Progress Report
CERN IdeaSquare Summer School

Powered by


Student	Field	University
Félice Feldmann	Applied Physics	Delft University of Technology
Elia Mergaert	Aerospace Engineering	Delft University of Technology
Nicholas Kuijlaars	Mechanical Engineering	Delft University of Technology
Ertuğrul Kılıç	Computer Science	University of Amsterdam
Divya Gajera	Computational Science	University of Amsterdam

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1 Introduction

The CERN summer school is a joint initiative of Delft University of Technology and CERN's innovation pole Ideasquare, giving the opportunity to 25 students of Delft University, University of Amsterdam and Erasmus University Rotterdam to embark on an adventure to find creative and innovative applications to novel technologies developed under the ATTRACT Project. During the summer school, the students are divided in five teams of five students, working from May to July towards the goal of finding an application to their ATTRACT technology. The journey began in the Netherlands, on the campuses of Delft and Amsterdam, where the five teams underwent the first steps of the ideation process. After that, the teams met again in Ideasquare, on the CERN campus in Geneva, where they finalized their respective concepts during an intensive week of work, culminating in a pitch in front of experts and researchers working at CERN.

Team 5, composed of five students from TU Delft and the University of Amsterdam—Divya Gajera, Ertuğrul Kılıç, Nicholas Kuijlaars, Elia Mergaert, and Félice Feldmann took part in this adventure by working on the HipMed technology. This progress report documents their journey through the innovation process and their collaborative engagement with the technology.

2 Team

2.1 Team background

Divya Gajera

Studying: MSc Computational Science
University: University of Amsterdam

As I enter my second year of the Computational Science Master's program at University of Amsterdam, I'm thrilled to participate in the CERN IdeaSquare Summer Course through our department's enrichment program. This opportunity aligns perfectly with my passion for interdisciplinary work, combining computer science, mathematics, and other fields. The course's focus on teamwork across fields and real-world impact greatly appeals to me, as I believe in the importance of applying computational methods to solve complex societal challenges. Outside of academics, I enjoy coding personal projects and participating in hackathons. This summer course at CERN promises to be an ideal blend of my academic interests and desire for collaborative, impactful work. Outside of academics, I enjoy hiking in the Dutch dunes, one of the few areas in the Netherlands with varied terrain.

Ertuğrul Kılıç

Studying: BSc Computer Science
University: University of Amsterdam

I have spent a significant part of my life studying various engineering principles. I majored in electrical engineering and mathematics at Delft University of Technology and am now entering my third year of my bachelor's in computer science at the University of Amsterdam. After conducting research in mine detection and computer vision, I was given the opportunity to participate in the CERN summer school, despite not being an honors student. I was thrilled to embark on another project with a research assignment on the side. Although my background is in engineering, developing new skills in entrepreneurship and innovation, while working and collaborating with talented students and researchers, has provided me with depth in another engaging and educational project. Additionally, learning and developing unique engineering solutions that can be useful to people worldwide has proven to be a worthwhile endeavor.

Nicholas Kuijlaars

Studying: BSc Mechanical Engineering
University: Delft University of Technology

In my two years studying Mechanical Engineering at Delft, I have primarily worked on projects given problems and often predefined by design, material, and time. The opportunity to work with new technology, innovate applications, and explore their commercial viability immediately intrigued me. Instead of constraining my problem solving by what I could manufacture now, thinking about what may be possible in the near future. The CERN IdeaSquare Summer School offers valuable experience in multidisciplinary teamwork, while allowing me to explore the intersection of engineering, innovation, and societal impact, developing valuable skills which I can carry on to future work. I hope to be able to bring a broader, more creative and open minded approach to my next project. I am also incredibly grateful for the opportunity to visit CERN and interact with some of the great minds at work there.

Elia Mergaert

Studying: BSc Aerospace Engineering
University: Delft University of Technology

I have been studying Aerospace Engineering for two years at Delft University of Technology. Through the Bachelor's Honors Program, I was offered the opportunity to participate in the CERN summer school. I was thrilled to take this chance to explore a field vastly different from engineering, and to be introduced

to the fields of innovation and entrepreneurship for the first time. I knew that this would be a unique opportunity to meet brilliant students from different backgrounds than mine, to develop new skills, create meaningful connections, and visit the CERN campus in Geneva. Last but not least, I was very excited at the idea of learning about the long and complex process that is behind many of the innovations the revolutionize our lives.

Félice Feldmann

Studying: BSc Applied Physics
University: Delft University of Technology

I am an Applied Physics student at Delft University of Technology with a strong commitment to advancing my knowledge and skills. The CERN IdeaSquare Summer School aligns perfectly with my aim of becoming a well-rounded physicist. I see this opportunity as a crucial component of my Honours Programme Bachelor, providing valuable hands-on experience in multidisciplinary teamwork, innovative problem-solving, design thinking, and prototyping. It will broaden my perspective on technology, teaching me to integrate diverse viewpoints and factors beyond technical aspects to achieve optimal outcomes. My long-held aspiration to contribute to groundbreaking research in high-energy physics at institutions like CERN and Nikhef further fuels my enthusiasm for this Summer School. I am eager to immerse myself in the unique environment of CERN, learn from leading experts, and explore the broader societal impacts of cutting-edge technologies in this field.

Figure 1: Personalities of Fast Falcon Vision.

As part of our team-building efforts, we completed a personality test that offered valuable insights into our individual characteristics. The results highlighted Ertuğrul's natural leadership and strategic thinking abilities, while Elia's profile underscored his strong interpersonal skills and commitment to collective success. Félice and Divya brought deep insights and idealism to the team, contributing thoughtful perspectives. Meanwhile, Nick's re-

sults reflected a practical and analytical approach to problem-solving, which complements our team's diverse skill set (Figure 1).

2.2 Team rules, superpowers and dragons

This summer student program is particularly intensive, featuring three-day design sprints in Delft and eight full days in Geneva. Given this demanding schedule, establishing ground rules within the team was essential for fostering high performance. These rules served as a crucial framework for guiding behavior, communication, and decision-making, ensuring effective and productive collaboration among team members. We collectively agreed upon the following team rules:

- **Respect:** Embrace feedback and diverse opinions with an open mind and understanding.
- **Accountability:** Take responsibility for the progress and success of the project.
- **Continuous Learning:** Cultivate curiosity and a drive to acquire new knowledge to advance the project.
- **Communication:** Maintain consistent and transparent communication. Address any disagreements promptly to prevent the buildup of frustration.
- **Creativity:** Encourage the sharing of ideas, regardless of their novelty, complexity, or perceived impracticality.
- **Collaboration:** Seek assistance when needed and offer support to teammates in need.

(a) Super Powers of Fast Falcon Vision (b) Dragons

Super Powers: In collaboration with the team, we identified the diverse strengths and capabilities within our group, aiming to leverage these to boost performance and foster effective collaboration. We have compiled these super powers into a clear and organized overview (Figure 2a).

Dragons: In collaboration with the team, we also identified potential challenges and obstacles that could impact our progress. Our aim is to address these issues proactively to maintain and enhance performance. Again we have compiled these dragons into a clear and organized overview (Figure 2b)

3 Innovation Process

3.1 Setting up the Process

Upon receiving the HipMed technology assignment, our team focused on discovering a novel and revolutionary application. We implemented the Design Thinking framework to guide our innovation process. Our initial task was to gain a comprehensive understanding of HipMed technology and cultivate an environment conducive to idea generation.

This preliminary stage, referred to as the Define phase, occurred during educational sessions and team gatherings in Delft throughout May and June. Key accomplishments during this phase included:

- Identifying the technology's distinctive features and summarizing our learnings about the technology
- Developing a concise 'We know how to' statement to capture our technology's potential

- Generating a diverse list of 100 potential industries for technology application

This methodical approach established a robust foundation for our innovation journey, ensuring we had a thorough grasp of HipMed technology before advancing to ideation and development stages, during which the initial ideas are refined through extensive research and discussions with fields experts. The outcome of this process was the shortlisting of five promising concepts, later reduced to a single final concept.

3.2 HipMed Technology

HipMed, or Hyperspectral Imaging for Precision Medicine in Cancer Diagnostics, is a pioneering project supported by the ATTRACT initiative. This initiative is dedicated to advancing breakthrough technologies with significant potential across various fields, including healthcare.

HipMed's initial aim is to revolutionize cancer prognosis with advanced optical technology, enhancing tumor diagnosis accuracy and expediting treatment decisions. Traditional methods rely on specific staining kits, which limit the information available to pathologists. In contrast, HipMed utilizes cutting-edge spectral imaging technology to capture the entire visible light spectrum at each pixel of a biopsy image, enabling detailed analysis with up to 40 spectral data points per pixel.

By analyzing the full light spectrum from each pixel, HipMed's system provides comprehensive insights into protein expression and cellular morphology of tumor cells. This enhances cancer type identification and staging, potentially reducing the need for additional biopsies and streamlining the diagnostic process. Unlike traditional methods, which examine only a few biomarkers per slide, HipMed's system can simultaneously image multiple biomarkers, overcoming these limitations.

Moreover, HipMed integrates Artificial Intelligence (AI) to aid pathologists in interpreting data. This combination of advanced optics and AI offers precise and efficient analysis in clinical settings, enabling the detection of subtle variations in cellular characteristics, such as protein expression or genetic markers. This detailed insight supports accurate cancer cell identification and profiling, aiding in tailored treatment planning.

Our team's task was to explore the potential applications of HipMed beyond the medical field, with a focus on potential broader societal benefits. To begin, we summarized the unique characteristics of HipMed:

1. **Full Spectrum Measurement:** It captures the entire visible light spectrum at each pixel with exceptional speed.

2. **Rapid Analysis:** Its innovative optical setup allows for the comprehensive examination of large biopsies within minutes.

3. **Specialized Biochemical Kit:** The kit is designed to identify critical properties of cancer cells with high precision.

4. **AI Integration:** Advanced artificial intelligence ensures optimal analysis of extensive datasets.

5. **Precision Drug Matching:** It facilitates the precise matching of drugs to specific cancer types.

Identifying the unique features of HipMed led to the creation of a "We know how to" statement that aims at summarizing the usefulness of the product in a clear and concise manner. For HipMed the final statement was: **We know how to take and interpret images containing more colors than regular pictures**.

Finally, the following data, provided by the technology developer was critical to our understanding of the possibility offered by HipMed:

- With engineering efforts, the HiMed camera can be miniaturized to a size of a few cm in dimensions.

- The performance of HipMed is highly dependent on lighting conditions, however in bright environments, the device is remarkably fast, being able to take pictures every few seconds.

- Mass production of our concept involving HipMed could make to technology very affordable, even to individuals, though R&D efforts would be necessary to adapt the technology.

3.3 Domain Exploration

Our understanding of the HipMed technology was used to build a list of a 100 industry fields in which it can potentially have novel, creative and useful applications. We generated this list using our own ideas, supplemented by concepts derived from existing applications that could be improved, ideas inspired by fiction and the wider world, and AI-generated suggestions. The 100 domains are outlined in the Figure 3.

Figure 3: 100 Industry Applications

After identifying 100 domains or industries, the team's focus shifts to gaining a deep understanding of these domains and exploring the potential role our technology could play within them. This involves a comprehensive research approach conducted over five rounds. In each round, each team member examines a specific domain, so as a team, we collectively cover 25 domains. During each round, team members select a domain to explore and analyze it, using a canvas similar to the one shown in Figure 4

Figure 4: In depth domain exploration

3.4 Narrowing it down - Tech-Applications fit

The next step was to narrow down the list of fields from a 100 to 10 to better focus the research. During this step, more specific applications for the fields that were retained were also identified, bringing us one step closer to a list of potential, concrete concepts. To achieve this task, each one of the 100 fields was assessed in terms of pain, market size and gap, feasibility and impact to identify the most promising ones. The necessary information to achieve such a ranking was obtained through research on the internet, but also back of the envelope impact estimations, as well as discussions with well informed industry personnel. The retained fields, along with their respective application are listed below:

- Forestry - Wildfire Monitoring
- Agriculture/Horticulture - Corp Monitoring
- Marine Biology - Population Monitoring
- Animal farming - Population Monitoring
- Food Safety - Quality Assessment
- Water Sanitation - Quality Assessment
- Mining - Ore Detection
- Art - Restoration
- Law - Document authentication
- Building Safety - Structural Prognosis

3.5 Final concepts

In our exploration of HipMed's potential applications beyond the medical field, we developed five concepts from the 10 applications retained in the previous step, by selecting the most promising ones after discussing them with industry experts. The five concepts where refined to the level of a concrete product idea. Amongst them was our final concept. The four remaining ones, that did not advance to the final stage, are detailed here:

Wildfire Monitoring

With the rising of global temperature, the frequency and intensity of wildfires, particularly in regions like Southern Europe, have increased. Leveraging HipMed's hyperspectral imaging technology, we proposed a system integrating drones and satellites to enhance wildfire detection and prevention. This system would capture detailed color information to scan forests, bushlands, and other fire-prone areas. By continuously analyzing real-time data with AI, we could

identify early signs of fire risk based on the color and pattern changes in vegetation. This advanced monitoring could improve predictions of potential wildfires and enable more targeted strategies for preventing their spread.

Meeting with Nathan Vercruyssen, an expert working at Cosine Remote Sensing, revealed that similar ideas are being developed by them, although not yet functional in practice. Moreover additional limitations emerged, like the fact that many wildfires are started by human activity, reducing the potential impact of this concept.

Bee Monitoring

Bees are essential pollinators whose populations are declining due to climate change, habitat loss, and pesticide use. Our concept involved equipping a small drone with HipMed's technology to monitor bees and their environment. This drone would track bee movements, their foraging patterns, and their interactions with their habitat. Additionally, it would assess environmental factors such as nutrient availability and the presence of flowering plants. Such data could assist beekeepers and farmers in ensuring the health of bee populations and optimizing crop pollination, while also providing insights into the actions needed to protect these vital pollinators.

However, through a meeting with a beekeeper from MoKa Honey we learned that one of the major reasons for the population decline of pollinators populations is the presence of very invasive *Varroa* mites, against which this concept would be of little help, limiting itself to monitoring the presence of the mites to optimize the timing of treatments, without solving the problem completely.

Plankton Health

Plankton plays a critical role in marine ecosystems, including oxygen production and sustaining oceanic life. However, plankton populations are declining due to factors like ocean warming and microplastic pollution. Our proposed concept utilized marine expeditions or autonomous vehicles equipped with HipMed to capture hyperspectral images of water samples. AI analysis of these images would allow for rapid assessment of plankton populations and their health. This approach would enable on-site processing of samples, providing faster and more detailed insights compared to traditional lab methods and satellite imaging, and could be instrumental in monitoring and preserving marine ecosystems.

Horticulture

In the face of growing global populations and unpredictable climate conditions, greenhouses are becoming increasingly important for food production. This concept aimed to enhance greenhouse efficiency using HipMed's hyperspectral imaging to monitor and optimize crop conditions, which is to this day still widely done by hand. By capturing detailed color information, the technology would provide a better understanding of plant needs regarding temperature,

light, water, pH, nutrient levels, and humidity. Real-time adjustments based on this data could significantly improve crop yield and productivity, making greenhouses more effective in feeding a growing world population.

Although this concept was not retained as the final one, meeting with a Horticulturist working at Royal Brinkman showed that this concept is very promising. In fact, hyperspectral imaging hasn't been implemented in horticulture yet due the time required to analyze the health of full greenhouses, which is prohibitively high. However, the HipMed technology is remarkably fast in analysing samples. Thus, by optimizing the monitoring protocols, this issue could be solved. Moreover, similar applications for which exposition time is less constraining were thought of. For instance, HipMed can be used to check the health of plants entering the greenhouse for the first time to ensure that no contaminant is introduced.

4 Final concept: Fresh Vision

4.1 Problem definition

Everyone was once faced with the common dilemma of whether to keep or discard food that's past its expiration date, of deciding whether a bottle of milk or jar of sauce is still safe to consume. This issue is not just a personal inconvenience but a widespread problem with far-reaching consequences. In 2022, the European Commission estimated that 600 million tonnes of food waste were generated from households alone, equivalent to the mass of 60,000 Eiffel Towers. This colossal waste translates into financial losses exceeding 100 billion euros annually within the EU, while also squandering valuable food resources that could otherwise aid those in need. Additionally, it involves the unnecessary expenditure of energy and resources used in food production.

4.2 Description of solution

Fresh Vision is an innovative application designed to tackle the food waste crisis using the advanced hyperspectral imaging technology offered by HipMed. Fresh Vision offers a simple yet effective solution for determining the edibility of food and beverages. By capturing a single picture of the food item with our specialized camera lens, the app performs a comprehensive analysis of discoloration, chemical changes, and the presence of specific bacteria and fungi. This analysis allows users to quickly ascertain whether their food is still safe and appetizing to consume.

To use it, a smartphone can be used to take a picture of the food item through the Fresh Vision lens. The Fresh Vision app processes the image and provides an instant assessment of its safety, indicating whether the food is 'Safe to Eat' or 'Not Safe to Eat.' Additionally, the app evaluates the flavour profile

based on factors such as acidity and sugar levels, providing you with a comprehensive overview of your food's condition. This tool would revolutionize eating experiences by eliminating guesswork and reducing food waste.

4.3 Impact

Fresh Vision is poised to make a profound impact on both environmental and economic fronts. Its implementation could potentially save hundreds of millions of tonnes of food from being wasted each year. This reduction in food waste could significantly decrease the 6 percent of global greenhouse gas emissions currently attributed to food waste and help conserve up to a quarter of the world's water supply. Furthermore, households using Fresh Vision could save hundreds of euros annually by preventing unnecessary food disposal.

Furthermore, the potential of Fresh Vision extends beyond individual households. It can be used in restaurants, where handheld scanners could quickly assess ingredient and dish quality, and in industrial and commercial settings with stationary or dynamic image scanners, ensuring food quality and reducing waste on a larger scale. By making Fresh Vision accessible and user-friendly, it would contribute to the UN's goal of reducing global food waste by 50 percent by 2030.

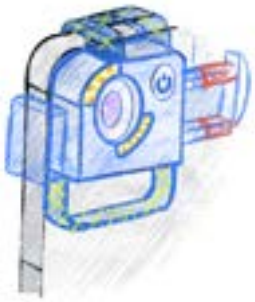
4.4 Prototype

To illustrate the final concepts to the public present during the final pitch presentation, it was necessary to build prototypes. Since three different formats for the final concept were thought of (namely the phone camera lens, the hand held scanner and the industrial scanner), a prototype for each was built. Since the HipMed technology was not available at hand, the prototypes were not functional. However, they served their purpose to showcase the dimensions, ease of use, and aspect of the products.

4.4.1 Consumer market - Phone camera lens

The phone camera lens prototype was designed for everyday consumers. This 3D-printed extension, compatible with a specialized smartphone application, transforms a regular smartphone into a food and beverage quality assessor. The emphasis during prototyping was placed on the overall structure and ergonomic design of the extension, particularly fitting it to an Apple iPhone 15 Pro for demonstration purposes. A key feature includes utilizing the phone's flashlight, integrated into the software, to ensure adequate illumination during assessments. This approach allows the extension to be adaptable for various modern smartphone brands without necessitating built-in lighting, making it a versatile tool for consumers.

(a) Final prototype



(b) Initial prototype sketch

Figure 5: Phone camera lens design process

4.4.2 Retail sectors - Handheld scanner

The handheld scanner was developed to address the specific needs of the hospitality and retail sectors, where robustness, reliability, and high-frequency usage are crucial. Unlike the consumer-focused phone camera lens, this device features an integrated camera, LED illumination, and a user-friendly interface (UI) all housed within a handheld unit. The prototype highlighted key functionalities, including a user-actuated trigger that initiates the LED lights and camera focus before capturing an image, housed in an aluminum and foam casing. The device is capable of distinguishing a wide range of colors, enhancing its ability to assess the quality of food and beverages.

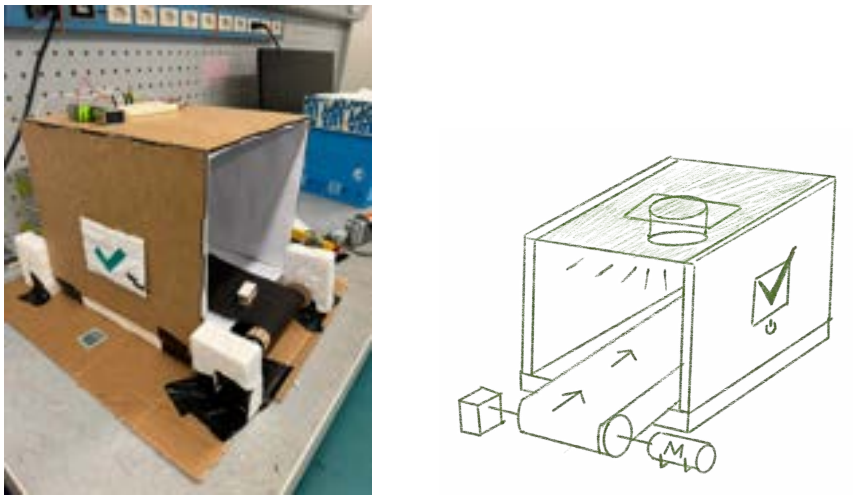
(a) Final prototype

(b) Initial prototype sketch

Figure 6: Handheld scanner design process

4.4.3 Logistics and industrial sectors - Industrial scanner

The industrial scanner was designed to meet the demands of logistics and industrial environments, where continuous product quality assessments are essential. This prototype features an automated system combining a conveyor belt and a scanning box equipped with LED lights for illumination. Products are transported via the conveyor belt into the assessment area, where they are scanned before the belt resumes movement. The conveyor is powered by a 12V DC motor. The prototype focused on demonstrating the integration of transportation and assessment processes.



(a) Final prototype (b) Initial prototype sketch

Figure 7: Industrial scanner design process

5 Individual reflections

Divya Gajera

The CERN IdeaSquare Summer School was an extraordinary experience that exceeded my expectations in unexpected ways. Initially, I anticipated a program heavily focused on technical projects, so I was surprised when the curriculum leaned more towards business and entrepreneurship. Despite my initial reservations, this shift opened my mind to new ways of thinking and broadened my understanding of the innovation process.

The collaborative environment was one of the most enriching aspects of the program. Working alongside a diverse group of students from various academic backgrounds was invigorating. The enthusiasm and dedication of my teammates were contagious, creating a synergy that propelled our project forward. This experience taught me the value of teamwork, where mutual respect and active listening can lead to powerful outcomes.

The hands-on experience at CERN, particularly the prototyping activities at IdeaSquare, was nothing short of inspiring. The opportunity to work in such a cutting-edge environment, surrounded by passionate peers and experts, deepened my appreciation for the innovation process. Engaging in thought-provoking discussions with both academic and industry professionals further expanded my knowledge and challenged me to think critically about our ideas.

While there were aspects of the program that could benefit from further refinement such as the timing of project work. I found the overall experience to be incredibly rewarding. The dynamic exchange of ideas and the opportunity to test our concepts in a real-world setting made the program both fun and intellectually stimulating.

For anyone looking to challenge themselves, expand their horizons, and engage in a truly unique learning experience, I highly recommend the CERN IdeaSquare Summer School. It's a rare opportunity to grow in an environment that fosters creativity, collaboration, and real-world innovation.

Ertuğrul Kılıç

Since it was my first time working on something non-technical, focusing on entrepreneurship and innovation, it was quite challenging for me to shift my mindset on how to discuss various existing and unique technological solutions. This experience allowed me to learn about the ideation process and how to apply it to various prototyping phases. I was already accustomed to following project processes based on a defined template that begins with the initiation phase and ends with the delivery phase. In this program, I was tasked with working on Mural boards, which are similar in that they provide a template to follow. This was something I enjoyed working with, and it helped me broaden my project evaluation skills.

Moreover, talking to professionals and reaching out to people to gather meaningful information regarding our innovative technological solutions was something I enjoyed the most during the program. Soft skills are not something I am very comfortable applying, but this program provided many opportunities to refine these skills. I am grateful for having done this at CERN, as well as with many other great people outside of CERN.

Additionally, working together with my team at CERN IdeaSquare gave me the chance to learn a lot about my fellow peers and to understand different aspects of the innovative technological solutions, given their unique set of skills from their respective majors.

Of course, there were a few things that did not go ideally. Reaching out to specialists too late is one important aspect, which caused us to learn about our respective technology much later. Applying my soft skills to engage more with the people at CERN IdeaSquare to learn more about applying our research methods is also something I would definitely work on in the future.

Finally, I am very pleased with how the project turned out and am very thankful to my fellow team members for their participation. This project allowed me to learn new skills regarding innovation, teamwork, and the application of soft skills. In the future, I plan to continue improving my soft skills. Developing and working on innovative and unique technological solutions for society by providing both research and extensive prototyping has been a fulfilling experience. In conclusion, I am very thankful to have participated in such an educational and enjoyable project.

Nicholas Kuijlaars

The CERN IdeaSquare Summer School was definitely a fun and interesting learning experience. While I initially expected a more technically focused program, the more creative and entrepreneurial approach provided an interesting challenge forcing me think and approach problems in a different way. I hope this broader perspective will allow me to consider a wider range of possibilities in finding the best solutions to engineering problems in the future.

The centrepiece of the program was the innovation process we followed. The focus of this process was looking for inspiration everywhere, and then digging deeper until we found an application, allowing us to make big leaps from what concepts might already exist. By contrast in mechanical engineering we typically look at already works and think about how it might be improved. Here, we were only allowed to start looking into the solution itself once we had multiple potential applications, which meant everyone in the group already had a few angles of attack ready in their head before we put pen to paper. The idea of developing prototypes much earlier in the design process, as a means of communicating an idea instead of later in the process for testing its functionality, is also something I hadn't really done before and will try to apply in my next project.

This project has also been a great opportunity to develop and refine my soft skills. Working in a multidisciplinary team is always valuable experience, particularly when the teams were selected to be a mix in both academic background

and personality types. While it may have impacted communication, it was essential for collectively bringing a broad perspective to the project. On the other side, engaging with industry experts and academic professionals, particularly in the context of presenting our project ideas, was initially daunting but ultimately rewarding. It has been a valuable reminder of the importance of clear and effective communication, especially when conveying complex technical concepts to a non-specialist audience. While they didn't always go perfectly, I have gained some confidence in my ability to navigate such discussions, a skill that I should be valuable in almost any future career.

Ultimately, the CERN IdeaSquare Summer School has been a valuable experience that has broadened my understanding of the intersection between technology, business, and innovation. It has equipped me with practical skills and a collaborative mindset that I am eager to apply in future projects. The experience has not only deepened my technical knowledge but has also inspired a more open minded approach to problem-solving, one that values creativity, adaptability, and interdisciplinary collaboration. I am grateful for the opportunity to have participated in this program and for the lasting impact it has had on my academic and professional journey.

Elia Mergaert

The CERN summer school was for me a valuable learning experience for multiple reasons.

Firstly, it was my first contact with the world of innovation and entrepreneurship. I therefore learned a lot regarding the ideation process and how to go from a very broad field of ideas and possibilities to much more realistic and defined concepts. I particularly liked working with the mural board (online tool used to keep track of our progress), as it allowed our team to get a great overview of the progress made in the ideation process. This proved to be very useful, as the final concepts were in fact a combination of our initial ideas and our more advanced thoughts.

The second major take away for me was the development of specific skills. In particular the soft skills associated with contacting professionals, meeting and discussing our ideas with them to get useful insights.

Finally, I learned a lot by being immersed in an environment like CERN, surrounded by scientists and innovation experts, all with different specializations, who were able to give us valuable insights every time we enquired. In addition, I learned a lot from my peers, who are all brilliant students coming from various different backgrounds.

If I had to go through this summer school again, I would do a few things differently.

I would get in touch with industry experts much earlier in the ideation process. In fact, I noticed that the most valuable insights on our specific concepts

always came from the meetings with these experts. Starting earlier with these meetings would have given us much more time to improve our concepts in detail.

Additionally, I would involve myself more in the prototyping process as I realized that it is a valuable skill to have, that I am currently still lacking.

Lastly, I would try to talk more to the people working at CERN, taking more advantage of the unique opportunity of spending a full week on their campus.

All in all I am glad to have participated to this summer school, that allowed me to broaden my horizons, by introducing me to a completely new field of work, by meeting students and experts, and by developing new skills. I could also discover areas in which I could still make a lot of improvement, like pitching and prototyping. It inspired me to develop new ideas and gave me the tools to bring them to life. To conclude, it is also important to note that aside from the work done, the summer school was also very fun and a unique occasion to discover Geneva and CERN surrounded by fellow students and friends.

Félice Feldmann

Participating in the CERN IdeaSquare Summer School was an extraordinarily enriching experience that significantly shaped my personal and academic journey. I am deeply grateful for the opportunity to engage with inspiring individuals and experts who generously shared their knowledge, offering invaluable skills and insights that I will carry forward.

One of the key aspects of the program was the comprehensive exploration of the Design Thinking process. From framing and ideation to prototyping and testing, the iterative nature of these activities refined my problem-solving abilities and enhanced my creative and critical thinking. Presenting our solutions to a variety of audiences further challenged us to communicate complex ideas effectively, a skill that I found crucial for future endeavors.

The program's emphasis on business and entrepreneurship provided a refreshing complement to my technical background. Delving into market research, value proposition development, and the intricacies of driving innovation broadened my understanding of how technical solutions must align with market needs. This fusion of technical and business perspectives has given me a more holistic view of the innovation landscape.

Collaborating within a multidisciplinary team was a highlight of the experience. The diverse viewpoints and expertise of my teammates fostered a dynamic environment where creative solutions emerged from collective effort. This taught me the importance of effective teamwork, open communication, and mutual respect in achieving shared goals, lessons that I will carry into future collaborative projects.

Being situated at CERN added a profound layer of inspiration to our work. Immersed in an environment synonymous with cutting-edge scientific research, I was motivated to push boundaries and explore new ideas. Engaging with professionals from various fields and stepping out of my comfort zone to seek their insights was particularly transformative, reinforcing the value of proactive engagement and continuous learning.

Reflecting on the experience, it is clear that the CERN IdeaSquare Summer School was more than just an academic program; it was an immersive journey that fostered a mindset of collaboration, innovation, and broader, creative thinking. I am immensely thankful for the opportunity to have participated, for the remarkable team I had the privilege to work with, and for the supportive environment cultivated by both CERN IdeaSquare, as well as the whole team of representatives and my fellow students. I am excited to apply these insights and skills to future projects, knowing that this experience has profoundly shaped my approach to challenges and opportunities.

6 Conclusion

The aim of this project was to develop as a team an innovative product that can bring a positive impact to our current society, by drastically changing our way of living, with at the center HipMed, a novel hyperspectral imaging technology. To reach this goal, we started from the technology, and gradually explored all the possibilities it offered. We first deepened our understanding of HipMed, which allowed us to identify more than a 100 fields of applications for it. Throughout our journey, we refined our search with thorough investigation of these fields, putting into action all the valuable insights we gained during the lectures and our discussions with experts. After two months of work, we reached our final design: an innovative food scanner capable of assessing the quality of food, which we believe holds significant potential for improving food waste management, and have a measurable impact on our world.

Throughout this project, we were all faced for the first time with the challenges of innovation. This pushed us to think critically and work together seamlessly. These experiences have been invaluable, providing us with new skills and insights that we will carry forward in our professional careers.

7 Acknowledgements

We thank Sem Carree and Dap Hartmann for organizing and facilitating the 2024 TU Delft CERN Summer School, and the CERN IdeaSquare team for their help and hospitality. We are also grateful to Professor Yuval Garini, developer of HipMed for accompanying us through this journey and sharing his knowledge and insights, and to all who provided advice throughout the project.