

School Closing Remarks

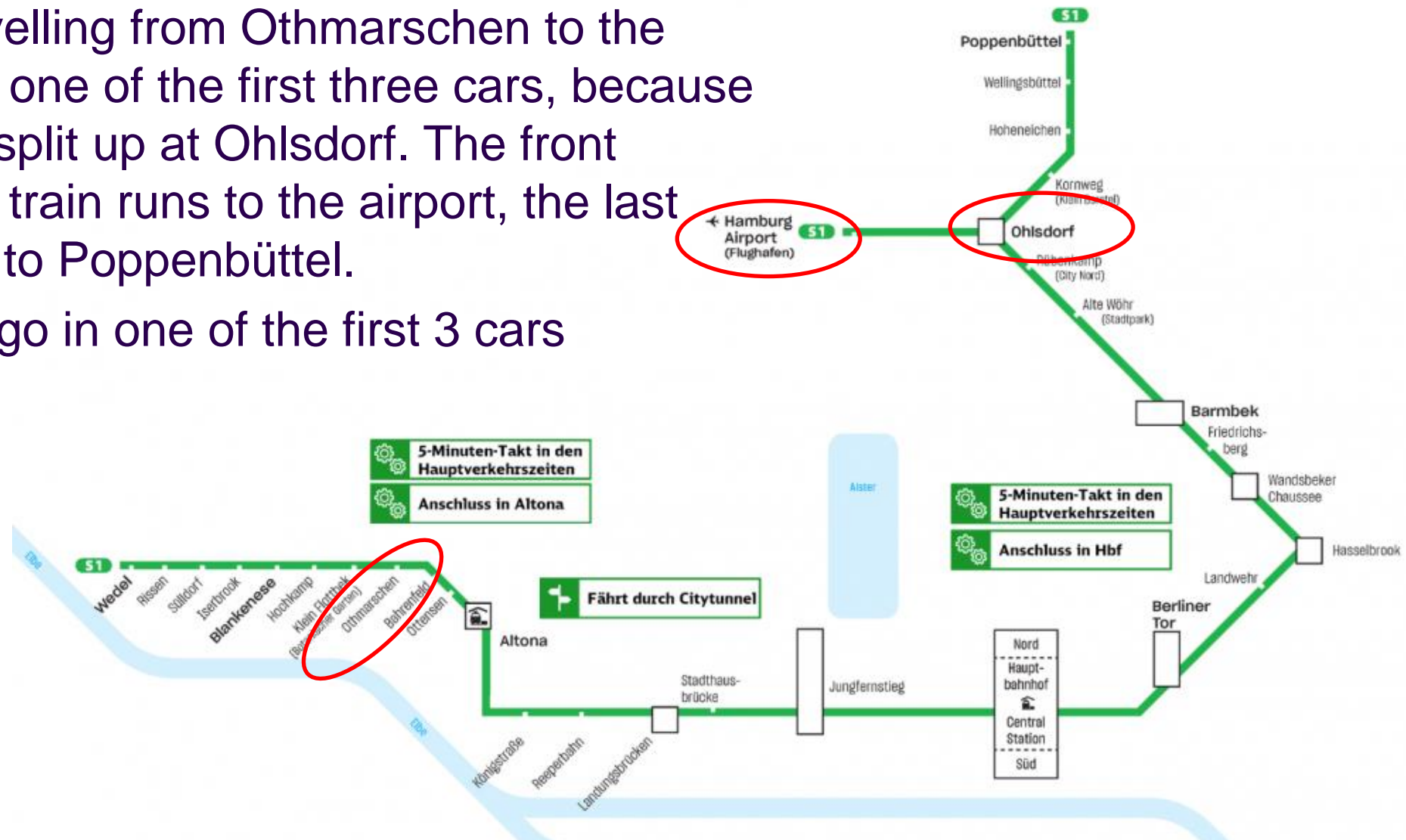
Friday 20th of September

Hostel

- ◆ Check out time is 10
- ◆ Please make sure you put back any glasses, cups etc in the kitchen
- ◆ Empty your fridge and locker in the kitchen, in case you put anything there
- ◆ Empty your rooms of any trash or bottles
- ◆ Breakfast starts on 07.00 on saturday

Going to the airport from DESY

- ◆ If you are travelling from Othmarschen to the airport, board one of the first three cars, because the S1 trains split up at Ohlsdorf. The front section of the train runs to the airport, the last three cars go to Poppenbüttel.
- ◆ in short: just go in one of the first 3 cars



Friday closing dinner

- ◆ Welcome to the closing dinner on Friday 20 at 19.30!
- ◆ Transport tickets/groups of 4-5
- ◆ Walk from DESY to train station S-Bahnhof Othmarschen: appr. 30 min
- ◆ Line: “S 1”, direction: Hauptbahnhof/main station to S-Bahnhof Landungbrücken.
- ◆ (only this line is available at “S-Bahnhof Othmarschen”)
- ◆ **Blockbräu** restaurant: directly at „Brücke 3” diagonally across the station (cross the pedestrian bridge).



Football match – Yellow vs Red teams



Football draw

- ◆ In large teams, the average individual performance tends to be equal
- ◆ The two randomly delected teams where 4-4 at the end of the level time
- ◆ But the red won at the penalties 2-1.
 - ◆ Sorry for the yellow teams, this is football



Photo and Meme competition

- ◆ The Jury has met in the Bistro after dinner

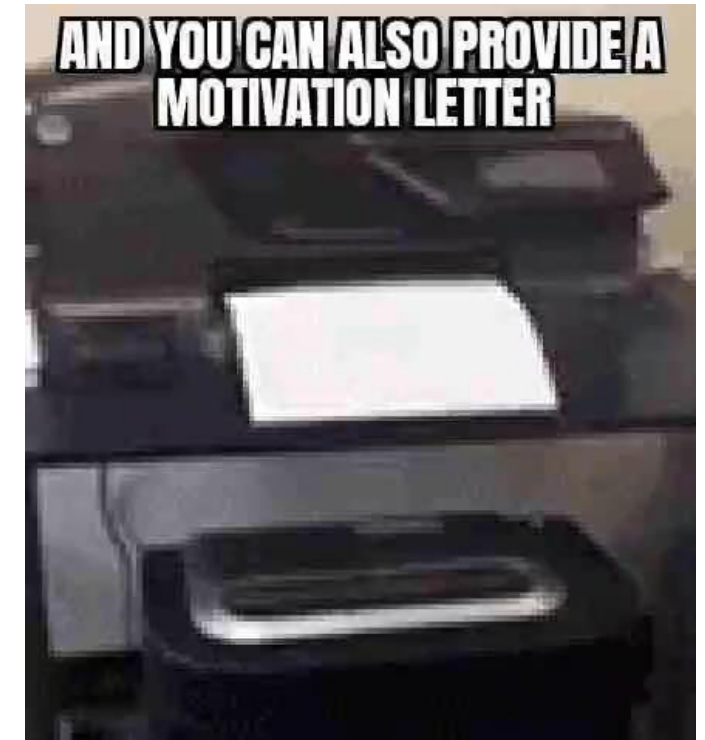
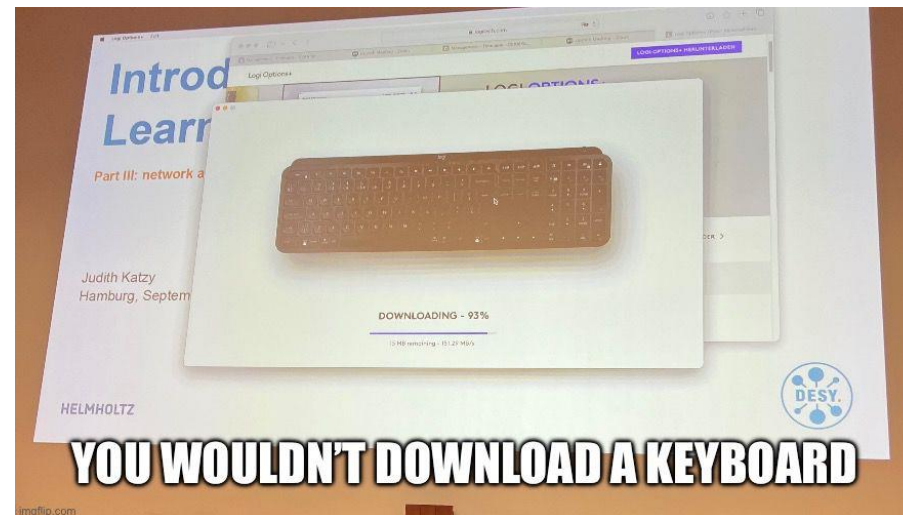
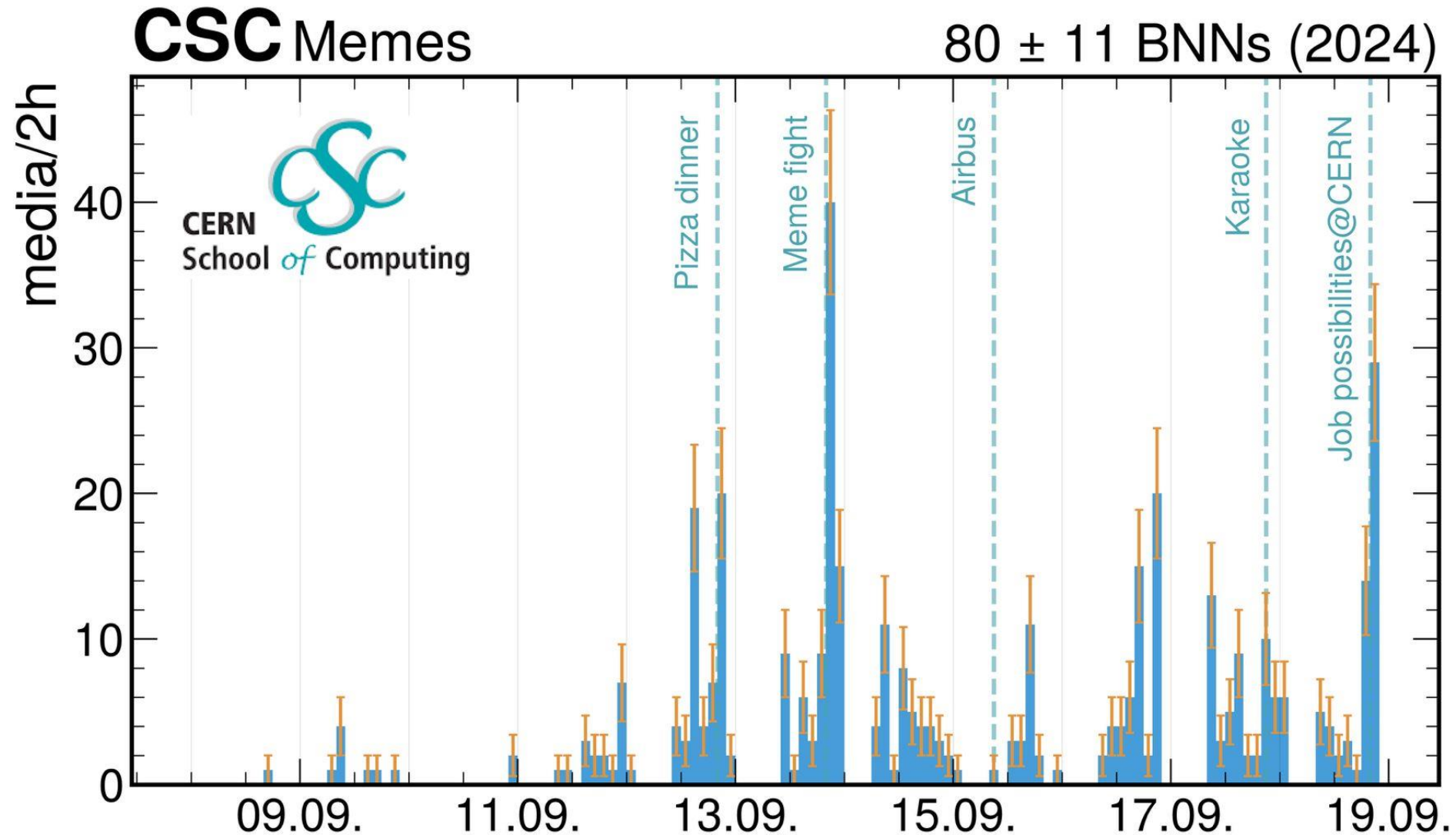


Photo and meme competition!

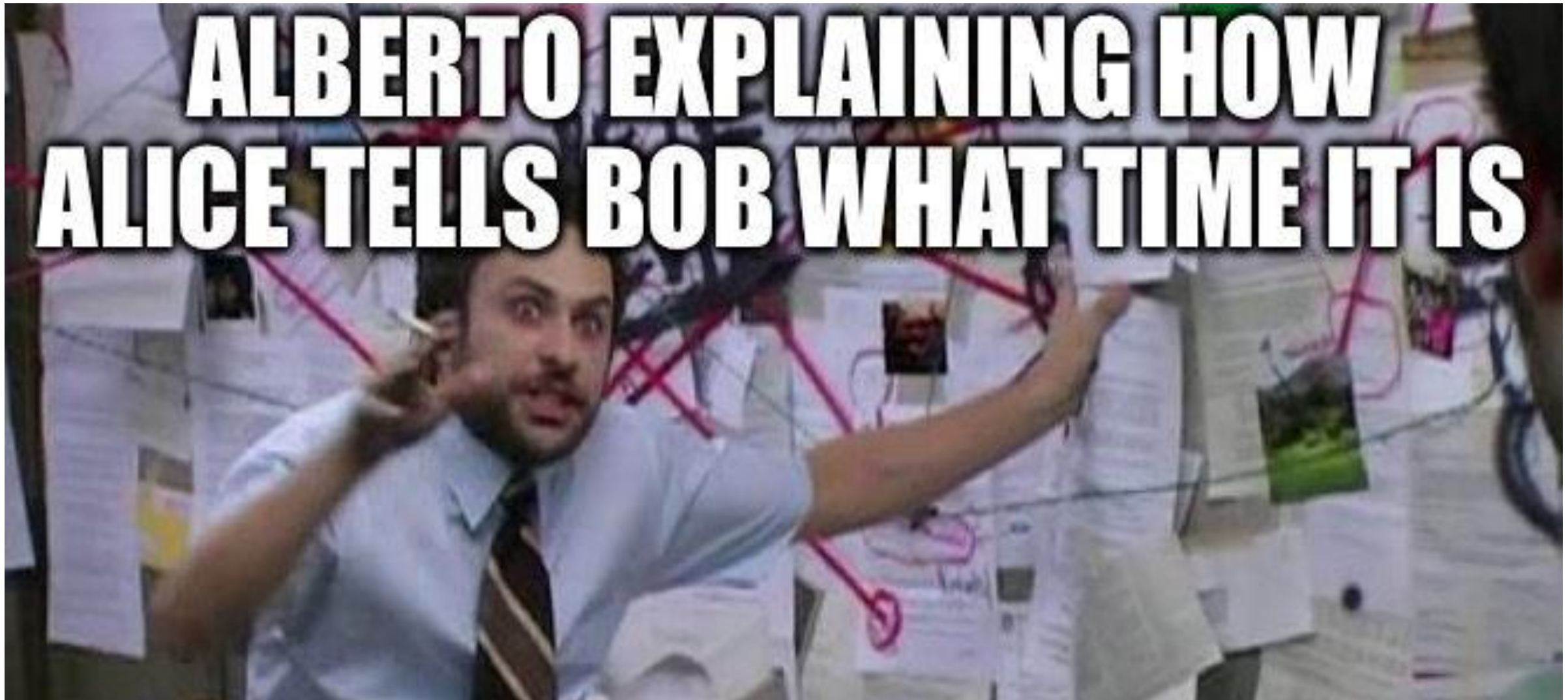
- No photos submitted!
 - (So, Kristina wins Photo competition!)
- The winners of the best meme competition are...



Artistic...(or?) Philipp!



School life... Philipp, again!



Humour... Sebastian Ruiz Gonzalez

Students for the whole hacking session:



Social events... Christina!



Best...of the rest

Me waiting for people to join the sports session:



Best sports

Best Toni



Corporate needs you to find the difference between this picture and this picture



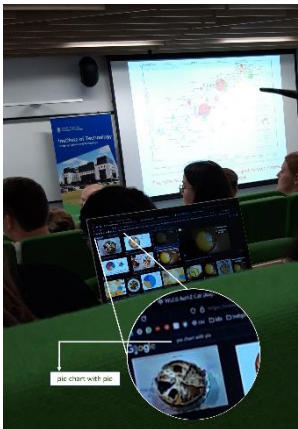
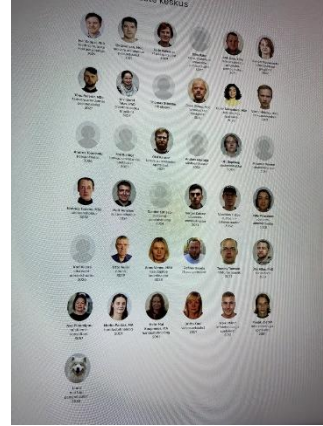
They're the same picture.

Toni when a student asks a weird question



Best Felix

Keep posting pictures to CERNBOX



-
- CSC 2023 poster
- Photo contest
- School Photo Gallery
- Very_simple_running_area_map_CSC.png

Important points

- ◆ **Feedback questionnaire**
 - ◆ anonymous feedback about the School, lectures, exercises
 - ◆ details will come by e-mail
 - ◆ **you *must* complete this feedback questionnaire**
 - ◆ **really, please do** – we need your input, so that we can evolve, and get even better!
- ◆ **Electronic version of the booklet (PDF)** is published on tCSC website
 - ◆ accessible only for logged-in people



Now, what's next ?

Post-school networking

CSC lunches at CERN



tCSC2016

09:49

[blurred]: anyone for lunch today?!

next CERN Schools of Computing

iCSC 2025

March 2025

**Call for contribution
in October 2024**

At CERN

sCSC 2025

April 2025

Subscription
opens in December

Abingdon, UK

tCSC 2024

June 2023

Subscription
opens in February 25

Malmö, Sweden

CSC 2025

July / August 2025

Subscription opens
In March 2025

Lund, Sweden

Attend other CSCs 😊

Advertise CSC
to your colleagues

If you are at CERN ...



CSC 2024 **On IT services**

4-8 November 2024
Ferney-Voltaire

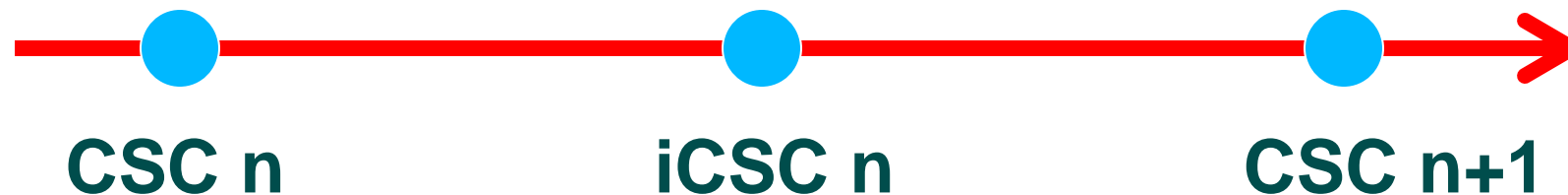


The **inverted** CERN School of Computing

Why an inverted CSC ?

- ◆ At every CSCs, the sum of the knowledge of the students often exceeds the one of lecturer teaching, and that it is frequent to find in the room real experts on particular topics. This is the idea behind iCSC.

Reversing the roles



2025: will be the 16th edition of the iCSC

2005

3rd iCSC
CERN School of Computing
Inverted CSC-2005
"Where students turn into teachers"

23-25 February 2005, CERN

Topics:

- Data Management and Data Bases
- Advanced Software Development and Engineering
- Web Services in Distributed Computing

Lecturers: all former CSC2004 students

2006

4th iCSC
CERN School of Computing
Inverted CSC-2006
"Where students turn into teachers"

6-8 March 2006, CERN

Topics:

- Computational Intelligence for HEP Data Analysis
- The Art of Designing Parallel Applications
- Software Testing Fundamentals and Best Practices

2008

5th iCSC
CERN School of Computing
Inverted CSC-2008
"Where students turn into teachers"

15 March 2008

Register now to get the printed booklet pre-lecture attendance possible

Topics:

- Virtualization: what it is, how it works
- Server Virtualization of workloads
- Unifying Storage Principles and Practices
- Grid Interactions from Cluster to Public-Key
- Modern Software Engineering meets HEP
- Metrics for Software Assurance Process

2010

6th iCSC
CERN School of Computing
Inverted CSC-2010
"Where students turn into teachers"

8-9 March 2008, CERN

Topics:

- OO Design patterns /Anti-patterns
- Make your code testable and faster
- Git: make more efficient managing your code
- Addressing multi-processor programming
- Log in on systems, what the users and the system do
- Systems - Tapping the system to find out what your Machine is Really Doing

2011

7th iCSC
CERN School of Computing
Inverted CSC-2011
"Where students turn into teachers"

3-4 March 2011, CERN

Topics:

- LAN Programming - The basics
- 3D graphics for HEP
- GPU Computing in HEP
- Computer Vision
- Testing for large scale systems
- Grid Interactions by LHC experiments

2013

8th iCSC
CERN School of Computing
Inverted CSC-2013
"Where students turn into teachers"

25-26 February 2013, CERN

Topics:

- LAN Programming - The basics
- 3D graphics for HEP
- GPU Computing in HEP
- Computer Vision
- Testing for large scale systems
- Grid Interactions by LHC experiments

2014

9th iCSC
CERN School of Computing
Inverted CSC-2014
"Where students turn into teachers"

24-25 February 2014, CERN

Topics:

- LAN Programming - The basics
- 3D graphics for HEP
- GPU Computing in HEP
- Computer Vision
- Testing for large scale systems
- Grid Interactions by LHC experiments

2015

10th iCSC
CERN School of Computing
Inverted CSC-2015
"Where students turn into teachers"

23-24 February 2015

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2016

11th iCSC
CERN School of Computing
Inverted CSC-2016
"Where students turn into teachers"

29 February - 2 March 2016

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2017

12th iCSC
CERN School of Computing
Inverted CSC-2017
"Where students turn into teachers"

6-8 March 2017

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2018

13th iCSC
CERN School of Computing
Inverted CSC-2018
"Where students turn into teachers"

5 to 8 March 2018

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2019

14th iCSC
CERN School of Computing
Inverted CSC-2019
"Where students turn into teachers"

4 to 7 March 2019

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2020

15th iCSC
CERN School of Computing
Inverted CSC-2020
"Where students turn into teachers"

28 September to 2 October 2020 - online school

Topics:

- Why GPUs have multiple levels of cache?
- Differences between 32 and 64 bit architectures
- Expanding data and model sizes: K, Vector and Scalar
- Approaches for memory paging in distributed computing
- Defining software architectures: HEP, DUNE, SPARC, WISAP?
- Using GPUs and CPUs in real-time environments
- Scalability of software in real-time architectures
- Simulation in Accelerators: been dynamics
- Understanding computing requirements in Accelerator beam simulations

2023

14th Inverted CERN School of Computing

6 to 9 March 2023

Programme:

- Machine Learning
- HEP Computing
- HEP Simulations
- Parallel Computing
- Computer Networks

Registration is open until 12 April!

<https://indico.cern.ch/e/iCSC-2024>

2024

15th Inverted CERN School of Computing

15 - 18 April 2024
4 days of lectures!

Programme:

- Machine Learning
- HEP Computing
- HEP Simulations
- Parallel Computing
- Computer Networks

Registration is open until 12 April!

<https://indico.cern.ch/e/iCSC-2024>

The inverted CSC

- ◆ At the end of each main school, we call students present to make proposals. When we receive sufficient proposals of appropriate quality, we organize an inverted school.



- ◆ The students combine their skills and elaborate on CSC related subjects.

The iCSC lectures 2024 selection process

- ◆ A tough competition
 - ◆ We have received 24 outstanding proposals
 - ◆ A total of 48 hours of lectures
 - ◆ Hard choices had to be made
- ◆ This should provide you with an excellent school content!

Remember: Selection process for lectures

- ◆ Discussions at the main / thematic school
- ◆ Lightning talks at the school
- ◆ Proposal after the school
- ◆ Review and selection by the CSC Advisory committee
- ◆ Lecture preparation and development with mentors
 - ◆ (1-2 mentors for each lecturer) (December, January)
- ◆ Finally, the presentation at the school

2023 -> 2024 ...



Main CSC, Tartu 2023



2024 iCSC lecturers



Bernardo Abreu Figueiredo
Karlsruhe HKA



Pratik Jawahar
University of Manchester



Spyridon Trigazis
CERN



Vlad-Andrei Badoiu
University Politehnica
Bucharest



Vlad Nastase
University Politehnica
Bucharest



Andrea Valenzuela Ramirez
CERN



Florine de Geus
CERN



Simone Rossi Tisbeni
Universita e INFN
Bologna



Francesco Vaselli
Scuola Normale Superiore
INFN, Pisa



Robin Hofsaess
KIT



Cristian Schusztter
CERN



Zenny Jovi Joestar Wettersten
CERN

Every presentation is supervised by mentors

- ◆ This year's mentors:
 - ◆ Andrei Gheata
 - ◆ Stephan Hageboeck
 - ◆ Pere Mato
 - ◆ Alberto Pace
 - ◆ Danilo Piparo
 - ◆ Sebastien Ponce
 - ◆ Toni Sculac
 - ◆ Are Strandlie
 - ◆ Sofia Vallecorsa

THANK YOU!

The 2023 topics

- ◆ Cloud & Containers - Everything you need to know
- ◆ Everything that can go wrong in a message passing system
- ◆ Authentication and Authorization for the WLCG
- ◆ Quantum Computing
- ◆ How a real-world C++ compiler works
- ◆ CPU Performance Profiling on Linux in the HEP Context
- ◆ Multiplatform Programming with Python
- ◆ A simple introduction to accelerated computing
- ◆ The most beautiful line you can draw with Kalman filter
- ◆ An introduction to Bayesian neural networks and uncertainty quantification in neural networks
- ◆ Graph Neural Networks: From fundamentals to Physics application
- ◆ MLOps - Going from Good to Great
- ◆ A Crash Course on Reinforcement Learning

The 2024 topics

- ◆ IPv6 adoption. How is it going?
- ◆ Computer Networks in HEP
- ◆ Networking for HPC
- ◆ Functional programming and its relevance for HEP computing
- ◆ Unraveling Grid Computing: From Basics to WLCG
- ◆ Revolutionizing HEP Simulations: A Comprehensive Introduction to Generative Models
- ◆ A Gentle Introduction to GPT Models and Their Impact on the HEP Community
- ◆ A Practical Guide to Modern Natural Language Processing
- ◆ Why do machines learn? Introduction to fundamentals and common misconceptions in ML
- ◆ The perfectly parallel program
- ◆ GPU Programming Made Easy with CuPy
- ◆ Advanced git course: How to git good!

Lecturers at the iCSC

- ◆ Many iCSC lecturers have become lecturers at various CSC schools
 - ◆ Sebastian Lopienski (2005), Brice Copy (2005), Zornitsa Zaharieva (2005), Andrzej Nowak (2008), Benjamin Radburn-Smith (2010), Thomas Keck (2016), Daniel Campora (2017) , Eamonn Maguire (2017), Hannah Short (2018), Tom Dack (2023), Francesco Vaselli (2024)
- ◆ ... And one of them became director of the school



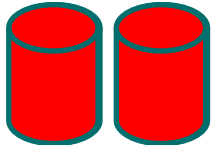
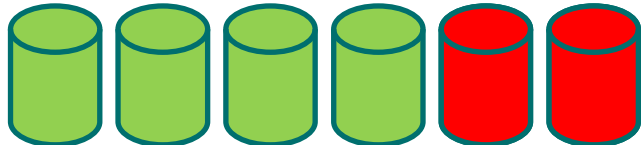


The exam ...

The Exam ...

- ◆ 34 questions, one question invalidated
 - ◆ To pass 17 or more correct answers

Which of the following RAID configuration maximises reliability ?

- ◆ RAID0 (striping) where data is distributed to 2 disks.
- ◆ RAID1 (mirroring) where data is copied twice on to 2 separate disks. 
- ◆ RAID5 (with 6 disks) where data is distributed to 5 disks and parity information is written to the remaining disk. 
- ◆ All RAID configurations increase reliability in an identical way.

- ◆ It the probability to fail is 0.01

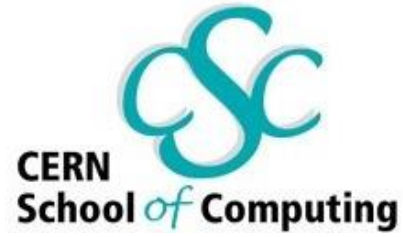
- ◆ RAID1:
 - ◆ 0.0001

- ◆ RAID5
 - ◆ 0.0144

) This is a binomial probability problem, where we want to find the probability of exactly 2 disks failing out of 6, given that each disk has a 0.01 probability of failure.

The binomial probability formula is:

$$P(X = k) = \binom{n}{k} p^k (1 - p)^{n-k}$$



Diplomas and/or Certificate of Attendance

Diplomas

- ◆ Not all participants took the exam, some did not pass
- ◆ You will be all called and receive
 - ◆ Certificate of attendance
 - ◆ School diploma + Certificate of ECTS credits



Distribution of diplomas and/or certificates

Response to reference letters

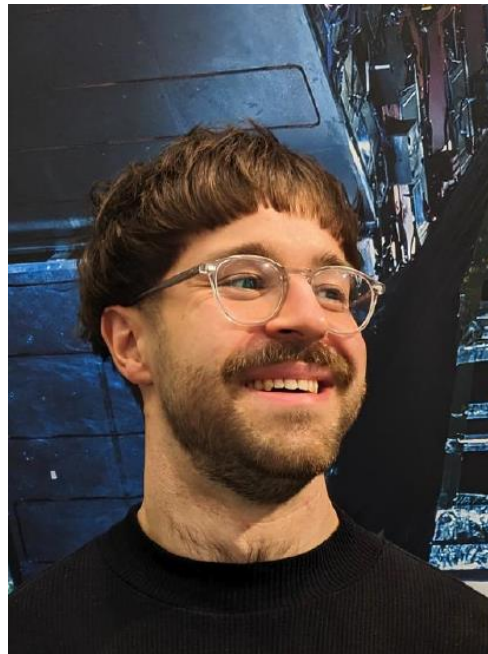
- ◆ I can write back to your supervisor
 - ◆ You will also receive a copy
 - ◆ Please let us know if should

We have a students with Distinction

- ◆ With a score of 30 / 33
 - ◆ Philipp Schreiner
 - ◆ Rongrong Cai
 - ◆ Thierry Guillaume Harte

Gold medals - Champions

- ◆ Nearly all answers correct 31/33
 - ◆ Felix Soubelet
 - ◆ Lorenz Gartner





Thanks

THANK YOU ALL SPEAKERS!

- The CSC speakers put in a lot of effort to prepare relevant lectures and exercise
- Without lecturers... no CSC!



The lecturers ...

- ◆ It is a major commitment to come and lecture at the school



+ Giulio

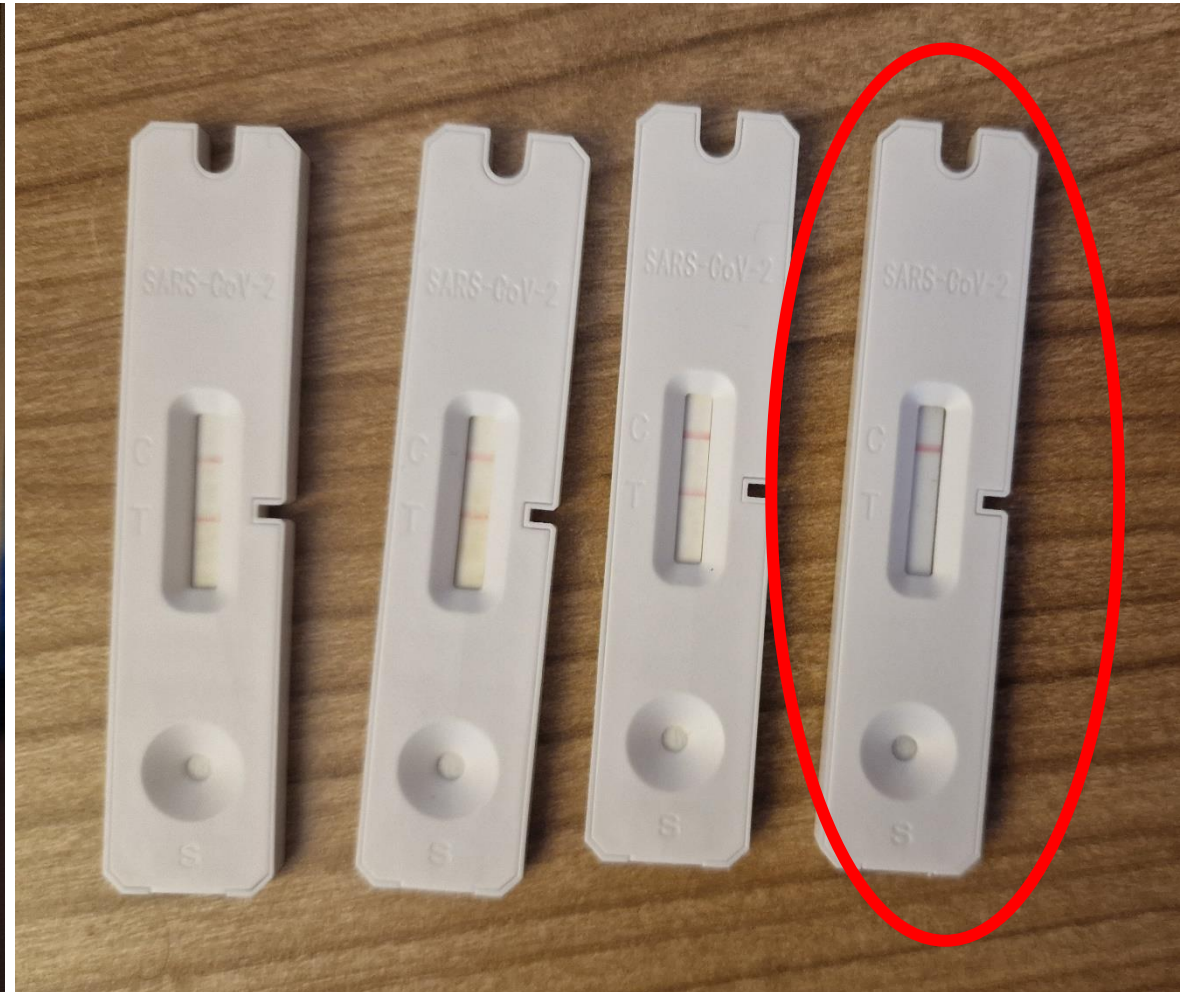


Thanks to the DESY organisers!

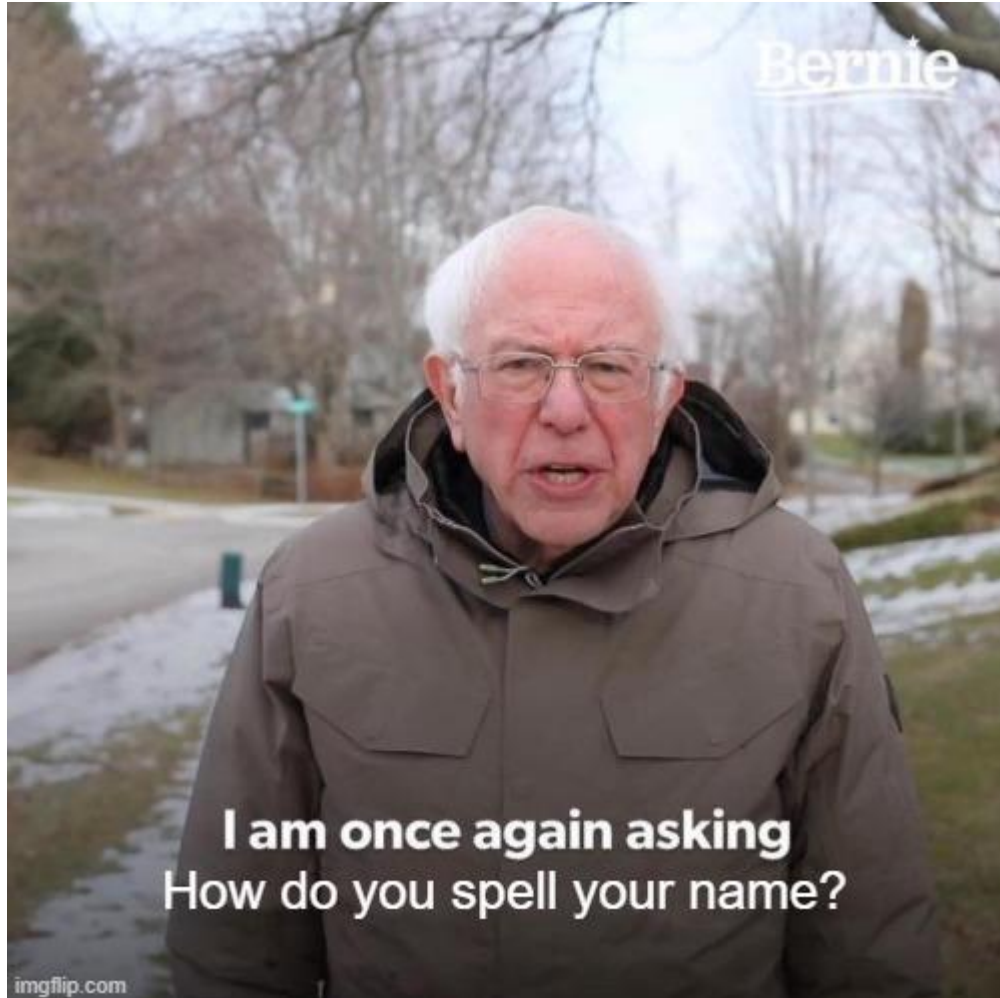
- The CSC team depends heavily on the local organising team
- Many helping hands behind the scenes
- Weekly meetings since a year
- Thank you Judith, Sabine, Thomas, Kerstin who planned it all, Anna and Birgit who showed us the way, Caroline that brought us drinks, Larissa from Hostel, the nice guards and the friendly Canteen staff! (and probably many more!)



We also had an unexpected issue



Special thanks to Adr...Andry...Annjay!
(For being all three of us the first week!)



And ...

◆ Kristina !



Finally ...

◆ Thanks to you, the **CSC 2024 participants**



A last message as School Director

- ◆ It is the end of a Marathon that started more than 2 years ago
- ◆ Some take-home messages ... about the school

What a fortnight !

Monday, September 9, 2024	Tuesday, September 10, 2024	Wednesday, September 11, 2024	Thursday, September 12, 2024	Friday, September 13, 2024	Saturday, September 14, 2024	Sunday 15 September 2024	Monday 16 September 2024	Tuesday 17 September 2024	Wednesday 18 September 2024	Thursday 19 September 2024	Friday 20 September 2024
9:00 AM Opening Ceremony ... 9:05 AM The DESY laboratory...	8:45 AM Introduction to Physics Computing L2: Digital Data, Sim...	8:45 AM Data Science L1: Tools for interactive data exploration	8:45 AM Data Management L1: Setting the scene: Storage technolo...	8:45 AM Software Design L4: Patterns for Parallel Software Development	8:15 AM Airbus Visit or free time						
9:25 AM Welcome address fr... 9:35 AM Research at CER... 9:55 AM 70 years of Physics... 10:15 AM Computing Infras... 10:30 AM The CERN School... 10:45 AM Break	9:45 AM Software Security L1: Introduction	9:45 AM Software Design L2: Base Concepts of Parallel Programm...	9:45 AM Software Security L3: Web application security, exercise d...	9:45 AM Data Management L3: Cryptography, authentication, a...							
11:20 AM Announcements 11:30 AM Introduction to Phys...	10:45 AM Announcements 11:00 AM Coffee break 11:30 AM Software Design L1: Parallelism in a Modern HEP Data...	10:45 AM Announcements 11:00 AM Coffee break 11:30 AM Software Design L3: Understanding, Debugging and Prof...	10:45 AM Announcements 11:00 AM Coffee break 11:30 AM Data Management L2: Cryptography, authentication, a...	10:45 AM Announcements 11:00 AM Coffee break 11:30 AM Exercises 1: Software Design							
12:30 PM Tools and Techniques L1: Introduction - Bob Jacobsen	12:30 PM Software Security L2: Security in different phases of softwar...	12:30 PM Data Science L2: Interactive exploration of non-numeric data	12:30 PM Exercise 4: - Bob Jacobsen Giulio Eulisse (CERN)	12:30 PM Exercises 2: Software Design			08:45 Data Analysis L3: Parameter estimation	08:45 Introduction to machine learning 2 - Judith Katzy (DESY, HAMBURG)	08:45 Introduction to Machine Learning 4 - Judith Katzy (DESY, HAMBURG)	08:45 Introduction to Machine Learning 5 - Judith Katzy (DESY, HAMBURG)	09:30 Exam
1:30 PM Lunch	1:30 PM Lunch	1:30 PM Lunch	1:30 PM Lunch	1:30 PM Lunch		10:00 Announcements 10:15 Data Analysis L1: Introduction - Toni Sculac (University of Split Faculty of Science (HR)) 11:15 Data Analysis L2: Probability density functions and Monte Carlo methods	09:45 Introduction to Machine Learning 1 - Judith Katzy (DESY, HAMBURG)	09:45 Introduction to Machine Learning 3 - Judith Katzy (DESY, HAMBURG)	09:45 Data Analysis L5 - Hypothesis testing and p-value	09:45 Machine Learning exercise 3 - Peter Steinbach	
2:30 PM Tools and Techniques L2: Tools for Collaboration, So...	2:30 PM Study or sports time	2:30 PM Study or sports time	2:30 PM Photo 2:45 PM Transport to Hamburg	2:30 PM Study or sports time		12:15 Sunday Excursion (incl lunch)	10:45 Announcements 11:00 Coffee break	10:45 Announcements 11:00 Coffee break	10:45 Announcements 11:00 Coffee break	10:45 Announcements 11:00 Coffee break	11:00 Coffee break
3:30 PM Exercise 1: Tools and Techniques	4:00 PM Coffee break	4:00 PM Coffee break	3:45 PM Hamburg hafenrundfahrt visit excursion	4:00 PM Coffee break			11:30 Data Analysis L4: Confidence intervals - Toni Sculac (University of Split Faculty of Science (HR))	11:30 Sustainable computing 2 - Ana Lucia Varbanescu (University of Twente)	11:30 Exercises 3: Data Technologies - Andreas Joachim Peters (CERN)	11:30 Exercise 3: Data Analysis - Toni Sculac (University of Split Faculty of Science (HR))	11:30 Traditional football match
4:30 PM Coffee break	4:30 PM Speeding up Ma... 4:38 PM The search of mag... 4:45 PM Exercises 1: Software Security	4:30 PM Downstream and ... 4:38 PM Error underestimat... 4:45 PM Exercise 3: Tools and Techniques	7:00 PM Transport to restau...	4:30 PM Developing Artificia... 4:38 PM Primer to Cloud Sec... 4:45 PM Exercise 3: Software Design			12:30 Sustainable computing - Ana Lucia Varbanescu (University of Twente)	12:30 Data Management L4: Distributed Hash Tables, Data Replication, Caching, Monit...	12:30 Exercises 4: Data Technologies - Andreas Joachim Peters (CERN)	12:30 Exercise 4: Data Analysis - Toni Sculac (University of Split Faculty of Science (HR))	
5:00 PM Exercise 2: Tools and Techniques	5:45 PM Exercises 2: Software Security - Sebastian Lopienski (CERN)	5:45 PM Exercise 3: Software Security - Sebastian Lopienski (CERN)	7:30 PM Pizza Dinner	5:45 PM Exercise 4: Software Design			13:30 Lunch	13:30 Lunch	13:30 Lunch	13:30 Lunch	13:30 Lunch
6:45 PM Transport to dinner venue (bus)	7:30 PM Dinner at DESY 8:30 PM Pub quiz at DESY	7:30 PM Dinner DESY	9:30 PM Return to DESY or e...	7:30 PM Dinner DESY			14:30 Study or sports time	14:30 Study or sports time	14:30 Study or sports time	14:30 Study or sports time	14:30 Graduation ceremony
7:30 PM Welcome dinner at Cap Polonio							16:00 Coffee break	16:00 Coffee break	16:00 Coffee break	16:00 Coffee break	16:00 Free time
10:00 PM Transport back to...							16:30 The Detector Safety Syste... 16:38 FLUKA simulation for a 10 ... 16:45 HHFramework - A common ... 16:53 Exercises 1: Data Analysis	16:30 Negative Weights in Monte C... 16:38 FLUKA simulation for a 10 ... 16:45 Exercise 1: Data Technologies - Andreas Joachim Peters (CERN)	16:30 Advanced Text Analysis fo... 16:38 Deep learning metrics for pr... 16:45 Machine Learning exercise 1 - Peter Steinbach	16:30 Machine Learning exercise 4 - Peter Steinbach 17:30 Spare / DESY visit	16:00 Free time
							17:53 Exercises 2: Data Analysis - Toni Sculac (University of Split Faculty of Science (HR))	17:45 Exercises 2: Data Technologies - Andreas Joachim Peters (CERN)	17:45 Machine Learning exercises 2 - Peter Steinbach		16:30 Free time
						18:30 Hamburger party	19:30 Dinner DESY	19:30 Dinner DESY	19:00 CERN, Computing and talent aquisition	19:30 Dinner DESY	18:30 Transport to dinner venue
								20:30 Karaoke evening	20:30 Networking dinner at DESY		19:30 Closing Dinner Party

Sometimes we hear ...

- ◆ There is too much to do, not enough time to rest or study
 - ◆ Reminder: Several activities are optional
 - ◆ Choice is freedom



**Work
Hard**



**Play
Hard**

The CERN CSC is not an everyday opportunity





If you liked it, tell your friend

The School Academic Dimension

- ◆ The school ...
 - ◆ ... is not a conference
 - ◆ ... is not a place for lecturers to present their work, promote their projects
 - ◆ Does not replicate of common training available at home institutes, or in member state's universities
 - ◆ Does not deliver “technical training” courses
- ◆ Focus on **persistent knowledge**, less notions and knowhow



Education Science: Focus on Knowledge

◆ Knowledge versus Knowhow

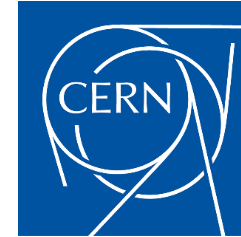
Knowledge	Knowhow
Articulated to other knowledge of the learner	Generally stand-alone information
By nature, when taken by the learner, different between learners	Initially, the same for every learner
Transferable , adaptable to other environments	Transfer requires effort
When taken by the learner, persistent	Will be forgotten if not practiced
Requires related knowledge pre-exist	Limited pre-requirements

Global Values versus Local Values

- ◆ Global Values
 - ◆ Science, Sports, Music, Literature, ...
- ◆ Local Value
 - ◆ Religion, Language, Literature, Music, ...

Becoming a Science ambassador

- ◆ Science is universal, and the scientific approach to problem, in many fields, could resolve many conflicts and misunderstanding
- ◆ Go beyond the pure science or computing skills
 - ◆ Bridging different domains is a rare skill
- ◆ Learn and improve also
 - ◆ Your communication skills
 - ◆ Teamwork
 - ◆ Leadership
 - ◆ Professionalism
 - ◆ Respect for diversity



Be ambitious, be brave

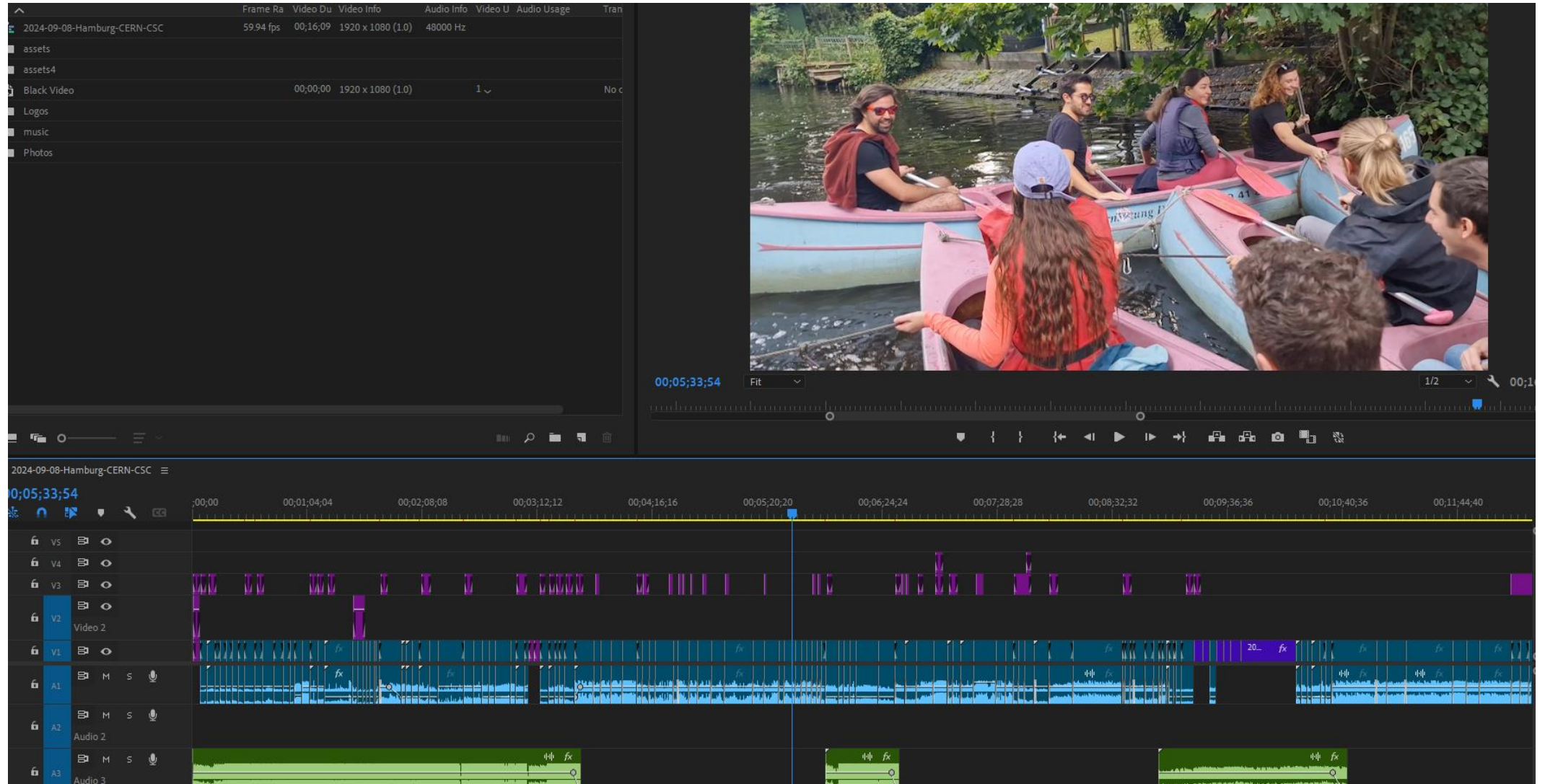
Be just and fear not

That's (almost) all Folks !

All good things come to an end...



But before closing the school



Summary of the School

- ◆ <https://youtu.be/nx91aVA1ljQ>

