

DATA MANAGEMENT PLAN

Grant Agreement number 21NRM01

Project short name HiDyn

Project full title Support for the standardisation of luminance distribution measurements for assessing glare and obtrusive light using high-dynamic-range imaging systems

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Confidentiality Status:
PU - Public, fully open

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European Partnership  Co-funded by the European Union

Data Management Plan

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1 Data management plan

1.1 Data summary

Questions	Answers
1 Will you re-use any existing data and what will you re-use them for? State the reasons if re-use of any existing data has been considered but discarded.	<p>The project will re-use internal data from the participants and publicly available data. The data will be re-used to verify the project results.</p> <p>For the revision of standards, i.e. ISO/CIE 19746:2014, the existing standards will be used as basic input. The CIE will provide personal copies to the consortium partners if this is required in a specific case. The project will be based mostly on new data. With respect to program code, internal data from EMPIR JRP 19NRM02 RevStdLED and EMPIR JRP 20NRM01 MetTLM and some program modules currently already freely available on GitHub (under GPL v3 licenses and CC licenses) will be used.</p>
2 What types and formats of data will the project generate or re-use?	<p>The project will generate data of the following types and formats:</p> <ul style="list-style-type: none"> • Graphics: png, tif, gif, tiff, jpg, nef, raw, cr2, svg, fig; • luminance images: tics, pf, pus; • Tables: opju, xlsx, csv, mat • Text: txt (Unicode), docx, pptx, pdf, md, bib • Program code: py (Python language), m (Matlab language) • Jupyter notebook • Datasets: hdf5, npz • CAD design: stl • Research outputs will include new methods, algorithms, source code and standard source
3 What is the purpose of the data generation or re-use and its relation to the objectives of the project?	<p>The data and other research outputs are generated from measurements, simulations, and verifications. They will be re-used by the consortium to meet all four technical objectives of the project and, to deliver impact and facilitate the take-up of the project outcomes (objective 5). They will be re-used for training purposes.</p> <p>The data is also collected for the purpose of generating new standardizing documents and for the revision of written standards in the field of radiometry and photometry. It is used in meeting the project's objectives and in conference and peer-reviewed publications. It is also used by official reporterships between CIE technical committees revising the international standards and to make the results available for the CIE TC 2-86, CIE TC 2-95 CIE TC2-96, and CIE TC 3-57.</p>
4 What is the expected size of the data that you intend to generate or re-use?	<p>The expected data volume is between 40 GB and 150 GB.</p> <ul style="list-style-type: none"> • HDR luminance image generation via LDR sequence (merging code) + uncertainty algorithms: source code (text files), size <1MB, • Glare and obtrusiveness assessment algorithm + uncertainty algorithms: source code (text files), size <1MB, • Virtual scenes for HDR luminance uncertainty evaluation testing: images, size 20x 20MB, • Virtual scenes for testing the glare evaluation: images, size 20x 10MB, • Virtual scenes for obtrusive light evaluation: images, size 20x 20MB

	<ul style="list-style-type: none"> Exemplary dataset: real scenes (experimental measurements): images, size 20x 20MB to 400MB
5 What is the origin/provenance of the data, either generated or re-used?	<p>Data originates from a variety of sources, including participant's pre-existing data, data from the scientific literature, and data collected during project activities by measurements, simulations, and verifications.</p> <p>The data generated is from measurements, simulations, and verifications. The data collected from domestic properties will remain confidential and will not be included in the repository.</p>
6 To whom might your data be useful ('data utility'), outside your project?	The data is suitable for use by other research groups working on topics related to HDR imaging, glare assessment, and obtrusive light. It will also be useful for standards committees including CIE TC 2-86, CIE TC 2-95, and CIE TC 3-57, to academic research and industry stakeholders for verification of their hardware/software.

1.2 Findable, Accessible, Interoperable and Re-usable (FAIR) Data

1.2.1 Making data findable, including provisions for metadata

Questions	Answers
7 Will data be identified by a persistent identifier?	<p>The following identifiers will be created:</p> <ul style="list-style-type: none"> Handle / DOI, Commit/tag on Git repository
8 Will rich metadata be provided to allow discovery? What metadata will be created? What disciplinary or general standards will be followed? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.	<p>The metadata created for all of the project's deposited datasets will be open under a Creative Commons Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles.</p> <p>The metadata will provide information at least about on the following: Description of the file (to help users understand what the file contain and how data need to be used); date of deposit; author(s); venue: possible embargo; acknowledgement of the European Partnership on Metrology funding; grant project name, acronym and number; licensing terms; persistent identifiers and the authors involved.</p> <p>Where applicable, the metadata will include persistent identifiers for related publications and other research outputs.</p>
9 Will search keywords be provided in the metadata to optimise the possibility for discovery and then potential re-use?	Yes, the following search keywords will be provided for use with the deposited datasets: HDR imaging, HDR algorithm, ILMD, luminance, luminance contrast, glare, obtrusive light, HiDyn.
10 Will metadata be offered in such a way that it can be harvested and indexed?	<p>Yes, the data/research outputs will be deposited and published in trusted repositories located using the Registry of Research Data Repositories (https://www.re3data.org) that comply with FAIR principles. The metadata are indexed in a searchable resource. Metadata are licensed under CC0, except for email addresses.</p> <p>The source code will be stored in PTB's GitLab server https://gitlab1.ptb.de/hidyn (as projects with restricted access and projects with public access), in GitHub (as public repositories in the Project https://github.com/HiDyn-EURAMET-EPM-21NRM01), or in a similar open access repository. After the completion of the project, in case the code is only stored in PTB's GitLab server, it will be decided</p>

	whether the code will be transferred to an additional open access repository.
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1.2.2 Making data accessible

Questions	Answers
Repository:	
11 Will the data be deposited in a trusted repository?	<p>The data and associated metadata, documentation and code will be deposited in a trusted open access repository, namely in PTB's open access repository https://oar.ptb.de or in the public repository of Zenodo https://zenodo.org/communities/hidyn/ (i.e. publications, guides, exemplary dataset) and on GitLab (program code and images for verification, https://github.com/HiDyn-EURAMET-EPM-21NRM01).</p> <p>Program code will be hosted and made available via PTB's SharePoint (within the consortium only) and using PTB's GitLab server https://gitlab1.ptb.de/hidyn with separate projects for internal and external availability or in GitHub (as public repositories in the Project https://github.com/HiDyn-EURAMET-EPM-21NRM01).</p> <p>Contracts, a contact list, minutes of meetings, project reports and deliverables, technical reports, and an archive of all presentations/publications will also be stored on PTB's SharePoint.</p>
12 Have you explored appropriate arrangements with the identified repository where your data will be deposited?	No. The data is expected to be uploaded via standard procedures and require no special arrangements.
13 Does the repository ensure that the data are assigned an identifier? Will the repository resolve the identifier to a digital object?	The repository will assign an identifier (DOI) to each of the project's deposited dataset. The repository will resolve the identifier to a digital object.
Data:	
14 Will all data be made openly available? If certain datasets cannot be shared (or need to be shared under restricted access conditions), explain why, clearly separating legal and contractual reasons from intentional restrictions. Note that in multi-beneficiary projects it is also possible for specific beneficiaries to keep their data closed if opening their data goes against their legitimate interests or other constraints as per the Grant Agreement.	<p>All the data that are needed to verify the results presented in scientific publications and in deliverables will be made openly available per default unless there is a specific reason not to publish the data.</p> <p>Other data may be made available on a case-by-case basis they are relevant for third parties.</p> <p>The following data will not be made publicly available:</p> <ul style="list-style-type: none"> - Data obtained with the permission of third parties, but the third parties have not agreed to make the data publicly available; - Data that compromise the protection of participant(s) intellectual property; - Data which are commercially sensitive and cannot be shared; - Data which are redundant to already openly available data, i.e. from repeated measurements of a constant scene. - Intermediate data generated during the course of the project and replaced by new data (e.g. repetition of tests) to avoid duplication and confusion in data usage

Questions	Answers
	The level of data made available will also be considered, for example, pre-processed data will not be provided unless there is a clear reason for doing so.
15 If an embargo is applied to give time to publish or seek protection of the intellectual property (e.g. patents), specify why and how long this will apply, bearing in mind that research data should be made available as soon as possible.	The data used in scientific publications, posters and oral presentations will be made available for re-use as soon as reasonably possible. If a patent application is pending, the data are expected to be subject of an embargo of 30 months.
16 Will the data be accessible through a free and standardised access protocol?	The data will be accessible through a free and standardized access protocol of the chosen open access repository. For the internal software code/scripts, users from the consortium are required to register to use the repository (GitLab project and SharePoint).
17 If there are restrictions on use, how will access be provided to the data, both during and after the end of the project?	There are no restrictions on the use of the published data expected so far. This topic was discussed at the M18 meeting, M27 meeting, and M36 meeting as more data may come in. But users will be required to acknowledge the project and the source of the data in any resulting publications, according to the latest version of the CC-BY license.
18 How will the identity of the person accessing the data be ascertained?	If necessary, an authentication system or a data on demand function will be provided.
19 Is there a need for a data access committee (e.g. to evaluate/approve access requests to personal/sensitive data)?	This consortium will not establish a Data Access Committee. The appointed corresponding author, with responsibility for the data, will, in consultation with the coordinator, decide alone about granting access to the data.
Metadata:	
20 Will metadata be made openly available and licensed under a public domain dedication CC0, as per the Grant Agreement? If not, please clarify why. Will metadata contain information to enable the user to access the data?	The metadata will be licenced under CC0, except for the email addresses. The metadata will contain information that enable users to access the data.
21 How long will the data remain available and findable? Will metadata be guaranteed to remain available after data are no longer available?	The data will remain available and findable for the lifetime of the open access repository.
22 Will documentation or reference about any software be needed to access or read the data and will this be included? Will it be possible to include the relevant software (e.g. in open source code)?	<p>The data can be read and used with common commercial software (e.g., MS Office, python, Matlab), specialized commercial software (e.g. ILMD control software, i.e. LMK LabSoft or LumiDisp, and software for glare evaluation, i.e. eval glare), software code/scripts developed by the consortium, or with free software. More maybe added during course of the project.</p> <p>No additional documentation is needed for the software. Many software code already exists, either as freeware or as a commercial product. Software generated to complement the guidelines will be made available for open access using PTB's GitLab server</p>

Questions	Answers
	https://gitlab1.ptb.de/hidyn , GitHub (as public repositories in the Project https://github.com/HiDyn-EURAMET-EPM-21NRM01), or Zenodo https://zenodo.org/communities/hidyn/ .

1.2.3 Making data interoperable

Questions	Answers
23 What data and metadata vocabularies, standards, formats or methodologies will you follow to make your data interoperable to allow data exchange and re-use within and across disciplines? Will you follow community-endorsed interoperability best practices? Which ones?	<p>The datasets will use the trusted repository's basic metadata schema for administrative data, which is compliant with the recommended standards used by DataCite (https://search.datacite.org/) and OpenAIRE (https://www.basemsearch.net/).</p> <p>For individual datasets, the following discipline-specific vocabularies, standards, formats, and methodologies will be used:</p> <ul style="list-style-type: none"> • International Vocabulary of Metrology (JCGM 200:2012) and the Guide to the expression of uncertainty in measurement (JCGM 100:2008, JCGM 101:2008) • HDF5 (hierarchical file format; subject-independent). • INSPEC (vocabulary + classification; physics). • CIE (International Lighting Vocabulary (ILV, CIE S 017/E:2020))
24 In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies? Will you openly publish the generated ontologies or vocabularies to allow their re-use, refinement or extension?	The compatibility of our project-specific ontologies and vocabularies will be guaranteed through appropriate mappings (glossary, alignment tables, etc.) to more commonly used ontologies i.e. the International Lighting Vocabulary (ILV). The generated ontologies and vocabularies will be published.
25 Will your data include qualified references ¹ to other data (e.g. other data from your project, or datasets from previous research)?	Yes, the project's datasets that will be deposited in the chosen repository will include qualified references to other datasets from the same project and/or from previous research.

1.2.4 Increase data re-use

Questions	Answers
26 How will you provide documentation needed to validate data analysis and facilitate data re-use (e.g. readme files with information on methodology, codebooks, data cleaning, analyses, variable definitions, units of measurement, etc.)?	A short README file (e.g. Markdown) will be provided together with the data, in order to enable data analysis and to facilitate data re-use.
27 Will your data be made freely available in the public domain to permit the widest re-use possible? Will your data be	The data will either be licensed under the latest available version of the Creative Commons Attribution International Public License (CC BY) or a license with equivalent rights as set out in the Grant Agreement. Users will be required to acknowledge the consortium and the source

¹ A qualified reference is a cross-reference that explains its intent. For example, X is regulator of Y is a much more qualified reference than X is associated with Y, or X see also Y. The goal therefore is to create as many meaningful links as possible between (meta)data resources to enrich the contextual knowledge about the data. (Source: **Fehler! Linkreferenz ungültig.**)

Questions	Answers
licensed using standard re-use licenses, in line with the obligations set out in the Grant Agreement?	of the data in any resulting publications. Alternatively, the Creative Commons Public Domain Dedication License (CC 0) will be used.
28 Will the data produced in the project be useable by third parties, in particular after the end of the project?	Any data published in open-access journals will be usable by third parties after the datasets have been deposited in the repository. The data that does not relate to peer-reviewed publications will be made available for re-use on a case-by-case basis.
29 Will the provenance of the data be thoroughly documented using the appropriate standards?	Yes, the provenance and context of the data will be thoroughly documented to meet relevant standards. Data will be accompanied by information on how they were captured, processed, analysed, and validated. Other information that enables interpretation and use will also be provided.
30 Describe all relevant data quality assurance processes.	Data quality will be assured through several quality assurance procedures: <ul style="list-style-type: none"> • Repeated and comparison measurements. • Adherence to standards for data recording. • Use of controlled vocabularies and standard terminology. • Metrological characterisation of the measurement setups. • Validation of the data collected. • Provision of test results along with the data. • Peer-review of publications based on the data.
31 Further to the FAIR principles, DMPs should also address research outputs other than data, and should carefully consider aspects related to the allocation of resources, data security and ethical aspects.	<p>The estimated costs for making the (data and) other research outputs FAIR is 6,000 € (personnel costs) (see question 34). The costs for making other research outputs FAIR were included in the project's budget and will be claimed if compliant with the Grant Agreement's conditions. The coordinator, with support from the participants, will also have overall responsibility for managing other research outputs (see question 36). Where feasible, long-term preservation will be ensured by depositing the other research outputs in repositories. The appointed corresponding author, with responsibility for the data, will, in consultation with the coordinator, decide on a case-by-case basis on which other research outputs will be deposited and for how long.</p> <p><i>Security of other research outputs</i> All participants work in compliance with scientific community guidelines. The participants will store other research outputs on their organisations' networks, which are protected by firewall, backups etc. Other research outputs will also be stored in the project's SharePoint environment, with password-protected login, PTB's Cloud Storage PowerFolder (https://box.ptb.de/folderstable), and the project's GitLab environments. Deposition in public repositories will provide additional security as they have multiple replicas in a distributed file system which is backed up on a nightly basis. This project will not generate sensitive other research outputs. The other research outputs will be safely stored in open access repositories.</p> <p><i>Ethical aspects</i> There are issues that could impact on the sharing of other research outputs.</p>

Questions	Answers
	<ul style="list-style-type: none"> Information relating to other research outputs acquired from third parties, e.g. manufacturers, will not be shared without their explicit consent. Information relating to other research outputs collected by the consortium at commercial sites will not be shared without the site owner's explicit consent. <p>The work has been reviewed and approved by the EPM ethics committee. If ethical issues are identified, the coordinator will contact MSU for advice.</p> <p>The project will not share other research outputs with identifiable personal information. Sensitive information relating to the other research outputs will be collected, separated as soon as possible and kept secure.</p>

1.3 Other research outputs

Questions	Answers
32 In addition to the management of data, beneficiaries should also consider and plan for the management of other research outputs that may be generated or re-used throughout their projects. Such outputs can be either digital (e.g. software, workflows, protocols, models, etc.) or physical (e.g. new materials, antibodies, reagents, samples, etc.).	<p>The software code/scripts developed in the project will be released under a licensing scheme compatible to the definition of the Open Source Initiative. i.e. GNU-GPL license (GNU 3.0), CC-BY 4.0, or MIT.</p> <p>This project will re-use existing data and other research outputs, i.e. GPGs from EMPIR 19NRM01 RevStdLED. Other research outputs will be exchanged via PTB's SharePoint (within the consortium only and with selected stakeholders) and PTB's Cloud Storage PowerFolder (https://box.ptb.de/folderstable). Please also see information provided in Section 1.1.</p>
33 Beneficiaries should consider which of the questions pertaining to FAIR data above, can apply to the management of other research outputs, and should strive to provide sufficient detail on how their research outputs will be managed and shared, or made available for re-use, in line with the FAIR principles.	As far as possible, the FAIR data approaches specified in questions 7-30 above will be applied to the management of this project's other research outputs. This commitment will be met by placing the new methods, and protocols in a repository in line with the requirements of the project's consortium agreement.

1.4 Allocation of resources

Questions	Answers
34 What will the costs be for making data or other research outputs FAIR in your project (e.g. direct and indirect costs related to storage, archiving, re-use, security, etc.) ?	The estimated costs for making the data and other research outputs Findable, Accessible, Interoperable and Re-usable (FAIR) are 6,000 € (personnel costs). These costs have been kept to a minimum by using a free repository and by making only relevant data and other outputs FAIR.
35 How will these be covered? Note that costs related to research data/output	The costs for making the data FAIR are included in the project's budget and will be claimed if compliant with the Grant Agreement's conditions.

management are eligible as part of the European partnership on metrology grant (if compliant with the Grant Agreement conditions).	
36 Who will be responsible for data management in your project?	The appointed corresponding author, with responsibility for the data, in consultation with the coordinator will have overall responsibility for the management of data/research outputs and quality assurance. The coordinator, with support from the participants, will be responsible for coordinating updates to the data management plan and for deciding on a case-by-case basis which data/research outputs will be kept and for how long, for organising backup and storage, archiving, and for depositing the data/research outputs within the chosen repositories.
37 How will long term preservation be ensured? Discuss the necessary resources to accomplish this (costs and potential value, who decides and how, what data will be kept and for how long)?	Long term preservation will be ensured by depositing the data within repositories. There are no costs associated with the long-term preservation of the data in these repositories. The appointed corresponding author, with responsibility for the data, will, in consultation with the coordinator, decide on a case-by-case basis on what data will be kept and for how long.

1.5 Data security

Questions	Answers
38 What provisions are or will be in place for data security (including data recovery as well as secure storage/archiving and transfer of sensitive data)?	All participants work in compliance with scientific community guidelines. The partners will store data on their organisations' networks, which are protected by firewall, backups etc. Data will also be stored in the PTB's SharePoint environment, with password-protected login, and PTB's Cloud Storage PowerFolder. An enhanced data security will be provided by the usage of multiple copies of the files. Deposition in the public repository will provide additional security as it has multiple replicas in a distributed file system which is backed up on a nightly basis. <i>Transfer of sensitive data:</i> This project will not generate sensitive data. Care were taken not to capture images of persons (or only capture persons with image resolution that do not allow to capture sensitive data) while working with camera systems.
39 Will the data be safely stored in trusted repositories for long term preservation and curation?	Yes, the data will be safely stored in the chosen repositories. PTB's Open Access Repository is stored on two physically and geographically separated servers that are regularly backed up.

1.6 Ethics

Questions	Answers
40 Are there, or could there be, any ethics or legal issues that can have an impact on data sharing? These can also be discussed in the context of the ethics review. If relevant, include references to ethics report(s) and the ethics section in the Annex 1.	There are no ethics or legal issues foreseen, related issues that could impact data sharing are: <ul style="list-style-type: none"> • Data acquired from third parties, e.g., manufacturers will not be shared without their explicit consent; • Data acquired from third parties, e.g. manufacturers, will not be shared without their explicit consent. • Data collected by the consortium at commercial sites will not be shared without the site owner's explicit consent. • Data acquired together with (potential) collaborators will be subject to the Letter of Agreement signed between the consortium and the collaborator.

Questions	Answers
	The work has been reviewed and approved by the EPM ethics committee. If ethical issues are identified, the coordinator will contact MSU for advice.
41 Will informed consent for data sharing and long-term preservation be included in questionnaires dealing with personal data?	The project does not deal with and has no plans to share data with identifiable personal information.

1.7 Other issues

Questions	Answers
42 Do you, or will you, make use of other national / funder / sectorial / departmental procedures for data management? If yes, which ones (please list and briefly describe them)?	Data management will be compliant with: <ul style="list-style-type: none"> • The research data policy of the European Partnership on Metrology; • The European laws (e.g., GDPR); • Institutional guidelines; • Scientific community guidelines.

2 Open science: research data management

Statement	Put an X in the box to confirm	Or, list any exceptions to this
All participants have adhered to the requirements of the project's GA and CA with respect to open science: research data management (GA Article 17 and its Annex 5) for this reporting period	<input checked="" type="checkbox"/>	