ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

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D3.5 - Thematic training event - first school for software development and deployment in the EOSC

Work Package	WP3, ESCAPE Open-source Scientific Software and Service Repository (OSSR)
Lead Author (Org)	CNRS
Contributing Author(s) (Org)	Thomas Vuillaume (LAPP, CNRS), Kay Graf (FAU), Mathilde Hubert (LAPP, CNRS)
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Version	Date	Authors	Notes
0.1	12/07/2021	Thomas Vuillaume (LAPP, CNRS)	ToC
0.2	13/07/2021	Thomas Vuillaume (LAPP, CNRS) Kay Graf (FAU)	First draft
0.3	13/07/2021	Mathilde Hubert (LAPP/CNRS)	Contributions on ToC, Project Summary, Executive Summary, Introduction, chapters 5.1, 5.2, 6.4, 7.5 and Appendix C
1.0	21/07/2021	Thomas Vuillaume (LAPP, CNRS)	Finalise document v1
1.1	21/07/2021	Thomas Vuillaume (LAPP, CNRS)	Implement feedback reviews

Disclaimer

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Acronym list

Term	Explanation
ASTERICS	Astronomy ESFRI & Research Infrastructure Cluster
CNRS	Centre national de recherche scientifique
CTA	Cherenkov Telescope Array
EGO	European Gravitational Observatory
ELT	Extremely Large Telescope
ESCAPE	European Science Cluster of Astronomy & Particle Physics ESFRI research infrastructures
ESFRI	European Strategy Forum on Research Infrastructures
ESF/RI	ESFRIs and major RIs as projects within ESCAPE
EST	European Solar Telescope

EOSC	European Open Science Cloud
FAIR	Findable, Accessible, Interoperable, Reusable
FAIR	Facility for Antiproton and Ion Research
H-LHC	High Luminosity LHC
KM3NeT	Cubic Kilometre Neutrino Telescope
LAPP	Laboratoire d'Annecy de Physique des Particules
JIVE	Joint Institute for VLBI ERIC
OSSR	Open Science Software and Service Repository (ESCAPE WP3)
RI	Research Infrastructure
SKA	Square Kilometre Array
WP	Work Package

1 Project Summary

ESCAPE (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) addresses the Open Science challenges shared by ESFRI facilities (CTA, ELT, EST, FAIR, HL-LHC KM3NeT and SKA) as well as other pan-European research infrastructures (CERN, ESO, JIVE and EGO) in astronomy and particle physics. ESCAPE actions are focused on developing solutions for the FAIRness of large data sets handled by the ESFRI facilities.

These solutions shall: i) connect ESFRI projects to EOSC ensuring integration of data and tools; ii) foster common approaches to implement open-data stewardship; iii) establish interoperability within EOSC as an integrated multi-probe facility for fundamental science.

To accomplish these objectives, ESCAPE aims to unite astrophysics and particle physics communities with proven expertise in computing and data management by setting up a data infrastructure beyond the current state-of-the-art in support of the FAIR principles.

ESCAPE Open-source Scientific Software and Service Repository (OSSR), ESCAPE WP3, is a sustainable open-access repository to share scientific software and services to the science community and enable open science. It will house astro-particle-physics-related scientific software and services for data processing and analysis, as well as test data sets, user-support documentation, tutorials, presentations and training activities.
It will enable a true multi-messenger data-driven cooperative approach based on the FAIR principle requirements and will become part of the EOSC global catalogue of services. In a collaborative effort of all ESCAPE partners, common and innovative approaches will be fostered.

A key aspect in order to secure the accomplishment of the OSSR objectives is the training of the Astronomy, Astroparticle & Particle Physics communities, in particular early career scientists.

2 Executive Summary

This document summarises deliverable D3.5 of the ESCAPE project, the *Thematic training event - first school for software development and deployment in the EOSC,* organized in the framework of the ESCAPE OSSR, WP3.

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6

With more than 1000 registrations, the ESCAPE Summer School on Data Science for Astronomy, Astroparticle & Particle Physics held online from 7 to 18 June 2021 was a success.

This event was a continuation of the ASTERICS summer schools held at the LAPP in 2017, 2018 and 2019. Dedicated to the development of projects for astrophysics, astroparticle physics & particle physics, the school that was supposed to take place at Laboratory of Annecy of Particle Physics (LAPP) was moved to an online event, due to the current situation in France and the rest of the world. A different organisation but with the same goal: to provide any software engineer, data scientist or interested students with the tools and good practices to do data science in their field and in the context of open data and open science.

3 Introduction

The ESCAPE partners aim at being in the forefront of best practice for the dissemination and exploitation of all the results that flow from the project. This report is dedicated to promoting the ESCAPE Summer School on Data Science for Astronomy, Astroparticle and Particle Physics and its related results, achievements and knowledge generated, while also setting a solid basis for its future exploitation.

4 School overview: objectives, synergies and audiences

The goal of reaching an Open Science system in EOSC is not possible without training of early career scientists, and especially the creation and maintenance of high-quality, open software need special consideration. This is tackled within the thematic training event, where young scientists in the field of astronomy, astro-particle and particle physics were taught the necessary ingredients for their software to become a part of open science by experienced code custodians.

Following the FAIR paradigm and as an example of good practices in code development, the full information of the school are openly available at https://indico.in2p3.fr/event/20424/, including scientific programme, agenda and links to all contributions (software repository, notebooks, contributions, presentations and recordings).

4.1 School programme and objectives

The aim of the school is to provide theoretical and hands-on training on Data Science and Python development for astrophysics, astroparticle physics and particle physics. It has been designed around the partners' needs and their open science developments. As such, a solid background of basic requirements to contribute to open science is provided.

The lectures are organised around 6 blocks:
- The coding environment, tools and good code practice module teaches participants to set up their scientific environment and the good practices.
- Version control, collaborative and continuous development and integration. In this section, participants learn how to use git and GitHub for collaborative developments, see what unit tests are and why they are important in your continuous development and integration process, how to package a library and manage it efficiently with version control.
- Profiling, debugging and optimising. A module to learn how to debug code efficiently, then profile it to find the computing bottlenecks and finally optimise the important bits.
- Scientific Python libraries. This module gives an overview of libraries that are the building blocks of scientific analysis in Python in astronomy, astroparticle and particle physics. Some are generic data science ones (numpy, scipy, pandas) while others are more community specific and developed by ESCAPE members or partners (astropy, gammapy, scikit-HEP).
- Introduction to machine learning. This module allows participants to discover what's hiding behind the buzzword and develop their first analysis using machine learning algorithms, from basic ones to neural networks.
- Open lectures: an introduction to Julia, Spark and a scientific webinar from a renowned professor.

Only a basic knowledge of the Python programming language was requested to best profit from most of the courses. The lectures are then designed and given by very experienced and talented developers or even authors themselves of the presented libraries

The complete agenda is accessible at https://indico.in2p3.fr/event/20306/timetable/ and provided in appendix. The scheduled programme has been thoroughly followed at the exception of the deep learning lecture that had to be cancelled due to an external event.

4.2 Target Audiences

The ESCAPE School targets any software engineer, data scientist or interested students from the astronomy, astroparticle and particle physics communities. As the event was

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8

organized in association with the ESFRI Projects and ESCAPE Partners, the school concerned them specifically.

Target audiences

Stakeholders	Description	Examples
Pan-European Research Organisations	These pan-European research infrastructures in astronomy and particle physics aim to address the Open Science challenges shared by ESFRI facilities involved in ESCAPE	European Organization for Nuclear Research (CERN), and European Southern Observatory (ESO)
ESFRI projects	The ESFRI projects concerned by ESCAPE all have the mission in common to provide open access to their quality certified scientific data, including dedicated analysis software stacks, and high-level science tools.	Cherenkov Telescope Array (CTA), Extremely Large Telescope (ELT), European Solar Telescope (EST), Facility for Antiproton and Ion Research in Europe (FAIR), High Luminosity-Large Hadron Collider (HL-LHC), cubic-kilometre-sized Neutrino Telescope (KM3NeT), Square Kilometre Array (SKA), European Gravitational Observatory (EGO), Joint Institute for VLBI ERIC (JIVE) and the various RIs operated by CERN and ESO.
ESCAPE Partners	The School was organized in association with ESCAPE partners, composed of 31 European organisations with a wealth of expertise and experience on astronomy, astroparticle and particle physics, three fields contributing heavily to the final designs of the ESFRI projects.	https://www.projectESCAPE.eu/partners
Industry, namely Small and Medium Enterprises	A network of industrial stakeholders	
Scientists Communities	Other international collaborations in astronomy, astroparticle and particle physics, Pan-European research consortia	APPEC, ASTRONET, NuPPEC, ECFA

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9

5 Organisation

5.1 Physical to online

Due to the CoVID-19 pandemic, the event has been first delayed from Summer 2020. Finally, as it became clear that the pandemic situation in France and the rest of the world did not allow in-person meetings, the ESCAPE Summer School has been moved to an online event happening from 7 to 18 June 2021.

The school was held as a continuation of the ASTERICS/OBELICS summer schools that were organised in-person at LAPP, in Annecy, France in 2017, 2018 and 2019.

5.2 Free and open registrations

Being online allowed us to propose a completely open and free of charge event. The registrations were done through the Indico platform through a simple registration form. No selection of any kind was applied to participation.

5.3 Online tools and resources

Previous editions of the school organised were very participative and lively. In order to recreate this participative environment online, we integrated several solutions and online tools to facilitate the communication between participants and tutors. The lectures were broadcasted live on YouTube where anyone could attend. Not only YouTube is a well known and easy to use platform for anybody, it eased the recording of the lectures that were readily available to be re-watched offline. Moreover, YouTube allows viewers to stop the video, even during a live session, thus allowing them to make sure they understood correctly a specific point or some manipulation tutors did and quickly go back to the live, something not possible with other visio-conference tools. The questions were then asked on slack by participants. Other tutors were present in the chat to answer some questions while the more general ones were kept and transmitted to the lecturer. We also noted a strong interaction and help between participants themselves, answering questions to one another or even solving technical issues. This organisation proved to be very efficient.

Here is a list of the tools and platforms used during the school to organize and share the material, as well as communicate with all school participants.

Tools	Description	Links

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10

Indico	This is the school entry point where the detailed program and the main information about the school organization can be found. It has been used to manage participants' inscriptions.	https://indico.in2p3.fr/event/20306/
Github	All the material for the lectures can be found in this repository as well as the install instructions to use the code included there.	https://github.com/ESCAPE2020/school2021
GitHub ticket issues	GitHub issues platform has been used for participants to report technical issues they could experience.	https://github.com/ESCAPE2020/school2021/issues
Lectures portal	This web portal provides a friendly experience to participants to find all the school material organized per lectures. It has been deployed using GitHub pages from the same repository as the school content, allowing teachers to contribute by self-adding links to their lectures resources.	https://ESCAPE2020.github.io/school2021/
YouTube channel	The lectures were broadcasted live on the YouTube platform where participants could watch them. They were then automatically registered in the ESCAPE playlist.	ESCAPE Data Science Summer School 2021
Slack	Slack was the main communication tool where all announcements were made. It was accessible only to registered participants to the school. It was also used for participants to ask questions to tutors, either during the live lectures on dedicated channels, or later.	https://ESCAPE-data-school.slack.com/
GatherTown	GatherTown is a platform that provides a virtual world to ease visio-communication. It was used mainly during coffee breaks or small group sessions.	https://gather.town/app/Rww2ZWwsxiA2Usz3/ESCAPE%20school
Twitter	Twitter was used to promote the school, the courses and the teachers before and during the event. A specific hashtag was used to follow the discussion #ESCAPESchool21	@ESCAPE_EU
LinkedIn	LinkedIn was used to promote the school, the courses and the teachers before and during the event	https://www.linkedin.com/company/projectESCAPE/

5.4 Communication plan

The first announcement of the online School was released on 26 April 2021, with a registration deadline set to 31 May 2021. The School was widely advertised to the Astronomy, Astroparticle and Particle Physics communities beyond ESCAPE through different channels, including:

- Emailing to stakeholders, then participants and tutors;
- News pieces on online web platforms such as ESCAPE and partners Websites;
- ESCAPE and partners Newsletters;
- ESCAPE Social Medias, Twitter, LinkedIn and YouTube;
- ESCAPE Summer School specific tools, Indico, Web Portal, Github, Slack and GatherTown;
- Banners and branded promotional material.

*ESCAPE Summer School announcement banner on ESCAPE Website*
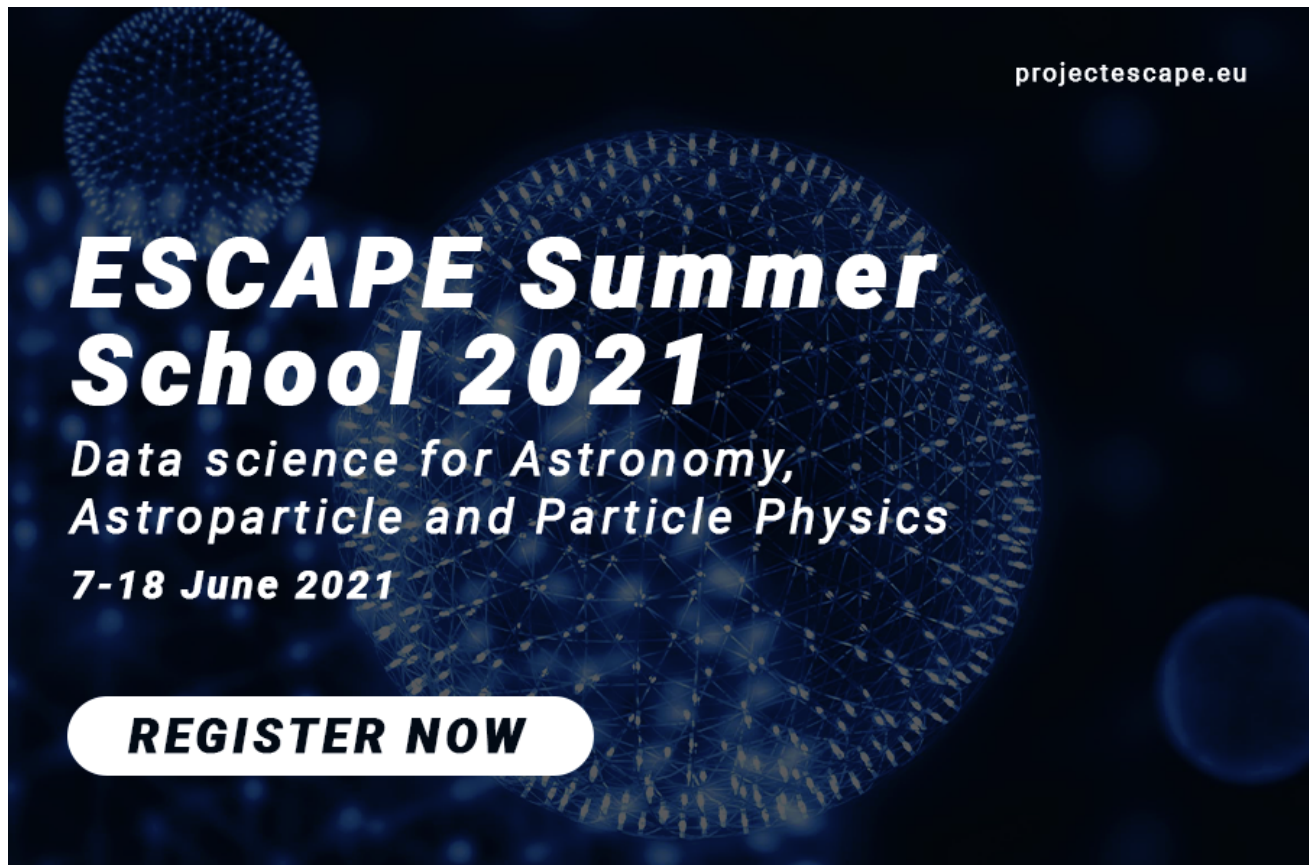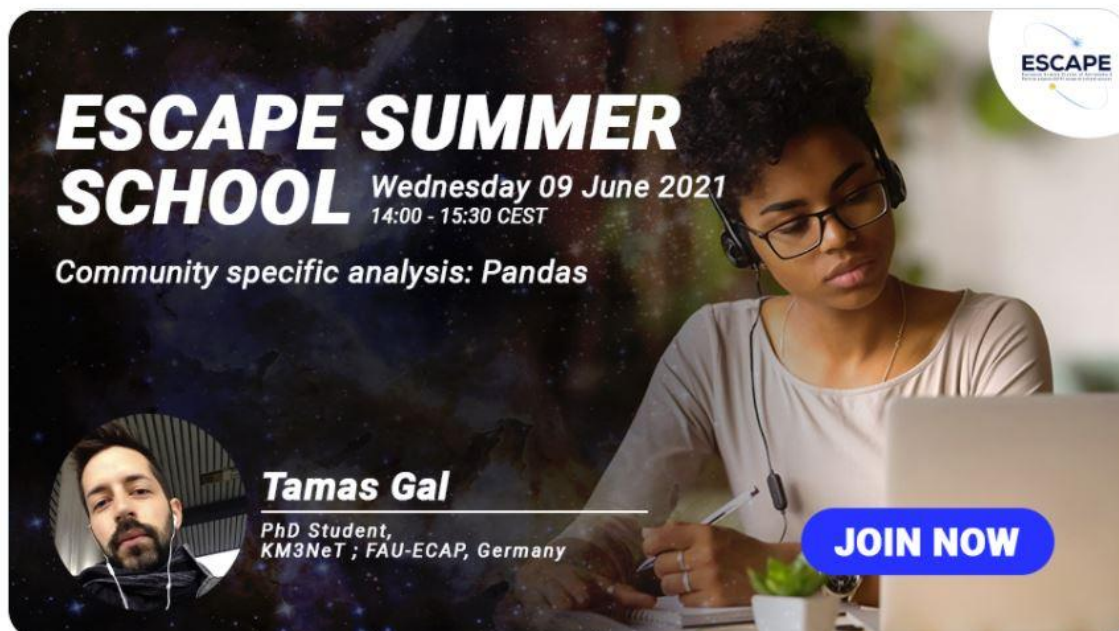
ESCAPE Summer School lecture announcement on ESCAPE Twitter account

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12

Details of the communication plan can be found in the Appendix C.

6 Results

6.1 Open teaching for open science

As ESCAPE is a strong actor in open science, the school content could be no less than entirely open. As such, all the material is openly accessible and distributed through open licenses, opening the possibility to anyone to modify it and re-use it in other contexts.

The content of the school is accessible through the school portal: https://ESCAPE2020.github.io/school2021/ but as also been integrated into the OSSR. To cite its content, please use https://doi.org/10.5281/zenodo.5093909.

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13

6.2 Participants demographics

A survey was conducted among registered participants between the registration deadline and the beginning of the school in order to better understand their background, knowledge and origins to better adapt and modulate the content. A total of 483 participants replied to the survey which has been conducted thanks to the open tool LimeSurvey hosted at LAPP. The data of this survey have been compiled and sent to the tutors prior to the school and are summarized here.

As a result of the open and free registrations, the event was truly international with all continents represented. Also, the vast majority of participants (96%) was not directly linked to ESCAPE partner institutions, a percentage not achieved with in-person schools, presumably due to the associated travel costs.
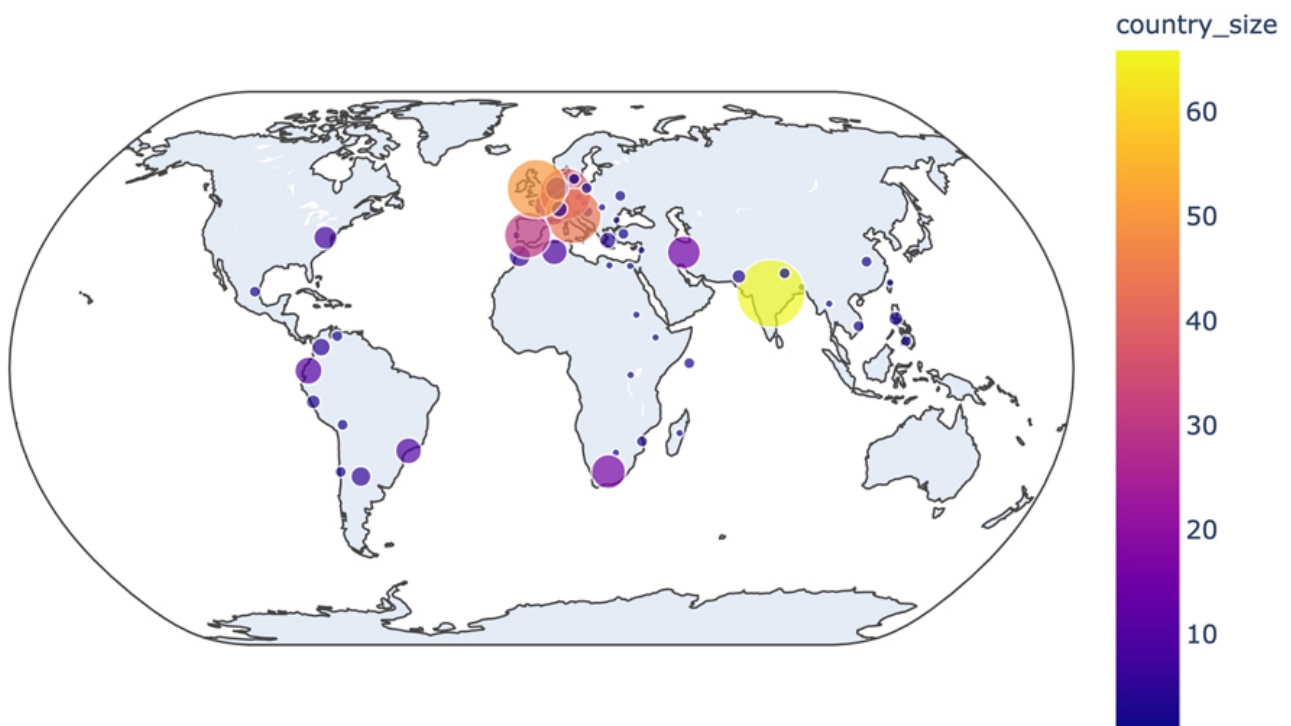
Number of participants by country that replied to the school survey.

Participants are mostly students or young researchers as shown in the following figures. The gender gap still exists in the physics communities but we have a large representation of women nonetheless.

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14

Age groups — <21: 7.0%, 21-25: 47.0%, 26-30: 25.3%, 31-35: 12.5%, 36-40: 3.4%, >40: 4.8%

Gender: How do you identify? — Woman: 41.7%, Man: 57.3%, Other: 0.5%, Non-binary: 0.5%

Positions — Undergraduate: 17.6%, Master student: 27.2%, PhD student: 34.2%, Postdoc: 10.8%, Senior researcher: 2.7%, Engineer in academia: 1.4%, Other: 6.0%
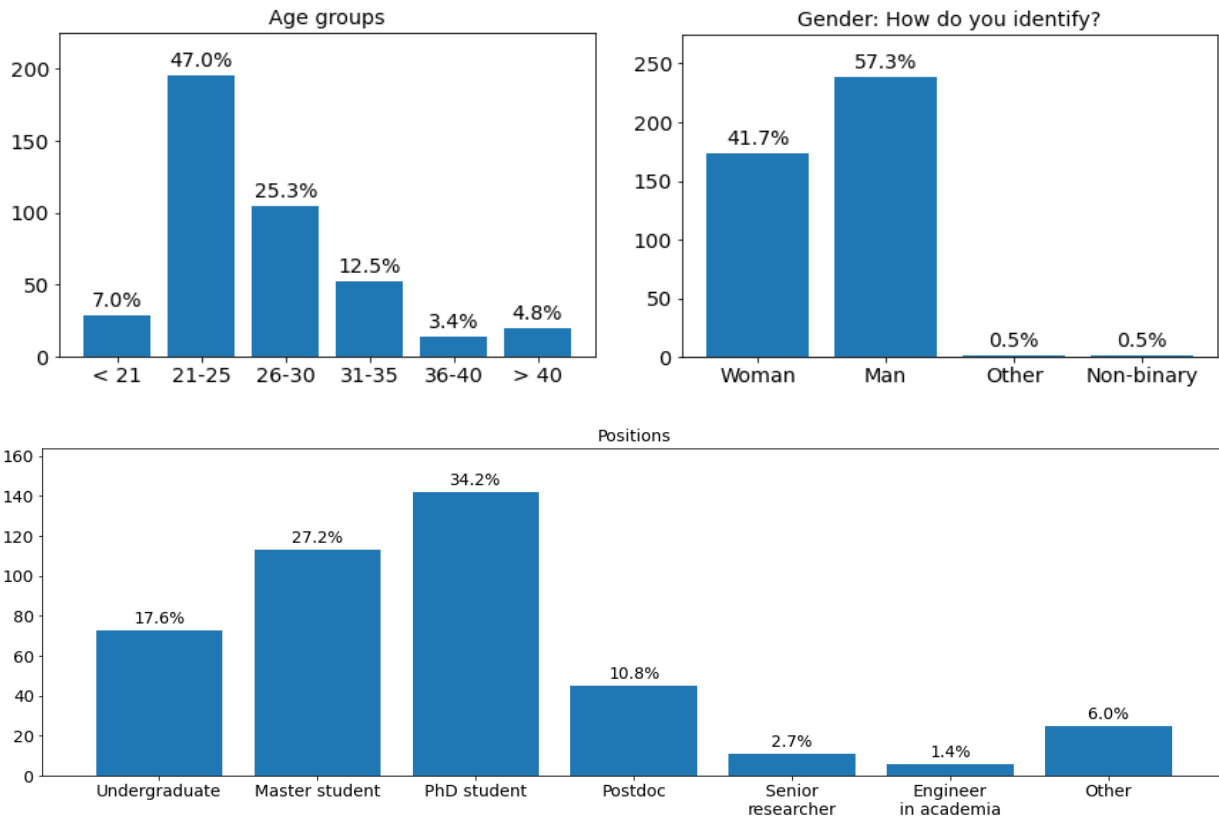
The participants register to the school mostly because they need such training for the present of future research.

Why did you register at the school? — [Personal knowledge]: 34.4%, Necessary for my work: 39.7%, For a specific course: 8.3%, [Curious]: 17.6%
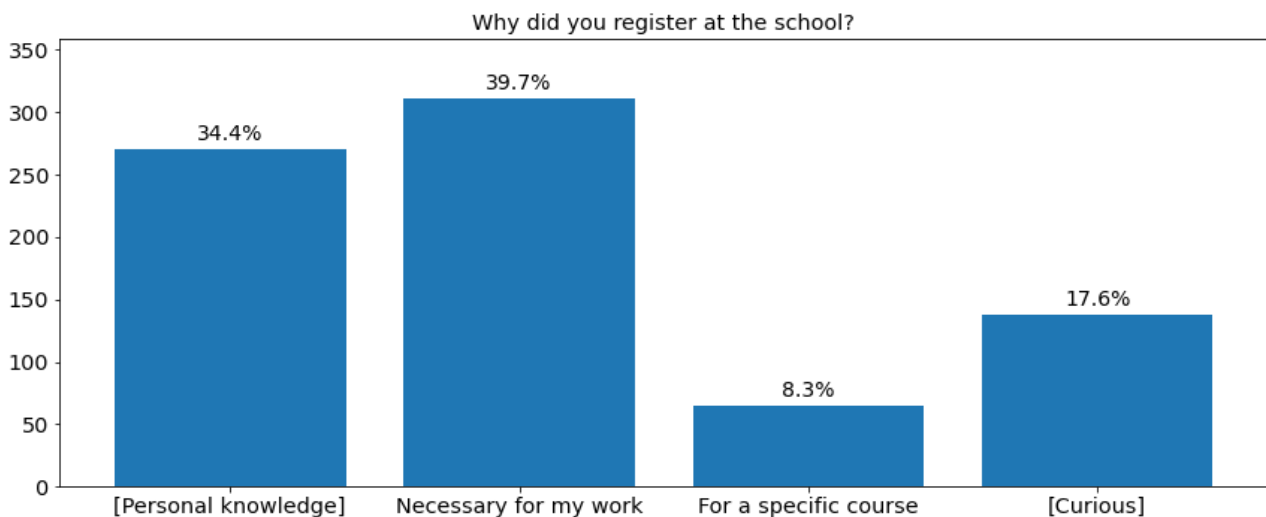
More figures on the participants' demographics are provided in the appendix.

6.3 Participants feedbacks

Another survey was conducted after the end of the school to get participants' feedback. A total of 205 participants gave feedback. This survey has been conducted thanks to the open tool LimeSurvey hosted at CC-IN2P3. The data of this survey have been compiled and summarized here.

The participants were generally very satisfied with the school, with 93% of satisfied or very satisfied responses.
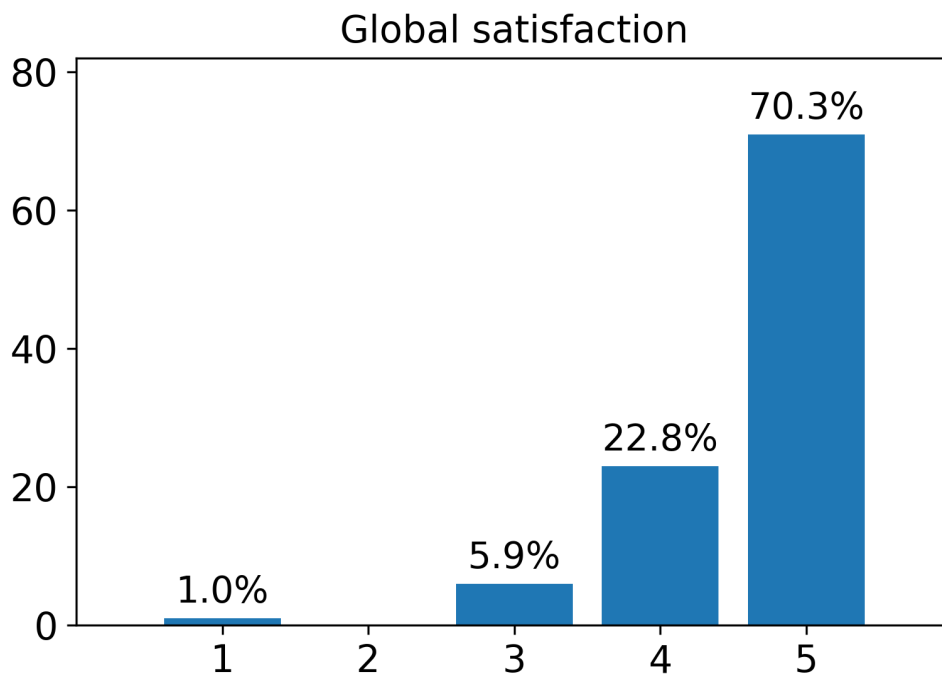
Their expectations have been well or entirely meet for 89% of the participants:

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16

Did the school meet your expectations?
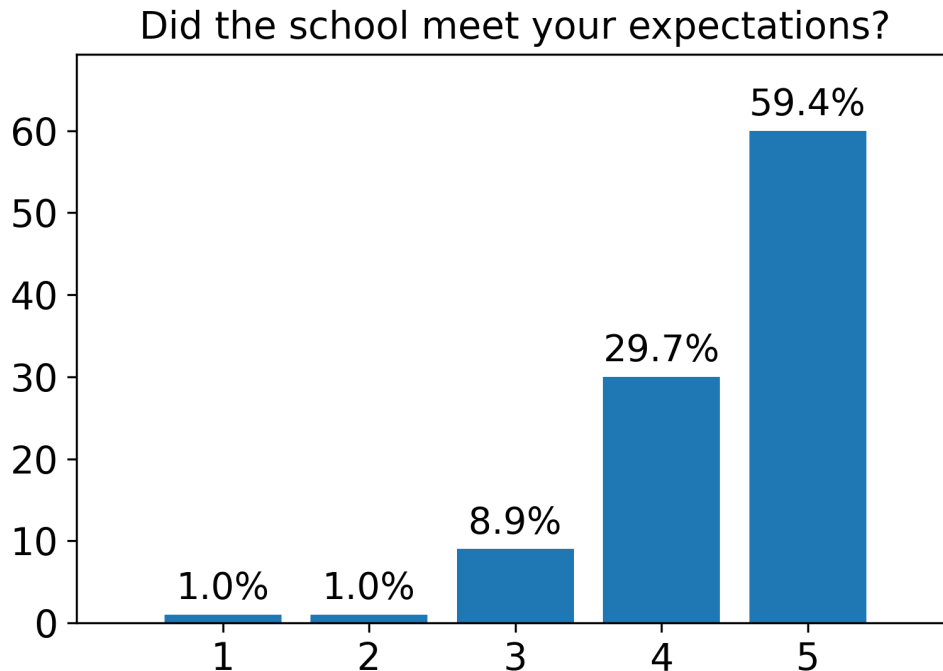
There have been many textual feedbacks, gathered in the appendix. In addition to the vast majority of overwhelmingly positive survey answers[1], there have been some issues raised to be taken into account for the next school:
- the agenda was tight and full;
- the provision of material should be done more in advance;
- more time for hands-on should be included;
- the duration of two weeks was thought rather long;
- the necessary skip of the deep learning was regretted;

Especially for this kind of event several reasons have been received in favour of all possible ways: hybrid, virtual or physical. However, the majority of 58.4 % was for a hybrid event (23.4% for virtual and 18.2% for a physical event).

Per lecture feedback was also gathered, compiled and transmitted to each tutors.

6.4 Audiences and figures

The School had 13 tutors, 1054 people registered with an average of 176 people following the 29 lectures on Youtube each day of the school.
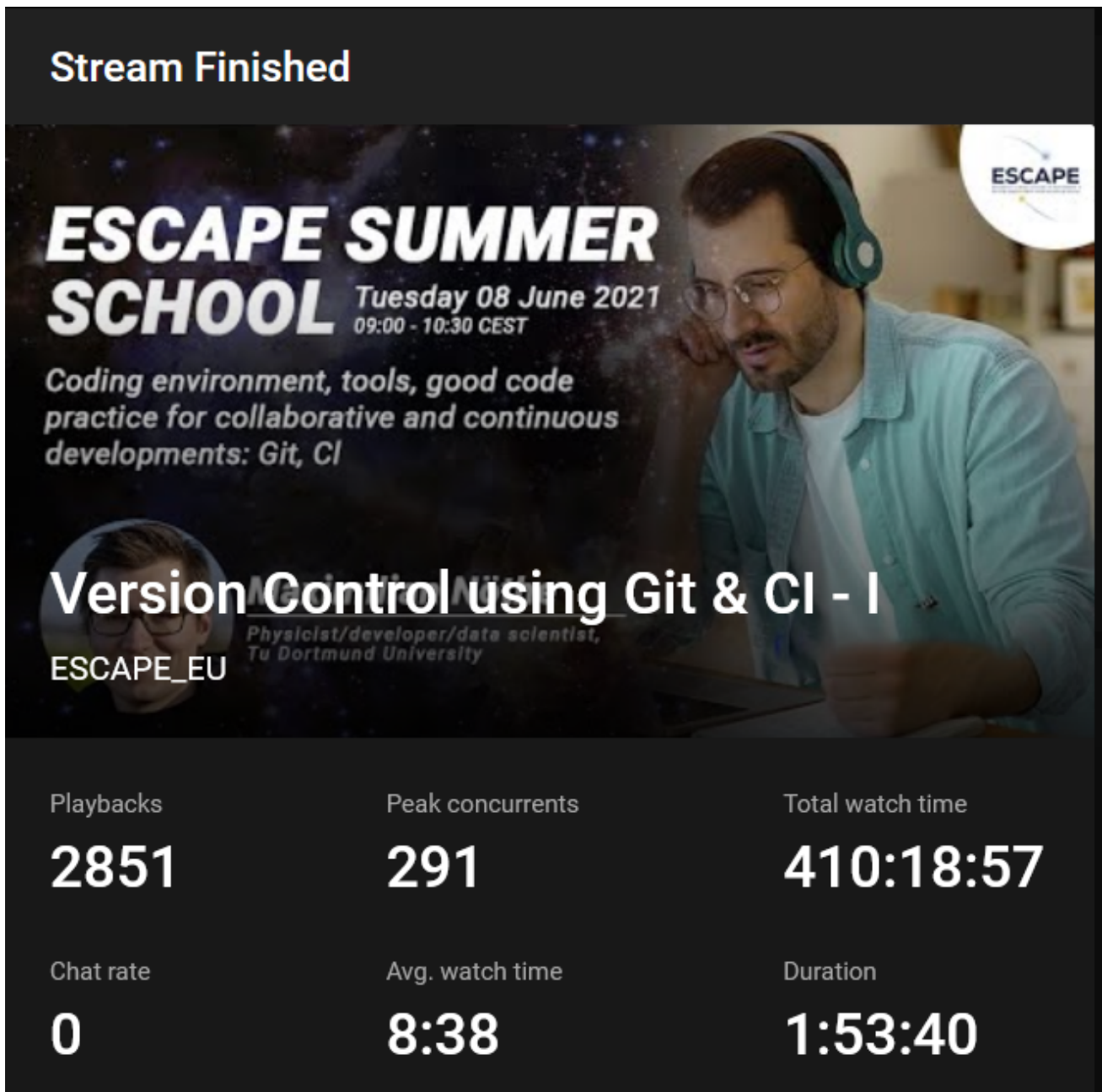
[1] "I think this was one of the best-organised conferences/workshops I have attended this year."

Project No 824064

Date 21.07.2021

D3.5 - Thematic training event - first school for software development and deployment in the EOSC

There were 406 unique views for the first day of school and 1680 unique views for the duration of the school.
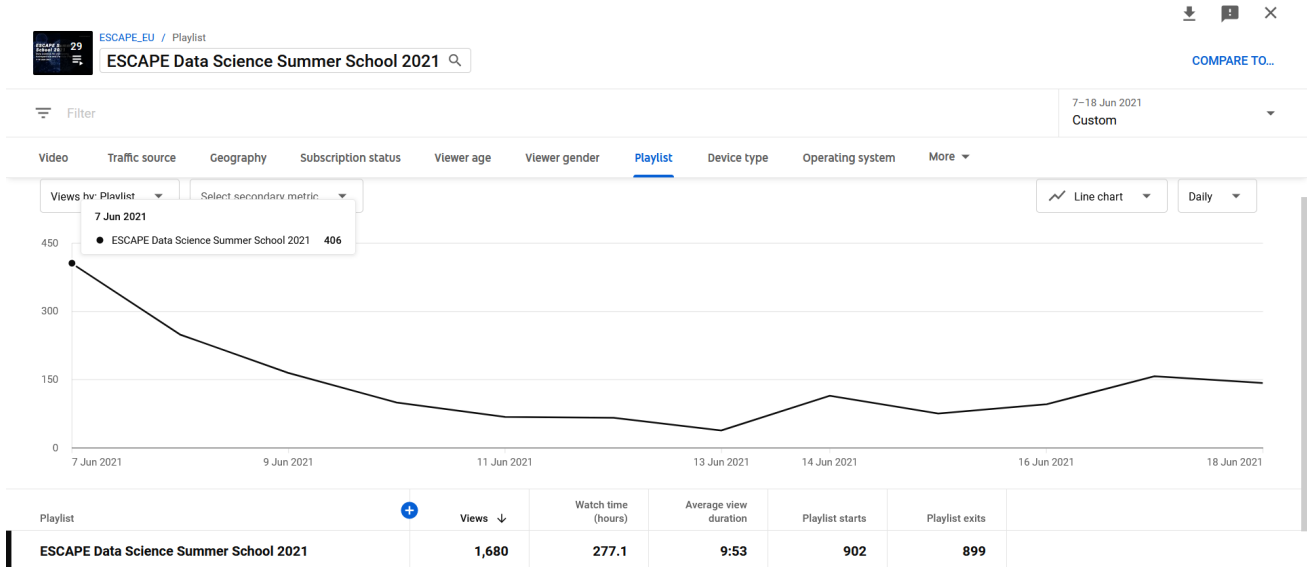
As the courses stay available on Youtube, the number of views has increased steadily since then, reaching more than 2000 views for some of them. The average viewing time is more than 15 minutes, attesting to the interest of the courses.
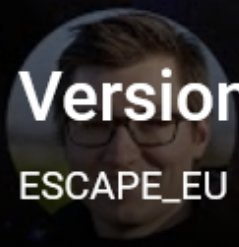
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19
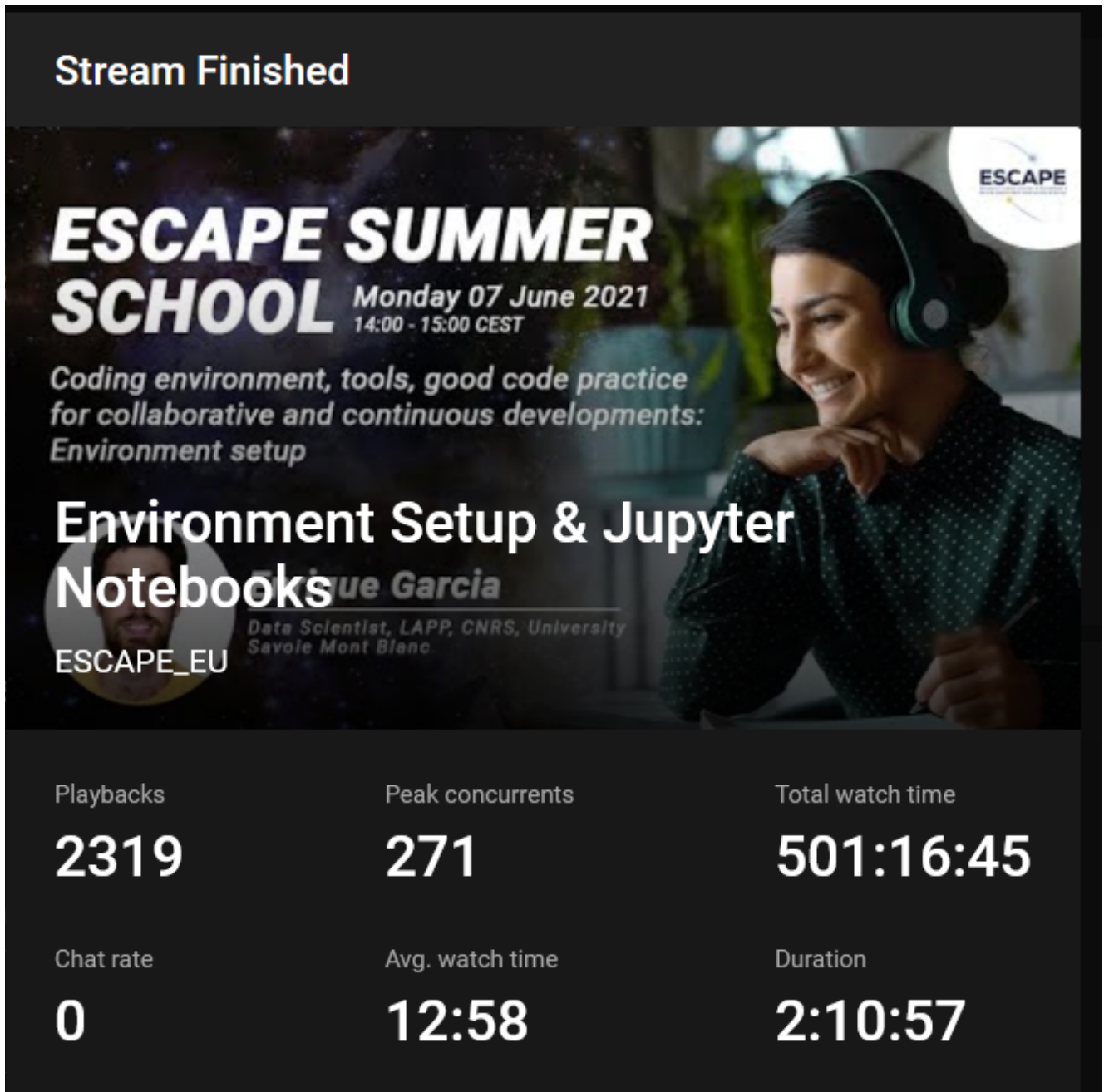
As proof of success, the YouTube channel reached almost 20,000 unique views over the two weeks of school and acquired 371 followers.

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20

In the selected period, your channel got 19,301 views

Views	Watch time (hours)	Subscribers ⚠
19.3K	4.7K	+371

7 Conclusion and next steps

The school was an overwhelming success and showed the need and acceptance of such a thematic training event by the targeted audience. Its audience was globale, as well in terms of geographic origin as in terms of origin of domain or experiment, which is a real success for open science and cross-domain fertilization. Such training events need to be sustained beyond the ESCAPE project's lifetime. In Summer 2022 there will be a second instance building on the feedback and with a special focus an EOSC-based open software environment.

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21

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Participants gathering for a virtual group picture

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22

8 Appendix

8.1 Appendix A: Participants survey

8.1.1 Participants origins
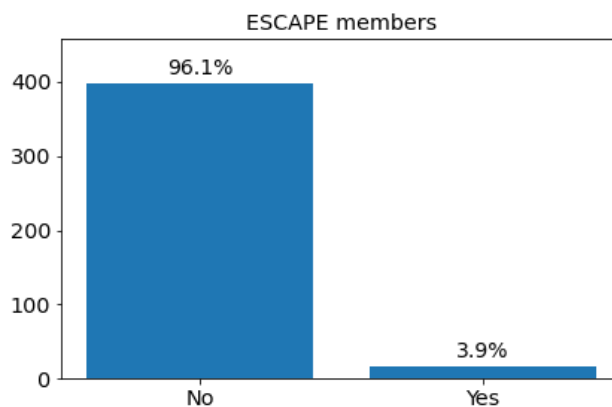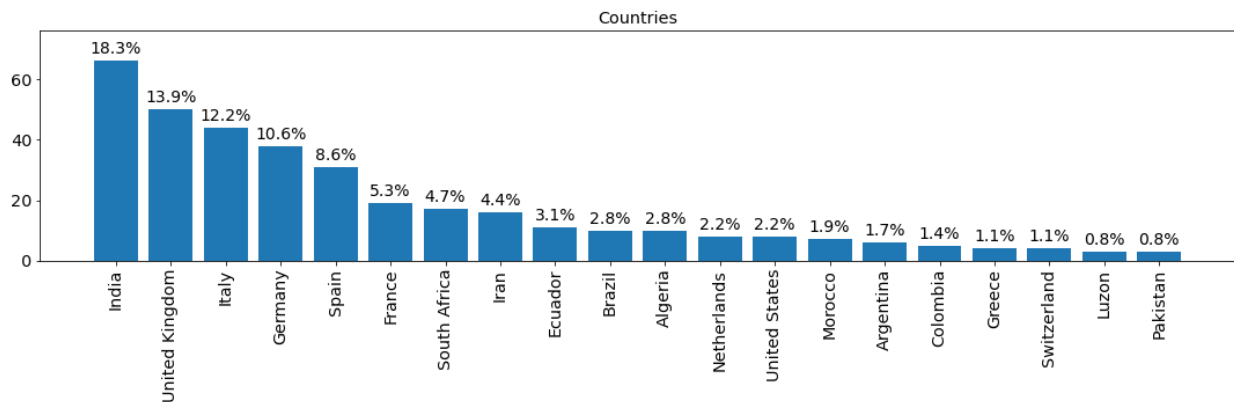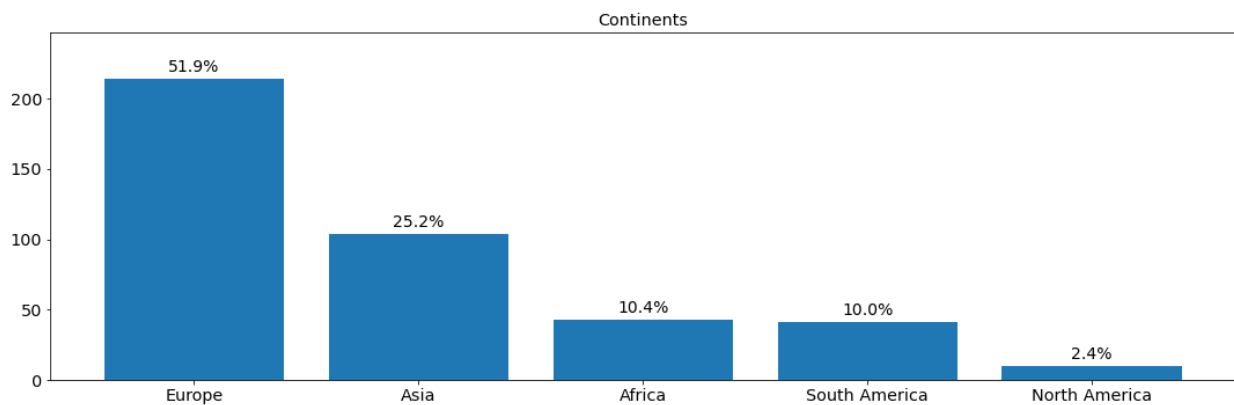
ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

23

Experiments and projects with more than one member participating
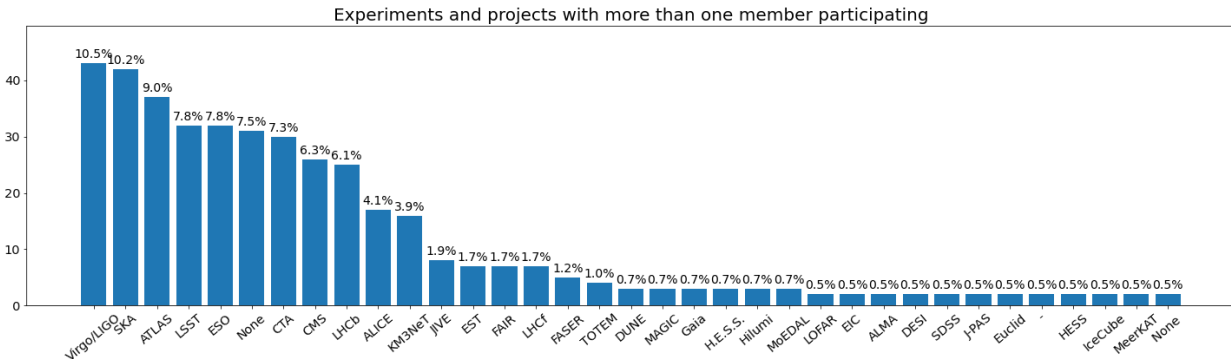
8.1.2 How did participants learn about the school?

How did you hear about the school?
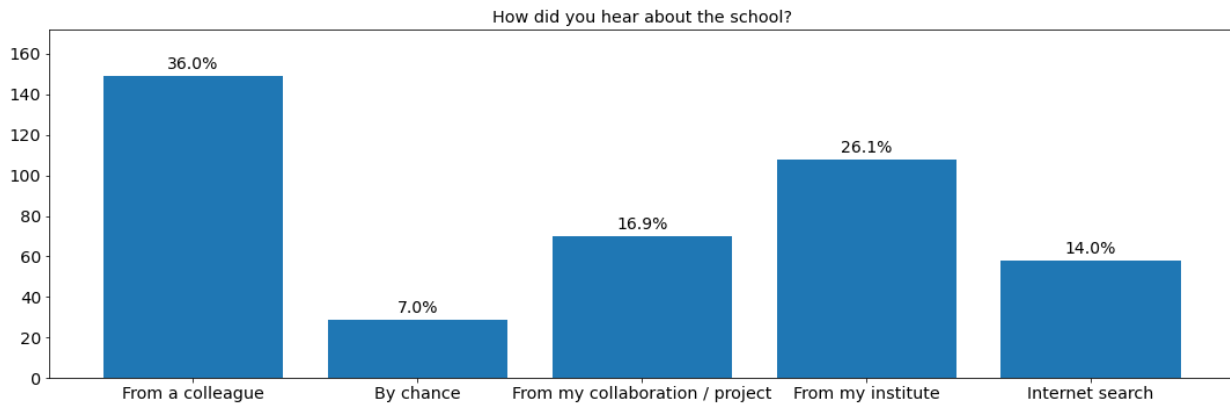
8.2 Appendix B: School agenda

The   detailed   agenda   can   be   found   on   the   school   indico:
https://indico.in2p3.fr/event/20306/timetable/. A summary is provided here.

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24

D3.5 - Thematic training event - first school for software development and deployment in the EOSC

ESCAPE SUMMER SCHOOL
from **Monday, 7 June 2021 (08:30)** to **Friday, 18 June 2021 (14:00)**

Monday, 7 June 2021	Tuesday, 8 June 2021	Wednesday, 9 June 2021	Thursday, 10 June 2021	Friday, 11 June 2021
09:00 **Welcome address** 09:10 **ESCAPE**	09:00 **Git**	09:00 **Python introduction, useful packages and libraries for data scientists**	09:00 **Reproducible science in practice**	09:00 **Scipy**
09:30 **School organisation** - Thomas Vuillaume				
10:30 **Coffee break**	10:30 **Coffee break**	10:30 **Coffee break**	10:30 **Coffee break**	10:30 **Coffee break**
11:00 **Reproducible science**	11:00 **Git**	11:00 **Numpy**	11:00 **Reproducible science in practice**	11:00 **Astropy**
12:30 **Lunch break**	12:30 **Lunch break**	12:30 **Lunch break**	12:30 **Lunch break**	12:30 **Lunch break**
14:00 **Environment setup**		14:00 **Pandas**	14:00 **Test driven devs - unit tests and continuous integration**	14:00 **Webinar: AI in Cosmological Experiments** - Ofer Lahav (University College London)
14:30 **Python and Notebooks**				15:00 **Discussion with teachers**
		15:30 **Matplotlib**	15:30 **Coffee break**	
			16:00 **Packaging**	

Monday, 14 June 2021	Tuesday, 15 June 2021	Wednesday, 16 June 2021	Thursday, 17 June 2021	Friday, 18 June 2021
09:00 **Debugging and profiling**		09:00 **Spark**	09:00 **Introduction to machine learning**	09:00 **Introduction to deep learning**
	10:00			
10:30 **Coffee break**		10:30 **Coffee break**	10:30 **Coffee break**	10:30 **Coffee break**
11:00 **Optimisation and parallelism in Python**		11:00 **Spark**	11:00 **Introduction to machine learning**	11:00 **Introduction to deep learning**
12:30 **Lunch break**		12:30 **Lunch break**	12:30 **Lunch break**	12:30 **Farewell**
14:00 **Gammapy**		14:00 **Introduction to Julia**	14:00 **Introduction to machine learning**	
15:00 **Coffee break**		15:00 **Analysis Workflow from the KM3NeT Open Data Center**		
15:30 **Scikit-HEP**		16:00 **An introduction to gravitational wave data analysis**		

8.3 Appendix C: Communication Plan

8.3.1 News

Website	Description	When	Link
ESCAPE Website	News item to better promote this ESCAPE School to the reference community	23/04/2021	https://www.projectESCAPE.eu/events/ESCAPE-summer-school-2021
LAPP Website	News item to better promote this ESCAPE school to the reference community	26/04/2021	https://lapp.in2p3.fr/spip.php?article3080&lang=en
ESCAPE Website	News item to give feedbacks on this ESCAPE school to the reference community	28/06/2021	https://www.projectESCAPE.eu/news/real-success-virtual-ESCAPE-summer-school-data-science-astronomy-astroparticle-particle-physics
LAPP Website	News item to give feedbacks on this ESCAPE school to the reference community	01/07/2021	https://lapp.in2p3.fr/spip.php?article3115&lang=en

8.3.2 Newsletters

Type of material	When	Link
ESCAPE Newsletter	18 May 2021	https://mailchi.mp/c11b8c8b61d8/ESCAPE-newsletter-n7-ESCAPE-virtual-summer-school-7-18-june-full-dress-rehearsal-exercise-of-the-ESCAPE-pilot-data-lake-much-more?e=55a35ab737
IN2P3 Newsletter	30 April 2021	https://cutt.ly/vmc0Qev
LAPP Newsletter	30 April 2021	

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26

CNRS Hebdo	29 April 2021	http://www.cnrs.fr/CNRS-Hebdo/alpes/lettre.php?numero=603
IDEFICS Newsletter	19 May 2021	https://sh1.sendinblue.com/2m29av1v9t7e.html?t=1625733447

8.3.3 ESCAPE Social Media

What	Description	Link
Twitter	Announcement of the school and each course. Creating a hashtag #ESCAPESchool21 to follow the discussion on this event	@ESCAPE_EU
LinkedIn	Announcement of the school and each course	ESCAPE
YouTube	Live broadcast of the school's lectures and creation of a playlist of all the school's recorded videos	https://www.youtube.com/watch?v=TUrJ_ludVx8&list=PL5l3baTu76qPbYZlRK0Yhr4P_wsl-84Hn

8.3.4 Communication Material

Type of material	Description	Links
Event banner on Indico	Showcase and give visibility to the School	https://indico.in2p3.fr/event/20306/logo-1725324874.png
Event banner on ESCAPE Website frontpage	Showcase and give visibility to the School	https://www.projectESCAPE.eu/ https://indico.in2p3.fr/event/20306/images/6748-E2s2dihWEAl9NOv.png
Event banner on LAPP Website frontpage	Showcase and give visibility to the School	https://lapp.in2p3.fr/?lang=en

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27

		https://indico.in2p3.fr/event/20306/images/6749-ESCAPESchoolLogo.jpg
Tutors banner	Showcase the lectures and give visibility to the School	https://indico.in2p3.fr/event/20306/images/6740-11.png https://indico.in2p3.fr/event/20306/images/6735-5.png https://indico.in2p3.fr/event/20306/images/6733-3.png https://indico.in2p3.fr/event/20306/images/6731-1.png https://indico.in2p3.fr/event/20306/images/6747-OferLahav.png https://indico.in2p3.fr/event/20306/images/6746-MachineLearning.png https://indico.in2p3.fr/event/20306/images/6745-E31JFZDXEAAw6q-.png https://indico.in2p3.fr/event/20306/images/6744-E31D2NkWQAICuER.png https://indico.in2p3.fr/event/20306/images/6743-E3_zXFnVoAIyJ8b.png https://indico.in2p3.fr/event/20306/images/6742-E3_e7PfWEAE6wR-.png https://indico.in2p3.fr/event/20306/images/6741-AxelDOnath.png
Videos	Making lectures accessible to all	https://www.youtube.com/watch?v=TUrJ_IudVx8&list=PL5l3baTu76qPbYZlRK0Yhr4P_wsl-84Hn

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28

8.4 Appendix D: Participants feedback

The following provides the raw feedback comments from participants.

8.4.1 Were you satisfied with the global organisation of the school?

I think this was one of the best-organised conferences/workshops I have attended this year.

Things went very smoothly, the only point of improvement was to provide the software instructions a bit earlier. One day before the meeting it was very tight. That was overcome in part by the introduction.

Very well organised. I would have liked the calendar to be available on the github website too.

Well planned and managed - excellent coverage of important topics.

The organizers did a great job. There were timely notifications prior to each event and all went very smoothly.

Very satisfied. Nothing to say

It was good, especially since the teaching was remotely

It was not very clear for me if we were supposed to follow the lectures in our own Jupyter notebook (not enough time for this). I think the "hands on" part of the school was very little. With so many lectures each day I could not find the time to do the exercises in the notebooks by myself.

It was really complete

I didn't experience any organisation related issues, and if there were the LOC/tutors seemed on hand to fix them.

I thought it would be very weird to have live streams here, and discussion there, but it went really well!

Very well organized as the resources were easy to follow and easily accessible for us who are in different time zones and not able to keep track the same way.

Really condensed and useful notions but it is a little hard to follow all the lectures live (too many hours in front of a screen!)

This was the best-organized workshop I ever attended.

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29

It is my first remote summer school and I am really pleased about the interactivity with students and especially tutors.

It was very interesting, the lectures went from easy to more complicated without skipping important stuff and everything was very well organized and easy to access.

Yeah, I think the school was well organized

Attending so many hours per day in remote mode has been quite difficult to me, I risked more and more times to lost the attention

I was very impressed with how the programme was run, and the availability to interact was very nice too (Slack, GatherTown etc). I did not interact much on Slack regarding asking questions, but it was very nice to see the instructors interacting with the questions (questions I had would have already been answered) and answering them on the platform as well as the livestream.

Loved the subjects and the reach of each one.

8.4.2 Did the school meet your expectations?

Even though not all of the information is directly useful for my work, if I ever need to learn or refresh my knowledge on one of the topics I will use this school's resources.

This was a very useful course, even for the parts I knew about before (like pandas and numpy), as I was shown new tricks to use.

YES

The school exceeded my expectations. It was the best workshop I have so far attended.

Il reste des formes que l'école est avancée dans l'aspect technique pour moi

I would have expected and preferred more exercises in groups or during the lecture.

Unfortunately, the deep learning lecture was cancelled and I think that this lecture should be one of the most important.

Exceeded my expectations

They were easy to understand

It highly, highly exceeded them. Please send me an email if this team organizes other schools.

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30

It highly exceeded my expectations. Please let me know if/when this team organises a different school

Some programs were hard to follow.

Yes it was good, I regret being in the North American time zones so I always felt behind in the school and missed most of the GatherTown interactions

Though it would have been nice if there had been more time to do the exercises, before they were being discussed.

Exceeded!

I also expected to find in there a lot of interactive sessions about deep learning but I understand that circumstance always surprises us. I hope I will learn them for the next season of ESCAPE.

In most of the aspects it even surpassed it, the contents were deep and thorough.

I've given 4 only because of the absence of the deep learning lecture.

I was very impressed with the content - I think the Git sessions were particularly useful for my use case, but of course all the other courses bolstered my coding skills too.

The keynote talks on reproducibility in science as well as a very insightful talk because of how we need to understand the importance of our work and allowing access to the wider community, so I enjoyed that very much.

Very well structures, it's a shame the last lecture had to be canceled

8.4.3 For future editions, should we have a physical, virtual or hybrid event?

A physical event has huge benefits for the interaction and workshop style parts, but I think this could also be handled in virtual break-out rooms in Gather. I could not have participated if this had been a physical event. The online setting was ideal, so I could plan my other work and family life around this. For a hybrid event my concern is that you're essentially organising an online and physical event, so two in one, which is a lot more work.

I understand that lectures would have been better if it was given and attended in person. But I could attend this school only because it was held online. Seeing how it would eventually benefit my career, I kindly suggest you introduce some hybrid way so that a physical audience, as well as an online audience, could enjoy this wonderful school.

Nothing beats physical interaction, but I wouldn't have been able to attend the school as an undergrad if the event was physical. So maybe a combination of both, physical for those

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31

able to attend in person, and virtual for those who are unable, might be great for future editions!

A virtual event is good choose

It was very nice that lectures were recorded, and it was easy to ask questions. But it would have been nicer to sit in person, since the lectures were long

Reasons why virtual is nice :
* A lot more participants can attend
* Participants from around the globe can attend without having to schedule trips
* Lectures can be followed live or later if not available during lecture
* During dense exercices or setup problems, possibility to pause the live, rewind if we missed an information and catch up with increased play speed
* Slack questions are easier to talk about with different participants and to select for the host than hand raised questions

Reasons why physical is nice:
* Even with the Gather portal it was hard exchanging with other participants
* For participants not being able to follow the lectures live, the fact that they were incremental lead to a lot of questions asked during lectures that have previously been answered but the participant did not attend the previous lecture

Hybrid would be harder to prepare for the organizers but could give the best of both worlds if the live events in audience are streamed in the same conditions and the questions are aggregated on slack or equivalent

This school, in person, must be fantastic

It would be awesome if it is physically but virtually allow people all over the world to attend

I think if it is physical in the future, it might still be useful to interact on a platform like slack. I like that it allows me to refer back to discussions, and see other people's thoughts/questions.

I am really unsure about this one. I like physical events (and I heard only good things about Annecy), but it is really a difference reaching 1e2 or 1e3 people.

I miss physical events, but I have to admit that the ability to pause and rewind the lectures was really useful.

It would be good for participants who won't be able to travel to be able to complete the course alongside a smaller group who are in attendance

For the specific case of a coding school, the virtual event format works really well. Avoiding the travel overhead is very nice.

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32

Of course I would have loved to drink a beer with you guys, but hopefully there will be other events :)

I enjoyed the School and, even if I come from a theoretical background and had no previous experience in data analysis, I learnt a lot. The YouTube streaming was perfect in this sense, giving me the chance of re-watching some things and proceed at my own pace. Also the fact that it was virtual and required no travel expenses made it easy for me to get the consent to participate from my Supervisor.
The Slack worked very well, with tutors very quick and exhaustive in their answers. I also had the chance of learning from questions that other participants asked there.
For all these reasons I would suggest a virtual event.

Hybrid events allow more participants to join. If this school had been an only physical school, I would have' not been able to attend. Keep making science and knowledge as accessible as possible :)

If it wasn't virtual I probably couldn't have attended anyway...

I believe this school should be virtual in the coming days as well, as it can accommodate the students from all over the world. :)

A hybrid event will allow a lot of students to participate in the school, who cannot be physically present because of one reason or the other.

Since it is virtual it is nice to be able to follow everything at your own place and being available to students far away (like me!), but in person allows a better networking and learning environment

I attended an OBELICS school a couple of years ago, and really liked the interaction when doing the exercises. OTOH, virtual means no travel time/cost.

More deep experience, more interactive in person and to make connections

A physical event is always better for learning. Virtual learning is ok in case of necessity. In this case it was the pandemic, in other cases it can be because we need to save time (for example when a person works and study at the same time) in other cases the lack of tutors or the fact that students are widespread located across a geographical region (maybe education in Alaska?).

However, making this school a virtual event has brought to many of us the possibility to participate in a high level school and to interact with experienced professionals is especially valuable.

A virtual event helps more assistants to come. It also helps to reconcile the school with other mandatory activities. In particular the last matter was really helpful to me since I had to perform some critical things at work during lecture-time.

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33

I do not know if this is desirable for the organization, but making people able to assist a bit of the lectures, not aiming to get a certificate assistant, can be also valuable.

In any case a hybrid event could bring the best of two situations with maybe not much of an investment, since I recognized the quality of this school is the same as a physical one and with the same dedication from the tutors.

I liked the format of the course very much. It allows you to combine it with your schedules and allows it to be free of charge and easy to attend to. The slack tool was very useful also.

I believe that it can be easily followed online and in this case it will give more opportunities to the participants.

I liked the school so much, Have learnt a lot in two weeks and have seen real intelligent instructors.

Easier to follow the lessons, especially the hands-on sessions, and interact with the tutors

It would be great to be able to meet in person to know the tutors and other participants.

8.4.4 For a future edition, what topics would you like to see on the scientific program?

Perhaps more about science platforms, which seem to be all the rage nowadays. How do you set this up, make it accessible, make it reproducible, etc. I know of JupyterLab, but is that the only option, or just the most used one.

maybe an overview on editors, this was a big takeaway for me. Seeing how other people write code. For example I did not know tab could autocomplete in command line, and had never heard of vim (which I am now trying to use)

While programming is definitely required, some lectures on statistics pertaining to the data that will be observed with future instruments would also be nice.

I would suggest introducing some more sessions from HEP, as for one a big area in science which deals with large data is HEP. And personally, I would also like to see more of them as I am a high energy physicist ;)

Data analysis from virtual observatories and archival data, for example of neutron stars and pulsars, solar observations, etc.

I'd love to see some stuff on the observational astronomy data pipeline. A different team in the group I'm part of at my institute works on the pipeline to acquire and process images

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34

from the GROWTH-india telescope, and I've always wanted to know more about how image processing and FITS file generation is done. Maybe a couple of lectures on that? :)

Programming in C ++ language

More topics from statistics:
methods like using Maximum Likelihood estimators, minimization, fitting, …
When we should use the Method and what are the pitfalls.

C++

Julia, R, Linux productivity tips, deeper numpy and scipy

Probabilistic programming

Do a lot of practical work on astronomical data sources

simulate detectors

If I remember correctly, I am one of the older (read as longer) in the field. Thus, most of the lectures were at least at the beginning known stuff. Maybe you can think of a beginner-track and an expert-track?

Maybe work through a problem from start to finish utilising the various skills learned, so that we learn how to work on a problem from start to finish, using good analytical and coding practices and the live use of debugging and utilisation all on one clear visual problem. Fibonacci numbers felt a bit too mathematical.

How to switch to Julia when trapped in the python ecosystem :P Jk, I am just lazy.

Spark was nice, maybe more in that direction? Slurm etc

I don't really care too much about it, but for other people maybe: Keras, pytorch, ... Anything NN related

Since we had packaging, debugging, ... the next step would be documentation? Deploying online documentation on github or smth else would be pretty cool

ROOT cern, Artificial Intelligence

some deep learning :-)

Topics such as C/C++, R, Machine learning, and Artificial Intelligence could be included.

A gentle introduction to Cython

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35

I would like to see quantum computing being connected to this. Because I believe, if we have to go to the more advanced and complicated simulations of matters, then our computation power will be short. :)

maybe a continuation of the topics started in this edition

The Deep Learning part that we missed out this time :)

more practice on different techniques of data analysis (eg. IACTS-CTA).

I really believe the topics addressed in the school represent a cohesive block of knowledge. Maybe more about programming techniques but I think it is not the scope of this school to provide basic programming tips.

I loved when lecturers gave us references in slack, for example some python youtube talks or how to make animations using matplotlib...a formal way to distribute references.

And please explain the date used during lectures!, I think for the kind of assistants of this school (young scientist) explaining the data used in lectures makes use to focus easier on the computations. We can not just forget the data nature.

More machine learning and deep learning, probably it would be extremely interesting just an overview about the future frontiers of the scientific computing like quantum computers

A more hand-on project on Julia, maybe a bit more on reproducible science but like a project.

More focus on ML /DL, and projects to be done by the participants.

It would be cool to maybe work on a project to solve a specific problem using real data - eg: using AstroML and Jupyter notebooks to test some ML models of galaxy classification or similar. That way, by putting knowledge in practice on a known Astro/Particle Physics problem, we can tackle problems with guidance from tutors on how they would approach it, etc.

I loved all the ones that I have seen, maybe more about pipelines.

8.4.5 Other recommendations you would like to give to the organizers regarding the school format

Organise small <10 people in Gather breakout rooms to work on a problem together, assign one tutor per room. Or, if there's not enough tutors, have more experienced students mixed

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36

with newbies. Make sure you schedule this as part of the programme, so people are not tempted to plan other work during that time (as I did for this school).
I would consider Discord instead of Slack for a next edition. I like the option for voice channels, which makes it easier to ask and follow-up on questions. Also, Discord syncs between my devices.

I really like how it stays on github and youtube

The slack interactions were very useful. So much useful information shared in that. If you could pin and collect the useful threads that would be a useful reference for the future.

None that I can think of

Good

Please have more time for hands-on sessions/ working with others.
I did not have additional time for this since we had so many lectures.

Working on a project with the help of the instructors would be interesting

I think the setup with youtube streams (and uploads) and slack for discussion was really the best. I really think that a large Zoom call would have been worse. I am not really a fan of slack, but I also don't know a better solution.

I did not use gather.town at all (except for the group picture), so I can not say anything about that. I am just not really good at digital socialising :'D When I go get a coffee, the breaks are over...

Hard in practice, but in an ideal world:
Have the talks ready at day one and have one common environment that does not need to be updated in between. Git/conda skills might be mandatory, but newer students might still be confused.

It would be a bit better if some of the hands-on sessions go a little slower so as to be in sync with the beginners or those who are self-taught programmers.

Not much. I found it to be very compact and absorbing. Thank you so much :)

There is a lot of topics covered at an intro level, choosing fewer topics would allow us to learn them more thoroughly

The School provided an enormous breadth of subjects. Sometimes I would have liked to go into more depth. Maybe some more in depth sessions could be arranged, e.g. by having parallel sessions.

If you can include a few more theorists, it'll be a cherry on top.

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37

I know the way we had was more relaxed since we could practice afterwards the lectures. But I will change from the format to make assistants to perform some activities during lectures. Or even have less practical sessions (instead of 2 hours 1 hour) and make assistants to do some basic practices at a local site. I know this can be difficult. In any case, trying to increase interactivity during the lecture. Or at least to make assistants put into practice the recipes given in the lecture.

Also I had some difficulties with my dated ubuntu version. It could have been more handy if beforehand the school, once you are admitted, to tell you within a month or so "this is our repository, you need these dependencies to work without problems during the school remotely".

Personally I believe in active participation during the school. What I would change would be to have tests or exercises after each lecture to be submitted so that I could have been more on guard and not leave some of the lectures for later:)

You are doing a great job, Please continue!!!

I think the way this virtual event was setup was really good. I liked the youtube livestream option, Slack and GatherTown (although I did not use it). I don't have any recommendations as I think it was set up really well.

More time to practise what we learn and maybe some group work.

8.4.6 Any final word or comment

I loved this school. I learn a lot from you guys. Thank you so much for helping us.

The organisers and lecturers did an awesome job! This was by far the most useful event I attended in the last few years. The lectures I couldn't attend are on my to-do list, but I know how that will go, so I look forward to another edition. I did miss some personal interaction and the opportunity to follow-up questions during the talk. You really tried hard with Slack, but it doesn't quite cut it.

Thanks for the excellent school!

This school definitely is helpful for anyone wanting to learn to code better. The best part was the various efficient resources demonstrated for sharing research, which is very helpful for people wanting to share the data, but getting overwhelmed with the sheer volume of the resources available. The tutors were also very thorough and extremely helpful, despite this being online. Looking forward to more great schools like this.

The school was an amazing experience and a great chance for anyone to familiarize themselves with so many tools. The instructors were incredible and made everything seem

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38

easy! I was having such a great time that even when my code wasn't running I was still happy (and even happier when I finally understood why that happened).
Great job from everyone on answering questions and helping. I can only say the best about this school and its instructors!

I strongly urge you to continue this school every year and possibly other programs like this as well. All the best

Grateful and satisfied participant
Nikhil

Thanks so much.

 Thank you

Thanks!

This was excellent and very well organized. Thank you????

The best school I attended virtually

I benefited a lot from this School, which strongly enriched my scientific knowledge and helped me in my prospective career. I consider this School as a great opportunity to meet students and researchers from all over the world to exchange experiences and knowledge. Thank you very much.

I thought the school was excellent, and I feel as though I've learnt a lot. Thanks again to all the organisers and tutors.

Thanks to the organizers and lecturers and those forgotten for a nice summer school!

Great course, learnt some useful skills and how I should be utilising version control, debugging, optimising my code and code structure. The machine learning aspects felt very basic and tagged on at the end, although maybe the cancellation of the final lectures was why it felt a little flat at the end.

Thanks for the organization, was a lot of fun :)

I barely had any contact with Python and none with the other topics taught during this school. Due to this it was quite difficult to keep up with the live lecture. So it was amazing to be able to rewatch the lecture and be able to follow along at my own pace. All the tutors did a fantastic job and I really liked the organization of the school and the support provided. For me personally it was extremely beneficial that the lectures were/are available online, although I feel like a big part of connecting to other scientists unfortunately is lost in a pure online format.

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39

Thanks a lot.

The quality of the school was really good. The practical aspects are fundamental, and most of the tutors showed actual hands-on examples. The legacy materials (videos and github) are very valuable. Congratulations

GREAT School, I learned a lot though some things are high level, it's great learning.

Thanks a lot for everything! I did the School out of my personal interest and in order to develop new skills, even if it doesn't necessarily have any direct applications in my research. I wanted to assess whether I like data analysis and how it is performed. I now feel definitely more confident than before with the idea of engaging with data science and I feel that it has widened my perspectives on what could happen at the end of my PhD.

It was a great school, the tutors were very interactive and very helpful and it helped improve my knowledge and skills in programming languages. I would love to attend it next year.

Thanks for all. It was a beautiful experience :D

Thank you very much for this school. I can't stress enough how rich and valuable it has been. I thought it was going to be more of a congress to assist and just listen and learn, but it was very, very practical.

Thank you very much. I greatly enjoyed the course, gather town, and slack community. Thank you :)

The school was wonderful.

Just to say thanks for a really nice summer school

Thank you for organizing the school. Had great fun learning things.

Kudos to all organizers and teachers. You did a great job.

Everything was amazing!!

I liked the organization as it is, I would be very happy if one of the next editions would be face to face.

I want to thank the organisation for letting so many people worldwide participate in this wonderful summer school which not only helps scientists doing science but also helps scientists to be better professionals out of science if they are required to do so. The interactivity during the course was superb. For the future I think to hybrid this school with physical attendance would increase the chances of more people benefiting from it regarding her/his situation.

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40

A big thanks to all the lecturers! Bye ;)

Thank you for giving me this opportunity!

Yes, Thank you so much in advance. I would like to have monthly webinars, workshops on a real case study, opportunities for a master degree or PhD.

Thanks for this workshop! I started my PhD the same week this course started, and it was some great timing. Although I attended the sessions that were mostly relevant to me, thanks to all the tutors and organisers for setting this up. I hope to cross paths with some of you in the future.

THANK YOU!

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41