2025 CERN Spring Campus

Report of Contributions

Contribution ID: **4** Type: **Presentation**

Enhancing Performance with Parallel Computing

Monday 5 May 2025 15:30 (1 hour)

In today's world of Big Data, artificial intelligence, and real-time applications, performance is more critical than ever.

This presentation delves into the fundamentals of parallel programming, focusing on optimizing performance using shared memory with multi-core CPUs and distributed memory across networked systems.
Through practical examples, we'll demonstrate how parallelism can significantly reduce computation times and enhance overall efficiency.
We'll explore profiling and performance analysis techniques to help you identify bottlenecks and opportunities for parallelization, leading to the introduction of tools like OpenMP and MPI to address these challenges.

A simulation, similar to Conway's Game of Life, will highlight the real-world advantages of parallel computing, showcasing the kinds of performance gains essential in fields like machine learning, data processing, and scientific simulations.
This simulation will also set the stage for our next topic on GPU parallelism.

Author: MARTINS, Joao

Presenter: MARTINS, Joao

Contribution ID: **5** Type: **Presentation**

Elevating Performance through GPU Parallelism

Thursday 8 May 2025 09:00 (1 hour)

As modern applications demand higher performance and richer visual experiences, GPUs have emerged as powerful tools for both rendering graphics and executing parallel computations.

This presentation explores the realm of GPU computing, highlighting its multiple functions, including applications in graphics rendering, machine learning, and general-purpose GPU (GPGPU) computing.
We'll provide an introduction to GPU architecture and walk through shader programming, demonstrating how APIs like CUDA and Metal unlock the full potential of modern graphics processors.

Through a simulation, you'll witness how shaders can significantly boost parallel performance, leading to higher frame rates and greater responsiveness compared to traditional CPU implementations.

We will also compare these GPU-accelerated solutions with CPU-based approaches, highlighting the remarkable performance improvements that GPUs bring to computational tasks.

Author: MARTINS, Joao

Presenter: MARTINS, Joao

Contribution ID: **6** Type: **Presentation**

Spring Campus Opening Ceremony

Monday 5 May 2025 09:30 (30 minutes)

Contribution ID: **7** Type: **Competition**

QuantumConnect: Particle Collision Challenge

Monday 5 May 2025 10:00 (30 minutes)

Step into the world of quantum coding with QuantumConnect, where you will craft your own Java programs to compete in a Connect 4-style game tournament. Like quantum particles racing through a collider, your program will need to react swiftly and precisely to outmaneuver opponents. Participants will have 45 minutes to create and submit their solutions, which will then go head-to-head in strategic battles, testing their adaptability and strategy.

In this fast-paced, quantum-inspired competition, outcomes will be as unpredictable as particle behavior at the quantum level. Competitors must rely on logic, quick thinking, and efficient coding to claim the title of QuantumConnect Champion. Join us for a session of intense collisions and high-energy gameplay, where coding and quantum mechanics collide in the ultimate challenge!

Contribution ID: **8** Type: **not specified**

Examination

Friday 9 May 2025 15:00 (1 hour)

Contribution ID: **9** Type: **not specified**

Prizegiving and closing remarks

Friday 9 May 2025 16:30 (45 minutes)

Presenters: JANKE, Jan (CERN); Mr BRAEGER, Matthias (CERN)

Contribution ID: **10** Type: **not specified**

Closing Party

Contribution ID: **15** Type: **Presentation**

Jan Janke - Presentation 2

Tuesday 6 May 2025 14:00 (1 hour)

Presenter: JANKE, Jan (CERN)

Contribution ID: **33** Type: **Presentation**

SAMK lecture

Contribution ID: **37** Type: **Presentation**

Business Analysis: Empowering Teams and Projects:

Monday 5 May 2025 14:00 (1 hour)

How does Business Analysis enhance collaboration and project success? In this session, we'll explore the role of the Business Analyst as a key player in any team. Learn how Business Analysis practices help bridge communication gaps, align stakeholders, and ensure that project goals deliver real value. This introduction highlights how BAs drive clarity, manage requirements, and foster teamwork, making them an essential part of high-performing projects.

Author: GOBERT, Sophie (CERN)

Presenter: GOBERT, Sophie (CERN)

Contribution ID: **38** Type: **Presentation**

Modern Natural Language Processing for Software Engineers - Part 1

Tuesday 6 May 2025 16:30 (1 hour)

This lecture series will offers you a comprehensive yet accessible journey through the history and state-of-the-art techniques in NLP. We'll explore a few essential concepts, practical applications, and emerging trends without drowning in the complex mathematics needed to unravel these tools.

The first lecture will cover the theoretical basis needed to grasp the nomenclature of NLP, ending with the most recent developments that have taken the industry by storm due to their performance - transformer models.

The second lecture will focus more on the practical aspects of applying generative AI and NLP techniques to real problems, from an engineering point of view. Rather than focusing on the research, we'll focus on what can be achieved by you as developers. We'll be live-coding a few examples using open source software in order to showcase the power and usefulness of these approaches. By the end, you should know what the trade-offs and limitations are behind all the "magic" of large language models, and what this means to you as a software engineer.

All code implementations will be in Python, but we will also briefly cover what the enterprise world is doing (e.g. in Java).

Author: Dr SCHUSZTER, Cristian (CERN)

Presenter: Dr SCHUSZTER, Cristian (CERN)

Contribution ID: **39** Type: **Presentation**

Python-Powered Trading: Strategies and Success

Wednesday 7 May 2025 09:00 (1 hour)

Ever thought of beating the market?

Explore the intersection of finance and programming as we dissect intricate trading strategies using Python. From backtesting techniques to predictive modeling, this session provides a deep dive into the scientific and programming aspects of algorithmic trading.

Whether you're a quantitative analyst or a coding enthusiast, this presentation offers a comprehensive exploration of the fusion between programming, and financial markets.

Author: URIA VALLE, Victor (Universidad de Oviedo (ES))

Presenter: URIA VALLE, Victor (Universidad de Oviedo (ES))

Contribution ID: **40** Type: **Presentation**

Beyond Numbers: Mastering Data Interpretation and Visualization with Power BI

Friday 9 May 2025 11:30 (1 hour)

Say goodbye to dull spreadsheets and obsolete Excel charts!

Explore how data transcends mere numerical figures, evolving into a rich tapestry of insights and narratives. We delve into the significance of interpretation, understanding the context, and crafting compelling visual stories that drive informed decision-making.

Discover the depth of data visualization techniques, from interactive dashboards to predictive analytics, all within the intuitive framework of Power BI.

Author: URIA VALLE, Victor (Universidad de Oviedo (ES))

Presenter: URIA VALLE, Victor (Universidad de Oviedo (ES))

Contribution ID: **45** Type: **Presentation**

Event Pattern Matching in real-time complex data processing

Monday 5 May 2025 11:30 (1 hour)

Event Pattern Matching (EPM) in real-time complex data processing refers to the technique of identifying and reacting to specific sequences of events within a continuous stream of data. It is commonly used in Complex Event Processing (CEP) systems to detect meaningful patterns or anomalies that occur across different data sources and over time.

This capability is essential in scenarios where large amounts of data are being generated continuously and require immediate or near-real-time analysis to extract actionable insights. Examples include financial markets, IoT sensors, network monitoring, and fraud detection.

In this lecture will provide an introduction to Pattern Matching strategies flavoured with typical examples from the industry.

Author: Mr BRAEGER, Matthias (CERN)

Presenter: Mr BRAEGER, Matthias (CERN)

Contribution ID: **46** Type: **Presentation**

Introduction to Alarming in Industrial Controls sector

Tuesday 6 May 2025 11:30 (1 hour)

Alarming in the industrial controls sector plays a critical role in ensuring the safety, efficiency, and reliability of automated systems. This process involves monitoring key parameters of industrial equipment and processes, generating alerts when predefined thresholds are breached, and enabling timely intervention to prevent malfunctions or safety incidents. Alarming systems are designed to provide real-time notifications to operators, facilitating quick decision-making and mitigating risks. An effective alarming strategy reduces downtime, enhances process control, and maintains compliance with safety regulations, making it a cornerstone of modern industrial automation and process control systems.

This lecture will provide you a good overview about Industrial Controls strategies for alarming, based on real examples from CERN's Technical Infrastructure Operators in the CERN Controls Centre (CCC).

Author: Mr BRAEGER, Matthias (CERN)

Presenter: Mr BRAEGER, Matthias (CERN)

Contribution ID: **48** Type: **Presentation**

TDD makes you a better everyday developer

Tuesday 6 May 2025 10:30 (1 hour)

Learning the Test Driven Development methodology can teach you many techniques and good habits that make you a better developer even when not following the strict TDD process.

In this talk we'll look at some of these techniques, why we use them when following the TDD process and how they still apply when not doing TDD.

For example:

- Powerful IDE code completion
- Encapsulation, single responsibility principle, dependency injection
- Code Coverage (and its pitfalls)
- Automated testing strategies: unit, integration, acceptance, etc…

Author: KERSHAW, Jesse (CERN)

Presenter: KERSHAW, Jesse (CERN)

Contribution ID: **49** Type: **Presentation**

Introduction to Test Driven Development Workshop

Wednesday 7 May 2025 11:30 (1 hour)

Even the most experienced Karate black belts must practice regularly to ensure they stay sharp. A Kata is series of movements practiced solo or in pairs; they teach the student proper form and position.

Using freely available tools we demonstrate live how to get started with and practice Test Driven Development by implementing a Kata - a simple coding exercise - designed to let us practice the basics of coding, unit testing and refactoring.

Attendees are encouraged to bring a laptop and follow along with the exercise in pairs or solo.

Author: KERSHAW, Jesse (CERN)

Presenter: KERSHAW, Jesse (CERN)

Contribution ID: **51** Type: **Presentation**

Importance of Data Collected from the Earth's Ionosphere - Part 1

Wednesday 7 May 2025 15:00 (1 hour)

This discussion aims to highlight the importance of gathering data from the ionosphere, which can provide valuable information for satellite communication and understanding the impact of solar activity on earth.

An increase in solar activity has recently resulted in some beautiful northern and southern lights! However, they can also interfere with radio transmission and navigation systems, affecting aeroplanes and satellite internet such as Starlink. Solar flares can also influence the climate and to understand that, we need to collect further information from the ionosphere. Studying this data has gotten easier and more accessible nowadays with the help of cube satellites, as they are relatively faster to develop and maintain. These cube satellites are equipped with microcontrollers on board that can filter and analyse the data received from the plasma wave receivers attached to the satellite. We will delve deeper into the design and processes involved during the seminar.

This lecture will be divided into two parts. The first session will introduce the topic, setting the foundation for understanding the key concepts. The second session will explore the practical aspects, examining real-world applications where these technologies have been implemented, along with their advantages and limitations. The seminar will conclude with an interactive discussion, providing the audience an opportunity to share insights and ask questions.

The key takeaway is highlighting the increasing benefits of cube satellites in studying not only outer space but also terrestrial problems. It provides further insight into the various uses of microcontrollers in data collection and processing, which can make studying the impacts of outer space activity on Earth more efficient and interesting.

Author: SENGUPTA, Sudeshna

Presenter: SENGUPTA, Sudeshna

Contribution ID: **53** Type: **Presentation**

Graph Databases, a Modern Approach to Connected Data

Tuesday 6 May 2025 09:00 (1 hour)

In this talk, I'll be covering why graph databases are gaining popularity for managing complex, connected data. We'll look at the motivation behind using them and how they differ from traditional relational databases. I'll also explain the transformation process—how to move from a relational model to a graph database and the benefits this brings. A live demo will be presented to the students.

Author: TSAVO, Foteini (CERN)

Presenter: TSAVO, Foteini (CERN)

Contribution ID: **54** Type: **Presentation**

Solving Real-World Challenges with Graph Databases

Thursday 8 May 2025 14:00 (1 hour)

In this talk we will focus on how graph databases tackle real-world challenges, such as social media analysis, recommendation systems, and fraud detection. I'll show how combining graph databases with machine learning enables us to uncover hidden patterns and deeper insights.
There will be a live demo showing the transformation of a relational database to a graph one, Neo4j, which is one of the top databases that are leading the way in this space.

Author: TSAVO, Foteini (CERN)

Presenter: TSAVO, Foteini (CERN)

Contribution ID: **55** Type: **Presentation**

Modernizing Legacy Code: A Case Study of React Implementation at CERN.

Wednesday 7 May 2025 16:30 (1 hour)

Have you ever been knee-deep in JavaScript, trying to spice up your web-site or web application, and things start getting insanely complex? Well, we hit that wall at CERN too with one of our flagshit applications, and guess what? We tackled it!
Come along and join me for this talk, where I will show you how we used React to build a new framework to modernize our code that's been around for more than 20 years. Whether you're a beginner trying to navigate your way, or a veteran, there's something for everyone.

Author: KEKELIDZE, Dmitry (CERN)

Presenter: KEKELIDZE, Dmitry (CERN)

Contribution ID: **56** Type: **Presentation**

Level up your Java code with Spring Framework

Thursday 8 May 2025 11:30 (1 hour)

Join me for a comprehensive introduction to Spring Framework, a veritable Swiss Army knife in the realm of Java development. In my talk, I'll guide you through the diverse implementation patterns offered by Spring, aimed at enhancing code robustness and scalability. You will also learn how the Spring Framework operates internally. Regardless of your programming background, this session offers essential knowledge and is especially useful for those who are new to Java.

Author: KEKELIDZE, Dmitry (CERN)

Presenter: KEKELIDZE, Dmitry (CERN)

Contribution ID: **63** Type: **Presentation**

Boost your productivity and reduce stress: agile best practices for students

Tuesday 6 May 2025 15:00 (1 hour)

In this two-part session, students will discover how agile project management best practices can be used to bring clarity, organization, and less stress into their daily lives. The first session, Organize Your Life Like a Pro, introduces simple tools like Kanban boards and prioritization techniques to help students tackle academic and personal tasks effectively. The second session, Staying Flexible – Agility in Everyday Decisions, encourages students to adopt an agile mindset, helping them adapt to unexpected changes with ease and optimize their routines. Together, these sessions provide practical, actionable strategies for managing time, tasks, and goals, empowering students to bring more balance and productivity into their busy lives.

Author: BOUBIR, Reda

Presenter: BOUBIR, Reda

Contribution ID: **67** Type: **Presentation**

Importance of Data Collected from the Earth's Ionosphere - Part 2

Friday 9 May 2025 09:00 (1 hour)

This discussion aims to highlight the importance of gathering data from the ionosphere, which can provide valuable information for satellite communication and understanding the impact of solar activity on earth.

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Author: SENGUPTA, Sudeshna

Presenter: SENGUPTA, Sudeshna

Contribution ID: **68** Type: **Presentation**

Introduction to Quantum Computing and Quantum Algorithms

Wednesday 7 May 2025 10:30 (1 hour)

This lecture introduces quantum computing, focusing on the fundamental principles that differentiate it from classical computing. Key topics include the basic concepts of quantum mechanics underlying quantum computation and the structure of quantum algorithms. Participants will gain insight into the potential of quantum computing for solving complex computational problems and its significance for future technologies. By the end of the lecture, attendees will have a foundational understanding of this emerging field and its possible impact.

Author: RIEGER, Carla Sophie (Technische Universitat Munchen (DE))

Presenter: RIEGER, Carla Sophie (Technische Universitat Munchen (DE))

Contribution ID: **69** Type: **Presentation**

Processing Data in the Quantum Domain

Thursday 8 May 2025 16:30 (1 hour)

In this lecture, we explore how quantum mechanics enables methods for data representation, manipulation, and processing that could surpass classical approaches in certain domains. This lecture' s topics include quantum data structures, encoding methods, and the quantum processing of (classical) datasets. Participants will gain an understanding of how quantum techniques can transform data processing and may open up new possibilities in the computational domain.

Author: RIEGER, Carla Sophie (Technische Universitat Munchen (DE))

Presenter: RIEGER, Carla Sophie (Technische Universitat Munchen (DE))

Contribution ID: **70** Type: **Presentation**

Gentle Introduction to Vector Databases & Vector Search

Friday 9 May 2025 10:30 (1 hour)

How can a machine locate a similar image? How can the song playing be detected? How can you detect who is speaking, based on their voice? How can image be searched with text?

In this introductory lesson about vectors, vector databases, and similarity search with vectors, we will determine how anything in the world can be turned into a vector, from which we can determine similarity with simple middle school mathematics.

Author: Mr POSTARI, Aleksi (SAMK)

Presenter: Mr POSTARI, Aleksi (SAMK)

Contribution ID: **71** Type: **Presentation**

Modern Natural Language Processing for Software Engineers - Part 2

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Author: Dr SCHUSZTER, Cristian (CERN)

Presenter: Dr SCHUSZTER, Cristian (CERN)

Contribution ID: **72** Type: **Presentation**

Staying Flexible –Agility in Everyday Decisions

Friday 9 May 2025 14:00 (1 hour)

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Author: BOUBIR, Reda

Presenter: BOUBIR, Reda

Contribution ID: **73** Type: **Presentation**

UX Design: Seeing Through the User's Eyes

Thursday 8 May 2025 10:30 (1 hour)

What happens when you design with the user in mind? In this introduction to UX Design, we' ll explore how adopting a user-centred perspective transforms the way teams approach product and service creation. Learn the basics of understanding user needs, mapping their journeys, and creating intuitive solutions.
This session highlights how UX Design fosters empathy and leads to experiences that are not only functional, but also delightful to use.

Author: GOBERT, Sophie (CERN)

Presenter: GOBERT, Sophie (CERN)

Contribution ID: **74** Type: **Presentation**

Jan Janke - Presentation 1

Monday 5 May 2025 10:30 (1 hour)

Presenter: JANKE, Jan (CERN)

Contribution ID: **75** Type: **Presentation**

From Small Datasets to Robust Models

Thursday 8 May 2025 15:00 (1 hour)

In his lecture, Toni will address the challenges of working with limited and hard-to-obtain data in solving complex problems. He will share real-world examples from his research, illustrating how robust models can be developed even when data is scarce and expensive to gather. This session will demonstrate that effective solutions often don't require large datasets, offering valuable insights into tackling hard problems with minimal data resources.

Author: Mr AALTONEN, Toni (SAMK)

Presenter: Mr AALTONEN, Toni (SAMK)