⟨EQUAL|TY⟩

Efficient QUantum ALgorithms for IndusTrY

WP7 Project Management

D7.4 Data management report

Version: 1.0

Date: 27/10/2025

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Document control

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Contributor(s)	all
Reviewer(s)	Kirill Shiianov, Hendrik Meer
Document description	This deliverable will report on the progress and application of the data management plan, considering the aspects such as data management and preservation.

[1] R: Document, report (excluding the periodic and final reports); DEM: Demonstrator, pilot, prototype, plan designs; DEC: Websites, patents filing, press & media actions, videos, etc.; DATA: Data sets, microdata, etc.; DMP: Data management plan; ETHICS: Deliverables related to ethics issues.; SECURITY: Deliverables related to security issues; OTHER: Software, technical diagram, algorithms, models, etc.

[2] PU – Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page); SEN – Sensitive, limited under the conditions of the Grant Agreement; Classified R-UE/EU-R – EU RESTRICTED under the Commission Decision No2015/444; Classified C-UE/EU-C – EU CONFIDENTIAL under the Commission Decision No2015/444; Classified S-UE/EU-S – EU SECRET under the Commission Decision No2015/444

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Version control

Version[3]	Editor(s), Contributor(s), Reviewer(s)	Date	Description
0.1	Pranjal Dhole	15/05/2025	Document template released
0.4	Linus Scholz, Felix K. Schwab	14/10/2025	Intermediate document proposed by editor
0.5	Kirill Shiianov, Hendrik Meer	16/10/2025	Intermediate review
0.8	Consortium	21/10/2025	Consortium review
0.9	Felix K. Schwab	24/10/2025	Document revised by editor
0.98	Kirill Shiianov	27/10/2025	Document proof-read for finalisation
1.0	Hendrik Meer	27/10/2025	Document released by project lead

[3] 0.1 – TOC proposed by editor; 0.2 – TOC approved by reviewer; 0.4 – Intermediate document proposed by editor; 0.5 – Intermediate document approved by reviewer; 0.8 – Document finished by editor; 0.85 – Document reviewed by reviewer; 0.9 – Document revised by editor; 0.98 – Document approved by reviewer; 1.0 – Document released by Project Coordinator.

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Abstract

A quantum revolution is unfolding, and European scientists are on the lead. Now, it is time to take decisive action and transform our scientific potential into a competitive advantage. Achieving this goal will be critical to ensuring Europe's technological sovereignty in the coming decades.

EQUALITY brings together scientists, innovators, and prominent industrial players with the mission of developing cutting-edge quantum algorithms to solve strategic industrial problems. The consortium develops a set of algorithmic primitives which could be used as modules for various industry-specific workflows. These primitives include differential equation solvers, material simulation algorithms, quantum optimisers, etc.

To focus our efforts, we target eight paradigmatic industrial problems. These problems are likely to yield to early quantum advantage and pertain to the aerospace and energy storage industries. They include airfoil aerodynamics, battery and fuel cell design, space mission optimisation, etc. Our goal is to develop quantum algorithms for real industrial problems using real quantum hardware. This requires grappling with the limitations of present-day quantum hardware. Thus, we devote a large portion of our efforts to developing strategies for optimal hardware exploitation. These low-level implementations account for the effects of noise and topology and optimise algorithms to run on limited hardware.

EQUALITY builds synergies with Quantum Flagship projects and Europe's thriving ecosystem of quantum start-ups. Use cases are being tested on quantum hardware from Europe's leading vendors and HPC centres. The applications targeted have the potential of creating billions of euros for end-users and technology providers over the coming decades. With EQUALITY, we aim at playing a role in unlocking this value and placing Europe at the centre of this development. The project gathers 8 partners and has a budget of €6M over 3 years.

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Consortium

The EQUALITY consortium members are listed below.

Legal Name on Grant Agreement	Short name	Country
CAPGEMINI DEUTSCHLAND GMBH	CAP	DE
DA VINCI LABS	DVL	FR
AIRBUS OPERATIONS GMBH	AOG	DE
DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV (DLR)	DLR	DE
FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGE-WANDTEN FORSCHUNG EV (FHG)	ENAS	DE
INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET AUTOMATIQUE (INRIA)	INRIA	FR
UNIVERSITEIT LEIDEN (ULEI)	ULEI	NL

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Disclaimer

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List of Abbreviations

DOI	Digital Object Identifier
GA	Grant Agreement
SLOC	Source Line of Code
WP	Work Package

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Executive Summary

This document is a deliverable of the EQUALITY project, funded under grant agreement number 101080142. This deliverable, D7.4 Data management report, is part of work package, WP7 Project Management, and reports on the data management in the EQUALITY project. Its basis is the data management plan laid out in deliverable D7.3 ”Data management plan” [1]. The main purpose of this document is to collect and present how data is handled and preserved by the project partners within the EQUALITY project. This includes how files will be handled after the end of the project.

1 Introduction

In this deliverable we collect information of all project partners on which kind of data was generated and how it was handled within the project. This allows to assess how closely the data management plan, D7.3 ”Data management plan” [1], has been followed and furthermore where data may be found after the project’s end. For this purpose, each project partner contributed a filled out form on the data management. This individual data is partly analysed and formatted to give project-wide estimations on the data used and produced.

2 Overview

This is a collection of data provided by the different project partners involved in the EQUALITY project. Minimal analyses were performed to provide rough parameters for the overall project, but otherwise the information provided is reproduced without further comment as it was made available by the project partners.

2.1 Adaptions to the original data management plan

Data management is a live and evolving task within each project. While the general basis in the EQUALITY project is the data management plan [1] created at the beginning of the project, each project partner has developed its own strategy to deal with specific needs or non-standard data. Hence, this report focuses more on listing the data along the broad lines such as FAIR and data preservation of the original plan rather than going into each detail. To consider each project partner’s individual situation, a questionnaire based on these broad lines was created and the answers given are stated for each partner separately.

2.2 Structure of information

The statements of each project partner will be listed in questionnaire style in the following section. Some general analysis and summary of the data management is provided in Sections 4 and 5.

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3 Data Management

The data management of the project is presented by each partner itself in order to better cover the individual situations and restrictions.

For partners Capgemini and DaVinci Labs no scientific or other compliance data was generated. All relevant data (communications kit, tracking and management datafiles) were stored on the project-internal One Drive hosted by Fraunhofer ENAS.

3.1 Partner: University of Leiden (ULEI)

3.1.1 Data Generated and Collected

- **Research Data**:
  - Experimental datasets on the performance of quantum algorithms, $<$ 1GB. Datasets were stored privately, but the code to generate it is public. It is possible to regenerate the dataset quite efficiently so storing the data used in research was not needed.
  - Several hundred compiled quantum circuits (.QASM file format) and experimental data in CSV format that gather metrics from said circuits. Other CSV files containing quantum simulation results.
- **Software/Code**:
  - GitHub repositories `AdrianPerezSalinas/reduce-and-chop`. One version, including presentation in the paper.
  - **WP2**: Four GitHub repositories
- **Publications**:
  Peer-reviewed paper [2], with code.
  https://arxiv.org/abs/2507.20694,
  https://arxiv.org/abs/2212.11862,
  https://arxiv.org/abs/2411.03110
- **Documentation**:
  Published Paper and D2.1
- **Other Outputs**: N/A

3.1.2 Data Repositories and Access

- **Primary repository**:
  Github, `AdrianPerezSalinas/reduce-and-chop`
  GitHubs linked in publications
- **Code repositories**:
  Github, `AdrianPerezSalinas/reduce-and-chop`
  GitHubs linked in publications
- **Institutional repository**: N/A
- **Current access status**: publicly accessible

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3.1.3 FAIR Compliance Achieved

- **Findable**: References to the repository are given in the paper
- **Accessible**: HTTP accessible
- **Interoperable**: Code in Python format
- **Reusable**: Examples provided, data generatable from available code.

3.1.4 Long-term Preservation

- **Repository commitment**:
  Private storage
  GitHub and Zenodo guarantees
- **Backup arrangements**: None
- **Migration strategy**: N/A
- **Maintenance contact**:
  Alejandro Villoria, Adrián Pérez-Salinas, Alfons Laarman

3.1.5 Usage and Impact

- **Download statistics**:
  WP1: No download
  WP2: N/A
- **Citations received**:
  WP1: Paper cited in 16 other papers (19/09/2025)
  WP2: N/A
- **Collaboration requests**:
  WP1: Collaboration requests based on paper, not data
  WP2: None
- **Community feedback**:
  WP1: No feedback on data.
  WP2: Feedback pertains to the respective publications.

3.1.6 Lessons Learned and Challenges

- **Successful approaches**:
  WP1: Storage and code locally, then commit to Github
  WP2: Upload to Zenodo and GitHub
- **Challenges faced**: N/A
- **Improvements made**: N/A
- **Recommendations**: N/A

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3.1.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**:
  WP1: No personal data is handled, all data is synthetic
  WP2: No personal data collected in research datasets
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**:
  WP1: No data is released, but code to create it is made public
  WP2: 100% of data
- **Restricted data**: N/A
- **Licensing approach**:
  WP1: Creative Commons licenses used for datasets, Apache for software
  WP2: MIT
- **Patent considerations**: Not considered

3.2 Partner: Fraunhofer Institute for Electronic Nano Systems (Fraunhofer ENAS)

3.2.1 Data Generated and Collected

- **Research Data**: DFT, MD, and MC data for Li-S battery and solid oxide fuel cells simulation.
- **Software/Code**: Code to generate initial input calculation files, and the post-processing scripts. Code for hybrid MC/MD simulation.
- **Publications**: One peer reviewed publication is under review, and another peer reviewed publication is in preparation. Preliminary results were presented at Psi-k Conference 2025.
- **Documentation**: The deliverables D4.3, case II (20 pages) and the publication will contain information that is sufficient to reproduce the main results.
- **Other Outputs**: N/A

3.2.2 Data Repositories and Access

- **Primary repository**: Fraunhofer ENAS provides a Microsoft SharePoint Server which hosts the following data for project EQUALITY, shared by all members of EQUALITY:
  - Reports (deliverables)

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  - Meeting presentations
  - Meeting minutes
  - Project plans and timelines
  - Project management documents
- **Code repositories**: N/A (some simple scripts for data evaluation are stored together with the data)
- **Institutional repository**: Simulation data created and stored on internal computer cluster at Fraunhofer ENAS
- **Current access status**:
  - EQUALITY data on ENAS SharePoint Server is accessible to all partners within project EQUALITY
  - Simulation data is accessible to ENAS members working on project EQUALITY

3.2.3 FAIR Compliance Achieved

- **Findable**: N/A
- **Accessible**:
  - Currently: N/A
  - Benchmark data will be published on Zenodo under Creative Commons CC-BY-4.0 license
- **Interoperable**: Non-proprietary file formats are used to store benchmark data and simulation results
- **Reusable**: Most relevant results will be published in journal papers under Creative Commons CC-BY-4.0 license

3.2.4 Long-term Preservation

- **Repository commitment**: papers will be on ArXiv; data will be on Zenodo, minimum of 10 years
- **Backup arrangements**: see ArXiv and Zenodo; internal automatic backup strategy on ENAS HPC cluster, minimum of 10 years
- **Migration strategy**: N/A
- **Maintenance contact**: Dr. Andreas Zienert

3.2.5 Usage and Impact

- **Download statistics**: N/A
- **Citations received**: N/A
- **Collaboration requests**: N/A
- **Community feedback**: Positive feedback of posters at Psi-k conference 2025

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3.2.6 Lessons Learned and Challenges

- **Successful approaches**: N/A
- **Challenges faced**: N/A
- **Improvements made**: N/A
- **Recommendations**: N/A

3.2.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**: No personal data collected in research datasets.
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**: N/A
- **Restricted data**: N/A
- **Licensing approach**: Journal papers planned to be published with Creative Commons licenses
- **Patent considerations**: N/A

3.3 Partner: German Aerospace Center, Cologne (DLR Cologne)

3.3.1 Data Generated and Collected

- **Research Data**: Qronos code (30 MB repository plus 1.9 GB job artifacts) containing multiple formats; theoretical considerations/derivations of formulae and SAT clauses in .tex and .pdf format
- **Software/Code**: 1 DLR GitLab repository with 9 branches and 72 commits
- **Publications**: 1 preprint
- **Documentation**: 1 technical report (10 pages), 1 user manual (25 pages)
- **Other Outputs**: Quantum circuits for testing purposes

3.3.2 Data Repositories and Access

- **Primary repository**: DLR GitLab
- **Code repositories**: DLR GitLab
- **Institutional repository**: DLR GitLab

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- **Current access status**: internal

3.3.3 FAIR Compliance Achieved

- **Findable**: Not yet, but planned
- **Accessible**: Not yet, but planned
- **Interoperable**: OpenQASM format partly established, very simple .txt files suffice as inputs
- **Reusable**: OpenQASM format partly established, very simple .txt files suffice as inputs

3.3.4 Long-term Preservation

- **Repository commitment**: Longevity of DLR (IT) infrastructure, at least 5 years from the project end
- **Backup arrangements**: Institutional backup
- **Migration strategy**: Open formats chosen to ensure future accessibility
- **Maintenance contact**: Dr. Michael Epping

3.3.5 Usage and Impact

- **Download statistics**: No external downloads yet
- **Citations received**: Not yet published
- **Collaboration requests**: 1 collaboration request from the Technical University of Munich
- **Community feedback**: Positive internal feedback

3.3.6 Lessons Learned and Challenges

- **Successful approaches**: Setting up a GitLab repository early
- **Challenges faced**: Getting the code to the current state of research as a starting point was troublesome since no approach was publicly documented despite numerous publications in that field. Every software aspect had to be derived once again from the very start.
- **Improvements made**: Thorough documentation of both technical aspects and mathematical derivations to be published for the public.
- **Recommendations**: Try to get in touch with the authors of such studies early on, even though not all of them will reply.

3.3.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

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- **Personal data handling**: No personal data collected in research datasets
- **Consent procedures**: N/A
- **Data subject rights**: No data subject requests received
- **Data protection measures**: All repositories met GDPR requirements

Intellectual Property Outcomes

- **Open data released**: All repositories met GDPR requirements
- **Restricted data**: 100% kept confidential until our paper is published
- **Licensing approach**: Software licensed by DLR, intended to eventually become Apache 2.0 (or similar)
- **Patent considerations**: None so far, maybe later on

3.4 Partner: German Aerospace Center (DLR Ulm)

3.4.1 Data Generated and Collected

- **Research Data**:
  - Trained weights (pyTorch binary files via pickle library) (approx. 120 files à 100kB)
  - Reference solutions (json files) (1 File à 1MB)
- **Software/Code**:
  - 3 GITLab repository with more than 13500 lines of different code
    - Pre-Pasqal-API code: >2925 (native Python), >2750 (Jupyter Notebook)
    - Pasqal-API code: >250 (native Python), >825 (Jupyter Notebook)
    - Post-Pasqal-API code: >3500 (native Python), >3250 (Jupyter Notebook)
  - Bash scripts for execution on HPC: approx. 200 lines of code
- **Publications**: N/A
- **Documentation**:
  - 3 deliverables (approx. 160 pages combined)
  - 1 milestone report (21 pages)
- **Other Outputs**: output solely dedicated to EQUALITY
  - Presentations (.pptx): 2 Webinars and 2 conferences
  - 2 posters (.pptx, PDF)

3.4.2 Data Repositories and Access

- **Primary repository**:Fraunhofer Sharepoint
- **Code repositories**: DLR-internal GitLab
  - Code repository divided in 3 sub-projects along the use-case definitions

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  - Simple models DQC model in Qiskit
  - Mid-complexity in Python using PASQAL Cloud API
  - High-complexity DQC/MLP models in Qadence/Pytorch with bash scripts for HPC and GPU usage
- **Institutional repository**:
  - DLR eLib, no publication yet
  - DLR-internal project teamsite
- **Current access status**: Code is not public

3.4.3 FAIR Compliance Achieved

- **Findable**: DLR internal usage only
- **Accessible**: Only for internal usage or upon reasonable request, open within the DLR working group
- **Interoperable**: use of standard file formats (e.g. pdf, docx, pptx, tex, py, ipynb, pytorch binaries)
- **Reusable**: GITLab: README files, code examples

3.4.4 Long-term Preservation

- **Repository commitment**: DLR-internal GITLab, minimum of 10 years
- **Backup arrangements**: DLR/HIU long-term storage, minimum of 10 years
- **Migration strategy**:
  - documented file archive (“README”, examples)
  - use of standard file formats (e.g. pdf, docx, pptx, tex)
- **Maintenance contact**: Prof. Dr. Birger Horstmann

3.4.5 Usage and Impact

- **Download statistics**: N/A
- **Citations received**: N/A
- **Collaboration requests**: Airbus (EQUALITY internal request), code base, but not further pursued so far
- **Community feedback**: No feedback

3.4.6 Lessons Learned and Challenges

- **Successful approaches**: Not used from our side yet, but the Zendoo project page is a nice idea

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- **Challenges faced**: Due to the inconsistent data management of the whole project, difficult to sum up information for this report
- **Improvements made**: N/A
- **Recommendations**:
  - Project-wide the topic of data management should be treated by one person constantly throughout the project time
  - Enforcing a minimum of standards early on

3.4.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**: No personal data in research data
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**: 0% of research data made publicly available
- **Restricted data**: 100% kept confidential due to commercial sensitivity (also due to Pasqal's IP)
- **Licensing approach**: N/A
- **Patent considerations**: N/A

3.5 Partner: Airbus Defence and Space GmbH (ADS)

With an overlap to University of Leiden (ULEI)

3.5.1 Data Generated and Collected

- **Research Data**: SAR data to train and benchmark machine learning models
- **Software/Code**: SAR Data Generator, 300 lines of code [ADS], GitHub repository containing machine learning pipeline (Quantum and classical benchmarks) [ULEI]
- **Publications**: One peer reviewed publication is in preparation. Preliminary results were presented at 'International Supercomputing Conference' (ISC) 2024 and 2025.
- **Documentation**: : The publication will contain information that is sufficient to reproduce the main results.
- **Other Outputs**: N/A

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3.5.2 Data Repositories and Access

ADS: proprietary/internal

ULEI

- **Primary repository**: GitHub (github.com/aQaLeiden/SAR-QML)
- **Code repositories**: GitHub 1 public repository without license
- **Current access status**: will be made publicly accessible after publication of paper

3.5.3 FAIR Compliance Achieved

- **Findable**: Code will be made findable on GitHub.
- **Accessible**: Code will be made findable on GitHub.
- **Interoperable**: All file formats will be usable with open-source software.
- **Reusable**: paper will published with Creative Commons CC-BY-4.0 license

3.5.4 Long-term Preservation

- **Repository commitment**: Code on GitHub, paper on ArXiv (see respective policies)
- **Backup arrangements**: Code on GitHub, paper on ArXiv (see respective policies)
- **Migration strategy**: Open formats chosen to ensure future accessibility
- **Maintenance contact**: Moriz Scharpenberg

3.5.5 Usage and Impact

- **Download statistics**: N/A
- **Citations received**: N/A
- **Collaboration requests**: N/A
- **Community feedback**: Positive feedback after ISC presentations.

3.5.6 Lessons Learned and Challenges

- **Successful approaches**: Focusing on communication to make this interdisciplinary project work.
- **Challenges faced**: A key partner from ULEI quit and had to be replaced.
- **Improvements made**: N/A
- **Recommendations**: N/A

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3.5.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**: No personal data collected in research datasets.
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**: Codebase for classical and quantum machine learning models will be made public.
- **Restricted data**: The codebase for the SAR data simulator is proprietary.
- **Licensing approach**: paper is planned to be published with Creative Commons licenses
- **Patent considerations**: N/A

3.6 Partner: AIRBUS (AIB)

3.6.1 Data Generated and Collected

- **Research Data**:

  Satellite mission planning

  - Two test datasets stored on private Pasqal gitlab https://gitlab.pasqal.com/equality_project (backuped in internal Airbus drive)
  - Graph algorithm results stored on private github repository https://github.com/pafloxy/smo-report
  - Quantum MIS results stored on internal Airbus drive

  PDEs

  - There may be code available on the Pasqal gitlab, however, currently we do not have access.
  - Scripts to generate plots shown in the report D5.3 are kept in the Airbus internal git repository, technically not publishable from there. However, the scientific value of these scripts is limited. Still we intend to summarize the code, such that we could share on request.

- **Software/Code**: **Satellite mission planning**
  - Open source MIS library from Pasqal: https://github.com/pasqal-io/maximum-independent-set
  - MIS library customization code stored on internal Airbus drive
  - Private Pasqal gitlab https://gitlab.pasqal.com/equality_project with QAOA library “quadencesmo” and test data reader code (backuped in internal Airbus drive)

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  - Graph algorithm code on private github repository https://github.com/pafloxy/smo

PDEs

  - Not publicly available, as the core functions are hosted by Pasqal and the documentation requires access rights.

- **Publications**:
  - no peer reviewed publications
  - BITKOM 2025, (Moriz Scharpenberg, Albana Weisz) (confirmed)
  - Q2B 2025, Paris (planned)
- **Documentation**:
  - Reports (D5.1, D5.2) approx. 75 pages
  - Report D5.3 currently worked on
  - Documentation of open source MIS library from Pasqal for satellite mission planning: https://pasqal-io.github.io/maximum-independent-set/latest
- **Other Outputs**: N/A

3.6.2 Data Repositories and Access

- **Primary repositories**:Gitlab, Pasqal
- **Code repositories**: N/A
- **Institutional repository**: N/A
- **Current access status**: Access via Pasqal, contact person in Airbus with Backup, IP situation partially unclear after bankruptcy

3.6.3 FAIR Compliance Achieved

- **Findable**: N/A
- **Accessible**: N/A
- **Interoperable**: N/A
- **Reusable**: N/A

3.6.4 Long-term Preservation

- **Repository commitment**: N/A
- **Backup arrangements**: N/A
- **Migration strategy**: N/A
- **Maintenance contact**: Moriz Scharpenberg

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3.6.5 Usage and Impact

- **Download statistics**: No downloads
- **Citations received**: No citations
- **Collaboration requests**: No collaboration requests
- **Community feedback**: No feedback received from outside the consortium

3.6.6 Lessons Learned and Challenges

- **Successful approaches**: N/A
- **Challenges faced**: N/A
- **Improvements made**: N/A
- **Recommendations**: N/A

3.6.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**: No personal data collected
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**: No data was released from us to outside the consortium
- **Restricted data**: N/A
- **Licensing approach**: N/A
- **Patent considerations**: N/A

3.7 Partner: INRIA (INRIA)

3.7.1 Data Generated and Collected

- **Research Data**: None
- **Software/Code**: https://github.com/TeamGraphix/graphix - 23 releases – over 20k SLOC — https://github.com/qat-inria/veriphix
- **Publications**: 1 available shortly
- **Documentation**: 1 technical report
- **Other Outputs**: None

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3.7.2 Data Repositories and Access

- **Primary repository**: N/A
- **Code repositories**: Github, 2 repos, Apache license
- **Institutional repository**: None
- **Current access status**: All publicly accessible

3.7.3 FAIR Compliance Achieved

- **Findable**: DOI's assigned
- **Accessible**: Accessible on github's website
- **Interoperable**: Not meaningful – code is based on available library and standard tools.
- **Reusable**: Permissive license, documented code.

3.7.4 Long-term Preservation

- **Repository commitment**: Zenodo
- **Backup arrangements**: Backup on private institutional repositories
- **Migration strategy**: Based on standard python and widely available modules.
- **Maintenance contact**: Maintenance contacts are defined within each repository. INRIA's dedicated data protection service can be reached at dpo (at) inria.fr

3.7.5 Usage and Impact

- **Download statistics**: N/A
- **Citations received**: N/A
- **Collaboration requests**: 2 collaboration requests
- **Community feedback**: Positive feedback on the available code during the dedicated workshops organised.

3.7.6 Lessons Learned and Challenges

- **Successful approaches**: CI and automated testing is enforcing code cleanliness.
- **Challenges faced**: Collaboration with non linked entity / individuals inceptors of the project can be difficult when late commers are dedicating institutional effort (people + money). Governance of open source projects suddenly growing in size is tricky.
- **Improvements made**: Full review of the initial code base, Added systematic tests + quality of code improvements
- **Recommendations**: N/A

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3.7.7 Compliance and Legal Outcomes

GDPR Compliance Results The project successfully maintained GDPR compliance throughout:

- **Personal data handling**: N/A
- **Consent procedures**: N/A
- **Data subject rights**: N/A
- **Data protection measures**: N/A

Intellectual Property Outcomes

- **Open data released**: All open data, no private research.
- **Restricted data**: N/A
- **Licensing approach**: Apache license
- **Patent considerations**: Not under consideration as not appropriate strategy given the current domain maturity.

4 Project Data Legacy and Sustainability

4.1 Data Preservation Status

Here below is a table summarising the persons of contact for each of the partners involved.

Partner	Contact	E-mail
ULEI	Prof. Dr. Alfons Laarman	a.w.laarman (at) liacs.leidenuniv.nl
ENAS	Dr. Andreas Zienert	andreas.zienert (at) enas.fraunhofer.de
DLR (Cologne)	Dr. Michael Epping	michael.epping (at) dlr.de
DLR (Ulm)	Prof. Dr. Birger Horstmann	birger.horstmann (at) dlr.de
Airbus (ADS)	Dr. Moriz Scharpenberg	moriz.scharpenberg (at) airbus.com
Airbus (AIB)	Dr. Moriz Scharpenberg	moriz.scharpenberg (at) airbus.com
INRIA	Prof. Dr. Harold Olivier, and INRIA's data protection service	dpo (at) inria.fr

Table 1: Data preservation overview by partner.

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4.2 Ongoing Maintenance and Support

- **Contact points**: Each partner has designated a contact person for post-project data queries. These are mentioned in the individual sections.
- **Documentation**: Comprehensive documentation ensures data remains usable without direct contact. Documentation is included in the main data repository unless mentioned otherwise.
- **Community engagement**: Active promotion in relevant research communities was established along the runtime of the project. Each partner takes over the communication streams of its own and collaborative activities past the project end.

5 Overall Assessment and Impact

5.1 Qualitative Impact

- **Research community benefit**: data and code availability to support further research in the WP domains as aerodynamics, electrochemical cells or mission planning, including improvement of quantum algorithms
- **Educational use**: Publicly available datasets and code can be used in educational activities, especially as some partners represent academic institutions

5.2 Lessons Learned for Future Projects

- **Best practices identified**:
  - Using consortium-wide Git for collaborative development of code
  - Using consortium-wide Overleaf for collaboration on scientific deliverables and reports
  - Centralised and expert management of code base and data by agreed partners
  - Documentation of all the code created, using lint and unit-tests, dependency management and other good practices of coding. This is especially important for any code that is exchanged within the consortium or to be published.
  - Using publicly available data or code from scientific publications, it was proven helpful to reach out to the authors soonest possible, to establish contact, ask for clarifications or source code.
  - Establishing good communication practices within the consortium has significantly facilitated the long-term work. This includes, among all: regular update meetings within a Work Package, regular consortium meetings, systematic on- and off-boarding for new members to ensure correct data management.
- **Common challenges**:
  - lack of personnel and inavailabilities, especially at the beginning of the project, may lead to non-synchronised data handling approaches
- **Recommendations**:

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- Map down all internal dependencies (in code, data, insights or expertise) in the beginning of the project, and structure the work and communication accordingly
- Managing access to data and code repositories, ensure resilience and avoid situations when only one person can edit access rights to core repositories.
- Ensure all the partners have access to the tools of choice (fileshare, repositories, file formats, etc) as soon as possible, and that solutions available to everyone are found. Firewalls, especially industrial ones, can be highly restrictive and hinder progress. Migrating evolved code and data bases is costly.
- Centralised data management could be helpful, with regular feedback loops to ensure consistent data handling throughout the project.

References

[1] EQUALITY. Data management plan. Report on Deliverable D7.3, EU's Horizon 2020, 2023.

[2] Adrián Pérez-Salinas, Radoica Draškić, Jordi Tura, and Vedran Dunjko. Shallow quantum circuits for deeper problems. *Phys. Rev. A*, 108:062423, 2023.

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