PROCEEDINGS OF SCIENCE

Outreach at LHCb

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The LHCb collaboration has a wide outreach program covering physics news and developments around its detector. Since March 2020, the focus has been to improve and develop the online presence to provide valuable outreach content during the pandemic and beyond. Online platforms allow the collaboration to stay in contact with the general public and communicate about new tools like online masterclasses and virtual tours. In addition, the surface area of the experimental side has been remodeled to enrich future in-person visits.

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In these proceedings the status of the main outreach activities at LHCb are discussed, including the online presence of the collaboration (Sec.1) and the developments on the LHCb (online) masterclasses (Sec.2). In addition, the presentation of the detector in its context during virtual visits (Sec.3) and the remodeling of the exhibition at the experimental site (Sec.4) are presented.

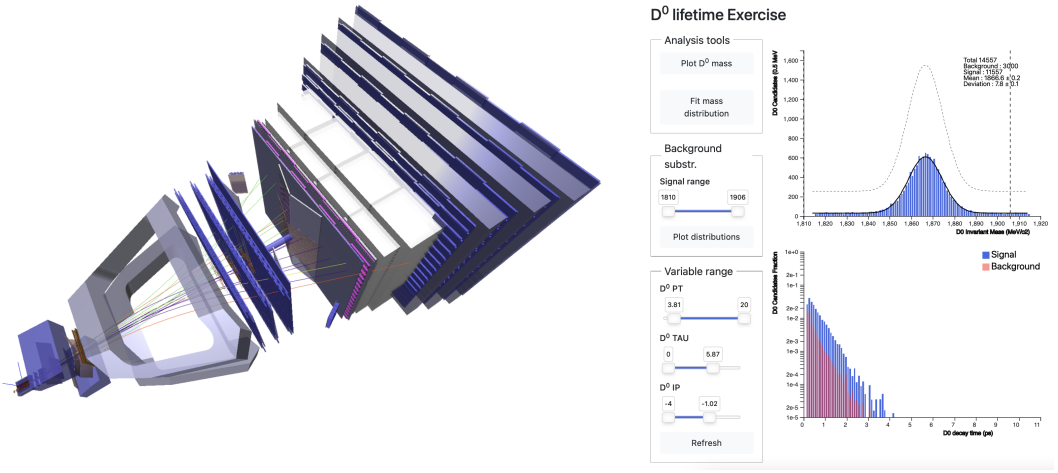
1. LHCb on the web

The online presence of the LHCb collaboration is the most efficient tool to engage with the general public. To provide valuable outreach content during the pandemic, the collaboration improved old online tools and developed new ones. The LHCb public website [1] was redesigned and launched at the end of 2021. News regarding new physics results or the accomplishment of milestones in the detector development or installation are published in chronological order on the main page. In addition, introductions to the b physics and the physics program in general are given, as well as to the detector, data collection and the collaboration. All published articles and subpages have an increasing amount of details aiming to provide access to the information for different levels of expertise.
The LHCb collaboration has a dedicated social media team providing suitable content for each of the four platforms on which LHCb is active. While LHCb is present on YouTube, Facebook, Twitter and Instagram, especially the latter two are important. Posts on Twitter [2, 3] attract a lot of attention from science journalists allowing to improve the exchange and coverage from important results in general news media. The visual content of Instagram [4] allows to attract the attention of the general public. This enables engaging with larger groups and educating about the work done at the LHCb experiment. The YouTube channel is used to publish videos from the installation process or giving tours with detailed information about the detector.
During the pandemic a large effort was put into communicating important physics results not only via traditional newspaper coverage, but also on new online media. *The Conversation* [5] is one of the latter, allowing for high quality articles, as their content is produced by academics and researchers. The news stories e.g. about the first evidence of violation of lepton flavour universality generated up to 200.000 reads per LHCb story, worldwide. In addition, other formats like podcast episodes [7] are also available.

2. Online masterclasses

LHCb takes part in the international masterclasses for high-school students organised by the International Particle Physics Outreach Group [8]. The LHCb masterclass aims to immerse students in particle physics with introductory lessons in physics as well as on the LHCb detector followed by an exercise on data analysis and an online meeting with scientists at CERN. Usually the students travel to the participating institutes, giving them even more insights on the work of particle physicists. The exercise for the LHCb masterclass is now accessible online [9]. Examples for the event display part and the analysis part of the D^0 lifetime measurement exercise are given in Fig. 1. The online access of the exercise simplified moving the masterclasses to a fully online format, since no software installations are necessary anymore. The online masterclass is held using Zoom webinars and online

quizzes have been included to improve the engagement with the students.



(a) Event display part if the exercise.

(b) D^0 analysis part of the exercise.

Figure 1: Example pictures of the masterclass exercise, that is now fully accessible online.

Due to the online format, the audience of the masterclasses has changed to more diverse groups of individual students as well as classes from high schools. While the attendance numbers still remain below the pre-pandemic ones, an increase has been observed compared to 2020. In addition, students from more remote areas have been reached, that usually have been unable to attend in person at the universities.

3. Virtual tours

Since the start of the pandemic the outreach team launched a virtual format for visits of the LHCb experiment. The goal is to present the experiment in its full context and to show details that are normally inaccessible in person by walking through the detector itself.

The virtual visit is held via a Zoom webinar to improve the experience of the audience. The host of the tour usually starts with a short introduction to the LHCb experiment and the physics the collaboration studies. The short introduction ends with meeting the surface guide in the control room. The guide shows the room and gives explanations of its importance, adapted to the knowledge of the audience. Afterwards the underground guides are in the spotlight, giving an overview from the visitor platform in the cavern as shown in Fig. 2. One of the guides then shows the detector in details by walking through it. Depending on the situation at the experimental site on the day of the visit, the surface guides can also show the biometric doors for cavern access giving more details on safety protocols at CERN. As an alternative, it is also possible to show detector pieces from the surface exhibition like the spare

Figure 2: Picture of underground guides during the start of a virtual tour.

Vertex Locator or visit the assembly hall, where different subdetectors are being built. The choice is usually adapted to the knowledge and interest of the audience. The visit ends with a dedicated question and answer session to deepen the understanding of the audience. During the visit, usually at least one technical helper is present to help solving technical issues of the attendees and answer questions live in the dedicated Zoom feature. The visits are recorded and made available to the attendees at the dedicated Indico page of each visit [10]. The website also includes a feedback survey to enable continuous improvement of the virtual tour scenarios.
The virtual visits usually have between 250 and 400 attendees and have been held in English, French, German and Italian so far. In addition to these classic virtual visit, the LHCb collaboration also had VIP events, hosted a CERN alumni event and had several smaller visits from national institutes.

4. New exhibition

The surface area of the main building at the experimental side is used as part of in-person visits by displaying posters and detector parts in showcases. In 2020, the LHCb exhibition has been redesigned to allow for a more interactive experience during in-person visits. The exhibition covers four different zones with the goal to enrich the experience of on-site visits. The project is funded by CERN.
The new exhibition starts with the entrance across the control room allowing the visitors to get a first introduction to the experiment and to learn how the detector and the data taking are monitored. The next stop is the multimedia room, which was finished in November 2021. It has three main elements aiming to introduce the visitor to the LHCb detector and the physics the collaboration is studying. The first element is a flat detector model in the middle of the room, providing an overview of the detector geometry. On the side, aligned with the model, are illuminated panels showing more details about the different sub-detectors. The heart of the installation is a combination of screens and a projector presenting animations and videos to explain the detector. A view of the room is shown in Fig.3.

After leaving the room the group will enter an area which displays components of real sub-detectors, such as the replacement detector of the first Vertex Locator. These serve as supplements to provide more detailed explanations for each detector and underlying technology. The last and final zone is located towards the cavern access point. A model of the full cavern is displayed allowing to give an overview of the cavern topology or prepare for a possible cavern access.
Due to the suspension of in-person visits during the pandemic, the upgrade and re-modeling of the exhibition has been performed without an impact on visitors.

5. Conclusion

The LHCb collaboration actively and continuously works on developing new and improving old outreach activities. One goal is to make the research carried out at LHCb comprehensible and accessible, even without prior knowledge of physics. The second one is to attract people to join the LHCb collaboration with masterclasses for young students.

Figure 3: Photography of the new multimedia room as part of the improved exhibition at the experimental site of LHCb.

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