

ALICE virtual visits and masterclasses during the COVID pandemic

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With the onset of the COVID pandemic in 2020 all outreach and educational activities with in-person participation had to stop. The ALICE Collaboration adapted to the new situation and continued reaching out to the public using the multitude of online tools and platforms available. Here we focus on two of our main outreach activities, virtual visits and masterclasses.

With the cancellation of all in-person visits, virtual visits became the only way to explore the experiment. ALICE had already been offering virtual visits for remote audiences with equipment installed in the ALICE Run Control Centre (ARC). We recently acquired dedicated mobile equipment for the virtual visits to the cavern and developed a scenario which includes both the cavern and the ARC as well as a Q&A session. In this way, visitors from many countries have the opportunity to interact with scientists and to see parts of the experiment that they would never be able to see during a real visit.

ALICE has been participating in the International Masterclasses (IMC) programme ever since measurements based on LHC data were introduced in it. The packages used had been developed by simplifying the ALICE event display and were based on ROOT. With the spreading of the COVID pandemic the 2020 IMC programme was interrupted. In 2021, with most activities taking place remotely, it was obvious that web-based versions were needed. The implementation of such versions allowed us to hold remote masterclasses for high-school students, thus ensuring the continuity of this important outreach activity of our community. In addition we reached new countries and also involved high-school teachers in this global effort.

*** *The European Physical Society Conference on High Energy Physics (EPS-HEP2021), ****

*** *26-30 July 2021 ****

*** *Online conference, jointly organized by Universität Hamburg and the research center DESY ****

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1. Introduction

Among the many outreach and communication tools available in our digital era, "traditional" activities such as visits still hold an important place. They allow the visitors to see the tools of scientific research and come in contact with scientists, offering them a better insight into the world of science. A big effort has been made over the years to involve ALICE members as guides and accommodate as many visit requests as possible.

Out of various educational activities for different age groups, particle physics masterclasses, addressed to high-school students with the aim of inspiring them, is the most prominent one. Many ALICE institutes organise masterclasses based on ALICE data. With the onset of the COVID pandemic all these activities had to stop. In the following sections we discuss how we adapted them, using online platforms, thus ensuring the continuity of our outreach programme even without in-person participation.

2. ALICE visits

Visits to the ALICE experiment are very popular, the highlights being the tour of the underground cavern during shutdown periods of the LHC. At all times visitors can see the exhibition, installed on the surface at Point 2, where a short film introduces them to ALICE and real detector items are on display. The visitors cover a broad spectrum, and in their majority they are high-school or university students. During 2019, more than 12 000 visitors (1000 groups) had the opportunity to visit ALICE (the underground installations and/or the exhibition); in addition, during the CERN Open Days, 14-15 September 2019, 2600 persons visited the ALICE cavern.

With the onset of the COVID pandemic all in-person visits were cancelled.

3. ALICE virtual visits

Following the lead of ATLAS and CMS, who first introduced organised virtual visits [1], and after years of doing ad-hoc ALICE virtual visits with our personal laptops or phones, some time ago we installed dedicated equipment in the ALICE Run Control Centre (ARC). This is basically videoconferencing equipment, including two high resolution cameras: one fixed, showing the speaker, and one robot camera, with predefined positions showing different views inside the ARC.

Virtual visits were organised upon request, for remote audiences, and often combined with local events. These were taking place mainly from the ARC. Occasionally these virtual visits included also a tour of the cavern, done with the virtual guide's private phone or tablet.

When CERN returned to "normality" after the first lockdown due to the pandemic, it became clear that, due to the COVID measures, it would be some time before in-person visits could restart. Virtual visits were the only alternative, so they became the norm. We therefore started conducting such visits in a more systematic, organised way and with better equipment. For the underground tours we acquired dedicated equipment, consisting of a Samsung Galaxy mobile phone with a good camera, a stabiliser arm (gimbal) and headphones paired with the phone via bluetooth. An ALICE virtual visit includes both a tour of the cavern, possible during the LHC Long Shutdown (LS2) and a tour of the ARC; ideally, it is conducted with two guides, one in the cavern and one in the ARC.

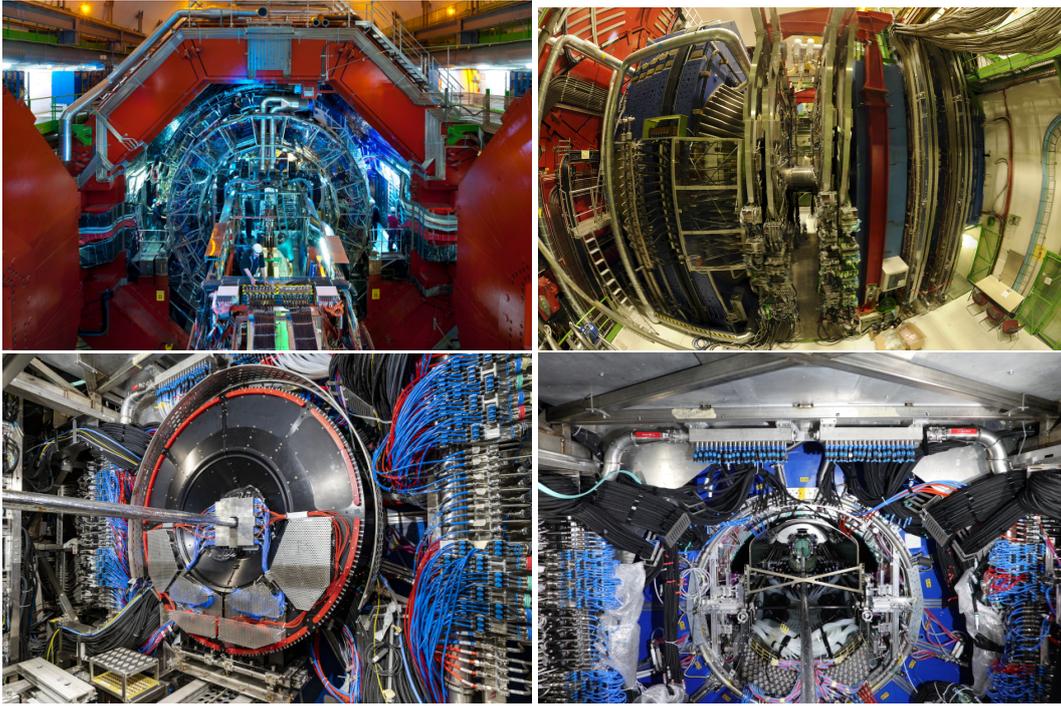


Figure 1: Some of the views offered to the ALICE virtual visitors. Top left: the ALICE solenoid with the doors open; top right: the muon spectrometer; bottom left: the Fast Interaction Trigger (FIT), A-side, and the beam pipe; bottom right : the outer barrel of the new Inner Tracking System (ITS) and the beam pipe.

Depending on installation work in the cavern, the guide can go to the low-beta platform, in front of the ALICE solenoid; on the muon spectrometer side; and near the beam pipe, to show the "heart" of ALICE (see Figure 1). In reality, virtual visitors get to see more than during a tour in person.

Upon request by a school, university or a local event's organisers and once date and time are agreed on, the visit is registered on a dedicated indico category [2] and guides are identified, trying to match the language requirement of the audience. In addition, "open virtual visits" for individuals are organised regularly [3]; these are announced on social media (FB, Twitter) [4] and on the CERN virtual tours and talks site [5]. They include a short introduction, visit to the cavern, tour of the ARC and a Q&A session at the end. Typical duration is between one and one-and-a-half hours, depending on the number of questions from the participants. The virtual visits are done using zoom or zoom webinar. If recording of the visit has been requested, this is also done via zoom.

Hundred virtual visits have taken place since April 2018 (when we started registration on indico) and in the last year more than 70. Some thousands of people in more than 25 countries have been reached. Involving colleagues of different nationalities we have conducted visits in nine languages. An ALICE virtual visit for an event [6], organised by the Victoria and Albert Museum, London, on the occasion of the exhibition "Alice: Curiouser and Curiouser" [7] was followed by thousands of middle-school students in the UK and elsewhere.

4. ALICE masterclasses

The "International Masterclasses - hands-on particle physics" (IMC) [8], the flagship activity of IPPOG (the International Particle Physics Outreach Group) [9], is a very successful outreach programme addressed to high-school students. Invited to a university or research centre, they spend a day of immersion in particle physics, following lectures and analysing real data from an experiment using dedicated software packages. At the end of the day they participate in a videoconference, connecting up to five different institutes, and discuss their results, similarly to what is common practice for international collaborations. ALICE has been participating in IMC since 2011, when measurements using data from the LHC experiments replaced the previous measurements based on LEP data. In addition to participation in the international masterclasses programme, held in the period February - April every year, ALICE members organise local masterclasses (without videoconference), sometimes going to the schools, as well as masterclasses for physics teachers.

Analysing data collected with the ALICE detector, high-school students search for strange particles from their V^0 decays, identify them based on the invariant mass of the decay products and eventually observe strangeness enhancement, one of the first signals for the Quark Gluon Plasma [10]; or they count tracks of charged particles in proton-proton and lead-lead collisions and calculate the nuclear modification factor R_{AA} [11].

These measurements were done, until recently, with packages based on ROOT, which had been developed simplifying the ALICE event display program. Installation of ROOT was therefore a prerequisite. Versions for Linux, Ubuntu, macOS were available, and in the last years also for windows; another alternative was the virtual box - virtual machine method. All these required installation of the software and testing prior to the masterclasses.

5. ALICE masterclasses in the COVID times

With schools and universities closing as countries went to lockdown in March 2020, the international masterclasses 2020 were interrupted half-way. In the autumn of 2020, as the second wave of the pandemic led to new lockdowns, it became clear that the only possibility for international masterclasses 2021 was to hold them online, with the students at home. The ROOT-based versions of the ALICE exercises were not suitable for such a scenario; the installation of software by the students on all sorts of PCs, laptops or tablets might have been problematic. The packages were therefore rewritten from scratch, based on Javascript in one case and using Jupyter notebooks in the other; these new versions can be run using simply a browser (see Figure 2).

Thanks to these tools we were able to organise masterclasses with students participating remotely. On the 11th February, "International Day of Women and Girls in Science" [12], established by a United Nations resolution in 2015, ALICE masterclasses for girls were held in India, the Czech Republic and Greece. On this occasion, the University of Jammu organised the first ALICE masterclasses in India; the Czech Technical University in Prague held masterclasses as part of a broader event for girls, including particle physics, mathematics, quantum technologies and nuclear chemistry; in Greece, masterclasses were held for high-school students in Thessaloniki, with lecturers and tutors from CERN, the University of Thessaloniki and India. All three sessions were very successful and greatly appreciated by the girls.

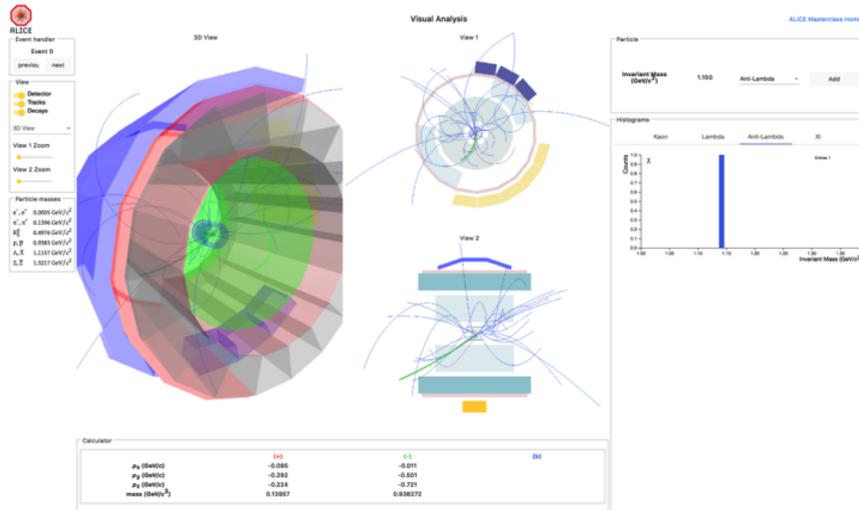


Figure 2: The web-based version of the ALICE masterclass exercise on strange particles.

During the "official" period of IMC 2021, 25 sessions with ALICE measurements were held and 6 videoconferences. In almost all cases students were at home. Zoom was used for the introductory talks. For the data analysis the students were sent to zoom breakout rooms in small groups of 5-6 persons with one tutor per room. The merging of the results and the final discussion were done once everybody was back in the main zoom room.

Virtual visits to ALICE were included in the day's schedule for almost all ALICE masterclasses. In this way many participants got a glimpse of the experiment, whereas in previous years, it was the "privilege" of those invited to CERN from the local area.

The end-of-the-day videoconference was done via zoom webinar. This made it easier for moderators to participate since their physical presence at CERN was not required. The students had many questions, which indicates that they are less inhibited when they do not need to speak and are more at ease submitting questions in writing. However many made the remark that they missed seeing the other students - the international nature of the event conveyed with the videoconference was somewhat lost.

Running the masterclasses in this way the students inevitably missed the in-person interactions. However there were certain advantages: students in remote places could be reached, who could not participate when travelling to the organising institutes was required. Lecturers and tutors could participate located in different places, which gave flexibility to the organisation. In some cases (Sarajevo, Thessaloniki, Chania) physics teachers participated as tutors during the analysis, after following a training session beforehand. Their participation gives them the advantage that, being familiar with the tools, they can use them in class for extracurricular activities. Some female students who had participated in masterclasses for girls helped as tutors during a later session.

Even though some institutes chose not to participate since they could not invite students, the overall impression of those who took part was positive. The flexibility that the online platforms offer allowed to reach people who could not participate in the "classical" format of the event.

6. Summary and conclusions

The use of online platforms provided a nice substitute for events with physical presence of the participants and ensured the continuity of the outreach and educational activities of the ALICE collaboration in the times of the COVID pandemic.

The virtual visits give to remote audiences the opportunity to get a glimpse of a CERN experiment and interact with scientists; they even allow virtual visitors to see more than during a real visit. Online masterclasses, made possible due to browser-based versions of the analysis exercises, allow students in remote places to participate. They also offer more freedom in the organisation, with lecturers, tutors and moderators connecting from anywhere. In this way new people were involved.

We hope that we can return to normality soon and look forward to resuming our activities with in-person interaction. However, having gained experience with online events, we intend to continue, in parallel to real visits, also virtual visits for those who can not travel to CERN. As for the masterclasses, in addition to inviting students to institutes, we intend to organise also online sessions. During IMC 2022 there will be a period dedicated to online masterclasses, giving the opportunity to students in remote places to participate.

References

- [1] <https://pos.sissa.it/cgi-bin/reader/contribution.cgi?id=234/349>
- [2] <https://indico.cern.ch/category/10137/>
- [3] <https://indico.cern.ch/category/13603/>
- [4] <https://www.facebook.com/ALICE.experiment/>, <https://www.twitter.com/ALICEexperiment/>
- [5] <https://visit.cern/virtual>
- [6] <https://www.vam.ac.uk/event/oBQ6aMVx/v-a-and-cern-classroom-live-june-2021>
- [7] <https://www.vam.ac.uk/exhibitions/alice-curiouser-and-curiouser>
- [8] <https://physicsmasterclasses.org>
- [9] <https://ippog.org>
- [10] <https://alice-masterclass.web.cern.ch>
- [11] <http://www-alice.gsi.de/masterclass/>
- [12] <https://en.unesco.org/commemorations/womenandgirlinscienceday>