources per node

***Generally, we would expect users to use all of a node’s processor units. If that is not the case, can you please explain your reasons in detail in the box below?***

***Duplicate this box for each different hardware target you are applying to use (CPU and GPU) and please clearly specify which DiRAC system you wish to use.***

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### Exploitation of memory per node

*We would expect an application to make optimal use of the system memory.*

***Please explain the memory profile for your application in the box below.***

***If users ask for a number of resource hours purely on the scaling expectations of their code but only use minimal memory, then this should be explicitly stated and strong evidence of good to excellent scaling must be given in section 4.2.***

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### Exploitation of the fast interconnect

*The systems are architected for HPC applications. If an application requires many low-core runs, this has to be explicitly stated and reasons for using the specified systems must be given.*

***Please explain how you will make use of the interconnect in the systems you are applying to use. If the interconnect is not used heavily in your application explain why the system you are applying for is still appropriate.***

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### Job mix

*Please see* [*http://www.dirac.ac.uk/*](http://www.dirac.ac.uk/) *and the guidance notes for this call for a detailed description of the hardware resources. Please also see the comments* [*Definition of resource hours*](#_Definition_of_resource)*at the beginning of this document.*

***Please complete the following table for each of system (for each combination of system and CPU/GPU partition) you apply for and please clearly specify which DiRAC system you wish to use:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of system:** |  | **Largest Job** | **Typical Job** | **Smallest Job** |
| **Number of nodes** | |  |  |  |
| **Number of CPU cores used per node (please see system specifications)** | |  |  |  |
| **Number of GPUs required per node (usually 0 – 4). Delete this row where appropriate.** | |  |  |  |
| **Wall-clock time for each job** | |  |  |  |
| **Number of jobs of this type** | |  |  |  |
| **Total memory required per node** | |  |  |  |

***For the thematic projects, the applicants must provide an appropriate profile for ALL MAJOR SUBPROJECTS stating which codes will be used.***

* + 1. **Unusual job requirements**

*The vast majority of jobs to be run on DiRAC systems are expected to use the existing batch system queues and associated policies. In exceptional circumstances there may be the need for occasional alternatives (e.g. reservations).*

***If this is expected to be the case please describe here what is needed and why for the RAC panel to consider.***

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## Resource Usage Breakdown by 3-month Periods

*For each of the approved projects there will be an overall allocation for a fixed period. This allocation will then be split equally over the number of yearly quarters. If a project expects to have a non-uniform usage, the RAC should be informed.*

### Allocation spreading

***If the applicants are happy with the same quarterly allocation, please state this clearly by deleting as appropriate. Otherwise, please continue on to fill in the table below.***

***Any unused allocation at the end of a quarter will be lost!***

***I am happy with equal quarterly allocations within each year:***

**Yes/No**

***If you have selected equal quarterly allocations, would you like a reduced allocation just in the first quarter to allow for setting up or adapting to a new environment, new postdoc(s) starting, etc. If you are requesting multiple systems please also indicate in the box which system(s) this applies to:***

**Yes/No**

***If yes, what fraction of the first year’s allocation would you like for the first quarter? If you are requesting multiple systems please also indicate in the box which system(s) this applies to:***

***If a non-equal allocation has been selected please enter the number of CPU core hours/GPU hours per quarter in the table below; expand the table if required and replicate if different across systems. Please note that the RAC will do its best to take into account a given profile of resource allocations but it may not always be possible to provide this.***

* **Any unused allocation at the end of a period is lost**
* **You cannot move between different allocation periods**
* **A period = 3 months**

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| --- | --- |
| **Name of DiRAC Service requested:** | |
| **Period** | **Number of CPU core hours/GPU hours** |
| **Period 1: start 1 April 2024** |  |
| **Period 2** |  |
| **Period 3** |  |
| **Period 4** |  |
| **Continue table for longer projects…** |  |

### Project

Please indicate here in this box if you have an existing RAC project you wish to reuse/continue using for RAC 16 (please give the actual code of the project of the form dpXYZ). If a new project is required just put “new”.

### Workflow

Could the applicants please give a break-down of the expected workflow?

#### Short projects

***In the following box please give a break-down summary of the expected workflow. Points to consider here: Will the project start immediately with production runs? Are there different types of production runs? Is there a mix of CPU load? Will there be periods of development during the project? Do you envisage startup difficulties? How have you taken into account any of the above in the way your allocation will be spread across the project? Your science case breaks down how your use of computer time will produce scientific data; this section should complement that by summarising how you will consume the time in terms of running jobs in the system. For example, whether you consume time roughly linearly running similar jobs throughout the project, or whether this varies as the project progresses. The information here should complement the information provided in the tables regarding job mix and allocation spreading.***

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#### Thematic projects

***In the box below please give the following information: If there are well-defined subprojects will they start at the same time? Will they be staged? Will there be periods of high demand? Would exclusive use of a part of the system be beneficial and why? Will there be considerable development – what requirements would there be during this phase? Has RSE time been requested? When would that be required?***

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## Proposed Use of DiRAC Resources - Storage Space requirements.

***Please complete the following table by indicating the amount and type of storage space you require.***

* /home: Small, backed-up. For project-critical files (e.g. source code). Available at all services.
* /scratch or /work or /data: Large, high-performance, not backed-up. For input and output from calculations. Available at all services.
* Tape: Large off-line data sets stored for possible future retrieval. Available at Durham (20PB) and Edinburgh (8PB).

Note: For /scratch or /work or /data allocations, a small allocation is typically in the range 1-10TB, while a large allocation is >100TB.

***Please complete the following table for each of the resources requested***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Site** | **DiRAC@Cambridge** | | **DiRAC@Leicester** | | | | **DiRAC@Edinburgh** | | **DiRAC@Durham** | | | |
| Filesystem | Home (GiB) | Work / scratch (TiB) | DIaL2 home (GiB) | DIaL2 scratch (TiB) | DIaL3 home (GiB) | DIaL3 scratch (TiB) | home/work (TiB) | Tape (TiB) | Cosma home (GiB) | Cosma7 data (TiB) | Cosma 8 data (TiB) | Tape (TiB) |
| Default (if exists) | 50GiB  per user |  | 100GiB default per user |  | 100GiB default per user |  |  |  | 10GiB default per user |  |  |  |
| Existing storage from previous project (to be retained) |  |  |  |  |  |  |  |  |  |  |  |  |
| New storage amount |  |  |  |  |  |  |  |  |  |  |  |  |
| **Total storage amount** |  |  |  |  |  |  |  |  |  |  |  |  |

***Please note: The PI is responsible for removing the data from the system. There will be a 3 month grace period after the end of the project during which this should be done.***

**Please explain how data requirements would change if your compute resources were not awarded in full (e.g. if you only receive 80% of your compute time would your storage requirements reduce to 80% or remain the same as for the full allocation).**

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# Technical Assessment (*To be completed by TWG/RSE team).*

**Please enter the date received by TWG/RSE team: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

***Please complete the following boxes. Below the simple Yes/No answer could you please comment?***

|  |  |
| --- | --- |
| **Do the applicants have the technical expertise required for the proposed work?** | **Yes/No** |
| ***[enter comment]*** | |

|  |  |
| --- | --- |
| **Is the software specified technically suitable for DiRAC? [comment for each system requested or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment]*** | |

|  |  |
| --- | --- |
| **Has evidence of scaling and efficiency been provided that shows speedup to required job size for the software specified? [comment for each system requested or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment]*** | |

|  |  |
| --- | --- |
| **Has the applicant described their workflow clearly, does it make sense and have potential bottlenecks been considered? [comment for each system requested or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment]*** | |

|  |  |
| --- | --- |
| **Is the compute time requested reasonable and has the job breakdown been technically justified [comment for each system requested or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment]*** | |

|  |  |
| --- | --- |
| **Are the storage requests reasonable? [comment for each system or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment]*** | |

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| --- | --- |
| **Is the application, as outlined above, suitable for access to the DiRAC service?** | **Yes/No** |
| D**oes the project require the technical capabilities of DiRAC?** | **Yes/No** |
| ***[enter comment – including suggestions for alternatives if appropriate]*** | |

|  |  |
| --- | --- |
| **Would a different computing resource within DiRAC be more appropriate for some or all of the work carry out here? [comment for each system requested or duplicate as appropriate]** | **Yes/No** |
| ***[enter comment – including suggestions for alternatives if appropriate]*** | |

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| **Please provide a short summary of your assessment** |
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**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Position (Job Title):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date Completed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. The DiRAC HPC service providers are the Universities of Cambridge, Durham, Edinburgh and Leicester and the DiRAC Project Office is hosted by University College London. [↑](#footnote-ref-1)