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Human Organ Atlas Hub (HOAHub)

**Application Form  
for BM18 Beamtime Allocation at ESRF**

**Overview of HOAHub**

Hierarchical Phase-Contrast Tomography (HiP-CT), co-developed through a UCL led Long-term Proposal (LTP) at European Synchrotron Radiation Facility (ESRF), uniquely enables hierarchical scanning of a whole organ at 8-20 𝜇m/voxel down to <1 𝜇m/voxel in local regions anywhere within the intact organ**.** With the completion of beamline BM18, sample preparation (21 days) and imaging (24hrs) of intact brains is routinely down to 22 days. These developments herald new potentials for HiP-CT.

To fully utilise the capabilities of HiP-CT on BM18 we have created a physical and virtual Human Organ Atlas Hub (HOAHub), which will use HiP-CT to scan whole human organs with local cellular resolution. This HOAHub brings together interdisciplinary groups to produce the novel experimental and computational methods needed to analyse and interpret the scale-bridging HiP-CT data. The goals of the HOAHub are to:

1. Solve key biomedical challenges.

2. Correlate up and down scales and across modalities.

3. Enable groups worldwide to use HiP-CT and propagate the technique to other beamlines and facilities.

4. Create an open access Human Organ Atlas (HOA, [human-organ-atlas.esrf.eu](https://human-organ-atlas.esrf.eu/)) in health, ageing and disease.

The HOAHub has been awarded 48-60 shift per year, over 3 years. There are two main routes for beamtime allocation **Biomedical challenge beamtime** and **Feasibility beamtime[[1]](#footnote-1)**. Both may utilise new samples or may apply to rescan samples currently held onsite at ESRF (provided by the LADAF). In addition, HOAHub provides on-site and virtual training in: HiP-CT scanning (training beamtimes), sample prep, image reconstruction and image analysis.

**Guidance**

This form is to be completed when requesting either route for HOAHub beamtime.

If beamtime is approved, all users on the application form must complete user registration at ESRF and should attend at HiP-CT training (when applicable) ahead of their scheduled beamtime.

Please pay particular attention to the requirement that future grant proposals, new collaboration and high-impact publications should result from the allocation of beamtime. The specification criteria by which the proposals will be ranked are:

1. Scientific and Biomedical Merit:
   * a grade between 1 and 5 will be assigned, with 5 being the top score.
   * See Guidance notes on website to optimise your submission.
2. Impact:
   * graded 1-5, based on potential for :
     + establishing new, or building on existing HOAHub collaborations, both academic and industrial
     + supporting the [HOAHub aims](https://mecheng.ucl.ac.uk/HOAHub/).
     + helping develop personnel and disseminate HiP-CT
3. Prior Track Record and Feasibility of Proposed Experimental and Analysis Methods.
   * grade 1-5, based on outputs from prior projects, and commitment to HOAHub Training including:
     + publications
     + grants
     + building on / establishing new, collaborations
     + impact on society
     + assigned personnel/infrastructure for training and analysis
4. Number of people trained.

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| Proposal | HOAHub BM18 proposal |

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| --- | --- |
| Experiment Title |  |

|  |  |  |
| --- | --- | --- |
|  | Name | Affiliation |
| Principal Investigator[[2]](#footnote-2) |  |  |
| Co-Investigator |  |  |
| Co-Investigator |  |  |
| Co-Investigator |  | (*Add or remove more rows as appropriate.)* |

|  |  |
| --- | --- |
| Contact Name |  |
| Telephone |  |
| Email |  |

**Check one of the below options[[3]](#footnote-3):**

Biomedical Challenge Beamtime  Feasibility Beamtime

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| --- | --- |
| Shifts Requested (1 shift = 8 hours) |  |
| Special requirements of beamline |  |
| Is the work industrially sponsored? |  |
| Has a similar proposal been submitted previously? Give details. |  |
| Will you utilise new samples, existing samples held at ESRF[[4]](#footnote-4) or a combination of both? |  |
| Has this proposal been discussed with the Beamline Scientist ([Hector Dejea](mailto:hector.dejea@esrf.fr) or [Paul Tafforeau](mailto:paul.tafforeau@esrf.fr)) at ESRF BM18, and what is their feedback? Give details.[[5]](#footnote-5) |  |

|  |  |
| --- | --- |
| Brief summary of the proposal, including key objectives and science impact (max. 250 words) |  |

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| Briefly summarise proposed contributions and interactions with the wider HOAHub (max. 200 words)[[6]](#footnote-6) |  |

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| Publications and or grant proposal you hope will arise from the beamtime if granted. (max. 100 words) |  |

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| **Experience and Training Requirements** |

HiP-CT is a complex technique that generate very large (up to 10TB per sample) datasets. Training is offered as a part of the HOAHub. All teams with accepted proposals will have priority access to send team members to ESRF on-site and virtual training (1-3 days), approx. 3-1 months ahead of their beamtime. Training is offered in 1) Sample preparation (utilising our specialised on-site organ preparation lab), 2) HiP-CT scanning procedure (basic training in running HiP-CT scans on BM18) 3) Image reconstruction (basic principles and example datasets), and 4) Image analysis (large data handling best practices and utilising cloud storage etc).

What training is required will depend on the prior expertise of the team, this section allows us to understand these needs.

**Prior Beamline/Synchrotron experience**

Please state your prior use of Synchrotron facilities or other Beamlines**[[7]](#footnote-7)**, and how this has supported existing grants, lead to new proposals/ grants, and what impact they resulted in (papers and other impacts). Please expand as required.

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| --- | --- | --- | --- |
| **Prior/Current Synchrotron Proposals (No./Title, 3 most relevant ones)** |  | Dates |  |
| Resulting Impact attributed (grants, publications, collaborations) |  | | |

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| **Prior Image Analysis[[8]](#footnote-8)**  Please state your prior use of large imaging data volumes, what size of data were you working with and what computational and personnel resource was used? (max. 200 words) |  |

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| **Prior Sample Preparation Experience[[9]](#footnote-9)**  Please state your prior experience of human sample handling.  (max. 150 words) |  |

**What Training requirements do you foresee you /your team needing?**

|  |  |
| --- | --- |
| **Training Requirements** | **Number of people require training** |
| Sample prep (required for first accepted biomedical challenge) |  |
| Beamline functioning (required for biomedical challenge) |  |
| Image reconstruction |  |
| Image analysis |  |
| **Total number of people require training above:[[10]](#footnote-10)** |  |

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| **Experimental Information** |

**Sample Information – (ESRF form will be required if accepted)**

|  |  |
| --- | --- |
| Sample type(s) (organ) |  |
| Number of samples |  |
| Sample size approx. largest diameter and length (cm) |  |
| Are other experimental upstream or downstream analyses planned E.g. histology, MRI?  If yes please specify |  |

**Scanning Requirements**

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| --- | --- |
| Required whole sample overview resolutions |  |
| Required number and resolution of zoom regions |  |

**Sample Ethics[[11]](#footnote-11)**

Does the sample have local ethical consent (attach a copy to application)

Has French transport ethics been applied for (attach application documents)

Has French transport ethics been applied for (attach approval letter)

**Sample Environment**

|  |  |
| --- | --- |
| Required rigs (specify temperatures, pressures, etc.) |  |
| Are samples radioactive? Give details. |  |
| Are there any other sample hazards? Give details. (Note all human sample must be deactivated, through e.g. fixation or other approved method) |  |
| What solution will your sample be scanned in. If none of the list is applicable please type your requirements. | Choose an item. |
| Sample arrival and removal: By user or shipped[[12]](#footnote-12) | Choose an item. |

**External Peer-Review**

When you submit your application via email, you can let us know here if there are any reviewers that you suggest are particularly suitable to comment on your application, or those that you consider we should not approach (please provide a brief factual reason).

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| **Science Case (up to two pages, including figures and references)** |

Please clearly state the aims and objectives and provide details on the image (or other) analysis methods that will be applied to the data once collected, and what data/compute infrastructure will be used to perform this.

1. Data access only requests – Request for access to existing HOAHub data for novel image analysis method development may be considered. Please email the request to [hoahubesrf@gmail.com](mailto:hoahubesrf@gmail.com). [↑](#footnote-ref-1)
2. For a biomedical challenge beamtime, PI must be a **member** of HOAHub. [↑](#footnote-ref-2)
3. A feasibility beamtime is normally ~1 shift and is for the purpose of testing a new idea or acquiring data for grant application. These beamtimes may also be used for training new user groups. A biomedical challenge beamtime is normally 2-6 shifts, and is a planned series of scans that will help solve a biomedical challenge. [↑](#footnote-ref-3)
4. Please contact ESRF Beamline Scientist for a list of organs currently held onsite at ESRF. [↑](#footnote-ref-4)
5. It is essential to discuss with Beamline Scientist before submitting a proposal to obtain realistic number of shifts required and other experimental information. [↑](#footnote-ref-5)
6. Please address the following questions: Are you using existing data from the HOA (i.e. controls)? How will you expand the HOA? What working groups will you be interacting with? What will you contribute – data, methods, etc. to the HOAHub? [↑](#footnote-ref-6)
7. If you do not have experience with synchrotron imaging, kindly provide details of any other relevant imaging modalities you are familiar with. [↑](#footnote-ref-7)
8. Not limited to HiP-CT or synchrotron X-ray techniques. [↑](#footnote-ref-8)
9. Not limited to sample preparation for HiP-CT or synchrotron X-ray techniques. [↑](#footnote-ref-9)
10. Number of unique individuals who require any of the above training. For example, it will be 1 (instead of 4) if that person requires all the above trainings. [↑](#footnote-ref-10)
11. All samples must have both local ethics and authorisation from French Ministry of Research for transportation of human organs and derivatives to ESRF (French transport ethics), these must be awarded ahead of the beamtime. HOAHub provides templates and assistance for application of French transport ethics but not local ethics. Please contact the Co-chair, Director or beamline scientist for further information or to discuss timelines for application. If applying to use organs already held onsite, these have all necessary ethical approval. [↑](#footnote-ref-11)
12. Shipping conditions are specified in French transport ethic documentation and protocol must be followed. [↑](#footnote-ref-12)