



# Fostering Opportunities Towards Slovak Excellence in Advanced Control for Smart Industries

## **D5.4. Progress report**

Date by 29 February 2024  
v.1



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## DELIVERABLE INFORMATION

<b>Work package</b>	WP5 – Project management and DEC Activities
<b>Task</b>	Task T5.1: Project coordination, management, monitoring
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<b>Dissemination Level</b>	PU - Public

<b>Abstract</b>	<p>The project aims at increasing the research and academic prospects of Slovak University of Technology in Bratislava, Slovakia (STUBA) and at initiating the evolution of STUBA into a modern, reputed excellent institution that performs high-quality research in advanced automatic control, educates top-quality scholars and industrial practitioners, and is successful in active dissemination and exploitation of its research and innovation efforts. For this purpose, STUBA teams up with two renowned research groups in automatic control from RU Bochum, Germany (RUB) and Pisa University, Italy (UNIPI). The specific goals of the action are to reinforce the collaboration with the two research groups from Western Europe, to intensify research in advanced automatic control, to open up new collaboration channels through academic and industrial networking, to train excellent young/senior researchers and project managers, and to effectively disseminate and exploit the research results of STUBA. The unique features of the project are: - Adoption/amendment of internal research project-related rules and procedures and develop project management toolbox, - Research efforts aiming at the continued creation of high-quality research results and software tools, - Establishment of a series of guest scientific and academic lectures, - Exchanges and training of project managers and research (junior and senior) personnel, - Organisation of conferences and invited sessions, seminars with industry, and annual summer schools, - Preparation and implementation of a new PhD curriculum at STUBA, - Establishment of an academic-industrial research and innovation cluster.</p>
<b>Keywords</b>	<p>Control theory and optimization; Sensor networks, embedded systems, hardware platforms; Embedded systems;</p>

	Monitoring and control systems; Embedded systems in automation and control.
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### Document Revision History

Version	Date	Description of change	List of contributors

### Disclaimer

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## PARTNERS

The consortium of FrontSeat consists of 3 partners, as presented here below.



**STUBA**

**Slovak University of Technology in Bratislava**



**RUB**

**Ruhr University Bochum**



**UNIFI**

**University of Pisa**

# 1. EXPLANATION OF WORK CARRIED OUT AND OVERVIEW OF THE PROGRESS OF THE WORK

## 1.1 Executive Summary

This report provides an overview of the progress and achievements within of the project FrontSeat that was reached within the first half of the project – 16 months. The report consist of the 5 work packages describing each task and achieved results. FrontSeat is built around four main areas of intervention, corresponding to the four project specific objectives SOs:

Under Strategic Objective 1 (SO1), efforts have been directed towards enhancing the administrative staff's capacity at STUBA in managing EU-funded projects. Through activities within WP1, such as staff exchanges, webinars, and case studies, project managers' capabilities have been significantly bolstered. Notably, the adoption of co-created tools and the implementation of best practices have elevated STUBA's reputation, resulting in increased project support and successful submissions for Horizon Europe grants.

Strategic Objective 2 (SO2) aims at strengthening STUBA's scientific excellence in the field of automatic control. Activities within WP2 include the creation of a research plan, exchange programs for researchers, and collaborative paper publications with project partners. While progress has been made, some key performance indicators like the number of joint conference papers and ESR exchanges are yet to meet initial expectations, but are planned to be reached at the end of the project.

Under Strategic Objective 3 (SO3), STUBA is committed to enhancing its role in the knowledge triangle of research, education, and innovation. Through activities outlined in WP3 and WP4, such as dissemination efforts, collaborative actions, and networking activities, STUBA has actively engaged with academia, industry, and regional R&I actors. Despite challenges, significant achievements, including scientific guest lectures, joint summer schools, and the initiation of academic-industrial clusters, highlight progress in this area.

Lastly, Strategic Objective 4 (SO4) focuses on boosting STUBA's reputation internationally and attracting talented scientists. Notable accomplishments include the preparation of a preliminary PhD curriculum for a new program in Process Control, designed to meet the evolving needs of smart industries. The collaboration with RUB and the transfer of best practices underscore STUBA's commitment to academic excellence and innovation.

Overall, while significant strides have been made across all strategic objectives, there remain areas for improvement and ongoing activities to ensure the continued success and impact of the FrontSeat project.

More detailed achievements of all SOs are summarised here:

### **SO1 To develop capacities of STUBA administrative staff in management of EU-funded projects (WP1, 5)**

The capacities of STUBA administrative staff in management of EU-funded projects is developed via various activities within WP1. Staff exchanges, webinars and case studies enhanced the capacities of the project managers greatly. The co-created tools are being adopted by STUBA project managers and used in their daily work. Good practice of FrontSeat in a sense of the cooperation within the main project centre and the faculty increased the reputation and attractiveness for other faculties.

The number of supported projects by main project centre of STUBA increased, bringing 2 awarded projects within Widera call of Horizon Europe.

Key performance indicators:

Expected	Reached M1-M16
<b>200 h training</b>	32 h in person + 48 h remote hands-on-training on project drafting – 80 h together
<b>10 POs trained</b>	10 STUBA POs taking part to training events so far
<b>2 project proposals jointly submitted</b>	1 proposal submitted (and granted).
<b>3 case studies</b>	Ongoing activity
<b>3 best practices</b>	Ongoing activity
<b>1 management toolbox</b>	Ongoing activity

## SO2 Strengthening the scientific excellence of the beneficiary STUBA in the field of automatic control (WP2)

The scientific excellence of STUBA in the field of automatic control is being strengthened through activities within WP2. That includes creating a research plan, exchanging early-stage and senior researchers taking part in the conferences and publishing joint papers with the project partners.

Key performance indicators:

Expected	Reached M1-M16
<b>Research agenda for research reinforcement at STUBA</b>	<a href="#">Research plan</a>
<b>10 ESRs from STUBA to UNIPI and to RUB</b>	6 ESRs from STUBA to UNIPI and RUB
<b>5 ESRs from UNIPI and from RUB to STUBA</b>	2 ESRs from UNIPI and from RUB to STUBA
<b>3 experienced researchers involved in mutual exchanges</b>	13 experienced researchers involved in mutual exchanges
<b>10 joint conference papers</b>	2
<b>10 journal papers with co-authoring by ESRs published</b>	5

### SO3 To enhance STUBA role in the knowledge triangle research – education – innovation (WP3, 4)

STUBA is enhancing its role in the knowledge triangle research – education – innovation by actively disseminating the project goals and results within the academia, industry and regional R&I actors. The project is executing cooperation-stimulation, networking and communication activities, which include collaborative actions such as participation at jointly-organised invited sessions at conferences, common publication of high-quality research papers, the organisation of joint summer schools and exchange stays, newsletters and public-oriented communication (seminars, magazine articles, etc.). Fruitful discussions and networking activities are stimulated during “Academia meets industry” seminars. Exchanges of the researchers brings and opportunity to enhance the educational quality of STUBA.

Key performance indicators:

Expected	Reached M1-M16
at least two invited sessions at major conferences in the field of automatic control	1
a scientific lecture-series held at STUBA	established, ongoing
10 scientific guest lectures at STUBA annually	19 guest lectures at STUBA
2 guest lectures at RUB and UNIPI	14 guest lectures at RUB and UNIPI
2 blocks of pedagogical guest lectures annually at STUBA	Ongoing activity
2 blocks of pedagogical guest lectures annually at RUB and UNIPI	Ongoing activity
“Academia meets industry” series with three events held at STUBA	2 events already organised
3 summer schools	1
academic-industrial research and innovation cluster initiated at STUBA	T3.5 Academic-industrial cluster will start at M24

### SO4 Boost STUBA reputation in the international arena and its attractiveness for talented scientists (WP4)

The preliminary PhD curriculum for a new PhD program of Process Control is prepared with the help of RUB and its research school. The best practice was transferred to STUBA and presented to rector and vice-rectors of STUBA. The curriculum was designed to address the needs of today’s smart industries – ideas and inspiration coming from the “Academia meets Industry” meetings.

Key performance indicators:



Expected	Reached M1-M16
<b>2 research school officers trained</b>	2
<b>about 40h of training in total</b>	Around 30 hours in person + online
<b>1 new PhD curriculum on smart control</b>	Preliminary PhD curriculum Process Control

## 1.2 Explanation of the work carried out per WP

### 1.2.0 Research component

The research activities of the FrontSeat project revolved around the development of advanced automatic control solutions. They were aimed at cementing the position of STUBA among the top developers of highly versatile and modern software for automatic control solutions by exploiting synergies between the partners in different areas of automatic control and in various engineering disciplines. The main topics included novel developments in Model Predictive Control (MPC). The work done involves:

- Theoretical contributions <sup>1 2</sup>

These works (co-authored by STUBA and RUB) achieved reduction of computational burden in MPC and proposed versatile tuning approaches of advanced controllers.

- Application studies <sup>3</sup>

Here, we showcased an efficient implementation of MPC together with energy-optimizing control solution.

- Software developments <sup>4 5</sup>

A new software toolbox for advanced MPC design was presented extending the Multi-Parametric toolbox (MPT). MPTplus introduced several advanced MPC controller design methods, including memory-efficient explicit tube MPC design and tube MPC controller.

Further research activities of FrontSeat were stimulated by extensive exchange of junior and senior

<sup>1</sup> Mitze, R., Kvasnica, M., & Mönnigmann, M. (2023). Exploiting symmetries in active set enumeration for constrained linear–quadratic optimal control. *Automatica* 151, p. 110900. Zenodo. <https://doi.org/10.1016/j.automatica.2023.110900>

<sup>2</sup> Dyrska, R., Müller, J., Fikar, M., & Mönnigmann, M. (2023). Simple Controller Tuning for Unmanned Aerial Vehicles using Governors. 24th International Conference on Process Control (PC23), Štrbské Pleso, Slovakia. <https://doi.org/10.5281/zenodo.8058124>

<sup>3</sup> Raphael Dyrska, Michaela Horváthová, Peter Bakaráč, Martin Mönnigmann, & Juraj Oravec. (2023). Heat exchanger control using model predictive control with constraint removal, *Applied Thermal Engineering*, 227, pp. 120366, ISSN 1359-4311. <https://doi.org/10.1016/j.applthermaleng.2023.120366> <https://zenodo.org/records/7767419>

<sup>4</sup> Holaza, J., Galčíková, L., Oravec, J., & Kvasnica, M. (2024). A software package for MPC design and tuning: MPT+. 2023 62nd IEEE Conference on Decision and Control (CDC), Singapore. <https://doi.org/10.5281/zenodo.10556501>

<sup>5</sup> Holaza, J., Kvasnicová, K., Pavlovičová, E., & Oravec, J. (2023). Tube MPC Extension of MPT: Experimental Analysis, 24th International Conference on Process Control (PC23), Štrbské Pleso. <https://doi.org/10.5281/zenodo.8037663>

researchers (WP3). The long-term stays of ESRs from STUBA J. Boldocký, M. Čorňák, D. Dzurková (all at RUB), and R. Fáber (at UNIPI) were supported by the short-term stays of the senior researchers from STUBA: Prof. F. Duchoň, Dr. M. Gulán, Dr. M. Klaučo (all at RUB), and Dr. R. Paulen (at UNIPI) and by the mentoring visits Prof. G. Pannocchia (UNIPI) and Prof. M. Mönnigmann (RUB) at STUBA.

The upcoming research activities will concern data-based automatic control, where several research paths have been already open within FrontSeat and are currently under investigation. Intensified preparation of joint research publications will be conducted to provide high reputation and visibility to the research performed at STUBA.

### **1.2.1 WP1 – Capacities Building in Research Management (Lead: UNIPI Contributors: STUBA, RUB) M1-M31**

The objective of the WP is to **support transformation of the existing Project Centre** at STUBA into a fully developed EU Office in condition to support STUBA ESRs and scientists in competitive project proposals design and management.

During the first half of the project (M1-M16) the consortium managed to reach planned results. All 3 partners are involved in this work package. More details of each task are given below.

Task 1.1. Ex-ante assessment, in progress monitoring and ex-post evaluation (M1–M31)  
Leader: UNIPI (2 PM), Contributors: STUBA (1 PM)

The need assessment on training needs was initiated at M1. The October 2022 mission to Bratislava of the UNIPI team members Michele Padrone - Head of Research Support Services - and Francesca Ceron - Senior Research Manager at the Services for Research Unit – offered the opportunity of meeting the STUBA Project Centre POs as well as Faculties administrative staff committed to EU project management. The need assessment meetings were performed during the two days preceding the Kick-off meeting. Here below the agenda:

Tuesday 25 October - Meeting with STUBA EU Office Research Managers

- introduction to STUBA overall structure
- the STUBA Project Centre: current structure, services provided and future perspectives
- open discussion

Wednesday 26 October - meeting with STUBA project managers from the faculties

- the STUBA Faculties administrative staff: its role in research management and administration
- open discussion

Attendees:

STUBA rectorate: *Viltare Platzner, Peter Cuninka, Štefan Hičak, Barbora Čutriková*

STUBA Faculty of Mechanical engineering: *Lucia Ploskuňáková*

STUBA Faculty of Electrical Engineering and Information Technology: *Martin Donoval*

STUBA The Faculty of Materials Science and Technology in Trnava: *Katarína Kostecká*

STUBA Faculty of Chemical and Food Technology: *Alžbeta Lapšanská*

UNIPI: *Francesca Ceron*

Once back, the findings were further discussed via remote meetings, bringing to the preparation of D1.1, which was submitted in time.

The deliverable included a detailed planning for WP1 activities up to December 2023. The activities implementation was subject to continuous monitoring, jointly performed by UNIFI and STUBA team members via remote meetings, email exchanges. Additionally, monitoring meetings were always planned in staff exchange missions agendas (T1.2).

The monitoring has brought to the second version of D1.1 which includes monitoring results and further planning from January 2024 to April 2025, when WP1 will conclude its activities.

Task T1.2: Staff exchange (M6–M28)

Leader: UNIFI (2 PM), Contributors: STUBA (2 PM)

The task refers to the organisation of 12 short stays of 1 week each, committing UNIFI and STUBA administrative staff.

Here the details of the 3 staff exchanges implemented so far:

1. UNIFI staff mission to STUBA. The mission was performed in March 2023. UNIFI staff: Francesca Ceron and Marco Bargagna. The mission lasted 5 days.
2. STUBA Project Centre staff mission to UNIFI. The mission was performed in April 2023. STUBA staff: Viltare Platzner and Peter Cuninka. The mission lasted 5 days.
3. UNIFI staff mission to STUBA. The mission was performed in June 2023. UNIFI staff: Francesca Ceron and Martina Calamusa. The mission lasted 4 days.

Activities were performed accordingly to the planning included in D1.1. The topics covered by the hands-on training session are detailed here below (April 2023 Pisa, 15 short training sessions for a total of 12 hours training):

- UNIFI Units structure and organisation
- scouting activities at UNIFI
- newsletter and social media
- grant Agreement Preparation – GAP
- proposals/projects monitoring and statistics
- Net4UNIFI and participation to European Networks
- technology Transfer Office: core activities, Patent, Spin Off and Entrepreneurial Training, technological Transfer Project and Companies Relationship, Success stories of technological transfer Projects
- UNIFI central services and Departments in project management
- coordination of 2 central services Units in practice
- UNIFI policies for research promotion
- consortium agreements and other relevant Agreements
- relationships with NCPs and consultants (the EUCore case study)
- tools for reporting personnel costs (timesheet)
- auditing exercise
- general aspects of good EU project management – departments vs. central offices
- good practices in EU project management and monitoring applied to FrontSeat

Tool co-development sessions (2 sessions 2h each) focused on: Part A of a project proposal, actual costs budget setting, lump sum budget setting (March 2023, Bratislava).

The following UNIPI staff took part to the events: Francesca Zampagni, Chiara Caccamo, Marco Bargagna, Martina Calamusa, Michele Padrone, Angelica Salvadori, Elena Di Stefano, Valentina del Soldato, Elena Favilli, Silvia Innocenti, Carla Papa, Francesca Ceron, Marco Bargagna

The following STUBA POs were targeted: Viltare Platzner, Peter Cuninka, Barbora Čutříková, Alžbeta Lapšanská, Lucia Ploskuňáková.

Additionally, the following 4 interactive workshop of 3h duration each were organised, structured as presentation + practical exercise:

### 1. STUBA March 2023

Practical workshop #1 Horizon Europe: overview, the Funding and Tender portal of the European Commission and the submission procedure

Practical workshop #2 Horizon Europe: the RIA/IA/SCA template and the evaluation process

### 2. STUBA June 2023

Practical workshop #1 The Horizon Europe non-scientific sections of the proposal

Practical workshop #2 Budget setting in RIA/IA/CSA, ERC, and MSCA: actual costs, lump sum, unit cost, and fixed rate

March FrontSeat events complemented the info day organised at STUBA premises by the Project Centre with the support of SK NCP.

#### Task T1.3: Webinars (M6–M28)

Leader: UNIPI (2 PM), Contributors: STUBA (1 PM)

T1.3 included the organisation of 3 webinars over the whole WP duration. During the need assessment, it was decided to perform them in presence, as it would amplify their impact at the local level, and the topics were set: MSCA DN, MSCA PF, ERC.

In 2023, EIC Pathfinder was added to the list because of the interest expressed by STUBA researchers, and the open seminar of 1,5h was delivered in June 2023. EIC seems a very appealing opportunity given the nature of research performed at STUBA. Both Pathfinder Open and Challenges were introduced together with a case study of success. A total of 11 people among STUBA researchers and administrative staff attended the seminar.

Despite the effort to communicate the events, STUBA researchers and STUBA administrative staff's participation in seminars remains below expectations. The option of proposing them on-line was evaluated negatively by the consortium. An additional effort to communicate the next events will be done and we estimate that the inclusion in the agenda of the real-life experiences from MSCA and ERC grantees would make the difference.

The updated version of D1.1 details the planning for the remaining seminars (May 2024).

#### Task T1.4: Case studies and best practices development (M6–M31)

Leader: UNIPI (2 PM), Contributors: STUBA (1 PM), RUB (1 PM)

T1.4 for this reporting period refers to the drafting of joint proposals. Here below are listed the activities performed in the reporting period.

HORIZON-CL4-2024-TWIN-TRANSITION-01-44 (deadline 07/02/24). The partnership identified this topic as of interest in spring 2023 after having analysed possible alternatives in CL4 Work Program. Nevertheless, after an extensive feasibility assessment, the consortium decided not to proceed, as the consortium could not integrate a sufficient number of relevant industrial actors making the proposal competitive.

HORIZON-WIDERA-2023-ACCESS-06 (deadline 28/09/2023). The proposal NAP HOP-ON TWIN-ON-A-CHIP BRAINS FOR MONITORING INDIVIDUAL SLEEP HABITS was jointly drafted and submitted for evaluation. The project is about the inclusion of STUBA - Laboratory of Medical and Applied Electronics PI Dr. Erik Vavrinsky to the running project NAP (ID:101099310), coordinated by UNIPI – Research Centre E. Piaggio PI Dr. Chiara Magliaro and financed under the EIC Pathfinder Open. The proposal was successful, and the consortium invited to the GAP phase (amendment of the current NAP GA) the 31st of January 2024. The amendment process is ongoing.

The project development have seen the closer and continuous collaboration of STUBA and UNIPI POs from the identification of the call, up to the possible “matching” between competencies and to project drafting;

HORIZON-MSCA-2024-DN-01-01 (deadline 27/11/2024). The consortium has taken the decision to apply to the MSCA DN 2024 because of its consistency with WP4 “Initiating a new PhD programme”. As per the HOP-ON initiative, the UNIPI and STUBA POs will cooperate on proposal drafting.

Erasmus Without Paper IIA ID: IIA\_PISA01\_SKBRATISL01\_13498. The agreement covers mobility for both students and Researchers and was signed between UNIPI and STUBA. The thematic areas are 0710 - Engineering and Engineering Trades, 0610 - Information and Communication Technologies (ICTs). Mobility for students (both incoming and outgoing): max 8 PhD or Master-level students for max 10 months. Mobility for researchers/professors max 8 of them (both incoming and outgoing) for 7 days max with 8h of teaching commitment. Validity of the agreement: a.y. 2027-2028.

The Erasmus agreement was also signed with RUB University for the mobilities of students and researchers.

*Deliverables (In the reporting period M1-M16):*

- D1.1 Report on assessment and training plan M2  
Submitted on time

*Milestones (In the reporting period M1-M16):*

No milestones during this period.

Risks and mitigation for WP1:

Risk number	Description	The risk materialized Yes/No
1	Withdrawal of a partner or a partner stops cooperation. (Likelihood: Low, Severity: Medium)	No
2	Partner does not deliver all necessary inputs. (Likelihood: Medium, Severity: Medium)	No
3	Disputes in the consortium. (Likelihood: Low, Severity: Low)	No
4	Low motivation of the partners to conduct training activities at STUBA premises. (Likelihood: Medium, Severity: Medium)	No
5	Continuation of the COVID pandemics. (Likelihood: Medium, Severity: Medium)	No
6	Conflict in Ukraine expands to Slovakia. (Likelihood: Low, Severity: High).	No

### 1.2.2 WP2 - Promoting Excellence in Automatic Control Research (Lead: STUBA Contributors: UNIPI, RUB) M1-M33

The objective of this Work Package is to **develop** and to **maintain collaborative research activities** in the field of advanced automatic control by **enhancement of research capabilities of the STUBA group, coordination of development of software tools, preparation and submission of joint research projects, long-term stays of early-stage researchers and short-term exchanges** of experienced researchers and scholars. The research will be focused on data- and model-based optimal control which will be treated as a case study for future successful projects.

During the first half of the project (M1-M16) the consortium managed to reach planned results. All 3 partners are involved in this work package. More details of each task are given below.

#### Task T2.1: Excellent research (M1–M12)

Leader: RUB (2 PM), Contributors: STUBA (1 PM), UNIPI (1 PM)

Task T2.1 started at the beginning of the project by setting up the [research plan](#) (M4) and ended with the audit of STU at M12 conducted by RUB at the Faculty of Chemical and Food Technology in STUBA ([D2.1](#)).

**The research plan** includes development of software tools, a plan of jointly advised PhD theses and postdoctoral project topics, and the list of targeted conferences that were jointly attended.

Considering the diverse research topics covered at STUBA today, **the research audit** is focused on the core topic covered by the FrontSeat projects, specifically automatic control applications relevant to smart industry needs. The Faculty of Chemical and Food Technology was chosen as the starting point and representative for all topics. The audit was guided by questions proposed by the participating research groups at UNIPI and RUB, where STUBA had the opportunity to suggest additional questions. The audit took place from the 21st to the 24th of August 2023 while the



partners from RUB were visiting STUBA.

**The results of the audit** showed that STUBA is already operating at a very high level in regard to research output. This holds for both the quantity and the quality of the scientific output. UNIPI and RUB encourage STUBA to increase sensitivity to new research trends. Measures towards this goal are, for example, strengthening international cooperation across all units of STUBA, increased participation at international conferences of members of all units of STUBA, and invitations of high-ranking guest lecturers. Furthermore, RUB and UNIPI encourage STUBA to continue their work on remodeling the current Ph.D. curriculum towards an increased time for research and to simplify the requirements necessary to get the Ph.D. degree.

#### Task T2.2: Software development and support (M7–M24)

Leader: STUBA (2 PM), Contributors: RUB (1 PM), UNIPI (1 PM)

**MPTplus:** The Multi-Parametric Toolbox (or MPT for short) is an open-source, MATLAB-based toolbox for parametric optimization, computational geometry, and model predictive control. With over two decades of evolution, MPT has solidified its status as a cornerstone in academic circles, boasting an impressive track record of tens of thousands of downloads. MPTplus is a direct extension of MPT, remaining committed to the principles of open-source collaboration, and inviting contributions from the community to foster continuous improvement and innovation. With its user-friendly interface and comprehensive documentation, MPTplus aims to empower users to leverage state-of-the-art methods for efficient problem-solving and analysis. Besides other updates, the main emphasis is placed on a brand-new framework for tube model predictive control design, as well as on various advanced implementation techniques of explicit model predictive policies. MPTplus has showcased its capabilities to a broader scientific audience through papers and presentations at esteemed international conferences such as the International Conference on Process Control 2023 and the IEEE Conference on Decision and Control 2023. More information about this toolbox can be found on its dedicated webpage at <https://github.com/holaza/mptplus/wiki>.

**SIPPY:** STUBA started to collaborate with UNIPI on the open-source package for parameter estimation of dynamical processes SIPPY hosted at github.com. For the time being, the package originally developed by UNIPI contains methods for identification SISO and MISO systems in input/output representation and methods for identification of state-space models. Researchers from STUBA contributed to the development of the package and discussed possible new features and improvements: identification of continuous-time systems, identification of MIMO systems using matrix fraction descriptions.

#### Task T2.3: Research projects (M7–M30)

Leader: UNIPI (2 PM), Contributors: STUBA (1 PM), RUB (1 PM)

The task started at M7, while STUBA staff members from the Project center were on a mission at UNIPI (WP1 T1.2: Staff exchange) by exploring the calls of Horizon Europe that could match the interest and the fields of project partners. Two potential opportunities were found - *HORIZON-CLA-2024-TWIN-TRANSITION-01-44: Digital transformation and ensuring a better use of industrial data, which can optimise steel supply chains (Clean Steel Partnership) (IA)* and *Hop-on facility* from the Horizon Europe program “Widening participation and strengthening the European Research Area”.

Both opportunities were explored. For the IA action, all 3 Universities contacted local steel factories and made new contacts and inquiries regarding the project. The project was discussed numerous times during the General Assembly meetings online and during the consortium meeting at M13 at UNIPI. Nevertheless, because of not enough partners and interest from the industry it was decided not to submit the proposal, but to keep the options open for the upcoming calls. Even though the project proposal was not submitted all 3 partners made new connections with local industries and started a discussion about future cooperations.

For the Hop-on facility call project **NAP - twiN-on-a-chip brAins for monitoring individual sleeP habits** funded under the program The European Innovation Council (EIC) coordinated by UNIPI was selected. Research teams from STUBA were identified as suitable to bring added value to the project and the project TWIN-ON-A-CHIP BRAINS FOR MONITORING INDIVIDUAL SLEEP HABITS – HOP ON was submitted and recently invited for funding.

In addition, complementary project to FrontSeat from NextGen Europe/Slovakia program was submitted. The **FS-Match (FrontSeat Match project)** is specifically aimed at fostering research excellence in the field of automatic control. It is supported by three other specific objectives:

*SO1: Excellence in Automatic Control Research*

The group at STUBA contributes significantly to the development of theory in the field of automatic control as well as to software solutions in the areas of control and optimization.

Based on the results of the research audit in the FrontSeat project, we will focus on four main research directions that link and intensify the collaborative research activities at the individual institutes at STUBA. These will be: (1) optimal and predictive control, (2) robust and hierarchical control, (3) modelling and identification, (4) machine learning, artificial intelligence, robotics.

KPIs: 20 conference papers, 10 journal publications Q1-Q2, 30 SCI citations, 15 members in technical committees of professional organizations

*SO2: Education and strengthening of research links in the field of automatic control*

Education in the field of automatic control will be strengthened especially at PhD level. We will invite foreign top researchers for lecture-discussion stays, support mentoring schemes for PhD students, and collaborate with foreign groups in the preparation of English online courses.

KPIs: 15 number of PhD students trained, 4 PhD students mentored, 10 number of international visits, 10 English online courses

*SO3: Development of infrastructure to support research in the field of automatic control*

The project will build a distributed control laboratory with industrial DCS technologies to validate control algorithms with industrial solutions. The computer network will also be upgraded for this purpose. We will also improve the infrastructure capabilities for hybrid (face-to-face plus online) seminars.

KPIs: 1 DCS laboratory built

Task T2.4: Long-term stays of ESRs and exchanges of experienced researchers (M3–M33)

Leader: RUB (9 PM), Contributors: STUBA (14 PM), UNIPI (8 PM)

The task started with the plan of the exchanges at M3, for both Senior and Early stage researchers. During these exchanges Senior researchers gave scientific/pedagogical lectures, discussed future possibilities of research projects. While Early stage researchers engaged in the mentoring schemes supervised by SRs and worked on the joint research topics with other ESRs.



	Name of the researcher	SR/ES R*	Dates (from - to)	From-To	Objective	Results
1.	Ján Boldocký	ESR	6-9 Feb 2023	STUBA-RUB	Mentoring scheme, introduction	<a href="#">Blog post</a>
2.	Martin Gulan	SR	6-9 Feb 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
3.	Michal Balla	ESR	6-9 Feb 2023	STUBA-RUB	Mentoring scheme, introduction	<a href="#">Blog post</a>
4.	Rudolf Pribiš	SR	6-9 Feb 2023	STUBA-RUB	Scientific/Pedagogical lectures + outline possible joint research	<a href="#">Blog post</a>
5.	Oto Haffner	SR	6-9 Feb 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
6.	Erik Kučera	SR	6-9 Feb 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
7.	Martin Gulan	SR	6-9 Feb 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
8.	Raphael Dyrska	ESR	27 Feb-3 March 2023	RUB-STUBA	Scientific lectures, joint research	<a href="#">Blog post</a>
9.	Rastislav Fáber	ESR	18-25 March 2023	STUBA-UNIPI	Mentoring scheme, introduction	<a href="#">Blog post</a>
10.	Radoslav Paulen	SR	18-25 March 2023	STUBA-UNIPI	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
11.	Gabriele Pannocchia	SR	8-10 March 2023	UNIPI-STUBA	Scientific lectures + shape joint research projects, possibly involving Italian or Slovakian companies	<a href="#">Blog post</a>
12.	Marco Vaccari	SR	11-15 Sep 2023	UNIPI-STUBA	Lecture at the Summer School + work on joint research projects	<a href="#">Blog post</a>
13.	Riccardo Bacci di Capaci	SR	18-22 Sept 2023	UNIPI-STUBA	Scientific lectures + work on joint research projects	<a href="#">Blog post</a>
14.	Gabriele Pannocchia	SR	5-10 June	UNIPI-STUBA	Attendance of the conference+ work on joint research projects	<a href="#">Blog post</a>

			2023			
15.	Martin Mönnigmann	SR	22-24 August 2023	RUB-STUBA	Pedagogical lecture, joint research	<a href="#">Blog post</a>
16.	David Müller	ESR	21-25 August 2023	RUB-STUBA	Joint research, introduction	<a href="#">Blog post</a>
17.	Marek Čornák	ESR	15 Sep-15 Oct 2023	STUBA-RUB	Study, work on joint research projects	<a href="#">Blog post</a>
18.	Ivan Sekaj	SR	6-10 Nov 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
19.	Riccardo Bacci di Capaci	SR	7-10 Nov 2023	UNIPI-STUBA	Scientific lectures + Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
20.	Martin Klaučo	SR	7-10 Nov 2023	STUBA-RUB	Scientific/Pedagogical lectures + work on joint research projects	<a href="#">Blog post</a>
21.	Raphael Dyrška	ESR	13-24 Nov 2023	RUB-STUBA	Pedagogical lecture, joint research	<a href="#">Blog post</a> <a href="#">Blog post</a>
22.	Sebastian Leonow	SR	13-17 Nov 2023	RUB-STUBA	Pedagogical lecture, joint research	<a href="#">Blog post</a> <a href="#">Blog post</a>
23.	David Müller	ESR	8-12 Jan2024	RUB-STUBA	Work on joint research projects	<a href="#">Blog post</a>
24.	Martin Mönnigmann	SR	8-12 Jan2024	RUB-STUBA	Work on joint research projects	<a href="#">Blog post</a>
25.	Diana Dzurková	ESR	22 Jan-1 March 2024	STUBA-RUB	Lecture, joint research projects	Still ongoing
26.	Rastislav Fáber	ESR	31 Jan-31 May 2024	STUBA-UNIPI	Mentoring scheme, work on joint research projects	Still ongoing
27.	Ján Boldocký	ESR	15 Feb-15 June 2024	STUBA-RUB	Mentoring scheme, work on joint research projects	Still ongoing

\*Senior researcher/Early stage researcher

*Deliverables (In the reporting period M1-M16):*

- D2.1 Report on research audit and research-intensification activities M12

Submitted on time

*Milestones (In the reporting period M1-M16):*

- M2 Detailed research plan completed M4

Milestone reached on time

Risks and mitigation for WP2:

Risk number	Description	The risk materialized Yes/No
1	Withdrawal of a partner or a partner stops cooperation. (Likelihood: Low, Severity: Medium)	No
2	Partner does not deliver all necessary inputs. (Likelihood: Medium, Severity: Medium)	No
3	Disputes in the consortium. (Likelihood: Low, Severity: Low)	No
4	None of the project proposals accepted for funding. (Likelihood: Low, Severity: Low)	No
5	The research and training plan is not fulfilled to the full extent during the short-/long-term stay. (Likelihood: Medium, Severity: Low)	No
6	Low motivation of ESRs to commit to the project. (Likelihood: Low, Severity: Medium)	No
7	Continuation of the COVID pandemics. (Likelihood: Medium, Severity: Medium)	No
8	Conflict in Ukraine expands to Slovakia. (Likelihood: Low, Severity: High).	No

### ***1.2.3 WP3 - Promoting Visibility through Strategic Networking (Lead: STUBA Contributors: UNIPI, RUB) M3-M36***

The objective of this Work Package is to establish of a **series of guest scientific/pedagogical lectures and seminars** with active participation from industry at STUBA, to **organise invited sessions and participation at scientific conferences**, and to **organise summer schools**. A research and innovation cluster of legal entities will be initiated. Participation of students and ESRs from external (worldwide) research groups and from industrial practitioners will be stimulated. The FrontSeat project will be actively promoted at the events. All lectures and seminars will be held as public events, video-recorded, made available on the Internet, and linked to the project website.

During the first half of the project (M1-M16) the consortium managed to reach planned results. All 3 partners are involved in this work package. More details of each task are given below.

#### Task T3.1: Invited sessions (M3–M36)

Leader: RUB (3 PM), Contributors: STUBA (1 PM), UNIPI (1 PM)

The task started with setting up the plan of targeted international conferences at M3 in a form of a

deliverable [D3.1. Schedule of planned participation at international conferences and of guest lectures](#)

Conference	Sponsors/organizers	Location	Dates	Participation and goals	Results
<b>Process Control Conference 2023</b>	IEEE	Štrbské Pleso, Slovak Republic	June 6-9, 2023	G. Pannocchia plenary speaker STUBA Organizer Joint publications (planned) Invited session organized by FrontSeat partners (planned)	Joint publication and invited session were organized
<b>European Control Conference 2023</b>	EUCA	Bucharest, Romania	June 13-16, 2023	Publications by the partners (submitted)	The researchers from RUB participated, but no joint publications were admitted
<b>IFAC World Congress 2023</b>	IFAC	Yokohama, Japan	July 9-14, 2023	Joint publications (submitted)	All 3 partners participated at the conference
<b>Conference on Decision and Control 2023</b>	IEEE	Marina Bay Sands, Singapore	December 13-15, 2023	Joint publications (planned)	The researchers from STUBA participated, but no joint publications were admitted

The international conferences were targeted strategically to disseminate the joint research to wide academic community. **The International Conference on Process Control (PC)** is a biannual international conference organized by STUBA and sponsored by the Institute of Electrical and Electronics Engineers (IEEE). PC brings together experts in control from academia and industry and, thus, is an ideal platform for increasing the visibility of STUBA as well as of the partners. Equally importantly, the PC conferences provide ideal opportunities for fostering joint work with industrial partners that may serve as project partners in future Horizon Europe projects. FrontSeat will contribute to PC in 2023 and in 2025. **The European Control Conference (ECC)** is an annual conference organized by the European Control Association (EUCA), which is sponsored by both worldwide professional organizations in the field of automatic control, the IEEE and **the International Federation of Automatica Control (IFAC)**. ECC is the largest European conference in the field and therefore provides similar opportunities as PC but with a wider scope of topics and a broader audience and participants. FrontSeat aims to contribute to ECC 2023 and ECC 2024. The IFAC World Congress, which takes place every three years, is the flagship conference of IFAC, the international umbrella organization for all national organizations of control professionals in the fields of Mechanical, Process, and Chemical Engineering. Since the World Congress is the most important and biggest event of IFAC, it provides a perfect opportunity for the FrontSeat team to keep in touch with the newest developments in their professional fields, and to present FrontSeat as a seed for future consortia in the field of automatic control. **The IEEE Conference on Decision and Control** is a specialized conference in the particular research fields of the partners, which provide an opportunity to both keep up with the current developments in the field, and to present the state of the art achieved in FrontSeat to specialists from all over the world.

### Task T3.2: Guest lectures (M3–M36)

Leader: STUBA (4 PM), Contributors: RUB (3 PM), UNIPI (3 PM)

The task started with setting up the plan of guest lectures in STUBA and partner universities at M3 in a form of a deliverable [D3.1. Schedule of planned participation at international conferences and of guest lectures](#)

The guest lectures were held by top researchers from STUBA, UNIPI, RUB, and other Universities from the consortium networks, including industry partners. The lectures (scientific and pedagogical) are taking place on a regular basis. Almost all the lectures were given in person + streamed online. More details on the lectures can be found in the FrontSeat blog - <https://frontseat.stuba.sk/category/research-seminar/>

Scientific lectures held in M1-M16:

Number	Date	Place	Lecturer	Affiliation	Title
1.	October 10, 2022	STUBA + stream	Radoslav Paulen	STUBA	Convexification techniques for stationary and dynamic optimization
2.	October 14, 2022	STUBA + stream	Miroslav Fikar	STUBA	Simple Tuning of Arbitrary Controllers using Governors
3.	October 18, 2022	STUBA	Fatima Matamoros	National Center for Scientific Research / Université de Lorraine, Nancy, France	Modeling and Optimization of Low-Pressure Gas-Carburizing Furnaces
4.	October 25, 2022	RUB + stream	Mikael Kurula	Abo Akademi University, Turku, Finland	Explicit Model Predictive Control for PDEs
5.	November 4, 2022	STUBA + stream	Roman Kohút Karol Kiš	STUBA	Deep Learning and its Place in Process Control
6.	November 11, 2022	STUBA + stream	Kristína Fedorová	STUBA	Towards a Fully Decentralized ALADIN Algorithm
7.	November 25, 2022	STUBA + stream	Peter Bakaráč	STUBA	The Whole Procedure of a Device Development
8.	December 2, 2022	STUBA + stream	Lenka Galčíková	STUBA	Self-Tunable Approximated Explicit Model Predictive Control
9.	December 9, 2022	STUBA + stream	Ľuboš Čirka	STUBA	Data Collection and Processing
10.	December 16, 2022	STUBA + stream	Martin Kalúz	STUBA	Lattice-based Cryptography: From LWE to Public-key Encryption
11.	February 7, 2023	RUB + stream	Oto Haffner	STUBA	Introducing the Institute of Automotive Mechatronics
12.	February 7, 2023	RUB + stream	Erik Kučera	STUBA	Technologies for Industry 4.0: Augmented Reality, Cloud and Petri Nets
13.	February 7, 2023	RUB + stream	Rudolf Pribiš	STUBA	Experimental Platform for Digital Technology for Industry 4.0
14.	February 8, 2023	STUBA + stream	Yuri Shardt	TU Ilmenau	Soft Sensors: Applications and Ruminations

15.	February 17, 2023	stream	Sebastian Leonow	RUB	Collaborative control under strict security requirements on lean embedded hardware
16.	February 17, 2023	stream	Riccardo Bacci di Capaci Marco Vaccari	UNIPI	Acid Gas Treatment in Waste-to-energy Plants: a case study of system identification and advanced control
17.	March 1, 2023	UNIPI	Radoslav Paulen	STUBA	Optimal Control of Batch Membrane Processes
18.	March 3, 2023	STUBA + stream	Raphael Dyrska	RUB	Simple Controller Tuning for Unmanned Aerial Vehicles using Governors
19.	March 3, 2023	UNIPI	Rastislav Fáber	STUBA	Machine Learning-based Classification of Industrial Datasets
20.	March 10, 2023	STUBA + stream	Gabriele Pannocchia	UNIPI	Systems Identification Algorithms and software tools for the application of MPC in process control systems
21.	March 17, 2023	STUBA + stream	Martin Mojto	STUBA	Multi-fidelity Modeling with Gaussian Process Model
22.	March 24, 2023	STUBA + stream	Ján Boldocký Anna Vargová	STUBA	AutomationShield: An Open-Source Hardware and Software Initiative for Control Engineering Education
23.	March 31, 2023	STUBA + stream	Martin Klaučo	STUBA	Active Set Prediction using Machine Learning for the complexity reduction in Nonlinear Model Predictive Control
24.	April 14, 2023	STUBA + stream	Boris Rohaľ-Ilkiv	STUBA	Spline-based continuous-time MPC
25.	April 21, 2023	STUBA + stream	Michal Kvasnica	STUBA	Challenges and opportunities in forecasting, optimization, and monetization of renewable energy
26.	April 28, 2023	STUBA + stream	Ľubomíra Horanská	STUBA	Nonadditive integrals as a tool for aggregation
27.	May 5, 2023	STUBA + stream	Matúš Furka	STUBA	Comprehensive Analysis of Modern Cryptographic Schemes for Secured Process Control
28.	May 12, 2023	STUBA + stream	Michaela Horváthová	STUBA	Deep-Learning-Driven Tunable MPC with Stability Guarantees
29.	May 19, 2023	STUBA + stream	Pavel Jičinský	University of Pardubice, Czech Republic	Motion Analysis Tool for Orthopedic Diseases
30.	May 26, 2023	STUBA + stream	Juraj Holaza Juraj Oravec	STUBA	Tube MPC Extension of MPT
31.	June 7, 2023	STUBA + stream	Stefan Krämer	Bayer AG	AI or Process Control – Process Understanding and Good Dynamic Modelling Remains Key
32.	June 8, 2023	STUBA + stream	Evren Turan	NTNU Trondheim, Norway	Strategies for efficient and robust model predictive control
33.	June 8, 2023	STUBA + stream	Johannes Jäschke	NTNU Trondheim, Norway	Strategies for efficient and robust model predictive control



34.	June 9, 2023	STUBA + stream	Gabriele Pannocchia	UNIPI	Control and Optimization in the Presence of Uncertainties: Theory and Practice
35.	June 13, 2023	STUBA + stream	Paisan Kittisupakorn Sirikanya Singcuna	Chulalongkorn University, Thailand	Use of PLC for sequential control applications
36.	August 22, 2023	STUBA + stream	Martin Mönnigmann	RUB	Teaching “recursive stability” of MPC to engineering students
37.	September 6, 2023	RUB + stream	Rudolf Pribiš	STUBA	Experimental Platform for Digital Technology for Industry 4.0
38.	September 6, 2023	RUB + stream	Oto Haffner	STUBA	Introducing the Institute of Automotive Mechatronics
39.	September 6, 2023	RUB + stream	Erik Kučera	STUBA	Digital Technologies for Industry 4.0: Augmented Reality, Cloud and Petri Nets
40.	September 15, 2023	STUBA + stream	Marco Vaccari	UNIPI	Introduction to MPC Code
41.	September 19, 2023	STUBA + stream	Riccardo Bacci di Capaci	UNIPI	A System Identification Package for Python: actual features and future developments
42.	September 28, 2023	RUB + stream	Marek Čorňák	STUBA	Human-Robot Collaboration with Gesture Control
43.	October 6, 2023	STUBA + stream	Lenka Galčíková	STUBA	Tube model predictive control
44.	October 12, 2023	UNIPI + stream	Alberto Bemporad	IMT Lucca, Italy	Learning-based Methods for Model Predictive Control
45.	October 12, 2023	UNIPI + stream	Mario Villanueva	IMT Lucca, Italy	Set-Based Computing in Robust Control: A Polytopic Approach
46.	October 20, 2023	STUBA + stream	Cesar de Prada	University of Valladolid, Spain	Developing Grey-box Process Models
47.	October 27, 2023	STUBA + stream	Roman Kohút	STUBA	Do sequences matter? Application for carbon emission prediction of the electricity grid
48.	November 3, 2023	STUBA + stream	Ahmed Mairi	Mouloud MAMMERI University, Algeria	Globally linearizing control of distributed parameter systems described by time-fractional partial differential equations
49.	November 8, 2023	RUB + stream	Ivak Sekaj	STUBA	Machine Learning and Genetic Algorithms
50.	November 9, 2023	STUBA + stream	Riccardo Bacci di Capaci	UNIPI	Valve Stiction and MPC: A Long Sticky and Freaky Journey
51.	November 9, 2023	RUB + stream	Martin Klaučo	STUBA	Machine Learning Methods for Active Set Prediction: Accelerating NMPC Computation
52.	November 10, 2023	STUBA + stream	Kristína Fedorová	STUBA	Real-time Parallelizable MPC using Spatio-temporal Splitting
53.	November 14, 2023	STUBA + stream	Sebastian Leonow	RUB	Embedded Implementation of a Neural Network Controller Emulating Nonlinear MPC in a Process Control Application

54.	November 24, 2023	STUBA + stream	Raphael Dyrška	RUB	An Introduction to Unmanned Aerial Vehicles
55.	December 1, 2023	STUBA + stream	Maroš Baumgartner	STUBA	Robust data transmission in 5G networks without infrastructure
56.	December 8, 2023	STUBA + stream	Mikel Ferrero Jaurrieta	Universidad Pública de Navarra, Spain	On symmetry in the sequential-dependent information fusion in neural networks
57.	February 20, 2024	RUB	Ján Boldocký	STUBA	Real-Time Implementation of Differentiable Predictive Control on Embedded Microcontroller Hardware

Pedagogic lectures held in M1-M16:

Number	Date	Place	Lecturer	Affiliation	Title
1.	November 14, 2022	STUBA	Milan Horňák Réka Lőrincz	Slovnaft a.s., Bratislava, Slovakia	Modelling in Process Industry (Lecture from Industry)
2.	December 6, 2022	STUBA	Ladislav Nagy Marián Bartal	Yokogawa	Industrial Automation (Lecture from Industry)
3.	January 13, 2023	RUB + stream	Martin Gulan	STUBA	AutomationShield: an open-source hardware and software initiative for control engineering education
4.	March 3, 2023	UNIPI + stream	Radoslav Paulen	STUBA	Introduction to Optimization
5.	March 9, 2023	STUBA + stream	Gabriele Pannocchia	UNIPI	Offset-free tracking with Model Predictive Control
6.	June 8, 2023	STUBA + stream	Evren Turam Johannes Jäschke	NTNU Trondheim	Strategies for efficient and robust model predictive control (Workshop)
7.	August 22, 2023	STUBA + stream	Martin Mönnigmann	RUB	Teaching “recursive stability” of MPC to engineering students
8.	October 20, 2023	RUB + stream	Ivan Sekaj	STUBA	TBA
9.	October 10, 2023	STUBA	Ladislav Nagy Miloš Pinka	Yokogawa Actemium	Functional Safety Workshop
10.	November 13, 2023	STUBA	Michal Mateáš	Schaeffler Slovensko	Mathematical modelling as a cornerstone in the product development

### Task T3.3: Seminars with industrial participation (M3–M24)

Leader: STUBA (3 PM), Contributors: RUB (1 PM), UNIPI (1 PM)

The task started with the formation of the idea how to stimulate the discussions between academia and high-profile industry managers. The goal is to organize meetings with industry called “Academia meets Industry” in order to i) create opportunities to cooperate or develop already created cooperation ii) to profile cybernetics graduate iii) to improve employment opportunities for cybernetics graduates iv) to support technology transfer in cybernetics.

To achieve these tasks the FrontSeat Industry Council for Cybernetics was formed including 20 industrial members (each academic institute nominates 4 industrial members), 5 academic



members (one from each institute contributing to FrontSeat).

The first meeting of “Academia meets industry” was held in M5 where the newly formed FrontSeat Industry Council for Cybernetics met. Current Industrial partners are:

- Ing. Karol Ľubušký, Slovnaft a.s.  
Large enterprise, refinery
- Ing. Zuzana Kovaríková, VUEZ a.s.  
SME, technology provider (automation, engineering, energetics)
- Ing. František Jantoška, SCHUNK Intec s.r.o.  
SME, technology provider (gripping systems)
- Ing. Daniel Zverko, IQLOGY s.r.o.  
SME, technology provider (automation, robotics, vision)
- Ing. Peter Beňo, PhD., Photoneo s.r.o.  
SME, technology provider (bin picking, robotics, vision)
- Ing. Ondrej Kolimár, SmartBase  
SME, software development (digital transformation)
- Ing. Martin Morháč, SOVA Digital a.s.  
SME, technology provider (digital transformation)
- Ing. Tomáš Polóni, PhD., Garrett Motion Slovakia, s.r.o.  
Large enterprise, manufacturing (automotive)
- Ing. Pavol Buček, PhD., ŽP VVC s.r.o.  
SME, R&D (iron works, metal forming)
- Ing. Hynek Procházka, PhD., Prosystemy s.r.o.  
SME, technology provider (control systems)

The first meeting was focused on getting to know each other and hearing the first ideas and thoughts on how this cooperation could work. After a short round table presentation Associate Prof. Radoslav Paulen presented a good practice example from his cooperation with the company Slovnaft. The most important part of the meeting was the discussion. The industrial partners presented their approach to the cooperation and raised valuable questions. Practices and good and bad experiences were discussed. In the end, the Council agreed to prepare some more clear vision of needs from the part of the industry, so the Slovak University of Technology in Bratislava could easier understand what kind of students, with what skills, they could suggest. Council agreed to meet at least 2-times per year in an informal setting, to stimulate more active discussion.

This led to the second “Academia meets industry” meeting which took place in M9 in more informal setting. The meeting started with short presentations of the participating institutes from five faculties of the Slovak University of Technology in Bratislava, given by their representatives, namely Prof. Fikar, Prof. Vrábek, Prof. Rosinová, Prof. Duchoň, and Dr. Juhás. In addition to introducing the workplace, its personnel, and study programs, the presentations focused on current research activities and selected examples of cooperation with industry. They were intertwined with stimulating discussion and questions raised by the industrial partners representing seven companies: Ing. Peter Beňo, PhD. (Photoneo), Ing. František Jantoška (Schunk), Ing. Hynek Procházka, PhD. (Prosystemy), Ing. Ondrej Kolimár (SmartBase), Ing. Daniel Zverko (IQLOGY), Ing. Zuzana Kovaríková (VUEZ), Ing. Pavol Buček, PhD. (ŽP VVC).

The next point of the meeting was a presentation of Ing. Zuzana Kovaríková of VÚEZ, a.s. who presented their cooperation with the Institute of Robotics and Cybernetics in terms of joint R&D

projects, co-supervised bachelor, master, and dissertation theses, and a particular success story that resulted in a robotic workplace for intelligent welding of small-scale production. At the end of June, this joint result will also be presented in Munich at Automatica – the world’s leading trade fair for smart automation and robotics. The meeting continued with the discussions and it was decided to organize 3<sup>rd</sup> meeting at the Faculty of Materials Science and Technology in Trnava (STU) in March 2024 where in turn the industrial partners shall give presentations and identify potential problems to be solved.

During the consortium meeting at UNIPI, which took place 12-13 October 2023, an industrial research center Consorzio Polo Tecnologico Magona (CPTM) was visited. Consortium partners were engaged in detailed discussions on technological and knowledge transfer from academia to industry. On the second day Delegate for Industrial Relations of UNIPI Chiara Galletti presented strategy and actions to strengthen the university/industry cooperation.

#### Task T3.4: Summer schools (M8–M36)

Leader: RUB (4 PM), Contributors: STUBA (1 PM), UNIPI (1 PM)

The first Summer School on Embedded Optimal Control was organized in September 2023 (M12) in STUBA, Slovakia. Focus of the summer school was both hard and soft skills, project work and presentations, as well as social program and networking. The program took 5 working days.

Scope of the summer school - this 5-day summer school aimed to give both theoretical background and hands-on knowledge with advanced methods and tools for embedded optimal control. The courses covered selected state-of-the-art approaches to the formulation and practical solution of optimal control problems, including real-time model predictive control design as well as its data-driven near-optimal alternative using machine learning, with a focus on their implementability on embedded computing hardware. All lecture topics were accompanied by intensive computer exercises. The second part of the course introduced the participants to a family of microcontroller-based pocket laboratories integrating various control experiments. Participants then started to work on a self-chosen application problem by selecting a particular hardware platform and one of the control algorithms presented earlier. Towards the end of the course, they presented the obtained results. A lecture focused on presentation skills was also a part of the course.

Program Schedule					
	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 – 10:00	Registration	Lecture: MPC Code	Lecture: Embedded Control and Automation Shields	Lecture: Soft Skills Presentation	Project Presentations
10:00 – 12:00	Lecture: Optimal Control and MPT3	Workshop: MPC Code	Workshop: Automation Shields		
12:00 – 13:00	Lunch	Lunch	Lunch	Lunch	
13:00 – 14:00	Workshop: MPT3	Lecture: Machine Learning Connected to Process Control	Project Assignment	Project Work	
14:00 – 17:00		Workshop: Machine Learning	Social Program and Banquet		

Program of the Summer School

There were 19 participants from 4 countries and 6 universities – SK (9), DE (4), IT (2), CZ (4), mostly PhD students. The registration was also open to the external students which widened the

audience.

Key Speakers:

- Michal Kvasnica (SK, STUBA), Recognized expert in the field of predictive control
- Gergely Takács (SK, Garret Motion), Recognized expert in the field of real-time embedded control
- Martin Klaučo (SK, STUBA), Recognized expert in the field of artificial intelligence
- Marco Vaccari (IT, UNIPI), Recognized expert in the field of process modeling/simulation/optimization
- Martin Ždímal (SK), Lecturer of English/Slovak languages with 18-year experience, Trainer of soft/hard skill

Speakers were invited from partner University – UNIPI and STUBA, and from industry (Garret Motion).

After the Summer School the questionnaire was send to the students to evaluate the program. The questions were divided into few groups:

- Level of difficulty;
- Level of usefulness;
- Level of interest;
- Organization level (1-5);
- Social program (1-5);
- Dinner (1-5);
- Overall (1-5).

The lectures and the workshops were evaluated rather positively, even though one could see that the level of expertise within the students was different causing the various evaluations of the usefulness and interest of the program.

Nevertheless, the overall evaluation of the summer school got on average 4.3 points out of 5, which is a very positive number.

The good practises and lessons learned will be handed to UNIPI where 2<sup>nd</sup> summer school will be organized in September 2024.

All the presentations, photos and other materials can be found [here](#).

Task T3.5: Academic-industrial cluster (M24–M36)

Leader: UNIPI (2 PM), Contributors: STUBA (1 PM), RUB (1 PM)

T3.5 Academic-industrial cluster will start at M24

*Deliverables (In the reporting period M1-M16):*

- D3.1 Schedule of planned participation at international conferences and of guest lectures M3  
Submitted on time

*Milestones (In the reporting period M1-M16):*

- M1 First “Academia meets industry” seminar M4
- M4 Schedule of the guest lectures finalised M7

- M6 First Summer School M13

All the milestone reached on time

Risks and mitigation for WP3:

Risk number	Description	The risk materialized Yes/No
1	Withdrawal of a partner or a partner stops cooperation. (Likelihood: Low, Severity: Medium)	No
2	Partner does not deliver all necessary inputs. (Likelihood: Medium, Severity: Medium)	No
3	Disputes in the consortium. (Likelihood: Low, Severity: Low)	No
4	A planned conference invited session is cancelled because of low number of contributions. (Likelihood: Low, Severity: Low)	No
5	Low motivation of the partners to conduct training activities at STUBA premises. (Likelihood: Medium, Severity: Medium)	No
7	Continuation of the COVID pandemics. (Likelihood: Medium, Severity: Medium)	No
8	Industrial partners not interested in project (Likelihood: Low, Severity: Medium)	No?
9	Conflict in Ukraine expands to Slovakia. (Likelihood: Low, Severity: High).	No

#### **1.2.4 WP4 - Initiating a new PhD programme (LEAD: RUB Contributors: UNIPI, STUBA) M3-M24**

The objective of this WP is to **increase of the excellence status** of STUBA and to **prepare and implement a new PhD programme** on smart control in STUBA.

During the first half of the project (M1-M16) the consortium managed to reach planned results. All 3 partners are involved in this work package. More details of each task are given below.

##### Task T4.1: Staff exchange and Knowledge-transfer (M3–M15)

Leader: RUB (3 PM), Contributors: STUBA (3 PM), UNIPI (1 PM)

This task started with the presentation of the Annegret Kunde (RUB) when participating in an online meeting on February 17, 2023 (M5) with an introductory presentation about RUB-RS (RUB Research School) and the planned schedule for this task.

In March (M6) the first knowledge exchange on supporting structures for Early-Stage Researchers started with an online meeting with staff members from STUBA (Maria Buciova and Prof. Miroslav Fikar) and RUB-RS (Dr. Christiane Wüllner and Annegret Kunde). Dr. Christiane Wüllner provided insights into the development and constitution of RUB-RS, which started as a project funded by third-party money and has developed into a permanent central institution of Ruhr Universität Bochum supported by all departments and the rectorate. The RUB-RS website was

used for orientation and provided a base for discussion. Dr. Ursula Justus, who is responsible for the qualification programme at RUB-RS, joined the meeting. Furthermore, the prerequisites at STUBA for the expansion of the support structures for ESRs were analysed. In preparation for the on-site exchange, the need for further development of the services was explored.

**The first staff exchange** took place in April 24-26, 2023 where Prof. Ján Híveš, Vice-rector for Science and Research, and Mária Búciová, Head of the Department of Science and International Scientific and Technical Cooperation, from STUBA visited RUB. During this time, the two STUBA staff members gained comprehensive insights into the various fields of activity of the RUB-RS and its history, as well as into the Ph.D. programmes and research activities with their respective labs of the Faculty of Mechanical Engineering. The exchange ended with planning the next steps in the project and the schedule for the next exchange.

**The second staff exchange** took place from June 27-29, 2023, Dr. Christiane Wüllner and Dr. Jörn Benzinger from RUB-RS visited STUBA for hands-on cooperation and continued discussions of the design of support structures for ESRs at STUBA. This included transfer of experience with setting up a university-wide Ph.D. programme and insights into the marketing activities of RUB-RS for international recruitment. It also covered RUB's ethics and integrity concepts as well as the incoming schemes.

The task was concluded with the deliverable [D4.2. Training material documenting job shadowing and webinars](#) on M15.

#### Task T4.2: Devising a new PhD curriculum at STUBA (M3–M24)

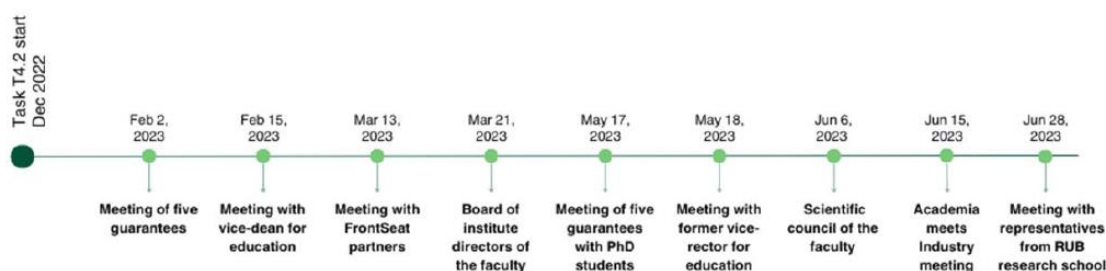
Leader: STUBA (3 PM), Contributors: RUB (2 PM), UNIPI (1 PM)

One of the Specific Objectives (SO4) of the project FrontSeat, is to boost STUBA reputation in the international arena and its attractiveness for talented scientists. To reach this objective the project consortium sets the goal to develop a new PhD programme in automatic control for smart industries in STUBA. The goal is to address the specific needs of today's and future society and smart industries.

PhD study programs in Cybernetics exist at four faculties of Slovak University of Technology in Bratislava (STUBA), but the one in Faculty of Chemical and Food Technology (FCHPT) entitled Process Control was chosen as a suitable example on which to document the rebuilding in terms of the proposed properties. At the same time, it will serve as a case study for other programs in the field of Cybernetics. Moreover, its general structure could be used as a model for the reconstruction of other PhD programs at STUBA. Preparation of the new study program entitled Smart Process Control is based on the best practices of League of European Research Universities (LERU), the best practices found from consultations among project partners RUB and UNIPI and based on the input from seminars with industry (series Academia meets Industry).

In the picture the main steps of the preparation of the preliminary curriculum are presented:

## Meetings regarding the new PhD study program in STUBA (Feb-July 2023)



Timeline of the meetings with various bodies during the preparation of the new PhD study program

The final documents for the new PhD program are being prepared, nevertheless, there is a chance that the process will be stopped or slowed down because of internal processes of STUBA.

Preliminary document presenting new PhD curriculum at STUBA is presented in D4.

*Deliverables (In the reporting period M1-M16):*

- D4.1 Preliminary document presenting new PhD curriculum at STUBA M10
- D4.2. Training material documenting job shadowing and webinars M15

All the deliverables were submitted on time

*Milestones (In the reporting period M1-M16):*

- M5 Preliminary version of a new PhD curriculum at STUBA M10

The milestone reached on time

Risks and mitigation for WP4:

Risk number	Description	The risk materialized Yes/No
1	Withdrawal of a partner or a partner stops cooperation. (Likelihood: Low, Severity: Medium)	No
2	Partner does not deliver all necessary inputs. (Likelihood: Medium, Severity: Medium)	No
3	Disputes in the consortium. (Likelihood: Low, Severity: Low)	No
4	The Education and Scientific Council of STUBA does not accept the proposed new PhD curriculum. (Likelihood: Low,	No



	Severity: Medium)	
7	Continuation of the COVID pandemics. (Likelihood: Medium, Severity: Medium)	No
8	Conflict in Ukraine expands to Slovakia. (Likelihood: Low, Severity: High).	No

### **1.2.5 WP5 - Project Management and DEC Activities (Lead: STUBA Contributors: UNIPI, RUB) M1-M36**

The objectives of this WP are 1. **achieve project goals** and mission in time and budget; 2. pool and **coordinate partners efforts**; 3. smooth and timely **communication with the EC**; 4. **full respect of GA** prescriptions, including OS; 5. define and implement proper **data management**; 6. **exploitation of the research achievements**; 7. **dissemination of project results**; 8. **communication of project activities, goals and impact to general public**, ensuring proper visibility to EC financing.

During the first half of the project (M1-M16) the consortium managed to reach planned results. All 3 partners are involved in this work package. More details of each task are given below.

#### Task T5.1: Project coordination, management, monitoring (M1–M36)

Leader: STUBA (12 PM), Contributors: RUB (1 PM), UNIPI (1 PM)

Project coordination started with the appointment of the project manager and the organization of the kick-off meeting (M1), during which all the most important project questions were discussed with the consortium. During the kick-off meeting the deliverables and milestones were presented as well as the plan for upcoming consortium meetings.

After the meeting the official communication channel and sharing platform was established under STUBA's SharePoint. All the documents and information are kept there and accessible to all the consortium members. The templates for the presentations, deliverables and letterheads were created and distributed to the consortium.

The following consortium meetings were organized (planned to have 2 times per year, one in person and 1 online):

- Kick-off meeting in Bratislava, STUBA on 27-28/10/2022;
- Online consortium meeting 17/02/2023;
- Consortium meeting in Pisa, UNIPI on 12-13/10/2023.

During each consortium meeting each WP and each task is presented indicating achievements and plans for the upcoming 6 months. All consortium partners participated in these meetings and after each meeting, the minutes are created and distributed within the consortium. Project management meeting in STUBA is held every 2 weeks while General Assembly (PIs from STUBA, UNIPI and RUB) meets approximately once per month, or upon the need.

All the deliverables and milestones were submitted to the coordinator for the review and submitted to the portal on time.

UNIPI staff from Research services office is supporting STUBA project manager as help desk all along the task deployment.

#### Task T5.2: Data Management (M4–M36)

Leader: RUB (2 PM), Contributors: STUBA (1 PM)

The task started with the identification of the Project Data Manager from RUB who started to work on the DMP to make sure that the project is aligned with all Open Data requirements.

Data summary:

- Existing data will be used for scientific and industrial purposes available from previous joint projects of the partners;
- All common data types and formats are used;
- Data is primarily generated for research and testing purposes;
- Other purposes cover administrative tasks;
- Data will be generated by experiments, surveys, interviews and subscriptions;
- Data will mainly be useful for other researchers or industry.

Fair data:

- Data will be identified by a DOI;
- Metadata of deposited publications provide information about the publication, Horizon Europe funding, grant project name, acronym and number, licensing terms;
- Keywords are properly set to optimize possibility of discovery; clear file versioning;
- Repository used is Zenodo;
- European Open Science Cloud (EOSC) compliant; accessible through http protocol;
- No restrictions on data use after the project (also for third parties);
- Quality of data will be ensured via multiple internal reviewing processes.

Allocation of resources:

- Using Zenodo does not cause any additional cost;
- Long term preservation is ensured through Zenodo;
- Data will be stored for lifetime of Zenodo; will run for the next 20 years at least;
- Storing data in Zenodo is free of charge, regardless of the storage time;

Data security and ethics:

- All data stored in Zenodo will be secured by multiple backups;
- Zenodo operates system for automatic detection and recovery of file corruption on disks;
- Personal data should be anonymized with tools like OpenAIRE Amnesia;
- In compliance with the GDPR, informed consent for data sharing and long term preservation will be included in questionnaires dealing with personal data.

More information and a full data management plan can be found here - [DMP](#). There will be 2 more updates during the project.

Task T5.3: Exploitation (M7–M36)

Leader: RUB (1 PM), Contributors: STUBA (1 PM)

The exploitation plan was set within the DEC plan which is described in the [D5.1 DEC \(Dissemination, Exploitation and Communication\) plan](#)

Brief summary of Exploitation Plan:

Exploitation plan split into 2 categories – plan for project members (STUBA, RUB, UNIPI) and



other (Slovak and Czech universities, students, society, industry, European R&I institutions).

#### Exploitation Plan for STUBA:

- Successfully apply for EU projects by exploiting new management structures by using management toolbox. Results can be seen in the description of WP1.
- Reach out to other universities as mentor/supervisor through gained experience and updated administration.
- Intensify STUBA-internal collaboration, especially in field of cybernetics. The new PhD curriculum will be used as an example for other faculties.
- Increase attractiveness to academic and industrial partners. Mostly done through the “Academia meets Industry” seminars.
- Exploit extended network for new industrial collaborations. Mostly done through the “Academia meets Industry” seminars.
- Use input from consortium to expand to new research topics. Guest lectures, new Ph.D. curriculum, short-term and long-term staff exchanges etc.
- New Ph.D. curriculum will attract more students and researchers and the quality of Ph.D. students (hard and soft skills) is expected to increase.
- Extend collaboration with RUB and UNIPI in following EU projects. See results in the description of T1.4 and T2.3

#### Exploitation Plan for RUB and UNIPI:

- Exploit experiences gained from FrontSeat project
  - Application for future funding projects
  - Revise their own administrative structures
  - Use training material for future projects
- Further exchanges of Ph.D. students within new Ph.D. curriculum
- Exploit contribution to MPT (software)
  - Gain scientific visibility
  - New contacts in academia and industry
  - Strengthen international networks
- Exploit early access to new functionalities of MPT for own research

#### Exploitation Plan for others:

- Slovak research, innovation, and public
  - Reinforce “Slovak Control Network”
  - Attract international students and industrial partners
- Slovak and Czech universities
  - Other universities can build up similar structures based on training material and reports
  - Benefit from established academic-industrial cluster
- European R&I institutions
  - Exploit advanced automatic control solutions for meeting goals within European

institutions

- Results of FrontSeat should be used as a blueprint for future proposals of countries in similar positions
- Scientific community and industry
  - Use of new functionalities within open-source MPT
  - Collaborative exploitation of research results presented in articles and at conferences

#### Task T5.4: Dissemination (M7–M36)

Leader: UNIPI (1 PM), Contributors: STUBA (1 PM), RUB (1 PM)

The dissemination plan was set within the DEC plan which is described in the [D5.1 DEC \(Dissemination, Exploitation and Communication\) plan](#)

Dissemination objectives were set in the DEC plan: i) increase visibility of the partner institutions, with special refers to STUBA; ii) support young researcher's career development; iii) support exploitation of project scientific results; iv) increase the international reputation of partner institutions.

To achieve these goals the strategy was set through these activities:

i) publication of scientific papers in peer-reviewed journals. The publications have open access (encourage/train to the use of Open Science tools); All the publications with the referenced to FrontSeat are stored in [Zenodo](#).

ii) presentations at international scientific conferences (T3.1) f.e. During the IFAC World Congress The members of the FrontSeat consortium presented 10 research papers.

iii) participation in relevant local, national, and EU-level events. The project is presented in various events such as open doors of various faculties - [Blog post](#), meetings with various stakeholders, such as an event held by Center for Scientific and Technical Information of the Slovak Republic - [Blog post](#).

iv) contributing to the Project newsletter (in a specific section) - the separate section with the link to Zenodo was included to the newsletter, with an ambition to separately present most interesting publications in the upcoming newsletter coming up in April 2024;

v) the guest lectures (T3.2) and the summer schools (T3.4) are opportunities disseminate cutting-edge approaches to early-stage researchers.

#### Task T5.5: Communication (M1–M36)

Leader: STUBA (2 PM), Contributors: RUB (1 PM), UNIPI (1 PM)

The task started at M1 of the project and already during the Kick-off meeting the communication manager presented the project logo, website and the communication KPIs. The visual identity and social media were created and distributed among partners. Each partner of the project assigned a communication manager.

The communication plan was set within the DEC plan which is described in the [D5.1 DEC \(Dissemination, Exploitation and Communication\) plan](#)

After the internal evaluation of the website and other communication materials, it was decided to hire a marketing company to rebrand the design of the website, roll-up, and other materials, and to

create a brand book. A communication guide was distributed to the consortium in order to have downloadable templates for flyers and other materials. All the information regarding the communication templates is published on the website - <https://frontseat.stuba.sk/resources-and-publications/>

These are the most important communication activities:

- All the partners are contributing to the **blog on the website**, which includes the small blog texts of all the activities of the project - <https://frontseat.stuba.sk/blog/>
- **2 newsletters** were created and distributed that contained the most important events of the period. The newsletters are created 2 times per year, and they are accessible to everyone via project website - <https://frontseat.stuba.sk/newsletters/> The number of subscribers is lower than expected, but the project partners are constantly encouraged to promote it within their networks.
- **Social media** – at the beginning of the project Facebook for the project was created. After a year in the project and seeing low interest of the platform LinkedIn was created to reach bigger audience, especially researchers and universities. Creation of LinkedIn already brought positive results, as it was noticed that young researchers are keener to share their academic experiences on LinkedIn, than on Facebook.

Key communication indicators over the project implementation:

Indicator	Minimum expected quantity	Reached M1-M16
Unique hits on the project website	2000	10,315
Newsletter subscribers (distributions)	300 (6×2,000)	78 (94)
Followers/likes on social-media pages	1,500	86
Published blogs (hits on blogs)	40 (50×40)	84 (9221)
Articles/interviews in public-oriented media	6	4
Open Days presentations	12	12

*Deliverables (In the reporting period M1-M16):*

- D5.1 DEC (Dissemination, Exploitation and Communication) plan M5
- D5.2 Project website and social media M5
- D5.3 Data management plan M6

All the deliverables were submitted on time

*Milestones (In the reporting period M1-M16):*

- M3 Data management plan M6

All the milestone reached on time.

## Risks and mitigation for WP5:

Risk number	Description	The risk materialized Yes/No
1	Withdrawal of a partner or a partner stops cooperation. (Likelihood: Low, Severity: Medium)	No
2	Partner does not deliver all necessary inputs. (Likelihood: Medium, Severity: Medium)	No
3	Disputes in the consortium. (Likelihood: Low, Severity: Low)	No
4	Continuation of the COVID pandemics. (Likelihood: Medium, Severity: Medium)	No
5	Conflict in Ukraine expands to Slovakia. (Likelihood: Low, Severity: High).	No

### 1.3. Impact

Tables below summarize the progress of the project on the expected impacts of the Destination and the expected impacts of the topic:

Expected impacts of the Destination	Project during M1-M16
Increased science and innovation capacities for all actors in the R&I system in widening countries	Collaborative research activities are helping STUBA to become a recognised player in the field of automatic control. Participation in major conferences, publishing in top-tier journals, uptake of the software is a result of cooperation.
Structural changes leading to a modernised and more competitive R&I systems in eligible countries;	New PhD programme designed according to the modern needs, under the guidance of RUB and UNIPI. Improved project centre of STUBA makes the university more competitive towards preparation of research projects.
Reformed R&I systems and institutions leading also to increased attractiveness and retention of research talents	New PhD programme designed according to the modern needs, under the guidance of RUB and UNIPI.
Higher participation success in Horizon Europe and more consortium leadership roles	1 submitted Horizon Europe project (and awarded) together with UNIPI. STUBA also increased the consortium leadership roles winning one more project under Twinning scheme.
Stronger linkages between academia and business and improved career permeability	Stronger linkages between academia and business during the “Academia meets Industry” meetings.
Strengthened role of the Higher Education sector in research and innovation	Exchanges of ESRs, newly designed PhD program mirroring the current trends and needs.

Greater involvement of regional actors in R&I process	A number of regional industrial partners are involved in the project helping to strengthen the cooperation with the academia.
Improved outreach to international scale for all actors	Joint session at the international conferences, invited sessions and jointly written papers are improving the outreach on the international level for all the project partners.

Expected outcomes of the topic	Project during M1-M16
Improved excellence capacity and resources in Widening countries enabling to close the still apparent research and innovation gap within Europe.	Various activities improved excellence capacity and resources in STUBA, in particular - Research audit performed by RUB gave valuable suggestions for the faculty and the University, staff trainings and exchanges within WP1, knowledge transfer from RUB Research school and meetings with industry helped to shape innovative and modern PhD programme for Process control which will be used as an example for the other faculties, guest lectures, joint conferences and joint research activities helps STUBA to play a bigger role in the international field.
Enhanced strategic networking activities between the research institutions of the Widening countries and at least two internationally-leading counterparts at EU level.	The joint research activities with RUB and UNIPI can be seen almost throughout each activity of the project.
Raised reputation, research profile and attractiveness of the coordinating institution from the Widening country and the research profile of its staff.	Various staff trainings (of project managers, research school officers, researchers) is giving a great value in raising the research profile and reputation of STUBA.
Strengthened research management capacities and administrative skills of the staff working in institutions from the Widening country.	All the activities within WP1 can show the results of the strengthened capacities of research managers.
Improved creativity supported by development of new approaches in R&I collaboration, increased mobility (inwards and outwards) of qualified scientists.	ESR and Senior researchers are collaborating within few work packages of the project. The intensive schedule of scientific lectures and mobilities of the staff is on the schedule.

## 2. OPEN SCIENCE

The following measures were implemented and carried out on a regular basis. A Zenodo community called “FrontSeat” was opened, and all project related digital outputs were uploaded there by the respective consortium members. The repository ensures that every digital output of the project will be identified by a DOI. All the DOI-identified materials will be reusable under a CC-BY licensing or a Creative Commons Public Domain Dedication CC 0. No embargo was applied

on any digital output allowing full open-sharing of research with a minimum time between publication and availability. In order to stay up to date, Zenodo and the most important new publications are also highlighted in the regular newsletter.

All Information necessary will be given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication, to ensure reproducibility of the results obtained during the action. All digital outputs use widely established data formats. This avoids errors or deviations when converting data formats and further increases reproducibility of results. More specific information on used data formats are documented in the DMP, which is public on the project's website. Additionally, the provenance of all data will be thoroughly documented using the appropriate standards (e.g. ReadMe Files).

### 3. DEVIATIONS FROM ANNEX 1 AND ANNEX 2 (IF APPLICABLE)

N/A

## ABBREVIATIONS

Abbreviation	Expanded Version
STUBA	Slovak University of Technology in Bratislava
UNIFI	University of Pisa
RUB	Ruhr University Bochum
MPC	Model Predictive Control
IEEE	Institute of electrical and electronics engineers
DSC	Distributed control systems
ESR	Early stage researcher
SR	Senior researcher
EUCA	European control association
IFAC	International Federation of Automatic control
DOI	Digital object identifier
DMP	Data management plan