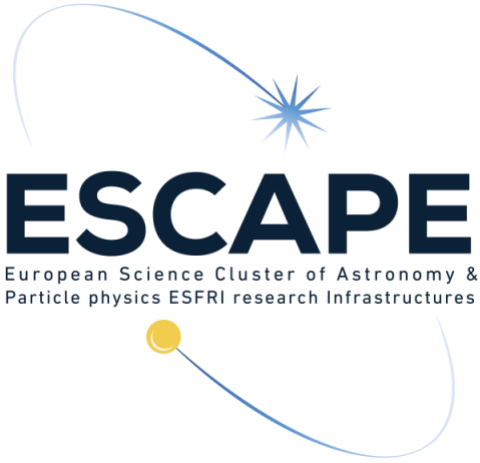

Project Title	European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructure
Project Acronym	ESCAPE
Grant Agreement No	824064
Instrument	Research and Innovation Action (RIA)
Topic	Connecting ESFRI infrastructures through Cluster projects (INFRA-EOSC-4-2018)
Start Date of Project	04.02.2019
Duration of Project	48 Months
Project Website	www.projectESCAPE.eu

D3.8 - Thematic training event - second 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); Maud Coppel (LAPP, CNRS)
Due Date	31.*08*.2022
Date	10.08.2022
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Dissemination Level

X	PU: Public
	PP: Restricted to other programme participants (including the Commission)
	RE: Restricted to a group specified by the consortium (including the Commission)
	CO: Confidential, only for members of the consortium (including the Commission)

Versioning and contribution history

Version	Date	Authors	Notes
0.1	10/08/2022	Thomas Vuillaume (LAPP, CNRS)	First Draft
0.2	16/08/2022	Maud Coppel (LAPP, CNRS)	Communication section
0.3	17/08/2022	Thomas Vuillaume (LAPP, CNRS)	Text and format edit

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

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Table of content

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 D3.8 of the ESCAPE project, the *Thematic training event - second school for software development and deployment in the EOSC,* organized in the framework of the ESCAPE OSSR, WP3.

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After a successful first edition of the ESCAPE School held online in June 2021, the second edition has been organized physically at LAPP, Annecy (France) from June, 19 to June 24 2022.

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 is openly available at https://indico.in2p3.fr/event/26913/, 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 such as numpy, scipy, pandas or astropy.
- 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

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/26913/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 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

5 Organisation

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 and of the first ESCAPE Data Science School organised online in 2021.
It has been held at LAPP, Annecy (France) and welcomed 24 participants and 10 teachers.

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5.1 Online registrations and fees

The registration was done online at a cost of 300€ for external participants, including lectures content and tuition for the duration of the school, coffee breaks, lunch breaks, accommodation to center Jean XXIII from Sunday (19-06-2022) night to Friday (24-09-2022) morning and social diner.

5.2 Online tools and resources

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
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/26913
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/school2022
GitHub ticket issues	GitHub issues platform has been used for participants to report technical issues they could experience.	https://github.com/ESCAPE2020/school2022/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 lecture resources.	https://ESCAPE2020.github.io/school2022/
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://edass2022.slack.com/

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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 #ESCAPESchool22	@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/

5.3 Communication plan

The first announcement of the 2022 School was released on 29 April 2022 on the ESCAPE website, with a registration deadline set to 23 May 2022. 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;
- Banners and branded promotional material.

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

In addition to the announcement, several reminders have been issued on the communication channels before the registration deadline.
During the event, posts were shared on the ESCAPE Social Media to ensure knowledge that the event was happening.

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Facebook Twitter

VIEWS 20,766

19 June 2022 to 24 June 2022

We are pleased to announce that the ESCAPE Summer School on Data Science for Astronomy, Astroparticle and Particle Physics will be back in Annecy in 2022!
The school will be held at LAPP in Annecy from 19 to 24 June 2022. All participants will be accommodated at the Centre Jean XXIII, at a walking distance from LAPP.
The program of the school is devoted to project development for astrophysics, astroparticle physics & particle physics. The aim of the school is to provide theoretical and hands-on training on Data Science and Python development:

- Coding environment and good code practices
- Version control and collaborative development
- Debugging and profiling
- Python packaging
- Scientific libraries for data science and analysis
- Machine learning

The school is open to all. However, basic knowledge of Python is required to benefit from most of the courses. Acceptation to the school is automatic within the limit of available seats. All information regarding the school organization will be sent to participants after the registration deadline.

Figure 1: ESCAPE Summer School announcement on ESCAPE Website

Figure 2: ESCAPE Summer School lecture announcement on ESCAPE Twitter account

6 Results

6.1 Audiences and figures

The school welcomed 24 participants and 10 tutors. The low participation compared to previous years may be accounted the pandemic and current situation not back to previous times with many people still reluctant to travel. Nevertheless, a reflection on the other potential reasons should be carried out.

6.2 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/school2022/ but as also been integrated into the OSSR. To cite its content, please use https://doi.org/10.5281/zenodo.6981096.

6.3 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. The data of this survey have been compiled and sent to the tutors prior to the school and are summarized here.

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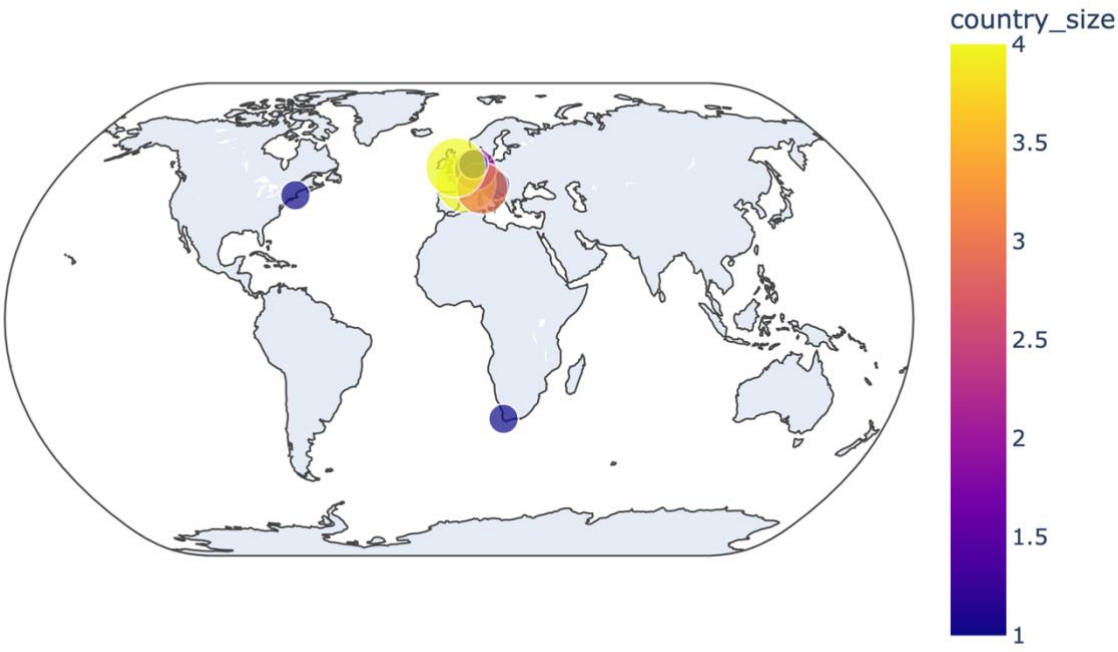
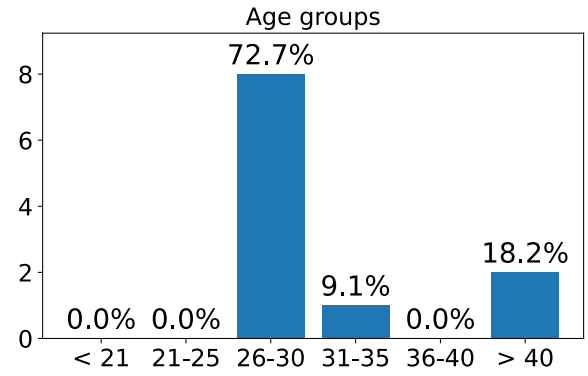
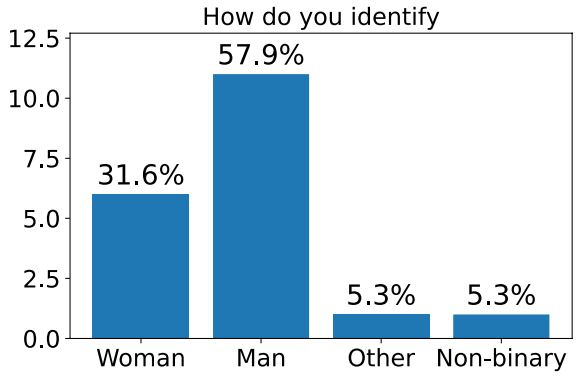
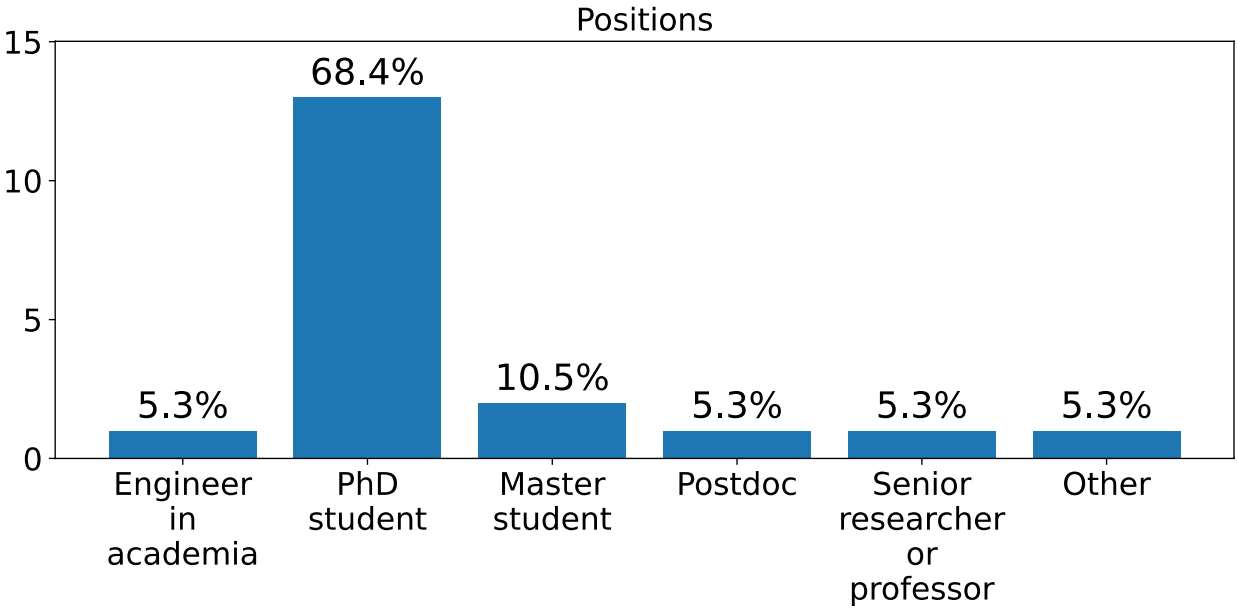


Figure 3: Number of participants by country that replied to the school survey.

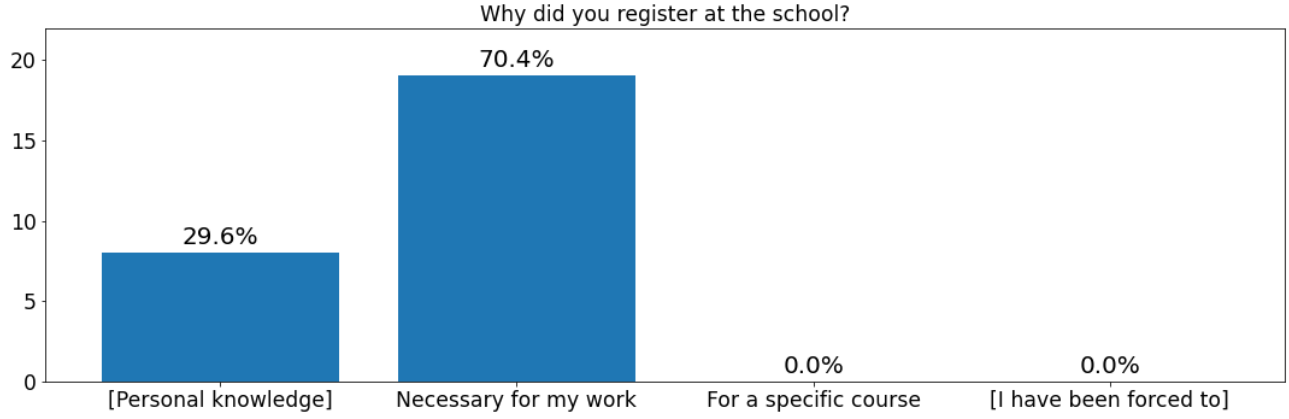
Participants are mostly students or young researchers as shown in the following figures. The gender gap still exists in the physics communities but we have a large representation of women nonetheless.







The participants register to the school mostly because they need such training for the present of future research.



More figures on the participants' demographics are provided in the appendix.

6.4 Participants feedbacks

Another survey was conducted after the end of the school to get participants' feedback with 15 answers collected. 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:

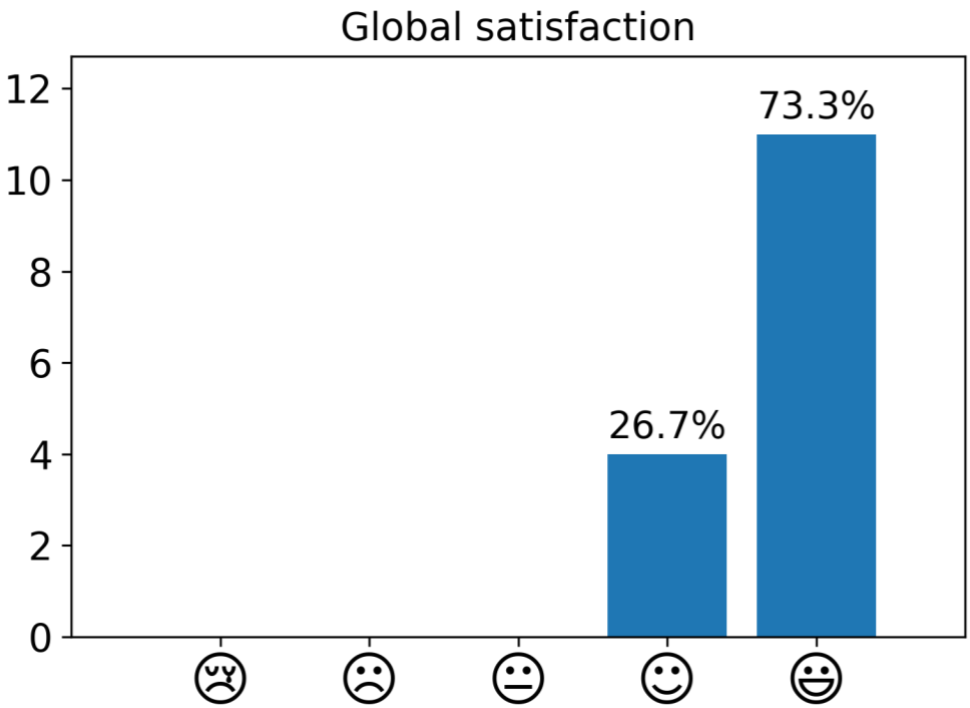


Figure 4: Participants global satisfaction

Their expectations have been well or entirely met for 93% of the participants who are leaving the school with improved skills and knowledge:

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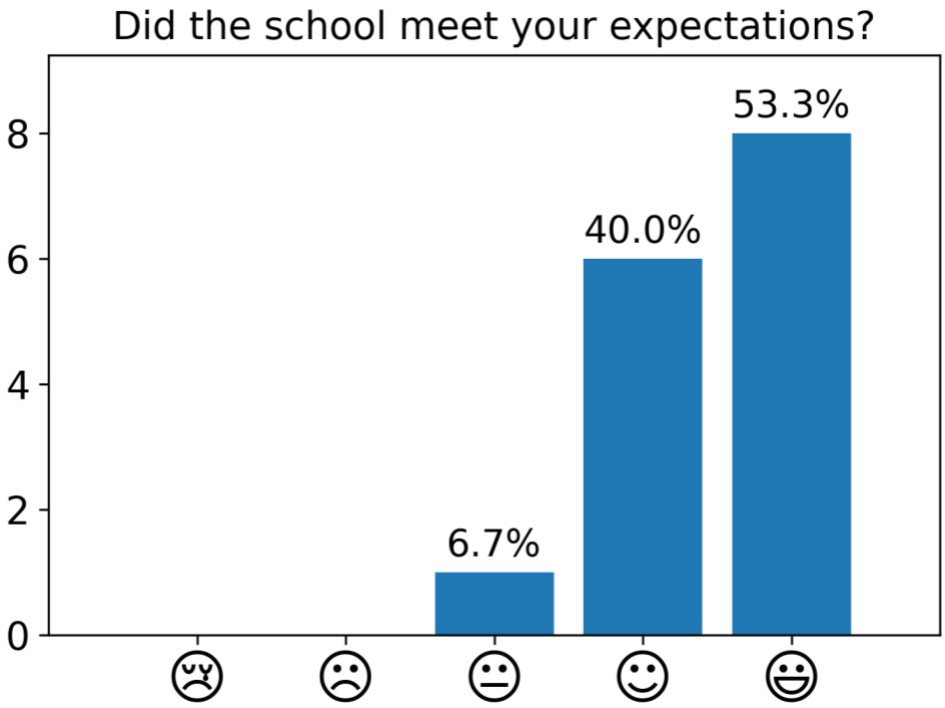

Figure 5: Participants evaluation of school regarding their expectations

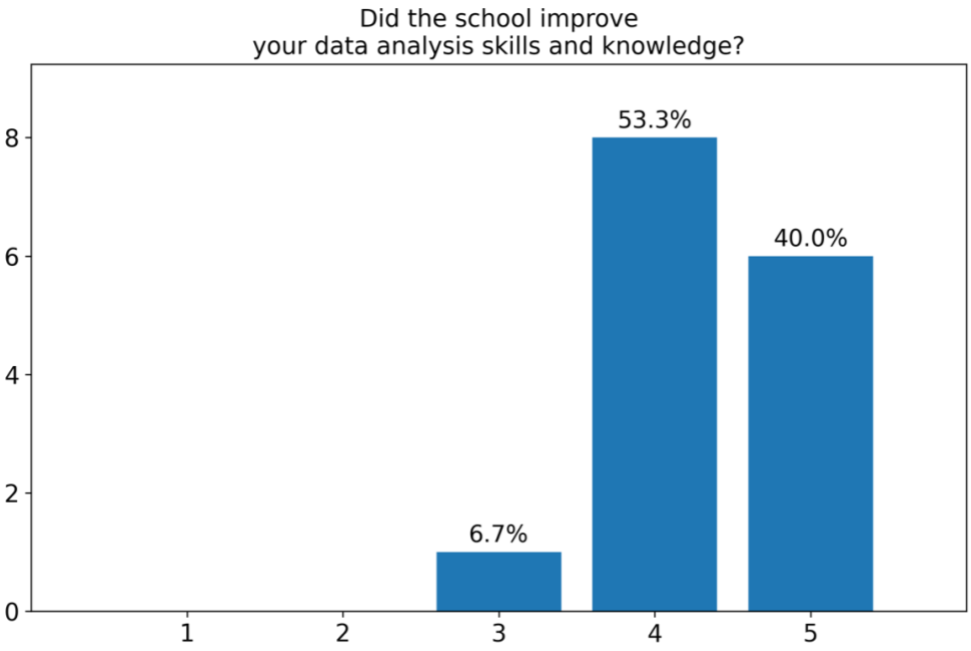

Figure 6: Participants self-evaluation of the school impact on their skills and knowledge (1 = None, 5 = very important)

7 Conclusion and next steps

Even though the number of participants did not reach the expected ones, the school was a success and showed once again the need and acceptance of such a thematic training event by the targeted audience.

Figure 7: Group picture

8 Appendix

8.1 Appendix A: Participants feedback

The following provides the raw feedback comments from participants.

8.1.1 Were you satisfied with the global organisation of the school (1 not, 5 very)?

The first day was a bit unorganised but this soon changed. Makes sense given it's the first one in person for a while

8.1.2 Did the school meet your expectations?

Met and exceeded

8.1.3 Do you think the school has improved your data analysis skills and knowledge?

I have been inspired to become a better programmer

Has definitely improved my knowledge. My skills require to go over the material in a longer span of time and try out what I have learnt.

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

A hybrid event will reach a wider audience and create more interaction in online platforms such as slack.

It was great to be there in person. Although the possibility of hybrid and virtual events are great in theory, I think there is no comparison with respect to have the change not only to directly interact face to face, but also interact on a more personal level and exchange experiences. It brings up new ideas if anything.

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

I would reduce the overview on the scientific packages and focus more on how we should structure our code in our everyday work (using git, python packages and modules, maybe some give us a bugged code that we have to fix)

Reproducible environments with GNU Guix

An overview of Statistics for data science

Delve some more into containerisation and maybe python packaged. How to create them and share them, i.e. through anaconda or pip.

Intermediate python lecture covering topics like design patterns
High performance computing
Algorithms and Data Structures

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

I think that I would only change the hands-on type of lectures. Due to time constraints, they are really fast to go through. It might be interesting to maybe have less exercises but leave more time and freedom in compiling them (i.e. not giving half written code but letting write from scratch to solve the problem). I think those exercises that were compiled this way have been the most useful to me.

The school should be a bit longer to allow time to work on the exercises.
Office hours for participants who may have questions regarding software development or data science applications in their own work

8.1.7 Any final word or comment

Thanks to organisers for great school!

Thank you to the organizing committee and the speakers. The summer school was well paced and perfectly structured. I appreciate that the school provided up-to-date content, including recent trends in the field of data science for astrophysics.

Over all it was a great experience. I think much of my current work can be improved by what I learned in this school.

Thanks so much for creating such an invaluable program!

8.2 Appendix B: Communication plan

What	Who/Where	Link	When
Banner	ESCAPE Website	https://projectescape.eu	29/04/2022
News	ESCAPE Website	https://projectescape.eu/events/escape-summer-school-2022	29/04/2022
Post	ESCAPE Twitter	https://twitter.com/ESCAPE_EU/status/1522599572475764736	06/05/2022
Post	ESCAPE LinkedIn	https://www.linkedin.com/posts/projectescape_datascience-machinelearning-python-activity-6928341481900417024-i2Y5?utm_source=linkedin_share&utm_medium=member_desktop_web	06/05/2022
News	ESCAPE Newsletter	https://mailchi.mp/482505ca76f2/escape-newsletter-n11-escape-webinar-on-esfris-eosc-virtual-observatory-outcomes-of-escape-dios-workshop-escape-adventures-in-ai-much-more?e=19f2e82be7	03/06/2022

Email	ESCAPE Consortium		22/03/2022
Email	ESCAPE Consortium		02/05/2022
Email	LAPP		02/05/2022
News	LAPP Website	https://lapp.in2p3.fr/spip.php?article3203&lang=en	03/05/2022
Post	LAPP Twitter		09/05/2022
Post	LAPP LinkedIn		09/05/2022
Newsletter	LAPP internal newsletter		29/04/2022
News	IDEFICS Newsletter		05/05/2022
News	IN2P3 Newsletter		02/05/2022
News	CNRS Alpes website		02/05/2022
Meeting	LAPP internal meeting		05/05/2022
Email	IN2P3 Communication officers		09/05/2022
Email	Insu		10/05/2022
Email	Terascale		10/05/2022
Email	CTA		10/05/2022
Email	SKA		10/05/2022
Email	FAIR		10/05/2022
Email	CERN (HLHC)		10/05/2022
Email	LSST		10/05/2022
Email	Virgo		10/05/2022
Email	ESO		10/05/2022
Email	KM3NeT		10/05/2022
Email	JIVE		10/05/2022
Email	ELT		10/05/2022
Email	EST		10/05/2022
Email	ATLAS		10/05/2022
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