Masterclass Feedback

Carl Gwilliam & Saskia Charity

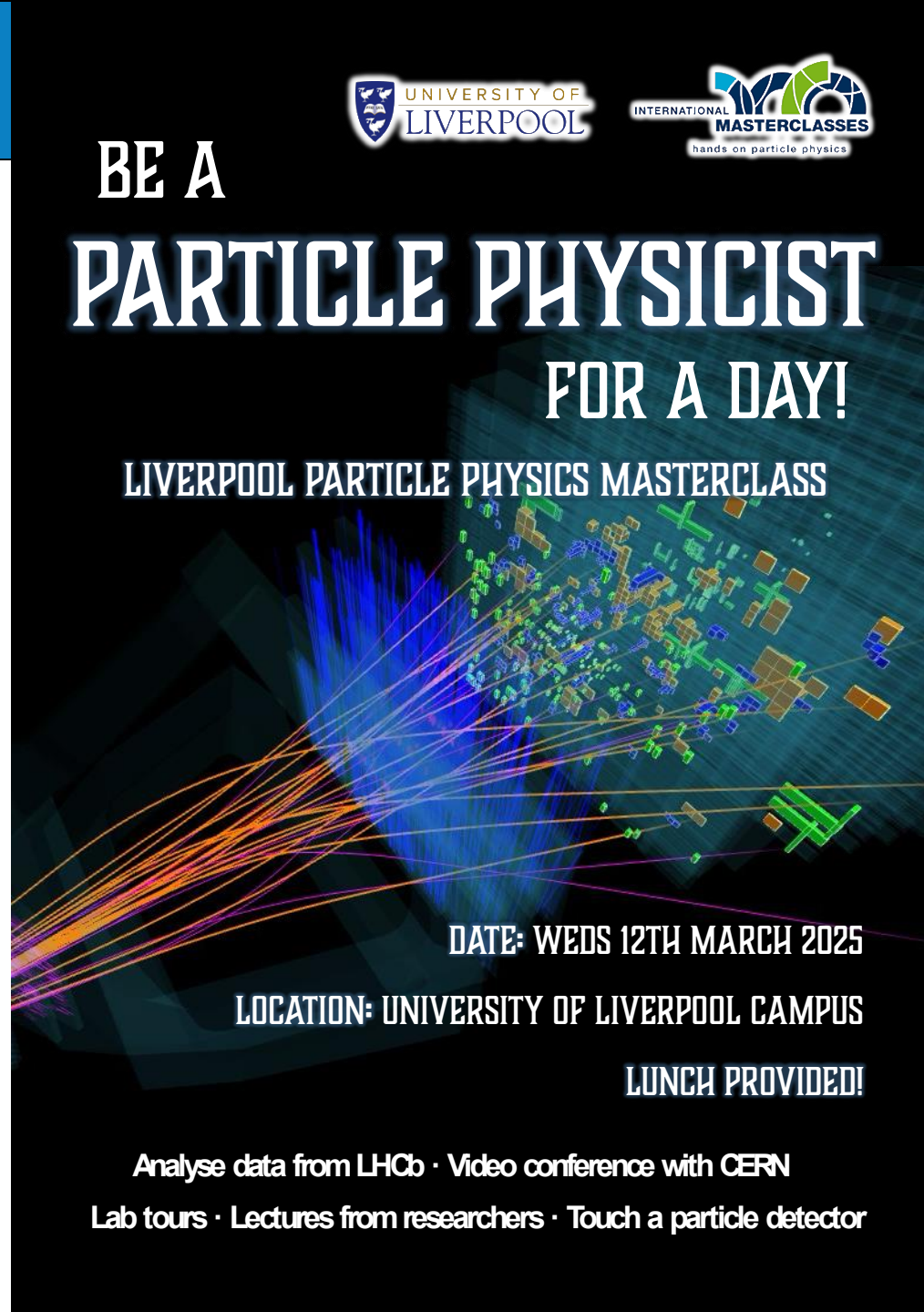
UNIVERSITY OF LIVERPOOL

28th July 2025

Particle Physics Masterclass Meeting

Introduction

- In March, Liverpool hosted 1st Masterclass in over a decade
  - Coordinated by Carl and Saskia, with help from >25 staff + PhD students and 10 undergraduate students (thanks!)
- Goals
  - Show what it is like to be a particle physicist for the day
  - Encourage students to come to Liverpool to do Physics
- Attended by more than 150 year-12 A-level students
  - ≈20 schools from across north-west & as far away as Jersey
  - 50 places dedicated to widening-participation schools
- Pre/Post-questionnaires to gain valuable feedback
  - Will look at some key takeaways from this today
- Based on this we need to plan next year
  - Particularly, what we could/should change



Reminder: Agenda

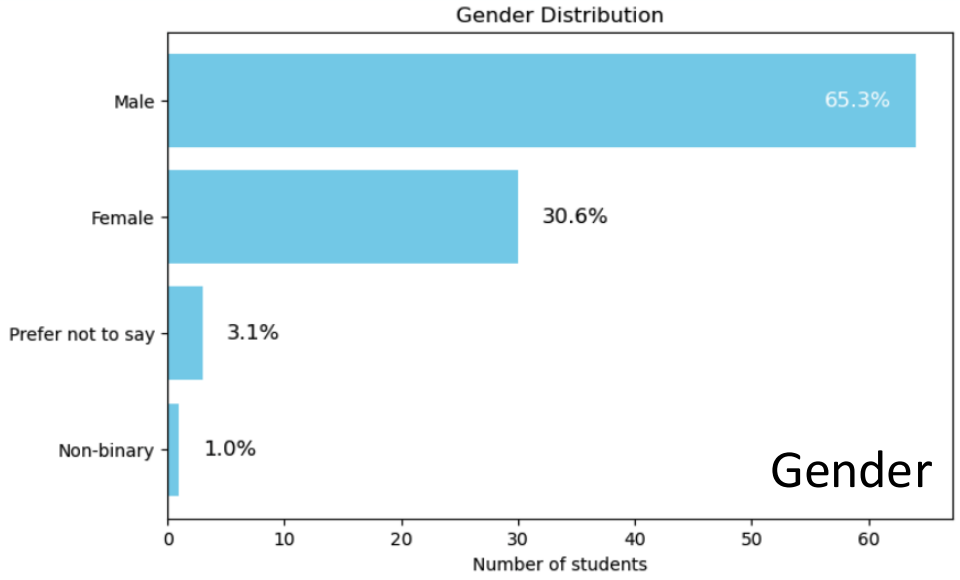
https://indico.ph.liv.ac.uk/event/1883/

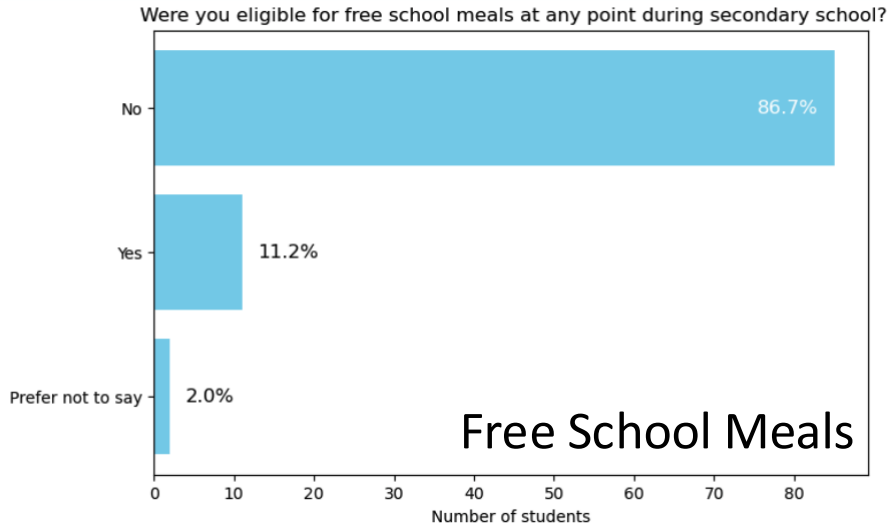
10:00 → 10:10	**Welcome**		10m
10:10 → 10:55	**Particle Physics Overview**	Introductory talk linked to A-level by Saskia	45m
10:55 → 11:10	**Comfort break**		15m
11:10 → 12:00	**LHCb Lectures**		
11:10	**LHCb Experiment Overview**	Talks on LHCb by **David Hutchcroft** + **Paras Naik** with Liverpool-built VELO detector on display	20m
11:35	**LHCb Hands-on Session Introduction**		20m
12:00 → 13:00	**Lunch (CTL atrium)**		1h
13:00 → 14:45	**Hand-on Session (+ Lab tours)**	Hands-on activity on real LHCb data, led by David + tours of teaching labs with demonstrations by UGs	1h 45m
14:45 → 15:00	**Walk to Yoko Ono Lennon Centre**		15m
15:00 → 16:00	**Video Conference with CERN**	Compare results with other groups + virtual tour of LHCb led by Liverpool PhD student **Ho Sang Li**	1h
16:00 → 16:30	**Feedback and Close**		30m

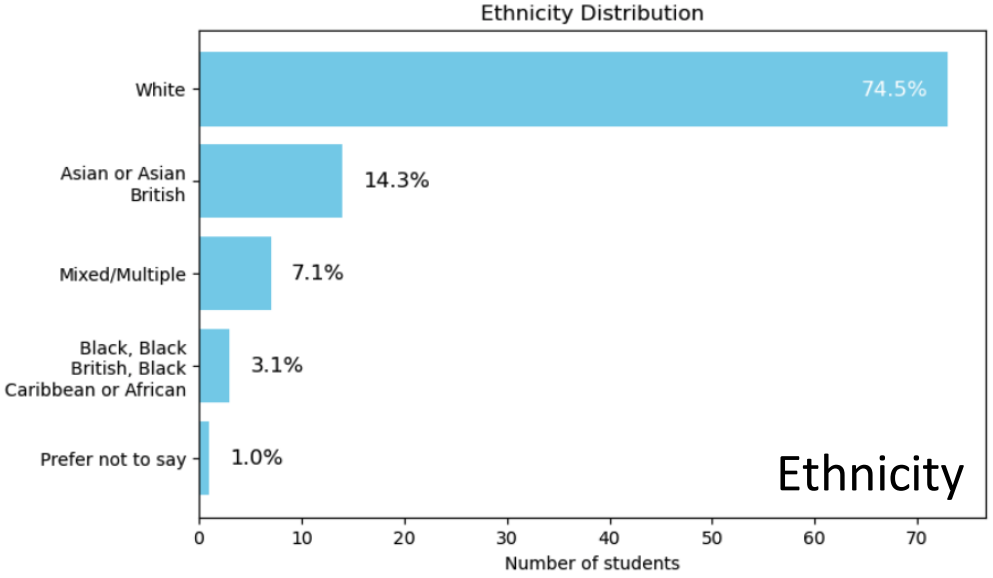
Rio de Janeiro, UFRJ | Geneva, CERN | Pisa | Bologna | Liverpool

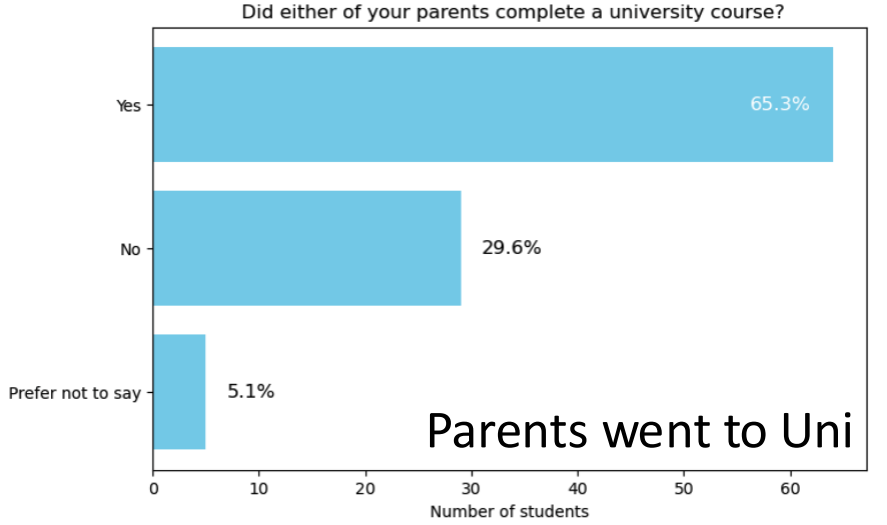
Student Feedback

Demographics



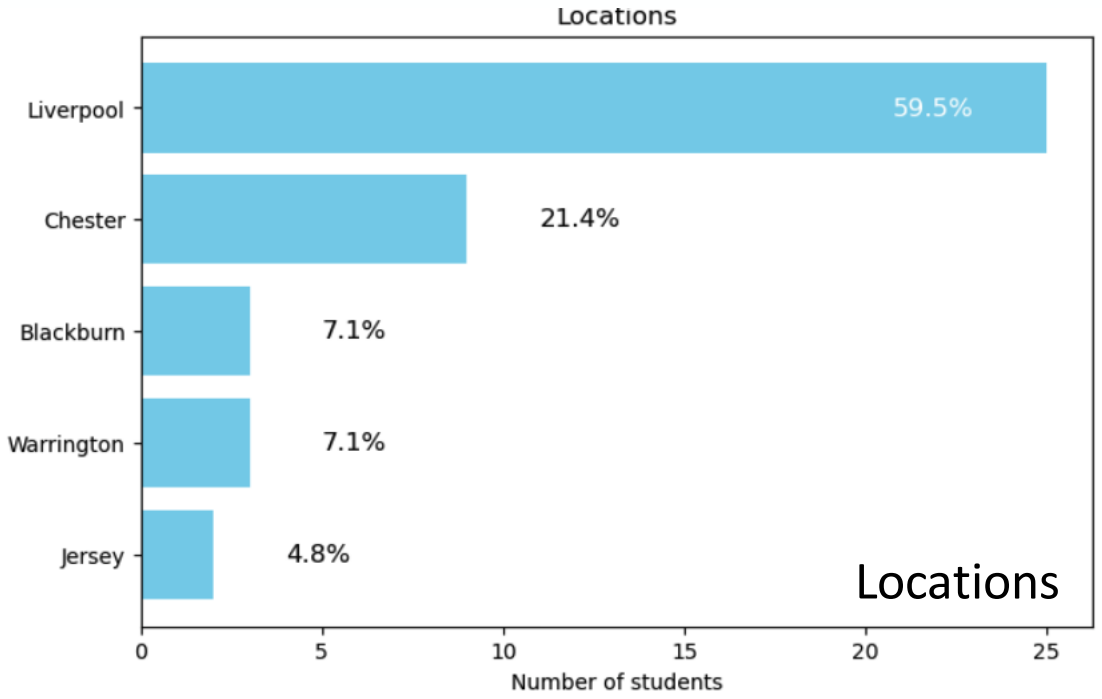


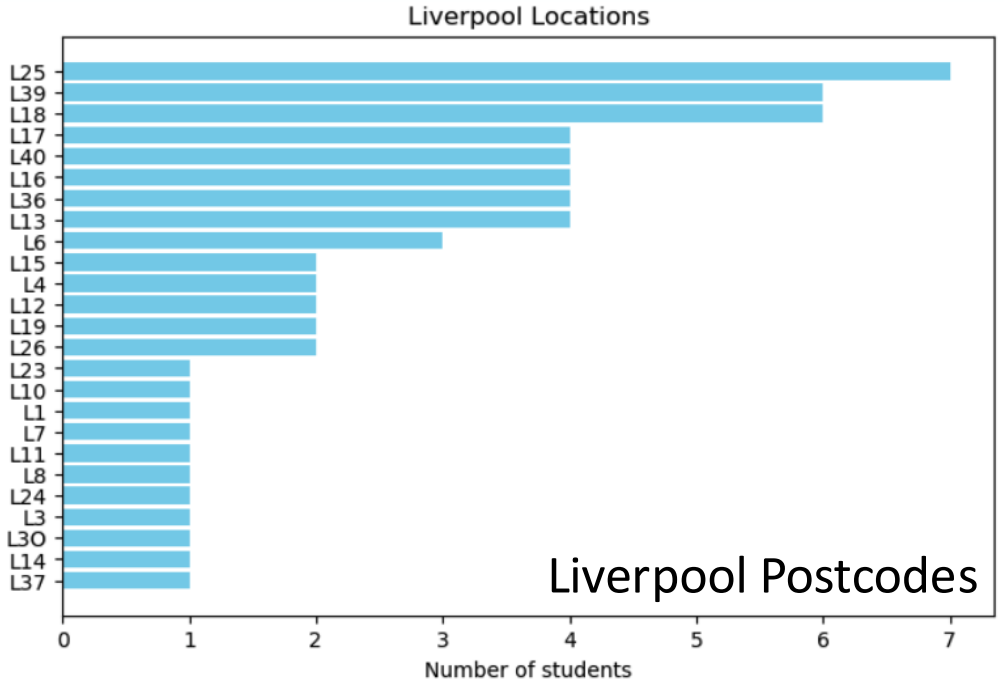




Locations

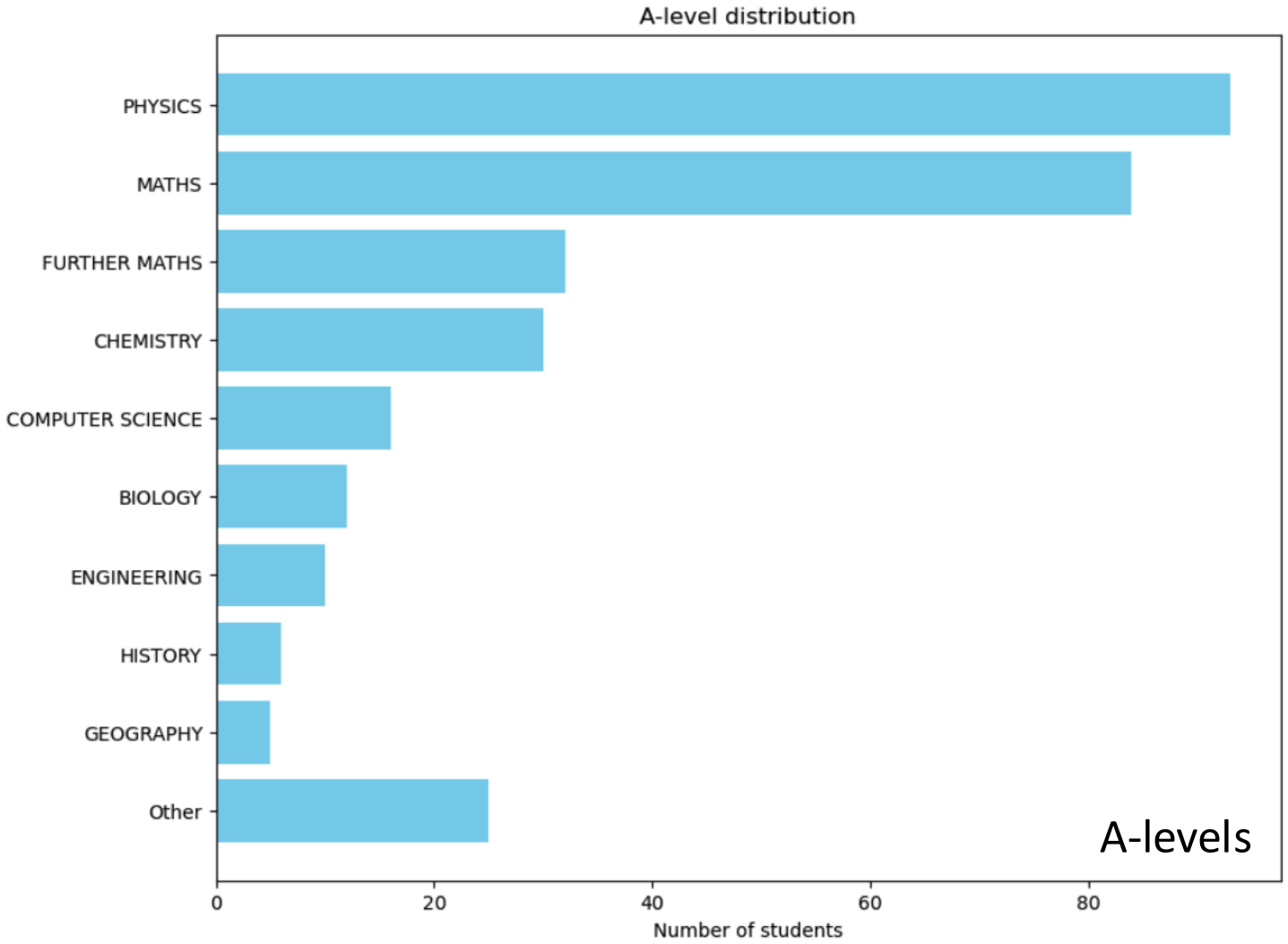
- As expected, mostly from Liverpool (see postcodes) and wider Northwest area

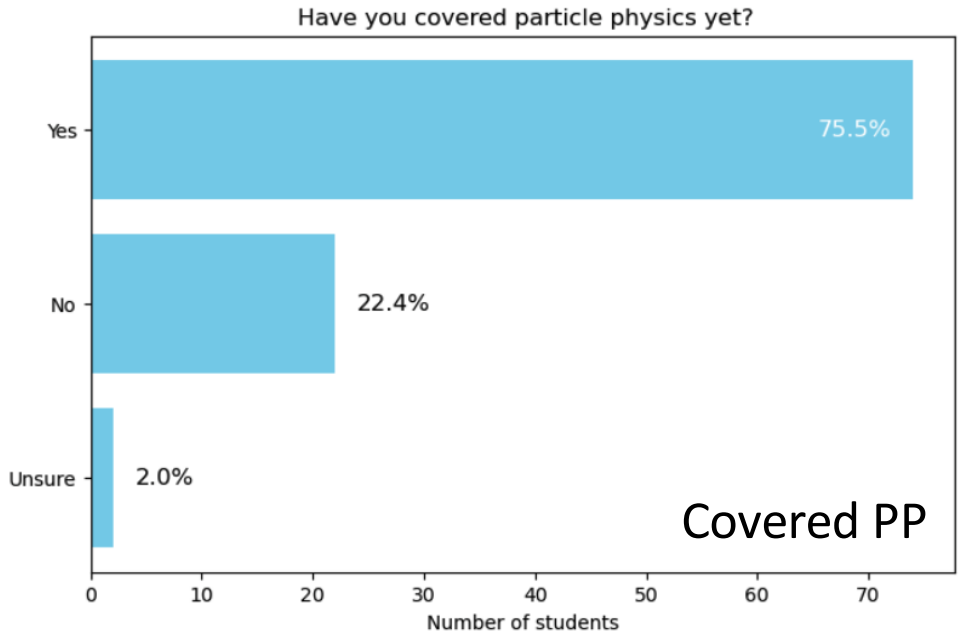




A-levels

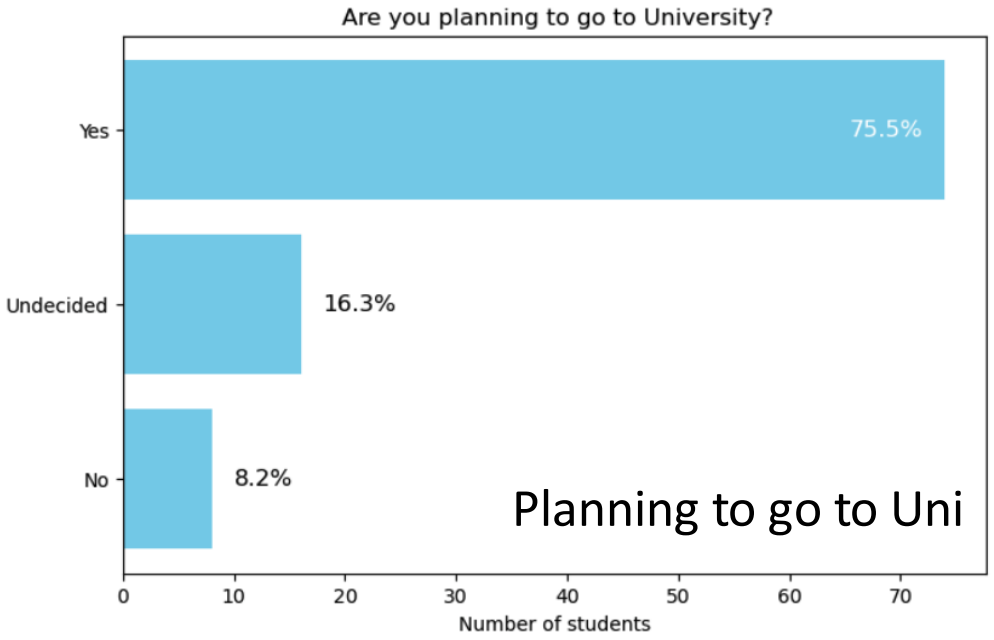
- Fairly standard A-level distribution, with ~3/4 having covered PP already

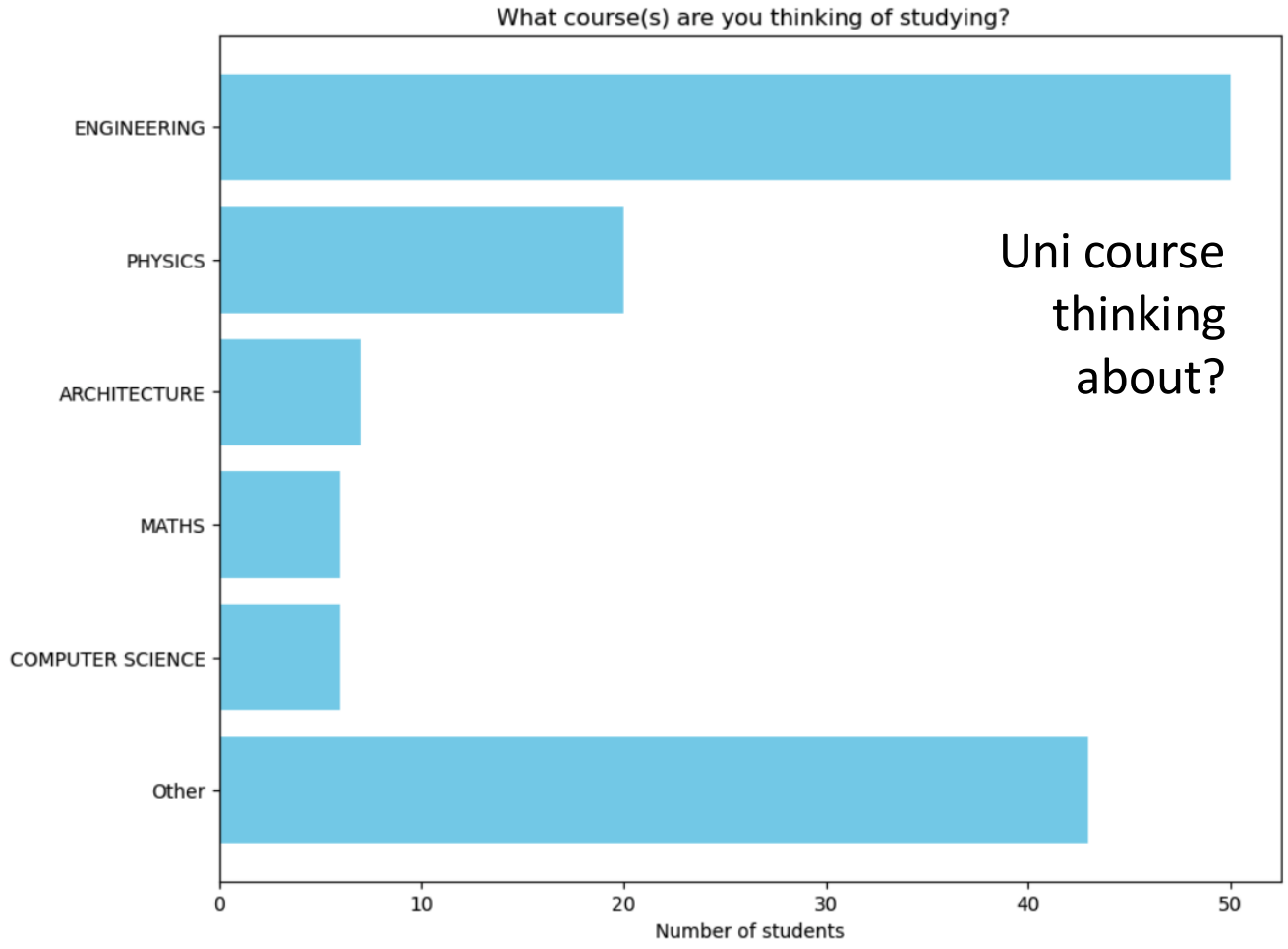




Uni Plans: Pre

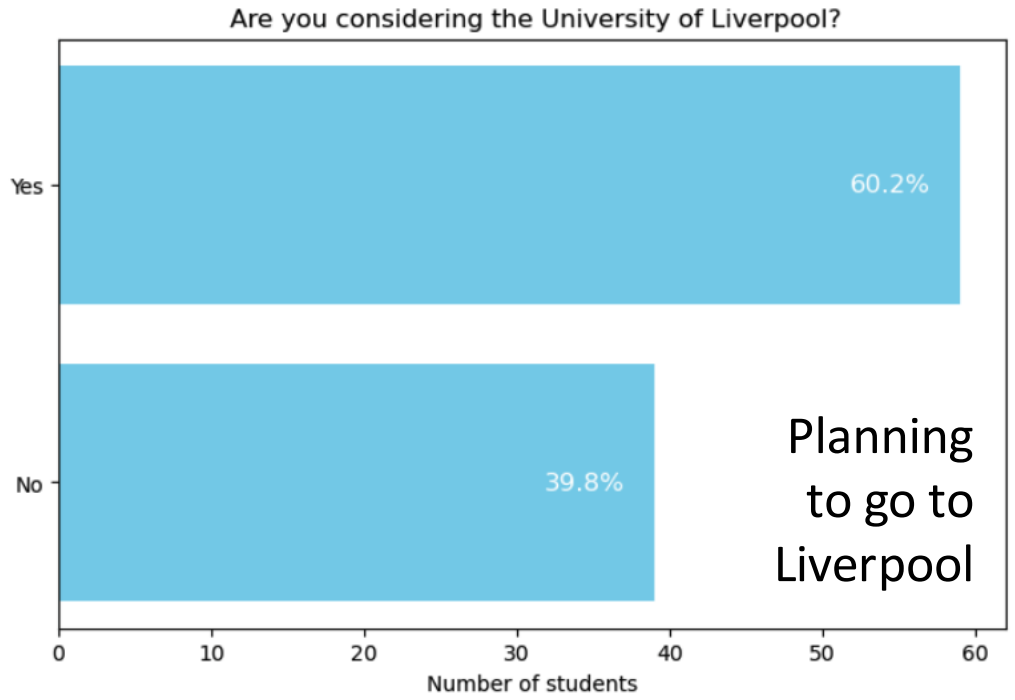
- ~3/4 planning to go to Uni with physics second most common course (selection bias)

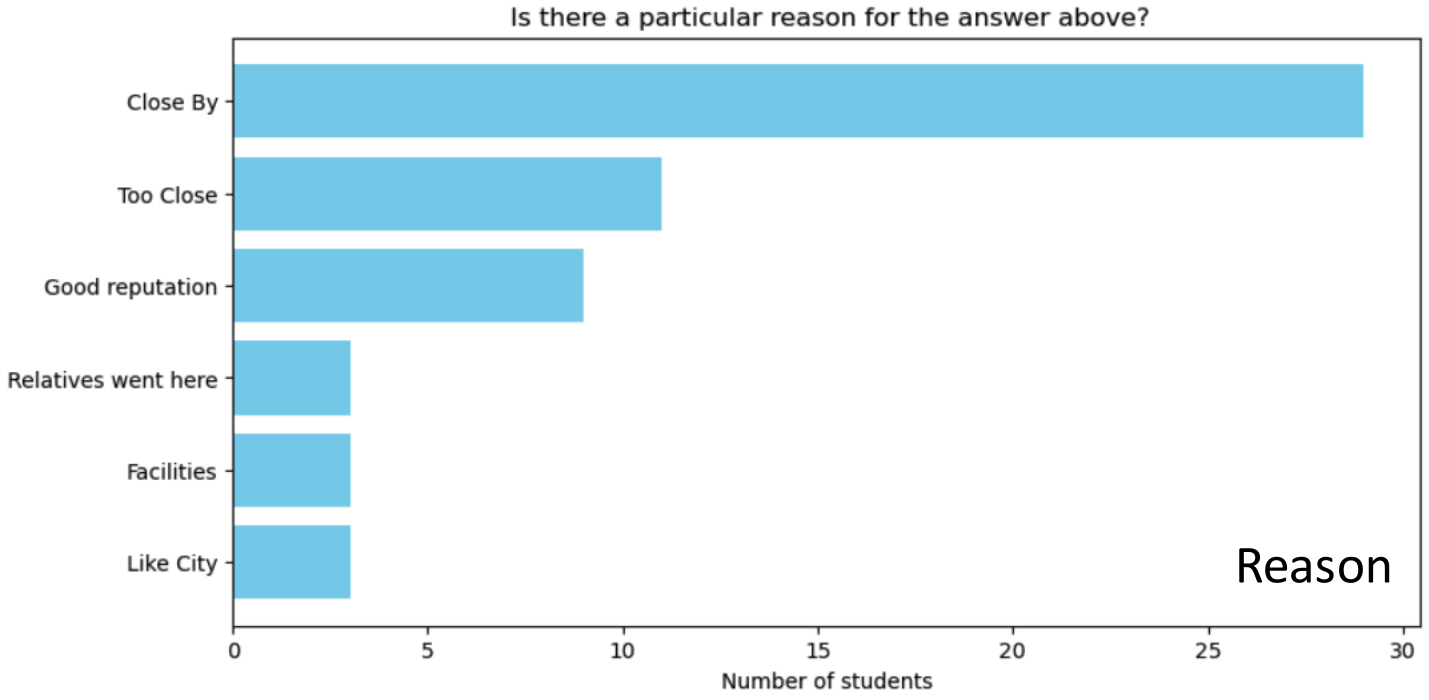




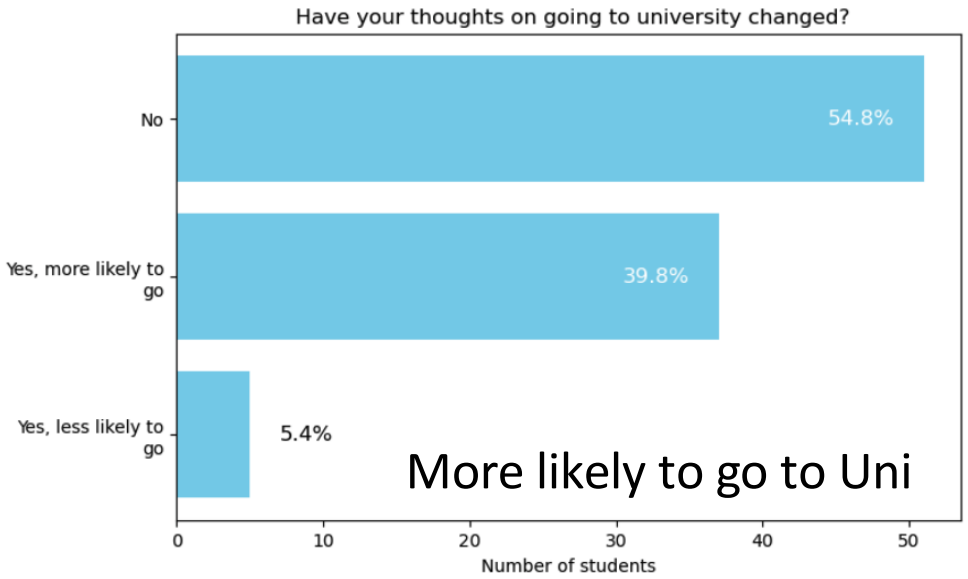
Uni Plans: Pre (2)

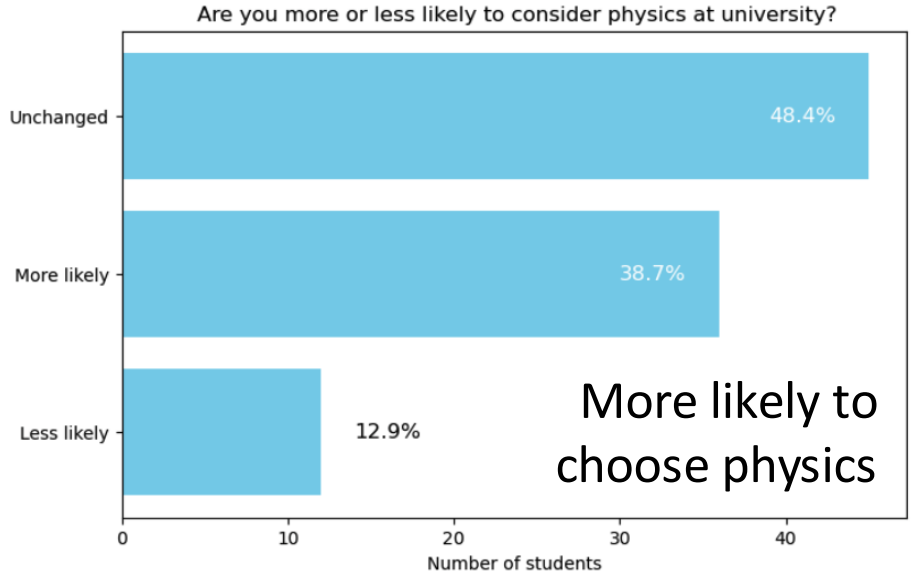
- ≈60% planning to go to Liverpool

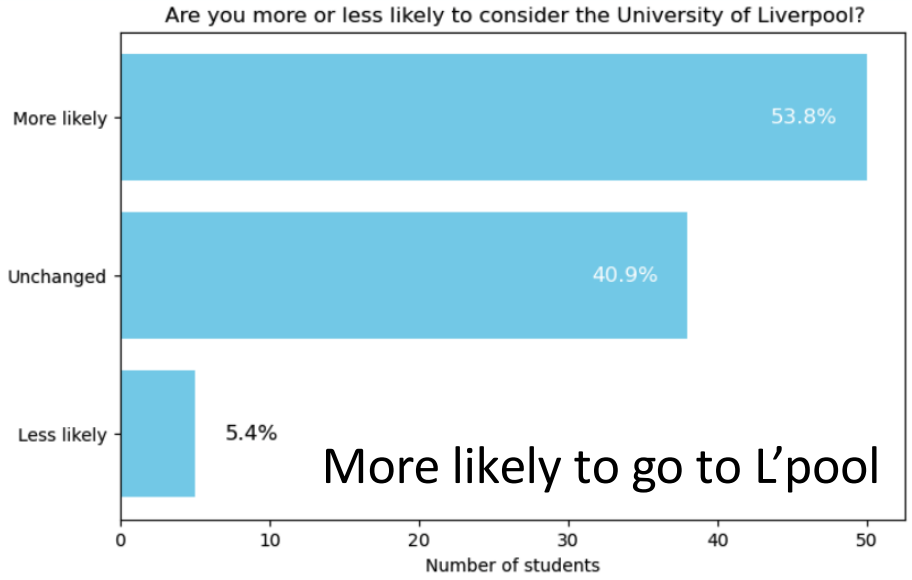




Uni Plans: Post



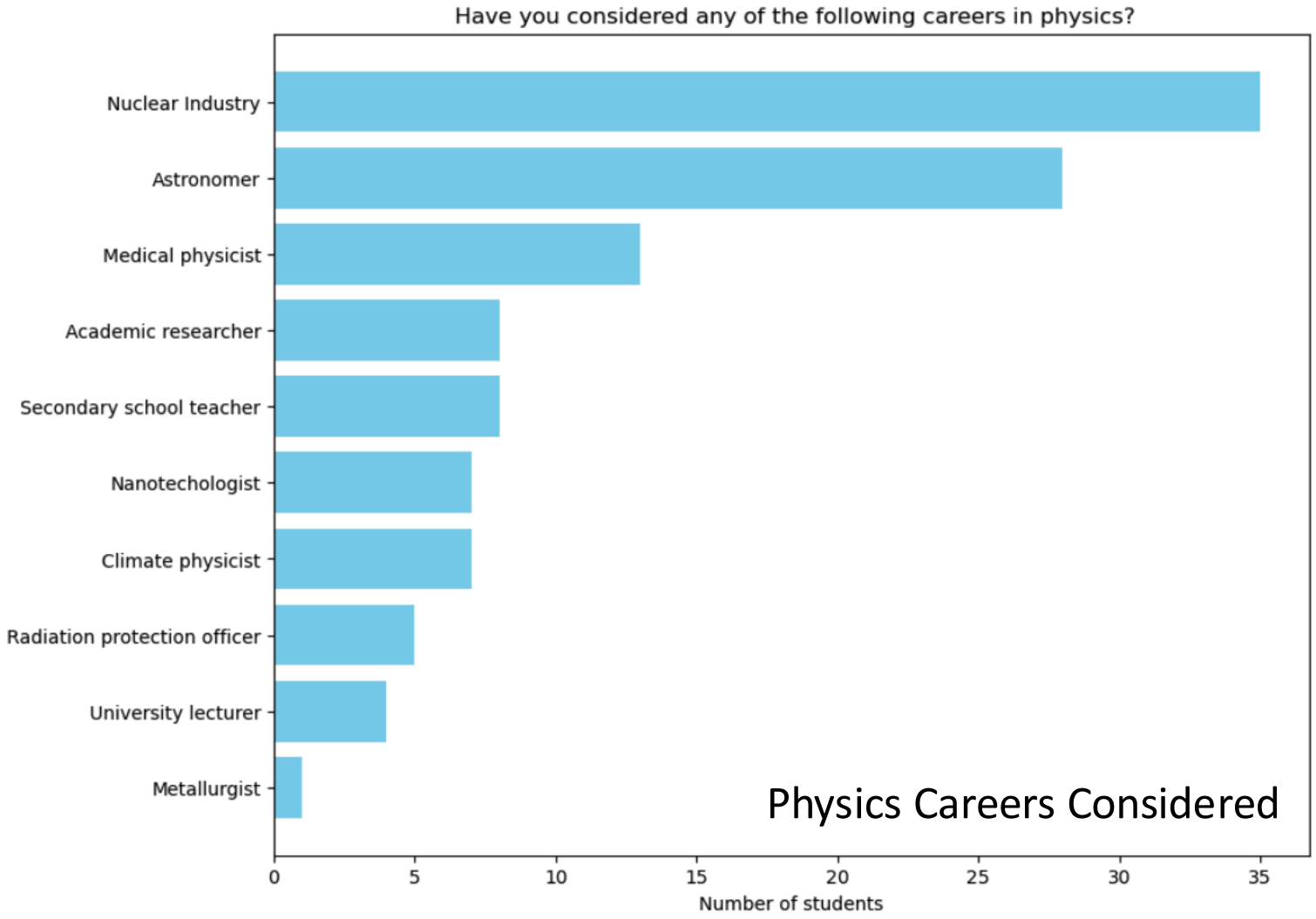




- Around 40% more likely to go to Uni
  - Similar amount more likely to choose to study physics (though 13% less so)
- >50% more likely to go to Liverpool

Career Plans: Before and After

- ≈40% more likely to consider a career in physics (10% less likely)



Other

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Curator, Astrophysicist
Engineer
Quantity surveyor
Mechanical engineer
Biophysist
Robotics
Other astronautics industries
Mechanical engineering
Engineering
Robotic engineer
Engerneer
Architecture
Physicist/Astrophysics
Working with cars
Civil engineering
Engineering
Robotics Engineer
Aerospace and defence (British Aerospace etc)
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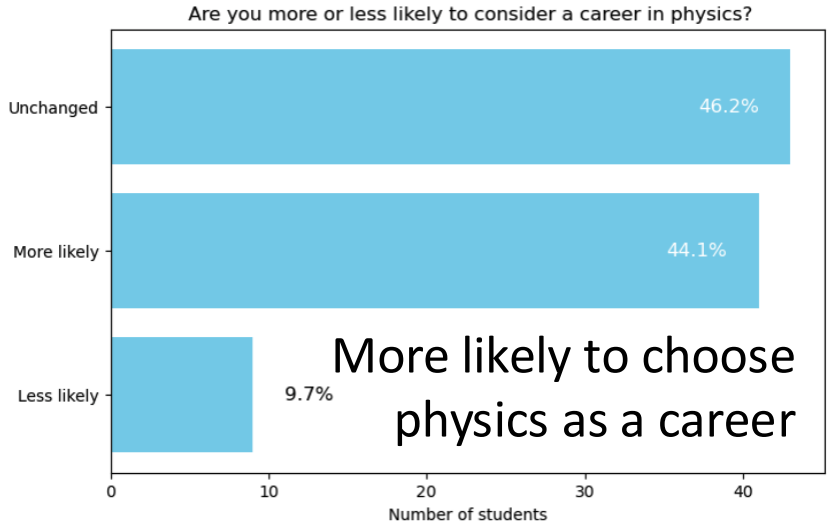
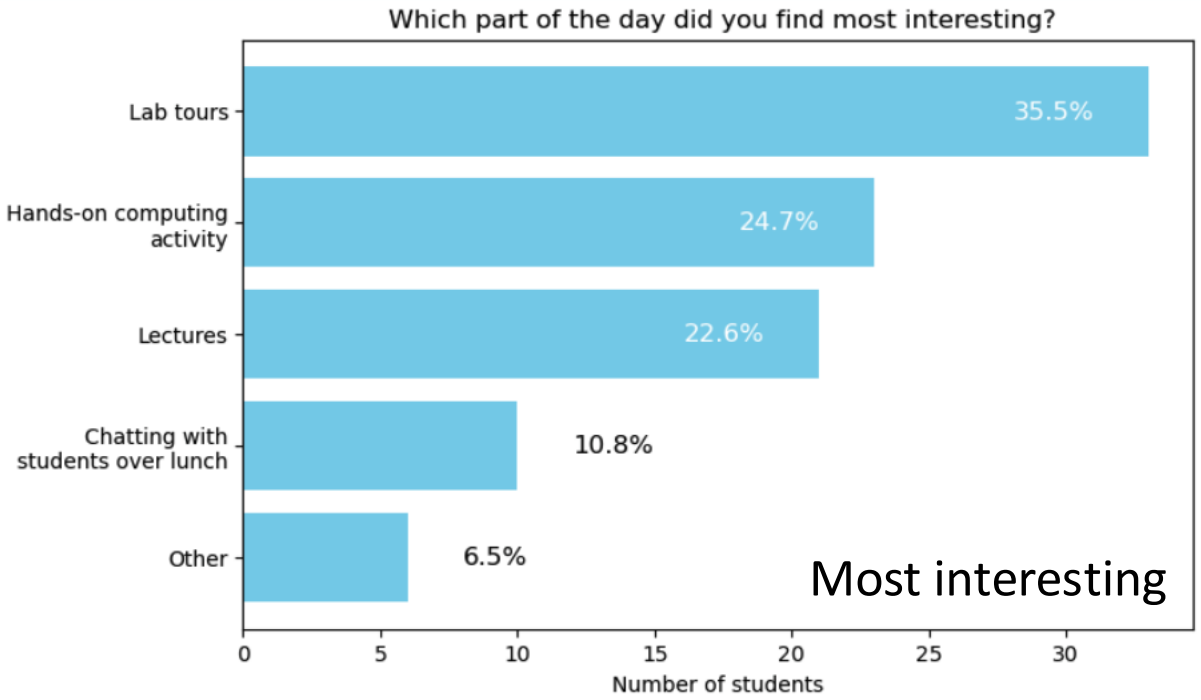
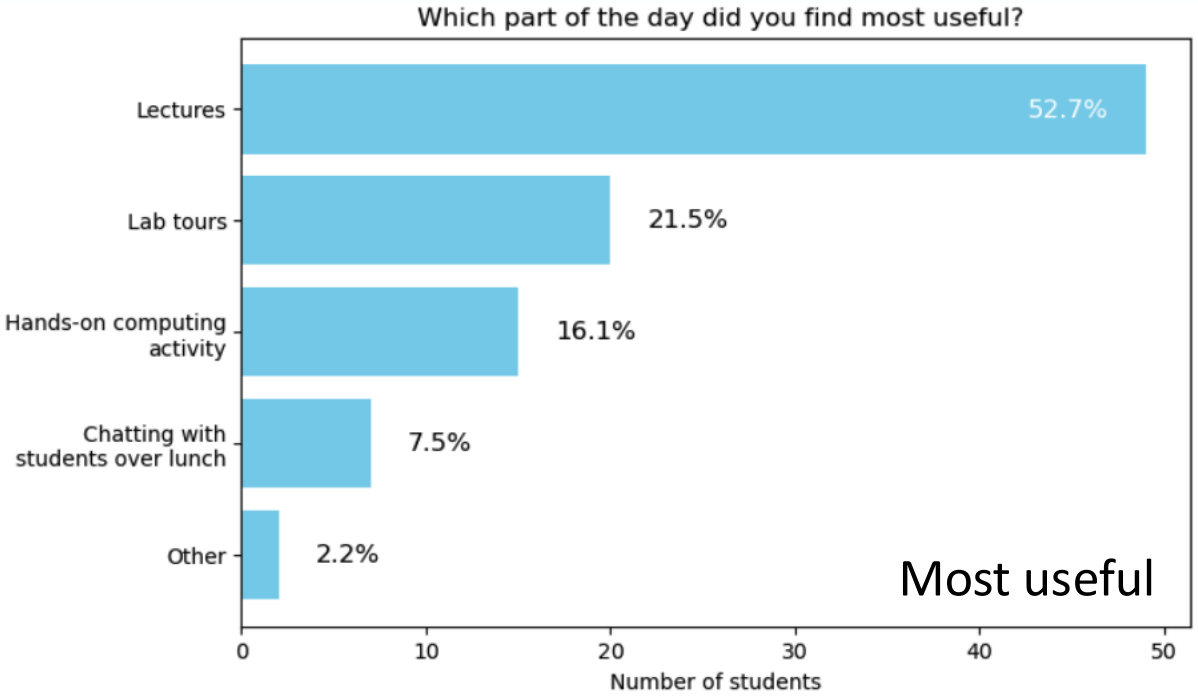


Most Interesting / Useful

- Students found teaching lab tours and hands-on exercises most interesting
  - But lectures were considered most useful
- Somehow forgot to include Video Conference in options it seems ☹



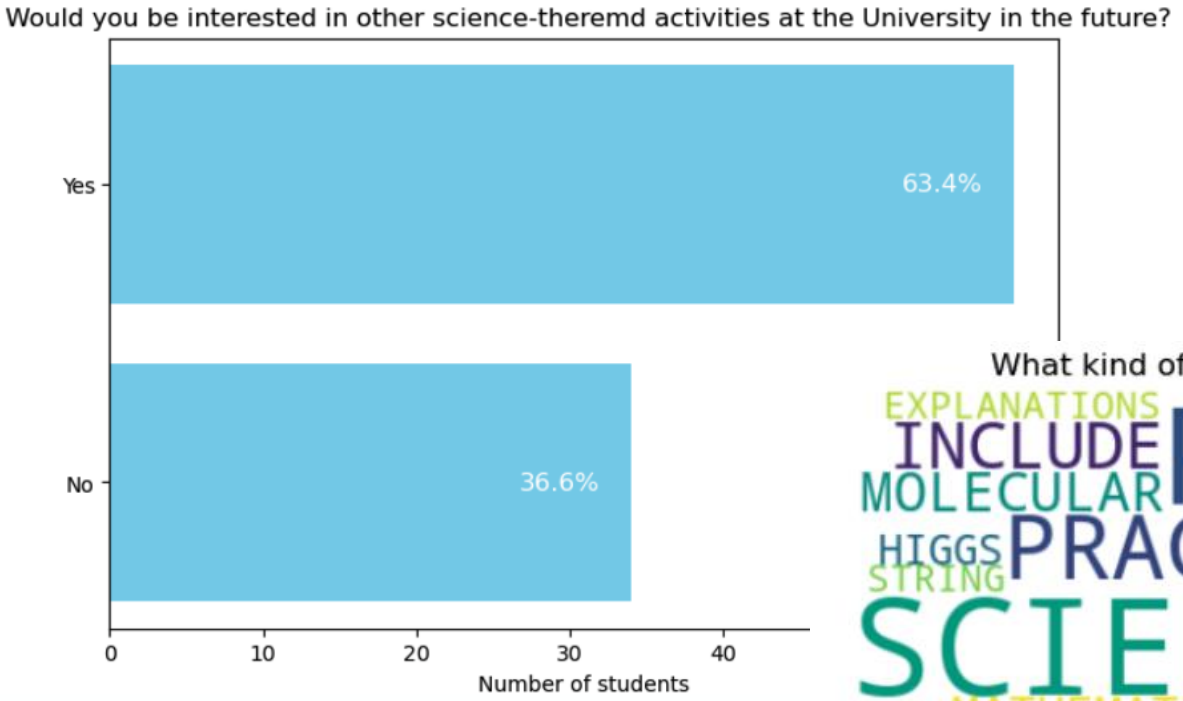


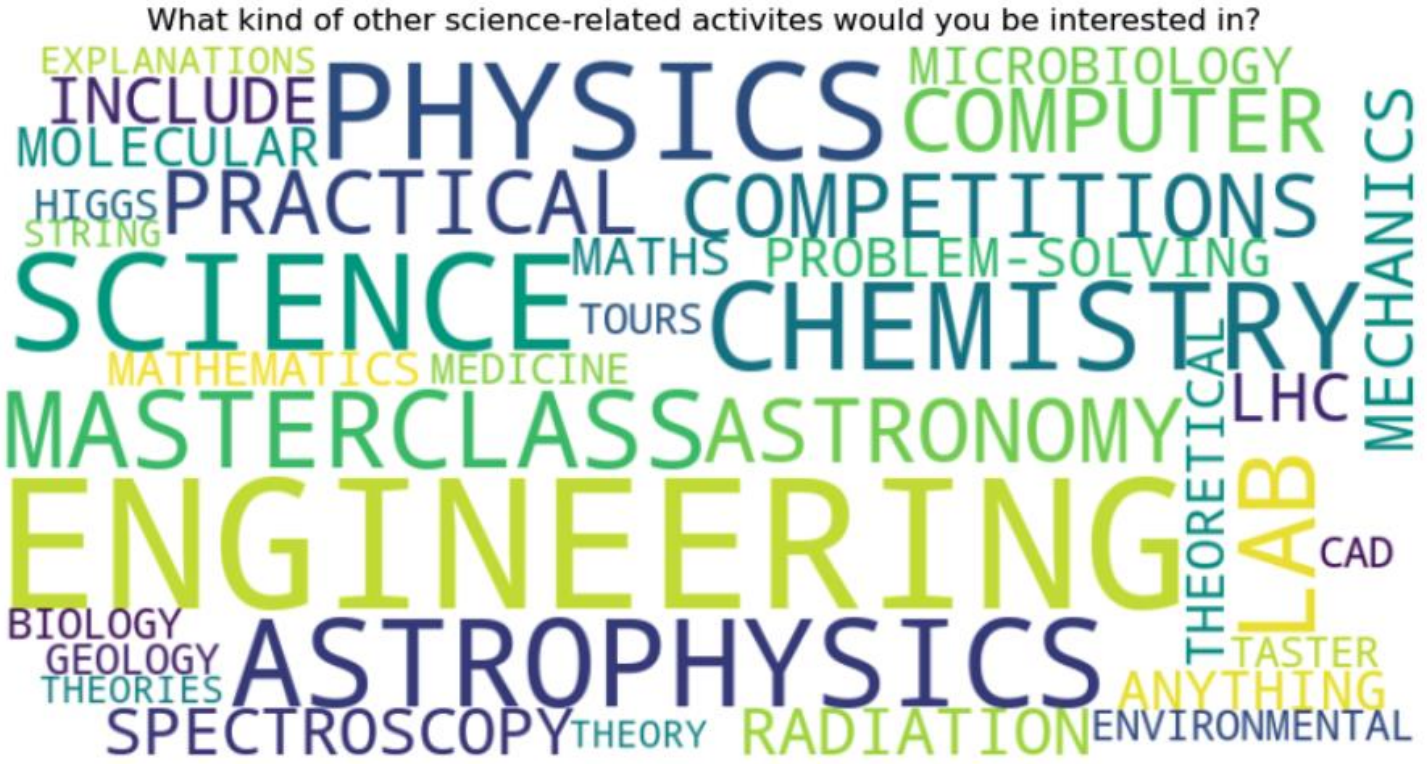
How can we improve?

- Less lectures and/or frontal talking at them
  - With more interactive components to break these up
- More time in labs / more hands-on practical experiments
  - This is not really the main scope of the day so not sure we can do so much there?
- More explanation of the hands-on activity
  - Though not clear what
  - Likely demonstrator dependent
- Staggered lunch to avoid queues and make sure food left for those at the end
  - Bagged lunches might make this better.
- More detailed comments in backup

Interest in other science activities?

- Interest in other science activities, eps. Engineering + Astrophysics





Teachers

What was your overall opinion of the Masterclass?

- Generally, very good feedback
  - Excellent
  - Excellent information and interesting activities

  - Very interesting. The pupils were well engaged.
  - It was very interesting
  - Very enjoyable.
  - Good. Very informative with a great deal of detail.

  - Good, the talks were pitched at the right level and the variety of activities was good.
  - Good experience, plenty of opportunities for year 12s to interact with staff and students.
  - Generally interesting needed a bit more stretch.
  - I enjoyed it as did the pupils. It also gave them a good insight into study at HE
  - Engaging content.
  - Well received

  - Nice mix of lectures, student activity , tours and zoom meeting.
  - Instructions and information before were clear and timely.

What did you think of the timetable?

- Again, generally positive feedback, but maybe shorten and need to rethink lunch
  - Perfect
  - Excellent

  - The timetable was good
  - Good. Plenty of rest breaks. Finishing with the video conference worked well.
  - Good variety of activities. Length of activities about right.
  - Good mix of activities.
  - Good a bit too long on data

  - Well-considered
  - Well organised and timings were appropriate.
  - On the whole the day kept to timetable.

  - Lunch was a little rushed but otherwise good
  - It ran well, though I think it could have been beneficial to stagger the lunches slightly
    - e.g. start some tours during the lunch break and let those groups eat slightly later.

What did you think of the lectures?

In particular, were the topics interesting to your students, and was the material at an appropriate level?'

- Generally positive feedback but the second lecture was difficult to follow and highlighted overrun
  - All excellent
  - Yes and yes.
  - Brilliant first lecture Could have listened all day
  - Lectures were great and material was at a suitable level

  - Topics were interesting, accessible to students then added to their previous knowledge
  - Good start. The pupils enjoyed that they could follow the links as it connected well with their programme of study.
  - Good level, some basics students were familiar with and then extended their knowledge and allowed them to see what they are learning could be used for

  - The first lecture was interesting but the second the students found difficult to follow.
  - They were good level for the students though could have had more additional work.

  - The length, depth and content were appropriate.
  - For a none physicist like myself the material was pitched high but well explained.
    - Seemed ideally pitched for our students.
  - Talks interesting but some time keeping issues which was a shame.

What did you think of the lab tours?

- Really liked lab tours but would like them to be longer and more-hands on (+ more staggered)
  - Excellent
  - Brilliant great to talk to students
  - Super. Nice to meet the undergraduates.
  - The lab tours were good and gave great inspiration in what other physics practical work we could do in school.

  - Good, but a few students wanted an actual tour rather than demos.
  - The lab tours were of interest to pupils and showcased the next level of lab work well.
  - Interesting for the pupils.

  - The lab tours where good but the groups were too close together.
    - So hearing the volunteers was difficult.
  - Could have been a bit longer or with more variety of activities.
  - Would like to have had a little longer to try out a few more.
  - Would have preferred them to be a bit more hands on. Student demonstrators were very good.
  - Would like more lab content

What did you think of the computing exercise?

- Generally good but perhaps need a bit better/less text-heavy instructions (+ could be a bit shorter)
  - Excellent
  - Great with the support of the staff.
  - Fabulous but 15 mins too long
  - Great for the highest level students, but others struggled to understand what it was about.
  - Good, the students enjoyed it.
  - Did not take part but it seemed to keep the attention of all students

  - The assistants were very helpful.
  - Well organised demonstrator input helpful for students.

  - The instructions were very text heavy and the students found them difficult to follow.
  - It would have been helpful to have previous information about the computer exercise so that I could have better supported students.
    - [Demonstrators] were excellent but they couldn't help everyone all at once
  - Pupils were a bit unclear as to the task initially.
    - Once staff had discussed it individually they understood.
  - Instructions could have been slightly lower level but the presence of the demonstrators compensated well
  - The first exercise was clear. I think some of them struggled to grasp the second task.

  - The computing session was a little bit too long as the students completed the work 10-15 mins before end

What did you think of the video conference with CERN?

- Generally, positive feedback but one found it not very useful. Suggestion to pre-arrange questions.
  - Super
  - Excellent
  - Great idea.
  - Very interesting
  - It was interesting for the students listening to students from around the world doing same class as them.
  - Fun. Nice to see how real world interaction is done.
  - Nice to join other groups from around the world.
  - It was a good talk with good interactions between the speakers.
  - The videoconference was informative and entertaining! The pupils enjoyed it.
  - Exciting opportunity for students
  - Great Chemistry between presenters was magnificent

  - Technical issues happen, but it would have been better had the questions been pre-agreed to keep the meeting flowing.
  - Technical problems didn't help but even so it was the least useful part of the day

Is there anything we could do to improve the masterclass?

- With regards to logistics/organisation/travel etc ...

- Lunch
  - Perhaps more lunch stations or keep some of the drinks and cakes until the end.
  - The lunch venue didn't have loads of seating.

- Labs
  - Spread the lab experiments out a bit.

- Hands-on exercises
  - Just clarity of second task on the software data analysis.

- General
  - Some bottle necks with house keeping but these are hard to avoid.

Is there anything we could do to improve the masterclass? (2)

- With regards to content delivered, the activities and student engagement …
- Lectures
  - Make the second lecture a little more student friendly like the first.
- Video conference
  - Video calls never seem to work well at these events.
- Labs
  - More lab opportunities.
- General
  - It might be nice for the demonstrators to join the group for the full day including for (perhaps with an UG as well) so that the students have more chance to ask questions in a smaller group setting about the content but also life at uni etc.
  - Set them some more challenges

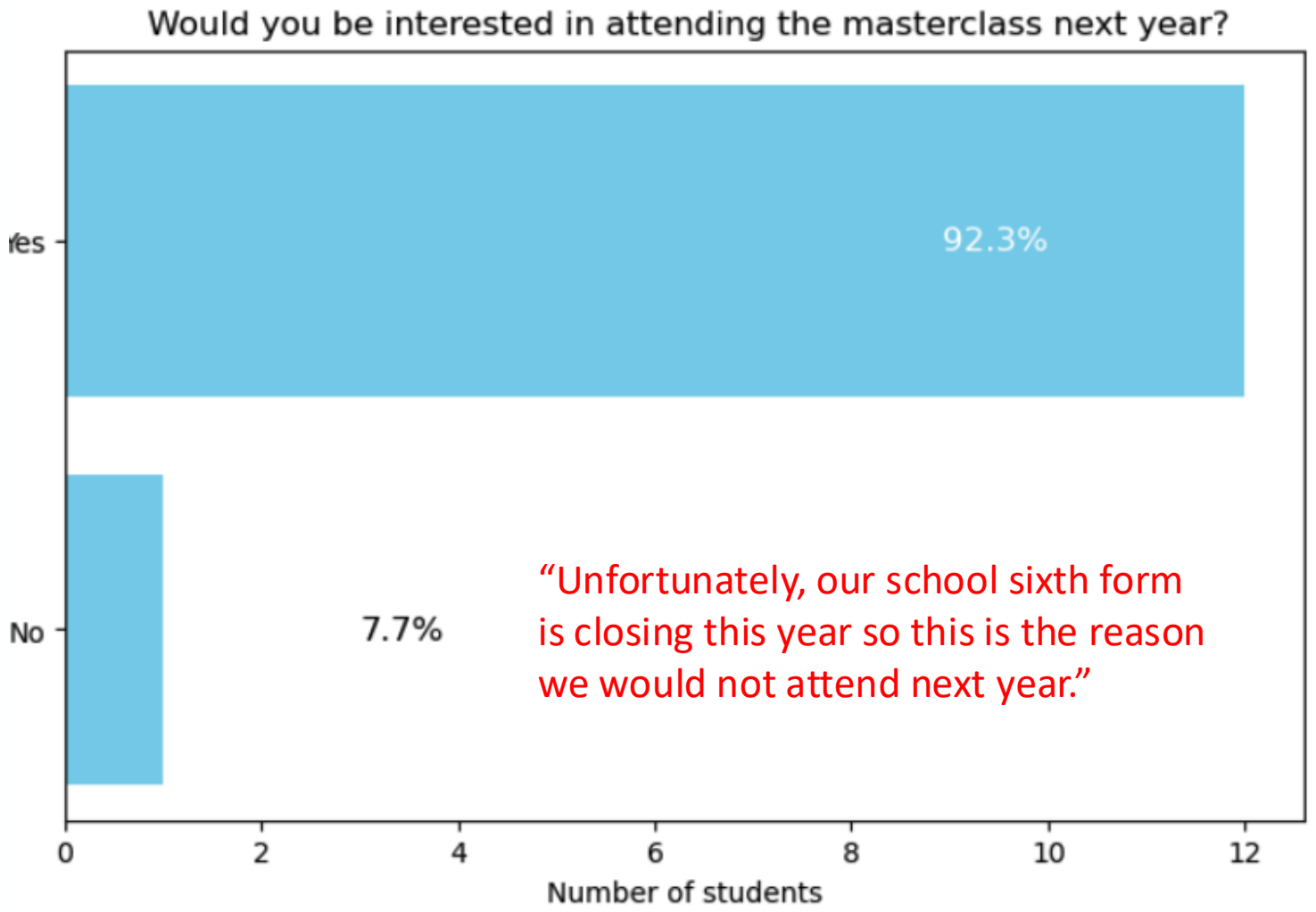
Are there any other suggestions/comments?

That could help us improve the experience next time

- Please continue with these events.
- No - can you restart the Physics Olympics. That was always outstanding.
- Split the lunch and shorten

Would you be interested in attending the masterclass next year?

- 100% (of those that will still have a sixth form) would come back



"Unfortunately, our school sixth form is closing this year so this is the reason we would not attend next year."

Next Year

What could/should we change?

- Do we want to change the exercise?
  - Some issues with mouse location but overall OK with positive feedback + have experience now
  - Should check for improvements to the ATLAS one (see demonstration)

- Lectures
  - Consolidate two LHCb lectures, focusing on explanation of hands-on part
  - Have some interactive exercises between the two lectures. What?

- Lab tours
  - Having the lab tours staggered during the hands-on exercise didn't work so well as people got out of sync with the two parts and missed the averaging of the mass
  - Possibilities:
    - Have a morning slot with 3 staggered activities (what?), including lab tour, rotating?
    - Have a longer staggered lunch with lab tours during that? Others?
  - Any way to make more hands on? Charlie?

- Lunches
  - Need a way to avoid long queues and lack of food at end
  - Packed lunches? Staggered lunches?

What could/should we change? (2)

- Do we still want to be part of the IPPOG or do standalone?
  - Standalone would give us more leeway on when and timing of day
  - Can we organise our own VC with Liverpool LHCb at CERN?
    - Is there a virtual tour of LHCb in case we can't go down
  - Can still do the quiz (which was the most interesting part)

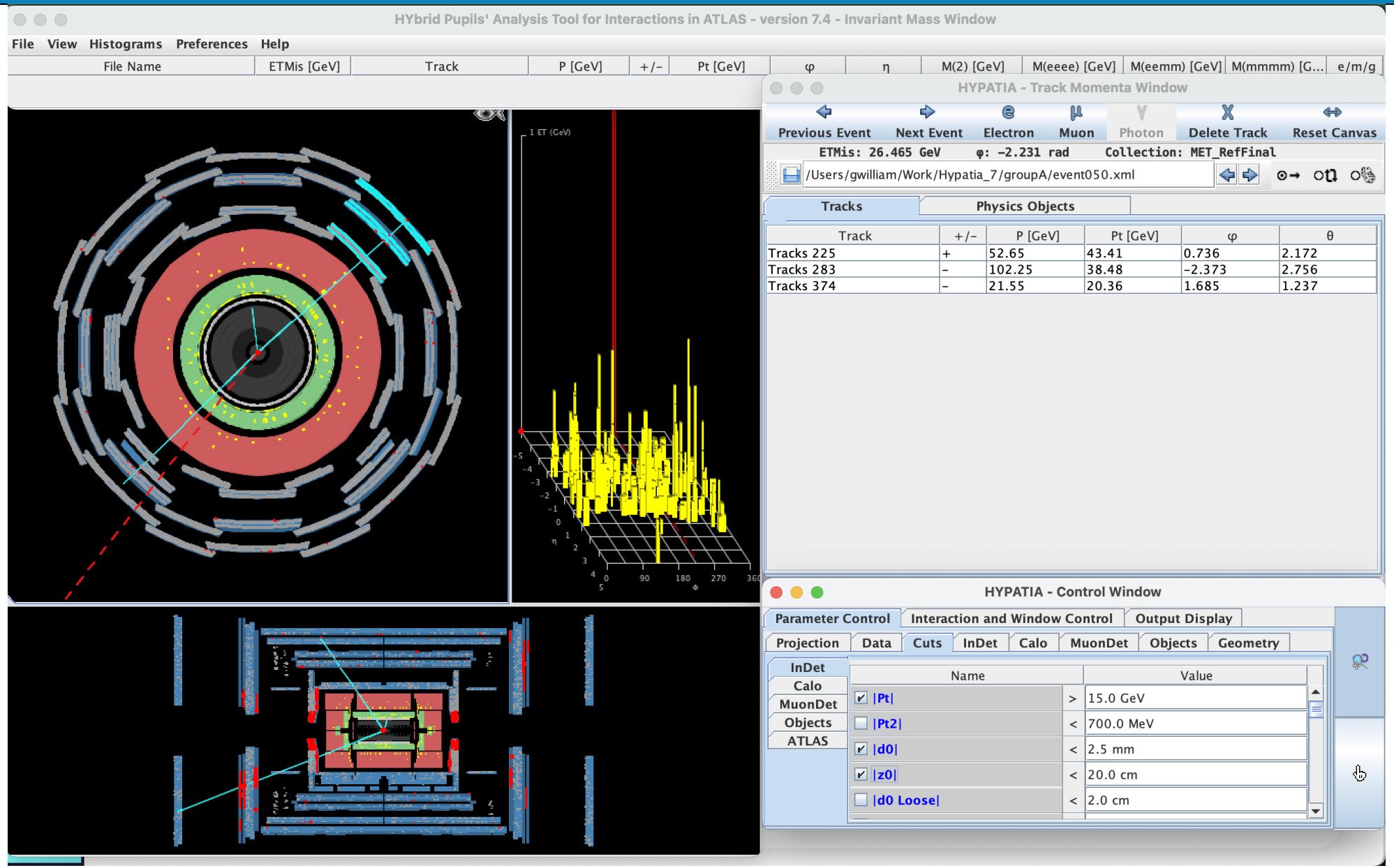
- Do we want to do more than one day?
  - Could have easily filled more places this year ("sold out" in 2 days)
  - Two days would accommodate more (can't do on one), likely with each slightly less packed
  - Would depends strongly on availability of staff/students to help
  - Would potentially allow to use gflex for (part of morning)
    - Can group with demonstrator earlier
    - Can more easily do hands on activities

- Room booking was a pain
  - Trying to see if we can get classified as a recruitment activity so can book rooms before finish timetabling

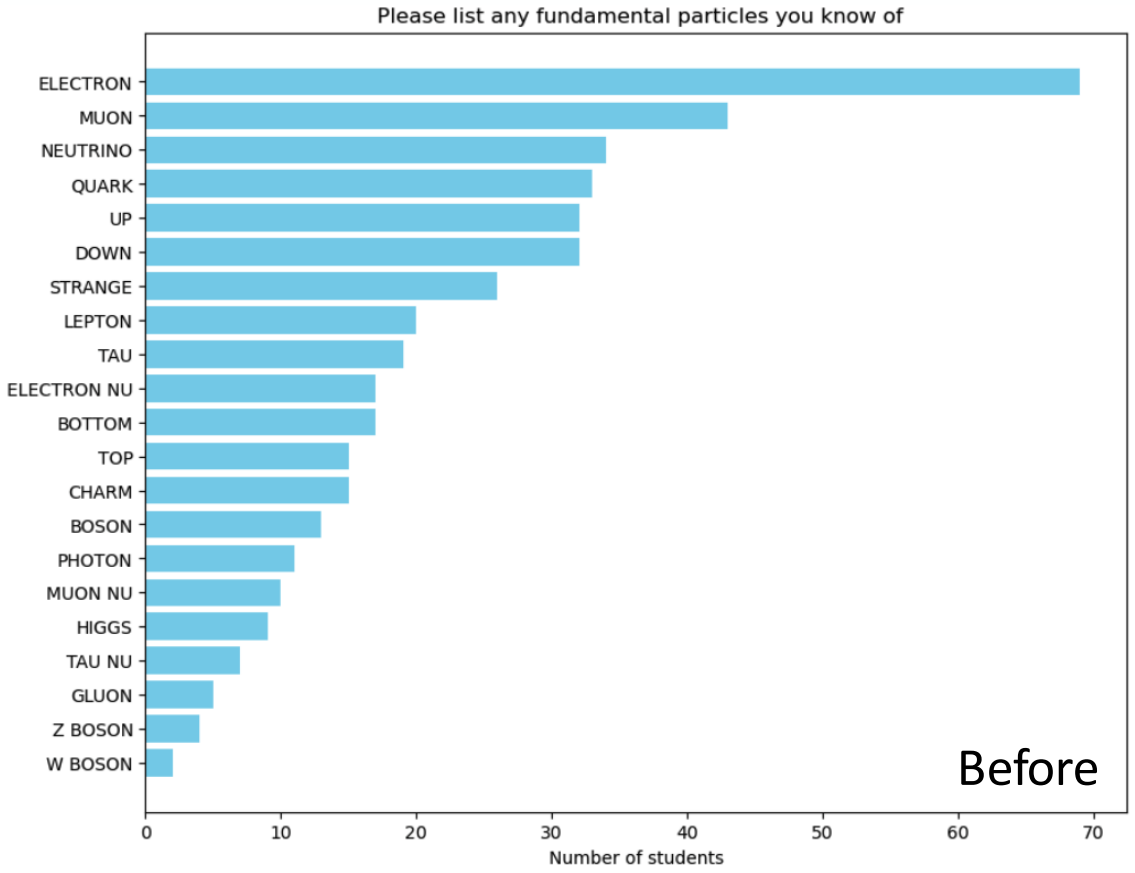
- Other thoughts and suggestions?
  - Which date or date(s) would work best?

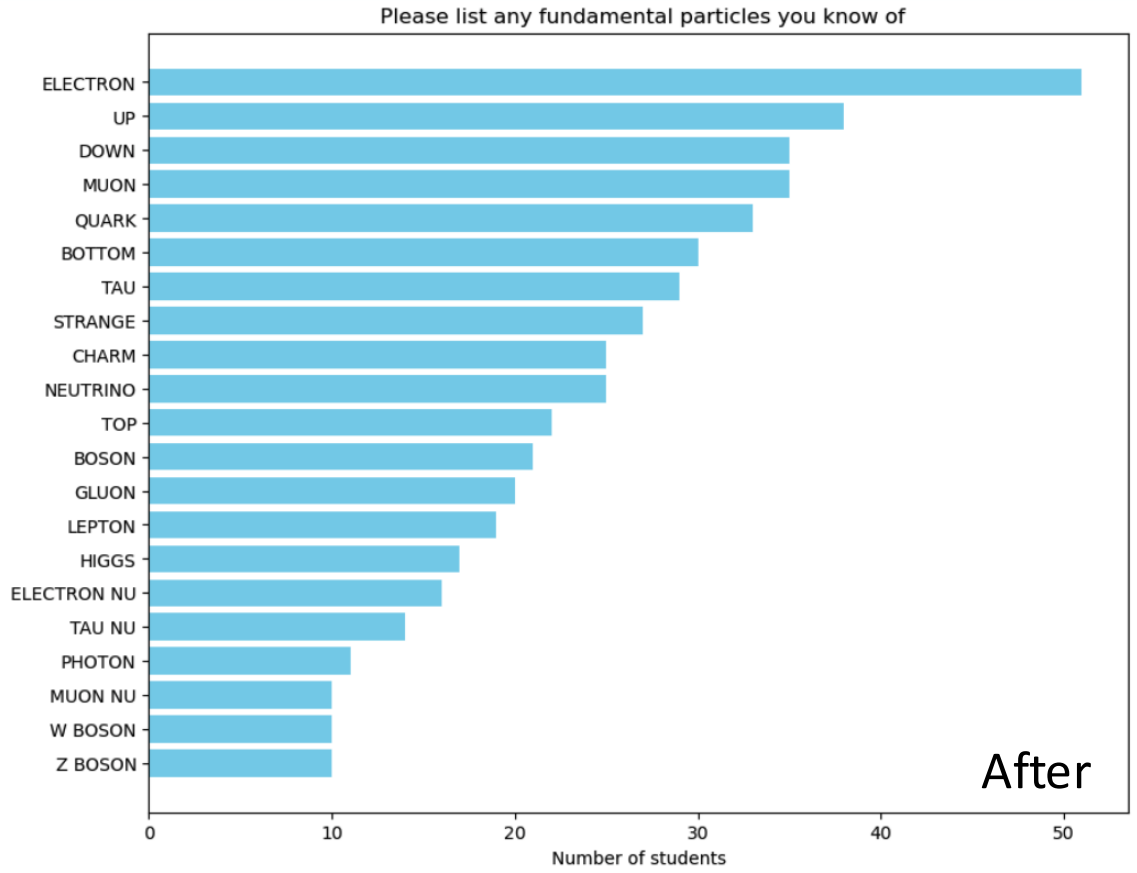
Back-up

ATLAS Example

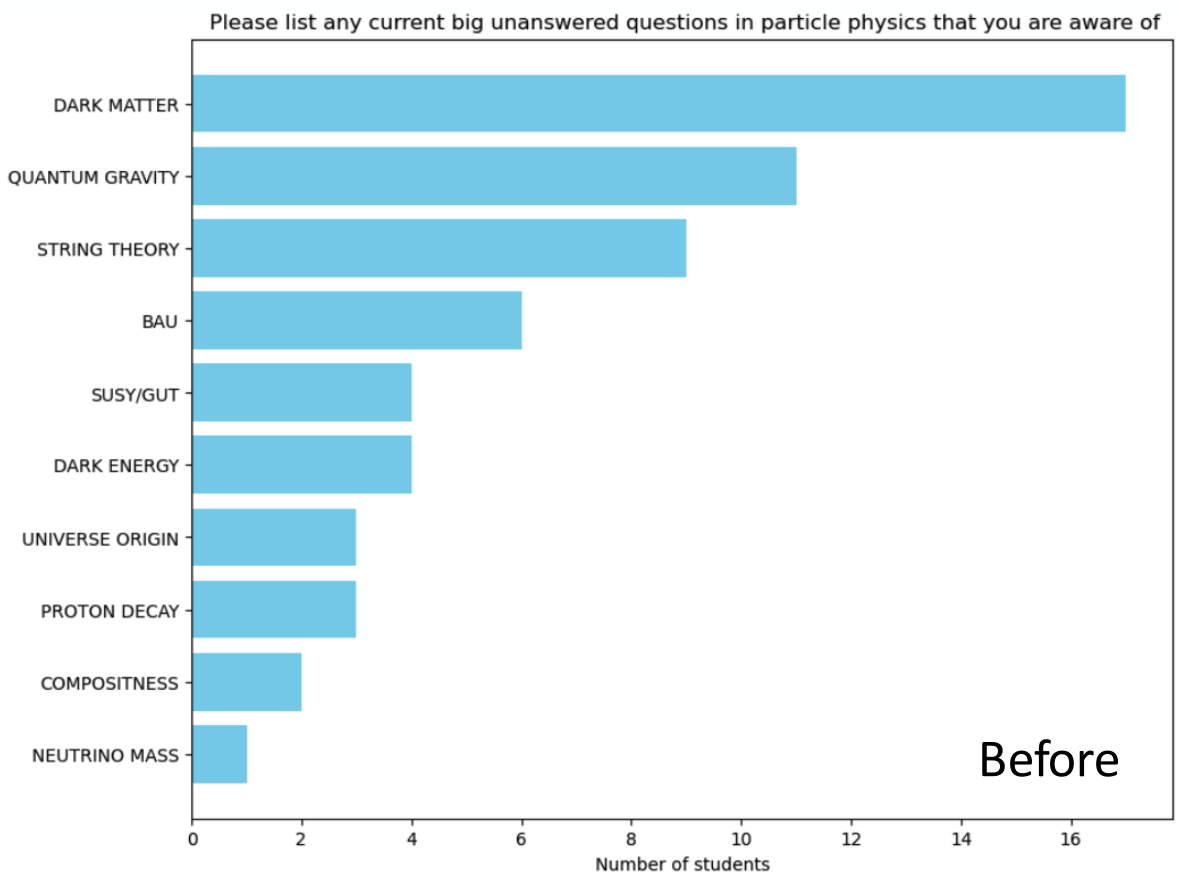


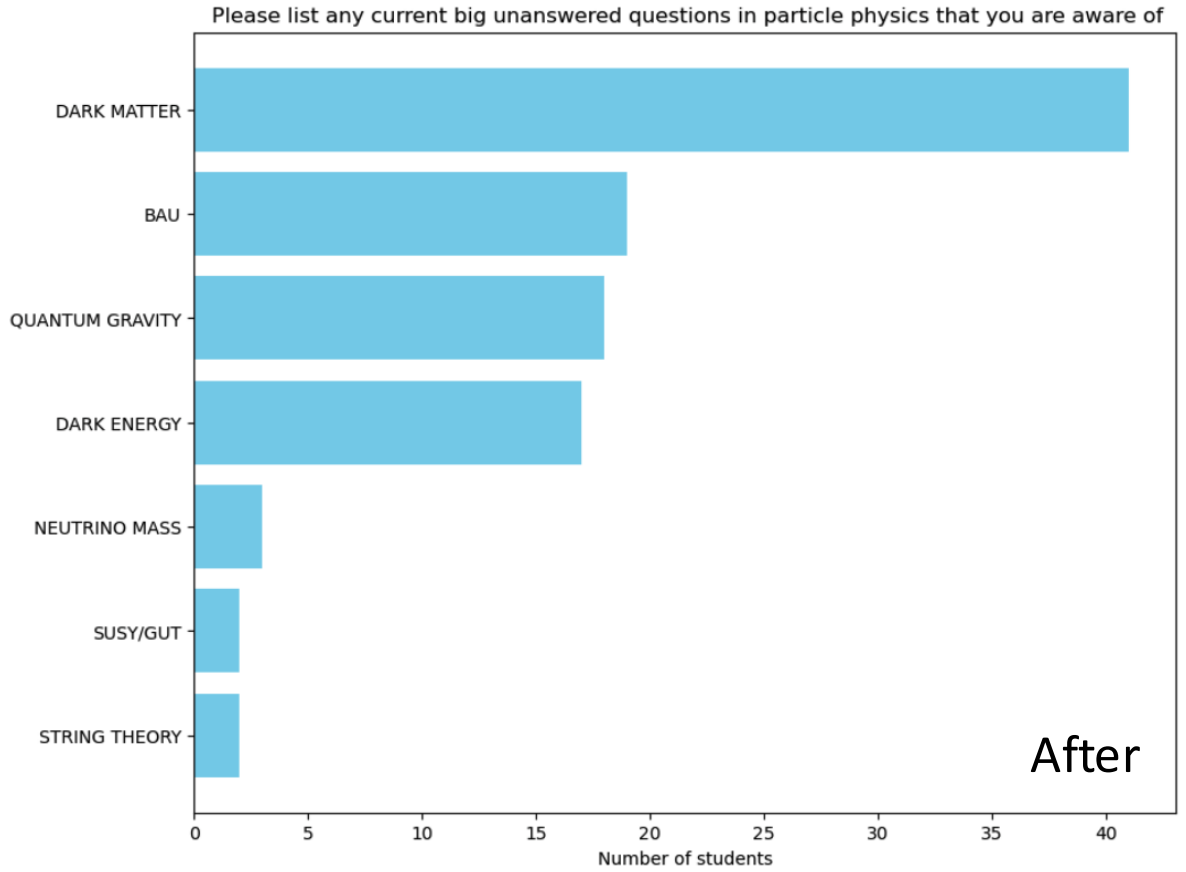
Fundamental Particles





Unanswered Questions





How Improve (1)

Lecture related:
- Less just talking to us
- More food at lunch and less yapping
- Don't make us sit down for so long please. The chairs are so uncomfy
- Some of the lectures covered the same or similar things and got repetitive at times.
- Make the lectures more to our level of understanding
- Comfort of lecture halls
- Less lectures because they are really boring
- Prepare the presentations earlier
- Less yapping
- More lectures
- Have more a level relevant information in the lectures
- More interactive stuff during the lectures.
- Give out resources related to the material covered in the lectures.
- More technical testing on the speakers in the lecture
- Improved microphone and audio quality for lectures and conferences

Lab related:
- Food and more experiments

- More interactive experiments in the lab
- More time in the lab tour
- More practical aspects
- With lab tours more hands on equipment
- More experiments.
- More lab time
- Longer, more detailed lab tours.
- More experiment demonstrations
- More time exploring and explaining the hands on computer practical
- More practicals
- Condu t more practicals
- Higher frequency of lab time
- More time on the lab tours
- Live demonstration of anti matter collisions with matter
- More mentors to help with the practicals
- Hands-on practical experiments
- More time on the lab tours.
- Might be better if I could spend more time in lab
- Let us see the actual labs and see more of the campus

Hands-on related:
- More explanation for the hands-on activity
- The computer part finished quickly with too much time to spare
- With lab tours more hands on equipment
- There were some technical issues with the hands-on computer element that made it difficult.
- More time exploring and explaining the hands on computer practical
- Hands-on practical experiments
- More in depth explanation of the hands on activity.

How Improve (1)

Lunch related:
- More food at lunch and less yapping
- more chatting with students over lunch
- Limit the fatties that took 3 donuts because I didn’t end up getting one
- Food and more experiments

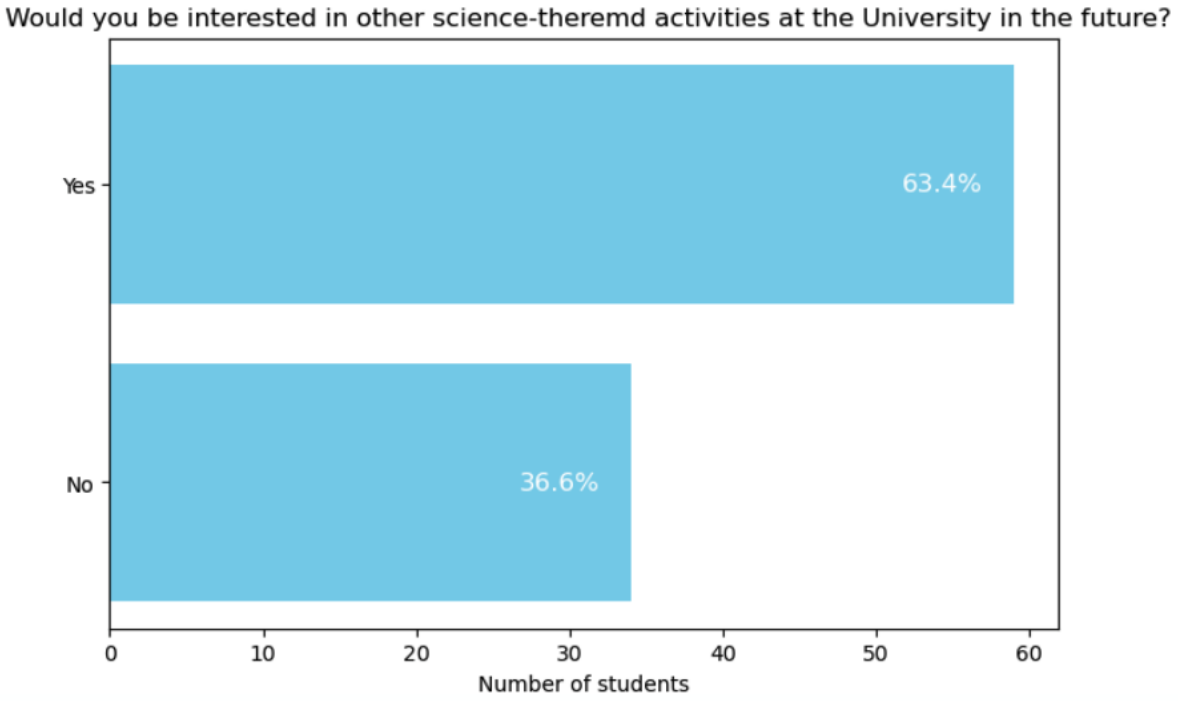
- More food and drink at lunch.
- More food, it ran out fast
- Staggered lunch so there are shorter queues
- more food
- Achieving higher abg concentration + more food

Other:
- Make it more inclusive for each individual
- More interactive experiences
- More activities that mix the he different schools, eg problem solving
- More comfortable chairs
- Put instructions on how to use the coffee machine

Make lockers easier to open
- More interactive
- I think it wouldve potentially been better within smaller groups although i can recognise the cost and space problems
- more activities
- More detailed info
- More chances to chat with current students
- More entertaining
- Reduce the amount of technical language used
- Schedule's handed out

Interest in other science activities?

- Interest in other science activities, eps. Engineering + astro



Other: 10
- Radiation
- Include the other sciences
- Problem solving activities or competitions
- Molecular/ microbiology masterclass
- Fun ones
- Environmental sciences and geology
- Taster days, competitions, experiences, courses
- Computer Science Materclasses
- Stuff about the higgs
- Explanations of theories in science eg String Theory

Enginnering: 10
- Engineering
- Engineering
- Engineering
- Engineering
- Engineering
- engineering
- Engineering
- CAD Engineering
- Engineering
- Engineering

Astro: 5
- Astrophysics
- Anything to do with astronomy
- Astrophysics/theoretical physics masterclasses
- Astrophysics/Astronomy
- Astrophysics

Chemistry: 4
- Chemistry
- Maybe chemistry spectroscopy
- Maths, Chemistry
- Chemistry medicine biology

Maths: 2
- Maths, Chemistry
- Mathematics

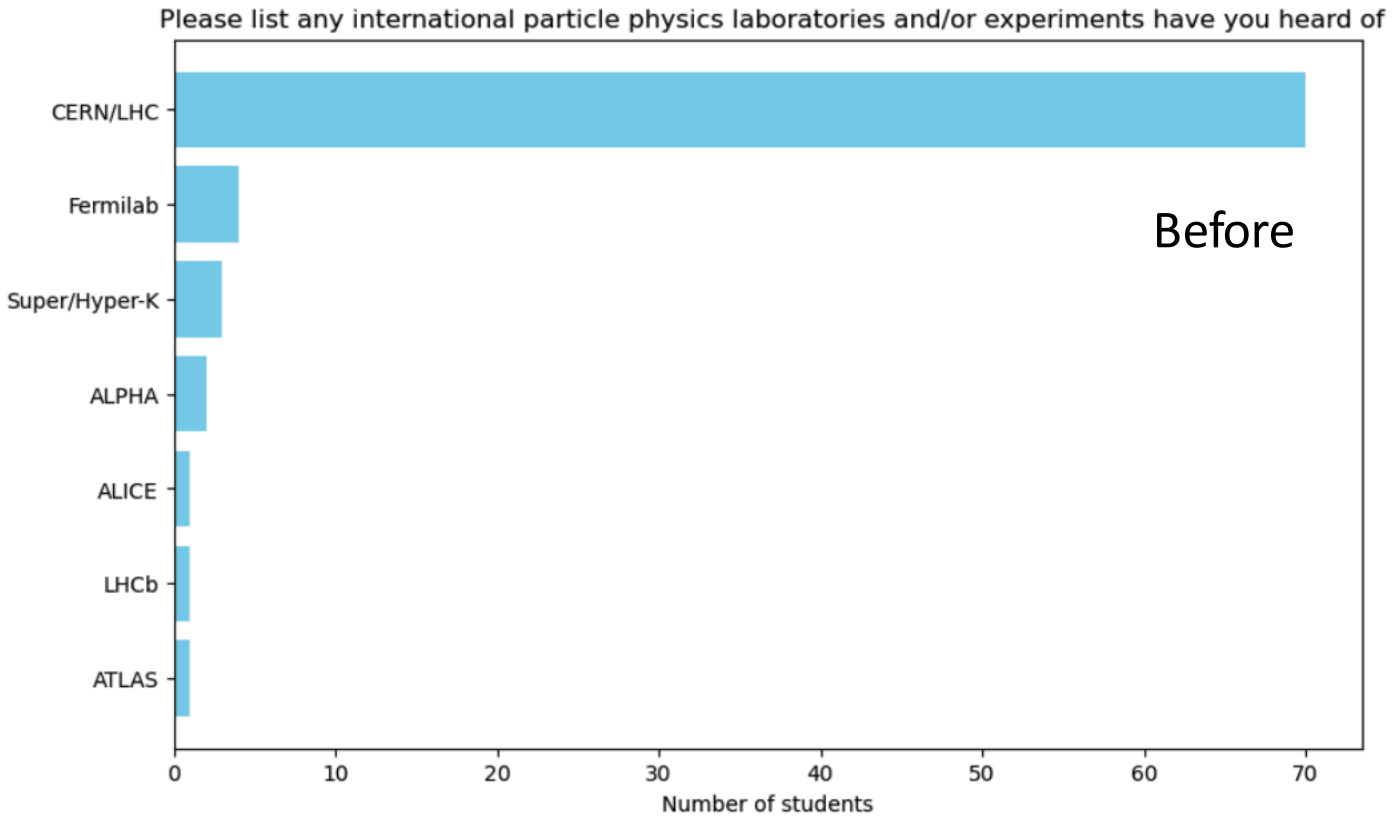
Phys: 8
- Astrophysics
- Physics and LHC
- Mechanics or physics centered
- Astrophysics/theoretical physics masterclasses
- Physics and Computer Science!!!
- Astrophysics/Astronomy
- Physics related ones
- Astrophysics

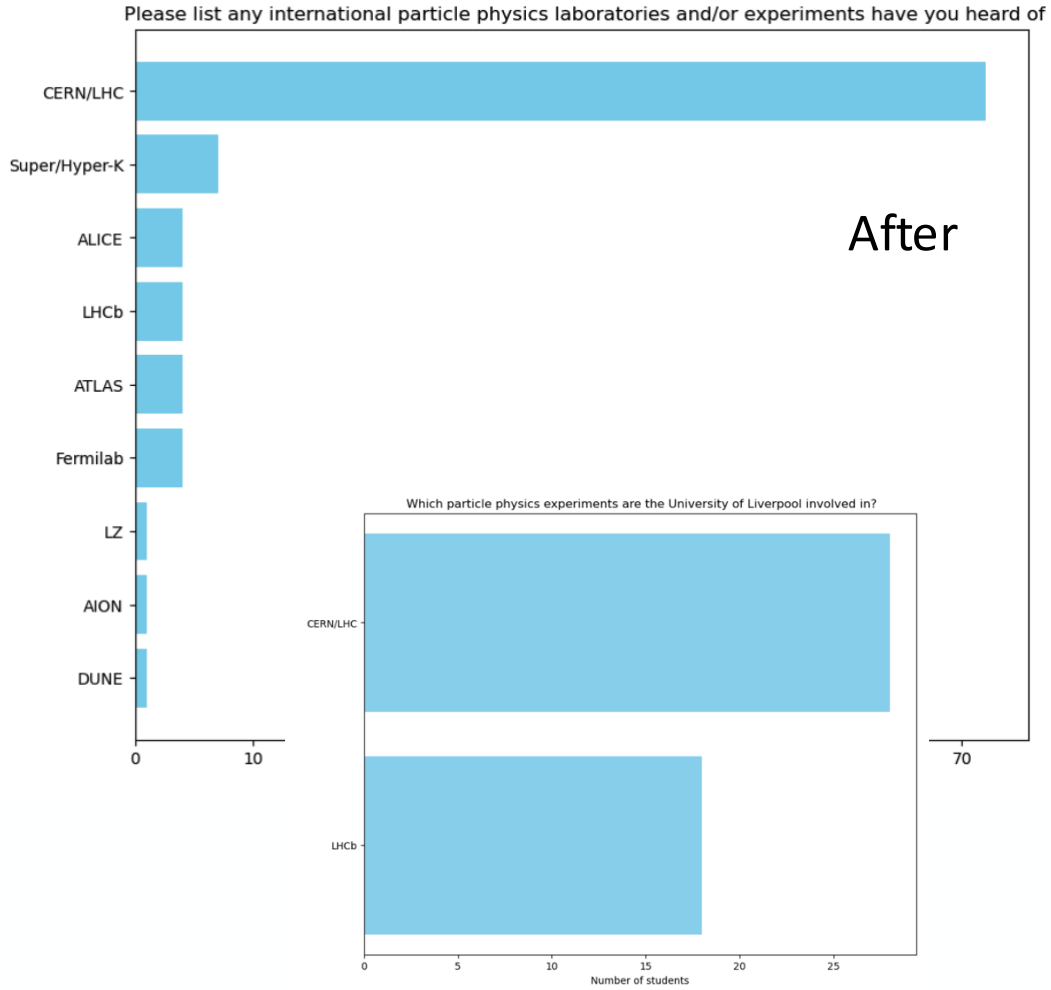
Lab: 3
- Lab work.
- Lab practical tours
- Lab practicals

Back-up: Physics Questions

Physics Labs/Expteriments

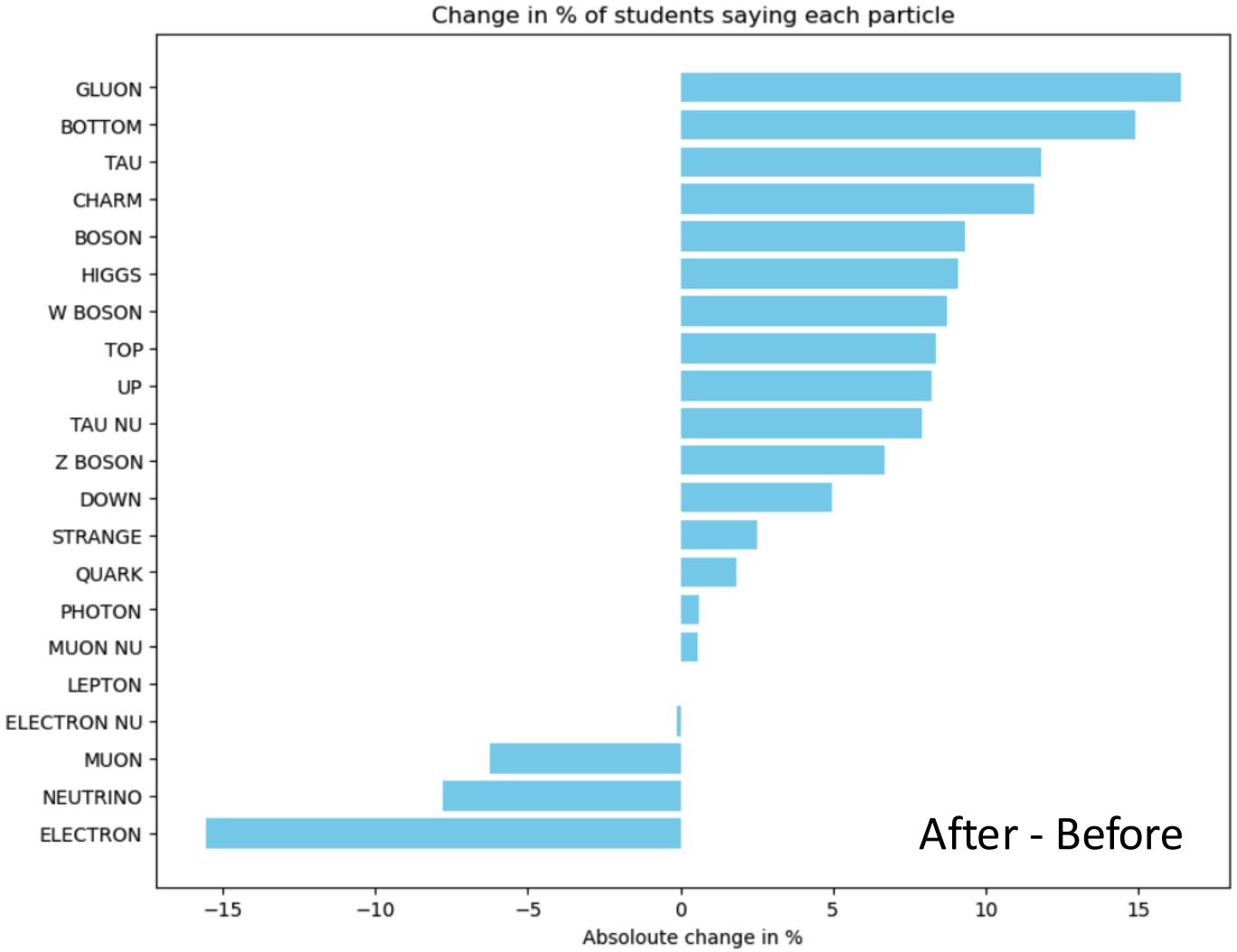
- Similar list of labs/experiments before and after
  - Did learn that we are involved in CERN/LHC and specifically LHCb





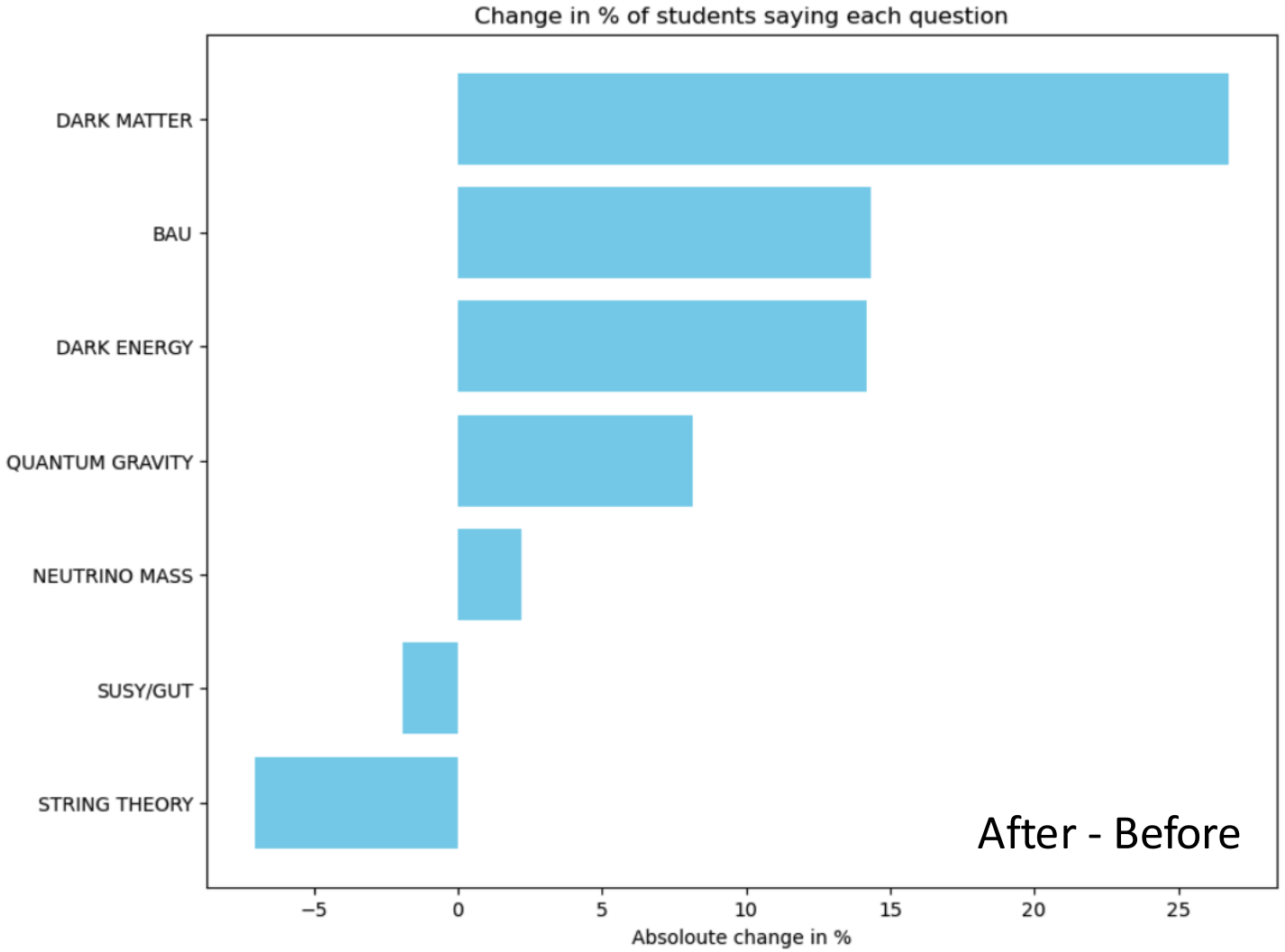
Fundamental Particles:

- Could name a wider variety of particles after compared to before
  - Before and after responses in backup



Unanswered Questions

- More people mentioning Dark Matter/Energy and BAU afterwards
  - Before and after responses in backup



D0 Meson

- Learnt what a D0 decayed too and that flight distance depends on lifetime
  - But not that it depends on the gamma factor