



VIPERLAB

FULLY CONNECTED VIRTUAL AND PHYSICAL
PEROVSKITE PHOTOVOLTAICS LAB

D 4.9 Overview of all networking activities in WP4-NA1

DELIVERABLE
REPORT

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PHISICAL PEROVSKITE PHOTOVOLTAICS LAB
VIPERLAB**

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**D 4.9 OVERVIEW OF ALL NETWORKING ACTIVITIES IN
WP4-NA1**

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DISCLAIMER

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TABLE OF CONTENT

EXECUTIVE SUMMARY	4
1. INTRODUCTION	5
2. OVERVIEW OF ALL NETWORKING ACTIVITIES IN WP4-NA1	5
2.1 STRATEGIC WORKSHOPS ON HARMONIZATION AND STANDARDIZATION CHALLENGES	5
• <i>First Workshop: Vienna, September 2022</i>	<i>5</i>
• <i>Second Workshop: Karlsruhe, March 2023</i>	<i>6</i>
• <i>Third Workshop: Brussels, November 2024</i>	<i>6</i>
2.2 WEBINARS	7
2.3 PUBLIC ENGAGEMENT AND DISSEMINATION.....	7
3. CONCLUSIONS	7



EXECUTIVE SUMMARY

Through a series of networking activities, i.e., workshops, webinars, and public engagement activities, VIPERLAB has addressed key challenges in harmonizing testing and standardization protocols.

A series of three workshops has been organized. The first workshop in Vienna in September 2022 identified critical issues such as international standards, ISOS protocols for stability assessments, and type-approval requirements for perovskite PV. This foundational event brought together researchers, industry stakeholders, and experts to prioritize collaborative strategies. In March 2023, a second workshop in Karlsruhe combined discussions on harmonization with a broader focus on aligning R&D priorities with industrial needs, generating actionable recommendations for advancing innovation. The third workshop in Brussels in November 2024 emphasized sustainability and circularity, showcasing VIPERLAB's work on harmonized measurement protocols and fostering collaborations with other European projects.

In addition to workshops, VIPERLAB organized webinars to highlight the importance of standardized testing and reporting practices, engaging a diverse audience and bridging the gap between research advancements and practical applications. The project also utilized conferences, public events, and its Knowledge Exchange Platform to disseminate results and reinforce its impact. Presentations at major events such as ISOS-15 and EUPVSEC underscored the critical role of harmonized practices in scaling perovskite PV technologies.

Through these efforts, VIPERLAB has successfully cultivated a strong community of researchers, industry leaders, and policymakers. It has made significant progress in standardizing testing and aging protocols, contributing to consistency across laboratories and advancing international discussions on perovskite PV standards. The insights generated by VIPERLAB have informed European research agendas and industrial strategies, providing clear pathways for achieving sustainable, scalable, and commercially viable perovskite PV technologies. These achievements position VIPERLAB as a cornerstone initiative in the integration of renewable energy solutions.



1. INTRODUCTION

VIPERLAB is an infrastructure project that aims to create a European environment where various infrastructures from 13 VIPERLAB partners can be accessed by different users from Europe and abroad. VIPERLAB objectives for Transnational and Virtual Access Activities (TA/VA) are to:

- Offer state-of-the-art and cutting-edge key infrastructure that covers the whole innovation/value chain: from material preparation to characterization of perovskite devices and modules
- Support, widen, and facilitate access for the emerging / starting scientific perovskite PV community as well as for users from industry/SMEs

WP4-NA1 of the VIPERLAB project focused on harmonization and standardization challenges for perovskite photovoltaics (PV). Its networking activities included strategic workshops, regular communication through meetings, webinars, and public dissemination efforts. Below is a consolidated overview of these activities. For more details, refer to the other deliverables of WP4 and to the VIPERLAB Knowledge Exchange Platform (KEP) and the official VIPERLAB website.

2. OVERVIEW OF ALL NETWORKING ACTIVITIES IN WP4-NA1

2.1 Strategic Workshops on Harmonization and Standardization Challenges

- **First Workshop: Vienna, September 2022**
- **This foundational event aimed to identify critical challenges in harmonizing and standardizing perovskite PV technologies. Around 40 attendees participated, including researchers, industry stakeholders, and external experts. Key Topics:**
 - **International standardization issues specific to perovskite PV.**
 - **Adoption of ISOS protocols for stability assessments.**
 - **Approaches for achieving type-approval requirements in perovskite PV technologies.**
- **Highlights:**
 - **Presentations on perovskite module upscaling and degradation mechanisms.**
 - Discussions identified collaborative strategies and prioritized next steps for harmonization.



Figure 1. First strategic VIPERLAB workshop on main harmonization/standardization challenges for Perovskite PV.



- **Second Workshop: Karlsruhe, March 2023**

Held during the "Energy Conversion and Storage Days," this workshop combined WP4 harmonization goals with WP6's focus on a Strategic Research and Innovation Agenda (SRIA).

- **Key Topics and approach:**

- Divided into working groups on device processing, characterization, and applications.
- Focused discussions on harmonization potentials, trends, and action plans.

- **Highlights:**

- Generated actionable recommendations for aligning R&D priorities with industrial needs.
- Introduced harmonization goals into larger PV innovation roadmaps.

- **Follow-Up:** A public webinar on "Standardization for Perovskite PV" was organized, drawing wide interest.

- **Third Workshop: Brussels, November 2024**

This event was co-organized with the "EERA PV BECOME PV Workshop," emphasizing sustainability, reliability, and circularity.

- **Highlights:**

- Dissemination of VIPERLAB's round-robin results on measurement and aging protocol harmonization.
- Discussions on product validation and application-specific requirements, with a focus on vehicle-integrated photovoltaics (VIPV) or product-integrated PV (PIPV), respectively.
- Discussions revisited key milestones and future directions for integrating standardization into industrial workflows.
- Collaboration with other research projects (e.g., Pearl, Pepperoni) and EERA-PV initiatives fostered impactful discussions.



Figure 2. "EERA PV BECOME PV workshop" on "Boosting the Exploitation and commercialisation of Emerging PV technologies".

2.2 Webinars

As an extension of the second workshop, VIPERLAB hosted a public webinar on standardization. The event demonstrated the importance of standardized testing and reporting practices. Attendees from diverse backgrounds reinforced the relevance of harmonization in bridging research advancements with practical applications.

2.3 Public Engagement and Dissemination

VIPERLAB utilized multiple channels for outreach and dissemination:

- **VIPERLAB public events:** i.e., in Brussels 2023 or at the 41st European Photovoltaic Solar Energy Conference (EUPVSEC) in 2024 in Vienna reviewed the project's outcomes, emphasizing harmonized practices as critical for scaling perovskite PV technologies.
- **Knowledge Exchange Platform (KEP):** A repository for sharing outcomes, resources, and workshop results.
- **Conferences:** i.e., presentations and / or contributions at/to the ISOS-15 conference 2024 in Berlin or the 41st EUPVSEC highlighted the project's efforts in establishing consistent measurement protocols.
- **Project Website:** Regular updates ensured accessibility of information related to standardization activities.

3. CONCLUSIONS

The VIPERLAB D4.9 report provides a summarized overview on all networking activities carried out in the course of WP4-NA1: Harmonization and path towards standardization. For more details, refer to the other deliverables of WP4 and to the [VIPERLAB Knowledge Exchange Platform \(KEP\)](#) and the official [VIPERLAB website](#).

Through its strategic networking activities, the VIPERLAB project has successfully cultivated a robust community of stakeholders, including researchers, industry experts, and policymakers. The workshops and webinars organized under WP4 (and other WPs of VIPERLAB) served as fertile platforms for fostering collaboration, sharing knowledge, and aligning efforts across the perovskite PV ecosystem.

The project made significant strides in advancing standardization by developing harmonized testing and aging protocols. These efforts not only improved measurement consistency across laboratories but also contributed meaningfully to international discussions on standardizing perovskite PV technologies.

Moreover, actionable insights derived from VIPERLAB's discussions have played a pivotal role in shaping European research agendas and industrial strategies. The outcomes provided clear pathways for achieving sustainability and scalability in perovskite PV technologies, ensuring their readiness for broader commercial adoption and integration into renewable energy solutions.

