Liverpool Particle Physics Masterclass 2026

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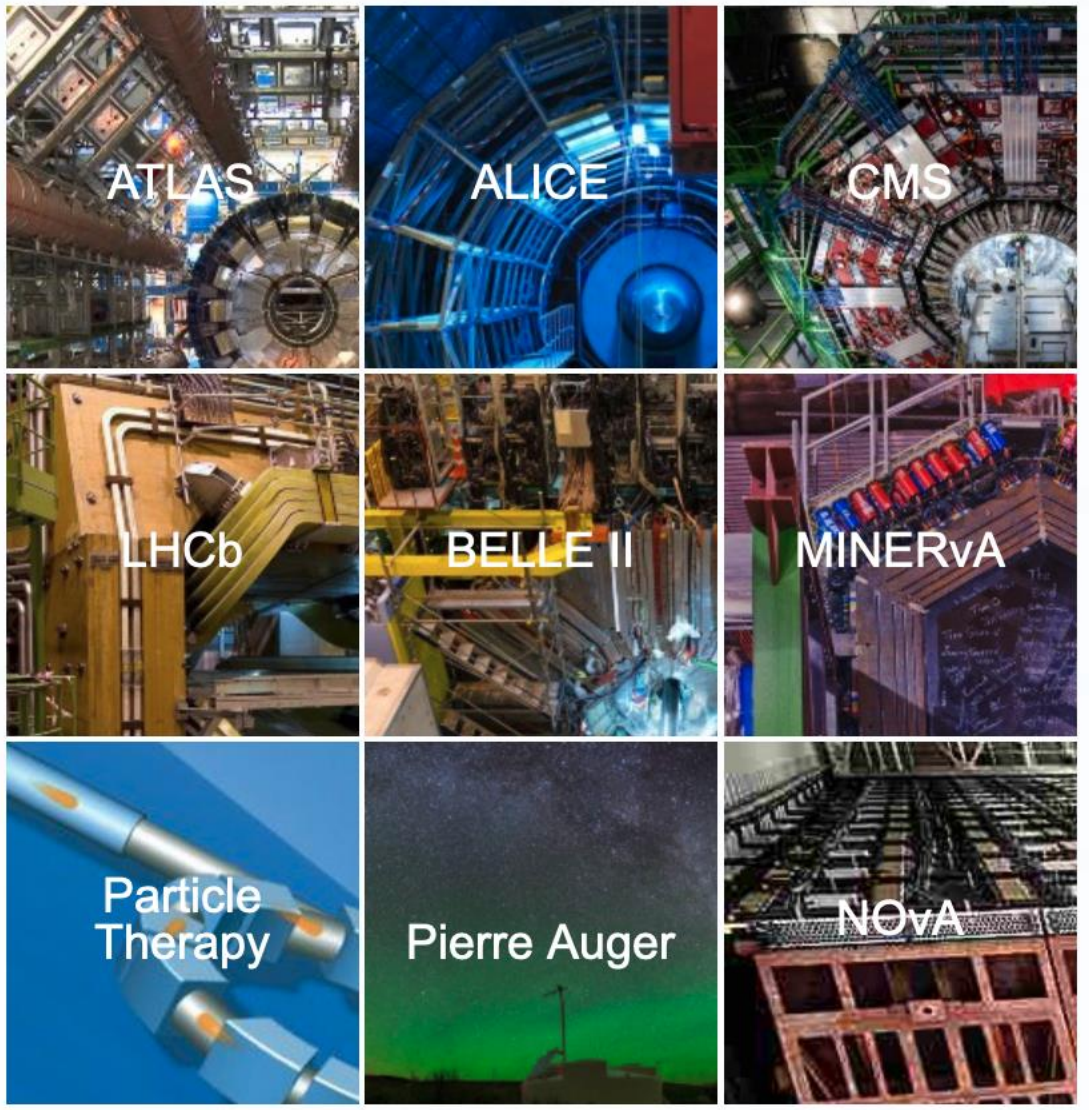
8th October 2025

Liverpool PP Masterclass Meeting

UNIVERSITY OF LIVERPOOL

International PP Masterclasses

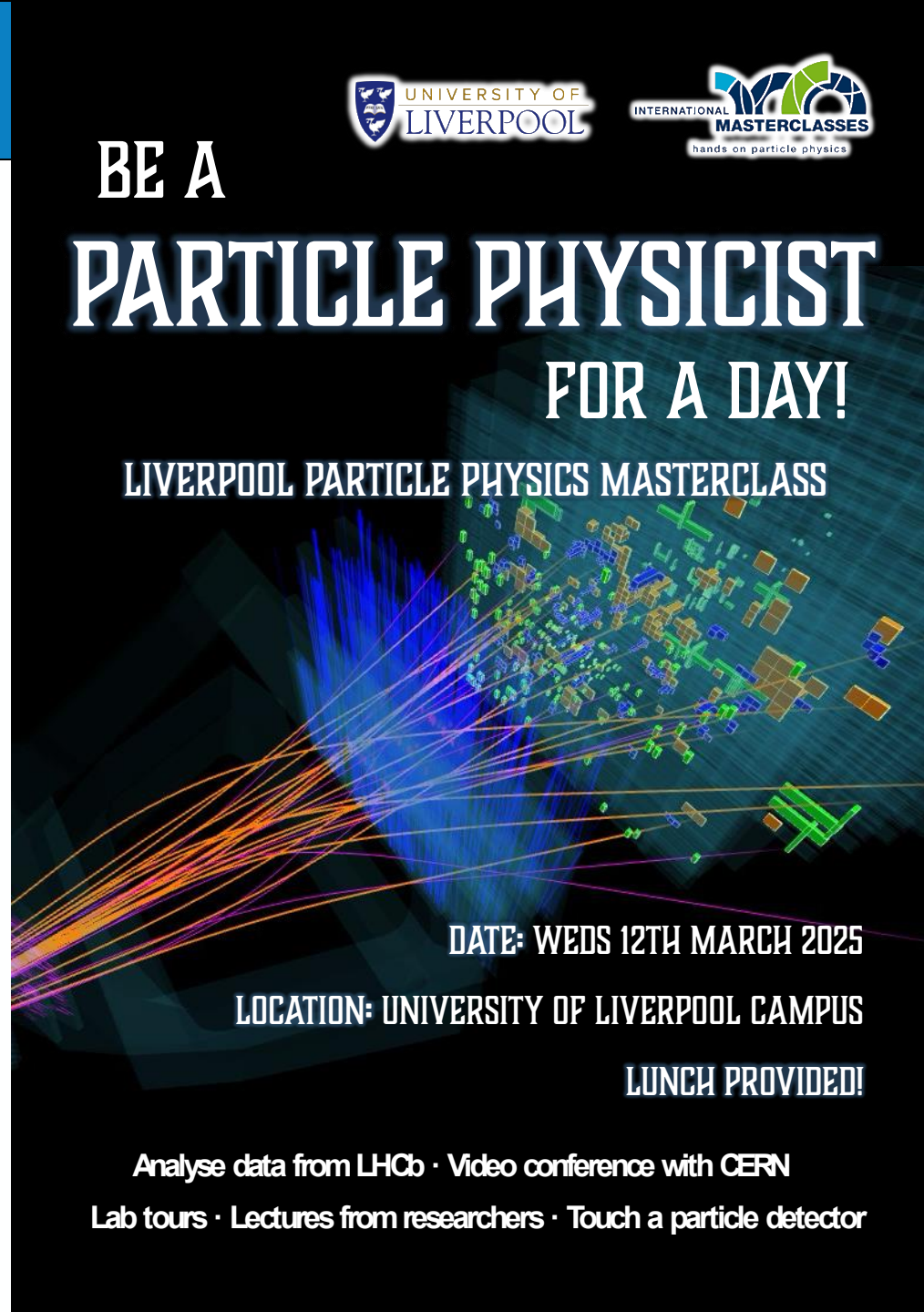
- Each year 13,000+ students in >60 countries learn about the mysteries of particle physics as part of the International Particle Physics Outreach Group (IPPOG)
  - https://physicsmasterclasses.org/
- In person one day session at a university/research centre, in Spring, with talks and hands-on activities
  - Many activities on several experiments to choose from
  - VC discussion with other institutes at end of the day
- Aimed at 15-19 year olds (i.e. year 11-13 students)
  - Although year 12 ideal since they will have started A-levels and not yet applied for university
- Goals
  - Show what it is like to be a particle physicist for the day
  - Encourage students to come to Liverpool to do Physics



2025 Liverpool Masterclass

Overview

- 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!)
- 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
- Day was a huge success with generally positive feedback from both teachers and students alike
  - Students found teaching lab tours and hands-on exercises most interesting, but lectures most useful
  - 100% of schools would come back and >50% of students more likely to come to Liverpool afterwards
- Plan to keep 2026 event broadly similar
  - But address the main constructive feedback from last time
    - (see backup for details)



Agenda

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

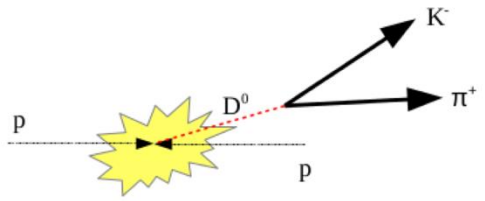
10:00 → 10:10	**Welcome**		10m
10:10 → 10:55	**Particle Physics Overview**	Introductory talk linked to A-level by Saskia	45m
10:55 → 11:10	**Comfort break**		15m
11:10 → 12:00	**LHCb Lectures**		
11:10	**LHCb Experiment Overview**	Talks on LHCb by **David Hutchcroft** + **Paras Naik** with Liverpool-built 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

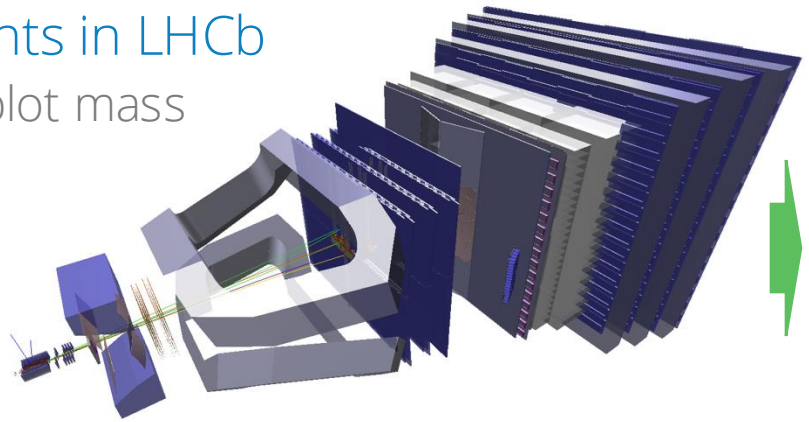
Rio de Janeiro, UFRJ | Geneva, CERN | Pisa | Bologna | Liverpool

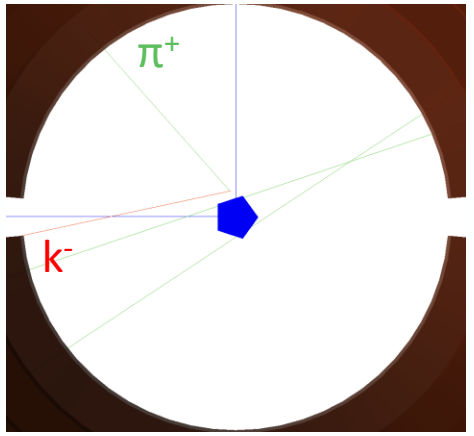
Hands-on Activity

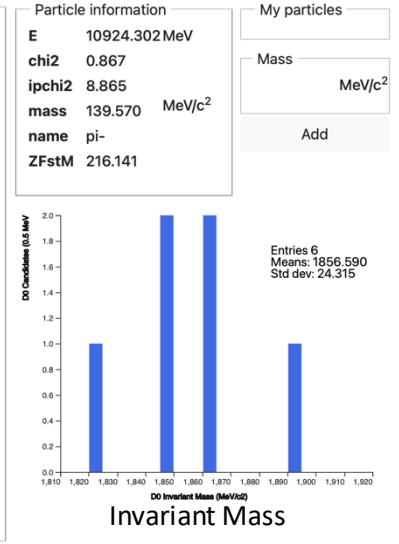
https://lhcb-outreach.web.cern.ch/lhcbinternationalmasterclasses/d0-lifetime/

- Identify $D^0 \rightarrow k^{\pm}\pi^{\mp}$ events in LHCb
  - Find decay tracks + plot mass

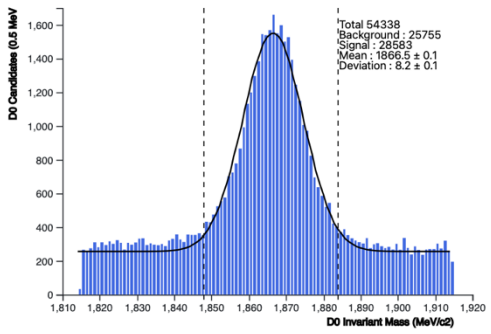


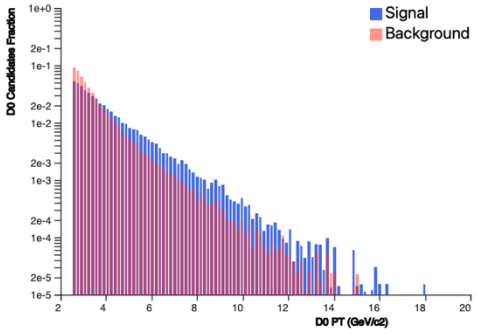


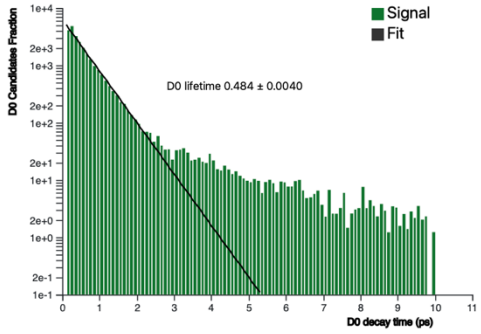


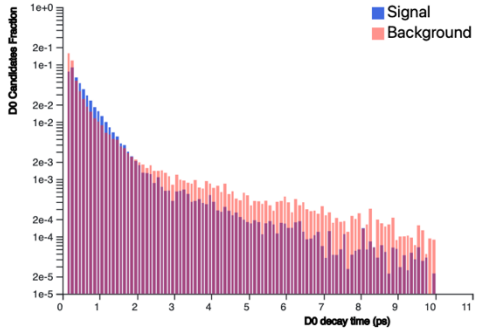


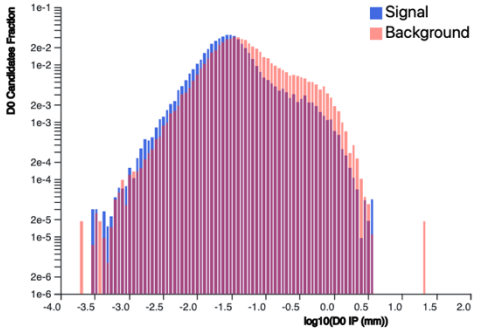
Invariant Mass

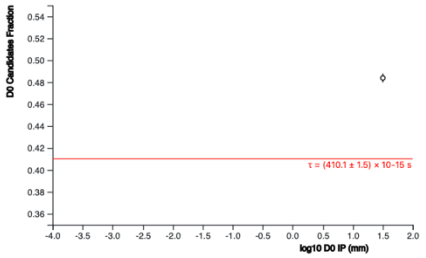












- Separate signal from background via cuts and extract D^0 lifetime
  - Report at video conference

2026 Liverpool Masterclass

Dates/Times

- Call for dates already announced by IPPOG and we have put in the following options
  - Wednesday 18th March
    - In term time, hence Weds only option
  - Friday 27th March
    - In Uni but not school easter holiday

- Should get conformation of which is chosen in November
  - If both dates are possible could consider to run two days given interest last time
  - Would depend on sufficient person power and likely too much of a stretch

- Thanks to Gita, our new APVC(E) we already have rooms booked for these days ☺
  - Have the entire CTH/CTL for the full day (to prevent anyone else using)
  - Includes lecture theatres, GFlex, both PCTC (could use both?!) and atrium

- Like last time we would propose to run it from 10:00 – 16:00
  - Giving time for schools to arrive and then return back

Morning

- Start with the introductory lecture from Saskia in CTH LTB like last time
  - Received very good feedback, with students finding it most useful
- To address feedback that there were too many lectures and not enough interaction
  - Move to Gflex (if numbers allow)
  - Split into groups and rotate round different activities
    - Lab tours (to prevent disruption to hands-on activity with schools getting out of sync that we had)
  - Need to come up with at least two other activities e.g.
    - Find the higgs, particle builder,, quirky quarks, SM game from BSF, Quark Quest, Q&A, Pub Quiz, …
- Then have a single LHCb lecture just before lunch
  - Geared strongly towards the hands-on activity that will come in the afternoon
- Lunch (12-13:00)
  - Move to pre-packed lunches to prevent issues seen last time
    - Long queues and the first people eating all the food
  - Could use both the atrium and the Gflex to allow more space for people to sit
    - Would need to pay for cleaning of Gflex though in that case

Afternoon

- Dedicated to the hands-on LHCb activity from 13-~14:45
  - There is an updated version in progress that they hope will be ready in time
  - Will need to familiarise ourselves with this and have a training session nearer the time
  - Based on feedback, need to make instructions less text heavy and more user friendly
    - But some central effort already in this direction
- Followed by Video Conference (VC) with CERN back in CTL LTB at 15:00-16:00
  - Based on feedback need to prepare students more for this
    - Students to present our results
    - A couple of questions to ask
  - Might be helpful for this to get into LT a bit in advance (as we don't have to travel as far this time)
- Will again run the pre/post-questionnaires
  - Both as the schools arrive (< 10:00) and before they leave (> 16:00)
  - Based on these, and developments in the exercises, may make larger changes for future years

Planning and Next Steps

People

- We need people to
  - Help organise the event
  - To participate on the day
- Advance organisation
  - Suggest/test interactive exercises
  - Update LHCb hands-on instructions (if needed)
- On the day
  - People to lead a group of around 10 students from a school
  - Be there for the interactive exercises and the hands-on sessions
    - Based on feedback would be good to be there for everything except the lecture (say 11-16:00) to develop bond with students
    - Will require ~20 people
  - One person to lead the VC session and test the setup before

Next steps

- "Official" schedule
  - Oct: register with your preferred dates and measurement when contacted by organizers
  - Nov: preliminary schedule is created by organizers - make reservations for lecture hall with video conferencing facility and PC pool
  - Dec: check your profile on www.physicsmasterclasses.org, does it need an update?
  - Dec: prepare your local agenda and a link for registration
  - Jan: send invitation letters to schools and students
  - Feb: plan preparation talks
  - Feb: introduce tutors to measurement, use the material here
  - Feb: perform video test and prepare for the video conference, download the manual
  - immediately before your event:
    - print tally sheets, if required for measurement
    - print answer sheet for quiz
    - download local language version of quiz
    - print certificates of participation
  - after the event: send media coverage, photos, and lectures for our archive

We are here

- Most urgent items are
  - Finalise the plan for the day and develop the interactive exercises
  - Make sure we have sufficient people signed up for the day itself

- Communication
  - Will have semi-regular meetings on a fortnightly or monthly basis as needed
    - To avoid polling each time good to find a general slot, so please fill the poll below:
    - https://www.when2meet.com/?32832020-awh5y
  - Please also sign up to the MS Team's channel
    - General | PPMasterclass-O365-Team | Microsoft Teams